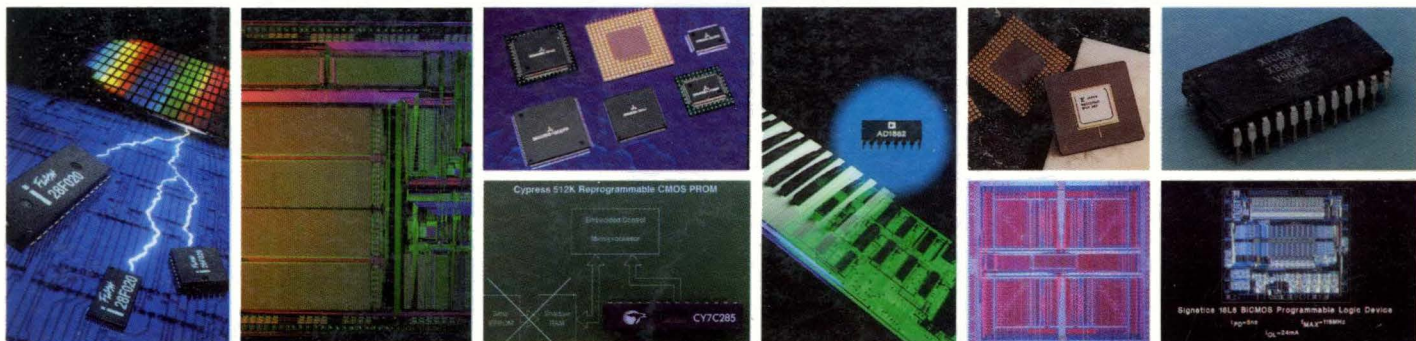


1991

IC MASTER



3. Advertisers Technical Data

- Manufacturers and Distributors Directory
- Advertisers Data Pages



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Q. Who makes a Dual, Low Offset Voltage Op Amp?

A. This is a **LINEAR** device. Turn to the LINEAR section in Volume One. The first page of the section shows the starting page for each type of device. Turn to the page where Dual Units appear. Look down the list for the device you need. Advertisers' devices are listed in bold face. Turn to the page in Volume Two where more information may be available.

Q. I need an IC with Music capability. Which Master Selection Guide should I use?

A. Turn to the **Master Selection Guide Function Index** starting on page 10. Look through the list until you find **Music**. The page numbers for each kind of device are shown.

Q. I plan to use a digital gate array or some other semicustom ASIC in my next project. Where do I find it in the MASTER? Who makes these things?

A. Turn to Volume One. Turn to the first page of **ASICs/Custom**. Find Gate Arrays and all of the other devices listed here. Now you can find the device you need. After you find the type of device you need, turn to the proper page and find the manufacturer. Advertisers' pages are in Volume Three.

Q. I know the digital IC I need is available. Is it available in a surface mount package?

A. There are two ways to solve this problem. If you know the manufacturer's device number, turn to the Part Number Index in Volume One. Find the basic number and the page number and line where that device is listed in the MASTER. Turn to that page. If the device is available for surface mounting, an open diamond symbol will appear. You can also turn directly to the digital section and turn to the function of the device you want. The symbol will indicate an SMD is available.

Q. I am looking for an application note on a specific device. Where can I find out if one is currently available?

A. Pick up Volume Two. Turn to the Application Note Directory. Here you will find app notes arranged by **function**. Find the function involved and turn to the page where the app note is listed.

Q. We need a device that meets MIL standards. Where do I look in the MASTER?

A. Turn to the **MILITARY** section in Volume One. The Military Device Testing table shows which manufacturers do what kinds of MIL work. Followed by the MIL-STD-1562R directories for microcircuits which contains numerous tables relating to various standards of classification. The next list is a QPL listing based on the latest Defense Electronics Supply Center (DESC) Qualified Product Listing. Additional information is often supplied by the advertisers' pages in Volume Three.

Q. I know the basic part number is 2502 and that's all I know. Where do I look?

A. That's easy in the **MASTER**. Turn to the Part Number Index. All prefixes and suffixes have been stripped away. Turn to the page where 2502 appears. All manufacturers with that kind of number appear in order along with the page and line number where the device is described.

Q. How many manufacturers claim to make a pin-for-pin and function-for-function equivalent to a Motorola MC68000?

A. Turn to the Alternate Source Directory in the back of Volume Two. Turn to Motorola's listings. Those manufacturers who claim to be equivalent are listed in order. If you have an IBM or Compatible computer with a hard drive, you can get the 1991 IC **MASTER Alternate Source Directory** on a disk. The disk is Clipper compiled from dBasell+ and is delivered compressed by PKARC. This is the complete list of alternate sources and allows you to add notes such as your own part numbers, prices, sources and the like. Call Hearst (516) 227-1300 and ask for Book Sales for further information.

Q. I looked in the Alternate Source Directory. The part I want an alternate source for isn't listed. Why not?

A. Are you sure you looked through the entire listing for the original manufacturer? Some devices may be listed in odd ways depending on how the **MASTER's** editors receive the information. Then there is the probability that no other manufacturer makes an exact replacement for your part. It is important for you to understand how the Alternate Source Directory is compiled. Manufacturers supply the information that **their** part is an exact replacement for **another** part. The original manufacturer does **not** tell us his part can be replaced by those listed.

Q. What do the manufacturers' part numbers mean? I have a Signetics N8X02N. What do all the letters and numbers mean?

A. Look in Volume Two for the Part Number Guide. Turn to the Signetics portion. Now you know the N prefix means, zero to plus seventy degrees Centigrade. The N suffix indicates the package style. The numbers and letters in the middle are the device type. Each manufacturer has a different code system. Understanding the systems is a great help in comparing devices.

Q. I found the device I want in the MASTER. What are the pinouts? Where can I get more details? Where can I get a price? What is the delivery time?

A. You have just defined exactly what the IC MASTER does. The MASTER is a guide to tell you which devices are available on a commercial basis. After you know this, the next step is to contact the manufacturer, a local sales office or a distributor.

Q. Where can I find the addresses and telephone numbers of manufacturers, local sales offices and distributors?

A. Pick up Volume Three. Turn to the Manufacturers and Distributors Directory. Read the first page. The information on this page will help you understand why the information in the Directory is so important. It will save time and aggravation.

Q. I just saw a new device advertised in Electronic Products magazine. It isn't listed in the MASTER. Why not? When will it be listed?

A. Preparing the information for the annual IC MASTER is a tremendous undertaking. It requires the cooperation of every single manufacturer. All of the material must be organized, cross referenced and placed in the data base. This data base must be closed off in November in order to meet the publishing date of late January. That is why some devices are not listed. They came on the market too late for the deadline. There are two updates to the annual MASTER. They are called the **IC MASTER UPDATE**. One is issued in the late Spring and the other in the early Fall. Be sure to sign up for copies when you get your new IC MASTER. If you are not sure whether or not you have requested the updates, please write to the Circulation Department at the address shown on page 2 of this MASTER. Be sure to indicate which edition of the MASTER you are using.

ABBREVIATIONS OF COMPANY NAMES

ABB HAFO	ABB HAFO Inc.	Comlinear	Comlinear Corporation	Harris	Harris Semiconductor
Acculin	Acculin, Inc.	Commodore	Commodore Semiconductor Group	HP	Hewlett-Packard-Logic Systems Division
Actel	Actel Corporation	CompDyn	Computer Dynamics Sales	HNB-Sys	Racal-Rebac
Adams-Russell	Adams-Russell Electronics Co., Inc.	CompVision	Computervision	HLevel	Hilevel Technology, Inc.
Adaptec	Adaptec	ControData	Control Data	Hitachi	Hitachi America, Ltd.
Adv Analog	Advanced Analog	Crystal	Crystal Semiconductor Corp.	Holt	Holt, Integrated Circuits, Inc.
AdvLinear	Advanced Linear Devices	CustomArrays	Custom Arrays Corp.	Honeywell	Honeywell
AMD	Advanced Micro Devices, Inc.	Cybernetic	Cybernetic Micro Systems	Hughes	Hughes Aircraft Co.
AEG Corp	AEG Corporation-Telefunken	Cypress	Cypress Semiconductor Corp.	Hyundai	Hyundai Electronics America
Allegro Micro	Allegro Micro Systems, Inc.				
Altera	Altera Corporation	DAZIX	Daisy/Cadnetix, Inc. (DAZIX)	IBM	IBM
Am Automation	American Automation	Dallas	Dallas Semiconductor	IC DESIGNS	IC DESIGNS
AnalDesTools	Analog Design Tools, Inc.	Data I/O	Data I/O Corporation	IKos	IKOS Systems, Inc.
AD	Analog Devices	Datel	Datel, Inc.	ILC-DDC	ILC Data Device Corp.
AnalogSys	Analog Systems	Dense-Pac	Dense-Pac Microsystems, Inc.	Inova	Inova Microelectronics Corp.
Analogic	Analogic Corporation	Devtek	Devtek Systems	IntCirSys	Integrated Circuit Systems, Inc.
Apex	Apex Microtechnology Corporation	Digital RF	Digital RF Solutions Corp.	ICSI	Integrated CMOS Systems, Inc.
AMCC	AMCC (Applied Micro Circuits Corporation)	Dionics	Dionics Inc.	IDT	Integrated Device Technology, Inc.
AppMicroSys	Applied Microsystems Corporation	DSP Group	DSP Group, Inc.	ILSI	Integrated Logic Systems Inc.
Aptek	Aptek Microsystems			ISSI	Integrated Silicon Solution Inc.
Aspen	Aspen Semiconductor Corp.	ECl Semi	ECl Semiconductor	Intel	Intel Corporation
AT&T	AT&T Microelectronics, 52AL330240	EdsunLabs	Edsun Laboratories, Inc.	Intergraph	Intergraph
ATMEL	ATMEL Corporation	EG&G-Reticon	EG&G Reticon Corporation	ICT	International CMOS Technology
Avasem	Avasem Corporation	Elantec	Elantec, Inc.	IMI	International Microcircuits, Inc.
		EDI	Electronic Designs Inc.	IMP	International Microelectronic Products
		Ericsson	Ericsson Components	Interpoint	Interpoint Corporation
Benchmark	Benchmark	Exar	Exar Corporation	Intronics	Intronics, Inc.
BinaryTech	Binary Technology, Inc.	EXEL	EXEL Microelectronics, Inc.	IXYS	IXYS Corporation
Bipolar	Bipolar Integrated Technology				
Brooktree	Brooktree Corporation	Force	Force Computers, Inc.	Kontron	Kontron Electronics, Inc.
Burr-Brown	Burr-Brown Corporation	Fujitsu	Fujitsu Microelectronics, Inc.	Krueger	Krueger Company
		FutureNet	FutureNet		
Cadcam	CADAM Inc.			Lambda	Lambda Semiconductors
Cadence	Cadence Design Systems, Inc.	Gali	Gali Motion Control	Lansdale	Lansdale Semiconductor
CaseTech	Case Technology	Gazelle	Gazelle Microcircuits, Inc.	Lattice	Lattice Semiconductor Corp.
Catalyst Rsch	Catalyst Research	Gennum	Gennum Corporation	Lin Int Sys	Linear Integrated Systems
Catalyst Semi	Catalyst Semiconductor	GenRad	GenRad Inc.	LinearTech	Linear Technology Corporation
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CMD Micro	California Micro Devices Corporation	Greenwich	Greenwich Instruments USA	LSI Logic	LSI Logic Corporation

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Marconi	Marconi Circuit Technology	Power Integ	Power Integrations, Inc.	Technitrol	Technitrol, Inc.
Maxim	Maxim Integrated Products	Proximity	Proximity Technology Inc.	Tektronix	Tektronix, Inc.
MCE	MCE Semiconductor			TeledyneS	Teledyne Semiconductor
Mentor	Mentor Graphics Corporation	Qualcomm	Qualcomm Incorporated	Teltone	Teltone Corporation
MetaSoft	Meta-Software, Inc.			Teradyne	Teradyne, EDA Inc.
Micrel	Micrel	RadstoneTech	Radstone Technology Corp.	TI	Texas Instruments, Inc.
MicroLinear	Micro Linear	Ramtron	Ramtron Corporation	Thaler	Thaler Corp
MicroNet	Micro Networks Company	Raytheon	Raytheon Company	ThirdDomain	Third Domain, Inc.
MicroPwr	Micro Power Systems, Inc.	Ricoh	Ricoh Corp.	Toko	Toko America Inc.
MICRO-LINK	Micro-Link Products	Rockwell	Rockwell International	Toshiba	Toshiba America Electronic Components, Inc.
Micro-Rel	Micro-Rel	ROHM	ROHM Corporation	TranSwitch	TranSwitch Corporation
MicroSys	MICRO/SYS			TriQuint	Tri Quint Semiconductor
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Microcosm	Microcosm Inc.	Samsung	Samsung Semiconductor, Inc.	Ultra Analog	Ultra Analog, Inc.
MicronTech	Micron Technology	Sanyo	Sanyo Semiconductor Corporation	UMC	Unicorn Microelectronics Corp.
Micropac	Micropac Industries, Inc.	Saratoga	Saratoga Semiconductor	United	United Silicon Structures, Inc.
Microsim	MicroSim Corporation	SBE	SBE, Inc.	UTMC	United Technologies Microelectronics Center
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Miller	Miller Technology Inc.	SEEQ	SEEQ Technology, Incorporated	Universal	Universal Semiconductor Inc.
Mitel	Mitel Semiconductor	Seiko Instr	Seiko Instruments USA, Inc.		
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MonSys	Monolithic Systems Corporation	Sharp	Sharp Electronics Corporation	Valid	Valid Logic Systems
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Mosel	Mosel	Sierra	Sierra Semiconductor Corporation	ViewLogic	Viewlogic Systems Inc.
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Orion	Orion Instruments, Inc.	Spancom	Spancom Corporation		
		Stac	Stac Electronics	ZAX	Zax Corp.
Panasonic	Panasonic Industrial Company/Electronic Components Division	SMC	Standard Microsystems Corporation	Zendex	Zendex Corporation
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- AZ Phoenix**
Morrison & Fern Inc., 602-966-4601
- CA Agoura**
Burr-Brown, 818-991-8544
- CA San Jose**
Burr-Brown, 408-559-8600
- CA Santa Ana**
Burr-Brown, 714-835-0712
- CO Denver**
Burr-Brown, 303-452-3545
- FL Altamonte Springs**
V.G. Sales Co., Inc., 407-831-8688
- FL Ft. Lauderdale**
V.G. Sales Co., Inc., 305-938-4333
- FL Largo**
V.G. Sales Co., Inc., 813-536-7787
- GA Tucker**
Rep Inc., 404-938-4358
- IL Arlington Hts.**
Burr-Brown, 708-437-2877
- IA Cedar Rapids**
Rep Associates, 319-373-0152
- KS Kansas City**
BC Electronics, 913-342-1211
- MD Hunt Valley**
Marktron, Inc., 301-628-1111
- MD Rockville**
Marktron, Inc., 301-251-8990
- MA Boston**
Burr-Brown, 508-670-9800
- MI Farmington**
Burr-Brown, 313-474-6533
- MN Bloomington**
Electrn. Sales Agency, Inc., 612-884-8294
- MS Tucker**
Rep Inc., 404-938-4358
- MO Brington**
BC Electronics Sales, Inc., 314-739-6683
- NM**
See Phoenix, AZ (Morrison & Fern Inc.)

- NY Endicott**
Advanced Comps. Corp., 607-785-3191
- NY Kingston**
Advanced Comps. Corp., 914-339-1730
- NY Rochester**
Advanced Comps. Corp., 716-544-7017
- NY Scottsville**
Advanced Comps. Corp., 716-889-1429
- NY Syracuse**
Advanced Comps. Corp., 315-699-2671
- NY Yonkers**
Burr-Brown, 914-964-5252
- NC Winston-Salem**
Murcota Corp., 919-722-9445
- OH Cincinnati**
Burr-Brown, 513-891-4711
- OH Cleveland**
K-T/Depco Marketing, 216-442-6200
- PA Pittsburgh**
K-T/Depco Marketing, 412-367-1011
- PA Spring House**
QED Elctns., 215-643-9200
- TN Jefferson City**
Rep Inc., 615-475-4105
- TX Dallas**
Burr-Brown, 214-783-4555
- TX Houston**
Burr-Brown Corp., 713-988-6546
- UT Salt Lake City**
Aspen Sales Inc., 801-265-8365
- WA Kent**
Burr-Brown, 206-859-9220
- Can Mississauga, Ontario**
Allan Crawford Assocs., 416-890-2010
- Int'l Argentina, Buenos Aires**
Conorpe, S.A., TEL: 54-1-325-6761
- Int'l Australia, Clayton-Victoria**
Kenelec, TEL: 61-3-560-1011
- Int'l Austria, Wien**
Burr-Brown GmbH, TEL: 43-222-626371
- Int'l Belgium, Bruxelles**
Burr-Brown Intl. N.V., TEL: 32-2-521-86-50
- Int'l Brazil, Sao Paulo**
Aplicanos Electronicas Artimar, TEL: 55-11-231-0277
- Int'l Chile, Santiago**
Coasin Chile Ltda., TEL: 56-251-4747
- Int'l Columbia, Bogota**
Instrumentacion Ltda., TEL: 57-1-612-1313
- Int'l CHINA**
Schmidt & Co., TEL: 8-330222
- Int'l Denmark, Copenhagen**
Prescom A/S, TEL: 45-44-532244
- Int'l England, Watford**
Burr-Brown Int'l Overseas Mkt, TEL: 44-92333837
- Int'l Finland**
Perel OY, TEL: 358-14-21600
- Int'l France, Le Chesnay**
Burr-Brown Intl. S.A., TEL: 33-1-395-43558
- Int'l Germany, Filderstadt**
Burr-Brown Intl. GmbH, TEL: 49-711-701025
- Int'l Greece, Athens**
Peter Caritato & Assoc. S.A., TEL: 30-1-9020165
- Int'l Hong Kong, Wanchai**
Schmidt & Co.(H.K. Ltd.), TEL: 011-852-8330222
- Int'l Hungary**
Siex Elektronikelemente GmbH, TEL: 49-911-60-7014
- Int'l India, Bombay**
Oriole Services & Consalts. Pty., Ltd., TEL: 91-22-5122973
- Int'l Indonesia**
Microtronics Assocs. Pte. Ltd., TEL: 743-1835
- Int'l Israel, Ramat-Hasharon**
Gallium Electronics, TEL: 972-3-5402242
- Int'l Italy, Milano**
Burr-Brown Int'l S.r.l., TEL: 39-2-58010504
- Int'l Japan, Tokyo**
Burr-Brown Japan Ltd., TEL: 81-3-586-8141
- Int'l Japan, Tokyo**
Burr-Brown Japan Ltd., TEL: 03 586-8141

- Int'l Korea, Seoul**
Oyang Corp., TEL: 82-2-732-8031
- Int'l Malaysia, Penang**
Microtronics Assoc., TEL: 60-4-214-518
- Int'l Netherlands, Schiphol-Oost**
Burr-Brown Intl. B.V., TEL: 31-20-6010041
- Int'l New Zealand, Auckland**
Enertec Services, TEL: 64-9-479-2377
- Int'l Norway, Oslo**
Hefro Elektronikk A/S, TEL: 47-6-87-02-05
- Int'l Portugal, Lisbon**
Cristalonica, TEL: 351-1-534631
- Int'l S. Africa, Johannesburg**
Advanced Semiconductor, TEL: 27-11-802-5820
- Int'l Singapore**
Microtronics Assoc. Pte. Ltd., TEL: 65-748-1835
- Int'l Spain, Madrid**
Unitronics SA, TEL: 34-1-242-5204
- Int'l Sweden, Upplands Vasby**
Burr-Brown Intl. AB, TEL: 46-760-93010
- Int'l Switzerland, Zurich**
Burr-Brown Intl AG, TEL: 41-7240928
- Int'l Taiwan, Taipei**
Alpha Precision Instrmn., TEL: 886-2-508-3066
- Int'l Thailand, Bangkok**
Microtronics Thai Pte. Ltd., TEL: 66-2-255-76822
- Int'l Venezuela, Caracas**
Eniac C. A., TEL: 582-241-6214
- Int'l Yugoslavia-Elzas**
Elektrotehna Ljubljana, TEL: 38-61-329745

Cadarm

CADAM Inc.
1935 N. Buena Vista St.
Burbank, California 91504
818-841-9470

Cadence Design Systems

Cadence Design Systems, Inc.
555 River Oaks Parkway
San Jose, California 95134
408-943-1234
FAX: 408-943-0513

Case Technology

Case Technology
2141 Landings Dr.
Mt. View, California 94043
415-962-1440

Catalyst Research

Catalyst Research
Mine Safety Appliances Company
1421 Clarkview Road
Baltimore, Maryland 21209-9987
301-296-7000
TELEX: 87-768

Catalyst Semiconductor

Catalyst Semiconductor
2231 Calle de Luna
Santa Clara, CA 95054
408-748-7700
FAX: 408-980-9209

Sales Office & Representatives

- AL Huntsville**
Southeast Technical Group, Inc., 205-534-2376
- AZ Scottsdale**
Tusar, 602-998-3688
- CA Escondido**
Eagle Technical Sales Assoc., 619-743-6550
- CA Irvine**
Spinnaker Sales, 714-261-7233
- CA Milpitas**
Emerging Tech. Sales, 408-263-9366

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Catalyst Semiconductor (Cont'd)		WI	Milwaukee LTD Technologies, 414-774-1000	OH	Columbus Electronics Marketing Corp. (Hdqtrs), 614-299-4161
CA	Santa Clara Catalyst Semi. Sales (Western Area), 408-748-7700	Can	British Columbia, Delta Minka Ventures Ltd., 604-943-5020	Can	Ontario, Markham Semad (Headquarters), 416-475-8500
CA	Shingle Springs Emerging Technology Sales, 916-676-4387	Can	Ontario, Kanata J-Squared Technologies, 613-592-9540	Can	Quebec, Pointe Claire Future Elctrcns. (Hdqtrs), 514-694-7710
CO	Aurora Moss Marketing, 303-340-8535	Intl	Austria, Vienna Ing E. Steiner, TEL: 0222-827474	Cermetek Microelectronics	
CT	Hamden Comptech, 203-934-6757	Intl	Belgium, St. Stevens-Woluwe BETEA SA/NV, TEL: 02-725-1080	Cermetek Microelectronics, Inc. 1308 Borregas Avenue, P.O. Box 3565 Sunnyvale, California 94088-3565 408-752-5000 TWX: 910-379-6931	
FL	Longwood Catalyst Semi. Sales (SE), 407-682-1995	Intl	Belgium, Strombeek Catalyst Semi. Inc., TEL: 32-2-2677-7025	Distributors	
FL	Melbourne Photon Sales, Inc., 407-259-8999	Intl	Denmark, Allerod Delco A.S., TEL: 042-277733	CA	Los Angeles Bell Industries, Inc., 213-826-6778
FL	Oldsmar Photon Sales, Inc., 813-785-4735	Intl	England, Berkshire XACT Tech. Ltd., TEL: 635-521678	NY	Farmingdale Milgray Electronics, 516-420-9800
FL	Orlando Photon Sales, Inc., 407-896-6064	Intl	England, Berkshire Microprocessor & Memory Distrib., TEL: 0734-313232	Cherry Semiconductor	
FL	Pompano Photon Sales, Inc., 305-977-6872	Intl	England, Bucks Catalyst Semiconductor U.K., TEL: 0908-260874	Cherry Semiconductor Corporation 2000 South County Trail East Greenwich, Rhode Island 02818 401-885-3600 TELEX: WUI-6817157 FAX: 401-885-5786	
GA	Lawrenceville Southeast Technical Group, Inc., 404-979-2055	Intl	Finland, Espoo Telercas, TEL: 90-452-1255	Chips and Technologies	
IL	Itasca LTD Technologies, 708-773-2900	Intl	France, Sevres Tekelec Airtronic, TEL: 45-34-75-35	Chips and Technologies, Incorporated 3050 Zanker Road San Jose, California 95134 408-434-0600 TWX: 272929 CHIPS UR	
IL	Roscoe LTD Technologies, 815-389-1000	Intl	France, Velizy Cedex Mustronic, TEL: 34-65-90-44	Cirrus Logic	
IN	Leesburg SAI Marketing, 219-834-1010	Intl	Hong Kong, Kowloon Bay Randy Electronics, TEL: 7953-889	Cirrus Logic, Inc. 3100 W. Warren Ave. Fremont, California 94538 415-623-8300	
IA	Cedar Rapids Cahill, Schmitz & Howe, Inc., 319-377-8219	Intl	India Spectra Innovations (San Jose, CA Hdqtrs), TEL: 408-954-8474	Sales Office & Representatives	
KS	Overland Park Electri-Rep, 913-649-2168	Intl	Israel, Holon Segtec, TEL: 972-3-556-7458	AL	Huntsville REP, Inc., 205-881-9270
MD	Annapolis Electronic Engineering & Sales, Inc., 301-269-4234	Intl	Italy, Milan Silverstar Ltd S.P.A., TEL: 02-661-251	CA	Fountain Valley Dynarep, Inc., 714-545-3255
MD	Bowie Electronic Engineering & Sales, Inc., 301-249-0616	Intl	Japan, Tokyo Marubun Corp., TEL: 03-639-9851	CA	Laguna Hills Sales Off. (Southern CA), 714-472-3939
MA	Tyngsboro Comptech, 508-649-3030	Intl	Korea, Seoul D & S Corp., TEL: 822-J75-4490	CA	San Jose Sales Off. (Northern CA), 408-436-7110
MI	Fenton SAI Marketing, 313-750-1922	Intl	Latin America Intectra, Inc. (Mt. View, CA Hdqtrs), TEL: 415-967-8818	CA	Santa Clara Phase II, 408-980-0414
MN	Eden Prairie Hanna Lind, 612-942-8554	Intl	Malaysia Serial System Marketing, TEL: 65-2938830	CA	Simi Valley Dynarep, Inc., 805-527-0072
MS	Meridian Southeast Technical Group, Inc., 601-485-7055	Intl	Netherlands Zoetermeer Tekelec Airtronic B.V., TEL: 079-310100	CA	Thousand Oaks Sales Office (Southern CA), 805-371-5381
MO	St. Louis Electri-Rep, 314-993-4421	Intl	Norway, Oslo Henaco A.S., TEL: 02-162110	CO	Boulder Sales Office (Rocky Mt. Area), 303-939-9739
NJ	East Hanover Cooper-Simon-Emtec, 201-428-0600	Intl	Singapore Marubun Electronics (s) PTE Ltd., TEL: 65-223-8855	CO	Longmont Luscombe Engineering, 303-772-3342
NJ	Haddonfield Sunday-O'Brien, 609-429-4013	Intl	Singapore Serial System Marketing, TEL: 65-2938830	CT	Wallingford Technology Sales, Inc., 203-269-8853
NY	East Rochester William Kreger Assoc., 716-381-4430	Intl	Spain, Madrid ATD Electronica, TEL: 1-234-4000	FL	Boca Raton Sales Off. (South Eastern Area), 407-994-9883
NY	Port Jefferson Catalyst Semi. Sales (NE Area), 516-331-5566	Intl	Sweden, Spanga Pelcon Electronics, TEL: 795-98-70	GA	Norcross Sales Office (South Eastern Area), 404-263-7601
NC	Zebulon Southeast Technical Group, Inc., 919-269-5589	Intl	Switzerland, Dietikon Datacomp A.G., TEL: 01-740-5140	GA	Tucker REP, Inc., 404-938-4358
OH	Centerville Omega Sales, Inc., 513-434-5507	Intl	Taiwan, Taipei Marobun Taiwan Inc., TEL: 2717-0211	IL	Arlington Heights Coombs Associates, Inc., 312-439-9810
OH	Cleveland Omega Sales, Inc., 216-360-9400	Intl	Taiwan, Taipei Princeton Tech., TEL: 2717-1439	IL	Westchester Sales Office (North Central Area), 708-449-7715
OH	Worthington SAI Marketing Corp., 614-785-0454	Intl	West Germany, Hamburg Catalyst Semi., Inc., TEL: 49-40-422-50-76	MA	Andover Sales Off. (North Eastern Area), 508-474-9300
OR	Portland Northwest Marketing Assoc., 503-620-0441	Intl	West Germany, Ingolstadt Edgar Beckert Elektronik, TEL: 841-62922		
TX	Austin Logic 1 Sales, 512-345-2952	Intl	West Germany, Munich Tekelec Airtronic GmbH, TEL: 089-51640		
TX	Houston Logic 1 Sales, 713-444-7594	Distributors			
TX	Richardson Logic 1 Sales, 214-234-0765	FL	Miami All American Semiconductor (Hdqtrs), 305-621-8282		
UT	Salt Lake City Moss Marketing, 801-363-5875	NY	Amityville Nu Horizons Elctrcns. (Headquarters), 516-226-6000		
VA	Manassas Electronic Engineering & Sales, Inc., 703-690-7984	NY	Farmingdale Milgray Elctrcns. (Headquarters), 516-420-9800		
VA	Remington Electronic Engineering & Sales, Inc., 703-439-2810	NY	Melville Arrow/Kieruff Electronics Corp., 516-391-1300		
WA	Bellevue Northwest Marketing Assoc., 206-455-5846				

Cirrus Logic (Cont'd)	
MA	Waltham Technology Sales, Inc., 617-890-5700
MN	Minneapolis Reptek, Inc., 612-331-8865
NJ	Princeton Sales Off. (North Eastern Area), 609-520-9696
NY	Central Islip Technology Sales, Inc., 516-232-2870
NY	Fairport Technology Sales, Inc., 716-223-7500
NY	Ithaca Technology Sales, Inc., 607-273-1188
NC	Charlotte REP, Inc., 704-563-5554
NC	Morrisville REP, Inc., 919-469-9997
OH	Beachwood Thompson & Associates, 216-831-6277
OH	Dayton Thompson & Associates, 216-831-6277
OH	Orient Thompson & Associates, 614-877-4304
OK	Locust Grove IMPAQ Sales, 918-479-6493
PA	Dresher CMS Marketing, 215-885-4424
TN	Jefferson City REP, Inc., 615-475-4105
TX	Austin Sales Office (So. Central Area), 512-794-8490
TX	Austin IMPAQ Sales, 512-335-9666
TX	Carrollton IMPAQ Sales, 214-247-3300
TX	Dallas Sales Off. (South Central Area), 214-733-6929
TX	Houston IMPAQ Sales, 713-820-0288
UT	Midvale Luscombe Engineering, 801-565-9885
WI	Milwaukee Coombs Associates, Inc., 414-351-6123
Can	British Columbia, Burnaby Vitel Electronics, 604-439-1136
Can	Ontario, Kanata Vitel Electronics, 613-592-0090
Can	Ontario, Mississauga Vitel Electronics, 416-676-9720
Can	Quebec, Lachine Vitel Electronics, 514-636-5951
Intl	France, Antony Cedex Aquitech, TEL: 33-40-96-9494
Intl	Hong Kong, Tsimshatsui Lestina Intl, TEL: 852-3-7351736
Intl	Japan, Kanagawa Sales Office, TEL: 81-462-76-0601
Intl	Japan, Tokyo Marubun Corp., TEL: 81-3-639-9844
Intl	Japan, Tokyo Dia Semicon Systems, TEL: 81-3-487-0386
Intl	Korea Crown Corp., TEL: 82-2-521-9527
Intl	Singapore Sales Office, TEL: 65-353-2122
Intl	Singapore Scan Electronics, TEL: 65-294-2112
Intl	Taiwan, Taipei ROC Sales Office, TEL: 886-2-718-4533
Intl	United Kingdom, England Amega Electronics, Ltd., TEL: 44-256-843166
Intl	West Germany, Herrsching Sales Office, TEL: 49-81-52-2030
Intl	West Germany, Planegg Scantec GmbH, TEL: 49-89-859-8021
PR	San German Technology Sales, Inc., 809-892-4745

California Micro Devices	
California Micro Devices Corporation Microcircuits Division 2000 West 14th Street Tempe, Arizona 85281 602-921-4545 FAX: 602-921-6298	
Comlinear	
Comlinear Corporation P.O. Box 20600 Fort Collins, Colorado 80522 303-226-0500 TELEX: 45-0881 FAX: 303-226-0564	
Commodore	
Commodore Semiconductor Group 950 Rittenhouse Road Norristown, PA 19403 215-666-7950 FAX: 215 647-0791	
Computer Dynamics	
Computer Dynamics Sales 107 South Main Street Greer, South Carolina 29650 803-877-8700	
Computervision	
Computervision 15 Crosby Drive Bedford, Massachusetts 01730 617-275-1800	
Control Data	
Control Data Computer Systems and Services P.O. Box 0 Minneapolis, Minnesota 55440 612-853-8390	
Control Data	
Control Data Scientific Information Services 8100-34th Ave. South Minneapolis, Minnesota 55420 612-853-3511	
Crystal Semiconductor	
Crystal Semiconductor Corp. 4210 S Industrial Dr. Austin, Texas 78744 512-445-7222	
Custom Arrays	
Custom Arrays Corp. 525 Del Rey Ave. Sunnyvale, California 94086 408-749-1166 TELEX: 5106005119	
Cybernetic Micro Systems	
Cybernetic Micro Systems P.O. Box 3000 San Gregorio, California 94074 415-726-3000 TELEX: 910-350-5842	
Cypress Semiconductor	
Cypress Semiconductor Corp. 3901 North First Street San Jose, California 95134 408-943-2600	

Daisy/Cadnetix (DAZIX)	
Daisy/Cadnetix, Inc. (DAZIX) 700 East Middlefield Rd., P.O. Box 7006 Mountain View, California 94039-7006 415-960-0123 FAX: 415-960-6933	
Dallas Semiconductor	
	
FAX: 214-450-0470	
Dallas Semiconductor 4350 Beltwood Parkway South Dallas, Texas 75224 214-450-0400	
Sales Office & Representatives	
AL	Huntsville Glen White & Assoc., 205-882-6751
AZ	Scottsdale Haas & Associates, 602-998-7195
CA	Cupertino Dallas Semi. (West Coast/W. Canada), 408-257-7841
CA	Irvine Dallas Semi. (Headquarters W. Coast/W. Canada), 714-727-2476
CA	San Diego Harvey King, Inc., 619-587-9300
CA	Santa Clara I Squared, Inc., 408-988-3400
CA	Thousand Oaks S C Cubed, 805-496-7307
CA	Tustin S C Cubed, 714-731-9206
CO	Wheat Ridge Waugaman Assoc., 303-423-1020
CT	Meriden Dallas Semi. (Northeast/E. Canada), 203-235-6808
CT	Wallingford Technology Sales Inc., 203-269-8853
FL	Altamonte Springs Semtronic Assoc., Inc., 407-831-8233
FL	Clearwater Semtronic Assoc., Inc., 813-461-4675
FL	Ft. Lauderdale Semtronic Assoc., Inc., 305-731-2484
GA	Duluth Dallas Semi. (Headquarters Southeast), 404-623-5813
GA	Norcross Glen White & Assoc., 404-441-1447
IL	Rolling Meadows Sumer, Inc., 708-991-8500
IN	Indianapolis Dallas Semi. (Headquarters North Central), 317-844-5044, 317-573-3999
IN	Indianapolis Electronic Sales & Eng., 317-849-4260
IA	Cedar Rapids Cahill, Schmitz & Howe, 319-377-8219
KS	Olathe Technical Sales Assoc., 913-829-2800
MA	Woburn Mill-Bern Associates, 617-932-3311
MI	Livonia Giesting & Associates, 313-478-8106
MN	St. Paul Cahill, Schmitz & Cahill, 612-646-7217
MO	St. Louis Technical Sales Assoc., 314-521-2044

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Dallas Semiconductor (Cont'd)	
NJ	Haddonfield Sunday O'Brien Inc., 609-429-4013
NJ	Marlton Dallas Semi. (Headquarters East Coast), 609-596-1919
NY	Cicero Advanced Components, 315-699-2671
NY	Rockville Centre S-J Associates, 516-536-4242
NC	Huntersville Glen White & Associates, 704-875-3777
NC	Raleigh H & A Sales, 919-846-0082
OH	Cincinnati Giesting & Associates, 513-385-1105
OH	Cleveland Giesting & Associates, 216-261-9705
OH	Columbus Giesting & Associates, 614-486-5616
OK	Tulsa West Associates, Inc., 918-665-3465
OR	Beaverton Western Tech. Sales, 503-644-8860
PA	See Haddonfield, NJ (Sunday O'Brien Inc.)
PA	Pittsburgh Giesting & Associates, 412-828-3553
TN	Gray Glen White & Associates, 615-477-8850
TX	Austin West Associates, Inc., 512-343-1199
TX	Dallas Dallas Semi. (Headquarters S. Central/West), 214-788-2197
TX	Dallas Dallas Semi. (South America Office), 214-788-2197
TX	Dallas Dallas Semi. (Headquarters), 650-244-1664
TX	Dallas Dallas Semi. (Pacific RIM Office), 214-450-5363
TX	Houston West Associates, Inc., 713-621-5983
TX	Richardson West Associates, Inc., 214-680-2800
UT	Salt Lake City Waugaman Associates, 801-261-0802
VA	Falls Church S.J. Chesapeake, 703-533-2233
WA	Bellevue Western Tech. Sales, 206-641-3900
WA	Spokane Western Tech. Sales, 509-922-7600
WI	Brookfield Sumer, Inc., 414-784-6641
Can	British Columbia, Burnaby Davetek Marketing, 604-430-3680
Can	Ontario, Kanata Electro-Source Inc., 613-592-3214
Can	Ontario, Rexdale Electro-Source Inc., 416-675-4490
Can	Quebec, Pointe Claire Electro-Source Inc., 514-630-7486
Intl	England, Birmingham Dallas Semi. (European Office), TEL: 44-21-782-2959
Intl	England, Lightwater Surrey Dallas Semi. (European Office), TEL: 44-276-71193
PR	Hato Rey Semtronic Associates, Inc., 809-766-0700
Distributors	
AL	Huntsville Hall-Mark Electronics, 205-837-8700
AZ	Phoenix Sterling Electronics, 602-437-5565
AZ	Phoenix Wyle Labs, 602-437-2088
AZ	Phoenix Hall-Mark Electronics, 602-437-1200
AZ	Scottsdale Added Value Electronic Dist. Inc., 602-951-9788
AZ	Tempe Insight Electronics, 602-829-1800
CA	Augora Hills Insight Electronics, 818-707-2100
CA	Calabasas Wyle Labs, 818-880-9000
CA	Camarillo Milgray Electronics, 805-484-4055
CA	Chatsworth Hall-Mark Electronics, 818-773-4500
CA	Chatsworth Sterling Electronics, 818-407-8850
CA	Irvine Insight Electronics, 714-727-2111
CA	Irvine Wyle Labs, 714-863-9953
CA	Irvine Hall-Mark Electronics, 714-727-6000
CA	Irvine Milgray Electronics, 714-753-1282
CA	Rancho Cordova Wyle Labs, 916-638-5282
CA	Rocklin Hall-Mark Electronics, 916-624-9781
CA	San Diego Added Value Electronic Dist. Inc., 619-558-8890
CA	San Diego Insight Electronics, 619-587-0471
CA	San Diego Sterling Electronics, 619-271-6555
CA	San Diego Hall-Mark Electronics, 619-268-1201
CA	San Diego Wyle Labs, 619-565-9171
CA	San Jose Hall-Mark Electronics, 408-432-4000
CA	Santa Clara Wyle Labs, 408-727-2500
CA	Sunnyvale Insight Electronics, 408-720-9222
CA	Tustin Added Value Electronic Dist. Inc., 714-259-8258
CA	Tustin Sterling Electronics, 714-259-0900
CA	Visalia Added Value Electronic Dist. Inc., 209-734-8861
CA	Westlake Village Added Value Electronic Dist. Inc., 818-889-2861
CO	Englewood Hall-Mark Electronics, 303-790-1662
CO	Englewood Sterling Electronics, 303-792-3939
CO	Thornton Wyle Labs, 303-457-9953
CO	Wheat Ridge Added Value Electronic Dist. Inc., 313-422-1701
CT	Cheshire Hall-Mark Electronics, 203-271-2844
CT	Milford Milgray Electronics, 203-878-5538
CT	Wallingford Sterling Electronics, 203-265-9535
FL	Casselberry Hall-Mark Electronics, 407-830-5855
FL	Largo Hall-Mark Electronics, 813-530-4543
FL	Pompano Beach Hall-Mark Electronics, 305-971-9280
FL	Winter Park Milgray Electronics, 407-647-5747
GA	Duluth Hall-Mark Electronics, 404-623-4400
GA	Norcross Milgray Electronics, 404-446-9777
IL	Arlington Heights Milgray Electronics, 708-253-1212
IL	Rosemont Advent Electronics, 708-297-6200
IL	Wood Dale Hall-Mark Electronics, 708-860-3800
IN	Indianapolis Advent Electronics, 317-872-4910
IN	Indianapolis Hall-Mark Electronics, 317-872-8875
IA	Cedar Rapids Advent Electronics, 319-363-0221
KS	Lenexa Hall-Mark Electronics, 913-888-4747
KS	Lenexa Sterling Electronics, 913-492-5406
KS	Overland Park Milgray Electronics, 913-236-8800
MD	Columbia Sterling Electronics, 301-290-3800
MD	Columbia Hall-Mark Electronics, 301-988-9800
MD	Columbia Milgray Electronics, 301-621-8169
MA	Billerica Hall-Mark Electronics, 617-935-9777
MA	Burlington Wyle Labs, 617-272-7300
MA	Wilmington Milgray Electronics, 508-657-5900
MA	Woburn Sterling Electronics, 617-938-6200
MI	Farmington Hills Advent Electronics, 313-477-1650
MI	Livonia Hall-Mark Electronics, 313-462-1205
MN	Eden Prairie Hall-Mark Electronics, 612-941-2600
MN	Minneapolis Sterling Electronics, 612-831-2666
MO	Earth City Hall-Mark Electronics, 314-291-5350
NJ	Marlton Milgray Electronics, 609-983-5010
NJ	Mt. Laurel Hall-Mark Electronics, 609-235-1900
NJ	Parsippany Milgray Electronics, 201-335-1766
NJ	Parsippany Hall-Mark Electronics, 201-515-3000
NJ	S. Plainfield Sterling Electronics, 201-769-7000
NM	Albuquerque Sterling Electronics, 505-884-1900
NY	Fairport Hall-Mark Electronics, 716-425-3300
NY	Farmingdale Milgray Electronics, 516-391-3000
NY	Pittsford Milgray Electronics, 716-381-9700
NY	Ronkonkoma Hall-Mark Electronics, 516-737-0600
NC	Raleigh Hall-Mark Electronics, 919-872-0712
NC	Raleigh Milgray Electronics, 919-790-8094
OH	Cleveland Milgray Electronics, 216-447-1520
OH	Solon Hall-Mark Electronics, 216-349-4632
OH	Worthington Hall-Mark Electronics, 614-888-3313
OK	Tulsa Sterling Electronics, 918-663-2410
OK	Tulsa Hall-Mark Electronics, 918-254-6110
OR	Beaverton Wyle Labs, 503-643-7900
OR	Beaverton Almac Electronics, 503-629-8090
OR	Beaverton Insight Electronics, 503-644-3300
TX	Austin Added Value Electronic Dist. Inc., 512-454-8845
TX	Austin Hall-Mark Electronics, 512-258-8848
TX	Austin Sterling Electronics, 512-836-1341
TX	Austin Wyle Labs, 512-345-8853

Dallas Semiconductor (Cont'd)		Intl	India	NM
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TX	Dallas Milgray Electronics, 214-248-1603	Intl	Israel STG Int'l, TEL: 972-3-5618231	NY Canastota New York Hytek Assoc., Inc., 315-697-8415
TX	Dallas Added Value Electronic Dist. Inc., 214-404-1144	Intl	Italy Comprel, S.P.A., TEL: 39-2-612-0641	NC Greensboro Pen-Tech Associates, Inc., 919-852-6000
TX	Houston Hall-Mark Electronics, 713-781-6100	Intl	Japan Microtek Inc., TEL: 81-3-371-1811	OH Chesterland Electro Sales Associates, 216-729-0190
TX	Houston Wyle Labs, 713-879-9953	Intl	Japan Systems Marketing, TEL: 81-3-254-2751	OH Dayton Electro Sales Associates, 513-426-5551
TX	Houston Sterling Electronics, 713-623-6600	Intl	Korea Vine Overseas Trading Corp., TEL: 82-2-266-1663	OR Beaverton Northwest Test & Measurement, 503-645-9000
TX	Richardson Insight Electronics, 214-783-0800	Intl	Norway BIT Elektronikk A.S., TEL: 47-3847099	PA Pittsburgh Electro Sales Associates, 412-322-9000
TX	Richardson Wyle Labs, 214-235-9953	Intl	Portugal Comelta-Spain, TEL: 34-1-754-3001	TX Austin Testech, Inc., 512-338-9246
TX	Stafford Milgray Electronics, 713-240-5360	Intl	Singapore Dynamar Computer Products PTE Ltd., TEL: 65-281-3388	TX Boyd Testech, Inc., 817-433-2592
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UT	Salt Lake City Sterling Electronics, 801-972-5444	Intl	Spain Comelta, S.A., TEL: 34-1-754-3001	TX Richardson Testech, Inc., 214-644-5010
UT	West Valley City Added Value Electronic Dist. Inc., 801-975-9500	Intl	Sweden Commit Electronics AB, TEL: 46-8-732-6213	UT See Phoenix, AZ (Zeus Electronics, Inc.)
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WA	Bellevue Almac Electronics, 206-643-9992	Intl	Thailand Dynamar Computer Products Co. Ltd., TEL: 66-2-511-5104	WI Waukesha Torkelson Associates, 414-784-7736
WA	Kirkland Insight Electronics, 206-820-8100	Intl	The Netherlands Alcom Electronics BV, TEL: 31-10-451-9533	Can Ontario, Mississauga Data I/O Canada, 416-678-0761
WA	Redmond Wyle Labs, 206-881-1150	Intl	West Germany Astek Elektronik Vertriebs GmbH, TEL: 49-4191-8007-0	Can Quebec, Dorval Data I/O Canada Corp., 514-684-1185
WA	Seattle Hall-Mark Electronics, 206-547-0415	Intl	West Germany Atlantik Elektronik GmbH, TEL: 49-89-857-000	Intl Amsterdam Data I/O Europe, TEL: 31-0-206622866
WA	Spokane Almac Electronics, 509-924-9500	Data I/O		
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Can	Alberta, Edmonton ITT Multicomponents, 800-332-8387	AL	Huntsville Pen-Tech Associates, Inc., 205-881-9298	Intl Denmark, Glostrup Dana Tech K/S, TEL: 45-0-43-434547
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Can	Ontario, Nepean ITT Multicomponents, 613-596-6980	FL	West Palm Beach Pen-Tech Associates, Inc., 407-640-0800	Intl Ireland, Dublin Atron Electronics Ltd., TEL: 35-0-31988433
Can	Ontario, Willowdale Milgray Electronics, 416-756-4481	FL	Winter Springs Pen-Tech Associates, Inc., 407-291-0669	Intl Israel, Tel Aviv Telsys Ltd., TEL: 972-0-3-492001
Can	Quebec, Ville St. Laurent ITT Multicomponents, 514-335-7697	FL	Winter Springs Pen-Tech Associates, Inc., 407-366-8706	Intl Italy, La Spezia Sistrel SpA, TEL: 39-0187-20743
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Intl	Austria Hitronik Vertriebs GmbH, TEL: 43-222-824199	IL	Buffalo Grove Torkelson Associates, 708-520-0710	Intl Italy, Napoli Sistrel SpA, TEL: 39-081-7679700
Intl	Belgium Betea N.V., TEL: 32-2-725-1080	IN	Indianapolis Torkelson Associates, 317-244-7867	Intl Italy, Pescara Sistrel SpA, TEL: 39-085-837593
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Intl	France Newtek, TEL: 33-1-46872200, 33-1-676-985601	MN	Minneapolis Torkelson Associates, 612-835-2414	Intl Italy, Verona Sistrel SpA, TEL: 39-045-595338
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Intl	Great Britain Joseph Electronics, TEL: 44-21-643-6999	NH	Nashua Data I/O Corporation, 603-889-8511	Intl Japan, Tokyo Data I/O Japan, TEL: 81-3-432-6991
Intl	Great Britain Dialogue Dist. Ltd., TEL: 44-276-682001			Intl Netherlands, Veldhoven Simac Electronics B.V., TEL: 31-0-40-582911
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Intl	Turkey, Istanbul EMPA/Istanbul, TEL: 90-1-5806561/5806510
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Intl	W. Germany, Graefelfing Data I/O Instrumatic GmbH, TEL: 49-0-89-858580
Intl	W. Germany, Graefelfing Instrumatic Electronic Systems, TEL: 49-0-89-8020

Datel, Inc.	
Datel, Inc. 11 Cabot Blvd. Mansfield, Massachusetts 02048 508-339-3000 TELEX: 174388 FAX: 508-339-6356	
Specific Product Information: Dave DeLuca ext. 294	
Applications Engineering: Applications Engineering: ... Bob Leonard ... ext. 241	
Literature: Literature "Hot Line" ext. 169	
Price and Delivery: Jean Wentz ext. 131	
Follow up on Order: Joe Tavares ext. 194	

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CA	La Mirada Select Electronics, 213-921-5159
CA	Mt. View Intectra, 415-967-8818
CA	Santa Clara W.J. Electronics, 408-982-9222
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FL	Largo Q REP, Inc., 813-397-8431
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IL	Hoffman Estates Carvel Engineering & Sales, Inc., 312-885-8800
KS	Lenexa Midtec Assoc., 913-541-0505
MD	Columbia Delta III Assoc., 301-730-4700
MA	Mansfield Datel, 508-339-3000
MA	Waltham Datcom, 617-891-4600
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MO	St. Louis Midtec Assoc., 314-275-8666
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NM	Albuquerque S & S Technology Inc., 505-255-5599

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NY	Elmont Crane and Egert, 516-872-0800
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PA	Pittsburgh Arthur H. Baier Company, 412-367-7799
PA	Pittsburgh Arthur Baier Co., 412-367-7799
TX	Carrollton Technical Marketing, Inc., 214-387-3601
TX	Houston Technical Marketing, Inc., 713-783-4497
TX	Round Rock Technical Mktg., Inc., 512-244-2291
UT	Salt Lake City Elcom Inc., 801-485-7415
WA	Bellevue Advanced Power Components, 206-527-7945
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WI	Sheboygan Carvel Engineering & Sales Inc., 414-457-8800
Can	British Columbia, Vancouver Future Electronics, 604-294-1166
Can	Ontario, Ottawa Future Electronics, 613-820-8313
Can	Quebec, Pointe Claire Future Electronics, 514-694-7710
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Intl	Australia, Mortlake N.S.W. Elmeasco Instrs. Pty. Ltd., TEL: 02-7362888
Intl	Austria, Wien Moor Lackner, TEL: 222-610620
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Intl	Denmark, Kokkedal C-88 APS, TEL: 45-2-244888
Intl	Finland, Espoo Kauko Markkinat, TEL: 358-0-520455
Intl	France, Montigne Le Bretonneux Datel, TEL: 33-1-34-60-01-01
Intl	Germany, Muenchen Datel, TEL: 49-89-530741
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Intl	Israel, Herzlia Vectronics, Ltd., TEL: 52-556070
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Intl	Korea, Seoul KumOh Electric Ltd., TEL: (0) 2-701-5011
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Intl	Norway, Oslo Hightech A.S., TEL: 47-6-879330
Intl	Singapore Francotone Elctrns. Ltd., TEL: 65-283-1888/289-1618
Intl	South Africa, Transvaal Electronic Building Elements, TEL: 27-12-803-7680/93
Intl	Spain, Madrid Amitron, S.A., TEL: 34-1-247-9313/248-5863
Intl	Sweden, Hagersten Martinsson Elektronik AB, TEL: 46-8-744-0300
Intl	Switzerland, Dietikon Ineltro AG, TEL: 41-1-7414121

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Intl	United Kingdom, England, Hampshire Datel, TEL: 44-256-469085
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NY	New York C.A. Int'l. Export & Import Co. (China), 212-925-2553, 212-966-0061
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Intl	Belgium, Brussels Masterchips SPRL, TEL: 32-2-219-5862/1484
Intl	Denmark, Kokkedal C-88 Aps, TEL: 45-2-244888
Intl	Finland, Espoo Ulkkokaupat, OY, TEL: 358-0-520455
Intl	Greece, Piraeus General Electronics Ltd., TEL: 1-492-2068
Intl	Hampshire Datel (UK) Ltd., TEL: 44-256-469085
Intl	Hong Kong, Kowloon Tektron Electronic (HK) Ltd., TEL: 852-3-880629
Intl	Hong Kong, Kowloon Electronic Components (HK) Ltd., TEL: 852-3-880629
Intl	Hong Kong, Kowloon Tektron Electronic, TEL: 852-3-880629
Intl	Iceland, Reykjavik Sameind HF, TEL: 354-191-21366
Intl	India, Secunderabad Kaytronics Electronic Engineering, TEL: 847924/845573
Intl	Italy, Milano Lasi Elettronica S.p.A., TEL: (02) 2440012, (02) 2440212
Intl	Muenchen Datel GmbH, TEL: 49-89-530741
Intl	New Zealand, Auckland David Reid Electronics Ltd., TEL: 64-9-488-049
Intl	Norway, Oslo B.T. Hightech A.S., TEL: 47-6-879330
Intl	Singapore Francotone Electronics, TEL: 65-283-0888/289-1618
Intl	South Africa, Pretoria Electronic Bldg. Elements, TEL: 27-12-8037680/93
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Intl	Sweden, Hagersten Martinsson Elektronik AB, TEL: 46-8-744-0300
Intl	Switzerland, Dietikon Ineltro AG, TEL: 41-1-7414121
Intl	Taiwan, Taipei Sertek International, TEL: 886-2-5010055
Intl	The Netherlands Simac Electronics B.V., TEL: 31-40-582911
Dense-Pac	
	
FAX: 714-897-1772	
Dense-Pac Microsystems, Inc. 7321 Lincoln Way Garden Grove, California 92641 714-898-0007 FAX: 714-897-1772	

Dense-Pac (Cont'd)	
Sales Office & Representatives	
AL	Huntsville Advanced Components Marketing, 205-881-5493
AZ	Tempe Trembly Assoc., 602-967-2058
CA	Anaheim Westrep, 714-527-2822
CA	San Diego Westrep, 619-566-6580
CA	Santa Clara Quorum Technical Sales, 408-908-0812
CO	Wheat Ridge Trembly Associates, 303-421-8900
FL	Altamonte Springs VG Sales Co., Inc., 407-381-8688
FL	Ft. Lauderdale V.G. Sales, 305-938-4333
FL	Largo V.G. Sales, 813-536-7787
GA	Norcross Advanced Components Marketing, 404-448-7025
IL	Glendale Heights Synergistic Sales, Inc., 708-858-8686
MD	Glen Burnie Logical Technology, 301-766-7444
MO	Bridgeton BC Electronic Sales, Inc., 314-739-6683
NV	Las Vegas Trembly Assoc., 702-739-9770
NM	Albuquerque Trembly Assoc., 505-266-8616
OH	Dayton Fivestar Electronics, 513-299-1718
OH	Solon Five Star Electronics, 216-349-1611
OR	Beaverton Olson Technical Sales Corp., 503-643-9488
TX	Dallas Robert R. Thomas Co., 214-233-8235
UT	North Salt Lake Trembly Assoc., 801-295-4703
WA	Bellevue Olson Technical Sales, 206-883-7792
WI	Brookfield McMahon Sales Inc., 414-782-3335
Can	British Columbia, Burnaby Vitel Electronics, 416-668-0904
Can	Ontario, Kanata Vitel Electronics, 613-592-0090
Can	Ontario, Mississauga Vitel Electronics, 416-676-9720
Can	Quebec Lachine Vitel Electronics, 514-636-5951
Intl	Israel, Tel Aviv STG Intl., TEL: 972-3-561-8231
Intl	Japan, Tokyo Jepico Corp., TEL: 81-3-348-0611
PR	Mayaguez VG Sales, 809-831-4050

Distributors	
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Intl	England, Wales, Ireland Joseph Devine, TEL: 44-908-311-162
Intl	France, Massy Paris Sud Electronique, TEL: 33-1-6920-6699
Intl	Hong Kong Components Agent Ltd., TEL: 852-499-2688
Intl	India, Bangalore Connect, TEL: 91-812-540-620
Intl	Italy, Milano R.E.C., SRL, TEL: 39-2-9350-3074

Intl	Italy, Parma R.E.C. SRL, TEL: 39-521-698-641
Intl	Italy, Parma Commital S.P.A., TEL: 39-521-698-641
Intl	Italy, Roma R.E.C. SRL, TEL: 39-6-9107-450
Intl	Netherlands Avio-Diepen. B.V., TEL: 31-703-400-922
Intl	Scotland Kelpie E-M Ltd., TEL: 44-259-4-3333
Intl	Singapore Jireh Electronics, TEL: 65-271-9629
Intl	South Korea, Seoul J & Co., Ltd., TEL: 82-2-785-3836
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Intl	Sweden Nordquist & Berg, TEL: 46-8-764-6710
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Intl	West Germany, Munchen Hot Electronic, TEL: 49-89-612-1092-96
Intl	West Germany, Schorndrf Hot Electronic, TEL: 49-7181-3093

Devtek Systems	
	Devtek Systems P.O. Box 5224 Lancaster, Pennsylvania 17601 717-560-0652

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	Digital RF Solutions Corp. 3080 Olcott, Ste. 200-D Santa Clara, California 95054-3209 408-727-5995, 800-782-6266 FAX: 408-727-6474

Dionics	
	Dionics Inc. 65 Rushmore Street Westbury, New York 11590 516-997-7474 TWX: 510-222-0974


DSP Group	
	DSP Group, Inc. 4050 Moorpark Avenue San Jose, California 95117 408-985-0722 FAX: 408-985-2108

ECI Semiconductor	
	ECI Semiconductor 975 Comstock Street Santa Clara, California 95054 408-727-6562

Edsun Laboratories	
	Edsun Laboratories, Inc. 564 Main St Waltham, Massachusetts 02154 617-647-9300 TELEX: 853664 FAX: 617-894-6927

EG&G Reticon	
	EG&G Reticon Corporation 345 Potrero Avenue Sunnyvale, California 94086-4197 408-738-4266 TWX: 910-339-9343

Elantec	
	Elantec, Inc. 1996 Tarob Court Milpitas, California 95035 408-945-1323, outside CA 1-800-821-7429 TWX: 910-997-0649 FAX: 408-945-9305

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Electronic Designs Inc. 42 South Street Hopkinton, Massachusetts 01748 508-435-2341 TELEX: 948004 FAX: 508-435-6302	

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AL	Daphne Interep Associates, 205-478-1036
AL	Huntsville Interep Associates, 205-881-1096
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AZ	Phoenix EDI West (Direct Sales Office), 602-840-0004
CA	San Diego C.K. Associates, 619-279-7650
CA	Santa Clara Technology Sales Inc., 408-727-7200
CA	Woodland Hills Varigon, 818-594-5080
CT	Yalesville Comp Rep Associates, 203-269-1154
FL	Orlando Component Design Marketing, 407-240-3903
GA	Norcross Interep Associates, 404-449-8680
IL	Elk Grove Vlg Carlson Elect. Sales Assoc., 708-956-8240
IN	Indianapolis STB & Associates Inc., 317-844-9227
IA	Cedar Rapids Carlson Electronic Sales Assoc., 319-378-1450
MD	Severna Park New Era Sales, Inc., 301-544-4100
MA	Westwood Comp Rep Associates, 617-329-3454
MI	Framington Hills Action Components, 313-442-9880
MN	St. Paul K-Rep, 612-681-9510
MO	Florissant G.M. Brown & Assoc., 314-839-3600
NJ	W. Caldwell Technical Marketing Group, 201-226-3300
NY	Melville Technical Marketing Group, 516-351-8833
NY	New York Eastern Electronics Inc., 212-956-8100
NY	Syracuse T-Squared Electronics Co. Inc., 315-463-8592
NY	Victor T-Squared Electronics Co. Inc., 716-924-9101
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OH	Lyndhurst Midwest Marketing Associates, 216-381-8575
OK	Broken Arrow G.M. Brown & Associates, 918-251-2084

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- TX** **Grand Prairie**
Ion Associates, Inc., 214-647-8225
- TX** **Houston**
Ion Associates, Inc., 713-537-7717
- TX** **Irving**
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- WA** **Bellevue**
Thorson Company Northwest, 206-455-9180
- WI** **Milwaukee**
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- Can** **Ontario, Mississauga**
Indigo Electronics Ltd., 416-670-0284
- Can** **Quebec, Montreal**
Indigo Electronics Ltd., 514-626-6104
- Intl** **Australia, Bundoora**
KC Electronics Pty. Ltd., TEL:
011-613-467-4666
- Intl** **Australia, Victoria**
KC Electronics Pty. Ltd., TEL:
011-613-467-4666
- Intl** **Belgium, Zaventem**
Alcom Electronics BVBA, TEL: 32-3-828-38-80
- Intl** **Denmark, Frederiksberg**
T.M. A. Electronics, TEL: 45-3833-3030
- Intl** **France, Les Ulis Cedex**
Microel, TEL: 33-16-907-08-24
- Intl** **Germany, Heidenheim**
Inteltek, TEL: 49-73-21-20077
- Intl** **Israel, Tel-Aviv**
RDT Electronics Engineering Ltd., TEL:
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- Intl** **Italy, Milan**
Dimac Elettronica SRL, TEL: 39-39-491514
- Intl** **Norway, Oslo**
Henaco A/S, TEL: 47-2-16-21-10
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Monolitica S.A., TEL: 34-3-219-40-16
- Intl** **Sweden, Stockholm**
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- Intl** **Switzerland, Schieren**
Dimos AG., TEL: 41-1-730-40-88
- Intl** **The Netherlands**
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- Intl** **Tiawan, Taipei (ROC)**
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- Intl** **United Kingdom, Oxon**
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- Intl** **United Kingdom, Surrey**
Electronic Designs Europe Ltd., TEL:
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- CA** **San Jose**
Zeus Components, Inc., 408-629-4789
- CA** **Yorba Linda**
Zeus Components, Inc., 714-921-9000
- CT** **Danbury**
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- FL** **Miami**
All American, 305-621-8282
- FL** **Oviedo**
Zeus Components, Inc., 407-365-3000
- FL** **Sunrise**
All American, 305-572-7999

- MD** **Columbia**
Zeus Components, Inc., 301-997-1118
- MA** **Wakefield**
Zeus Components, Inc., 617-246-8200
- NM** **Albuquerque**
Alliance Electronics, 505-292-3360
- NY** **N. Lindenhurst**
Phase 1 Technology Corp., 516-957-4900
- NY** **Port Chester**
Zeus Components, Inc., 914-937-7400
- NY** **Ronkonkoma**
Zeus Components, Inc., 516-737-4500
- OH** **Dayton**
Zeus Components, Inc., 513-293-6162
- TX** **Richardson**
Zeus Components, Inc., 214-783-7010
- Can** **Ontario, Markham**
Semad, 416-475-8500

Ericsson

Ericsson Components
(Formerly RIFA, Inc.)
403 International Parkway
Richardson, Texas 75085-3904
214-480-8300



NU HORIZONS ELECTRONICS CORP.

- NY (516) 226-6000
- NJ (201) 882-8300
- MA (617) 246-4442
- No. NY (716) 248-5980
- MD (301) 995-6330
- PA (609) 596-1833
- FL (305) 735-2555



Exar

Exar Corporation
2222 Qume Drive, PO Box 49007
San Jose, CA 95161-9007
408-434-6400
TWX: 910-339-9233

Sales Office & Representatives

- AL** **Huntsville**
Interep Inc., 205-881-1096
- AK**
Call EXAR Direct
- AZ** **Mesa**
Systems Sales of Arizona, 602-464-9989
- AR**
See Texas
- CA** **Cerritos**
EXAR Corp. (Southern Regional Sales),
231-860-1919
- CA** **Cossta Mesa**
Competitive Tech. Inc., 714-557-3042
- CA** **Escondido**
Eagle Technical Sales, 619-743-6550
- CA** **San Jose**
Exar Corp. (Northern Regional Sales),
408-432-7294
- CA** **San Jose**
Tri Par, 408-262-3190
- CO** **Lakewood**
Candal Inc., 303-935-7128
- CT** **Danbury**
HLM Assoc., 203-791-1878
- DE**
See Maryland
- DC**
See Maryland
- FL** **Altamonte Springs**
Semtronic Assoc., 305-831-8233

- FL** **Clearwater**
Semtronic Assoc., 813-461-4675
- FL** **Ft. Lauderdale**
Semtronic Assoc., 305-731-2484
- GA** **Norcross**
Interep Associates, 404-449-8680
- HI**
Call EXAR Direct
- ID**
See Washington
- IL** **Northbrook**
Dolin Sales Co. Inc., 708-498-6770
- IL** **Schaumburg**
EXAR Corp. (Central Regional Sales),
708-303-0063
- IL** **Southern Illinois**
See Missouri
- IN** **Kokomo**
Schillinger Assoc. Inc., 317-455-2708
- IA** **Cedar Rapids**
C.H. Horn & Assoc., 319-393-8703
- KS** **Wichita**
DLE Electronics, 316-683-6400
- KY**
See Ohio
- LA**
See Texas
- ME**
See Massachusetts
- MD** **Westminster**
Chesapeake Tech., 301-875-0004
- MA** **Burlington**
A/D Nova Sales, 617-270-9600
- MA** **Burlington**
EXAR Corp. (Eastern Regional Sales),
617-273-3927
- MI**
See EXAR Corp. (East/Central)
- MN** **Minneapolis**
Components Group, 612-374-1250
- MS**
See Alabama
- MO** **St. Louis**
The John G. Macke Co., 314-432-2830
- MT**
See Colorado
- NE**
See Missouri
- NV**
See California, No.
- NH**
See Massachusetts
- NJ** **Haddonfield**
Sunday-O'Brien, 609-429-4013
- NJ** **Northern New Jersey**
See Great Neck, NY
- NM** **Albuquerque**
System Sales of Ariz., 505-889-2901
- NY** **Buffalo**
Quality Comps., 716-837-5430
- NY** **Central Islip**
EXAR Corp. (Eastern), 516-582-4420
- NY** **Great Neck**
Trionic Assoc., 516-466-2300
- NY** **Manlius**
Quality Comps., 315-682-8885
- NC** **Raleigh**
Zucker Assoc., 919-782-8433
- ND**
See Minnesota
- OH** **Centerville**
Omega Sales Inc., 513-434-5507
- OH** **Cleveland**
Exar Corp. (East/Central Regional Sale),
216-292-8106
- OH** **Cleveland**
Omega Sales Inc., 216-360-9400
- OK**
See Texas
- OR** **Tigard**
Components West, 503-684-1671
- PA**
See Haddonfield, NJ

Exar	(Cont'd)	Intl		CA		
PA	See EXAR Corp. (East/Central)	Intl	Singapore, Singapore SeaMax Engineering PL, TEL: 4451828	CA	West Lake Village A.V.E.D., 818-889-2861	
RI	See Massachusetts	Intl	Singapore, Singapore ROHM Elctns. Co. Pte. Ltd., TEL: 65-745-9342	CA	Westlake Village Jaco, 805-495-9998	
SD	See Minnesota	Intl	South Africa, Randburg South Continental Devices (Pty.) Ltd., TEL: 789-2400	CO	Englewood Sterling Elec, 303-792-3939	
TN	See North Carolina	Intl	South America (Mt. View CA) Intectra, TEL: 415-967-8818	CO	Thornton Marshall Elctns., 303-451-8444	
TN	Green Ville Interep, 615-639-3491, 615-639-3492	Intl	Spain, Madrid Unitronics, S.A., TEL: 34-542-5204	CO	Westminister Future Electronics, 303-650-0123	
TX	Austin Sage Marketing, 512-335-0300	Intl	Sweden Traco A.B., TEL: 46-0-8930000	CO	Wheatridge Bell Inds., 303-424-1985	
TX	Bedford Sage Marketing, 817-267-7781	Intl	Switzerland, Baden-Datwill Ascrom-Primotec, TEL: 415-6840171	CO	Wheatridge A.V.E.D., 303-422-1701	
UT	Bountiful Anderson Assoc., 801-292-8991	Intl	Tawian, Taipei, China Sea Union, TEL: 751-2063	CT	Bethel Future Electronics, 203-743-9594	
VT	See Massachusetts	Intl	Turkey, Istanbul Inter, A.S., TEL: 90-1-360-4374	CT	Wallingford Marshall Elctns., 203-265-3822	
VA	See Maryland	Intl	W. Germany, Munchen ROHM Electronics GmbH, TEL: 089-350-7021	DE	See Pennsylvania	
WA	Redmond Components West, 206-885-5880	Intl	West Germany, Muehlenstrasse ROHM Elctns. GmbH, TEL: (02161) 61010-1	FL	Altamonte Springs Marshall Elctns., 305-767-8585	
WA	Spokane Components West, 509-922-2412	Distributors			FL	Altamonte Springs Future Electronics, 407-767-8414
WV	See EXAR Corp. (East/Central)	AL	Bell Industries, 205-837-1074	FL	Clearwater Future Elctns., 813-578-2770	
WI	See Minnesota	AL	Huntsville Reptron, 205-722-9500	FL	Deerfield Beach Bell Industries, 305-421-1997	
WI	Milwaukee Dolin Sales Co. Inc., 414-482-1111	AK	Call EXAR Direct	FL	Fort Lauderdale Marshall Elctns., 305-977-4880	
WY	See Colorado	AZ	Phoenix Marshall, 602-496-0290	FL	Ft. Lauderdale Reptron, 305-735-1121	
Can	Ontario, Brampton Clark Hurman Assoc., 416-840-6066	AZ	Phoenix Sterling Elctns., 602-437-5565	FL	Ft. Lauderdale Nu Horizons, 305-735-2555	
Can	Ontario, Nepean Clark Hurman Assoc., 613-727-5626	AZ	Phoenix Future Electronics, 602-968-7140	FL	Tampa Reptron, 813-855-4656	
Can	Quebec, Pointe Claire Clark Hurman, 514-426-0453	AZ	Tempe Bell Industries, 602-966-7800	GA	Norcross Reptron, 404-446-1300	
Intl	Australia, Mentone, Victoria Tronic Bits, TEL: 61-3-555-6777	CA	Bell Inds, 213-515-1800	GA	Norcross Future Electronics, 404-441-7676	
Intl	Austria, Vienna Transohm Vertriebs GmbH, TEL: 43-222-610660	CA	Agoura Hills Bell Inds., 818-706-2608	GA	Norcross Marshall Elctns., 404-923-5750	
Intl	Brazil, Baqueri ROHM Elctna. Ltda., TEL: 421-4577	CA	Chatsworth Marshall Elctns., 818-407-4100	GA	Norcross Bell Industries, 404-662-0923	
Intl	Denmark, Horsholm Mer-el A/S, TEL: 45-42-571000	CA	Chatsworth Future Electronics, 818-772-6240	ID	See Washington	
Intl	England, Woking Surrey Microlog, TEL: 444-83-729551	CA	Cypress Bell Inds, 714-895-7801	IL	Bensenville Goold Electronics, 708-860-7171	
Intl	Finland, Espoo Yleiselektroniikka/oy, TEL: 90-452-1255	CA	El Monte Marshall Elctns., 818-307-6000	IL	Elk Grove Village Bell Industries, 312-640-1910	
Intl	Finland, Espoo Spelicon, TEL: 35804375280	CA	Irvine Marshall Elctns., 714-458-5360	IL	Schaumburg Marshall Elctns., 708-490-0155	
Intl	France, Sevres Cede Tekelec Airtronic, TEL: 1-4534-7535	CA	Irvine Future Electronics, 714-250-4141	IL	Schaumburg Reptron, 708-882-1700	
Intl	Holland, Amsterdam Nijkerk Elek., TEL: 20-5495969	CA	Los Angeles Bell Inds, 213-826-6778	IL	Schaumburg Future Electronics, 312-882-1255	
Intl	Hong Kong, Kowloon ROHM Elctns. Ltd., TEL: 3-7399791	CA	Milpitas Marshall Elctns., 408-943-4600	IL	Urbana Bell Industries, 217-328-1077	
Intl	India, Banalore Testech Elec, TEL: 611201	CA	Rancho Cardova Marshall Elctns, 916-635-9700	IN	Ft. Wayne Bell Industries, 219-423-3422	
Intl	Israel, Herzlia Vectronics Ltd, TEL: (052) 556070	CA	Rocklin Bell Inds., 916-652-0414	IN	Indianapolis Marshall, 317-297-0483	
Intl	Italy, Milano Moxel S.R.L., TEL: 02-61-29-05-21	CA	San Diego Bell Industries, 619-268-1277	IN	Indianapolis Bell Industries, 317-634-8200	
Intl	Japan, Kawasaki-Shi CTC Components Systems Co. Ltd., TEL: 044-852-1825	CA	San Diego Marshall Elctns., 619-578-9600	IA	See Illinois	
Intl	Japan, Kyoto EXAR Japan Corp., TEL: 075-322-8440	CA	San Diego Future Electronics, 619-278-5020	KS	Lenexa Marshall Elec., 913-492-3121	
Intl	Japan, Tokyo Tokyo Electron Ltd., TEL: (0423) 33-8111	CA	San Diego A.V.E.D., 619-558-8890	KY	See Indiana	
Intl	Korea, Seoul Hanaro Corp., TEL: (02) 784-1144	CA	San Jose Exar Corporation, 408-434-6400	LA	See Texas	
Intl	Mexico Electronica Comp., TEL: 575-8465	CA	San Jose Future Electronics, 408-434-1122	ME	See Massachusetts	
Intl	New Zealand, Auckland Professional Elctns. Ltd., TEL: 493-0480	CA	San Jose Jaco, 408-432-9290	MD	Columbia Vantage Components, 301-720-5100	
Intl	Norway, Oslo Hefro Elektronikkas, TEL: 47-02-107300	CA	Sunnyvale Bell Inds., 408-734-8570	MD	Columbia Future Electronics, 301-995-1222	
Intl	Portugal, Lisboa Niposom J. Nabais Lda, TEL: 351-1896610	CA	Tustin A.V.E.D., 714-259-8258	MD	Columbia Nu Horizons Elect., 301-995-6330	

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Exar	(Cont'd)		
MA Wakefield Nu Horizons, 617-246-4442		OH Dayton Marshall Elctns., 513-898-4480	Can Alberta, Calgary ITT Multicomponents, 403-251-5888
MA Westborough Future Electronics, 617-366-2400		OH Dayton Bell Industries, 513-434-8231	Can Alberta, Calgary Future Electronics, 403-235-5325
MA Wilmington Marshall Elctns., 617-658-0810		OH Dayton Bell Industries, 513-435-8660	Can Alberta, Edmonton Future Electronics, 403-438-2858
MA Winchester Bell Industries, 617-729-5800		OH Solon Marshall Elctns., 216-248-1788	Can Alberta, Edmonton ITT Multicomponents, 403-451-4001
MI Ann Arbor Bell/Graham, 313-971-9093		OH Solon Reptron Electronics, 216-349-1415	Can British Columbia, Vancouver Future Electronics, 604-294-1166
MI Livonia Reptron Elctns., 313-525-2700		OH Westerville Marshall, 614-891-7580	Can British Columbia, Burnaby ITT Multicomponents, 604-291-8866
MI Livonia Marshall Elctns., 313-525-5850		OH Worthington Reptron Elctns., 614-436-6675	Can Manitoba, Winnipeg ITT Multicomponents, 204-786-8401
MI Livonia Future Electronics, 313-591-4004		OK Tulsa Jaco/QC, 918-664-8812	Can Manitoba, Winnipeg Future Electronics, 204-339-0554
MN Eden Prairie Future Electronics, 612-944-2200		OR Beaverton Future Electronics, 503-645-9454	Can New Brunswick, Monoton ITT Multicomponents, 506-857-8011
MN Minnetonka Reptron, 612-938-0000		OR Beaverton Marshall Elctns., 503-644-5050	Can Nova Scotia, Dartmouth ITT Multicomponents, 902-465-2350
MN Plymouth Marshall Elctns., 612-559-2211		OR Lake Oswego Bell Inds., 503-241-4115	Can Ontario, Concord ITT Multicomponents, 416-736-1144
MS See Georgia		PA Mc Kean Advacom, 814-476-7774	Can Ontario, Downsview Future Electronics, 416-638-4771
MO Bridgeton Marshall Electronics, 314-291-4650		PA Pittsburgh Marshall, 412-788-0441	Can Ontario, Nepean ITT Multicomponents, 613-226-7406
MT Call EXAR Direct		RI See Massachusetts	Can Ontario, Ottawa Future Electronics, 613-820-8313
NE See Missouri		SC Call EXAR Direct	Can Ontario, Rexdale Marshall, 416-674-2161
NV See California		TN Nashville Bell Industries, 615-367-4400	Can Quebec Marshall, 514-683-9440
NH Hudson Bell Industries, 603-882-1133		TX Addison Jaco/QC, 214-733-4300	Can Quebec, Montreal Future Electronics, 514-694-7710
NJ Berlin GCI, 609-768-6767		TX Austin Jaco/QC, 512-835-0220	Can Quebec, St. Foy Future Electronics, 418-682-5775
NJ Fairfield Marshall Elctns., 201-882-0320		TX Austin Marshall Elctns., 512-837-1991	Can Quebec, Ville St. Laurent ITT Multicomponents, 416-736-1144
NJ Fairfield Future Electronics, 201-227-4346		TX Brownsville Marshall Electronics, 512-542-4589	Can Saskatchewan, Saskatoon ITT Multicomponents, 306-933-2888
NJ Marlton Nu Horizons, 215-557-6450		TX Carrollton Marshall Elctns., 214-895-9200	
NJ Mt. Laurel Marshall Elctns., 609-234-9100		TX Carrollton Reptron Electronics, 214-702-9373	
NJ Mt. Laurel Future Electronics, 609-778-7600		TX El Paso Marshall Electronics, 915-593-0706	
NJ Pinebrook NuHorizons, 201-882-8300		TX Houston Marshall Elctns., 713-895-9200	
NM Albuquerque Bell Inds., 505-292-2700		TX Richardson Future Electronics, 214-437-2437	
NY Central Islip Exar Corporation, 516-582-4420		TX Richardson Bell Industries, 214-690-0466	
NY East Rochester Nu Horizons, 716-248-5980		TX Sugarland Jaco/QC, 713-491-2255	
NY Farmingdale Bell Industries, 516-752-9303		UT Brookfield A.V.E.D., 801-975-9500	
NY Hauppauge Marshall Elctns., 516-273-2424		UT Salt Lake City Marshall Elect., 801-485-1551	
NY Hauppauge JACO, 516-273-5500		UT Salt Lake City Bell Inds., 801-972-6969	
NY Hauppauge Future Electronics, 516-2324-4000		UT Salt Lake City Future Electronics, 801-972-8489	
NY Johnson City Marshall Elctns., 607-798-1611		VT See Massachusetts	
NY Liverpool Future Elec., 315-451-2371		VA See Maryland	
NY N. Amityville Nu Horizons, 516-226-6000		WA Bell Inds., 206-885-9963	
NY Rochester Marshall Elctns., 716-235-7620		WA Bellevue IEC, 206-455-2727	
NY Rochester Future Elec., 716-272-1120		WA Bothell Marshall Elctns., 206-486-5747	
NC Charlotte Future Electronics, 704-529-5500		WA Redmond Future Electronics, 206-881-8199	
NC Raleigh Marshall Elec., 919-878-9882		WV See Virginia	
NC Raleigh Reptron Electronics, 919-832-3117		WI Brookfield Marshall Elec., 414-797-8400	
OH Cleveland Exar Corporation, 216-292-8106		WI Mequon Taylor Elec. Co., 414-241-4321	
		WI Waukesha Bell Inds., 414-547-8879	
		WY See Colorado	

NU HORIZONS

NU HORIZONS ELECTRONICS CORP.

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 NJ (201) 882-8300
 MA (617) 246-4442
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EXEL Microelectronics

EXEL Microelectronics, Inc.
 2150 Commerce Dr, P.O. Box 49038
 San Jose, California 95161
 408 432-0500
 TELEX: 17339
 TWX: 910-338-2116
 FAX: 408 434-6444 or 408 432-8710

Sales Office & Representatives

AL	Huntsville Strategic Marketing, 205-464-0490
AK	See Redmond, WA (Components West)
AZ	Mesa System Sales, 602-464-9989
AR	See Austin, TX (Sage Marketing)
CA	Dana Point Eltec Enterprises, 714-493-7003
CA	Mountain View Trinity Technologies, Inc., 415-961-1700
CA	San Jose Exel Microelectronics, 408-432-0500

EXEL Microelectronics (Cont'd)		RI	Distributors
CO	Colorado Springs Alliance Electronics, 719-531-5200	See Burlington, MA (Ad Nova)	AL Huntsville Marshall Industries, 205-881-9235
CO	Denver Alliance Electronics, 303-433-1648	SC See Nashville, TN (Strategic Marketing)	AL Huntsville Reptron, 205-722-9500
CT	Fairfield NRG Limited, 203-384-1112	SD Minneapolis, MN (Components Group)	AK See Exel Direct
DE	See Baltimore, MD (Conroy Sales)	TN Jonesboro Strategic Marketing	AZ Phoenix Marshall Industries, 602-496-0290
FL	Altamonte Springs Semtronic Assoc., 407-831-8233	TN Nashville Strategic Marketing, 615-883-7882	AZ Scottsdale Added Value Electronic Dist., 602-951-9788
FL	Clearwater Semtronic Assoc., 813-461-4675	TX See Albuquerque, NM (System Sales Of AZ)	AZ Tempe Bell Industries, 602-966-7800
FL	Ft. Lauderdale Semtronic Assoc., 305-731-2484	TX Austin Sage Marketing, 512-335-0300	CA Agoura Hills Bell Industries, 818-706-2608
GA	See Nashville, TN (Strategic Marketing)	TX Bedford Sage Marketing, 817-267-7781	CA Carlsbad Aegis Electronic Group, Inc., 619-729-2026
HI	See San Jose, CA (Exel Microelectronics)	UT See Denver, CO (Alliance Electronics)	CA Chatsworth Marshall Inc., 818-407-4100
ID	See Redmond, WA (Components West)	VT See Burlington, MA (Ad Nova)	CA Cypress Bell Industries, 714-894-7801
IL	Northbrook Dolin Sales Co., 708-498-6770	VA See Baltimore, MD (Conroy Sales)	CA El Monte Marshall Ind. (Corp. Office), 818-459-5500
IN	Kokomo Schillinger Assoc., 317-455-2708	WA Redmond Components West, 206-885-5880	CA Irvine Marshall Ind., 714-458-5360
IA	See San Jose, CA (Exel Microelectronics)	WV See Kokomo, IN (Schillinger Associates)	CA Los Angeles Bell Industries, 213-826-6778
KS	See San Jose, CA (Exel Microelectronics)	WI See Minneapolis, MN (Components Group)	CA Milpitas Marshall Ind., 408-942-4600
KY	See Nashville, TN (Strategic Marketing)	WI Glendale Dolin Sales, 414-482-1111	CA Rancho Cordova Marshall Ind., 916-635-9700
LA	See Austin, TX (Sage Marketing)	WY See Denver, CO (Alliance Electronics)	CA Rocklin Bell Industries, 916-652-0414
ME	See Burlington, MA (AD Nova)	Can Ontario, Mississauga Canadian Marketing Tech., 416-612-0900	CA San Diego Bell Industries, 619-268-1277
MD	Baltimore Conroy Sales, 301-296-2444	Intl Australia, Victoria Tronic Bits, TEL: 011-613-555-6777	CA San Jose Marshall Ind., 619-578-9600
MA	Burlington A/D Nova Sales, 617-270-9600	Intl France, Rungis Cedex Rohm Electronics GmbH, TEL: 011-33-1-46-759051	CA San Jose Future Electronics, 408-434-1122
MI	Grasse Point Park Greiner Associates, Inc., 313-499-0188	Intl Hong Kong, Kowloon Tektron Electronics Ltd., TEL: 011-852-388-0629	CA Sunnyvale Bell Industries, 408-734-8570
MN	Minneapolis Components Group, 612-374-1250	Intl Hong Kong, Kowloon RTI Industries Co.Ltd., TEL: 011-852-795-7421	CA Tustin A.V.E.D., 714-259-8258
MS	See Huntsville, AL (Strategic Marketing)	Intl Hong Kong, Kowloon Rohm Electronics Co. Ltd., TEL: 011-852-7399791-8	CO Broomfield Future Electronics, 303-650-0123
MO	St. Louis John Macke, 314-432-2830	Intl India, Bombay Jatin Electronics Pvt.Ltd, TEL: 011-91-22-411-45-85	CO Thornton Marshall Ind., 303-451-8383
MT	See Denver, CO (Alliance Electronics)	Intl Japan, Tokyo KH Electronics Corp., TEL: 011-81-3-587-1041	CO Wheatridge Bell Industries, 303-424-1985
NE	See San Jose, CA (Exel Microelectronics)	Intl Japan, Tokyo Systems Mktg, TEL: 011-81-3-254-2751	CT Bethel Future Electronics, 203-743-9594
NV	See Mountain View, CA (Trinity Technologies, Inc.)	Intl Korea, Seoul Hanaro Corp., TEL: 011-82-2-558-1144	CT Meriden JACO, 203-235-1422
NH	See Burlington, MA (Ad Nova)	Intl Malaysia, Penang Microtronics Associates Pte. Ltd., TEL: 04-214518	CT Wallingford Marshall Ind., 203-265-3822
NJ	See Great Neck, NY (Trionic Associates)	Intl Mexico Electronica Comp Modulos, TEL: 011-52-604-95-19	DE See Pittsburgh, PA (Marshall Ind.)
NJ	See Willow Grove, PA (Tech Sales Associates)	Intl New Zealand, Auckland Professional Elctrn. Ltd., TEL: 64-9-463-048	FL Altamonte Springs Bell Industries, 407-339-0078
NM	Albuquerque System Sales, 505-889-2901	Intl Singapore, Industrial Park Microtronics Assoc. PTD, Ltd., TEL: 011-65-748-1835	FL Altamonte Springs Marshall Ind. (Orlando Div.), 407-767-8585
NY	Buffalo Quality Comps., 716-837-5430	Intl So. Africa, Randburg South Continental Devices, TEL: 011-27-11-886-2920	FL Altamonte Springs Future Electronics, 407-767-8414
NY	Great Neck Trionic Assocs., 516-466-2300	Intl Taiwan, Taipei Sea Union Eng. Ltd., TEL: 011-886-2-7516856	FL Altamonte Springs Vantage Components Inc.
NY	Manlius Quality Comps., 315-682-8885	Intl Tawian, Taipei Jeritron Ltd., TEL: 011-886-2-882-0710	FL Clearwater Future Electronics, 813-578-2770
NC	See Nashville, TN (Strategic Marketing)	Intl Thailand, Bangkok Microtronics Thai Ltd., TEL: 662-254-8676	FL Deerfield Beach Vantage Components Inc., 305-429-1001
ND	See Minneapolis, MN (Components Group)	Intl United Kingdom, Milton Keynes Rohm Electronics, TEL: 011-44-908-271311	FL Fort Lauderdale Reptron, 305-735-1112
OH	See Kokomo, IN (Schillinger Associates)	Intl West Germany, Korschbroich Rohm Electronics GmbH, TEL: 011-49-2161-6101	FL Ft. Lauderdale Nu Horizons, 305-735-2555
OK	See Austin, TX (Sage Marketing)	PR Hado Rey Semtronic Associates, 809-766-0701	FL Ft. Lauderdale Marshall Ind., 305-977-4880
OR	Tigard Components West, 503-684-1671		FL St. Petersburg Marshall Ind., 813-576-1399
PA	See Kokomo, IN (Schillinger Associates)		FL Tampa Reptron, 813-855-4656
PA	Willow Grove Tech Sales Associates, 215-784-0170		FL Tampa Reptron, 813-855-4656

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EXEL Microelectronics (Cont'd)					
GA	Norcross Bell Electronics, 404-662-0923	NH	Hudson Bell Industries, 603-882-1133	UT	Salt Lake City Future Electronics, 801-972-8489
GA	Norcross Repron, 404-446-1300	NJ	Clifton Vantage Components, 201-777-4100	VT	See Massachusetts
GA	Norcross Marshall Ind., 404-923-5750	NJ	Fairfield Marshall Ind., 201-882-0320	VA	See Maryland
GA	Norcross Future Electronics, 404-441-7676	NJ	Fairfield Future Electronics, 201-227-4346	WA	Bothell Marshall Ind., 206-486-5747
ID	See Washington	NJ	Marlton Nu Horizons, 609-596-1833	WA	Redmond Bell Industries, 206-885-9963
IL	Elk Grove Village Bell Industries, 312-640-1910	NJ	Mt. Laurel Future Electronics, 609-778-7600	WA	Redmond Future Electronics, 206-881-8199
IL	Schaumburg Marshall Ind., 708-490-0755	NJ	Mt. Laurel Marshall Ind., 609-234-9100	WA	Redmond JACO Electronics, Inc., 206-882-9700
IL	Schaumburg Repron, 708-882-1700	NJ	Pine Brook Nu Horizons, 201-882-8300	WA	Waukesha Marshall Ind., 414-796-8400
IL	Schaumburg Future Electronics, 708-882-1255	NM	Albuquerque Bell Industries, 505-292-2700	WA	Waukesha Bell Ind., 414-547-8879
IN	Ft. Wayne Bell Electronics, 219-423-3422	NY	E. Rochester Nu Horizons, 716-248-5980	WY	See Colorado
IN	Indianapolis Bell Electronics, 317-875-8200	NY	Farmingdale Bell Industries, 516-652-9303	Can	Alberta, Calgary Future Electronics, 403-235-5325
IN	Indianapolis Marshall Ind., 317-297-0483	NY	Hauppauge JACO, 516-273-5500	Can	Alberta, Calgary ITT Multicomponents, 403-273-2780
KS	Lenexa Marshall Ind., 913-492-3121	NY	Hauppauge Marshall Ind., 516-273-2424	Can	Alberta, Edmonton Future Electronics, 403-438-2858
KY	See Indiana/Ohio	NY	Johnson City Marshall Ind., 607-798-1611	Can	Alberta, Edmonton ITT Multicomponents, 403-436-9555
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Applications Engineering:
Ed Barnett, Director of ASIC Product Mktg.

Literature:
Technical publications

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MA	Wilmington Marshall Industries, 508-658-0810	NC	Raleigh Repron Electronics, 919-870-5189
MA	Wilmington Marshall Ind., 508-658-0810	NC	Raleigh Marshall Industries, 919-878-9882
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NY	Amityville Nu Horizons, 516-226-6000
NY	Rochester Nu Horizons, 716-248-5980
Intl	Japan, Tokyo Kawasho Corp., TEL: 81-03-578-5190

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Sales Office & Representatives

AL	Huntsville EMA, Inc., 205-880-8050
AK	See Worcester, MA (Micro Networks)
AZ	Phoenix Compass Marketing, 602-996-0635
AR	See Dallas, Tx (Micro Networks-TX)
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CA	San Jose Nelson Electronic Sales, 408-437-9300
CA	Santa Ana U.S. Regional Sales, 714-261-5044
CO	Englewood Compass Marketing, 303-721-9663
CT	Wallingford John E. Boeing Co., 203-265-1318
DE	See Owings Mills, MD (Walker-Houck Assoc.)
DC	See Owings Mills, MD (Walker-Houck Assoc.)
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HI	See Worcester, MA (Micro Networks)
ID	Boise James J. Backer Co., 208-343-9831
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IL	Itasca Beta Technology Sales, Inc., 708-250-9586
IN	Ft. Wayne Corrao & Marsh, 219-482-2725
IA	Davenport Rush & West Assoc., 319-388-9494
KS	Olathe Rush & West Assoc., 913-764-2700
KY	See Greenfield, IN (Corrao & Marsh)
LA	See Dallas, TX (Micro Networks-TX)
ME	See Chelmsford, MA (John E. Boeing Co.)
MD	Owings Mills Walker-Houck Assocs., 301-356-9500
MA	Chelmsford John E. Boeing Co., 508-256-5800
MA	Worcester U.S. Regional Sales, 508-852-5400
MI	Farmington Hills Action Components Sales, 313-442-9880
MN	Eden Prairie Aldridge and Assocs., 612-944-8433
MS	See Greenville, SC (EMA, Inc.)
MO	St. Louis Rush & West Assoc., 314-965-3322
MT	See Englewood, CO (Compass Marketing)

NE	See Davenport, IA (Rush & West Assoc.)
NV	See San Jose, CA (Nelson Electronic Sales)
NV	See Phoenix, AZ (Compass Marketing)
NH	See Chelmsford, MA (John E. Boeing Co.)
NJ	See Norristown, PA (Rivco January, Inc.)
NJ	See Rockville Centre, NY (S-J Assoc., Inc.)
NM	Albuquerque Compass Marketing, 505-344-9990
NY	Rockville Centre S-J Sales Assoc., Inc., 516-536-4242
NY	Victor NET Sales Co., 716-924-1844
NC	Greensboro Greensboro Div., 919-852-6200
NC	Raleigh EMA, Inc., 919-847-8800
ND	See Eden Prairie, MN (Aldridge and Assoc.)
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SD	See Eden Prairie, MN (Aldridge and Assoc.)
TN	See Greenville, SC (EMA, Inc.)
TX	Dallas U.S. Regional Sales, 714-261-5044
TX	Dallas Sales Office, 214-341-7248
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UT	Bountiful Anderson Assoc., 801-292-8991
VT	See Chelmsford, MA (John E. Boeing Co.)
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WA	Seattle James J. Backer Co., 206-285-1300
WV	See Owings Mills, MD (Walker-Houck Assoc.)
WI	Milwaukee Beta Technology Sales, Inc., 414-543-6609
WY	See Englewood, CO (Compass Marketing)
Can	Quebec, Lachine Vitel Electronics, 514-636-5951
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Intl	Italy, Milano Unitrode S.R.L., TEL: 39-2-48007831
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- CA** Cardiff
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CO	Parker Promotional Technology, 303-841-4664
CT	Cheshire Datatrack Engineering, Inc., 203-271-1311
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FL	Cooper City NEC Electronics (Eastern), 305-438-8114
FL	Ft. Lauderdale V.G. Sales Co. Inc., 305-938-4333
FL	Largo V.G. Sales Co. Inc., 813-536-7787
FL	Maitland NEC Electronics (Southeast), 407-875-1145
GA	Norcross 20th Century Marketing Inc., 404-445-1999
GA	Norcross NEC Electronics (Southeast), 404-447-4409
IL	Arlington Heights NEC Electronics (Midwest), 312-577-9090
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IN	Ft. Wayne Technology Marketing Corp., 219-432-5553
IA	Cedar Rapids Stan Clothier Co., 319-393-1576
KS	Overland Park AME Sales, 913-262-3871
KY	Louisville Technology Marketing Corp., 502-893-1377
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MA	Natick NEC Electronics (Northeast), 508-650-4100
MA	Woburn Compass Technology, 617-933-3336
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MI	Novi Miltimore Sales, 313-349-0260
MI	Troy NEC Electronics (Midwest), 313-680-0506
MN	Bloomington NEC Electronics (Midwest), 612-854-4443
MN	Eden Prairie Stan Clothier Company, 612-944-3456
MO	St. Charles AME Sales, 314-926-2599
NJ	Fairfield Metro Logic Corp., 201-575-5585
NJ	Moorestown TAI Corp., 609-776-5353
NY	Fairport NEC Electronics (Northeast), 716-425-4590
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NY	Jericho NEC Electronics (Northeast), 516-932-5700
NY	Pittsford Elcom Sales, 716-385-1400
NY	Skaneateles Elcom Sales, 315-685-8245
NC	Charlotte Quantum Marketing Inc., 704-523-8822
NC	Durham NEC Electronics (Southeast), 919-544-4132

NC	Raleigh Quantum Marketing Inc., 919-846-5728
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WA	Bellevue Venture Electronics, 206-454-4594
WI	Mequon Martan Inc., 414-241-4955
Can	British Columbia, Burnaby Kaytronics Western, 604-294-2000
Can	Ontario, Concord Kaytronics, 416-669-2262
Can	Ontario, Kanata Kaytronics, 613-592-6606
Can	Quebec, Ville St-Laurent Kaytronics, 514-745-5800
PR	Mayaguez V.G. Sales Co. Inc., 809-831-4151

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CA	Irvine Prism Associates, 213-641-6768
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CO	Denver (CO, UT, WY, MT) Donahue Sales Co., 303-455-1719
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NY	Rochester Gen-Tech, 716-467-5016
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PA	West Chester (E. PA, So. NJ, DE) TCA & Associates, 215-692-6853
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TX	Dallas (LA, OK, TX, AR) Oeler & Menelaides, 214-361-8876
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FL	Ft. Lauderdale Nu Horizons, 305-735-2555
FL	Longwood Jaco Electronics, 407-332-0668
FL	Tampa Jaco Electronics, 813-628-4665
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MD	Columbia Jaco Electronics Inc., 301-995-6620
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MA	Wilmington Jaco Electronics, 617-273-1860
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NY	Hauppauge Jaco Electronics, 516-273-5500
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CA	Escondido Reider Associates, 619-741-0496
CA	San Diego Reider Associates, 619-741-0496
CT	See Milford, MA (AFM Group)
DE	See Harleysville, PA (Thomas Jackson Associates)
FL	See Huntsville, AL (Mec-Elec Components, Inc.)
GA	See Huntsville, AL (Mec-Elec Components, Inc.)
IL	Berkeley ESA Technical Marketing, 708-544-0120
ME	See Milford, MA (AFM Group)
MA	Milford AFM Group, 508-478-3355
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MS	See Huntsville, AL (Mec-Elec Components, Inc.)
NH	See Milford, MA (AFM Group)
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NY	Webster Impaq Electronic Sales, 716-265-2540
PA	Harleysville Thomas Jackson Associates, 215-256-8877
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TN	See Huntsville, AL (Mec-Elec Components, Inc.)
VT	See Milford, MA (AFM Group)
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Intl	Taiwan, Taipei Chanel Trading Co., Ltd., TEL: 02-561-8462
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Intl	Taiwan, Taipei Taiwan EI-EN Enterprise Co., Ltd., TEL: 02-3225970
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Intl	France, Rue Anatole AXCO S.a.r.l., TEL: 1-47581220
Intl	Hong Kong Array Electronics, Ltd., TEL: 4816832
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Intl	Hong Kong, North Point S & T Enterprises, Ltd., TEL: 5-784921
Intl	Singapore S & T Enterprises, Ltd., TEL: 7459235

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CA Irvine
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Simpson & Assoc., 303-794-8381

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Kitchen & Kutchin, 203-239-0212

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See Sterling, VA (Beacon North)

DC
See Sterling, VA (Beacon North)

FL Orlando
Currie, Peak & Frazier, Inc., 407-855-0843

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See Salt Lake City, UT (Quorum 3)

GA Duluth
Currie, Peak and Frazier, Inc., 404-497-9404

GA Norcross
Rockwell Int'l Semiconductor, 404-446-7414

IL Itasca
LTD Technologies Inc., 312-773-2900

IL Rosemont
Rockwell Int'l Semiconductor, 312-297-8862

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Robert O. Whitesell & Associates, 317-359-9283

IN Kokomo
Robert O. Whitesell & Associates, 317-457-9127

IA Cedar Rapids
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		Intl	Mexico, DF Philips Components, TEL: 52-721-64-984
		Intl	Mexico, Guadalajara, Jal Philips Components, TEL: 52-36-52-27-70
		Intl	Netherlands, Eindhoven Philips Nederland B.V., TEL: 31-40-783749
		Intl	New Zealand, Auckland Philips New Zealand Ltd., TEL: 64-9-605914
		Intl	Norway, Oslo Norsk A/S Philips, TEL: 47-2-68-02-00
		Intl	Peru, San Isidro Cadesa, TEL: 51-14-707-080
		Intl	Philippines, Makati Metro Manila Philips Ind. Dev., Inc., TEL: 63-2-810-01-61
		Intl	Portugal, Lisbon Philips Portuguesa SARL, TEL: 351-1-68-31-21
		Intl	Singapore, Singapore Philips Singapore, Pte., Ltd., TEL: 65-350-2000
		Intl	South Africa, Randburg SA Philips (Pty), Ltd., TEL: 27-11-889-3911
		Intl	Spain, Barcelona Copresa S.A., TEL: 34-3-301-63-12
		Intl	Sweden, Stockholm Philips Components, A.B., TEL: 46-8-782-10-00
		Intl	Switzerland, Zurich Philips A.G., TEL: 41-1-488-2211
		Intl	Taiwan, Taipei Philips Taiwan, Ltd., TEL: (2) 712-0500
		Intl	Thailand, Bangkok Philips Electrical Co., Ltd., TEL: 233-6330-9
		Intl	Turkey, Istanbul Turk Philips Ticaret A.S., TEL: 90-1-179-27-70
		Intl	United Kingdom, London Philips Components, TEL: 44-01-580-6633
		Intl	Uruguay, Montevideo Luzilectron S.A., TEL: 598-91-56-41/42/43/44
		Intl	Venezuela, Caracas Magnetica S.A., TEL: 58-02-241-7509
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Silicon Compiler Systems			
Silicon Compiler Systems 2045 Hamilton Ave. San Jose, California 95125 408-371-2900 FAX: 408-559-4916			
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Silicon General			
Silicon General Semiconductors 11861 Western Avenue Garden Grove, California 92641 714-898-8121 TELEX: 69-2411 TWX: 910-596-1804 FAX: 714-893-2570			

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Silicon Systems					
<p>Silicon Systems Inc. 14351 Myford Road Tustin, California 92680 714-731-7110 TWX: 910-595-2809</p>					
Sales Office & Representatives					
AL	Huntsville Technology Marketing Associates, Inc. (TMA), 205-883-7893	OR	Beaverton Western Technical Sales, 503-644-8860	NY	Ronkonkoma Hallmark Elctns., 516-737-0600
AZ	Scottsdale Western Hightech Marketing, Inc., 602-860-2702	PA	Erdenheim Omni Sales, 215-233-4600	NC	Raleigh Hallmark Elctns., 919-872-0712
CA	Carson Silicon Systems, Inc. (L.A. District), 213-532-1524	TX	Austin OM Associates Inc., 512-794-9971	OH	Solon Hallmark Elctns., 216-349-5632
CA	San Diego Hadden Associates, 619-565-9444	TX	Houston OM Associates Inc., 713-789-4426	OH	Worthington Hallmark Elctns., 614-888-3313
CA	Santa Clara Silicon Systems, 408-980-9771	TX	Richardson Silicon Systems, 214-669-3381	OK	Tulsa Hallmark Elctns, 918-665-3200
CA	Santa Clara Magna Sales, 408-727-8753	TX	Richardson OM Associates Inc., 214-690-6746	TX	Austin Hallmark Elctns., 512-258-8848
CA	Thousand Oaks SC Cubed, 805-496-7307	UT	Salt Lake City Lange Sales, 801-487-0843	TX	Dallas Hallmark Elctns., 214-553-4300
CA	Tustin SC Cubed, 714-731-9206	VA	Lynchburg Burgin-Kreh Associates, 804-239-2626	TX	Houston Hallmark Elctns., 713-781-6100
CA	Tustin Silicon Systems, Inc., 714-731-7110	WA	Bellevue Western Technical Sales, 206-641-3900	UT	Murray Hallmark Elctns., 801-268-3779
CO	Littleton Lange Sales, 303-795-3600	WA	Spokane Western Technical Sales, 509-922-7600	WI	New Berlin Hallmark Elctns., 414-797-7844
CT	Fairfield NRG Limited, 203-384-1112	Can	British Columbia, Richmond Enerlec Sales, 604-273-0882	Can	British Columbia, Surrey Enerlec, 604-888-1667
FL	Deerfield Beach Technology Marketing Associates, Inc. (TMA), 305-427-1090	Can	Downsview, Ontario Har-Tech Electronics Ltd., 416-665-7773	Can	Ontario, Downsview Har-Tech Electronics, 416-665-7773
FL	Largo Technology Marketing Associates (TMA), 813-541-1591	Can	Nepean, Ontario Har-Tech Electronics Ltd., 613-726-9410	Intl	Argentina, Buenos Aires YEL S.R.L., TEL: 54-1-46-211
FL	Orlando Technology Marketing Associates, Inc. (TMA), 407-857-3760	Can	Pointe Claire, Quebec Har-Tech Electronics Ltd., 514-694-6110	Intl	Australia, Victoria R&D Electronics, TEL: 61-3-808-8911
GA	Atlanta Technology Marketing Associates, Inc. (TMA), 404-446-0569	Distributors			
IL	Rolling Meadows Phase II Marketing, 708-806-1130	AL	Huntsville Hallmark Elctns., 205-837-8700	Intl	Austria Allmos Gesmbh, TEL: 43-1-627-1953
IN	Indianapolis STB Assocs., 317-844-9227	AZ	Phoenix Hallmark Elctns., 602-437-1200	Intl	Belgium D & D Electronics BVBA, TEL: 32-3-828-3880
KS	Kansas City B.C. Electronics, 913-342-1211	CA	Citrus Heights Hallmark Elctns., 916-722-8600	Intl	Brazil Hitech, TEL: 55-11-531-9355
KY	Louisville Technology Marketing Corporation (TMC), 502-893-1377	CA	San Diego Hallmark Elctns., 619-268-1201	Intl	Denmark C-88, TEL: 45-42-24-48-88
MD	Baltimore Burgin-Kreh Associates, Inc., 301-265-8500	CA	San Diego Aved, Inc., 619-792-0257	Intl	England, Essex Pronto Electronic Systems Ltd., TEL: 44-81-554-6222
MA	Woburn Mill-Bern Associates, 617-932-3311	CA	San Jose Hallmark Elctns., 408-432-4000	Intl	Finland, ESP0021 Komdel Oy, TEL: 358-0-885011
MI	Brighton A.P. Associates, 313-229-6550	CA	Torrance Hallmark Elctns., 213-217-8400	Intl	France Datadis, TEL: 33-1-69-20-41-41
MN	Minneapolis Ohms Technology, Inc., 612-932-2920	CA	Tustin Hallmark Elctns., 714-669-4100	Intl	Germany, Munich Atlantik Elektronik GmbH, TEL: 49-89-857-0000
MO	St. Louis B.C. Electronics, 314-739-6683	CA	Tustin Hallmark Elctns., 714-669-4100	Intl	Greece, Athens Peter Caritato & Assoc. Ltd., TEL: 30-1-902-0115
NH	Salem Silicon Systems, Inc., 603-898-1444	CA	Tustin Aved, Inc., 714-259-8258	Intl	Hong Kong, Wanchai CET LTD, TEL: 852-5-200922
NJ	West Caldwell Technical Marketing Group, 201-226-3300	CO	Englewood Hallmark Elctns., 303-790-1662	Intl	India Malhar Corp., TEL: 812-56-4998
NM	Albuquerque Western High Tech Mktg., 505-884-2256	CT	Wallingford Hallmark Elctns., 203-271-2844	Intl	Israel, Tel Aviv RAPAC, TEL: 972-3-477-115
NY	Melville Technical Marketing Group, 516-351-8833	FL	Clearwater Hallmark Elctns., 813-530-4543	Intl	Italy, Milano Cefra S.p.A, TEL: 39-223-5264
NY	Rochester Electra Sales, 716-427-7860	FL	Orlando Hallmark Elctns., 305-855-4020	Intl	Japan, Tokyo Internix, TEL: 81-3-369-1105
NY	Syracuse Electra Sales, 315-463-1248	FL	Pompano Beach Hallmark Elctns., 305-971-9280	Intl	Mexico Panamtek, TEL: 52-36-303029
OH	Cincinnati Makin Associates, 513-871-2424	GA	Norcross Hallmark Elctns., 404-447-8000	Intl	Netherlands Alcom Electronics BV, TEL: 31-10-451-9553
OH	Columbus Makin & Associates, 614-793-7370	IL	Wooddale Hallmark Elctns., 312-860-3800	Intl	Norway, Asker Hans Schive, TEL: 47-2-900-900
OH	Solon Makin & Associates, 216-248-7370	IN	Indianapolis Hallmark Elctns., 317-291-5350	Intl	Portugal Diode, TEL: 351-1-57-1390
		KS	Lenexa Hallmark Elctns., 913-888-4747	Intl	Seoul, Korea Hanaro Corporation, TEL: 82-2-558-1144
		MD	Columbia Hallmark Elctns., 301-988-9800	Intl	Singapore Dynamar Computer Products, TEL: 65-281-3388
		MA	Billerica Hallmark Elctns., 617-935-9777	Intl	So. Africa South Continental Devices, TEL: 27-11-789-2400
		MI	Detroit Hallmark Elctns., 313-462-1205	Intl	Spain, Madrid Diode, TEL: 34-1-455-3686
		MN	Bloomington Hallmark Elctns., 612-941-2600	Intl	Sweden, Taby Bexab Ele., TEL: 46-8-732-8980
		MO	St. Louis Hallmark Elctns., 314-291-5350	Intl	Switzerland, Zurich Eleyptic, TEL: 41-1-493-1000
		NJ	Fairfield Hallmark Elctns., 201-575-4415		
		NJ	Mount Laurel Hallmark Elctns., 609-235-1900		
		NY	Rochester Hallmark Elctns, 716-244-9290		

Silicon Systems (Cont'd)

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Intl Thailand, Bangkok
Dynamar Computer Products, TEL:
662-278-3690

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Simtek Corporation
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Colorado Springs, Colorado 80920
719-531-9444, 719-531-9481

Sales Office & Representatives

AL Huntsville
Montgomery Marketing, Inc., 205-830-0498

AZ Tempe
Reptronix, Ltd., 602-345-4580

AR
See Dallas, TX (Quad State Sales & Mktg)

CA Anaheim
Westrep, 714-527-2822

CA Santa Clara
Electec Sales, Inc., 408-496-0706

CT Wallingford
Advanced Tech Sales, Inc., 203-284-0838

DE
See Mt. Laurel, NJ (S-J Associates, Inc.)

DC
See Falls Church, VA (S-J Associates, Inc.)

FL Altamonte Springs
Sales Engineering Concepts, Inc., 407-682-4800

FL Deerfield
Sales Engineering Concepts, Inc., 305-426-4601

GA Norcross
Montgomery Marketing, Inc., 404-447-6124

ID
See Bellevue, WA (Micro Sales, Inc.)

IA
See Eden Prairie, MN (Aldridge Assoc., Inc.)

LA
See Dallas, TX (Quad State Sales & Mktg.)

ME
See North Reading, MA (Advanced Tech Sales, Inc.)

MD
See Falls Church, VA (S-J Associates, Inc.)

MA North Reading
Advanced Tech Sales, Inc., 508-664-0888

MN Eden Prairie
Aldridge Associates, Inc., 612-944-8433

MS
See Huntsville, AL (Montgomery Mktg, Inc.)

NV
See Tempe, AZ (Reptronix, Ltd.)

NV
See Santa Clara, CA (Electec Sales, Inc.)

NH
See North Reading, MA (Advanced Tech Sales, Inc.)

NJ
See Melville, NY (Parallax)

NJ Mt. Laurel
S-J Associates, Inc., 609-866-1234

NM Albuquerque
Reptronix, Ltd., 505-292-1718

NY Melville
Parallax, 516-351-1000

NC Raleigh
Montgomery Mktg, Inc., 919-944-8433

ND
See Eden Prairie, MN (Aldridge Assoc. Inc.)

OK
See Dallas, TX (Quad State Sales & Mktg.)

OR Beaverton
Micro Sales, Inc., 503-645-2841

PA
See Mt. Laurel, NJ (S-J Associates Inc.)

SC
See Raleigh, NC (Montgomery Mktg Inc.)

SD
See Eden Prairie, MN (Aldridge Assoc. Inc.)

TN
See Norcross, GA (Montgomery Mktg, Inc.)

TN
See Huntsville, AL (Montgomery Mktg, Inc.)

TX
See Albuquerque, NM (Reptronix, Ltd.)

TX Dallas
Quad State Sales and Marketing, 214-669-8567

VA Falls Church
S-J Associates, Inc., 703-533-2233

WA Bellevue
Micro Sales, Inc., 206-451-0568

WI
See Eden Prairie, MN (Aldridge Assoc., Inc.)

PR
See Deerfield Bch, FL (Sales Engineering Concepts, Inc)

Distributors

AL Huntsville
Arrow/Kierulff Electronics Group, 205-837-6955

AZ Phoenix
Arrow/Kierulff Electronics Group, 602-437-0750

CA Chatsworth
Arrow/Kierulff Electronics Group, 818-701-7500

CA Tustin
Arrow/Kierulff Electronics Group, 714-838-5422

CO Aurora
Arrow/Kierulff Electronics Group, 303-373-5616

CT Wallingford
Arrow/Kierulff Electronics Group, 203-265-7741

FL Deerfield Beach
Arrow/Kierulff Electronics Group, 305-429-8200

FL Lake Mary
Arrow/Kierulff Electronics Group, 407-333-9300

GA Duluth
Arrow/Kierulff Electronics Group, 404-497-1300

IL Itasca
Arrow/Kierulff Electronics Group, 708-250-0500

IN Indianapolis
Arrow/Kierulff Electronics Group, 317-299-2071

IA Cedar Rapids
Arrow/Kierulff Electronics Group, 319-395-7230

KS Lenexa
Arrow/Kierulff Electronics Group, 913-541-9542

MD Columbia
Arrow/Kierulff Electronics Group, 301-995-6002

MA Wilmington
Arrow/Kierulff Electronics Group, 508-658-0900

MI Livonia
Arrow/Kierulff Electronics Group, 313-462-2290

MN Edina
Arrow/Kierulff Electronics Group, 612-830-1800

NJ Marlton
Arrow/Kierulff Electronics Group, 609-596-8000

NY Hauppauge
Arrow/Kierulff Electronics Group, 516-231-1000

NC Raleigh
Arrow/Kierulff Electronics Group, 919-876-3132

OH Centerville
Arrow/Kierulff Electronics Group, 513-435-5563

OH Solon
Arrow/Kierulff Electronics Group, 216-248-3990

OR Beaverton
Arrow/Kierulff Electronics Group, 503-645-6456

TX Austin
Arrow/Kierulff Electronics Group, 512-835-4180

TX Carrollton
Arrow/Kierulff Electronics Group, 214-380-6464

TX Houston
Arrow/Kierulff Electronics Group, 713-530-4700

Can British Columbia, Burnaby
Arrow/Kierulff Electronics Group, 604-421-2333

Can Ontario, Mississauga
Arrow/Kierulff Electronics Group, 416-670-7769

Can Quebec, Dorval
Arrow/Kierulff Electronics Group, 514-421-7411

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FAX: 508-670-9001

Solarise Enterprises

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Solitron Devices

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Semiconductor Group
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407-848-4311, 800-888-8763
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Sony Corporation of America

SONY®

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Sony Corporation of America
10833 Valley View Street
Cypress, California 90630
714-220-9100

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Sony Corporation of America

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Sales Office & Representatives

AL	Huntsville Rep, Inc., 205-881-9270
AZ	Tempe FP Sales, 602-894-5303
CA	Carlsbad Addem Sales, 619-729-9216
CA	Cypress Sony Corp. of America (Southwest), 714-229-4442
CA	Laguna Hills H-Technical Sales II, Inc., 714-583-1488
CA	Mountain View Brooks Technical Group, 415-960-3880
CA	San Jose Sony Corp of America (Northwest), 408-432-0190
CO	Aurora Electrodyne, 303-695-8903
FL	Palm Harbor Sigma Tech Associates, 813-789-5522
GA	Tucker Rep, Inc., 404-938-4358
IL	Hoffman Estates Micro-Tex, Inc., 708-382-3001
IL	Itasca Sony Corp. of America (North Central), 708-773-6072
IN	Carmel Giesting & Associates, 317-844-5222
IA	Cedar Rapids JR Sales, 319-393-2232
MA	Burlington Tech Rep, 617-272-5965
MI	Coloma Giesting & Associates, 616-468-4200
MI	Comstock Park Giesting & Associates, 616-784-9437
MI	Livonia Giesting & Associates, 313-478-8106
MN	Eden Prairie High Tech Sales, 612-944-7274
MO	Briegeton Centech, Inc., 314-291-4230
MO	Raytown Centech, Inc., 816-358-8100
NJ	Mt. Laurel S-J Associates, Inc., 609-866-1234
NM	Albuquerque FP Sales, 505-345-5553
NY	E. Rochester Tri-Tech Electronics, Inc., 716-385-6500
NY	Endwell Tri-Tech Electronics, Inc., 607-754-1094
NY	Fayetteville Tri-Tech Electronics, Inc. (Syracuse), 315-446-2881
NY	Fishkill Tri-Tech Electronics, Inc (Hudson Valley), 914-897-5611
NY	Rockville Centre S-J Associates, Inc., 516-536-4242
NC	Charlotte Rep, Inc., 704-563-5554
NC	Morrisville Rep, Inc., 919-469-9997
OH	Cincinnati Giesting & Associates, 513-385-1105
OH	Cleveland Giesting & Associates, 216-261-9705
OH	Columbus Giesting & Associates, 614-486-5616
OR	Tigard Vantage Corp., 503-620-3280
PA	Pittsburgh Giesting & Associates, 412-828-3553
TN	Jefferson City Rep, Inc., 615-475-4105

TX	Austin B-P Sales, 512-346-9186
TX	Houston B-P Sales, 713-782-4144
TX	Irving Sony Corp. of America (South Central), 214-550-5200
TX	Richardson B-P Sales, 214-234-8438
UT	Salt Lake City Electrodyne, 801-264-8050
VA	Falls Church S-J Associates, Inc., 703-533-2236
WA	Bellevue Vantage Corp., 206-455-3460
WI	Waukesha Micro-Tex, Inc., 414-542-5352
Can	Ontario, Whitby Sony of Canada, Ltd., 416-686-2201
PR	Rio Piedras D.K. Marketing, 809-765-5380

Distributors

AL	Huntsville Marshall Ind., 205-881-9235
AZ	Phoenix Marshall Ind., 602-496-0290
CA	Agoura Hills Western Micro, 818-707-0377
CA	Camarillo Milgray Electronics, 805-484-4055
CA	Carlsbad Agels Electronic Group, Inc., 619-729-2026
CA	Chatsworth Marshall Ind., 818-407-0101
CA	El Monte Marshall Ind. (Headquarters), 818-307-6000
CA	Fountain Valley Bell Microproducts, Inc., 714-963-0667
CA	Irvine Marshall Ind., 714-458-5395
CA	Irvine Milgray Electronics, 714-753-1282
CA	Los Angeles Chorl America, Inc., 213-629-5531
CA	Milpitas Marshall Ind., 408-942-4600
CA	Milpitas Bell Microproducts, Inc., 408-434-1150
CA	Orange Western Micro, 714-637-0200
CA	Rancho Cordova Marshall Ind., 916-635-9700
CA	San Diego Marshall Ind., 619-578-9600
CA	San Diego Western Micro, 619-453-8430
CA	San Jose Merit Electronics, Inc., 408-434-0800
CA	Saratoga Western Micro, 408-725-1660
CO	Denver Robert Waxman, 303-623-1200
CO	Thornton Marshall Ind., 303-451-8444
CT	Danbury Phase I, 203-791-9042
CT	Milford Milgray Electronics, 203-878-5538
CT	Monroe Western Micro, 203-452-0533
CT	Wallingford Marshall Ind., 203-265-3822
FL	Altamonte Springs Marshall Ind., 407-767-8585
FL	Deerfield Vantage Components, 305-429-1001
FL	Ft. Lauderdale Marshall Ind., 305-977-4880
FL	St. Petersburg Marshall Ind., 813-576-1399
FL	Winter Park Milgray Electronics, 407-647-5747
GA	Norcross Milgray Electronics, 404-446-9777
GA	Norcross Marshall Ind., 404-923-5750
IL	Arlington Heights Milgray Electronics, 312-253-1212
IL	Schaumburg Marshall Ind., 312-490-0155
IN	Indianapolis Marshall Ind., 317-297-0483
KS	Lenexa Marshall Ind., 913-492-3121
KS	Overland Park Milgray Electronics, 913-236-8800
MD	Columbia Milgray Electronics, 301-621-8169
MD	Columbia Vantage Components, 301-720-5100
MD	Silver Spring Marshall Ind., 301-622-1118
MA	Burlington Western Micro, 617-273-2800
MA	Wilmington Bell Microproducts, Inc., 508-658-0222
MA	Wilmington Marshall Ind., 508-658-0810
MA	Wilmington Milgray Electronics, 617-657-5900
MI	Livonia Marshall Ind., 313-525-5850
MN	Plymouth Marshall Ind., 612-559-2211
MO	Bridgeton Marshall Ind., 314-291-4650
MO	Kansas City Sony Kansas City Part Center, 816-891-7550
NJ	Clifton Vantage Components, 201-777-4100
NJ	Fairfield Western Micro, 201-882-4999
NJ	Fairfield Marshall Ind., 201-882-0320
NJ	Garfield Phase I, 201-403-0002
NJ	Marlton Western Micro, 609-596-7775
NJ	Marlton Milgray Electronics, 609-983-5010
NJ	Mt. Laurel Marshall Ind., 609-234-9100
NJ	Parsippany Milgray Electronics, 201-335-1766
NY	Farmingdale Milgray Electronics, 516-420-9800
NY	Hauppauge Marshall Ind., 516-273-2424
NY	Johnson City Marshall Ind., 607-798-1611
NY	N. Lindenhurst Phase I, 516-957-4900
NY	New York Chorl America, Inc., 212-563-3264
NY	Pittsford Milgray Electronics, 716-834-9405
NY	Rochester Marshall Ind., 716-235-7620
NY	Smithtown Vantage Components, 516-543-2000
NC	Raleigh Marshall Ind., 919-878-9882
OH	Cleveland Milgray Electronics, 216-447-1520
OH	Dayton Marshall Ind., 513-898-4480
OH	Solon Marshall Ind., 216-248-1788
OK	Tulsa Marshall Ind., 918-622-7151
OR	Beaverton Western Micro, 503-629-2082
OR	Beaverton Marshall Ind., 503-644-5050

Sony Corporation of America (Cont'd)

PA Pittsburgh
Marshall Ind., 412-788-0441

TX Austin
Marshall Ind., 512-837-1991

TX Carrollton
Western Micro, 214-248-3775

TX Carrollton
Marshall Ind., 214-233-5200

TX Dallas
Milgray Electronics, 214-248-1603

TX El Paso
Marshall Ind., 915-593-0706

TX Harlingen
Marshall Ind., 512-542-4589

TX Houston
Marshall Ind., 713-895-9200

UT Salt Lake City
Milgray Electronics, 801-272-4999

UT Salt Lake City
Marshall Ind., 801-485-1551

WA Bothell
Marshall Ind., 206-486-5747

WA Redmond
Merit Electronics, Inc., 206-869-7557

WA Redmond
Western Micro, 206-881-6737

WI Waukesha
Marshall Ind., 414-797-8400

Can Ontario, Brampton
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Sophia Systems

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Sprague Electric
See Allegro Microsystems

Stac Electronics

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Standard Microsystems Corp.

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Stanford Telecommunications

Stanford Telecommunications Inc.
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Santa Clara, California 95056-0968
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Sales Office & Representatives

AZ Phoenix
Blackhart Assoc., 602-893-3488

CA Los Altos
Cain-White & Co., 415-948-6533

CA Santa Clara
Stanford Telecommunications, Inc.,
408-980-5684

CA Tustin
Youngowirth & Olenic, 714-838-5144

IL Arlington Hts.
DYTEC/Central, 708-394-3380

IN Indianapolis
DYTEC/Central, 317-297-5988

MA Natick
Wayland Engineering Sales, 508-655-6080

NJ Totowa
Technical Marketing Assoc., 201-812-0356

TX Dallas
Mc Donald Assoc., 214-239-3293

VA Sterling
Beacon North, 703-478-2480

Intl France, St. Denis
P2M, TEL: 1-34611184

Intl Israel, Neve-Monosan
Regev Aviation, TEL: 03-352359

Intl Italy
Milano Micro Elit, TEL: 4817900

Intl Italy, Roma
Elettronica Micro-Onde, TEL: 06-8278551

Intl Switzerland, Zurich
Dimos AG, TEL: 01-62-61-40

Intl United Kingdom, St. Albans, Hert
Chiptech, Ltd., TEL: 0727 40476

Intl West Germany, Breisach
Bacher GmbH, TEL: 07664-53-76

Intl West Germany, Munchen
Bacher GmbH, TEL: 089-26-50-94

STC Semiconductors

STC Semiconductors (Previously Stantel-STC)
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Sunshine Semiconductor Inc.
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Supertex, Inc.
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AL Huntsville
CSR Electronics, 205-533-2444

CA Santa Clara
Synergy Semi (Corp. Hdqts), 408-730-1313

CT Wallingford
Technology Sales, Inc., 203-269-8853

GA Atlanta
CSR Electronics, 404-396-3720

IL Schaumburg
Victory Sales, Inc., 708-490-0300

MD Anapolis
Electronic Engineering & Sales Inc.,
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MA Waltham
Technolgy Sales, Inc., 617-890-5700

MA Winchester
Synergy Semi (Eastern Area Hdqtrs),
617-932-9220

MN Minneapolis
HMR Inc., 612-888-2122

NY Fairport
Technology Sales, Inc., 716-223-7500

NY Jericho
J-Squared Marketing, 516-935-3200

NC Raleigh
CSR Electronics, 919-878-9200

PA Huntingdon Valley
Omega Electronics Sales, Inc., 215-947-4135

TX Austin
Southern States Marketing, 512-835-5822

TX Houston
Southern States Marketing, 713-789-2426

TX Richardson
Southern States Marketing, 214-238-7500

Can Ontario, Nepean
Clark-Hurman Associates, 613-727-5626

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- AL** **Huntsville**
Montgomery Marketing Inc., 205-830-0498
- AZ** **Scottsdale**
Summit Sales, 602-998-4850
- AR**
Richardson, TX (MIL-REP Assoc. Inc.)
214-644-8731
- CA** **Canoga Park**
Bager Electronics, 818-712-0011
- CA** **Encinitas**
Bager Elec., 619-632-8816
- CA** **Fountain Valley**
Bager Elctns., Inc., 714-957-3367
- CA** **Los Altos**
El Repco Inc., 415-962-0660
- CA** **Sunnyvale**
TAEC, 408-737-9844
- CA** **Tustin**
TAEC, 714-259-0368
- CO** **Westminster**
Straube Assoc. Mountain States, Inc.,
303-426-0890

- CT** **Hamden**
Datcom Inc., 203-288-7005
- DE**
- DC** See Horsham, PA (Nexus Tech.)
- DC** **Lutherville, MD**
D.G.R. Inc., 301-583-1380
- FL** **Altamonta Springs**
Sales Engineering Concepts, 407-682-4800
- FL** **Deerfield Beach**
Sales Engineering, 305-426-4601
- GA** **Norcross**
Montgomery Marketing, Inc., 404-447-6124
- GA** **Norcross**
TAEC, 404-368-0203
- ID** **Spokane**
Components West, 509-922-2412
- IL**
- IL** See St. Louis, MO (R.W. Kunz)
- IL** **Deerfield**
TAEC, 708-945-1500
- IL** **Elk Grove**
Carlson Electronic Sales, 312-956-8240
- IA** **Cedar Rapids**
Carlson Elec., 319-378-1450
- KS** **Wichita**
D.L.E. Electronics, 316-744-1229
- LA**
- ME** See Houston, TX (MIL-REP Assoc. Inc.)
- MD** **Lutherville**
D.G.R. Inc., 301-583-1360
- MA** **Burlington**
TAEC, 617-272-4352
- MA** **Waltham**
Datcom, Inc., 617-891-4600
- MI** **Novi**
Action Components Sales, 313-349-3940
- MN** **Minneapolis**
Electric Components Sales Inc., 612-933-2594
- MS**
- MO** See Huntsville, AL (Montgomery Mktg. Inc.)
- MO** See Wichita, KS (D.L.E. Elec.)
- MO** **St. Louis**
R.W. Kunz, 314-966-4977
- MT**
- NV** See Redmond, WA (Components West)
- NV** **Los Altos**
El Repco Inc., 415-962-0660
- NH**
- NJ** See Waltham, MA (Datcom Inc.)
- NJ** **Fort Lee**
Nexus Technology, 201-947-0151
- NM**
- NY** See Scottsdale, AR (Summit Sales)
- NY**
- NY** See Ft. Lee, NJ (Nexus Tech.)
- NY** **Syracuse**
Leonard D. Allen, Inc., 315-437-3710
- NC** **Cary**
Montgomery Mktg. Inc., 919-467-6319
- NC** **Raleigh**
Montgomery Marketing, Inc., 919 851-0010
- ND**
- ND** See Minneapolis, MN (Electric Components Sales)
- OH** **Solon**
J.R. Thornberry, 216-245-4995
- OK**
- OK** Richardson, TX (MIL-REP Assoc. Inc.)
214-644-6731
- OR** **Tigard**
Components West, 503-684-1671
- PA** **Horsham**
Nexus Tech., 215-675-9600
- RI**
- RI** See Waltham, MA (Datcom Inc.)
- TN**
- TN** See Huntsville, AL (Montgomery Mktg.)
- TX** **Houston**
MIL-REP Associates, Inc., 713-444-2557
- TX** **Richardson**
TAEC, 214-480-0470

- UT** **Salt Lake City**
Straube Assoc. Mountain States, Inc.,
801-263-2640
- VT**
- VA** See Waltham, MA (Datcom Inc.)
- WA** See Lutherville, MD (D.G.R. Inc.)
- WA** See Minneapolis, MN (Electronic Components Sales)
- WA** **Redmond**
Components West, 206-885-5880
- WA** **Redmond**
Components West, 206-855-5880
- WA** **Spokane**
Components West, 509-922-2412
- WV**
- WV** See Lutherville, MD (D.G.R. Inc.)
- WI** **Milwaukee**
Carlson Electronic Sales, 414-476-2790
- WY**
- WY** See Westminster, CO (Straube Assoc.)
- Can** **Ontario, Kanata**
Electro Source, 613-592-3214
- Can** **Ontario, Rexdale**
Electro Source, 416-676-4490
- Can** **Quebec, Pointe Claire**
Electro Source, 514-630-7486

Distributors

- AL**
- AL** See Norcross, GA (Reptron Elec.)
- AL** **Huntsville**
Marshall Elec., 205-881-9235
- AK**
- AK** See Dallas, TX (Sterling Elec.)
- AK**
- AK** See Carrollton, TX (Marshall Elec.)
- AZ** **Phoenix**
Sterling Electronics-Phoenix, 602-437-5565
- AZ** **Phoenix**
Marshall Elec., 602-496-0290
- AZ** **Tempe**
Insight Elec., 602-829-1800
- CA** **Agoura**
Western Microtechnology, 818-707-0377
- CA** **Agoura**
Insight Electronics, 800-677-7716
- CA** **Chatsworth**
Marshall Elec., 818-407-0101
- CA** **Chatsworth**
Sterling Elec., 818-407-8850
- CA** **El Monte**
Marshall Corp, 818-307-6000
- CA** **Fountain Valley**
Bell Micro, 714-963-0667
- CA** **Irvine**
Insight Electronics, 800-677-7716
- CA** **Milpitas**
Bell Micro, 408-434-1150
- CA** **Milpitas**
Marshall Elec., 408-942-4600
- CA** **Orange**
Western Microtechnology, 714-637-0200
- CA** **Rancho Cordova**
Marshall Elec., 916-635-9700
- CA** **San Diego**
Western Microtechnology, 619-453-8430
- CA** **San Diego**
Sterling Elec., 619-271-6555
- CA** **San Diego**
Insight Electronics, 800-677-7716
- CA** **San Diego**
Marshall Elec., 619-578-9500
- CA** **San Jose**
Merit Electronics, Inc., 408-434-0800
- CA** **Saratoga**
Western Microtechnology, 408-725-1660
- CA** **Tustin**
Sterling Elec., 714-259-0900
- CO** **Englewood**
Sterling Electronics-Denver, 303-792-3939

Toshiba America Electronic Components (Cont'd)

CO **Thornton**
Marshall Elec., 303-451-8383

CT **Wallingford**
Sterling Elec.-Wallingford, 203-265-9535

CT **Wallingford**
Cronin Elctns., Inc., 203-265-3134

CT **Wallingford**
Marshall Elec., 203-265-3822

DE
See West Berlin, NJ (General Components)

DE
See Silver Spring, MD (Marshall Elec.)

DE
See Horndon, VA (Sterling Elec.)

DC
Silver Spring, MD (Marshall Elec.)

DC
See Richmond, VA (Sterling Elec.)

FL **Altamonte Springs**
Marshall Elec., 407-275-1742

FL **Ft. Lauderdale**
Reptron Ft. Lauderdale, 305-735-1112

FL **Ft. Lauderdale**
Marshall Elec., 305-977-4880

FL **St. Petersburg**
Marshall Elec., 813-573-1399

FL **Tampa**
Reptron, 813-855-4656

GA **Norcross**
Reptron Atlanta, 404-446-1300

GA **Norcross**
Marshall Elec., 404-923-5780

ID
Beaverton, OR (Western Micro) 503-629-2082

ID
See Salt Lake City, UT (Marshall Elec.)

IL **Bensenville**
Goold Elec., 708-860-7171

IL **Bridgeton, MO**
Marshall Elec., 314-291-8554

IL **Schaumburg**
Marshall Elec., 708-490-0155

IN
See Plymouth, MN (Marshall Elec.)

IN
Elk Grove Vill, IL (Goold Elec.) 708-860-7171

IN **Indianapolis**
Marshall Elec., 317-297-0483

KS **Lenexa**
Sterling Elec., 913-492-3121

KY
See Dayton, OH (Marshall Elec.)

LA
See Carrollton, TX (Marshall Elec.)

LA **Dallas, TX**
Sterling Elec., 214-243-1600

ME
See Burlington, MA (Western Micro)

ME
See Needham Heights, MA (Cronin Elec.)

ME
See Woburn, MA (Sterling Elec.)

ME
See Wilmington, MA (Marshall Elec.)

MD
See Richmond, VA (Sterling Elec.)

MD **Columbia**
Nu Horizons, 301-995-6330

MD **Silver Spring**
Marshall Elec., 301-622-1118

MA **Burlington**
Western Micro, 617-273-2800

MA **Needham Heights**
Cronin Electronics, Inc., 617-449-5000

MA **Wakefield**
Nu Horizons, 617-246-4442

MA **Wilmington**
Marshall Elec., 508-658-0810

MA **Wilmington**
Bell Micro, 508-658-0222

MA **Woburn**
Sterling Elec., 617-938-6200

MI **Grand Rapids**
Calder Electronics, 616-698-7400

MI **Livonia**
Reptron/Livonia, 313-525-2700

MI **Livonia**
Marshall Elec., 313-525-5850

MN **Minneapolis**
Sterling Elec., 612-831-2266

MN **Minnetonka**
Reptron Electronics, 612-938-0000

MN **Plymouth**
Marshall Elec., 612-559-2211

MS
See Huntsville, AL (Marshall Elec.)

MO
See Lenexa, KS (Marshall Elec.)

MO **Bridgeton**
Marshall Elec., 314-291-8554

NE **Lenexa, KS**
Marshall Elec., 913-492-3121

NV
See Saratoga, CA (Western Micro)

NV
See Phoenix, AZ (Sterling Elec.)

NV
See Phoenix, AZ (Marshall Elec.)

NV **Rancho Cordova**
Marshall Elec., 916-635-9700

NH
See Needham Hts., MA (Cronin Elec.)

NH
See Burlington, MA (Western Micro)

NH
See Wilmington, MA (Marshall Elec.)

NH
See Woburn, MA (Sterling Elec.)

NJ **Marlton**
Nu Horizons, 609-596-1833

NJ **Mt. Laurel**
Marshall Elec., 609-234-9100

NJ **Pine Brook**
Nu Horizons, 201-882-8300

NJ **South Plainfield**
Sterling Elec., 201-769-7000

NJ **West Berlin**
General Components, 609-768-6767

NM
See Phoenix, AZ (Marshall Elec.)

NM **Albuquerque**
Sterling Elec., 505-884-1900

NY **Amityville**
Nu Horizons, 516-226-6000

NY **Johnson City**
Marshall Elec., 607-798-1611

NY **Rochester**
Nu Horizons, 716-248-5980

NY **Rochester**
Marshall Elec., 718-235-7620

NY **Rome**
Rome Elctns., 315-337-5400

NC **Raleigh**
Marshall Elec., 919-878-9882

ND
See Plymouth, MN (Marshall Elec.)

ND
See Minnetonka, MN (Reptron Elec.)

OH **Dayton**
Marshall Elec., 513-898-4480

OH **Solon**
Marshall Elec., 218-248-1788

OH **Solon**
Reptron Elec., 216-349-1415

OH **Worthington**
Reptron Elec., 614-436-6675

OK
See Carrollton, TX (Marshall Elec.)

OK
Beaverton, OR (Western Micro) 503-629-2082

OK **Tulsa**
Sterling Electronics-Tulsa, 918-663-2410

OR **Beaverton**
Marshall Elec., 503-644-5050

PA
See West Berlin, NJ (General Components)

PA
See Mt. Laurel, NJ (Marshall Elec.)

PA **Marlton**
Nu Horizons, 215-557-6450

PA **Pittsburg**
Marshall Elec., 412-788-0441

RI
See Burlington, MA (Western Micro)

RI
See Wilmington, MA (Marshall Elec.)

RI
See Needham Hts., MA (Cronin Elec.)

RI
Woburn, MA (Sterling Elec.) 617-938-6200

TN
See Huntsville, AL (Marshall Elec.)

TX **Austin**
Sterling Electronics, 512-836-1341

TX **Austin**
Marshall Elec., 512-837-1991

TX **Austin**
Insight Elec., 512-467-0800

TX **Carrollton**
Marshall Elec., 214-233-5200

TX **Dallas**
Sterling Elec., 214-243-1600

TX **Dallas**
Milgray Electronics, 214-248-1063

TX **Dallas**
Insight Elec., 214-783-0800

TX **El Paso**
Marshall Elec., 915-593-0706

TX **Houston**
Sterling Electronics, 713-623-6600

TX **Houston**
Marshall Elec., 713-895-9200

TX **Houston**
Insight Elec., 713-448-0800

UT
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UT **Salt Lake City**
Marshall Elec., 801-485-1551

UT **Salt Lake City**
Milgray Elec., 801-272-4999

VT
See Wilmington, MA (Marshall Elec.)

VT
See Woburn, MA (Sterling Elec.)

VT
See Burlington, MA (Western Micro)

VT
See Needham Hts., MA (Cronin Elec.)

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Columbia, MD (Milgray Elec.) 301-621-8169

VA
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Sterling Elec., 703-290-3800

VA **Richmond**
Sterling Elec., 804-226-2190

WA **Bothell**
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WA **Redmond**
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Bensenville, IL (Milgray Elec.) 312-350-0490

WI
Elk Grove Vill., IL (Goold Elec.) 708-860-7171

WI **Milwaukee**
Marsh Elec., 414-475-6000

WI **Waukesha**
Marshall Elec., 414-797-8400

Can **Alberta, Calgary**
ITT Multicomponents, 403-273-2780

Can **British Columbia, Burnaby**
ITT Multicomponents, 604-291-8866

IC MASTER

Toshiba America Electronic Components (Cont'd)

- Can** **Manitoba, Winnipeg**
ITT Multicomponents, 204-786-8401
- Can** **Nova Scotia, Dartmouth**
ITT Multicomponents, 902-465-2350
- Can** **Ontario, Brampton**
Marshall Elec., 418-458-8046
- Can** **Ontario, Concord**
ITT Multicomponents, 416-736-1144
- Can** **Ontario, Nepean**
ITT Multicomponents, 613-596-6980
- Can** **Quebec, Ville St. Laurent**
ITT Multicomponents, 514-335-7679

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 MD (301) 995-6330
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CORP.

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UTMC Western Area (South-West),
714-830-1177
- CA** **Woodland Hills**
UTMC Western Area Sales, 818-992-5399
- CO** **Colorado Springs**
UTMC Sales Office (Main Facility),
719-594-8060, 719-594-8166
- MD** **Annapolis**
UTMC Eastern Area (South-East), 301-626-8690
- MA** **Waltham**
UTMC Eastern Area (North-East), 617-890-8862
- TX** **Richardson**
UTMC Western Area (East-Central/South),
214-480-9949

Unitrode Integrated Circuits

Unitrode Integrated Circuits Corp.
7 Continental Blvd.
Merrimack, New Hampshire 03054-0399
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TELEX: 95-3040
FAX: 603-424-3460

Universal Semiconductor

Universal Semiconductor Inc.
1925 Zanker Road
San Jose, California 95112
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FAX: 408-436-1125

Sales Office & Representatives

- AR** See Dallas, TX (Component Technology)
- CA** **Torrance**
Orion Eclipse (Southern California),
213-326-0999
- CT** **Guilford**
Data Mark, Inc., 203-453-0575
- LA** See Dallas, TX (Component Technology)
- OK** See Dallas, TX (Component Technology)
- RI** See Guilford, CT (Data Mark, Inc.)
- TX** **Dallas**
Component Technology, 214-783-8831
- Can** **Quebec, Pointe Claire**
Interep, 514-694-6544
- Intl** **Japan, Tokyo**
Nagase & Co., Ltd., TEL: 03-665-3661-3

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San Jose, California 95131
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TELEX: 887-591 (VADEM SNTA UD)
FAX: 408-943-9735

Valid Logic Systems

Valid Logic Systems
2820 Orchard Parkway
San Jose, California 95134
408-432-9400
FAX: 408-432-9430

Vanguard Semiconductor

Vanguard Semiconductor
Div of California Micro Devices
211 Topaz Street
Milpitas, California 95035
408-946-9111, 800-325-4966
FAX: 408-263-7846

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FAX: 508-480-0882

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San Jose, California 95134
408-433-6000, 800-344-5970

Vitesse Semiconductor

Vitesse Semiconductor Corp.
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Camarillo, California 93012
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VLSI Technology

VLSI Technology Inc. (VLSI)
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408-434-3100

Sales Office & Representatives

- AL** **Huntsville**
VLSI Technology, Inc., 205-539-5513
- AZ** **Tempe**
System Sales, 602-829-9338
- AZ** **Tempe**
VLSI Technology, Inc., 602-752-6450
- CA** **Cameron Park**
Emerging Technology, 916-676-4387
- CA** **Galabajas**
Centaur Corp., 818-704-1655
- CA** **Irvine**
VLSI Technology, Inc., 714-250-4900
- CA** **Irvine**
Centaur Corp., 714-261-2123
- CA** **San Diego**
Centaur Corp., 619-278-4950
- CA** **San Jose**
Emerging Technology, 408-433-9366
- CA** **San Jose**
VLSI Technology, Inc., 408-922-5200
- CO** **Longmont**
Luscombe Eng. of Co., 303-772-3342
- CT** **Wallingford**
VLSI Technology, Inc., 203-265-6698
- FL** **Orlando**
VLSI Technology, Inc., 407-240-9604
- FL** **Pompano Beach**
VLSI Technology, Inc., 305-971-0404
- GA** **Deluth**
VLSI Technology, Inc., 404-476-8574
- IL** **Hoffman Estates**
VLSI Technology, Inc., 708-884-0500
- IL** **Schaumburg**
VLSI Technology, Inc., 312-310-9595
- IA** **Cedar Rapids**
Seltec Sales, 319-364-7660
- MD** **Columbia**
Delta III, 301-730-4700
- MD** **Millersville**
VLSI Technology, Inc., 301-987-8777
- MA** **Wilmington**
VLSI Technology, Inc., 508-658-9501
- MN** **St. Louis Park**
VLSI Technology, Inc., 612-545-1490

VLSI Technology (Cont'd)	
NJ	Plainsboro VLSI Technology, Inc., 609-799-5700
NY	Fairport bbd Electronics, 716-425-4101
NY	Fairport VLSI Technology, Inc., 716-223-0590
NC	Durham VLSI Technology, Inc., 919-544-1891/92
OH	Cleveland VLSI Technology, Inc., 216-292-8235
OR	Beaverton Micro Sales, Inc., 503-645-2841
OR	Portland VLSI Technology, Inc., 503-244-9882
TX	Austin VLSI Technology, 512-343-8191
TX	Richardson VLSI Technology, Inc., 214-231-6716
UT	Midvale Luscombe Engineering, 801-565-9885
WA	Bellevue Micro Sales, Inc., 206-451-0568
Intl	England, Central Milton Keynes VLSI Technology, Ltd., TEL: 09-08/66-75-95
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Intl	Israel, Tel Aviv RDT Electronics, TEL: 3-483211-9
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Intl	West Germany, Munich VLSI Technology, GmbH, TEL: 89-9269050
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CA	Gardena Schweber Electronics, 213-320-8090
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CA	San Diego Schweber Electronics, 619-450-0454
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CT	Danbury Schweber Electronics, 203-748-7080
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KS	Overland Park Schweber Electronics, 913-492-2922
MD	Gaithersburg Schweber Electronics, 301-840-5900
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NY	Rochester Schweber Electronics, 716-424-2222
NY	Westbury Schweber Electronics, 516-334-7474
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OH	Dayton Schweber Electronics, 513-439-1800
OK	Tulsa Schweber Electronics, 918-622-8003
PA	Horsham Schweber Electronics, 215-441-0600
PA	Pittsburgh Schweber Electronics, 412-782-1600
TX	Austin Schweber Electronics, 512-458-8253
TX	Dallas Schweber Electronics, 214-661-5010
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WI	New Berlin Schweber Electronics, 414-784-9020
Intl	Australia, Brisbane Energy Control, TEL: 61-7-376-2955
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Intl	Brazil, Palo Alto Intl. Trade Development, TEL: 415-856-6686
Intl	Denmark, Karlslunde Interelko, TEL: 3-140700
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Intl	Eire and U.K., Sunbury on Thames Hawke Components, TEL: 1-9797799
Intl	Finland, Helsinki Oy Comdax, TEL: 0-670277
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Intl	Germany, Munich Data Modul GmbH, TEL: 89-560170
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CT	Southbury Dynamic Technologies, 203 262-6220
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FL	Orlando CM Marketing, 407 841-9924
FL	Tamarac CM Marketing, 305-722-9369
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NY	East Rochester L-Mar Associates, 716 381-9100
NY	Melville Technical Marketing Group, 516 351-8833
NY	Poughkeepsie L-Mar Associates, 914 462-8025
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TX	Austin Southern States Marketing, Inc., 512 835-5822
TX	Houston Southern States Marketing, 713 960-9556
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TX	Richardson Southern States Marketing, Inc., 214-238-7500
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Intl	Taiwan, R.O.C., Taipei Prospect Technology Corp., TEL: 02 721-9533
Intl	West Germany VTC Incorporated, TEL: 49 8071 5858
Intl	West Germany, Eching, Munich Mikron, GmbH, TEL: 089 31907-0

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PA	Pittsburgh Pioneer, 412-782-2300
TX	Austin Pioneer, 512-835-4000
TX	Dallas Pioneer, 214-386-7300
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IL, Jack Elk	312-490-5318
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CA	Santa Clara Criterion, 408-988-6300
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NJ	Mt. Laurel S.J. Associates Inc., 609-866-1234
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NM	Albuquerque S & S Technologies, 505-255-5599
NY	East Rochester Tri-Tech Electronics, 716-385-6500
NY	Endwell Tri-Tech Electronics, 607-754-1094
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TX	Dallas Southwestern Tech. Sales, 214-369-0977
TX	Dallas Southeast Regional Sales, 214-680-0077
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UT	Murray Butterworth Marketing, 801-969-5566
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Can	Ontario, Toronto Har-Tech Electronics, 416-665-7773
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PR	Milaville, Rio Piedras G & A Associates, 809-758-7001
Distributors	
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AL	Huntsville Lex Electronics, 205-895-0480
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AZ	Tempe Time Electronics, 602-967-2000
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CA	Calabasas Lex Electronics, 818-880-9686
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CA	San Diego Wyle Laboratories, 619-565-9171
CA	San Diego Insight, 619-587-0471
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FL	Altamonte Springs Vantage Components, 407-682-1199
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GA	Norcross Lex Electronics, 404-449-9170
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IL	Schaumburg Lex Electronics, 708-330-2888
IL	Schaumburg Marsh Electronics, 708-240-9290
IN	Indianapolis Time Electronics, 800-331-5114
IN	Indianapolis Lex Electronics, 317-843-1050
IA	Cedar Rapids Lex Electronics, 319-373-1417
IA	Cedar Rapids Time Electronics, 800-325-9085
KS	Overland Park Time Electronics, 800-325-9085
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MD	Baltimore Time Electronics, 301-964-3090
MD	Columbia Vantage Components, 301-720-5100
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MI	Livonia Lex Electronics, 313-525-8100
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NE	Time Electronics, 800-325-9085
NH	Lex Electronics, 800-833-3557
NJ	Clifton Vantage Components, 201-777-4100
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NJ	Mt. Laurel Lex Electronics, 609-273-7900
NJ	N. New Jersey Time Electronics, 201-882-4611
NJ	Pinebrook Lex Electronics, 201-227-7880
NM	Insight, 505-823-1800
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NY	Hauppauge Time Electronics, 516-273-0100
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NY	Smithtown Vantage Components, 516-543-2000
NY	Westbury Lex Electronics (Corp. Office), 516-876-4000
NC	Time Electronics, 800-833-8235
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PA	Pittsburgh Time Electronics, 800-331-5114
SD	Time Electronics, 800-331-5114
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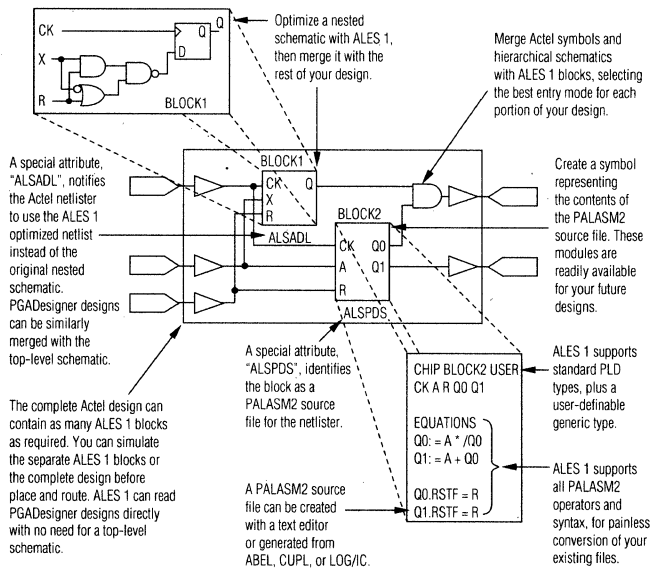
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ALES™ 1 Actel Logic Enhancer/Synthesizer

USING THE ACTEL LOGIC ENHANCER AND SYNTHESIZER (ALES 1)



Highlights

- Permits design of Actel FPGAs with familiar PLD tools ABEL™, CUPL™, LOG/IC™ and PGADesigner™
- Interfaces to Actel's Action Logic™ System (ALS) to allow painless conversion of existing PLD designs to Actel FPGAs
- Reduces design time for state machines and other sequential logic
- Optimizes logic designs from Boolean equations, state machines, or schematics for implementation in Actel FPGAs
- Multiple entry modes allow easy integration of PLD description and schematics

Fast, easy design enhancement

The Actel Logic Enhancer/Synthesizer (ALES 1) lets you quickly and easily implement logic in Actel FPGAs, using either popular PLD design tools or the familiar PALASM™2 syntax. It can provide Actel-specific logic implementation for existing files created with PLD design tools or netlist files generated from schematics. It will minimize delays or maximize logic utilization in Actel's FPGA architecture, and after creation, you can simulate either an ALES 1 block or your complete design.

What you need, when you need it

Use ALES 1 to create Actel FPGAs from a PALASM2 source file via a text editor — or generate them from ABEL, CUPL, or LOG/IC. Minc's PGADesigner produces Actel FPGA netlists directly. Used in conjunction with ALES 1, it permits system-level designs with Actel FPGAs. Or use PGADesigner to generate input for ALES 1 with schematic entry packages such as ORCAD™, P-CAD™ and FutureNet®.

ALES 1 transforms the equations and/or netlists into an Actel FPGA design file. The ALES 1 Enhancer is invoked automatically during the translation process to optimize the design for the Actel FPGA architecture.

ALES 1 uses four distinct algorithms to find the best mapping with Actel FPGA macros, based on either delay or module count, whichever suits your needs. You can specify a target value for the longest delay path; ALES 1 searches for an implementation that meets the value you require. If you specify a value of 0 ns, ALES 1 selects the fastest result found.

The most flexible way to design

ALES 1 is a tool that adapts to the way you already work. It puts no restrictions on the number of ALES 1 blocks your completed design contains. Each block is totally independent, allowing you complete freedom of entry mode.

For example, you can synthesize a PLD file using ALES 1, then merge it with the rest of your top-level schematic, which contains Actel macros and hierarchical schematics. Select the best entry mode for each portion of your design.

With ALES 1, there is never any need to reinvent the wheel. You create a symbol to represent the contents of each PALASM2 source file. These modules are always ready to drop into future designs.

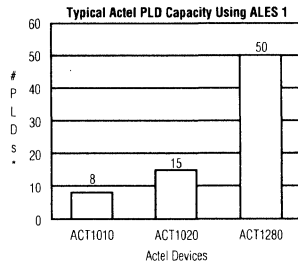
ALES 1 arms you with the powerful tools of Boolean equations, state description, and schematic enhancement, to let you create Actel FPGA designs *fast*.

ALES 1 supported systems

- PC386 with DOS 3.1 or higher, with either Viewlogic® 3.0 or higher or OrCAD/SDT® 3.22 or higher
- Apollo®/SR 10.1 or higher with Mentor Graphics® 7.0 or higher
- Sun-3™ with operating system 4.0.3 with a ValidGED® 9.1 or higher
- Sun-4™ with operating system 4.0.3, with either a ValidGED 9.1 or higher, and Viewlogic 4.0 or higher

ALES 1 system configuration

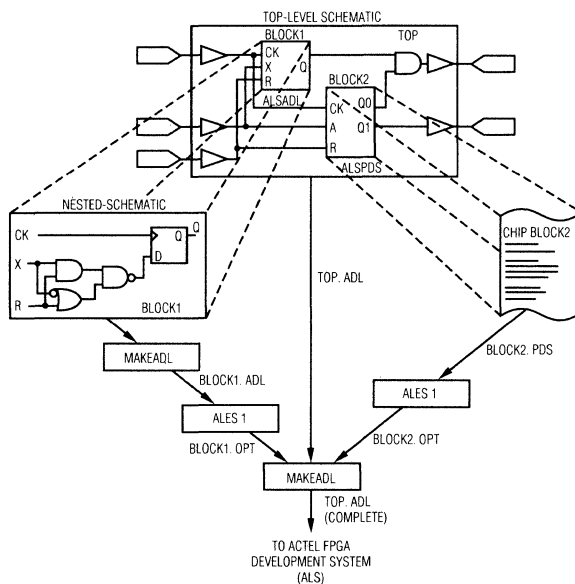
- 4 Mb memory (8 Mb recommended)
- 4 Mb free hard disk space
- ALES 1 software, including an ALES 1 authorization code



*Based on a sampling of 50 PLD designs.

This graph shows the typical number of PLDs which ALES 1 can map into Actel FPGA devices.

ALES 1 DESIGN FLOW



Actel



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SPECIAL INTEREST REPORT:

How Field Programmable Gate Arrays Compare With PLDs

Field Programmable Gate Arrays Combine Gate Array Flexibility and Density with PLD Convenience

Actel Corporation has developed a new generation of programmable devices that are categorized as field programmable gate arrays. Actel FPGAs combine the density and design flexibility of channeled gate arrays with the electrically programmable convenience of a PLD. Based on a patented CMOS antifuse technology, ACT™1 devices use less power and offer more gates per square inch than any other type of programmable logic. Their channeled gate array architecture is equally good for state machines, multipliers and glue logic — making

them the perfect vehicle for large scale logic integration.

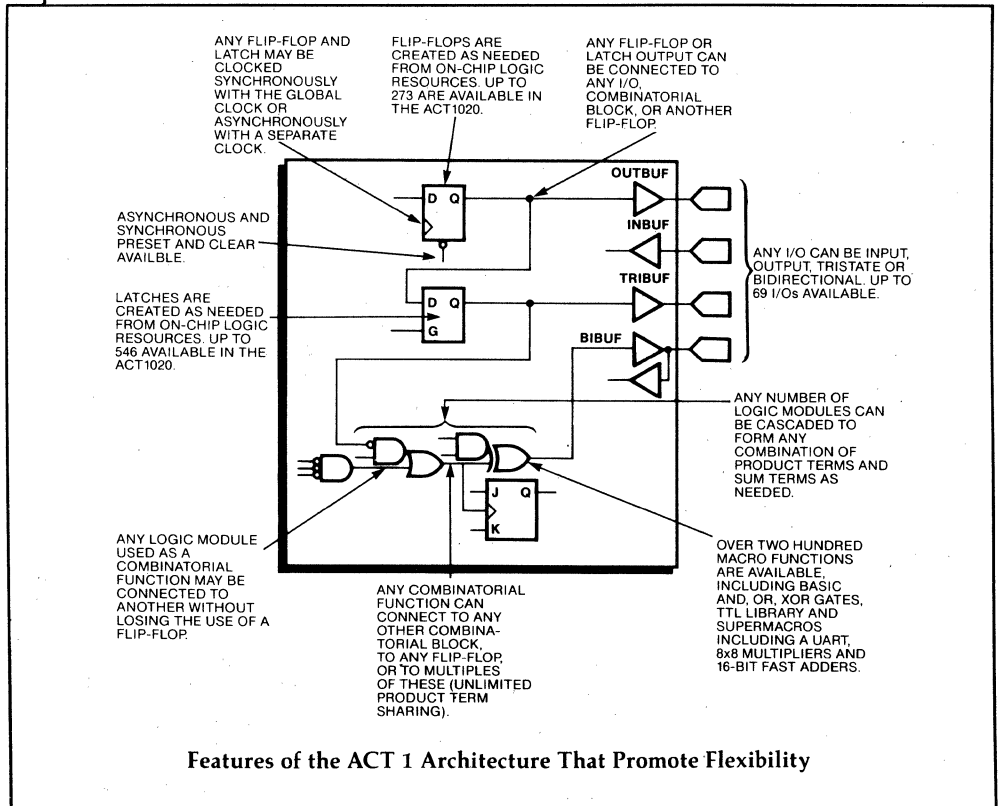
ACT 1 Architecture = More Flexibility, More Control

User-specified flip-flops keep gate utilization high. ACT 1 FPGAs comprise up to 546 flexible logic modules with programmable wiring for connecting them into user-specified circuits. The logic modules are efficient in implementing both combinatorial and sequential logic. JK and D flip-flops are implemented as needed using two logic modules, therefore, no dedicated flip-flops are required on the chip. A maximum of 273 flip-flops can be implemented in an 84-pin ACT1020 compared to the 8 or 10 flip-flops in a

typical 20 or 24-pin PLD respectively. A global clock network on-chip is provided to synchronously clock the flip-flops with minimal skew. The flip-flops can also be driven by different clock sources to accommodate asynchronous designs.

Greater flexibility reduces waste. An example of Actel's greater design flexibility versus traditional PLD structures can be seen in the implementation of product terms. Unlike PLDs, there are no AND-OR structures hard-wired to flip-flops in the ACT 1 device. PAL-type structures force the designer to use two whole macrocells when more than eight product terms are needed, wasting most of the second cell. Actel's smaller logic

Actel



modules can be cascaded to provide the needed resources without waste. Also, product terms made out of logic modules can be shared between flip-flops eliminating the need to create redundant product terms.

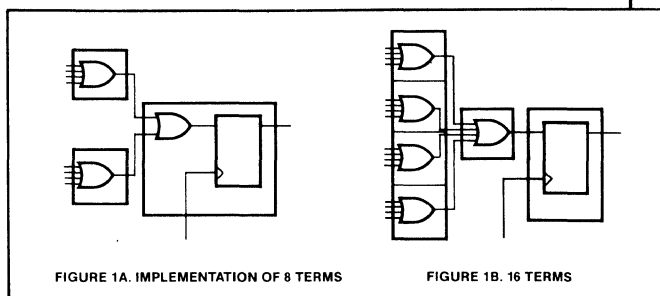
Programmable I/O pins gives the designer more options. The flexibility of the Actel architecture is evident again in the assignment of I/O pins. This is under the user's full control. All 69 I/O's of an ACT1020 can be programmed as inputs, outputs, tri-state outputs or bidirectional I/O outputs, at the user's discretion. In traditional PLD architectures a macrocell is often tied irrevocably to an I/O pin so that if the macrocell is used for something like a buried register or for feeding back the sum of products, the I/O pin is rendered unusable. With Actel's programmable I/O's, this waste is eliminated. The output of any gate or flip-flop may, at the user's discretion, be connected to any I/O without interfering with the use of any other gate or flip-flop.

Diagnostic capabilities beyond PLDs. Actel's software-addressable Actionprobe™ diagnostic tools are a unique feature that no other programmable device can duplicate. They can be connected to any point in the device so that by observing two external pins, the operation of any two internal nodes can be observed. This facility allows in-circuit debugging in which the designer can probe throughout the entire chip and observe performance and state in real time without generating time-consuming test vectors.

ACT 1 Performance = Greater Speed, Lower Power

Short propagation delays boost circuit speed. The ACT 1 architecture is suitable for a wide range of applications from datapaths to state machines and arithmetic functions. Critical path delay is proportional to the number of logic module levels. In traditional PLD

Complete testability contributes to high quality. ACT 1 arrays have built-in testability circuits that permit full functional testing at the factory. Since they are one-time programmable, everything is tested prior to shipment except the antifuse. To accommodate antifuse testing, Actel's programming unit, the Activator™ will test each antifuse during the programming cycle so that



architectures, a sizeable delay would be added each time a sum term is fed back. Figure 1 shows that one module delay is added to expand from 8 to 16 terms. At 2 microns in dimension, the logic module delay (including the net delay) is 9 ns. Chip-level system performance of 20-40 MHz is attained easily. Flip-flops are capable of toggling at 70 MHz.

Low power consumption. The ACT 1 device is fabricated using the low-power CMOS technology. Power consumption is dependent on the system speed, number of I/O's switching and number of logic modules used. The typical stand-by current is 3 mA, worst case 10 mA.

the user can be assured of a fully-tested, quality device.

Expanded Programmable Logic Integration

The advantage of using programmable logic devices has always been in the speed of design and lower cost of inventory. Now Actel's FPGAs augment these advantages by more flexibility, more usable gates and more control over the design.

Call your local Actel representative today for more information on how Actel can complement or extend your current programmable logic strategy. If you don't know who your representative is, call 1-800-642-0900 and ask for the name of the representative nearest you.



Corporate Offices:
955 E. Arques Avenue
Sunnyvale, CA 94086
Tel: 408/739-1010
Fax: 408/739-1540

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The AIC-6260 opens the world of SCSI to AT Motherboards by providing high performance and unmatched connectivity. A complete single-chip SCSI solution, the AIC-6260 features comprehensive software and design-in support, high-performance operation and complete compatibility with the SCSI-2 standard. Incorporating the AIC-6260 onto the PC Motherboard is especially easy with designed-in bus drivers allowing direct connection to AT and SCSI buses.

Architectural Overview

The AIC-6260 consists of two major functional sections: Host Interface Control and SCSI Control Logic. The AIC-6260 presents to the host processor a register-based command and control interface consisting of 32 8-bit Read/Write registers. The chip performs I/O address decoding on a 10-bit address input to the chip to map itself into one of two user-selectable starting I/O address locations: 340h or 140h. In addition, the address decode logic also generates an off-chip address select signal useful when setting up hardware jumper blocks for configuration option selection. To help simplify programming, the chip features a 16-byte RAM stack useful when saving SCSI Channel information in multithreaded applications. All signals on the Host Interface connect directly to a standard AT Bus with no buffering needed.

By using Programmed I/O, host data transfer rates approaching 4-MBytes/sec are possible by using the Repeat Instring instruction found on 80286, and higher, processors to take advantage of the large onboard 128-byte FIFO.

The AIC-6260 automates the most time consuming aspects of the SCSI interface with a built-in control sequencer. Through the control sequencer, SCSI Arbitration, Selection/Reselection and Data Transfers can be accomplished automatically with no intervention by the host processor. Alternatively, the host processor may individually control each SCSI signal for maximum flexibility. To assist the host in controlling SCSI operations, the AIC-6260 has available 16 interrupt conditions reflecting timing critical points in SCSI Bus operation. All AIC-6260 SCSI Bus signals feature built-in 48 mA open collector buffers allowing direct connection to SCSI Bus signals. SCSI Bus data transfers may be Asynchronous or Synchronous with up to an 8-byte offset.

Clocking for the AIC-6260 can be implemented by either using the onboard crystal oscillator circuit or an external clocking source of up to 20 MHz.

SCSI Connectivity

- Supports up to 56 logical SCSI devices
- Supports asynchronous and synchronous SCSI devices
- Programmable for either Initiator or Target operation
- Software support for up to 8 multitasking I/O processes
- Software drivers available for: Hard Disk, Streaming Tape, CD ROM, Digital Audio Tape (DAT), Magneto Optical Disk

Compatibility

- Completely SCSI-2 compatible
- Completely IBM PC AT Bus compatible
- Extensive compatibility testing with major PC systems and SCSI peripherals

Software Support

The AIC-6260 is supported by both a Bootable BIOS and ASPI Device drivers. ASPI is Adaptec's layered SCSI programming interface offering a standardized interface between the Hardware-Specific Manager and Unique Target Device Drivers.

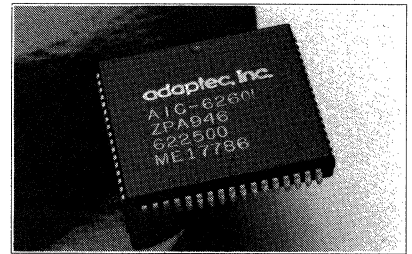
- System BIOS support available to provide Boot capability, low-level format, power management and support for up to two hard disk drives under DOS without additional software. Custom BIOS support configurations available.
- ASW-1210 DOS ASPI manager with multitasking support for up to 7 SCSI devices
- ASW-210 ASPI SY-TOS for MS-DOS Tape Backup module
- ASW-220 ASPI SY-TOS for OS/2 Tape Backup Module
- ASW-310 ASPI Sytos Plus for MS-DOS Tape and DAT Backup module
- ASW-410 ASPI CD-ROM for MS-DOS module

Additional Software Support

- ASW-1040 Novell NetWare 286 Software Driver
- ASW-1220 OS/2 ASPI/2 manager — LADDR compatible
- ASW-1240 Novell NetWare 386 Software Driver
- ASW-1250 SCO Unix ASPI manager

Design-In Support

- Design-In kit available containing:
 - AHA-1522 SCSI Host Adapter Evaluation Board
 - ASW-1210 DOS ASPI manager and disk driver
 - ASW-B626 BIOS for AIC-6260
 - Documentation Binder:
 - AIC-6260 Data Book
 - Compatibility Test Report
 - Design-In Schematic
 - Reliability Report
 - Packaging Specs
 - ASPI Interface Document
 - Application Notes
- Field and Factory Technical support



Features

- Single-chip PC/AT Bus-to-SCSI Bus interface
- Simplified programmer-friendly interface
- Powerful SCSI controller automates SCSI Phase Sequencing
- Low cost connectivity to multiple SCSI peripherals
- Compatible with SCSI-2 and Common Command Set (CCS)
- Built-in power management circuitry with software support
- Onboard bus drivers allow direct connect to host AT and SCSI Buses
- Pin-selectable clock source
- High Performance
 - Up to 10 MByte/sec burst transfers on Host Bus
 - Up to 5 MByte/sec synchronous transfers on SCSI Bus
- Comprehensive software support: DOS, OS/2, NetWare 286, NetWare 386, SCO Unix
- System BIOS support
- Supports 8-bit DMA or 16-bit PIO data transfers
- 128-byte data FIFO Buffer for superior host transfer performance

Technical Specifications

Process Technology:	1.2 μ m CMOS
Operating Temp. Range:	0°C to 70°C
Storage Temp. Range:	-65°C to 150°C
Operating Voltage Range:	4.75V to 5.25V
Power Consumption:	30 mA (150 mW) Operating @ 20 MHz with external clock 5 mA (25 mW) Powerdown Sleep Mode @ 20 MHz with external clock
Host Bus:	ISA (IBM PC/AT-compatible)
Host Data Trans. Modes:	8/16-bit PIO or 8-bit DMA
Host Transfer Rate:	Up to 10 MBytes/sec Burst
Min. PIO Cycle Time:	200 ns
Min. DMA Cycle Time:	400 ns
Host Data Buffering:	128-byte FIFO
Host Bus Drivers:	Vol = 0.5V max @ 24 mA on SD0-15, DRQ, IRQ, IOCS16 Voh = 2.4V min @ 8 mA on SD0-15, DRQ, IRQ
AT Bus I/O Addr Mapping:	340H or 140H, pin-selectable
Clock Frequency:	Up to 20 MHz internal or external clock, pin-selectable
SCSI Bus Transfer Modes:	8-bit Asynchronous or Synchronous
SCSI Transfer Rate:	Up to 5 MBytes/sec Synchronous
SCSI BUS Drivers:	Vol = 0.5V max @ 48 mA

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ALLEGRO PERIPHERAL POWER & DISPLAY DRIVERS

in order of (1) output current, (2) output voltage, and (3) number of drivers

OUTPUT RATINGS*			FEATURES					DEVICE TYPE ‡	HERM. AVAIL.	SMD AVAIL.		
mA	V	#	SERIAL INPUT	LATCHED DRIVERS	DIODE CLAMP	SAT. OUT.	INTERNAL PROTECT.					
SINK DRIVERS												
10	20	2 × 8	-	X	X	X	-	-	5881	-	X	
100	30	32	X	X	-	-	-	-	5833	-	X	
	40	8	-	-	-	X	-	-	2585†	X	X	
	40	32	X	X	-	-	-	-	5832	-	X	
	50	8	X	X	-	X	-	-	5824	-	-	
250	70	4	-	-	X	X	-	-	SERIES 400†	X	-	
	150	7	-	-	X	-	-	-	7003 & 7004	-	-	
300	50	8	-	-	X	X	-	-	2596	-	-	
	80	2	-	-	X	X	-	-	5711 thru 5714	-	-	
	80	4	-	-	X	X	-	-	5703 thru 5707	X	-	
	80	4	-	-	X	-	-	-	-	-	-	
350	50	4	-	X	X	-	-	-	SERIES 5800	-	X	
	50	7	-	-	X	-	-	-	2000	X	X	
	50	8	-	-	X	-	-	-	SERIES 2800	X	X	
	50	8	-	X	X	-	-	-	5801	-	X	
	60	16	4 TO 16-LINE LATCHED DECODER/DRIVER				-	-	-	5816	-	X
	70	2	-	-	X	X	-	-	5722	-	-	
	95	7	-	-	X	-	-	-	SERIES 2020	X	X	
	95	8	-	-	X	-	-	-	2820	X	X	
	100	8	X	X	-	-	-	-	SERIES 5821 thru 5823	X	-	
	100	8	X	X	X	-	-	-	5841 thru 5843	-	X	
400	26	2	1-Ø BRUSHLESS SENSOR/DRIVER			X	X	-	3626	-	-	
	50	7	-	-	X	-	-	-	SERIES 2010	X	-	
500	50	8	-	-	X	-	-	-	SERIES 2810	X	-	
	70	2	-	-	X	X	-	-	5752	-	-	
600	60	4	-	-	X	X	X	-	2547	-	X	
	60	4	-	-	X	X	-	-	2549	-	X	
	78	2	-	-	X	X	-	-	5741 thru 5744	-	-	
700	60	4	-	-	X	X	X	2543	-	X		
750	50	8	-	-	X	X	-	2597	-	-		
800	50	4	-	X	X	-	-	-	5830	-	-	
	50	4	-	X	X	X	-	-	5831	-	-	
900	14	2	1-Ø BRUSHLESS SENSOR/DRIVER			X	X	-	3625	-	-	
	70	2	-	-	X	X	-	-	5725	-	-	
1250	35	4	STEPPER MOTOR TRANSLATOR/DRIVER			-	-	X	5804	-	-	
	90	4	-	-	X	-	-	-	7068	-	-	
1500	80	2	-	-	X	-	-	-	2061 & 2062	-	-	
	80	4	-	-	X	-	-	-	2064 thru 2075	X	X	
1600	50	9	X	X	-	-	X	5829	-	X		
1700	80	3	X	X	X	-	X	5929	-	-		
1750	60	4	X	X	X	-	X	5825 & 5826	-	-		
1800	50	4	-	-	X	-	-	-	2544	-	-	
	50	4	-	-	X	-	-	-	2540	-	-	
4000	50	4	-	-	X	-	-	2878 & 2879	-	-		

SOURCE DRIVERS

-25	80	8	-	X	ACTIVE PULL-DOWN	-	-	-	5815†	X	X
	80	10	X	X	ACTIVE PULL-DOWN	-	-	-	5810†	X	X
	80	12	X	X	ACTIVE PULL-DOWN	-	-	-	5811	-	-
	80	20	X	X	ACTIVE PULL-DOWN	-	-	-	5812†	X	X
	80	32	X	X	ACTIVE PULL-DOWN	-	-	-	5818†	X	X
	110	6	-	-	-	-	-	-	6116†	-	-
-120	110	8	-	-	-	-	-	-	6118 & 6128†	X	X
	-25	8	-	-	X	X	-	-	2585	-	X
	30	8	-	-	X	X	-	-	2985	-	-
-350	50	8	X	X	X	X	-	-	5895	-	X
	35	8	-	-	X	-	X	-	2987	-	-
	80	8	-	-	X	-	-	-	2580 & 2588†	X	X
	80	8	-	-	X	-	-	-	2981 & 2984	X	X
-4000	80	8	X	X	X	-	-	-	5890 & 5891	-	-
	60	4	-	-	X	-	-	-	2944	-	-

SOURCE/SINK DRIVERS

±40	135	10	X	X	-	-	-	-	5910-2	-	-
±500	6.0	1	VOICE-COIL MOTOR DRIVER			-	X	X	8932	-	X
	40	2	DUAL FULL BRIDGE			X	-	-	2993	-	X
±750	45	2	DUAL PWM BRIDGE			X	X	X	2916	-	X
±800	16	1	VOICE COIL MOTOR DRIVER			-	X	X	8931 & 8958	-	X
±900	7.0	3	3-Ø BRUSHLESS CONTROL/DRIVER			-	DMOS	X	8901 & 8902	-	X
	14	3	3-Ø BRUSHLESS CONTROL/DRIVER			-	DMOS	X	8903	-	X
±1000	28	1	POWER OP AMP			X	-	-	3751	-	-
	40	2	DUAL POWER OP AMP			X	-	-	3755	-	-
±1500	45	2	DUAL PWM FULL BRIDGE			X	-	X	2917	-	X
±2000	15	3	HALF BRIDGE			X	X	X	2931	-	X
	30	1	HALF BRIDGE			X	-	X	2935 & 2950	-	-
	50	1	PWM FULL BRIDGE			X	-	X	2953 & 2954	X	-
	50	2	DUAL FULL BRIDGE			X	-	X	2938	X	-
±3000	14	3	3-Ø BRUSHLESS CONTROL/DRIVER			-	DMOS	X	8922	-	X
	45	2	PWM CONTROL			-	X	-	2932	-	-
	45	2	PWM CONTROL			-	X	-	2974	-	-
	45	3	3-Ø BRUSHLESS CONTROL/DRIVER			-	-	X	2936 & 2937	X	-
±3400	45	1	PWM CONTROL			X	-	-	2961	-	-
±4000	14	3	3-Ø BRUSHLESS CONTROL/DRIVER			-	DMOS	X	8925	-	X
±4800	65	2	PWM CONTROL			X	-	X	2966	-	-

*Current is maximum specified test condition, voltage is absolute maximum rating.

†Complete part number includes a prefix and suffix to identify operating temperature range and package style.

‡Output ratings shown are for selected units (suffix -1).



For application or engineering assistance, write or call
 Allegro Microsystems, Inc., 115 Northeast Cutoff, Box 15036
 Worcester, MA 01615, (508) 853-5000

ALLEGRO HALL-EFFECT AND OPTOELECTRONIC SENSORS

UNIPOLAR HALL-EFFECT SWITCHES				
Switch Points @ $T_A = +25^\circ\text{C}$		Max. Output Ratings	Device Type [‡]	Ext. Temp. Available
Max. Operate	Min. Release			
175 G	25 G	2x25 mA*/25 V	3235	—
200 G	50 G	25 mA/25 V	3140	yes
200 G	50 G	900 mA/28 V	5140	—
300 G	-25 G	24 V†	3055	yes
350 G	50 G	25 mA/25 V	3120	yes
450 G	30 G	25 mA/25 V	3113	—
500 G	125 G	25 mA/25 V	3119	yes
Vane Switch		25 mA/25 V	6450	—

*Output 1 switches on south pole, output 2 switches on north pole

†Multiplexed two-wire sensor; after proper address, power/signal bus current indicates magnetic field condition.

BIPOLAR HALL-EFFECT SWITCHES				
Switch Points @ $T_A = +25^\circ\text{C}$		Max. Output Ratings	Device Type [‡]	Ext. Temp. Available
Max. Operate	Min. Release			
+75 G	-75 G	25 mA/25 V	3133	yes
+95 G	-95 G	25 mA/30 V	3131	yes
+95 G	-95 G	25 mA/25 V	3132	yes
+150 G	-150 G	25 mA/25 V	3130	yes

BIPOLAR HALL-EFFECT LATCHES		
Switch Points @ $T_A = +25^\circ\text{C}$	Max. Output Ratings	Device Type [‡]
Max. Operate		
±150 G	15 mA/18 V	3177
±150 G	2x1.0 A/14 V*	3625
±150 G	2x450 mA/26 V*	3626
±170 G	15 mA/18 V	3175
±250 G	2x50 mA/25 V*	3275
±250 G	2x500 mA/30 V*	5275

*Complementary outputs for brushless dc motor control.

LINEAR OPTOELECTRONIC SENSORS	
Description	Device Type [‡]
Minimum output 280 nA/ $\mu\text{W}/\text{cm}^2$	3311
Minimum output 350 nA/ $\mu\text{W}/\text{cm}^2$	3312

LINEAR HALL-EFFECT SENSORS		
Description	Device Type [‡]	Ext. Temp. Available
Typical output 0.7 mV/gauss	3501	—
Typical output 1.3 mV/gauss	3503	yes

OPTOELECTRONIC SWITCHES	
Description	Device Type [‡]
Twilight sensor, ON below 10 $\mu\text{W}/\text{cm}^2$ typ.	3390
Open collector, ON below 55 $\mu\text{W}/\text{cm}^2$ typ.	3330
Internal pull-up, ON below 55 $\mu\text{W}/\text{cm}^2$ typ.	3360
Open collector, OFF below 55 $\mu\text{W}/\text{cm}^2$ typ.	3363

[‡]Complete part number includes a prefix and suffix to identify operating temperature range and package style.



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Allegro MicroSystems, Inc., 53 Regional Drive, Concord, NH 03301, (603) 228-5533

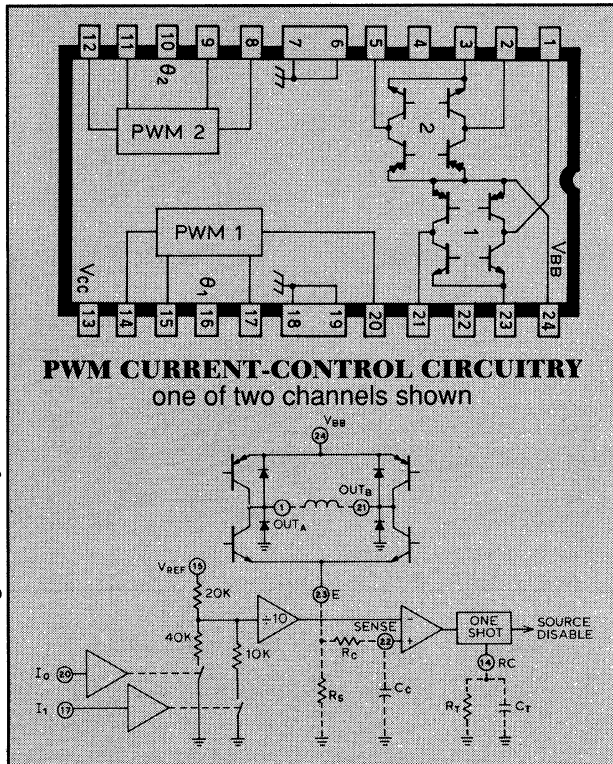
SMART POWER ICs

For Motor Driver Applications

SMART POWER integrated circuits from Allegro combine low-power CMOS, I²L, bipolar logic with bipolar or DMOS power drivers. Many devices are specifically intended for driving various types of motors (and other inductive loads) with ratings to ± 4.8 A or 90 V (sustaining) and include current sensing, thermal shutdown, and PWM current control. All motor drivers from Allegro include internal high-current clamp diodes.

UDN2916B

Dual Full-Bridge PWM Motor Driver



Allegro Microsystems

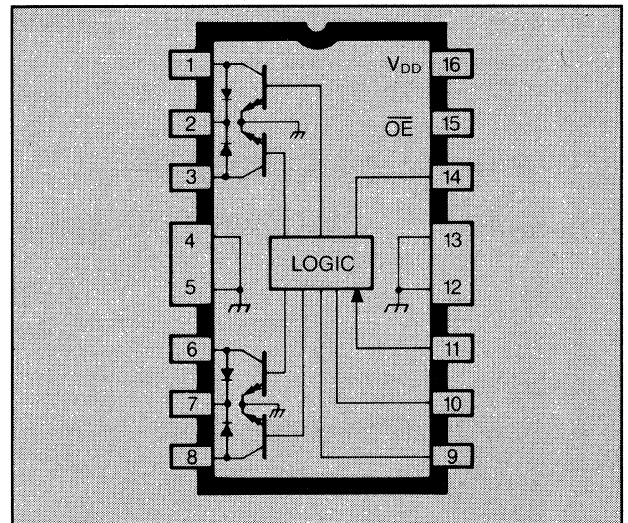
FEATURES:

- ± 750 mA continuous output current
- 45 V sustaining
- Internal clamp & flyback diodes
- Internal PWM current control
- Low output saturation voltage
- Crossover-current protected
- Internal thermal shutdown
- Power surface-mount package available
- Similar to dual PBL3717, UC3770

The UDN2916B is designed to drive both windings of a bipolar stepper motor or bidirectionally control two independent dc motors with peak start-up currents to 1 A. With PWM control, load current levels can be digitally-set at 0, 33, 67, or 100% of the user-determined maximum value.

UCN5804B

BiMOS II Stepper-Motor Translator/Driver



FEATURES:

- To 1.5 A per phase
- 35 V sustaining
- Wave drive, two-phase, & half-step formats
- Internal clamp & flyback power diodes
- Output enable and direction control
- Power-ON reset
- Internal thermal shutdown

Combining bipolar power drivers with low-power CMOS logic for sequencing and control, the UCN5804B provides complete control and drive of a four-phase unipolar stepper-motor to 1.5 A per phase. The three stepper-motor drive formats, direction of rotation, and output enable are externally selectable. All inputs are compatible with standard CMOS, PMOS, or NMOS circuitry allowing easy μ P control.



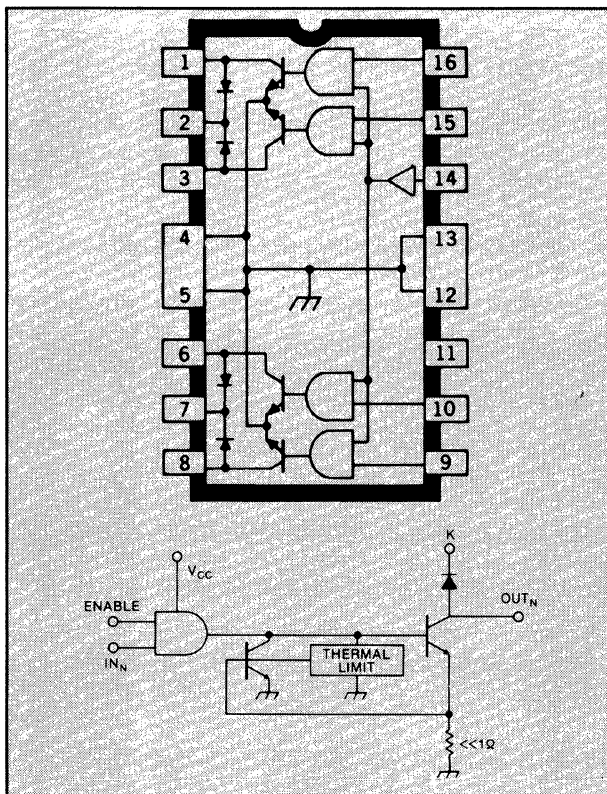
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POWER INTERFACE ICs

Allegro power interface ICs provide economical monolithic solutions to interfacing between low-power logic levels and peripheral power loads to 150 V or ± 4.8 A. Many devices include internal clamp diodes for use with inductive loads such as motors, relays, or solenoids; internal logic for serial-to-parallel conversion, decoders, latches, input or output enabling, and commutation or stepping logic for motors; and protection features such as thermal shutdown and current sensing/limiting.

UDN2543/49B

Quad Nand-Gate Power Drivers for Incandescent or Inductive Loads



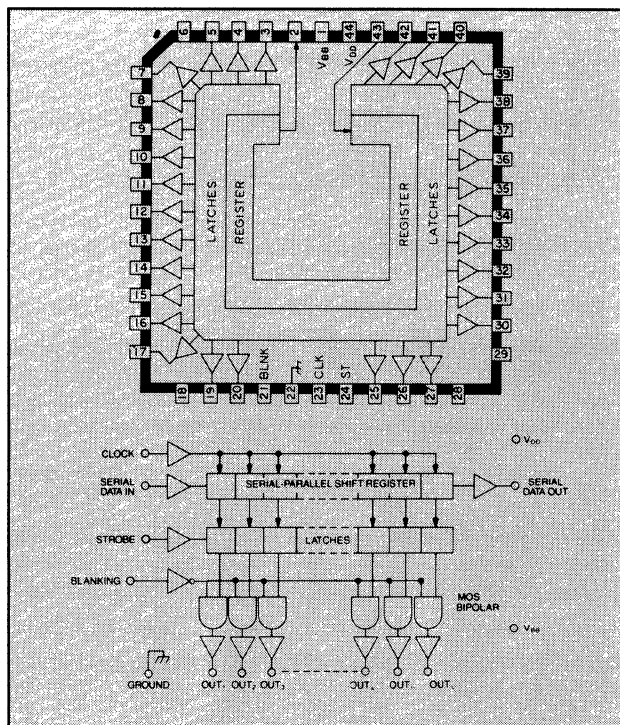
FEATURES:

- To 1 A and 60 V per output
- Over-current limited
- Internal clamp diodes
- Individual thermal limiting

The UDN2543B and UDN2549B are 4-channel drivers for use with incandescent lamps, relays, motors, or solenoids. Each channel is independently current and temperature limited to protect the load and driver against turn-on/inrush current, a stalled motor or shorted filament. Internal high-current clamp diodes and a sustaining rating to 40 V provide protection against inductive load transients. In the OFF state, the outputs will withstand up to 60 V.

BiMOS II

High-Speed Serial-Input Latched Drivers with Active DMOS Pulldowns



FEATURES:

- 10-Bit UCN5810AF/LWF (DIP/SOIC)
- 12-Bit UCN5811A (DIP)
- 20-Bit UCN5812AF/EPF (DIP/PLCC)
- 32-Bit UCN5818AF/EPF (DIP/PLCC)
- -25 mA/80 V source outputs
- 15 mA active DMOS pulldowns

"Smart power" BiMOS II drivers combine low-power, high-speed CMOS logic and control circuitry with bipolar power drivers for load ratings from 200 mA (32 channels) to 2 A (4 channels) or 150 V. Typical applications include VF, or LED displays; thermal, ink-jet, or impact print heads; stepper motors, and reed relays. Drivers intended for use with inductive loads include internal clamp diodes. Active DMOS pulldowns provide high-speed turn-off and reduced power requirements in display applications.

Allegro Microsystems

For application or engineering assistance, write or call Allegro Microsystems, Inc., 115 Northeast Cutoff, Box 15036 Worcester, MA 01615, (508) 853-5000



Formerly Sprague Semiconductor Group

SENSOR INTEGRATED CIRCUITS

UGN3235K

DUAL OUTPUT HALL EFFECT SWITCH

Type UGN3235K Hall effect sensors are bipolar integrated circuits designed for commutation of brushless dc motors, and other rotary encoding applications using multi-pole ring magnets. The device features two outputs which are independently activated by magnetic fields of opposite polarity.

Each sensor IC includes a Hall voltage generator, two Schmitt triggers, a voltage regulator, two output transistors, and on-board reverse polarity protection. The regulator enables these devices to operate from voltages ranging between 4.5 V and 24 V. On-chip compensation circuitry stabilizes the switch points over temperature.

Each open-collector output is independently operated by the proper amount and polarity of incident magnetic flux. Output 1 responds only to the positive flux from the south pole of a magnet, Output 2 to the negative flux from the north pole of a magnet. When the sensor experiences the field of a south magnetic pole greater than the maximum operate point of Output 1, that output switches to the LOW state and Output 2 is unaffected. When the incident flux falls below the minimum release point for Output 1, that output returns to the HIGH state and Output 2 remains unchanged.

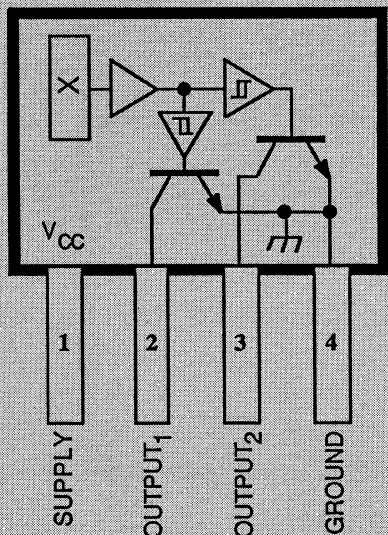
Output 2 independently responds in the same manner to the negative flux from the north magnetic pole of a magnet. In the region of 0 G, t_{off} , both outputs assume the HIGH or OFF state. This constitutes a delay that is independent of rate of change of the incident magnetic field and ensures that both outputs are never ON simultaneously. This is an essential feature for driving brushless dc motors with a minimum of reactive transient currents.

The UGN3235K is supplied in a four-pin plastic single in-line package (SIP) measuring just 0.200" wide x 0.130" high x 0.60" thick (5.08 x 3.3 x 1.54 mm).

FEATURES

- Reliable and Rugged Magnetic Sensing Switch
- Two Outputs Independently Switched by North and South Poles
- Independent Actuation of Outputs Minimizes Inductive-Load Reactive Transient
- Built-in Hysteresis Minimizes Interference from Stray Fields
- Operates from 4.5 V to 24 V
- Outputs Compatible with All Logic Levels
- On-Board Reverse Polarity Protection
- Open-Collector, Active-Low Outputs

Allegro Microsystems



Dwg. PH-007

Pinning is shown viewed from branded side.

ABSOLUTE MAXIMUM RATINGS at $T_A = +25^\circ\text{C}$

Power Supply, V_{CC}	25 V
Reverse Battery Voltage, V_{RCC}	-30 V
Output OFF Voltage, V_{OUT}	25 V
Output ON Current, I_{SINK}	50 mA
Magnetic Flux Density, B	Unlimited
Operating Temperature Range, T_A	-20°C to +85°C
Storage Temperature Range, T_S	-65°C to +150°C

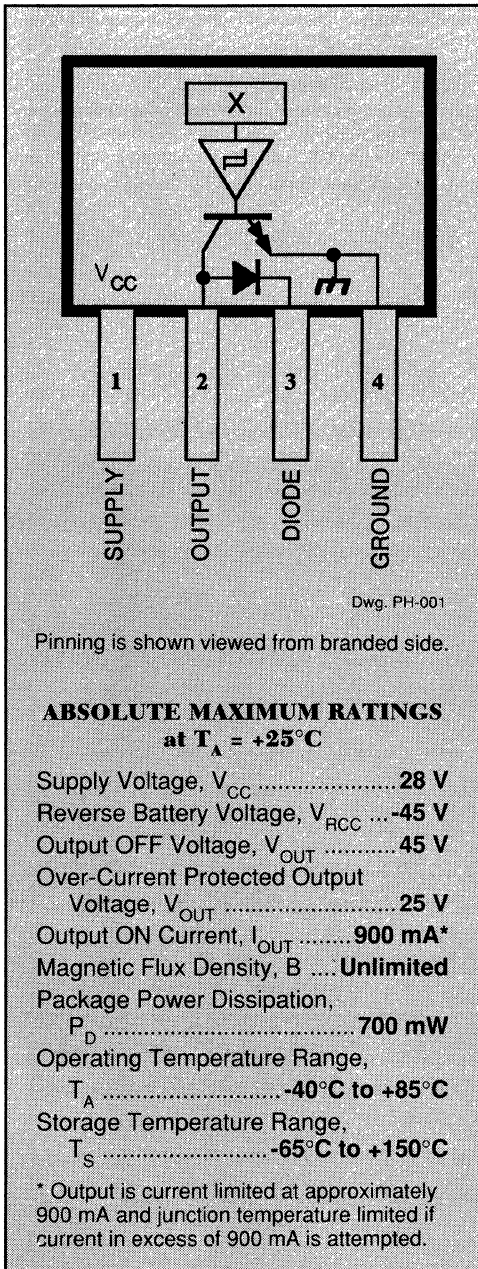


For application or engineering assistance, write or call
Allegro Microsystems, Inc., 53 Regional Drive
Concord, NH 03301, (603) 228-5533

SENSOR INTEGRATED CIRCUITS

UGQ5140K

PROTECTED POWER HALL[®] SENSOR/DRIVER



The UGQ5140K Hall effect sensor/driver is a monolithic integrated circuit designed for magnetic actuation of low-power incandescent lamps or inductive loads such as relays or solenoids. Included on chip is a Darlington power output that is capable of continuously sinking in excess of 300 mA. Internal protection circuitry limits surge (lamp turn-ON) or fault currents to approximately 900 mA. A sensitive magnetic threshold allows the device to be used in conjunction with inexpensive magnets or in applications that require relatively large operating distances.

Each sensor/driver includes a magnetic sensing Hall voltage generator, operational amplifier, Schmitt trigger, voltage regulator, and an open-collector, high-gain Darlington power output stage. The regulator allows use of the device with supply voltages of 4.5 V to 28 V. On-chip compensation circuitry stabilizes switch-point performance over temperature. The magnetic operation of this device is similar to that of the UGN3140U Hall effect switch.

The sensitive magnetic switch point coupled with the power output, current limiting, and thermal limiting circuitry allow the UGQ5140K to magnetically actuate various loads without requiring any external components.

The UGQ5140K is rated for operation over an extended temperature range of -40°C to +85°C. It is supplied in a four-pin mini-SIP plastic package, 0.200" (5.08 mm) wide, 0.130" (3.30 mm) high, and 0.060" (1.54 mm) thick.

FEATURES

- Magnetically Actuated Power Switch
- Temperature-Compensated Switch Points
- High Current Sink Capability
 - 300 mA Continuous
 - 900 mA Peak Current Limit
- Output Short Circuit Protection
- Low Quiescent Standby Current
- Linear Thermal Limiting
- Automotive Temperature Range
 - 40°C to +85°C, Operating
- Internal Inductive Flyback/Clamp Diode Protection
- Reverse Battery Protection
- Low-Profile 4-Pin Mini-SIP

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Hearst Engineering Software



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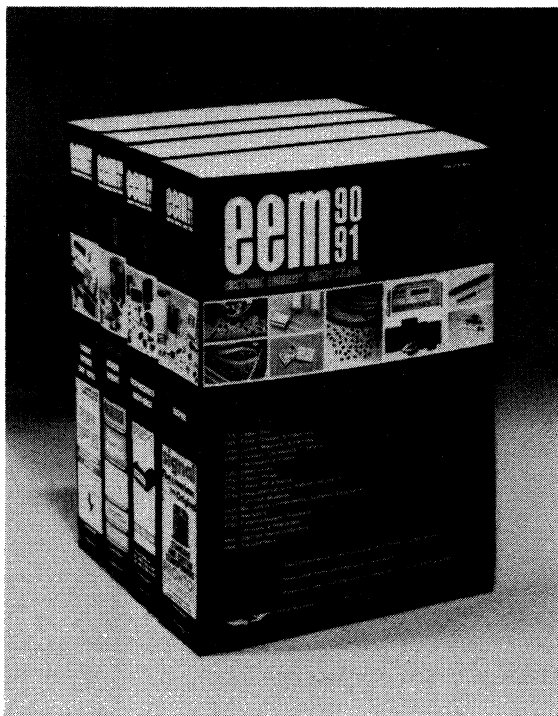
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Analog Devices



LINEAR PRODUCTS DATABOOK DATA CONVERSION PRODUCTS DATABOOK DSP PRODUCTS DATABOOK PMI ANALOG ICS DATABOOK

Four Volumes with Complete Technical Data on High Performance Amplifiers, Data Converters, Analog Signal Processing, Signal Conditioning, Digital Signal Processing Components, DSP Microprocessors and Related Products

The pages that follow in IC Master are the 1991 *Analog Devices Short Form Designers' Guide*. They contain selection guides to all of our product lines with key specifications that will lead you quickly to the optimum device for each application. This Designers' Guide also has block diagrams and descriptions of the latest new products from Analog Devices, particularly in the area of very high speed amplifier and data converter products. This Designers' Guide is a companion to our four comprehensive Databooks on Linear Products, Data Conversion Products, Digital Signal Processing Products, and Analog ICs from our newly acquired Precision Monolithics Division. Listed below are summaries of the product areas covered in each Databook.

Databooks are available free of charge from your nearest Analog Devices sales office or from the Analog Devices Literature Distribution Center at (617) 329-4700, Ext. 3392.

LINEAR PRODUCTS

- Operational Amplifiers
- Comparators
- Instrumentation Amplifiers
- Isolation Amplifiers
- Analog Multipliers/Dividers
- Log/Antilog Amplifiers
- RMS-to-DC Converters
- Mass Storage Components
- ATE Components
- Special Function Components
- Temperature Transducers
- Signal Conditioning Components & Subsystems
- Digital Panel Instruments
- Bus Interface & Serial I/O Products
- Automotive Components
- Application Specific ICs
- Power Supplies
- Component Test Systems

DATA CONVERSION PRODUCTS

- D/A Converters
- A/D Converters
- V/F & F/V Converters
- Synchro & Resolver Converters
- Sample/Track-Hold Amplifiers
- CMOS Switches & Multiplexers
- Voltage References
- Data Acquisition Subsystems
- Microcomputer I/O Boards
- Application Specific ICs
- Power Supplies
- Component Test Systems

DSP PRODUCTS

- DSP Processors
- Microcoded Support Components
- Floating-Point Components
- Fixed-Point Components

PMI ANALOG ICs

- Operational Amplifiers/Buffers
- Instrumentation Amplifiers
- SSM Audio Products
- Voltage Comparators
- Matched Transistors
- Voltage References
- D/A Converters
- A/D Converters
- Analog Switches/Multiplexers
- Sample-and-Hold Amplifiers/Special Functions
- Communication Products

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1991 SHORT FORM DESIGNERS' GUIDE

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1991 SHORT FORM DESIGNERS' GUIDE

This Designers' Guide serves as an update to the Selection Guides in the most recently released Databooks. It also provides the most current data on specifications and prices as well as the descriptions and block diagrams for many new products.

This Guide is intended to make it easy for users and potential users to become aware of, consider and compare products and product families available from Analog Devices as possible solutions to measurement and control, signal processing and system design problems. Once having arrived at preliminary choices, the user can look up complete information on the products in our Databooks, or else obtain data sheets on newer products by dropping a card in the mail or making a phone call to one of our sales offices (pages 100 and 101) or to our literature distribution center in Norwood, Massachusetts (617) 461-3392.

This book contains:

- Selection Guides and characteristics tables for comparing features and specifications for all products that are recommended for new designs, including products from our PMI division
- A comprehensive index to all products
- New product descriptions, specifications and block diagrams
- A list of products still in production but not listed in the primary tables because they are not recommended for new designs

- A list of products no longer available
- A list of products available to various military standards
- A description of our Application Specific Integrated Circuit capability
- Worldwide customer sales directory

PRODUCT DATABOOKS

Analog Devices has recently published a complete set of databooks which contain the data sheets and additional technical information on all of our current products. The products in these Databooks cover the entire range of data acquisition and signal processing requirements. If you have not already received a set of these Databooks, they can be obtained by contacting our main offices or one of our sales offices.

HOW TO USE THIS BOOK

This Volume

This volume is intended to lead the designer to the optimum component to fit a given application with the right mix of performance, features and cost, while also providing up-to-date information on new products. It is to be used in conjunction with our most recent Databooks and detailed data sheets, and provides source references for more detail.

If You Know the Product Number

Please turn to the product number index on page 102. This will lead you to the selection chart which contains that product and will allow you to compare it with other similar products. The selection chart will also tell you where more detailed data is available.

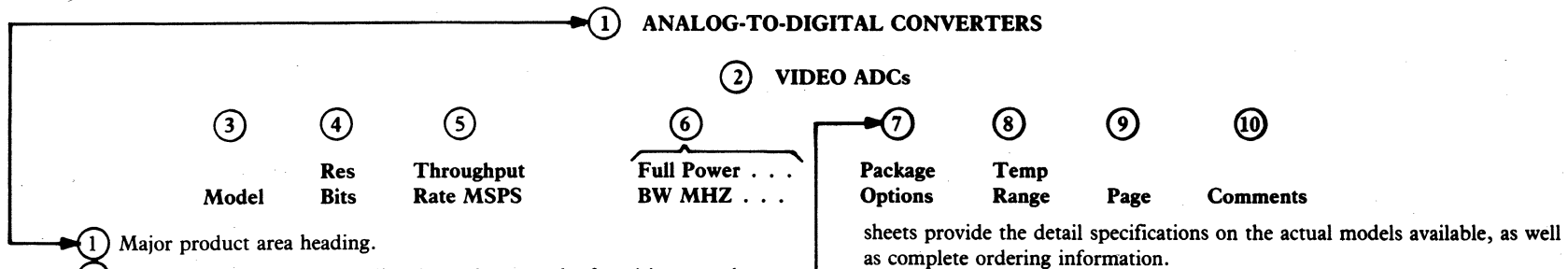
If You Don't Have a Product Number

If you have a product requirement, start with the table of contents; this will lead you to the proper selection charts of that product class. You can then quickly find a product with the needed mix of specifications.

If You Can't Find It Here . . . Ask!

This book contains all available products from Analog Devices through releases of 1990. If you have a product number which is not listed, or if you have a performance requirement which does not seem to be met in the Selection Guides, please call your nearest sales office or Analog Devices at (617) 937-1428. If you would like a data sheet on a specific product or our complete catalog, call (617) 461-3392.

Selection Guide Organization (Example)



- ① Major product area heading.
- ② Secondary product area heading (a product may be found in more than one area).
- ③ Generic part number (without suffixes for performance grades or packages).
- ④ Primary specification (first sort criterion).
- ⑤ Secondary sort specification.
- ⑥ Other key specifications. All specifications are min or max unless noted as typical.
- ⑦ Package options—product available in these package styles. Package guide at the bottom of each odd page.
- ⑧ Temperature ranges available—C = Commercial 0 to +70°C; I = Industrial -40°C to +85°C (some products -25°C to +85°C); M = Military -55°C to +125°C.
- ⑨ Page—Letter designation indicates the appropriate product databook in which complete data sheet information can be found. D = *DSP Products Databook*, C = *Data Conversion Products Databook*, L = *Linear Products Databook*, and P = *Precision Monolithics Division Databook*. SF = new product since databook publication. Block diagram and key features provided in the New Products section of this guide. Detailed data sheet available. N = design-in products not contained in databooks, but data sheets are available. Contact your nearest sales office for data sheets on any of the above.
- ⑩ Additional comments on features or applications.
Note that products are listed by generic part number only, such as AD9002, without additional suffixes for performance grade and package style (e.g., AD9002AD). In cases where product grades have differing values for a given specification, the range for all grades is given. The individual product data

PACKAGE OPTIONS

- 1 Hermetic DIP, Ceramic or Metal
- 2 Plastic or Epoxy Sealed DIP
- 3 Cerdip
- 4 Ceramic Leadless Chip Carrier
- 5 Plastic Leaded Chip Carrier
- 6 Small Outline "SOIC" Package
- 7 Hermetic Metal Can
- 8 Hermetic Metal Can DIP
- 9 Ceramic Flatpack
- 10 Plastic Quad Flatpack
- 11 Single-in-Line "SIP" Package
- 12 Ceramic Leaded Chip Carrier
- 13 Nonhermetic Ceramic/Glass DIP
- 14 J-Leaded Ceramic Package
- 15 Ceramic Pin Grid Array
- 16 TO-92

TEMPERATURE RANGES

- C Commercial—0 to +70°C
- I Industrial—-40°C to +85°C
(Some Products -25°C to +85°C)
- M Military—-55°C to +125°C

BOLDFACE TYPE

Boldface entries indicate products recommended for new design.

ASTERISK

*Denotes new product since the publication of the most recent Databook.

Analog Devices designs, manufactures and sells worldwide sophisticated electronic components and sub-systems for use in real-world signal processing. More than six hundred standard products are produced in manufacturing facilities located throughout the world. These facilities encompass all relevant technologies, including several embodiments of CMOS, BiMOS, bipolar and hybrid integrated circuits, each optimized for specific attributes and assembled products in the form of potted modules, printed-circuit boards and instrument packages.

State-of-the-art technologies have been utilized (and in many cases invented) to provide timely, reliable, easy-to-use advanced designs at realistic prices. Our popular IC products are available in both conventional and surface mount packages (SO, LCC, PLCC), and many of our assembled products employ surface mount technology to reduce manufacturing costs and overall size. More than twenty years of successful applications experience and continuing vertical integration insure that these products are oriented to user needs. The ongoing application of today's state-of-the-art and the invention of tomorrow's state-of-the-art processes strengthen the leadership position of Analog Devices in standard data acquisition and signal processing products and make us a strong contender in high performance, mixed signal ASICs.

NEW PRODUCTS FOR 1991

Analog Devices has made significant investments in the past few years to develop major new process and design technologies which have allowed us to expand our product lines extensively into many new areas such as video displays, digital audio, disk drive data retrieval and telecommunications. These new capabilities have also allowed us to offer higher performance and lower cost products in our traditional data acquisition and signal processing lines. They are all classified and summarized in this Guide, along with existing products which are suitable for new designs. New products will be marked with an "*" in the listings, and those which are not in the most recent Databooks are described in a special section of this book which includes their major features and a block diagram.

The primary thrust for new products is in the very high speed and video areas with fast new DACs, ADCs

and amplifiers directed primarily at display, signal processing, radar, ATE, disk drive and communications applications. Our DSP offerings have also been enhanced greatly by the ADSP-2100A, 12.5 MIPS Micro-processor. Our new DSP products include several new DSP microcomputers based on our powerful 2100 family architecture, and our first mixed-signal processor for voice band applications is the ADSP-21msp50.

TECHNICAL SUPPORT

Our extensive technical literature discusses the technology and applications of products for precision measurement and control and dynamic signal processing. In addition to tutorial material and comprehensive data sheets, we offer application notes, application guides, technical handbooks and several serial publications; for example, *Analog Productlog* provides brief information on new products being introduced, and *Analog Dialogue*, our technical magazine, provides in-depth discussions of new developments in analog and digital circuit technology as applied to data acquisition, signal processing, control and test. In addition to the Databooks and general short form selection guides such as this one, we also publish several short form catalogs on specific product families. Analog Devices also provides in-depth technical support through our sales offices and with a network of applications engineers available at our factory locations to discuss our products and your applications. A call to our central office in Norwood, Massachusetts will be directed to the engineer most closely associated with your interests.

SALES OFFICES

Backing up our design and manufacturing capabilities and our extensive array of publications is a network of sales offices and representatives throughout the United States and most of the world. They are staffed by experienced sales and applications engineers, and many of them maintain a local stock of Analog Devices products. Our Worldwide Service Directory, as of the publication date, appears on pages 100 and 101 at the back of the book.

RELIABILITY

The manufacture of reliable products is a key objective at Analog Devices. We maintain facilities that have been qualified under such standards as MIL-M-38510

for ICs in the U.S. and Ireland, and MIL-STD-1772 for hybrids. More than 30 of our products—both proprietary and second-source—have qualified for JAN part numbers; others are in the process. We have also specified and qualified over 200 products under the DESC and MIL-STD drawing programs. Most of our ICs are available in versions that comply fully with MIL-STD-883C Class B. In addition, we offer a wide variety of products compliant with MIL-M-38510, Level "S." An up-to-date listing of the products available under all of these programs begins on page 87 of this Designers' Guide. The detail specifications for products available in these various programs are published in our *Military Products Databook* for designers who specify ICs and hybrids for military contracts (the 1990 issue contains data on nearly 200 available product families). A newsletter, *Analog Briefings*, provides current information about the status of reliability at ADI and the most recent listings of product availability.

Our PLUS program makes available, at a small premium standard devices (commercial and industrial grades, plastic or ceramic packaging) for any user with demanding application environments. Subjected to stringent screening, similar to MIL-STD-883 test methods, they are often suffixed "/+" and are available from stock.

PRODUCTS NOT FOUND IN THE SELECTION GUIDES

For maximum usefulness to designers of new equipment, we have limited the contents of selection guides to products most likely to be used for the design of new circuits and systems. If the model number of a product you are interested in is not in the selection guides, turn to page 96 at the back of this volume where you will find a list of older products for which data sheets are available upon request. On page 97, you will find a guide to substitutions for products no longer available.

PRICES

Accurate, up-to-date prices are an important consideration in making a choice among the many available product families. Since prices are subject to change, current price lists and/or quotations are available upon request from our sales offices.

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Digital-to-Analog Converters

Current Output DACs

Model	Res Bits	Settling Time μ s typ	Bus Interface Bits ¹	Reference Volt Int/Ext (M) ²	Package Options	Temp Range	Page	Comments
AD9768	8	0.005	8, μ P	-1.26 V, Int	1, 4	C, M	C	Ultrahigh Speed, ECL Compatible, 20 mA Output Current
PM-7524	8	0.1	8, μ P	Ext (M)	2, 3, 4, 5, 6	C, I, M	P	CMOS, Low Cost, 8-Bit Multiplying DAC with Latch
AD7524	8	0.1	8, μ P	Ext (M)	2, 3, 4, 5, 6	C, I, M	C	CMOS, Low Cost, 8-Bit Multiplying DAC with Latch
DAC-08	8	0.135	8	Ext (M)	2, 3, 4, 6	C, I, M	P	8-Bit High Speed Multiplying DAC
DAC-20	8	0.150	8	10 V, Ext	2, 3	C	P	2-Digit BCD High Speed Multiplying DAC
DAC-1408A	8	0.25	8	Ext (M)	2, 3, 6	C, I	P	8-Bit Multiplying DAC
DAC-1508A	8	0.25	8	Ext (M)	3	M	P	8-Bit Multiplying DAC
DAC-888	8	0.400	8, μ P	Ext (M)	3	I, M	P	BYTEDAC 8-Bit High Speed Multiplying DAC
DAC-10	10	0.150	10	Ext (M)	2, 3, 6	C, M	P	10-Bit High Speed Multiplying DAC
*AD9720	10	0.005	—	Int	2, 3, 5, 14	C, M	SF-56	Ultrahigh Speed, ECL Compatible, Low Power, Low Glitch
*AD9721	10	0.005	—	Int	2, 3, 5, 14	C, M	SF-56	Ultrahigh Speed, TTL Compatible, Low Power, Low Glitch
AD561	10	0.25	10	Int	1, 2	C, M	C	Industry Standard 10-Bit DAC, JAN Part Available
DAC-100	10	0.300	10	6.6 V, Int	3	C, I, M	P	10-Bit Current Output DAC
DAC-86	10	0.500	10	Ext (M)	3	I	P	COMDAC Companding DAC (U-255 Law)
DAC-88	10	0.500	10	Ext (M)	3	I	P	COMDAC Companding DAC (U-255 Law)
DAC-89	10	0.500	10	Ext (M)	3	I	P	COMDAC Companding DAC (A-Law)
PM-7533	10	0.6	10	Ext (M)	2, 3, 5, 6	C, I, M	P	CMOS, Low Cost, 10-Bit Multiplying DAC
AD7533	10	0.6	10	Ext (M)	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost, 10-Bit Multiplying DAC
*AD9712A	12	0.022	—	Int	2, 3, 5, 14	C, M	N	ECL Compatible, Low Glitch, 0.5 LSB Typical DNL
*AD9713A	12	0.027	—	Int	2, 3, 5, 14	C, M	N	TTL Compatible, Low Glitch, 0.5 LSB Typical DNL
AD9712	12	0.030	12	-1.2 V, Int	2, 5	C	C	ECL Compatible Inputs, Low Glitch Energy
AD9713	12	0.030	12	-1.2 V, Int	2, 5	C	C	TTL Compatible Inputs, Low Glitch Energy
AD568	12	0.035	12	Int	3, 4	C, M	C	Highest Accuracy 12-Bit Ultrahigh Speed DAC
AD668	12	0.05	12	Ext (M)	3	C, M	C	Multiplying 12-Bit Ultrahigh Speed DAC
AD565A	12	0.25	12	10 V, Int	1	C, I, M	C	Industry Workhorse High Speed DAC; JAN Part Available
DAC-8043	12	0.25	Serial, μ P	Ext (M)	2, 3	C, I, M	P	8-Pin Serial Input 12-Bit CMOS DAC
PM-7542	12	0.25	4, μ P	Ext (M)	2, 3, 4, 6	C, I, M	P	CMOS, Nibble Load 12-Bit Multiplying DAC
AD DAC80-I	12	0.3	12	6.3 V, Int	1	C	C	Industry Standard, High Speed DAC
AD DAC85-I	12	0.3	12	6.3 V, Int	1	I, M	C	Improved Industry Standard
AD DAC87-I	12	0.3	12	6.3 V, Int	1	I, M	C	Improved Industry Standard
AD566A	12	0.35	12	10 V, Ext	1	C, M	C	High Speed DAC
DAC-8143	12	0.38	Serial, μ P	Ext (M)	2, 3, 6	I, M	P	12-Bit Serial Input DAC
PM-7543	12	0.38	Serial, μ P	Ext (M)	2, 3, 5, 6	C, I, M	P	CMOS, Serial Load 12-Bit Multiplying DAC
DAC-312	12	0.500	12	Ext (M)	2, 3, 6	C, M	P	12-Bit High Speed Multiplying DAC
PM-7541A	12	0.6	12	Ext (M)	2, 3, 4, 5, 6	C, I, M	P	CMOS, 12-Bit Multiplying DAC
AD7541A	12	0.6	12	Ext (M)	2, 3, 4, 5	C, I, M	C	CMOS, 12-Bit Multiplying DAC
DAC-8012	12	1.0	12, μ P	Ext (M)	2, 3, 5	C, I, M	P	12-Bit CMOS DAC with Memory
PM-7548	12	1.0	8, μ P	Ext (M)	2, 3, 5, 6	C, I, M	P	CMOS, Byte Load 12-Bit DAC, Specified with Single and Dual Supplies

Analog Devices

Model	Res Bits	Settling Time μ s typ	Bus Interface Bits ¹	Reference Volt Int/Ext (M) ²	Package Options	Temp Range	Page	Comments
AD7548	12	1	8, μ P	Ext (M)	2, 3, 4, 5	C, I, M	C	CMOS, Byte Load 12-Bit DAC, Specified with Single and Dual Supplies
AD562	12	1.5	12	Ext	1	C, I, M	C	Industry Standard, JAN Part Available
AD563	12	1.5	12	2.5 V, Int	1	C, M	C	Industry Standard
AD7542	12	2.0	4, μ P	Ext (M)	1, 2, 3, 4, 5	C, I, M	C	CMOS, Nibble Load 12-Bit Multiplying DAC
AD7543	12	2.0	Serial, μ P	Ext (M)	1, 2, 3, 4, 5	C, I, M	C	CMOS, Serial Load 12-Bit Multiplying DAC
AD7545A	12	1.0	12, μ P	Ext (M)	2, 3, 4, 5	C, I, M	C	CMOS, Improved AD7545
PM-7545	12	2.0	12, μ P	Ext (M)	2, 3, 4, 5, 6	C, I, M	P	CMOS, Parallel Load 12-Bit Multiplying DAC
AD7545	12	2.0	12, μ P	Ext (M)	2, 3, 4, 5	C, I, M	C	CMOS, Parallel Load 12-Bit Multiplying DAC
PM-7645	12	2.0	12, μ P	Ext (M)	2, 3, 4	C, I, M	P	PM-7545 Specified for +15 V Operation
AD7534	14	1.5	8, μ P	Ext (M)	1, 2, 5	C, I, M	C	CMOS, Byte Load
AD7535	14	1.5	8/14, μ P	Ext (M)	1, 2, 4, 5	C, I, M	C	CMOS, Parallel or Byte Load
AD7536	14	1.5	8/14, μ P	Ext (M)	1, 2, 4, 5	C, I, M	C	CMOS, Parallel or Byte Load, Bipolar Output
AD7538	14	1.5	14, μ P	Ext (M)	2, 3	C, I, M	C	CMOS, Parallel Load
AD1856	16	0.35	Serial, μ P	Int	2, 6	C	C	16-Bit PCM Audio DAC
*DAC-16	16	0.5	16	Ext (M)	2	I	SF-56	16-Bit High Speed Multiplying DAC
AD DAC71-I	16	1	16	6.3 V, Int	1, 7	C	C	High Resolution 16-Bit DAC
AD DAC72-I	16	1	16	6.3 V, Int	1, 7	C, I	C	High Resolution 16-Bit DAC
AD1860	18	0.35	Serial, μ P	Int	2, 6	C	C	18-Bit PCM Audio DAC
*AD1862	20	0.35	Serial, μ P	Int	2	C	SF-84	20-Bit Audio DAC

¹This column lists the data format for the bus with "μP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

²Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Digital-to-Analog Converters

Voltage Output DACs

Model	Res Bits	Settling Time μ s typ	Bus Interface Bits ¹	Reference Voltage Int/Ext (M) ²	Package Options	Temp Range	Page	Comments
AD557	8	0.8	8, μ P	Int	2, 5	C	C	Lowest Cost 8-Bit DACPORT™; Single +5 V Supply
AD7569	8	1	8, μ P	Int	2, 3, 4, 5, 6	C, I, M	C	CMOS, Complete 8-Bit DAC/ADC/SHA/Reference
AD558	8	3	8, μ P	Int	1, 2, 4, 5	C, M	C	10 V Out DACPORT. Single or Dual Supply
AD7224	8	7	8, μ P	2–12.5 V, Ext	2, 3, 4, 5, 6	C, I, M	C	CMOS, Low Cost 8-Bit DAC
DAC-06	10	1.5	10	6.7 V, Int	1	C, M	P	Twos Complement
DAC-210	10	1.5	10	7.6 V, Int	1	C, I	P	Sign-Magnitude/Internal Reference
DAC-05	10	2.0	10	6.7 V, Int	1	C, M	P	Sign-Magnitude or Unipolar Output
DAC-02	10	2.0	10	6.7 V, Int	1	C, M	P	Sign-Magnitude/Bipolar Output
AD662	12	3	12, μ P	2.0 V, Int	2, 3	C, I, M	C	Complete 12-Bit DACPORT™; Single +5 V Supply
AD DAC80-V	12	3	12	6.3 V, Int	1	C	C	Improved Industry Standard
AD DAC85-V	12	3	12	6.3 V, Int	1	I, M	C	Improved Industry Standard
AD DAC87-V	12	3	12	6.3 V, Int	1	I, M	C	Improved Industry Standard
AD667	12	3	4/8/12, μ P	10 V, Int	1, 2, 4, 5	C, I, M	C	Highest Accuracy Complete 12-Bit DAC
AD767	12	3	12, μ P	10 V, Int	1, 2	C, I, M	C	Fastest Interface Complete 12-Bit DAC
AD7848	12	4	12, μ P	3 V, Int	2, 3, 4, 5	C, I, M	C	CMOS, Complete 12-Bit DAC with DSP Interface
AD7845	12	5	12, μ P	Ext (M)	2, 3, 4, 5, 6	C, I, M	C	CMOS, 12-Bit Multiplying DAC with Output Amplifier
*AD7233	12	10	Serial	Int	2	I	SF-57	Smallest 12-Bit Serial DACPORT (8-Pin) Bipolar \pm 5 V Output Range
*AD7243	12	10	Serial	Int	2, 3, 6	I, M	SF-57	Low Cost 12-Bit Serial DACPORT in 16-Pin Package
AD7245	12	10	12, μ P	5 V, Int	2, 3, 4, 5	C, I, M	C	CMOS, 12-Bit Complete DAC, Parallel Load
AD7248	12	10	8, μ P	5 V, Int	2, 3, 4, 5	C, I, M	C	CMOS, 12-Bit Complete DAC, Byte Load
*AD7245A	12	10	12, μ P	5 V, Int	2, 3, 4, 5	C, I, M	SF-58	Faster, \pm 12 V AD7245
*AD7248A	12	10	8, μ P	5 V, Int	2, 3, 4, 5	C, I, M	SF-58	Faster, \pm 12 V AD7248
AD7840	14	4	14/Serial, μ P	3 V, Int	2, 3, 4, 5	C, I, M	C	CMOS, 14-Bit Complete DAC, Parallel or Serial Load
*AD766	16	1.5	Serial, μ P	Int	2, 3	C, I, M	SF-57	Zero-Chip Interface 16-Bit DSP DACPORT
AD1856	16	1.5	Serial, μ P	Int	2, 6	C	C	16-Bit PCM Audio DAC
AD569	16	3	8/16, μ P	\pm 5 V, Ext (M)	1, 2	I, M	C	Monolithic, 16-Bit Monotonic DAC
AD DAC71-V	16	5	16	6.3 V, Int	1, 7	C	C	High Resolution 16-Bit DAC
AD DAC72-V	16	5	16	6.3 V, Int	1, 7	C, I	C	High Resolution 16-Bit DAC
AD7846	16	6	16, μ P	Ext (M)	1, 2, 4, 5	C, I, M	C	CMOS, 16-Bit Multiplying DAC with Readback Capability
DAC1136	16	8	16	6 V, Int	Module	I	C	High Resolution and Accuracy
AD1147	16	20	16, μ P	10 V, Int	1	I	C	Internal 8-Bit Latched Input DACs for Offset and Gain Adjust

Analog Devices

Model	Res Bits	Settling Time μ s typ	Bus Interface Bits ¹	Reference Voltage Int/Ext (M) ²	Package Options	Temp Range	Page	Comments
AD1148	16	20	16, μ P	10 V, Int	1	I	C	Separate 8-Bit Bus for Internal Offset and Gain Adjust DACs
AD1860	18	1.5	Serial, μ P	Int	2, 6	C	C	18-Bit PCM Audio DAC
DAC1138	18	10	18	6 V, Int	Module	C	C	High Resolution and Accuracy
AD1139	18	40	8, μ P	-10 V, Int	1	C	C	True 18-Bit Accuracy

Video DACs

Model	Res Bits	Update Rate MHz min	Palette Size	External Reference	Package Options	Temp Range	Page	Comments
ADV476	6	66, 50, 35	256	I	2, 5	C	C	CMOS, Triple 6-Bit Color Palette RAM-DAC
ADV471	6	80, 50, 35	256	V/I	5	C	C	CMOS, Triple 6-Bit Color Palette RAM-DAC
ADV478	8	80, 50, 35	256	V/I	5	C	C	CMOS, Triple 8-Bit Color Palette RAM-DAC
ADV453	8	66, 40	256	V	2, 5	C	C	CMOS, Triple 8-Bit Color Palette RAM-DAC
*ADV101	8	80, 50, 30	—	V	2, 5	C	SF-59	CMOS, Triple 8-Bit Video DAC
*ADV7120	8	80, 50, 30	—	V	2, 5	C	SF-59	CMOS, Triple 8-Bit Video DAC
*ADV7121	10	80, 50, 30	—	V	2, 5	C	SF-59	CMOS, Triple 10-Bit Video DAC
*ADV7122	10	80, 50, 30	—	V	2, 5	C	SF-59	CMOS, Triple 10-Bit Video DAC
AD9701	8	225	—	—	1, 3, 4	I, M	C	Single 8-Bit Video DAC

LOGDAC™

Model	Res dB	Full Scale Range dB	Accuracy dB	Package Options	Temp Range	Page	Comments
AD7111	0.375	88.5	0.17	2, 3, 4	C, I, M	C	Low Distortion

¹This column lists the data format for the bus with "μP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

²Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

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Digital-to-Analog Converters

Multiple DACs

Model	Res Bits	Out Mode V/I	Settling Time μ s typ	Bus Interface Bits ¹	Reference Volt Int/Ext ²	# DACs	Package Options	Temp Range	Page	Comments
AD7669	8	V	1	8, μ P	Int	2	2, 5, 6	C, I, M	C	CMOS, Complete 8-Bit Dual DAC/ADC/SHA/Reference
DAC-8228	8	V	2.0	8, μ P	Ext (M)	2	2, 3, 6	I, M	P	CMOS, PM-7528 Pinout with Voltage Output
DAC-8229	8	V	2.0	8, μ P	Ext (M)	2	2, 3, 6	I, M	P	CMOS, Single or Dual Supply Operation
AD7769	8	V	2.5	8, μ P	Ext	2	2, 5	C, I	C	CMOS, Complete 8-Bit Dual DAC/2-Channel ADC
DAC-8426	8	V	3.0	8, μ P	10 V, Int	4	2, 3, 6	I, M	P	CMOS, Complete with 10 V Reference, Improved Timing
PM-7226A	8	V	3.0	8, μ P	Ext (M)	4	2, 3, 6	I, M	P	CMOS, Improved Timing, Specified for +5 V to +15 V Operation
AD7225	8	V	5	8, μ P	2-12.5 V, Ext	4	2, 3, 4, 5	C, I, M	C	CMOS, Separate Reference for Each DAC
DAC-8800	8	V	0.8	8, μ P	DC, Ext	8	2, 3, 6	I, M	P	Octal 8-Bit CMOS DAC (TrimDAC™)
*DAC-8840	8	V	3.5	Serial	Ext (M)	8	2, 3, 6	I, M	SF-61	CMOS, Four-Quadrant Multiplying with Op Amps
*DAC-8841	8	V	3.5	Serial	Ext (M)	8	2, 3, 6	I, M	SF-61	Octal 8-Bit, Two Quadrant, Multiplying TrimDAC, +5 V Operation
AD7228	8	V	5	8, μ P	2-10 V, Ext	8	2, 3, 4, 5	C, I, M	C	CMOS, Specified with Single and Dual Supplies, Skinny 20-Pin Package
AD7226	8	V	7	8, μ P	2-12.5 V, Ext	4	2, 3, 4, 5, 6	C, I, M	C	CMOS, No User Trims, Specified with Single and Dual Supplies
*AD7242	12	V	3	Serial	+3 V, Int	2	2, 3, 6	C, I	SF-58	Complete \pm 5 V 12-Bit Dual DAC
AD392	12	V	4	12, μ P	Int	4	8	C	C	Fast Bus Access Time (<40 ns), Data Readback Capability
*AD7837	12	V	5	8, μ P	Ext (M)	2	2, 3, 6	C, I, M	SF-60	CMOS, Byte Load, Double Buffered
*AD7847	12	V	5	12, μ P	Ext (M)	2	2, 3, 6	C, I, M	SF-60	CMOS, Parallel Load
AD390	12	V	8	12, μ P	+10 V, Int	4	1	C, M	C	Double Buffered, Simultaneous Update
AD7237	12	V	10	8, μ P	Int (+5 V), Ext	2	2, 3, 6	C, I, M	C	CMOS, Complete 12-Bit Dual, Byte Load
AD7247	12	V	10	12, μ P	Int (+5 V), Ext	2	2, 3, 6	C, I, M	C	CMOS, Complete 12-Bit Dual, Parallel Load
*DAC-8412	12	V	10	12, μ P	Ext	4	1, 2, 4	I, M	SF-61	Readback, Reset to Midscale, Low Power Quad DAC, +5 V to \pm 15 V Operation
*DAC-8413	12	V	10	12, μ P	Ext	4	1, 2, 4	I, M	SF-61	Equivalent to DAC-8412 with Reset to Zero Scale
AD664	12	V	10	12, μ P	\pm 14.5 V, Ext (M)	4	1, 2, 4, 5	C, I, M	C	Readback, Reset, Low Power Quad DAC
AD394	12	V	15	12, μ P	\pm 11 V, Ext (M)	4	1	C, M	C	Four Independent Reference Inputs, Bipolar Output

Analog Devices

Model	Res Bits	Out Mode V/I	Settling Time μ s typ	Bus Interface Bits ¹	Reference Volt Int/Ext ²	# DACs	Package Options	Temp Range	Page	Comments	Price 100s \$
AD395	12	V	15	12, μ P	± 11 V, Ext (M)	4	1	C, M	C	Four Independent Reference Inputs, Unipolar Output	120.80
*AD7244	14	V	3	Serial	+3 V, Int	2	2, 3, 6	C, I, M	SF-58	Complete ± 5 V 14-Bit Dual DAC	16.00
AD396	14	V	15	8, μ P	± 11 V, Ext (M)	4	1	C, M	C	Four Independent Reference Inputs, Bipolar Output, Simultaneous Update	168.10
*AD1868	18	V	1.5	Serial, μ P	Int	2	2, 6	C	SF-84	Dual 18-Bit Audio DAC, +5 V Single Supply	8.95
*AD1864	18	V/I	1.5	Serial, μ P	Int	2	2, 5	C	SF-84	Dual 18-Bit Audio DAC	20.45
PM7528	8	I	0.18	8, μ P	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	P	CMOS, Single Supply Operation, TLL Compatible at $V_{DD} = +5$ V	3.50
AD7528	8	I	0.2	8, μ P	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	C	CMOS, +5 V to +15 V Operation, TTL Compatible at $V_{DD} = 5$ V	5.95
DAC-8408	8	I	0.19	8, μ P	Ext (M)	4	2, 3, 5, 6	C, I, M	P	CMOS, Data Readback Memory Function	8.03
AD7628	8	I	0.35	8, μ P	Ext (M)	2	2, 3, 4, 5	C, I, M	C	CMOS, +12 V to +15 V Operation, TTL Compatible at $V_{DD} = 12$ V to 15 V	2.46
PM-7628	8	I	0.30	8, μ P	Ext (M)	2	2, 3, 4, 5, 6	I, M	P	CMOS, +5 V or +15 V Operation, Improved Timing	3.50
DAC-8221	12	I	0.45	12, μ P	Ext (M)	2	2, 3, 4, 6	C, I, M	P	CMOS, Buffered Inputs	10.88
*AD7568	12	I	0.5	Serial	Ext	8	4, 10	C, I, M	SF-60	Single +5 V Supply, Separate References, 44-Pin PQFP	†
DAC-8212	12	I	1.0	12	Ext (M)	2	2, 3, 5	C, I, M	P	CMOS, +5 V or +15 V Single Supply Operation	13.05
DAC-8222	12	I	1.0	12, μ P	Ext (M)	2	2, 3, 4, 6	C, I, M	P	CMOS, Double Buffered Inputs	11.66
DAC-8248	12	I	1.0	8, μ P	Ext (M)	2	2, 3, 6	C, I, M	P	CMOS, Double Buffered Inputs, Byte Load	11.60
AD7537	12	I	1.5	8, μ P	Ext (M)	2	2, 3, 4, 5	C, I, M	C	CMOS, Byte Load, Double Buffered	14.50
AD7547	12	I	1.5	12, μ P	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	C	CMOS, Parallel Load	14.50
AD7549	12	I	1.5	4, μ P	Ext (M)	2	2, 3, 4, 5	C, I, M	C	CMOS, Nibble Load, Double Buffered	16.95

¹This column lists the data format for the bus with " μ P" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μ P indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

²Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

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Analog-to-Digital Converters

Sampling ADCs

Model	Res Bits	Conv Time μ s max	SHA BW kHz typ ¹	Reference Volt Int/Ext ²	Bus Interface Bits ³	Package Options	Temp Range	Page	Comments
AD7821	8	0.66	100	0-5 V, Ext	8, μ P	2, 3, 4, 5, 6	C, I, M	C	CMOS, Bipolar or Unipolar Operation
AD7569	8	2	200	Int	8, μ P	2, 3, 4, 5, 6	C, I, M	C	CMOS, Complete I/O Port with DAC, ADC, SHA, Amps and Reference
AD7669	8	2	200	Int	8, μ P	2, 5, 6	C, I, M	C	CMOS, Complete I/O Port with 2 DACs, ADC, SHA, Amps and Reference
AD7769	8	3	200	Ext	8, μ P	2, 5	C	C	CMOS, Analog I/O Port with 2-Channel ADC for ± 10 V Input Signals
AD7820	8	2	7	0-5 V, Ext	8, μ P	2, 3, 4, 5, 6	C, I, M	C	CMOS, 8-Bit Sampling ADC
AD7824	8	2.5	10	0-5 V, Ext	8, μ P	2, 3	C, I, M	C	CMOS, 4-Channel, 8-Bit Sampling ADC
AD7828	8	2.5	10	0-5 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, 8-Channel, 8-Bit Sampling ADC
AD7575	8	5	50	1.23 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost
AD7579	10	18.5	25	2.5 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost 10-Bit Sampling ADC
AD7580	10	18.5	25	2.5 V, Ext	10, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost 10-Bit Sampling ADC
AD9005	12	0.1	38000	Int	12	8	C, M	C	Complete 12-Bit ADC with T/H, Reference and Timing Circuitry
AD9003	12	1	10000	Int	12	8	C	C	12-Bit, 1 MSPS ADC, Single 40-Pin DIP
*AD7886	12	1	350	Ext	12, μ P	1, 2, 10	C, I	SF-63	CMOS, 12-Bit 750 kHz Sampling ADC
AD678	12	5	1000	5 V, Int	8/12, μ P	1, 2, 5	C, M	C	BiMOS, High Impedance High Bandwidth Sampling Input, 10 V Range, AC/DC Tested
*AD7874	12	7.5	500	Int (+3 V)/Ext	12, μ P	2, 3, 5	C, I, M	SF-63	CMOS, Multiplexed Four Channel ADC for ± 10 V Input Signals
AD1332	12	8	125	-5 V, Int	12, μ P	1	I, M	C	Complete 12-Bit 125 kHz Sampling ADC for Digital Signal Processing, On-Chip FIFO
*AD7868	12	8	500	Int (+3 V)	Serial, μ P	2, 3, 6	C, I, M	SF-81	CMOS, Complete I/O Port with 12-Bit ADC and 12-Bit DAC
AD7870	12	8	500	3 V, Int	8/12/Serial, μ P	2, 3, 5, 6	C, I, M	C	CMOS, 100 kHz Throughput Rate
*AD7875	12	8	500	Int (+3 V)	8/12/Serial, μ P	2, 3, 5	C, I, M	SF-63	CMOS Complete 12-Bit ADC for Input Signals at ± 5 V
*AD7876	12	8	500	Int (+3 V)	8/12/Serial, μ P	2, 3, 6	I, M	SF-63	CMOS Complete 12-Bit ADC for Input Signals at ± 5 V
AD7878	12	8	500	3 V, Int	12, μ P	2, 3, 4, 5	C, I, M	C	CMOS, 100 kHz Throughput, On-Chip FIFO
AD1334	12	15	235	-5 V, Int	12, μ P	1	I	C	Four-Channel 65 kHz 12-Bit Sampling ADC, On-Chip FIFO
*AD1674	12	10	500	10 V, Int	8/12, μ P	1, 2	C, I, M	SF-62	Complete AD574A Pinout Compatible, Sampling Input
AD368	12	15	40-1000	6.3 V, Int	12	1	I, M	C	Complete 12-Bit ADC with Programmable Gains of 1, 8, 64, 512

Analog Devices

Model	Res Bits	Conv Time μ s max	SHA BW kHz typ ¹	Reference Volt Int/Ext ²	Bus Interface Bits ³	Package Options	Temp Range	Page	Comments
AD369	12	15	40-1000	6.3 V, Int	12	1	I	C	Complete 12-Bit ADC with Programmable Gains of 1, 10, 100, 500
AD363R	12	40	X	10 V, Int	12, μ P	1	C, M	C	16-Channel, 12-Bit DAS
AD364R	12	50	X	10 V, Int	12, μ P	1	C, M	C	High Speed, 16-Channel, 12-Bit DAS with Three-State Buffered Output
*AD9014	14	0.1	50000	Int	14	Board	C	SF-61	Wide, Spurious Free Dynamic Range to 10 MHz A _{IN} , 10.24 MSPS
AD679	14	10	1000	5 V, Int	8, μ P	1, 2, 5	C, I, M	C	BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Input Range, AC/DC Tested
AD779	14	10	1000	5 V, Int	14, μ P	1, 2	C, I, M	C	BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Input Range AC/DC Tested
AD7871	14	10	500	3 V, Int	8/14/Serial, μ P	2, 3, 5	C, I, M	C	CMOS, 14-Bit, Complete Sampling ADC
AD7872	14	10	500	3 V, Int	Serial, μ P	2, 3, 6	C, I, M	C	CMOS, 14-Bit, Complete Sampling ADC with Serial Output
DAS1152	14	40	X	10 V, Int	14	1	I	C	14-Bit High Accuracy Sampling ADC
DAS1157	14	55	X	10 V, Int	14	1	I	C	Low Power, 14-Bit Sampling ADC
DAS1153	15	50	X	10 V, Int	15	1	I	C	15-Bit High Accuracy Sampling ADC
DAS1158	15	55	X	10 V, Int	15	1	I	C	Low Power, 15-Bit Sampling ADC
*AD1382	16	2	2200	10 V, Int	8, μ P	1	C	SF-62	High Speed, 16-Bit Sampling ADC Guaranteed Dynamic Performance
*AD1876	16	10	X	5 V, Ext	Serial	1, 2	C	SF-62	Autocalibrating, 16-Pin DIP ADC
AD1380	16	20	900	Int	16/Serial	1	C	C	Low Cost, 16-Bit Sampling ADC
DAS1159	16	55	X	10 V, Int	16	1	I	C	Low Power, 16-Bit Sampling ADC

¹X indicates that the internal SHA bandwidth is not specified in kHz.

²Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

³This column lists the data format for the bus with " μ P" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μ P indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Analog-to-Digital Converters

General Purpose ADCs

Model	Res Bits	Conv Time μ s	Int SHA BW kHz ¹	Reference Voltage Int/Ext ²	Bus Interface Bits ³	Package Options	Temp Range	Page	Comments
AD7821	8	0.66	100	0-5 V, Ext	8, μ P	2, 3, 4, 5, 6	C, I	C	CMOS, Bipolar or Unipolar Operation
PM-0820	8	1.3	6.4	+5 V, Ext	8, μ P	2, 3, 5, 6	I, M	P	CMOS, Half-Flash, Low Power
AD7569	8	2	200	Int	8, μ P	2, 3, 4, 5, 6	C, I, M	C	CMOS, Complete I/O Port with DAC, ADC, SHA, Amps and Reference
AD7669	8	2	200	Int	8, μ P	2, 5, 6	C, I, M	C	CMOS, Complete I/O Port with 2 DACs, ADC, SHA, Amps and Reference
AD7820	8	2	7	0-5 V, Ext	8, μ P	2, 3, 4, 5, 6	C, I, M	C	CMOS, 8-Bit Sampling ADC
AD7769	8	2.5	200	Ext	8, μ P	2, 5	C, I	C	CMOS, Two-Channel ADC/DAC with Output Amplifiers
AD7824	8	2.5	10	0-5 V, Ext	8, μ P	2, 3	C, I, M	C	CMOS, 4 Channel, 8-Bit Sampling ADC
AD7828	8	2.5	10	0-5 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, 8 Channel, 8-Bit Sampling ADC
AD7575	8	5	50	1.23 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost
ADC-908	8	6.0		-10 V, Ext	8, μ P	2, 3, 4, 6	C, I, M	P	CMOS, +5 V Operation, Fast
AD670	8	10		Int	8, μ P	1, 2, 4, 5	C, I, M	C	Single Supply, Including In-Amp and Reference
AD7576	8	10		1.23 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost
PM-7574	8	15.0		-10 V, Ext	8, μ P	2, 3, 4, 6	C, I, M	P	CMOS, +5 V Operation
AD570	8	25		Int	8	1	C, M	C	
AD673	8	30		Int	8, μ P	1, 2, 5	C, M	C	
AD7581	8	66.7		-5 V-(-15 V), Ext	8, μ P	1, 2	C, I	C	CMOS 8-Bit ADC
AD579	10	1.8		10 V, Int	10/Serial	1	C, I	C	High Speed with Low Power
ADC-910	10	6.0		2.5-10 V, Ext	8, μ P	3	C, I, M	P	Bipolar, Fast with Byte Output
AD7579	10	18.5	25	2.5 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost 10-Bit Sampling ADC
AD7580	10	18.5	25	2.5 V, Ext	10, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Low Cost 10-Bit Sampling ADC
AD571	10	25		Int	10	1	C, M	C	
AD573	10	30		Int	8/10, μ P	1, 2, 5	C, M	C	Complete 10-Bit ADC
AD575	10	30		Int	Serial	1, 2	C, M	C	Complete 10-Bit ADC with Serial Output
AD9005	12	0.1	38000	Int	12	8	C, M	C	Complete 12-Bit ADC with T/H, Reference and Timing Circuitry
*AD671-500	12	0.5		5 V, Ext	12	1, 2	C, M	SF-64	12-Bit 500 ns Monolithic ADC
*AD671-750	12	0.75		5 V, Ext	12	1, 2	C, M	SF-64	12-Bit 750 ns Monolithic ADC
AD9003	12	1	10000	Int	12	8	C	C	12-Bit, 1 MSPS ADC; Single 40-Pin DIP
*AD7586	12	1	500	-4 V, Ext	12, μ P	1, 2, 5	C, I	SF-65	CMOS 12-Bit, 1 MHz ADC
*AD7886	12	1	350	Ext	12, μ P	1, 2, 10	C, I	SF-65	CMOS 12-Bit, 750 kHz Sampling ADC
AD578	12	3		10 V, Int	12	1	C, M	C	Complete, 3 μ s, 12-Bit ADC
*ADC-922	12	3		10 V, Ext	12, μ P	3	I, M	SF-66	Complete, 3 μ s, 12-Bit ADC with User Selectable Input Range
*AD7572A	12	3		Ext	8/12, μ P	2, 3, 4, 6	C, I, M	SF-64	Improved Version of Industry Standard
*ADC-7573	12	3		5.25 V, Ext	Serial	1, 2, 6	I, M	SF-66	Complete, 3 μ s, 12-Bit ADC in 8-Pin Mini-DIP

Model	Res Bits	Conv Time μ s	Int SHA BW kHz ¹	Reference Voltage Int/Ext ²	Bus Interface Bits ³	Package Options	Temp Range	Page	Comments
AD7672	12	3		-5 V, Ext	12, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Unipolar or Bipolar, -12 V, +5 V Supply
AD678	12	5	1000	5 V, Int	12, μ P	1, 2, 5	C, I, M	C	BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Range, AC/DC Tested
AD5240	12	5		6.3 V, Int	12	1, 8	C, I	C	Industry Standard
AD7572	12	5		-5.25 V, Int	12, μ P	2, 3, 4, 5	C, I, M	C	CMOS 12-Bit ADC
AD1332	12	8	125	-5 V, Int	12, μ P	1, 8	I	C	Complete 12-Bit 125 kHz Sampling ADC for Digital Signal Processing, On-Chip FIFO
*AD7874	12	7.5	500	Int (+3 V)/Ext	12, μ P	2, 3, 5	C, I, M	SF-63	CMOS, Multiplexed Four Channel ADC for ± 10 V Input Signals
*AD7875	12	8	500	3 V, Int	8/12/Serial, μ P	2, 3, 5	I, M	SF-63	CMOS, Complete 12- Bit ADC for Input Signals of +5 V
*AD7876	12	8	500	3 V, Int	8/12/Serial, μ P	2, 3, 5	I, M	SF-63	CMOS, Complete 12- Bit ADC for Input Signals of ± 10 V
AD7870	12	8	500	3 V, Int	8/12/Serial, μ P	2, 3, 4, 5	C, I, M	C	CMOS, 100 kHz Throughput, Serial, Parallel, or Byte Output
AD7878	12	10	500	3 V, Int	12, μ P	2, 3, 4, 5	C, I, M	C	CMOS, 100 kHz Throughput, On-Chip FIFO; Serial, Parallel or Byte Output
AD7772	12	10	X	5.25, Int	Serial, μ P	2, 3, 4, 5	C, I, M	C	CMOS, Serial Output 12-Bit ADC
*AD1674	12	10		10 V, Int	8/12, μ P	1, 2	C, I, M	SF-62	Complete, AD574 Pinout Compatible Sampling Input
AD ADC84/85	12	10		6.3 V, Int	12	1	C, I, M	C	Industry Standard
*AD7880	12	12	33	5 V, Ext	12	2, 3, 6	I	SF-66	12-Bit Single Supply Sampling ADC
ADC-912	12	12.5		-5 V, Ext	12, μ P	2, 3, 6	C, M	P	CMOS, Low Transition Noise
AD5210	12	13		-10 V, Int/Ext	12	1	I, M	C	Industry Standard (AD5211/12/14/15)
AD674A	12	15		10 V, Int	8/12, μ P	1	C, M	C	Complete 12-Bit ADC
AD368	12	15	40-1000	6.3 V, Int	12	1	I, M	C	Complete 12-Bit ADC with Programmable Gains of 1, 8, 64, 512
AD369	12	15	40-1000	6.3 V, Int	12	1	I	C	Complete 12-Bit ADC with Programmable Gains of 1, 10, 100, 500
AD572	12	25		10 V, Int	12	1, 8	I, M	C	12-Bit Successive Approximation ADC
AD ADC80	12	30		6.3 V, Int	12	1	I	C	Industry Standard
AD574A	12	35		10 V, Int	8/12, μ P	1, 2, 4, 5	C, M	C	Complete ADC with Reference and Clock
AD5200	12	50		-10 V, Int/Ext	12	1	I, M	C	Industry Standard (AD5201/02/04/05)
AD7578	12	100		5 V, Ext	12, μ P	1, 2	C, I, M	C	CMOS, 1 LSB Total Unadjusted Error

¹X indicates that the internal SHA bandwidth is not specified in kHz.

²Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

³This column lists the data format for the bus with " μ P" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μ P indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Analog-to-Digital Converters

General Purpose ADCs

Model	Res Bits	Conv Time μ s	Int SHA BW kHz ¹	Reference Voltage Int/Ext ²	Bus Interface Bits ³	Package Options	Temp Range	Page	Comments
AD7582	12	100		5 V, Ext	12, μ P	1, 2, 4, 5	C, I, M	C	CMOS, 1 LSB Total Unadjusted Error
AD679	14	10	1000	5 V, Int	8, μ P	1, 2, 5	C, I, M	C	BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Input Range, AC/DC Tested
AD779	14	10	1000	5 V, Int	14, μ P	1, 2, 5	C, I, M	C	BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Input Range, AC/DC Tested
AD7871	14	10	500	3 V, Int	8/14/Serial, μ P	2, 3, 4, 5	C, I, M	C	CMOS, 14-Bit Complete Sampling ADC
AD7872	14	10	500	3 V, Int	Serial	2, 3, 6	C, I, M	C	CMOS, 14-Bit Complete Sampling Serial ADC in 16-Pin DIP
ADC1131	14	12		Int	14	Module	C	C	14-Bit, High Speed ADC
ADC1130	14	25		Int	14	Module	C	C	14-Bit, High Speed ADC
DAS1152	14	40	X	10 V, Int	16	Module	I	C	14-Bit High Accuracy Sampling ADC
DAS1157	14	55	X	10 V, Int	16	Module	I	C	Low Power, 14-Bit Sampling ADC
DAS1153	15	50	X	10 V, Int	16	Module	I	C	15-Bit High Accuracy Sampling ADC
DAS1158	15	55	X	10 V, Int	16	Module	I	C	Low Power, 15-Bit Sampling ADC
AD1377	16	10	X	Int	16, Serial	1	C	C	Complete, High Speed 16-Bit ADC Operation over -25°C to $+85^{\circ}\text{C}$
AD1376	16	15		Int	16, Serial	1	C	C	Complete 16-Bit Converter; Industry Standard Pinout
*AD1378	16	17		Int	16, Serial	1	M	SF-64	Complete 16-Bit Converter; MIL Temp Range; Industry Standard Pinout
AD1380	16	20	900	Int	16, Serial	1	C	C	Low Cost, 16-Bit Sampling ADC Operation over -55°C to $+85^{\circ}\text{C}$ Temperature Range
ADC1140	16	35		10 V, Int	16	Module	C	C	16-Bit ADC, Operates over -25°C to $+85^{\circ}\text{C}$ Temperature Range
AD ADC71	16	50		6.3 V, Int	16	1, 8	C	C	Industry Standard
AD ADC72	16	50		6.3 V, Int	16	1, 8	C, I	C	Industry Standard
DAS1159	16	55	X	10 V, Int	16	1	I	C	Low Power, 16-Bit Sampling ADC
*AD7701	16	N/A	10 Hz	Ext (2.5 V)	Serial, μ P	2, 3, 6	I, M	SF-65	16-Bit Sigma Delta ADC
AD1170	18	1000		5 V, Int	8	1	C	C	7 to 22-Bit Programmable Integrating ADC
*AD7703	20	N/A	10 Hz	2.5 V, Ext	Serial	2, 3, 6	I, M	SF-65	20-Bit Sigma Delta ADC
AD1175K	22	50ms		6.95 V, Int/Ext	8	Module	C	C	High Accuracy, 22-Bit Integrating ADC

High Speed ADCs

Model	Res Bits	Throughput Rate MSPS min	Full Power BW MHz typ	Reference Voltage Int/Ext ²	Bus Interface Bits ³	Package Options	Temp Range	Page	Comments
AD9006	6	470	250 (min)	±1 V, Ext	6, μ P	4, 12	C, M	C	470 MSPS, 6-Bit ADC; 8.5 pF Input Capacitance
AD9016	6	470	250 (min)	±1 V, Ext	6, μ P	4, 12	C, M	C	470 MSPS, 6-Bit ADC with On-Board Demultiplexing Circuitry
AD9000	6	50	20	0.5–2 V, Ext	6	1, 3	C, M	C	MIL-STD-883, Rev. C, Devices Available; Low Error Rate
AD9028	8	300	250	–2 V, Ext	8	4	C, M	C	300 MSPS, 8-Bit ADC, Guaranteed Dynamic Performance
AD9038	8	300	250	–2 V, Ext	Dual 8	4	C, M	C	300 MSPS, 5-Bit ADC with On-Board 1:2 Demultiplexed Data Outputs
AD770	8	200	250	±2 V, Ext	8	1	C, M	C	High Bandwidth, Error Correction
AD9002	8	125	115	0.1–(–2.1) Ext	8	1, 4	I, M	C	Single Supply, Low Power, Low Input Capacitance, MIL-STD-883, Rev. C Device Available
			(Sm. Sig.)						
AD9012	8	75	180	–2 V, Ext	8	3, 4	I, M	C	TTL Compatible Outputs
AD9048	8	35	15	–2 V, Ext	8, μ P	2, 3, 5, 12	C, M	C	35 MSPS, 8-Bit Video ADC, 16 pF Input Capacitance
AD9502	8	13	7.5	Int	8	8	I	C	RS-170 Video Frame Grabber; Digitizes RS-170, NTSC, PAL Signals
*AD9078	8	25	30	Int	8	1, 2, 6	C	SF-68	Low Cost, 8-Bit Video Converter
*AD9058	8	60	150	+2, Int	8	1, 5, 14	C, M	SF-68	Dual 8-Bit, TTL Outputs
*AD9020	10	60	150	±1.75, Ext	10	4, 12	C, M	SF-67	Fastest 10-Bit TTL Monolithic
*AD9060	10	75	150	±1.75, Ext	10	4, 12	C, M	SF-67	Fastest 10-Bit ECL Monolithic

¹X indicates that the internal SHA bandwidth is not specified in kHz.

²Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

³This column lists the data format for the bus with " μ P" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μ P indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Analog-to-Digital Converters

Multiplexed ADCs

Model	Res Bits	# Chan	Conv Time μ s	SHA BW kHz	Reference Volt Int/Ext ¹	Bus Interface Bits ²	Package Options	Temp Range	Page	Comments
AD7769	8	2	2.5	200	Ext	8, μ P	2, 5	C	C	CMOS, Analog I/O Port with 2-Channel ADC for ± 10 V Input Signals
AD7824	8	4	2.5	10	0-5 V, Ext	8, μ P	2, 3	C, I, M	C	CMOS, On-Chip Track-Hold
AD7828	8	8	2.5	10	0-5 V, Ext	8, μ P	2, 3, 4, 5	C, I, M	C	CMOS, On-Chip Track-Hold
AD7581	8	8	66.7		-10 V, Ext	8, μ P	1, 2	C, I	C	CMOS
*AD1341	12	16	6.67		10 V, Int	16, μ P	12	C, M	SF-68	High Speed, 16-Channel Programmable 12-Bit DAS with 25 ns Bits Interface
*AD7874	12	4	7.5	500	Int (+3 V)/Ext	12, μ P	2, 3, 5	C, I, M	SF-63	CMOS, Multiplexed Four-Channel ADC for ± 10 V Input Signals
AD1334	12	4	15	235	-5 V, Int	12, μ P	1	I, M	C	Four-Channel 65 kHz 12-Bit Sampling ADC for Digital Signal Processing, On-Chip FIFO
AD363R	12	16	40		10 V, Int	12, μ P	1	C, M	C	High Speed, 16-Channel, 12-Bit DAS
AD364R	12	16	50		10 V, Int	12, μ P	1	C, M	C	16-Channel, 12-Bit DAS with Three-State Buffers
AD7582	12	4	100		4 V-6 V, Ext	12, μ P	1, 2, 4, 5	C, I, M	C	CMOS, 1 LSB Total Unadjusted Error

V/F and F/V Converters

Voltage-to-Frequency Converters

Model	Full-Scale Frequency MHz	Linearity % max	FS Calib Error % typ	Output Format	Input Range V	Package Options	Temp Range	Page	Comments
AD652	2	0.005-0.05	0.25-0.5	Pulse Train	0 to 10 0 to -10 ±5	3, 5	C, I, M	C	Synchronous, Multiple Input Ranges, Low Nonlinearity
AD650	1	0.005-0.1	5-10	Pulse Train	-10 to 0	1, 2, 5	C, I, M	C	Low Nonlinearity
AD654	0.5	0.1-0.4	10	Square Wave	0 to (V _S -4)	2, 6	C	C	Single Supply, Low Cost
ADVFC32	0.5	0.01-0.2	5	Pulse Train	0 to 10	2, 7	C, I, M	C	Industry Standard
AD537	0.15	0.07-0.25	5	Square Wave	-V _S to (+V _S -4)	1, 7	C, M	C	

Frequency-to-Voltage Converters

Model	Input Range kHz	Linearity % max	Response Time ms typ	Package Options	Temp Range	Page	Comments
451	0 to 10	0.03-0.008	4	Module	I	N	Complete, No External Components
453	0 to 100	0.03-0.008	0.8	Module	I	N	Complete, No External Components
AD650	0 to 1000	0.005-0.1	-	1, 2, 5	C, I, M	C	Low Nonlinearity
ADVFC32	0 to 500	0.01-0.2	-	2, 7	C, I, M	C	Industry Standard

¹Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

²This column lists the data format for the bus with "μP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, μP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Synchro and Resolver Converters

Synchro, Resolver, Inductosyn[†] and LVDT-to-Digital Converters

Model	Res Bits	Input Format ¹	Accuracy arc mins	Tracking Rate Options revs/sec ²	Reference Frequency Options Hz	Input Isol	Package Options	Temp Range	Page	Comments
SDC/RDC1741	12	S, R	±15.3	18	400, 2.6 k	Yes	8	C, M	C	Tristate, Latched Output Internal Transformer Isolation
SDC/RDC1742	12	S, R	±8.5	18	400, 2.6 k	Yes	8	C, M	C	Tristate, Latched Output Internal Transformer Isolation
AD2S81A ³	12	I, R	±30 ⁴	260	400→20 k	No	1	C	C	Monolithic, User Selectable Dynamic Characteristics, High Tracking Rate, Quality Velocity Output, Class 2 ESD
SDC/RDC1740	14	S, R	±5.3	12	400, 2.6 k	Yes	8	C, M	C	Tristate, Latched Output Internal Transformer Isolation
2S54	14	LVDT	±0.006 ⁵	360 LSB/ms ⁶	360→5 k	No	8	C, M	C	Direct Ratiometric Conversion of LVDT Signal, Selectable Input Gain. No External Trims
2S56	16	LVDT	±0.006 ⁴	360 LSB/ms ⁶	360→5 k	No	8	C, M	C	Direct Ratiometric Conversion of LVDT Signal, Selectable Input Gain. No External Trims
2S58	16	LVDT	±0.003 ⁵	680 LSB/ms ⁶	7k→11k	No	8	C, M	C	Direct Ratiometric Conversion of LVDT Signal, High Gain, Ultra-Linear
AD2S80A ³	16, 14, 12, 10 ⁷	I, R	±2, ±4, ±8	1040 ⁸	50→20 k	No	1	C, M	C	Monolithic, User Selectable Dynamic Characteristics, and Resolution High Tracking Rate and Quality Velocity Output, Class 2 ESD
AD2S82A ³	16, 14, 12, 10 ⁷	I, R	±2, ±4, ±8	1040 ⁸	50→20 k	No	5	C	C	Monolithic, User Selectable Dynamic Characteristics, and Resolution High Tracking Rate and Quality Velocity Output, Class 2 ESD
2S50	11	LVDT	±0.025 ⁵	200 LSB/ms ⁶	400, 1 k→10 k	No	1, 8	C, M	C	Direct Conversion of LVDT Signal, No External Trims Required, Tristate Output
*AD2S34	14	R	±2.6, ±4.0	20, 48	0.4, 2.6, 4.0 k	No	12	M	SF-69	Dual Channel Resolver-to-Digital Converter with On-Board Oscillator. No External Trims
*AD2S46	16	S, R	±1.3, ±2.6	12	0→2.6 k	No	1	M	SF-69	16 Bit Resolver/Synchro-to- Digital Converter, 1.3 arc min in a 28-Pin DIP Ceramic Package. No External Trims.
*AD2S44	12	S, R	±2.6, ⁹ ±4.0, ±5.2	20	0.4→2.6 k	No	8	M	SF-69	Dual Channel Resolver/ Synchro-to-Digital Converter with Loss of Track Detection. No External Trims.

Digital-to-Synchro and Resolver Converters

Model	Res Bits	Output Format ¹	Accuracy arc mins	Load Driving Capability	Reference Frequency Options Hz	Reference Input Volt Options V rms	Signal Output Volt Options V rms	Transformer Output Isolations	Package Options	Temp Range	Page	Comments
DRC1745	14	R ¹⁰	±2, ±4 ¹¹	2.0VA ¹²	dc→2600	0→3.4	0→6.8	Use Ext. STM 1680 and STM 1683 Transformer	8	M	C	Digital-to-Resolver Converter with Int. 2 VA Power Amplifier. Optional Int. TransZorb [‡] Protection. 2 Byte Latched Inputs.
*AD2S65	14	R	±2, ±4 ¹¹	-	dc→2600	0→3.4	0→6.8	-	8	C, M	N	Digital-to-Resolver Converter. Auto-nulling (AN) Option
DRC1746	16	R ¹⁰	±2, ±4 ¹¹	2.0VA ¹²	dc→2600	0→3.4	0→6.8	Use Ext. STM 1680 and STM 1683 Transformer	8	M	C	16-Bit Version of DRC1745
*AD2S66	16	R	±1, ±2, ±4 ¹¹	-	dc→2600	0→3.4	0→6.8	-	8	C, M	N	Digital-to-Resolver Converter. Auto-nulling (AN) Option

Input Transformers

Model	Description	Frequency Hz	Accuracy arc mins	Input Voltage Options V rms ¹³	Package Options	Package Size Inches (mm)	Page
5S72	Ref Isolation for 2S80/81/82	360 to 3000	N/A	11.8, 26, 115	Module	1.12 × 1.12 × 0.4 (28.5 × 28.5 × 10.2)	C
5S70	Signal Isolation for 2S80/81/82	360 to 3000	±0.33 (typ) ±1.5 (max)	11.8, 26, 90	Module	2.25 × 1.12 × 0.4 (57.0 × 28.5 × 10.2)	C

¹S = Synchro; R = Resolver; I = Inductosyn.

²Revs/sec equivalent to pitches/sec in the case of an Inductosyn; in general higher reference frequency options have higher tracking rates.

³Die Revision.

⁴Consult data sheet.

⁵LVDT converter accuracy given as % full-scale linearity.

⁶Slew Rate (min).

⁷Resolution is user selectable.

⁸Depends on resolution selected.

⁹±2.6 arc min only available over 0°C to 70°C.

¹⁰Synchro format output with external output transformer STM1683.

¹¹Depends on option.

¹²Can be used with pulsating power supply for reduced dissipation.

¹³Synchro and resolver format available on all models.

Boldface type: product recommended for new design.

*New product since the publication of the most recent Databooks.

[†]Inductosyn is a registered trademark of Farrand Industries, Inc.

[‡]TransZorb is a trademark of General Semiconductor Industries, Inc.

Sample/Track-Hold Amplifiers

Model	Specified Accuracy %	Acquisition Time μ s max	Aperture Time ns typ	Aperture Jitter ns typ	Droop Rate μ V/ μ s max	Package Options	Temp Range	Page	Comments
AD1154	0.00076	5.0	80	0.15	0.1	13	C, I	C	Low Cost 16-Bit Accurate, High Speed Amplifier
AD386	0.00076	4.1	12	0.040	0.1	1	C, M	C	High Resolution, High Speed Track-and-Hold Amplifier
AD389	0.003	2.5	30	0.4	0.1	1	C, I	C	High Resolution Track-and-Hold Amplifier
HTC-0300A	0.01	0.1	6	0.05	0.5	1	I, M	C	Ultrahigh Speed Track-and-Hold Amplifier
*AD781	0.01	0.9	20	0.1	1	2, 3, 6	C, I, M	SF-70	Complete 900 ns Sample-and-Hold Amplifier
*AD682	0.01	0.9	20	0.1	1	2, 3	C, I, M	SF-70	Two-Channel 900 ns Sample-and-Hold Amplifier
AD684	0.01	1.0	20	0.1	1	3	C, I, M	C	Quad, Monolithic 1 μ s SHA
AD346	0.01	2.0	60	0.4	0.5	1	C, M	C	High Speed Sample-and-Hold, Industry Standard
AD585	0.01	3.0	35	0.5	1	3, 4, 5	C, I, M	C	High Speed, Precision. On-Board Hold Cap
SMP-10	0.01	3.5	50	1	0.02	3	C, M	P	Low Droop Rate, High Sample/Hold Current Ratio
SMP-11	0.01	3.5	50	1	0.2	3	C, I, M	P	Low Droop Rate, Fast Hold Mode Settling Time
AD583	0.01	5.0	50	5		1	C	C	5 μ s SHA
*SMP-04	0.01	7.0	—	—	0.025	2, 3, 6	I, M	SF-71	CMOS, Quad Sample-and-Hold Amplifier
SMP-81	0.045	3.5	50	1	2.0	3	I	P	High Accuracy, Fast Acquisition for PCM Encodes
HTS-0010	0.10	0.019	2	0.005		1	C, I	C	Ultrahigh Speed Track-and-Hold Amplifier
HTS-0025	0.10	0.035	5	0.02		1	C, I	C	Ultrahigh Speed Track-and-Hold Amplifier
AD582	0.1	6.0	200	15		1, 8	C, M	C	Low Cost, 15 μ s
*SMP-08	0.1	7.0	—	—	0.02	2, 3, 6	I, M	SF-71	Octal, Sample-and-Hold with Multiplexed Input

Analog Switches & Multiplexers

CMOS Switches

Model	Function	Leakage Current nA max	R _{ON} Ω max	Latched	Package Options	Temp Range	Page	Comments
ADG201HS	Quad SPST	1	50		2, 3, 4, 5, 6	C, I, M	C	CMOS, High-Speed Quad Switch. 44 V Supply Maximum Ratings
ADG201A	Quad SPST	1-2	90		2, 3, 4, 5, 6	C, I, M	C	CMOS, 44 V Supply Maximum Ratings
ADG202A	Quad SPST	1-2	90		2, 3, 4, 5, 6	C, I, M	C	CMOS, 44 V Supply Maximum Ratings
ADG221	Quad SPST	1-2	90	X	2, 3, 4, 5, 6	C, I, M	C	CMOS, Latched Input, 44 V Supply Maximum Ratings
ADG222	Quad SPST	1-2	90	X	2, 3, 4, 5	C, I, M	C	CMOS, Latched Input, 44 V Supply Maximum Ratings
AD7510DI	Quad SPST	5-10	100		2, 3, 4, 5	C, M	C	DiCMOS, Dielectrically Isolated
AD7511DI	Quad SPST	5-10	100		2, 3, 4, 5	C, M	C	DiCMOS, Dielectrically Isolated
AD7590DI	Quad SPST	5	90	X	2, 3, 4, 5	C, I, M	C	DiCMOS, Latched, Dielectrically Isolated
AD7591DI	Quad SPST	5	90	X	2, 3, 4, 5	C, I, M	C	DiCMOS, Latched, Dielectrically Isolated
ADG211A	Quad SPST	5	115		2, 5, 6	C	C	CMOS, Low Cost, 44 V Supply Maximum Ratings
ADG212A	Quad SPST	5	115		2, 5, 6	C	C	CMOS, Low Cost, 44 V Supply Maximum Ratings
AD7512DI	Dual SPDT	5-10	100		2, 3, 4, 5	C, M	C	DiCMOS, Dielectrically Isolated
AD7592DI	Dual SPDT	5	90	X	2, 3, 4, 5	C, M	C	DiCMOS, Latched, Dielectrically Isolated

Bipolar JFET Switches

Model	Function	Leakage Current nA max	R _{ON} Ω max	Package Options	Temp Range	Page	Comments
SW-01	Quad SPST	1.0	100	3	I	P	Bipolar JFET, Improved DG201
SW-02	Quad SPST	1.0	100	3	I	P	Bipolar JFET, Improved DG202
SW-06	Quad SPST	2.0	80	2, 3, 4, 6	I, M	P	Bipolar JFET, Improved LF11333/13333
SW-201	Quad SPST	10.0	150	2, 6	I	P	Bipolar JFET, Improved Low Cost DG201
SW-202	Quad SPST	10.0	150	2, 6	I	P	Bipolar JFET, Improved Low Cost DG202
SW-7510	Quad SPST	1.0	75	3, 4	I, M	P	Bipolar JFET, Improved HI-7510
SW-7511	Quad SPST	1.0	75	3	I, M	P	Bipolar JFET, Improved HI-7511
SSM-2402	Dual SPST	10.0	85	2, 6	I	P	"Clickless" Bilateral Audio Switching
SSM-2412	Dual SPST	10.0	85	2, 6	I	P	Fast, Dual Audio Switch

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Analog Switches & Multiplexers

Analog CMOS Multiplexers

Model	Function	Leakage Current		Latched	Package Options	Temp Range	Page	Comments
		nA max	R_{ON} Ω max					
ADG506A	16:1	1	280		2, 3, 4, 5, 6	C, I, M	C	Superior Second Source to DG506A
ADG526A	16:1	1	280	X	2, 3, 4, 5, 6	C, I, M	C	Superior Second Source to DG526A
ADG507A	Dual 8:1	1	280		2, 3, 4, 5, 6	C, I, M	C	Superior Second Source to DG507A
ADG527A	Dual 8:1	1	280	X	2, 3, 4, 5, 6	C, I, M	C	Superior Second Source to DG527A
ADG508A	8:1	1	300		2, 3, 4, 5, 6	C, I, M	C	Superior Second Source to DG508A
ADG528A	8:1	1	300	X	2, 3, 4, 5	C, I, M	C	Superior Second Source to DG528A
AD7501	8:1	1-5	300		2, 3, 4	C, M	C	
AD7503	8:1	1-5	300		2, 3, 4	C, M	C	
ADG509A	Dual 4:1	1	300		2, 3, 4, 5, 6	C, I, M	C	Superior Second Source to DG509A
ADG529A	Dual 4:1	1	300	X	2, 3, 4, 5	C, I, M	C	Superior Second Source to DG529S
AD7502	Dual 4:1	1-5	300		2, 3, 4	C, M	C	

Analog Bipolar JFET Multiplexers

Model	Function	Leakage Current		Package Options	Temp Range	Page	Comments
		nA max	R_{ON} Ω max				
MUX-08	8:1	1.0	300	2, 3, 4, 6	C, I, M	P	Improved DG508
MUX-16	16:1	1.0	380	2, 3, 4, 5	I, M	P	Improved DG506
MUX-24	Dual 4:1	1.0	300	2, 3, 4, 6	C, I, M	P	Improved DG509
MUX-28	Dual 8:1	1.0	380	2, 3, 4, 5	I, M	P	Improved DG507
MUX-88	8:1	100	400	3	I	P	8-Channel Telecom Multiplexer

Video Multiplexer

Model	Function	Full Power BW	Crosstalk Rejection	Package Options	Temp Range	Page	Comments
		MHz min	F = 10 MHz dB				
AD9300	4:1	30	75	3, 4	C, M	C	Wideband Video Mux

Voltage References

Model	Output Voltage V	Initial Accuracy % FS max	Temp Stability ppm/°C max	Package Options	Temp Range	Page	Comments
AD589	+1.235	1.2-2.8	10-100	7	C, M	C	Two Terminal, 1.2 V Reference
*AD680	+2.5	0.2-0.6	20-25	2, 6, 16	C, I	N	Low Cost, Low Power 2.5 V Reference
AD580	+2.5	0.4-3	10-85	7	C, M	C	Precision, Three Terminal, 2.5 V Reference
AD1403	+2.5	0.4-1	25-40	2	C	C	Second Source, 2.5 V Reference
REF-43	+2.5	0.6-1	10-25	2, 3, 6, 7	I	P	Precision Bandgap Reference
REF-03	+2.5	0.6	50	2, 6	I	P	Low Cost Bandgap Reference
AD586	+5	0.05-0.4	5-25	3, 6	C, M	C	Precision, Buried Zener 5 V Reference
REF-02	+5	0.3-0.5	8.5-25	2, 3, 4, 6, 7	C, I, M	P	Precision Bandgap Reference
ADREF02	+5	0.3-0.5	8.5-25	3	C, M	C	5 V Reference
REF-05	+5	0.3-0.6	8.5-25	7	M	P	Guaranteed Long Term Stability
AD689	+8.129	0.05-0.2	5-25	3	C, M	C	Precision, 8.192 Volt Reference
AD2710	+10	0.01	1-5	2	C	C	Ultrahigh Precision 10 V Reference
AD2700	+10	0.025-0.05	3-10	1	C, M	C	Very High Precision 10 V Reference
AD587	+10	0.05-0.1	5-20	3, 6	C, M	C	Precision Buried Zener 10 V Reference
AD581	+10	0.05-0.3	5-30	7	C, M	C	Three Terminal 10 V Bandgap Reference
REF-01	+10	0.3-0.5	8.5-25	2, 3, 4, 6, 7	C, I, M	P	Precision Bandgap Reference
ADREF01	+10	0.3-0.5	8.5-25	3	C, M	C	10 V Reference
REF-10	+10	0.3-0.6	8.5-25	7	M	P	Guaranteed Long Term Stability
AD2712	±10	0.01	1-5	2	C	C	Ultrahigh Precision ±10 V Reference
*AD688	±10	0.02-0.05	1.5-6	3	I, M	SF-71	High Precision Monolithic ±10 V Reference
AD2702	±10	0.025-0.05	3-10	1	C, M	C	Very High Precision ±10 V Reference
AD2701	-10	0.025-0.05	3-10	1	C, M	C	Very High Precision -10 V Reference
REF-08	-10, -10.24	0.3-0.4	50-100	2, 3, 6	I, M	P	General Purpose Buried Zener Reference
AD588	Selectable	0.01-0.03	1.5-6	1, 3	C, I, M	C	Ultrahigh Precision, Monolithic Programmable Reference
AD584	Selectable	0.05-0.3	5-30	4, 7	C, M	C	Precision, Programmable Bandgap Reference

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Comparators

Model	Prop Delay ns max	Dispersion ps	Logic	V _{os} mV max	Package Options	Temp Range	Page	Comments
AD96685	3.5	50	ECL	2	3, 4, 5, 6, 7	I, M	L	Ultrafast
AD96687	3.5	50	ECL	2	3, 4, 5, 6	I, M	L	Dual AD96685
AD9696	4.5	100	TTL	2	2, 3, 6, 7, 12	C, M	L	Single Comparator
AD9698	4.5	100	TTL	2	3, 6, 7, 12	C, M	L	Dual Comparator
CMP-404	5.0	—	TTL	1.0	3	I, M	P	Quad Low Power Precision Comparator
CMP-08	9.5	—	ECL	2.5	3	I, M	P	High Speed with ECL Outputs
AD790	45	—	TTL	0.25-1	2, 3, 6	C, I, M	L	Fast, Precise Single Supply
CMP-05	55	—	TTL	0.6	2, 3, 6, 7	I, M	P	High Speed Precision Comparator
CMP-01	180	—	TTL	0.8	2, 3, 7	C, M	P	Fast Precision Comparator
CMP-02	270	—	TTL	0.8	2, 3, 7	C, M	P	Low Input Current Precision Comparator
CMP-04	300 typ	—	TTL	1.0	2, 3, 6	I, M	P	Quad Low Power Precision Comparator

Matched Transistors

Model	Type	V _{os} Max μV	TCV _{os} Max μV/°C	hFE Min ¹	ΔhFE max %	en max nV/√Hz ²	Package Options	Temp Range	Page	Comments
MAT-01	Dual NPN	100	0.5	500	3	7.5	7	M	P	Low Cost
MAT-02	Dual NPN	50	0.1	500	2	1	4, 7	I, M	P	Low Noise
MAT-03	Dual PNP	100	0.5	100	2	1	4, 7	I, M	P	Low Noise
MAT-04	Qual NPN	200	1	300	2	2.5	2, 3, 6	I, M	P	Low Cost
SSM-2210	Dual NPN	200	1	300	5	1	2, 6	I	P	Low Cost, Audio
SM-2220	Dual PNP	200	1	80	6	1	2, 6	I	P	Low Cost, Audio

Operational Amplifiers

Low Noise Amplifiers

Model	Voltage Noise en	Voltage Noise en	Current Noise In ± In-	I _B typ	V _{OS} mV	GBW MHz	SR V/μs	Settling	A _{CL} min	Package Options	Temp Range	Page	Comments
	typ 10 kHz nV√Hz	typ 1 kHz nV√Hz	typ 1 kHz pA√Hz					Time ns to %					
AD9611	1.1	1.6	38/38	1000	0.5	280	1900	13-0.01	1	2	I, M	N	Ultrafast Settling, Wide Bandwidth
AD9610	0.7	1.6	32/32	5000	0.3	100	3500	1-0.1	1	2	I, M	L	Wide Bandwidth, Fast Settling
AD9617	1.3	2.0	45/45	12000	0.5	190	1600	10-0.1	±1	2, 3, 6, 12	C, I, M	L	Low Distortion, Wide Bandwidth
AD9618	1.3	2.0	45/45	10000	0.5	160	1800	9-0.1	+5, -1	2, 3, 6, 12	C, I, M	L	Low Distortion, Wide Bandwidth
AD829	—	2	1.5	3300	0.2	750	230	65-0.1	1	2, 3, 6	C, I, M	L	High Speed, Low Noise, Video Amp
AD844	—	2	12/10	200	0.05	900	2000	100-0.1	1	2, 3, 6	I, M	L	Current Feedback Amplifier
AD846	—	2	6/20	100	0.025	450	450	110-0.01	1	2, 3	I, M	L	Current Feedback, Precision
AD849	—	3	—	3300	0.3	725	300	80-0.1	25	2, 3, 6	C, I, M	L	High Speed, Low Power
OP-27	3.5	3.0	0.4	10	0.01	8	2.8	—	1	2, 3, 4, 6, 7	C, I, M	P	Low Noise, Precision
AD OP-27	0.35	3	0.4/0.4	10	0.025	8	1.7	—	1	2, 3, 7	I, M	L	Low Noise, Precision
OP-227	3.5	3	0.4	10	0.02	8	2.8	—	1	3	C, I, M	P	Dual Matched Precision
OP-37	3.5	3	0.4	10	0.01	63	17	—	1	2, 3, 4, 6, 7	C, I, M	P	Fast, Precision A _{VCL} ≥ 5
AD OP-37	0.08	3	0.4/0.4	10	0.025	63	17	—	5	2, 3, 7	I, M	L	Low Noise, Precision
AD743	2.9	3.2	0.007	0.15	0.1	4.5	2.8	—	1	2, 3, 6	C, I, M	L	Ultralow Noise FET Input
OP-270	3.6	3.2	0.6	5	0.01	5	2.4	—	1	2, 3, 4, 6	I, M	P	Dual Monolithic
SSM-2139	3.6	3.2	0.6	5	0.02	30	11	—	3	2	I	P	Dual Audio
SSM-2134	5.5	3.5	0.6	350	0.3	10	13	—	3	2	I	P	Improved Replacement for "5534A"
OP-470	3.8	3.2	0.4	6	0.1	6	2	—	1	2, 3, 4, 6	I, M	P	Quad Monolithic, Low Noise
AD5539	—	4	—	6000	2	1400	600	12-1	+5, -4	2, 3	C, M	L	Improved Replacement for NE5539
AD840	—	4	—	3500	0.1	400	400	100-0.01	10	2, 3, 4	C, M	L	Wide Bandwidth, Precision
OP-50	5.5	4.5	0.23	1	0.01	25	3	—	5	3	I, M	P	High Output Current
AD848	—	5	—	3300	0.2	175	300	100-0.1	5	2, 3, 6	C, I, M	L	High Speed, Low Power
OP-471	9	6.5	0.4	7	0.25	6.5	8	—	1	2, 3, 4, 6	I, M	P	Quad Monolithic, Fast
OP-271	16	7.6	0.6	4	0.075	5	8.5	—	1	2, 3, 4, 6	I, M	P	Dual Monolithic, Fast
OP-61	16	3.4	1.7	130	0.1-0.2	200	45	300-0.01	10	2, 3, 4, 6	I, M	P	Wide Bandwidth
AD645	8	9	0.6/0.6	0.0007	0.1	2	2	—	1	2, 7	C, I, M	L	FET Input, Low I _B

¹I_C = 1 mA²f_c ≥ 100 Hz

Boldface Type: Product recommended for new design.

Operational Amplifiers

High Speed Amplifiers

Model	SR V/ μ s typ	GBW MHz typ	Settling Time ns to % typ	A_{CL} min V/V	V_{OS} mV typ	I_{OUT} mA min	Supply Current mA typ	Package Options	Temp Range	Page	Comments
AD9610	3500	100	18-0.1	1	0.3	50	21	7	I, M	L	Wide Bandwidth, Fast Settling
AD9611	2100	4200	13-0.1	-1	0.5	50	74	7	I, M	L	Ultrafast Settling, Wide Bandwidth
AD844	2000	900	100-0.1	1	0.05	80	6.5	2, 3, 6	I, M	L	Constant 10 ns Rise Time for Any Pulse Input, Current Feedback
AD9618	1800	8000	10-0.1	-1	0.2	60	31	2, 3, 6, 12	C, I, M	L	Low Distortion, Wideband, IMD \leq -70 dBc at 20 MHz
AD9617	1600	570	10-0.1	1	0.4	60	34	2, 3, 6, 12	C, I, M	L	Low Distortion, Wide Bandwidth, IMD \leq -70 dBc at 20 MHz
AD5539	600	1400	12-1	+5, -4	2	11	25	2, 3	C, M	L	Improved Replacement for SE/NE5539
AD846	450	450	110-0.01	1	0.025	65 typ	5	2, 3	I, M	L	High Speed, Precision, Current Feedback
AD840	400	400	100-0.01	10	0.1	50	10.5	2, 3, 4	C, M	L	Wide Bandwidth Precision, Fast Settling, $A_{VCL} \geq 10$
AD842	375	80	100-0.01	2	0.5	50	13	2, 3, 4, 7	C, M	L	Fast Settling, High Current Output, Cable Driver, $A_{VCL} \geq 2$
AD849	300	725	80-0.1	25	0.3	32 typ	5.1	2, 3, 6	C, I, M	L	High Speed, Low Power Preamp, Drives Capacitive Loads
AD848	300	175	100-0.1	5	0.2	32 typ	5.1	2, 3, 6	C, I, M	L	High Speed, Low Power, Drives Capacitive Loads
AD827	300	50	120-0.1	1	0.5	32 typ	10	2, 3, 6	C, I, M	L	Dual AD847
AD847	300	50	120-0.1	1	0.5	32 typ	5.1	2, 3, 6	C, I, M	L	High Speed, Low Power, Drives Capacitive Loads
AD841	300	40	110-0.01	1	0.5	50	11	2, 3, 4, 7	C, M	L	High Speed, Precision, Drives Capacitive Loads
AD843	250	34	135-0.01	1	0.5	50	12	2, 3, 4, 6, 7	C, I, M	L	FET Input, Fast Settling, High Speed
AD829	230	750	65-0.1	1	0.2	32 typ	5	2, 3, 6	C, I, M	L	High Speed, Low Noise, Video Amp
OP-61	200	45	300-0.01	10	0.1-0.2	22	6.1	2, 3, 4, 6	I, M	P	Wide Bandwidth, Ultralow Noise
AD845	100	16	350-0.01	1	0.7	50 typ	10	2, 3, 6	C, I, M	L	FET Input, Fast Settling, High Speed
OP-160	90	1300	75-0.1	1	2	35	6.5	2, 3, 6	I, M	P	High Speed, Current Feedback
OP-260	90	1000	250-0.1	1	1	20	9	2, 3, 4, 6, 7	I, M	P	Dual Current Feedback
OP-64	80	170	100-0.1	5	0.4-1.2	50	6.2	2, 3, 4, 6, 7	I, M	P	Wide Bandwidth, High Output Current
AD744	75	13	500-0.01	+2, -1	0.3	25	3.5	2, 3, 6, 7	C, I, M	L	FET Input, Fast Settling, High Speed, Custom Compensation
AD746	75	13	500-0.01	+2, -1	0.3	25	3.5	2, 3, 6, 7	C, I, M	L	Dual AD744
OP-17	30	60	600-0.1	1	0.2-0.5	5.5	4.6	2, 3, 6, 7	C, I, M	P	Precision, Low Power
SSM-2139	30	11	-	3	0.02	20	4	2	I	P	Dual, Low Noise
PM-157A	20	45	4000-0.01	1	1	5	5	3, 7	C, M	P	Improved Industry Standard

Model	SR V/ μ s typ	GBW MHz typ	Settling Time ns to % typ	A _{CL} min V/V	V _{OS} mV typ	I _{OUT} mA min	Supply Current mA typ	Package Options	Temp Range	Page	Comments
OP-44	23	120	200-0.1	3	0.3-1.5	20	6.5	3, 7	I, M	P	High Speed, Precision
AD713	20	4	1000-0.01	1	0.3	25 typ	10	2, 3, 7	C, I, M	L	Quad AD711
AD712	16	3	1000-0.01	1	0.3	25 typ	5	2, 3, 6, 7	C, I, M	L	Dual AD711
AD711	16	3	1000-0.01	1	0.3	25 typ	2.5	2, 3, 6, 7	C, I, M	L	Precision BiFET
OP-42	10	58	800-0.01	1	0.3-1.5	20	5.1	2, 3, 4, 6, 7	I, M	P	Precision, Fast Settling
SSM-2131	10	50	900-0.01	1	1.5	20	5.7	2, 6	I, M	P	Ultralow Distortion, Low Cost
*OP-282	9.0	4	1500-0.01	1	1	10	0.5	2, 3, 6	I	SF-72	Dual High Speed, Low Power
*OP-482	9.0	4	1500-0.01	1	2	10	1.0	2, 3, 6	I	SF-72	Dual High Speed, Low Power
OP-16	8	25	900-0.1	1	0.2-0.5	5.5	4.6	2, 3, 6, 7	C, I, M	P	Precision, Low Power
OP-15	6	13	1200-0.1	1	0.2-0.5	5.5	2.7	2, 3, 6, 7	C, I, M	P	Precision, Low Power
OP-215	5.7	18	900-0.1	1	0.2-2	5.5	6	2, 3, 4, 6, 7	C, I, M	P	Dual Precision
OP-249	4.7	22	900-0.01	1	0.2-0.4	20	5.6	2, 3, 4, 6, 7	I, M	P	Dual Precision, Low Power, Low Distortion
PM-156A	4.5	12	4000-0.01	1	1	5	5	3, 4, 7	C, M	P	Improved Industry Standard
OP-01	2.5	18	700-0.1	1	0.3-2	6	1.6	2, 3, 7	C, M	P	Inverting, High Speed

Boldface Type: Product recommended or new design.

*New product since the publication of the most recent Databooks.

Operational Amplifiers

Precision Amplifiers

Model	V _{OS} μV max	V _{OS} TC μV/°C max	Noise μV p-p 0.1-10 Hz typ	GBW MHz typ	Slew Rate V/μs typ	I _B nA max	CMRR dB f = 1 kHz typ	Package Options	Temp Range	Page	Comments
OP-177	10-60	0.1-1.2	0.35	0.6	0.3	1.5-2.8	110	2, 3, 6	I, M	P	Highest Precision
AD707	5-100	0.03-0.3	0.23	0.9	0.3	0.5-2.5	140	2, 3, 6, 7	C, I, M	L	Highest DC Precision
AD708	5-90	0.03-0.3	0.23	0.9	0.3	0.5-2.5	140	2, 3, 6, 7	C, I, M	L	Dual AD707
OP-77	25-100	0.3-1.2	0.35	0.6	0.3	2-2.8	105	2, 3, 4, 6, 7	C, I, M	P	Next Generation OP-07
AD OP-07	25-100	0.6-2.5	0.35	0.6	0.17	2-12	95	2, 3, 6, 7	C, M	L	Improved Industry Standard
OP-07	25-150	0.6-2.5	0.35	0.6	0.3	2-12	98	2, 3, 4, 6, 7	C, I, M	P	Low Offset Voltage
OP-27	25-100	0.6-1.8	0.08	8	2.8	40-80	125	2, 3, 4, 6, 7	C, I, M	P	Low Noise, Precision
AD OP-27	25-100	0.6-1.8	0.08	8	2.8	40-80	123	2, 3, 7	C, I, M	L	Ultralow Noise
OP-37	25-100	0.6-1.8	0.08	63	17	40-80	125	2, 3, 4, 6, 7	C, I, M	P	Fast, Low Noise, Precision A _{VCL} > 5
AD OP-37	25-100	0.6-1.8	0.08	63 (GBP)	17	40-80	123	2, 3, 7	C, I, M	L	Combines Precision and Speed
AD846	25-200	0.8-5.5	—	75	450	450	—	2, 3	C, I, M	L	High Precision, High Speed
OP-97	25-75	0.6-2	0.5	0.9	0.2	0.1-0.15	100	2, 3, 4, 6, 7	I, M	P	Low Power OP-07
OP-50	25-100	0.3-1	0.12	25	3	5-10	85	3	I, M	P	Low Noise, High Output Current A _{VCL} ≥ 5
PM-1012	35-50	1.5	0.5	0.5	0.2	0.1-0.15	100	2, 3, 6, 7	C, I, M	P	Low Power, Low I _B
AD705	25-90	0.6-2.0	0.5	0.8	0.15	0.1-0.15	110	2, 3, 6	C, I, M	L	Low I _B Precision Bipolar
AD704	50-100	0.6-1.5	0.5	0.8	0.15	0.15-0.25	110	2, 3, 6	C, I, M	L	Quad AD705
AD706	50-100	1.0-1.5	0.5	0.8	0.15	0.15-0.25	110	2, 3, 6	C, I, M	L	Dual AD705
AD517	50-100	1.3-3	2	0.25	0.1	0.25-2	94	7	C, M	L	
OP-297	50-200	0.6-2	0.5	0.5	0.15	0.1-0.2	105	2, 3, 6	I, M	P	Dual Precision, Low Power, Low I _B
AD844	50-300	1-5	—	60	2000	450	—	2, 3, 6	I, M	L	Precision, High Speed
OP-200	75-200	0.5-2	0.5	0.5	0.15	2-5	110	2, 3, 4, 6	I, M	P	Dual Monolithic, Precision
OP-270	75-250	1-3	0.08	5	2.4	20-60	115	2, 3, 4, 6	I, M	P	Dual Monolithic, Low Power
OP-227	80-180	1-1.8	0.08	8	2.8	40-80	125	3	I, M	P	Dual Matched, Low Noise
OP-207	100-200	1.3-1.8	0.35	0.6	0.2	3-7	98	3	C, M	P	Dual Matched, Precision
OP-21	100-500	1-5	—	0.6	0.25	100-150	60	2, 3, 6, 7	I, M	P	Low Power, Single Supply
PM-1008	120	1.5	0.5	0.5	0.2	0.1	100	2, 3, 7	C, M	P	Low I _B , Low Power
OP-400	150-300	1.2-2.5	0.5	0.5	0.15	3-7	110	2, 3, 4, 6	C, I, M	P	Quad, Monolithic, Precision
OP-90	150-450	2-5	3	—	—	15-25	80	2, 3, 4, 6	I, M	P	Micropower, Low Voltage, Single Supply
OP-221	150-500	1.5-3	—	0.6	0.3	80-120	60	2, 3, 6, 7	C, I, M	P	Dual Low Power, Single Supply
OP-220	150-750	1.5-3	—	0.2	0.05	20-30	30	2, 3, 6, 7	C, I, M	P	Dual Micropower, Single Supply
OP-271	200-400	2-5	—	5	8.5	20-60	125	2, 3, 4, 6	I, M	P	Dual, Fast, Low Noise
OP-290	200-500	3-5	3	0.02	—	15-25	100	2, 3, 4, 6	I, M	P	Dual Micropower, Low Voltage Single Supply

Model	V _{OS} μV max	V _{OS} TC μV/°C max	Noise μV p-p 0.1-10 Hz typ	GBW MHz typ	Slew Rate V/μs typ	I _B nA max	CMRR dB f = 1 kHz typ	Package Options	Temp Range	Page	Comments
AD547	250-1000	1-5	2	1	3	0.025-0.05	60	7	C, M	L	Low Drift BiFET
AD647	250-1000	2.5-10	4	1	3	0.035	76	4, 7	C, M	L	Dual AD547
OP-20	250-1000	1.5-7	—	0.1	0.05	25-40	30	2, 3, 6, 7	C, I, M	P	Micropower, Single Supply
OP-43	250-1500	5-10	—	2.4	6	0.005-0.02	100	2, 7	C, I, M	P	Low I_B, Fast
AD548	250-2000	2-20	2	1	1.8	0.03-0.015	83	2, 3, 6, 7	C, I, M	L	Low Power BiFET
AD648	100-2000	3-20	2	1	1.8	0.03-0.015	83	2, 3, 6, 7	C, I, M	L	Dual AD548
OP-41	250-2000	5-10	—	0.5	1.3	0.005-0.02	100	2, 6, 7	C, I, M	P	Low I_B
OP-22	300-1000	1.5-3	—	0.25	0.08	5-10	60	2, 3, 6, 7	C, I, M	P	Micropower, Programmable
OP-32	300-1000	1.5-3	—	4.5	1.5	5-10	90	2, 3	C, I, M	P	Micropower, Fast, Programmable
OP-470	400-1000	2-4	0.08	6	2	25-60	110	2, 3, 4, 6	C, I, M	P	Quad, Low Noise
OP-471	800-1800	4-7	0.25	6.5	8	25-60	108	2, 3, 4, 6	C, I, M	P	Quad, Fast, Low Noise

Boldface Type: Product recommended for new design.

Operational Amplifiers

Low Cost, General Purpose Amplifiers

Model	V _{OS} mV max	V _{OS} TC μV/°C max	I _B nA max	BW MHz typ ¹	SR V/μs typ	Settling Time μs 0.01% typ	Noise μV p-p 0.1–10 Hz typ	Package Options	Temp Range	Page	Comments
OP-177	0.01–0.06	0.1–1.2	1.5–2.8	0.6	0.3	—	0.35	2, 3, 6	I, M	P	Highest Precision Performance
AD707	0.015–0.09	0.1–1	1–2.5	0.9	0.15	—	0.23	2, 3, 6, 7	C, I, M	L	Very High DC Precision
AD705	0.025–0.09	0.6–2.0	0.1–0.15	0.8	0.15	—	0.5	2, 3, 6	C, I, M	L	Low I _B Precision Bipolar
AD704	0.05–0.10	0.6–1.5	0.15–0.25	0.8	0.15	8	0.5	2, 3, 6	C, I, M	L	Quad AD705
AD706	0.05–0.10	1.0–1.5	0.15–0.25	0.8	0.15	8	0.5	2, 3, 6	C, I, M	L	Dual AD705
OP-77	0.025–0.1	0.3–1.2	2–2.8	0.6	0.3	—	0.35	2, 3, 4, 6, 7	C, I, M	P	Next Generation OP-07
AD OP-07	0.025–0.15	0.6–2.5	3–12	0.6	0.17	—	0.35–0.38	2, 3, 6, 7	C, M	L	Improved Industry Standard
OP-07	0.025–0.15	0.6–2.5	2–12	0.6	0.3	—	0.35	2, 3, 4, 6, 7	C, I, M	P	Industry Standard Precision
OP-97	0.025–0.2	0.6–2	0.1–0.15	0.9	0.2	—	0.5	2, 3, 4, 6, 7	I, M	P	Low Power, Low I _B OP-07
PM-1012	0.035–0.05	1.5	0.1–0.15	0.5	0.2	—	0.5	2, 3, 6, 7	I, M	P	Low Power, Low I _B
AD711	0.025–2	3–20	0.025–0.05	4	20	1	2	2, 3, 6, 7	C, I, M	L	Excellent Combination of AC and DC Performance at Very Competitive Prices
PM-1008	0.12	1.5	0.1	0.5	0.2	—	0.5	2, 3, 7	C, M	P	Low Power Precision
OP-05	0.15–1.3	0.9–2	2–3	0.6	0.3	—	0.35	2, 3, 7	C, M	P	Instrumentation Operational Amplifier
AD548	0.25–2	2–20	0.01–0.02	1	1.8	8	2	2, 3, 6, 7	C, I, M	L	Low Power, High Performance
AD542	0.5–2	5–20	0.025–0.05	1	3	—	2	7	C, M	L	High Performance BiFET
AD544	0.5–2	5–20	0.025–0.05	2	13	—	2	7	C, M	L	High Performance BiFET
OP-02	0.5–5	8–10	30–100	1.3	0.5	—	0.65	2, 3, 7	C, M	P	Improved "741"
OP-11	0.5–5	10–15	300–500	3	1	—	0.7	2, 3, 4, 6	C, I, M	P	Improved Quad "741"
OP-09	0.5–5	10–15	300–500	3	1	—	0.7	3	C, M	P	Improved "4136," Quad
OP-01	0.7–5	8–20	30–100	2.5	18	—	—	2, 3, 7	C, M	P	Inverting, High Speed
OP-04	0.75–5	8–20	50–100	1.3	0.5	—	0.65	3, 7	I, M	P	Improved "747"
OP-14	0.75–5	8–20	50–100	1.3	0.5	—	0.65	2, 3, 6, 7	I, M	P	Improved "1458," Dual
AD741	3–6	20	200–500	1	0.5	—	—	2, 7	C, I, M	L	Improved Second Source

Low Power/Micropower Amplifiers

Model	ISY max mA	V _{os} max mV	I _B max nA	GBW typ MHz	SR typ V/μs	Package Option	Temp Range	Page	Comments
OP-22	0.0002-0.4	0.3-1	5-10	0.25	0.08	2, 3, 6, 7	I, M	P	Programmable, Single Supply
OP-32	0.0005-2	0.3-1	5-10	4.5	1.5	2, 3	I, M	P	Fast, Programmable A _{VCL} ≥ 10, Single Supply
OP-90	0.02	0.15-0.45	15-25	0.02	—	2, 3, 4, 6	I, M	P	Micropower, Low Voltage Single Supply
OP-290	0.04	0.2-0.5	15-25	0.02	—	2, 3, 4, 6	I, M	P	Dual, Micropower, Low Voltage, Single Supply
OP-20	0.08	0.25-1	25-40	0.1	0.05	2, 3, 4, 6	I, M	P	Micropower, Single Supply, Low Cost
OP-490	0.08	0.5-1	15-25	0.02	—	2, 3, 4, 6	I, M	P	Quad, Micropower, Low Voltage, Single Supply
OP-220	0.17	0.15-0.75	20-30	0.2	0.05	2, 3, 6, 7	I, M	P	Dual, Low Cost, Micropower, Single Supply
OP-80	0.325	1.5	0.00025-0.001	0.3	0.4	2, 6, 7	I, M	P	Low I _C , CMOS
OP-420	0.36	2.5-6	20-40	0.15	0.05	2, 3, 4, 6	I, M	P	Quad, Low Cost, Micropower, Single Supply
OP-21	0.3-0.4	0.1-0.5	100-150	0.6	0.25	2, 3, 6, 7	I, M	P	Low Cost, Low Power, Single Supply
PM-1008	0.6	0.12	0.1	3.5	0.2	2, 3, 6, 7	C, M	P	Low Power
OP-97	0.6	0.025-0.075	0.1-0.15	0.9	0.2	2, 3, 4, 6, 7	I, M	P	Precision, Low I _B
PM-1012	0.6	0.035-0.05	0.1-0.15	0.5	0.2	2, 3, 6, 7	C, I, M	P	Precision, Low I _B
OP-221	0.8	0.15-0.5	80-120	0.6	0.3	2, 3, 6, 7	I, M	P	Dual, Low Cost, Low Power, Single Supply
OP-41	1	0.25-2	0.005-0.02	0.5	1.3	2, 6, 7	I, M	P	Low Power, Low I _B
OP-43	1-1.2	0.25-1.5	0.005-0.025	2.4	6	2, 7	I, M	P	Fast, Low Power, Low I _B
*OP-297	1.25	0.05-0.2	0.1-0.2	0.5	0.15	2, 3, 4, 6	I, M	SF-72	Dual, Precision, Low I _B
OP-200	1.45	0.075-0.2	2-5	0.5	0.15	2, 3, 4, 6	I, M	P	Dual, Precision
OP-421	1.8	2.5-6	50-150	1.9	0.5	2, 3, 6	I, M	P	Quad, Low Cost, Low Power, Single Supply
OP-400	2.9	0.15-0.3	3-7	0.5	0.15	2, 3, 4, 6	C, I, M	P	Quad, Precision

¹Unity gain small signal bandwidth.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Operational Amplifiers

Low Input Current Amplifiers

Model	I_B pA max	Input Impedance		CMRR dB f=1 kHz typ	V_{OS} mV max	V_{OS} TC $\mu V/^\circ C$ max	BW MHz typ ¹	Package Options	Temp Range	Page	Comments
		Differential Ω||pF typ	Common Mode Ω||pF typ								
AD549	0.06–0.25	10^{13}||1	10^{15}||0.8	62	0.25–1	5–20	1	7	C, M	L	Monolithic, Lowest I_B
AD515A	0.075–0.3	10^{13}||1.6	10^{15}||0.8	62	1–3	15–50	1	7	C	L	Lower Cost AD515 Replacement
OP-80	0.25–1	—	—	90	1.5	—	0.3	2, 6, 7	I, M	P	Low Cost CMOS
AD546	0.5–1	10^{13}||1	10^{15}||0.8	62	1–2	20	1	2	C	L	Precision Low Cost Electrometer
AD645	1.5–3	10^{13}||1	10^{14}||3	94	0.25–0.5	5–10	2	2, 7	C, I, M	L	Low Noise, Precision BiFET
AD545A	1–2	10^{13}||1.6	10^{15}||0.8	62	0.25–1	3–25	1	7	C	L	Lower Cost AD545 Replacement
OP-41	5–20	—	—	98	0.25–2	5–10	0.5	2, 6, 7	C, I, M	P	High Stability JFET
AD548	10–20	10^{12}||3	3×10^{12}||3	84	0.25–2	2–20	1	2, 3, 6, 7	C, I, M	L	Low Power, Low Cost
OP-43	5–25	—	—	98	0.25–1.5	5–10	2.4	2, 7	I, M	P	Low I_B , Fast $A_{VCL} \geq 3$
AD547	25–50	10^{12}||6	10^{12}||13	60	0.25–1	1–5	1	7	C, M	L	Low Drift
AD711	25–50	3×10^{12}||5.5	3×10^{12}||5.5	62	0.25–2	3–20	4	2, 3, 6, 7	C, I, M	L	Low Cost BiFET, Excellent AC and DC Performance
PM-155A	50	—	—	90	2	5	2.5	3, 7	C, M	P	Improved Industry Standard
PM-156A	50	—	—	90	2	5	4.5	3, 7	C, M	P	Improved Industry Standard
PM-157A	50	—	—	90	2	5	20	3, 7	C, M	P	Improved Industry Standard
OP-15	50–200	—	—	90	0.5–3	5–15	6	2, 3, 6, 7	C, I, M	P	Precision BiFET
OP-16	50–200	—	—	90	0.5–3	5–15	8	2, 3, 6, 7	C, I, M	P	Precision BiFET
OP-17	50–200	—	—	90	0.5–3	5–15	30	2, 3, 6, 7	C, I, M	P	Fast, Precision BiFET

Quad Operational Amplifiers

Model	V_{OS} mV max	V_{OS} TC $\mu V/^\circ C$ max	I_B pA max	BW MHz typ ¹	Slew Rate V/ μs typ	Settling Time to 0.01% μs typ	Package Options	Temp Ranges	Page	Comments
AD704	0.05–0.10	0.6–1.5	150–250	0.8	0.15	—	2, 3, 6	C, I, M	L	Quad AD705, Low I_B Precision Bipolar
OP-400	0.15–0.3	1.2–2.5	3–7	0.5	0.15	—	2, 3, 4, 6	C, I, M	P	Quad Monolithic, Precision
OP-470	0.4–1	2–4	25–60	6	2	—	2, 3, 4, 6	C, I, M	P	Quad Monolithic, Low Noise
OP-490	0.5–1	5	15–25	0.02	—	—	2, 3, 4, 6	I, M	P	Micropower, Low Voltage, Single Supply
AD713	0.5–1.5	20	75–150	4	20	1	2, 3	C, I, M	L	Superior AC and DC Performance, Quad AD711
OP-11	0.5–5	10–15	300–500	3	1	—	2, 3, 4, 6	C, I, M	P	Improved Quad "741"
OP-471	0.8–1.8	4–7	25–60	6.5	8	—	2, 3, 4, 6	C, I, M	P	Monolithic, Fast, Low Noise
*OP-482	3.0	10	0.1	4.0	9	1.5	3, 4, 6	I	SF-72	High Speed, Low Power
PM-148/248	2.5	—	75	0.8	0.4	—	3	I, M	P	Improved Industry Standard
OP-421	2.5–6	10–15	50–150	1.9	0.5	—	2, 3, 6	I, M	P	Low Power, Low Cost, Single Supply
OP-420	2.5–6	10–25	20–40	0.15	0.05	—	2, 3, 4, 6	I, M	P	Micropower, Low Cost, Single Supply

Dual Operational Amplifiers

Model	V _{OS} mV max	V _{OS} TC μV/°C max	I _B nA max	BW MHz typ ¹	Slew Rate V/μs typ	Settling Time to 0.01% μs typ	Package Options	Temp Range	Page	Comments
AD708	0.03-0.1	0.3-1.0	1-2.5	0.9	0.3	—	2, 3, 7	C, I, M	L	Highest DC Precision; Excellent Matching Between Amps, Dual AD707
AD706	0.05-0.10	1.0-1.5	0.15-0.25	0.8	0.15	—	2, 3, 6	C, I, M	L	Dual AD705, Low I _B Precision Bipolar
*OP-297	0.05-0.2	0.6-2	0.1-0.2	0.5	0.15	—	2, 3, 6	I, M	N	Precision, Low Power, Low I _B
OP-200	0.075-0.2	0.5-2	2-5	0.5	0.15	—	2, 3, 4, 6	I, M	P	Dual Monolithic, Precision
OP-270	0.075-0.25	1-3	20-60	5	2.4	—	2, 3, 4, 6	I, M	P	Dual Monolithic, Low Noise
OP-227	0.08-0.18	1-1.8	40-80	8	2.8	—	3	I, M	P	Dual Matched, Low Noise
OP-207	0.1-0.2	1.3-1.8	3-7	0.6	0.2	—	3	C, M	P	Dual Matched, Precision
OP-221	0.15-0.5	1.5-3	80-120	0.6	0.3	—	2, 3, 6, 7	C, I, M	P	Low Power, Single Supply
OP-220	0.15-0.75	1.5-3	20-30	0.2	0.05	—	2, 3, 6, 7	C, I, M	P	Micropower, Single Supply
OP-271	0.2-0.4	2-5	20-60	5	8.5	—	2, 3, 4, 6	I, M	P	Dual Monolithic, Fast, Low Noise
OP-290	0.2-0.5	3-5	15-25	0.02	—	—	2, 3, 4, 6	I, M	P	Micropower, Low Voltage Single Supply
AD647	0.25-1	2.5-10	0.035-0.075	1	3	—	4, 7	C, M	L	Dual AD547
AD746	0.25-1	3-20	0.15	13	75	0.5	2, 3, 7	C, I, M	L	Precision, Fast Settling, Dual AD744
AD648	0.3-2	3-20	0.01-0.02	1	1.8	8	2, 3, 7	C, I, M	L	Low Power, BiFET, Dual AD548
AD712	0.3-3	5-20	0.05-0.075	4	20	1	2, 3, 6, 7	C, I, M	L	Excellent AC and DC Performance, Dual AD711
OP-10	0.5	2-4.5	3-7	0.6	0.17	—	3	C, M	P	Dual Matched, Precision
SSM-2139	0.5	2.5	80	30	11	—	2	I	P	Audio, Low Noise
OP-249	0.5-0.7	5-6	0.05-0.075	4.7	22	0.9-0.01	2, 3, 4, 6, 7	I, M	P	Fast, Low Distortion
AD642	0.5-2	—	0.035-0.075	1	3	—	7	C, M	L	Dual AD542
AD644	0.5-2	—	0.035-0.075	2	13	—	7	C, M	L	Dual AD544
OP-14	0.75-5	8-20	50-100	1.3	0.5	—	2, 3, 6, 7	I, M	P	General Purpose, Low Cost
OP-215	1-4	10	0.1-0.3	5.7	18	0.9-0.1	2, 3, 4, 6, 7	C, I, M	P	High Speed, Precision
*OP-282	2.0	10	0.1	4.0	9	1.5	3, 4, 6	I	SF-72	High Speed, Low Power
AD827	2.0-4.0	15	7000	50	300	0.065-0.1	2, 3, 6	C, I, M	L	Dual AD847, High Speed, Low Power
OP-260	3.5-7	10	1000-15000	90	1000	0.25-0.1	2, 3, 4, 6, 7	I, M	P	High Speed, Current Feedback

¹Unity gain small signal bandwidth.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Operational Amplifiers

Unity Gain Buffers

Model	-3 dB BW MHz typ	SR V/ μ s min	Settling Time to 0.02% ns typ	Rise Time 1V Step ns typ	I _{OUT} mA min	V _{OS} mV typ	I _{SS} mA max	Package Options	Temp Range	Page	Comments
AD9630	700	1800	8	0.9	50	2	22	2, 3, 6, 12	I, M	L	High Performance, Wide-Band Buffer
AD9620	600	2300	8	8	50	2	40	1	I, M	L	High Performance, Low Harmonic Distortion Buffer

Audio Preamplifiers

Model	en typ nV/ $\sqrt{\text{Hz}}$ 20 kHz BW	TDH typ G=1000 @ 1 kHz %	Slew Rate typ V/ μ S	BW typ G=100 MHz	Package Option	Temp Range ¹	Page	Comments
SSM-2015	1.3	0.007	8	0.7	2	C	P	Low Noise Microphase Preamp
SSM-2016	0.8	0.009	10	0.65	2	C	P	Lowest Noise, Wide Supply Voltage Range
*SSM-2017	0.85	0.009	14	0.25	2	I	SF-85	Low Cost, 8-Pin DIP

Instrumentation Amplifiers

Model	Gain Ranges	Gain Error % max	Gain TC ppm/°C max	BW MHz typ ²	Package Options	Temp Range	Page	Comments
AMP-03	1	0.008	—	3.0	1, 7	I, M	P	Precision Unity-Gain Differential Amplifier
AD526	1, 2, 4, 8, 16	0.01–0.15	2–5	4.0	1, 2	C, I, M	L	Software Programmable, μ P Interface
AD625	1–10,000	0.02–0.05	5	0.65	1, 2	C, I, M	L	Resistor Programmable, Low Cost
AMP-02	1–10,000	0.02	50	1.20	2, 3, 6	I, M	P	High Accuracy, 8-Pin Package Single Resistor Gain Set
AD624	1, 100, 200, 500, 1000	0.02–1.0	5–25	1.0	1	I, M	L	Pin Programmable
AD524	1, 10, 100, 1000	0.02–2.0	5–100	1.0	1, 4	I, M	L	Pin Programmable, Input Protection
AD365	1, 10, 100, 500	0.05–0.1	5–10	0.8	8	I	L	Digitally Programmable with T/H
AD522	1–10,000	0.05–1.0	2–50	0.3	1	I, M	L	Resistor Programmable
AD521	0.1–1000	0.25–3.0	3–50	2	1	C, M	L	Resistor Programmable
AMP-05	0.1–2000	0.5	20	3.0	3	I, M	P	JFET Input, Fast Settling
AMP-01	0.1–1000	0.6	10	0.57	3, 4, 6	C, I, M	P	Low Noise, Precision
SSM-2141	1	0.01	—	3	2	I	P	High Common-Mode Rejection Differential Line Receiver
*SSM-2142	1	0.1	—	—	2	I	SF-85	Balanced Line Driver

Isolation Amplifiers

Model	Peak Volt Iso V pk	Gain Range V/V	Gain Nonlin % max	Freq Resp kHz	Package Options	Temp Range	Page	Comments
284J	2500	1–10	0.05	1	Module	C	L	Medical, Single Channel, Low Cost
286J	2500	1–100	0.05–0.2	1	Module	C	L	Medical, Multichannel, Low Cost
289	2500	1–100	0.012–0.05	20	Module	C	L	Precision, Wide Bandwidth, Synchronized
290A	1500	1–100	0.1–0.25	2.5	Module	I	L	Single Channel, General Purpose
292A	1500	1–100	0.1–0.25	2.5	Module	I	L	Multichannel, General Purpose
AD202	1000–2000	1–100	0.025–0.05	2	2, 11	C	L	Lowest Cost, Small Size, Single Channel, –40°C to +85°C
AD203	2000	1–100	0.025	10	2	M	L	Rugged, Military Temperature Range, Wide Bandwidth
AD204	1000–2000	1–100	0.025–0.05	5	2, 11	C	L	Lowest Cost, Small Size, Multichannel, –40°C to +85°C
AD206	2000	1–10	0.015–0.03	100 kHz	11	I	L	100 kHz Bandwidth, Low Distortion Isolation Amplifier
AD208	1000–2000	1–1000	0.015–0.03	0.4–4 kHz	11	I	L	Precision, Low Cost, Single Channel, mV Input
AD210	3500	1–100	0.012–0.025	20	2	I, C	L	Precision, 3-Port Isolation, Wide Bandwidth
AD295	2500	1–1000	0.012–0.05	4.5	Module	I	L	–40°C to +100°C, Low Drift, 3-Port Isolation
281					Module	C	L	External Oscillator for 286J and 292A Isolation Amplifiers
AD246					2, 11	C	L	External Oscillator for AD204 Isolation Amplifier

¹Temperature Range: –10°C to +55°C for SSM-2015, –25°C to +55°C for SSM-2016, and –40°C to +85°C for SSM-2017.

²Unity gain small signal bandwidth.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Analog Multipliers/Dividers

Multipliers/Dividers

Model	BW MHz typ ¹	Total Error % FS max	Accuracy vs Temp %/°C typ	Package Options	Temp Range	Page	Comments
AD834	>500	2		2, 3, 6	C, I, M	L	Very High Speed 4-Quad Mult/Div
AD539	60	1.5-2.5	1-2% (T _{min} -T _{max})	1, 2	C, M	L	High Speed 2-Channel, 2-Quad Mult/Div
AD734	10	0.25-0.04	0.003	2, 3	I, M	N	High Accuracy Replacement for AD534
AD633	2	1		2, 6	C	N	Low Cost 4-Quad Multiplier
AD534	1	0.25-1.0	0.0008-0.022	1, 4, 7	C, M	L	High Accuracy 4 Quad Mult/Div
AD632	1	0.5-1.0	0.01-0.02	1, 7	I, M	L	High Accuracy Replacement for AD532
AD532	1	1-2	0.01-0.04	1, 4, 7	C, M	L	Accurate 4-Quad Mult/Div
AD538	0.4	0.5-1.0		1	I, M	L	Simultaneous Mult/Div/Exponentiator
AD535	0.02	0.5-5.0	0.01-0.05	1, 7	C	N	Dedicated Divider

Modulators/Demodulators

Model	Unity Gain BW MHz ¹	Gain	Slew Rate V/μs	Package Options	Temp Range	Page	Comments
AD630	2	±1, ±2	45	1, 2, 4	C, I, M	L	Balance Modulator/Demodulator with 10 V FS Output

Log/Antilog Amplifiers

Model	Input Range	Log Conformity RTI	BW kHz	Package Options	Temp Range	Page	Comments
755	1 nA-1 mA	0.5%	10	Module	I	L	Complete, Current and Voltage, 6 Decade, High Accuracy
757	1 nA-1 mA	0.5%	25	Module	I	L	Complete, Log/Antilog Ratio, 6 Decade, High Accuracy
759	20 nA-0.2 mA	1.0%	200	Module	I	L	Complete, Current and Voltage, 4 Decade, Lowest Cost
SSM-2100	10 nA-1 mA	0.4%	2	2	C	P	Internal Temperature Regulator
AD9521	0.4 V p-p	±1 dB	10-250 MHz	4, 7	C, M	L	Wideband Amplifier with Logarithmic Detected Output
AD640	0.75 mV-200 mV	±0.6 dB	120 MHz	1, 2, 4, 5	C, I, M	L	120 MHz, 50 dB, DC Demodulating Logarithmic Amplifier

RMS-to-DC Converters

Model	Conversion Accuracy mV \pm %Read max	Full-Scale Range V RMS	dB Output Error dB max	Package Options	Temp Range	Page	Comments
AD737	(0.2 \pm 0.3)-(0.4 \pm 0.5)	0.2		2, 3, 6	C, I	L	Low Cost, Low Power, No Output Buffer
AD736	(0.3 \pm 0.3)-(0.5 \pm 0.5)	0.2		2, 3, 6	C, I	L	General Purpose, Low Cost, Low Power
AD636	(0.2 \pm 0.3)-(0.5 \pm 0.6)	0.2	0.2-0.5	1, 7	C	L	Low Power
AD637	(0.5 \pm 0.2)-(1 \pm 0.5)	7	0.3 (typ)	1, 3, 6	C, M	L	High Accuracy, Wide Bandwidth
AD536A	(2 \pm 0.2)-(5 \pm 0.5)	7	0.3-0.6	1, 4, 7	C, M	L	General Purpose
SSM-2110	0.2 \pm 0.012	7	0.5	2	C	P	High Accuracy, Wide Dynamic Range

Special Function Components

Model	Description	Package Options	Temp Range	Page
AD639	Universal Trigonometric Function Converter	1	I, M	L
AD7341	Voiceband Transmission Filter for 14-Bit DAC	2, 5	C	L
AD7371	Voiceband Receive Filter for 14-Bit ADC	2, 5	C	L
AD9500	Digitally Programmable Delay Generator	3, 4, 5	I, M	L
AD9901	Digital Phase/Frequency Discriminator	3, 4, 5	C, M	L
AD9501	TTL/CMOS Digitally Programmable Delay Generator	2, 4, 5	C, M	L
*AD9950	32-Bit, 250 MSPS Phase Accumulator for DDS Applications	14	C, M	SF-72
PKD-01	Monolithic Peak Detector with Reset-and-Hold Mode	2, 3	C, M	P

Temperature Transducers

Model	I _{OUT} μ A/K	Cal Error $^{\circ}$ C max	Nonlin $^{\circ}$ C max	Package Options	Temp Range	Page	Comments
AC2626	1	0.5-5	0.3-1.5	3/16" Stainless Steel Sheath	C, M	L	General Purpose Temperature Probe 4" and 6" Length
AD590	1	0.5-5	0.3-1.5	7, 9	M+	L	Wide Temperature Range, Accurate
AD592	1	0.5-2.5	0.15-0.35	2	I+	L	Low Cost, Accurate

¹Unity gain small signal bandwidth.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Signal Conditioning Components & Subsystems

Model	V/I Transmitters		Isolated	Sensor		IC	Hybrid Package	Module	Page
	Loop Power	Local Power		Excitation	Sensor Type(s)				
AD594/AD595					Thermocouple	X			L
AD596/AD597					Thermocouple	X			L
AD598				X	LVDT	X			L
AD693	X	X		X	mV: All	X			L
AD694		X		X	0-2 or 10 V Input Range	X			L
1B21	X		X					X	L
1B22		X	X					X	L
1B31				X	Strain Gage		X		L
1B32				X	Strain Gage		X		L
1B41			X	X	RTD			X	L
1B51			X		Thermocouple, mV			X	L
AC1226					Thermocouple Cold Junction Compensator			X	L
2B20		X						X	L
2B22		X	X					X	L
2B23		X	X					X	L
2B24	X		X					X	N
2B30					Strain Gage, RTD			X	L
2B31				X	Strain Gage, RTD			X	L
2B50			X		Thermocouple, mV			X	L
2B52	X		X		Thermocouple, mV			X	N
2B53	X				Thermocouple, mV			X	N
2B54/2B55			X		mV, 4-Channel			X	L
2B57	X			X	Solid State (AD590)			X	N
2B58				X	3-Wire RTD			X	N
2B59	X			X	2-Wire RTD			X	N
3B Series					Modular Signal Conditioning Subsystem, Flexible, User Configurable				L
4B Series					Alarm Limit Subsystem				N
5B Series					Modular Signal Conditioning Subsystem; System Applications				L
6B Series					Software Configurable, Digitizing Signal Conditioning Subsystem				L
7B Series					Low Cost, Modular Process Control Signal Conditioners				L

Digital Panel Instruments

Digital Panel Meters

Model	Digits	FS Range	Data Output	Display Type	Page	Comments
AD2026-1	3	-99 mV to +999 mV	N/A	LED	L	+5 V Power
AD2010	3 1/2	±199.9 mV	BCD	LED	L	+5 V Power
AD2021	3 1/2	±199.9 mV, ±1.999 V, ±19.99 V	Serial	LED	L	+5 V Power
AD2026-2	3	-99 mV to +999 mV	N/A	LED	L	Line Power

Digital Temperature/Transducer Meters

Model	Interface	Readout	Digital Data Output	Page	Comments
AD2050	Thermocouple	LED 3 1/2 Digits	7-Bit Character Serial ASCII	L	Self-Calibrated, User Specified Thermocouple
AD2051	Thermocouple	LED 3 1/2 Digits	7-Bit Character Serial ASCII	L	Self-Calibrated, Switch Selected Thermocouple
AD2060	RTD/Thermister	LED 3 1/2 Digits	7-Bit Character Serial ASCII	L	Self-Calibrated, User Specified RTD/Thermister
AD2061	RTD/Thermister	LED 3 1/2 Digits	7-Bit Character Serial ASCII	L	Self-Calibrated, Switch Selected RTD/Thermister
AD2070	Thermocouple	LED 4 1/2 Digits	7-Bit Character Serial ASCII	L	Self-Calibrated, Autoranging Thermocouple
AD2071	Thermocouple	LED 4 1/2 Digits	7-Bit Character Serial ASCII	L	Self-Calibrated, Autoranging Thermocouple

Boldface Type: Product recommended for new design.

Digital Signal Processing Components

Fixed-Point Multipliers

Word Size	Model	Multiplication Time, ns ¹				I _{DD} ²		Twos Comp	Data Formats		Pins	Package Options	Logic Type	Page
		Clocked		Unclocked		Comm	MIL		Unsign Mag.	Mixed Mode				
8×8	ADSP-1080A	J=45 K=33	S=55 T=45	N/A	N/A	45	55	X			40	1, 2, 3, 4	TTL	D
8×8	ADSP-1081A	J=45 K=33	S=55 T=45	N/A	N/A	45	55		X		40	1, 2, 3, 4	TTL	D
12×12	ADSP-1012A	J=75 K=50	S=90 T=60	J=105 K=80	S=125 T=95	60	70	X	X	X	64 68	1, 2 4, 5, 15	TTL	D
16×16	ADSP-1016A	J=85 K=70	S=95 T=80	J=105 K=90	S=120 T=105	65	55	X	X	X	64 68	1, 2 4, 15	TTL	D
24×24	ADSP-1024A	J=120 K=95	S=150 T=120	N/A	N/A	75	90	X			84	15	TTL ⁴	D

Multiplier/Accumulators

Word Size	Model	Multiplication Accumulate Time ¹		Accum Size	# of Accum	I _{DD} ²		Pins	Package Options	Page
		Comm	MIL			Comm	MIL			
8×8	ADSP-1008A	J=60 K=50	S=75 T=60	19	1	40	45	48	1, 2	D
12×12	ADSP-1009A	J=85 K=70	S=100 T=85	27	1	70	75	64 68	1, 2 4, 15	D
16×16	ADSP-1010B	J=55 K=45	S=65 T=55	35	1	110	125	64 68	1 4, 3, 5, 15	D
16×16	ADSP-1101	J=90 K=80	S=105 T=95	40	2	75	75	100	15	D
16×16	ADSP-1110A	J=100 K=85	S=120 T=100	40	1	70	80	28	1, 2, 4, 5	D

Floating-Point Components

Model	Grade	# of Ports	Pipelined Throughput (ns)		Latency (ns)		IEEE Exact Divide (μ s)		IEEE Exact Square Root (μ s)		Package Options	Page
			32-Bit	64-Bit	32-Bit	64-Bit	32-Bit	64-Bit	32-Bit	64-Bit		
ADSP-3212 Multiplier/ Divider	K	3	50	50	130	155	0.300	0.600			15	D
	J	3	60	60	157	187	0.36	0.72				
ADSP-3222 ALU	K	3	50	50	130	155	0.8	1.5	1.45	2.90	15	D
	J	3	60	60	157	187	0.96	1.8	1.74	3.48		

Microcoded Support Components

PROGRAM SEQUENCER

Model	Grade	Program Address Size	Clock-to-Address Valid Delay	Minimum Cycle Time	Stack Depth	Number of Interrupts	Event Counters	Package Options	Page
ADSP-1402	J	16 Bits/64K Words	15 ns	65 ns	64 Words	10	4	15	D
	K	16 Bits/64K Words	25 ns	70 ns	64 Words	10	4	15	D

REGISTER FILE

Model	Word Size Bits	Cycle Rate ns	# of 16-Bit Ports	Bandwidth Bits/ μ s	# of Transfer Cycles	Bidirectional Port	Technology	Package Options	Page
ADSP-3128A	128 \times 16 or 64 \times 32	50	5	3,200	5	1	CMOS	15	D

¹ns max @ $T_A = +70^\circ\text{C}$ Commercial, $T_A = +125^\circ\text{C}$ Military.

²mA max, $f_{\text{CLK}} = \text{max}$, $V_{\text{DD}} = +5\text{ V}$ @ $T_A = +70^\circ\text{C}$ Commercial, $+125^\circ\text{C}$ Military.

³Contact factory.

⁴TTL levels of 0.8 V and +2.2 V.

Boldface Type: Product recommended for new design.

Digital Signal Processing Components

Processors and Development Tools

ADSP-2100/ADSP-2100A/ADSP-2101/ADSP-2105/ADSP-2111/ADSP-21msp50

Model	Cycle Time (ns)	Speeds (MHz)	Temperature ¹ Ranges	Package Options	Page
ADSP-2100	166	24	0°C to +70°C	10, 12, 15	D
	125	32	-55°C to +125°C		
ADSP-2100A	100	40	0°C to +70°C	10, 12, 15	D
	80	50	-55°C to +125°C		
ADSP-2101	100	40	0°C to +70°C	5, 15	D
	80	50	-40°C to +85°C		
	60	66	-55°C to +125°C		
*ADSP-2105	100	40	0°C to +70°C -40°C to +85°C	5	D
*ADSP-2111	77	52	0°C to +70°C -40°C to +85°C -55°C to +125°C	10, 15	D
*ADSP-21msp50	77	52	0°C to +70°C -40°C to +85°C	10, 15	D

Model

Description

SOFTWARE SUPPORT TOOLS

IBM PC‡

*ADDS-21XX-ASM-PC

ADSP-2100/2101/2105/2111 Combined Assembler Software For IBM PC

*ADDS-21XX-SIM-PC

ADSP-2100/2101/2105/2111 Combined Simulator Software for IBM PC

*ADDS-21XX-BUN-PC

ADSP-2100/2101/2105/2111 Combined C Compiler & Cross Software for IBM PC

*ADDS-2101-ASM-PC

ADSP-2101/2105 System Builder, Assembler, Linker, PROM Splitter for IBM PC

*ADDS-2101-SIM-PC

ADSP-2101/2105 Simulator for IBM PC

*ADDS-210XSW-PC

ADSP-2101/2105 C Compiler and Cross Software for IBM PC

ADDS-2121

ADSP-2100A System Builder, Assembler, Linker, PROM Splitter for IBM PC

ADDS-2122

ADSP-2100A Simulator for IBM PC

ADDS-2131

ADSP-2100A C Compiler and Cross Software for IBM PC

VAX/VMS

ADDS-2110

ADSP-2100A Cross Software and Simulator for VAX/VMX

ADDS-2130

ADSP-2100A C Compiler and Cross Software for VAX/VMX

*ADDS-2101-XSW-VAX-X

ADSP-2101/2105 C Compiler and Cross Software for VAX/VMS

SUN3 (UNIX BSD 4.2)

ADDS-2123-C

ADSP-2100A Cross Software for Sun3 (UNIX BSD 4.2)

ADDS-2133-C

ADSP-2100A C Compiler and Cross Software for Sun3 (UNIX BSD 4.2)

Model	Description
ADSP-2100/ADSP-2100A HARDWARE SUPPORT TOOLS	
ADDS-2150A-8	8 MHz ADSP-2100A In-Circuit-Emulator (110 V)
ADDS-2150AE-8	8 MHz ADSP-2100A In-Circuit-Emulator (220 V)
ADDS-2160-8	8 MHz ADSP-2100A Evaluation Board
*ADDS-2100A-ICE	50 MHz ADSP-2100A In-Circuit-Emulator with Trace Buffer
ADSP-2101/ADSP-2105 HARDWARE SUPPORT TOOLS	
ADDS-2101-ICE	50 MHz ADSP-2101/ADSP-2105 In-Circuit-Emulator with Trace Buffer (110 V)
ADDS-2101-ICE-E	50 MHz ADSP-2101/ADSP-2105 In-Circuit Emulator with Trace Buffer (220 V)
*ADDS-2101-EZ-ICE™	ADSP-2101/ADSP-2105 Compact, Easy-to-Use In-Circuit Emulator
*ADDS-2101-EZ-LAB™	ADSP-2101/ADSP-2105 Evaluation and Demonstration Board
*ADDS-2101-EZ-KIT™	ADSP-2101/ADSP-2105 Development Kit
ADSP-2111 HARDWARE SUPPORT TOOLS	
*ADDS-2111-EZ-ICE™	ADSP-2111 Compact, Easy-to-Use In-Circuit Emulator
*ADDS-2111-EZ-LAB™	ADSP-2111 Evaluation and Demonstration Board
An ADSP-2111 In-Circuit Emulator is currently under development.	
TRAINING COURSES	
ADDS-2190	ADSP-2100 Family 3 Day Workshop (Offered in Norwood, California, Europe or at Customer Facilities)
DEVELOPMENT TOOLS ACCESSORIES	
*ADDS-2100A-UMBIL	Umbilical Cable for ADSP-2100A In-Circuit Emulator
*ADDS-2101-UMBIL	Umbilical Cable for ADSP-2101 In-Circuit Emulator and EZ-ICE
*ADDS-2111-UMBIL	Umbilical Cable for ADSP-2111 In-Circuit Emulator and EZ-ICE
*ADDS-21XX-LMP	In-Circuit Emulator Logic Module Probe
*ADDS-101LADAPT	101 Lead Adaptor Socket for ADSP-2100A/2111 Umbilical Cable
*ADDS-2100PGA/PQFP-N	ADSP-2100A PGA to PQFP Surface Mount Adapter
*ADDS-2100PGA/PQFP-S	ADSP-2100A PGA to PQFP Socket Mount Adapter

¹Maximum at +70°C for Commercial, +85°C for Industrial, +125°C for Military.

*New Product since the publication of the 1989/1990 Databooks.

Boldface Type: Product recommended for new design.

‡IBM PC is a trademark of International Business Machines Corporation.

EZ-ICE, EZ-LAB and EZ-KIT are trademarks of Analog Devices, Inc.

Data Acquisition Subsystems

Model	Resolution Bits	Throughput		Bus Interface	Package Option	Temp Range	Page	Comments
		Rate kHz	No. Channels					
*AD1341	12	150	16/8	16	12	C, M	SF-68	Complete, Programmable DAS with Fast Bus Interface
AD1332	12	125	1	12	1	I	C	Complete 12-Bit 125 kHz Sampling ADC, On-Chip FIFO
AD1334	12	65	4	12	1	I	C	Four-Channel 12-Bit Sampling ADC, On-Chip FIFO
AD368	12	50	1	12	1	I, M	C	Complete 12-Bit ADC with Programmable Gains of 1, 8, 64, 512
AD369	12	50	1	12	8	I	C	Complete 12-Bit ADC with Programmable Gains of 1, 10, 100, 500
AD364R	12	20	16/8	12	1	C, M	C	High Speed 16-Channel 12-Bit DAS
AD363R	12	25	16/8	12	1	C, M	C	16-Channel 12-Bit DAS
AD1362			16/8		1	C, M	C	16-Channel Analog Front-End for 12-Bit ADC
DAS1152	14	25	1	14	1	I	C	14-Bit High Accuracy Sampling ADC
DAS1157	14	18	1	14	1	I	C	Low Power 14-Bit Sampling ADC
DAS1153	15	25	1	15	1	I	C	15-Bit High Accuracy Sampling ADC
DAS1158	15	18	1	15	1	I	C	Low-Power 16-Bit Sampling ADC
AD367	15		1	Serial	8	C	C	Integrating ADC with Programmable Gain Amplifier
DAS1159	16	18	1	16	1	I	C	Low Power 16-Bit Sampling ADC

Complete Analog I/O Ports

Model	Resolution Bits	Conv Time max μ s	SHA		Ref. Volt Int/Ext	Bus Interface	Package Options	Temp Range	Page	Comments
			BW kHz typ	Settling Time μ s						
AD7569	8	2	200	1	Int	8, μ P	2, 3, 4, 5, 6	C, I, M	C	CMOS, Complete I/O Port with DIAC, ADC, SHA, Amps and Reference
AD7669	8	2	200	1	Int	8, μ P	2, 5, 6	C, I, M	C	CMOS, Complete I/O Port with 2 DACs, ADC, SHA, Amps, and Reference
*AD7774	8	3	200	2	Int	8, μ P	2, 5	C	N	CMOS, I/O Port with 4-Channel 8-Bit ADC, 11-Bit and Two 8-Bit DACs
AD7769	8	3	200	2.5	Ext	8, μ P	2, 5	C	C	CMOS, Two-Channel ADC/DAC with Output Amplifiers
*AD7868	12	10	41	3	Int (+3 V)	Serial, μ P	2, 3, 6	I, M	SF-81	CMOS, Complete I/O Port with 12-Bit ADC and 12-Bit DAC
*AD7869	14	10	41	3	Int (+3 V)	Serial, μ P	2, 3, 6	C, I, M	SF-81	CMOS, Complete I/O Port with 14-Bit ADC and 14-Bit DAC

ATE Components

Pin Drivers

Model	Speed MHz	V _{RANGE}	Slew Rate at 5 V (V/ns)	Output Capacitance pF	Linearity % of V _{REF}	Package Options	Temp Range	Page
AD1322B	200	-2 V to 7 V	1.8	3.5	0.15	12	C	L
AD1322	200	-2 V to 7 V	1.6	8	0.5	12	C	L
AD1321	100	-2 V to 7 V	1.25	8	0.5	12	C	L

Comparators

Model	Prop Delay ns	Common-Mode Range	Dispersion ps	Input Capacitance pF typ	Input Offset mv max	Package Options	Temp Range	Page
AD1317	2.5	-2 V to 7 V	250	2 (max)	±10	12	C	L
AD96685	3.5	-2.5 V to 5 V	50	2	2	3, 4, 5, 7	I, M	L
AD96687‡	3.5	-2.5 V to 5 V	50	2	2	3, 4, 5	I, M	L
AD9696	7.0	-2.2 V to 3.7 V	100	3	2	2, 3, 6, 7	C, M	L
AD9698‡	7.0	-2.2 V to 3.7 V	100	3	2	2, 3, 6	C, M	L

Active Load

Model	Prop Delay ns	Program Current mA	Input Leakage nA	V _{OUT} Capacitance pF	Package Options	Temp Range	Page
AD1315	1.5	±50	±200	2	12	C	L

Delay Generators

Model	Description	Package Options	Temp	Page
AD9500	ECL Digitally Programmable	3, 4, 5	C, M	L
AD9501	TTL/CMOS Digitally Programmable	2, 3, 5	C, M	L

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

‡Dual Comparators

Disk Drive Components

Optical Storage Components

Model	Description	Package Options	Temp	Page
AD880	Optical Disk Drive Data/Servo Channel Processor	6	C	L

Magnetic Storage Components

Model	Description	Package Options	Temp	Page
AD890	Precision, Wideband Channel Processing Element	3, 5	C	L
AD891	Rigid Disk Data Channel Qualifier	3, 5	C	L
AD891A	50 Mb/s Rigid Disk Data Qualifier	5	C	L
AD892T/E	30 Mb/s Peak Detector	5	C	L
AD897	40 Mb/s Fully Integrated Disk Drive Read Channel	10	C	L

Servo Components§

Model	Description	Package Options	Temp	Page
AD7569	Complete, 8-Bit Analog I/O Port with DAC, ADC, SHA, Amps, and Reference	2, 3, 4, 5	C, I, M	C
AD7669	Complete, 8-Bit Analog I/O Port with 2 DACs, ADC, SHA, Amps, and Reference	2, 5	C, I, M	C
AD7769	8-Bit Analog I/O Port with Two-Channel ADC/DAC	2, 5	C	C

Automotive Components

Model	Description	Package Options	Temp Range	Page
*AD22001	5-Channel Monolithic Comparator for Lamp Monitoring	2	-40°C to +125°C	SF-82
*AD22050	Single-Supply Sensor Interface Circuit	2	-40°C to +125°C	SF-82
*AD22100	Monolithic Temperature Sensor with Signal Conditioning	2, 7, 11	-50°C to +150°C	SF-82
*AD22150	Monolithic Hall Effect Sensor with Signal Conditioning	11	-40°C to +150°C	SF-83
*AD22180	Battery Monitor Circuit	2, 11	-55°C to +125°C	SF-83
*AD22181	Alternator Control Circuit	7	-55°C to +125°C	SF-83

Voltage Controlled Amplifiers

Model	# of VCA's	THD % typ ¹	Dynamic Range dB typ	Gain Core Class	Package Option	Temp Range ²	Page	Comments
SSM-2013	1	0.015	106	A	2	C	P	Low Cost, Single
SSM-2014	1	0.02	116	A/AB	2	C	P	Differential Input/Output
*SSM-2018	1	0.007	118	A/AB	2	I	SF-85	Improved SSM-2014
SSM-2120	2	0.012	100	A	2	C	P	Dynamic Range Processor, 2 VCAs & 2 Level Detectors
SSM-2122	2	0.012	100	A	2	C	P	Excellent Price/Performance
SSM-2024	4	0.1	82	A	2	C	P	Low Cost, Current Controlled Amplifier

Other Audio Products

Model [¶]	Reference	Page
AD1856	Voltage Output DACs	SF-6
AD1860	Voltage Output DACs	SF-6
AD1862	Current Output DACs	SF-5
AD1864	Multiple DACs	SF-8
AD1868	Multiple DACs	SF-8
AD711	High Speed Amplifiers	SF-26
AD712	Dual Amplifiers	SF-33
AD713	Quad Amplifiers	SF-32
AD829	High Speed Amplifiers	SF-26
SSM-2100	Log/Antilog Amplifiers	SF-36
SSM-2110	RMS-to-DC Converters	SF-37
SSM-2131	High Speed Amplifiers	SF-26
SSM-2132	High Speed Amplifiers	SF-26
SSM-2134	Low Noise Amplifiers	SF-25
SSM-2139	Dual Op Amp	SF-33
SSM-2141	Instrumentation Amplifiers	SF-35
*SSM-2142	Instrumentation Amplifiers	SF-35, SF-85
SSM-2210	Matched Transistors	SF-24
SSM-2220	Matched Transistors	SF-24
SSM-2300	Sample/Track-Hold Amplifiers	SF-20
SSM-2402	Analog Bipolar JFET Switches	SF-21
SSM-2412	Analog Bipolar JFET Switches	SF-21

¹THD: G = -20 dB, Class A.²Temperature Range: -10°C to +55°C for SSM-2013, SSM-2014, SSM-2120, SSM-2122 and SSM-2024.

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

§For more information, see Complete Analog I/O Ports section.

¶These products are described in Selection Guides appearing in other sections of this Short Form Designers' Guide. Please refer to the section and page indicated for more information on a specific device.

Communications Products

Telecommunications Products

Model	Description	Package Options	Temp Range	Page
LIU-01	Serial Data Receiver Reconstructs Clock and Data	2, 3, 6	I	P
RPT-82	PCM Repeater Featuring Automatic ALBO	3, 6	I	P
RPT-83	PCM Repeater with ALBO and Clock Shutdown Circuit	3, 6	I	P
RPT-85	PCM Repeater with XR-T445 Pinout	3, 6	C, I	P
RPT-86	Low Power PCM Repeater with ALBO	2, 3, 6	I	P
RPT-87	Low Power PCM Repeater with ALBO and Clock Shutdown Circuit	2, 3, 6	I	P

Line Drivers/Receivers

Part Number	Power Supply Voltage	No. of RS-232 Drivers	No. of RS-232 Receivers	External Capacitors	Low Power Shutdown (SD)	TTL Three-State EN	No. of Pins	Package Options	Temp Range	Page
*AD230	+5 V	5	0	4	Yes	No	20	2, 3, 6	C, I	SF-86
*AD231	+5 V & +7.5 V to 13.2 V	2	2	2	No	No	14	2, 3, 6	C, I, M	SF-86
*AD232	+5 V	2	2	4	No	No	16	2, 3, 6	C, I, M	SF-86
*AD233	+5 V	2	2	None	No	No	20	2	C, I	SF-86
*AD234	+5 V	4	0	4	No	No	16	2, 3, 6	C, I	SF-86
*AD235	+5 V	5	5	None	Yes	Yes	24	2, 3	C, I	SF-86
*AD236	+5 V	4	3	4	Yes	Yes	24	2, 3, 6	C, I, M	SF-86
*AD237	+5 V	5	3	4	No	No	24	2, 3, 6	C, I	SF-86
*AD238	+5 V	4	4	4	No	No	24	2, 3, 6	C, I, M	SF-86
*AD239	+5 V & +12 V	3	5	2	No	Yes	24	2, 3, 6	C, I, M	SF-86
*AD241	+5 V	4	5	4	Yes	Yes	28	6	C, I	SF-86

Boldface Type: Product recommended for new design.

*New product since the publication of the most recent Databooks.

Analog Devices offers a full spectrum of capabilities in mixed-signal application specific integrated circuits (ASICs). These chip-level systems can implement combined analog/digital designs with 10- to 14-bit accuracy and 12- to 20-bit resolution that formerly required board-level solutions.

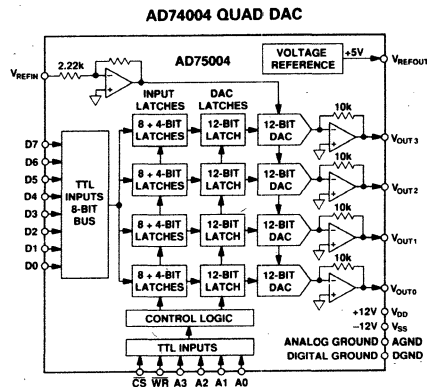
Analog Devices can incorporate most of the functions of its standard monolithic parts in full-custom and semicustom ICs. Full-custom parts optimize performance and space requirements, while cell-based semicustom parts reduce development time and engineering expense. Development costs can be cut further by tailoring a predefined system-on-a-chip known as a Linear System Macro to your application.

Analog's experienced design engineers work with powerful computer-aided design tools to design and lay out your circuit. Design centers are currently in Massachusetts, England and Ireland.

Multiple locations for fabrication, assembly and testing ensure a ready supply of production parts. Products can be processed in full MIL-38510 certified facilities.

DESIGN EXAMPLES

Analog Devices has created a variety of customer-specific and function-specific ASIC parts. Described here are three Linear System Macros, a custom chipset and a semicustom chip.

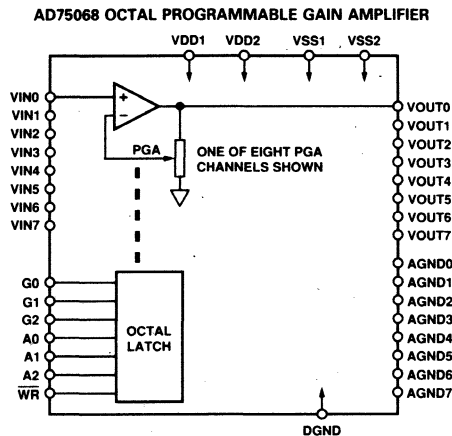


AD75004 Quad DAC

This circuit contains four separate 12-bit D/A converters with amplifiers for voltage output and an on-board reference. Double-buffering latches interface with an 8-bit parallel bus and permit updating of all four channels individually or simultaneously. Outputs swing ± 5 V, drive ± 5 mA, and settle within 5 μ s.

AD75068 Octal Programmable Gain Amplifier

The AD75068 contains eight programmable gain amplifiers (PGAs). Each is complete, including switch/resistor network and gain programming latch, and requires no external components. Each channel may be independently programmed for gains from 1 to 128. A unique circuit design maintains constant 2 MHz bandwidth at all gains and offers very low phase shift; the PGAs also feature low input bias current (<10 pA).

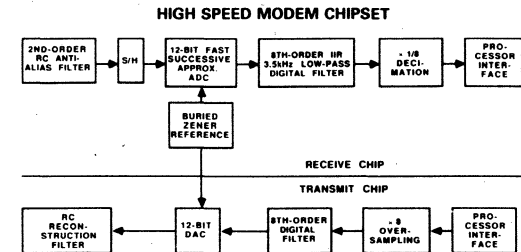


Derivative Circuits

The circuits outlined above can be modified to suit a specific customer's application. For example, the AD75004 quad DAC could be expanded to 6 channels, each of which may have separate reference inputs. The AD75068 could be configured to include filtering. These modifications, when based on standard library cells, can provide the fastest, most cost effective semicustom solution.

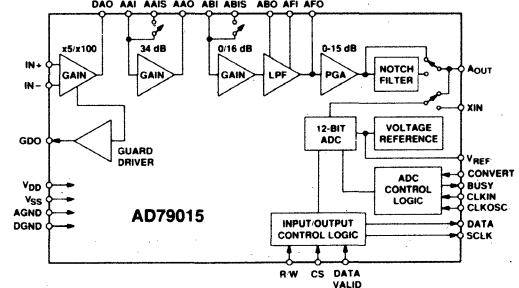
Modem Chipset

Library cells can be combined to form macro building blocks for high speed modems. This two-chip design concept filters and converts data to interface a digital signal processor with the analog circuitry of a 9600-baud modem. On one chip, the received signal passes through an antialiasing filter, sample-and-hold, 12-bit A/D converter, 8th-order digital filter and decimation. On the other chip, transmit data is $8 \times$ oversampled, then goes to an 8th-order filter, a 12-bit DAC and an active reconstruction filter.



AD79015 Low Level DAS

This circuit is a complete data acquisition system for low level signals (e.g., ECG and EEG) with a throughput of 10,000 samples per second. It provides high accuracy, high stability and functional completeness in a small 28-pin PLCC package. It includes a high performance instrumentation amp, low-pass and 50/60 Hz notch filters, and a 12-bit ADC with on-chip reference. It also includes a fast 8/12-bit serial port to interface to most microprocessor systems.



Application Specific Integrated Circuits

HIGH PERFORMANCE PROCESSES

Analog Devices' semicustom and custom circuits are fabricated using the same high performance processes as our standard-product ICs. These mixed bipolar-CMOS processes include thin-film resistors which may be laser trimmed for precise matching and provide stable performance over a wide temperature range.

The ABCMOS, BiMOS II, and Linear Compatible CMOS (LC²MOS) processes combine bipolar and CMOS devices on one chip. Functional density is an order of magnitude greater than previous mixed-signal processes; over 40,000 devices can be placed on a single chip. Bipolar transistors provide low noise, low off-set input stages and high-power output stages. The CMOS devices offer high input impedance, and make dense logic and analog switches for data converters, multiplexers and switched-capacitor filters. LC²MOS also provides a JFET for very low noise amplifiers, and a low-noise buried-Zener reference.

The bipolar-CMOS processes operate on supply voltages ranging from single +5 volts to split ± 15 V, with signal levels ranging from single-ended +3 V to ± 10 V. These processes are ideally suited for applications in data acquisition, instrumentation, industrial automation and telecommunications.

The following table summarizes the processes available for designing ASICs. Other processes in development will offer even higher speed, denser logic and higher integration of analog and digital functions.

CELL LIBRARIES

Cell libraries for the bipolar CMOS processes are described below. These libraries are growing with the development of new processes, macrocells and cells. Many new catalog parts will also be available as cells. Your local sales office can give you current information on the cell libraries and available Linear System Macros.

Operational amplifiers are available in bipolar, JFET and CMOS configurations. Representative bipolar op amp cells have performance characteristics similar to an

ANALOG DEVICES HIGH PERFORMANCE BiCMOS PROCESSES FOR ASICS

Process	Power	Signal	Features
ABCMOS	+5 V to ± 5 V	+3 V to ± 3 V	Fine Geometries; Double Metal
BiMOS II	± 5 V to ± 12 V	± 3 V to ± 10 V	Double Metal
LC ² MOS	+5 V to ± 15 V	+3 V to ± 10 V	JFET, Zener
LC ² MOS 2	+5 V to ± 5 V	+3 V to ± 3 V	Fine Geometries; Poly-Poly Capacitors, JFET, Zener

AD OP-27 and a slew-enhanced AD741. The LC²MOS process offers JFET op amps, including an AD711 equivalent.

Instrumentation amplifiers with performance comparable to the AD521 and AD524 are available. Linear comparators have response times down to 100 nanoseconds and strobed comparators have setup/access times down to 50 nanoseconds.

Digital-to-analog converters range in resolution from 8 to 16 bits, and include cells similar to the AD667 and AD1856. Analog-to-digital converters vary from 8 to 16 bits in resolution, and include cells equivalent to the AD7871 and AD674.

Support cells include sample-and-hold amplifiers with performance comparable to the AD585, low voltage bandgap references comparable to the AD584, and low noise buried Zener references.

RC active filters and programmable switched-capacitor filters are available with specifications in these ranges:

Topology: all classical filter types

Frequency Range: 200 Hz to 20 kHz (switched-cap) or 100 Hz to 1 MHz (RC)

Number of Sections: up to 10th-order (switched-cap) or 4th-order (RC)

Signal/Noise and THD: >75 dB, compatible with 12-bit data acquisition.

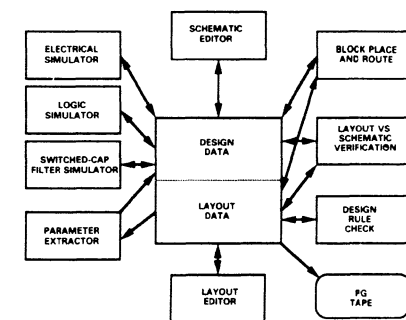
Logic cells include gates, counters, registers, micro-sequencer, PLA, RAM and ROM. Interface cells include 8-bit and 16-bit parallel I/O ports as well as synchronous serial ports and UARTs.

COMPUTER-AIDED DESIGN TOOLS

Designing a high performance mixed-signal IC is inherently more difficult than designing a gate array. The variety of analog and digital functions requires a cell-based approach. However, the use of powerful tools gives high confidence of functionality at first silicon through thorough simulation and layout verification. Complete computer-generated documentation of all schematics and analog and logic simulation waveforms permits thorough evaluation of Analog's design by your design staff before signoff for final layout and fabrication.

The overall work flow through the CAD environment is shown below. Key to meeting the special challenges of mixed analog/digital circuitry are the simulation and auto-layout tools, and the unification of design and layout information in a single database. Analog Devices has developed a suite of proprietary computer-aided design tools, called JANUS™, to address these issues and to implement turn-key designs.

COMPUTER-AIDED DESIGN FLOW



The JANUS schematic editor offers numerous time-saving techniques and provides for specification of such data as wire widths, routing layers and routing priorities. It automatically generates a netlist used by subsequent tools.

Analog uses several simulators, including electrical, logic and behavioral types. ADICE, a proprietary enhanced version of the SPICE electrical simulator, gives precision simulation of critical analog sections. It uses Newton-Raphson methods to iteratively solve nonlinear time-dependent simultaneous differential equations. It is efficient for circuits up to about 250 active devices and is used for the frequency domain or transient analysis of analog cells such as op amps, or sensitive digital cells such as dynamic RAM.

Event-driven simulators handle larger circuits, with thousands of devices, and are typically used to simulate logic. The JANUS mixed-signal simulator combines an event-driven simulator with Newton-Raphson methods. It dynamically partitions the circuit to apply the faster event-driven techniques where possible, and the matrix methods where necessary. It also dynamically sizes the matrix and time steps to speed simulation further. The simulator can operate at the transistor level or use behavioral models, or both at the same time, allowing trade-offs between accuracy and speed.

For layout, the challenge is to increase automation while accommodating the layout sensitivity of analog circuitry. Device generators exist for the full range of active and passive devices available in the technology to automatically create a physical representation of the circuit schematic. This layout may be optimized through conventional interactive polygon-pushing.

The JANUS routing editor is driven by the connectivity of the schematics, but allows great freedom to manually control the routing of critical analog signal paths or power/ground lines while autorouting noncritical nets and spacing the layout to achieve automatic enforcement of layout rules. The JANUS routing editor uses up to three interconnect levels, and will automatically expand and compact placement as necessary to achieve 100% routing.

Finally, industry-standard layout verification tools assure conformance of the layout to both the schematic and design rules to give high confidence of functionality in first silicon. The CAD tool suite communicates via industry-standard stream formats to external databases and pattern generators.

TEST AND TRIM

Analog Devices has over 20 years of experience in testing complex circuits and manufactures commercial test systems for precision linear ICs. In each fabrication facility, a computer network integrates Analog Devices, H-P, Teradyne and LTX test equipment. The design, wafer probe and test areas share data on the network for statistical analysis and device modeling.

All Analog Devices ASICs are tested at the wafer level, and most are laser-wafer trimmed to achieve high accuracy. Untrimmed thin-film resistors match within 1% to 0.1%, depending on area. Trimmed resistors can match to better than 0.01%. Wafers may be laser drift trimmed with a hot-chuck probe to minimize the effects of temperature on accuracy.

After packaging, all parts are tested to assure that they meet guaranteed specifications. Environmental handlers can verify parts at multiple temperatures. Burn-in is performed as specified by the customer.

PACKAGING

Analog Devices ICs are available in most modern package types, including high pin-count and surface mount varieties. ASICs may be assembled in any of Analog Devices' standard packages, listed below. This list is constantly expanded and other packages may be used if they are suitable for high performance applications.

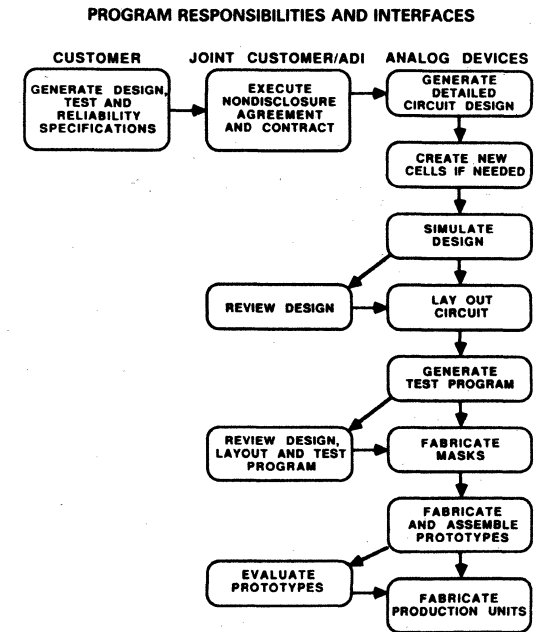
Available Packages

- Pin-grid array (PGA): 68 to 144 pins
- Leaded ceramic chip carrier (LDCC): 44 pins
- Leadless ceramic chip carrier (LCC): 20 to 68 I/Os
- Plastic quad flat pack (PQFP): 44 to 132 pins
- Plastic leaded chip carrier (PLCC): 20 to 68 pins
- Plastic dual in-line package (DIP): 14 to 64 pins
- Side-brazed DIP: 14 to 64 pins
- Frit-seal DIP (Cerdip): 14 to 40 pins
- Small outline (SO): 14 to 28 pins

PROGRAM RESPONSIBILITIES AND INTERFACES

The following figure shows the major phases in developing an ASIC and responsibilities during each phase. The overall development time depends on the complexity of the circuit and on how custom the design is.

Your Analog Devices Sales Engineer is your first interface for ASIC development. Your local sales office can provide further information on Analog Devices' custom/semicustom capabilities.



Power Supplies

Modular AC/DC Power Supplies

GENERAL DESCRIPTION

Analog Devices offers a broad line of modular ac/dc power supplies that provide both OEMs and designers a reliable, easy to use, low-cost solution to their power requirements. Models are available in PC mountable and chassis mountable designs with 5 volt to 15 volt (single, dual, triple) outputs and current ratings from

25 mA to 5 amps. Since these modular supplies are fully encapsulated, no trimming or external component selection is necessary; simply mount the unit, connect power and output leads, and you're on the air! Most Analog Devices' power supplies are available from stock in both large and small quantities with substantial discounts being applied to large quantity orders.

SPECIFICATIONS – Typical @ +25°C and 115 V ac 60 Hz unless otherwise noted*

Type	Model	Output Voltage Volts	Output Current mA	Line Reg. max %	Load Reg. max %	Output Voltage Error max	Ripple & Noise mV rms max	Dimensions Inches
PC Board Mounted	904	±15	±50	0.02	0.02	±200 mV -0 mV	0.5	3.5×2.5×0.875
	902	±15	±100	0.02	0.02	+300 mV -0 mV	0.5	3.5×2.5×1.25
	Dual Output 902-2	±15	±100	0.02	0.02	+300 mV -0 mV	0.5	3.5×2.5×0.875
	920	±15	±200	0.02	0.02	+300 mV -0 mV	0.5	3.5×2.5×1.25
	925	±15	±350	0.02	0.02	±1%	0.5	3.5×2.5×1.62
	921	±12	±240	0.02	0.02	+300 mV -0 mV	0.5	3.5×2.5×1.25
	Single Output 905	5	1000	0.02	0.05	±1%	1	3.5×2.5×1.25
	922	5	2000	0.02	0.05	±1%	1	3.5×2.5×1.62
	928	5	3000	0.05	0.10	±2%	5 (typ)	3.5×2.5×1.25
	923	±15	±100	0.02	0.02	±1%	0.5	3.5×2.5×1.25
Chassis Mounted		+5	500	0.02	0.05	±1%	0.5	
	Triple Output 927	±15	±150	0.02	0.02	±2%	0.5 (typ)	3.5×2.5×1.62
		+5	1000	0.02	0.10	±2%	1.0 (typ)	
	2B35J	±15	±65	0.08	0.10	(-0, +300 mV)	0.5	3.5×2.5×1.25
		+1 to +15**	125	0.08	0.10		0.25	
	2B35K	±15	±65	0.01	0.02	(-0, +300 mV)	0.5	3.5×2.5×1.25
		+1 to +15**	125	0.01	0.02		0.25	
	Dual Output 952	±15	±100	0.05	0.05	±2%	1	4.4×2.7×1.45
	970	±15	±200	0.05	0.05	±2%	1	4.4×2.7×1.45
	973	±15	±350	0.05	0.05	±2%	1	4.4×2.7×2.00
975	±15	±500	0.05	0.05	±2%	1	4.4×2.7×2.00	
Single Output 955	5	1000	0.05	0.15	±2%	2	4.4×2.7×1.45	
976	5	3000	0.05	0.10	±2%	5 (typ)	4.75×2.7×1.45	
977	5	5000	0.05	0.10	±2%	5 (typ)	4.75×2.7×1.45	
Triple Output 972	±15	±150	0.02	0.02	±2%	0.5 (typ)	4.75×2.7×1.45	
	+5	300	0.02	0.10	±2%	1.0 (typ)		
974	±15	±150	0.02	0.02	±2%	0.5 (typ)	4.75×2.7×1.45	
	+5	1000	0.02	0.10	±2%	1.0 (typ)		

*Consult Analog Devices Power Supplies Catalog for additional information.

**Resistor programmable.

Specifications subject to change without notice.

AC/DC POWER SUPPLY FEATURES

- Current Limit Short Circuit Protection
- PC Mounted and Chassis Mounted Versions
- Single (+5 V), Dual (±12 V, ±15 V), and Triple (±15 V/+5 V, ±15 V/+1 V to +15 V) Output Supplies
- Current Outputs:
 - 25 mA to 1000 mA for Dual and Triple Output Supplies
 - 250 mA to 5000 mA for Single Output Supplies
- Wide Input Voltage Range
- Low Output Ripple and Noise
- Excellent Line & Load Regulation Characteristics
- High Temperature Stability
- Free-Air Convection Cooling; No External Heat Sink Required

GENERAL SPECIFICATIONS

Power Requirements

Input Voltage Range: 105 V ac to 125 V ac
Frequency: 50 Hz to 250 Hz

Electrical Specifications

Temperature Coefficient: 0.02%/°C
Output Voltage Accuracy: ±2%, max

See Specifications Table

Breakdown Voltage: 500 V rms, min
Isolation Resistance: 50 MΩ

Short Circuit Protection: All ac/dc power supplies employ current limiting. They can withstand substantial overload including direct short. Prolonged operation should be avoided since excessive temperature rises will occur.

Environmental Requirements

Operating Temperature Range: -25°C to +71°C
Storage Temperature Range: -25°C to +85°C

Modular DC/DC Converters

GENERAL DESCRIPTION

Analog Devices' line of compact dc/dc converters offers system designers a means of supplying a reliable, easy to use, low cost solution to a variety of floating (analog and digital) power applications. These devices provide high accuracy, short circuit protected, regulated outputs with very low output noise and ripple characteristics.

Fourteen models are offered in five power levels of 1 watt, 1.8 watts, 4.5 watts, 6 watts and 12 watts. Input voltage versions include 5 volt, 12 volt, 24 volt and 28 volt with output ranges as follows: +5 volt, ± 12 volts and ± 15 volts at ± 60 mA to 1000 mA output current capability.

Most models are high efficiency (typically over 60% at full load) and feature complete 6-sided continuous shielding for EMI/RFI protection. A π -type input filter is contained, in some models, which virtually eliminates the effects of reflected input ripple current. Most Analog Devices' dc/dc converters are available from stock in both large and small quantities with substantial discounts being applied to large quantity orders.

DC/DC POWER SUPPLY FEATURES

- Inaudible (>20 kHz) Converter Switching Frequency
- Continuous, Six-Sided EMI/RFI Shielding Except on 1 Watt and 1.8 Watt Models
- Output Short Circuit Protection (Either Output to Common)
- Automatic Restart After Short Condition Removed
- Automatic Starting with Reverse Current Injected into Outputs
- Low Output Ripple and Noise
- High Temperature Stability
- Free Air Convection Cooling

No external heat sink or specification derating is required over the operating temperature range.

GENERAL SPECIFICATIONS FOR 1 W AND 1.8 W MODELS

Line Regulation – Full Range: $\pm 0.3\%$ ($\pm 1\%$ max, 949)
 Load Regulation – No Load to Full Load: $\pm 0.4\%$ ($\pm 0.5\%$ max, 949)

Output Noise and Ripple: 20 mV p-p, with 15 μ F tantalum capacitor across each output (2 mV rms max, 949)

Breakdown Voltage: 300 V dc min (500 V dc min, 949)

Input Filter Type: π

Operating Temperature Range: -25°C to $+71^{\circ}\text{C}$

Storage Temperature Range: -40°C to $+125^{\circ}\text{C}$ ($+100^{\circ}\text{C}$, 949)

Fusing: If input fusing is desired, we recommend the use of a slow blow type fuse that is rated at 150%–200% of the dc/dc converter's full load input current.

GENERAL SPECIFICATIONS FOR 4.5 W, 6 W AND 12 W MODELS

Line Regulation – Full Range: $\pm 0.07\%$ max ($\pm 0.02\%$ max, 951, 960 Series) ($\pm 0.1\%$ max, 943)

Load Regulation – No Load to Full Load: $\pm 0.07\%$ max ($\pm 0.02\%$ max, 951, 960 Series) ($\pm 0.1\%$ max, 943)

Output Noise and Ripple: 1 mV rms max

Breakdown Voltage: 500 V dc min

Input Filter Type: π

Operating Temperature Range: -25°C to $+71^{\circ}\text{C}$

Storage Temperature Range: -40°C to $+125^{\circ}\text{C}$

Fusing: If input fusing is desired, we recommend the use of a slow blow type fuse that is rated at 150%–200% of the dc/dc converter's full load input current.

SPECIFICATIONS – Typical @ $+25^{\circ}\text{C}$ at nominal input voltage unless otherwise noted*

Model	Output Voltage Volts	Output Current mA	Input Voltage Volts	Input ¹ Voltage Range Volts	Input Current Full Load	Output Voltage Error max	Temperature Coefficient / $^{\circ}\text{C}$ max	Efficiency Full Load min	Dimensions Inches
943	5	1000	5	4.75/5.25	1.52A	$\pm 1\%$	$\pm 0.02\%$	62%	2.0 \times 2.0 \times 0.38
958	5	100	5	4.5/5.5	200 mA	$\pm 5\%$	$\pm 0.01\%$ (typ)	50%	1.25 \times 0.8 \times 0.4
941	± 12	± 150	5	4.75/5.25	1.17A	$\pm 1\%$	$\pm 0.01\%$	58%	2.0 \times 2.0 \times 0.38
960	± 12	± 40	5	4.5/5.5	384 mA	$\pm 5\%$	$\pm 0.01\%$ (typ)	50%	1.25 \times 0.8 \times 0.4
962	± 15	± 33	5	4.5/5.5	396 mA	$\pm 5\%$	$\pm 0.01\%$ (typ)	50%	1.25 \times 0.8 \times 0.4
964	± 15	± 33	12	10.8/13.2	165 mA	$\pm 5\%$	$\pm 0.01\%$ (typ)	50%	1.25 \times 0.8 \times 0.4
965	± 15	± 190	5	4.65/5.5	1.7 A	$\pm 1\%$	$\pm 0.005\%$ (typ)	62% (typ)	2.0 \times 2.0 \times 0.38
966	± 15	± 190	12	11.2/13.2	710 mA	$\pm 1\%$	$\pm 0.005\%$ (typ)	62% (typ)	2.0 \times 2.0 \times 0.38
967	± 15	± 190	24	22.3/26.4	350 mA	$\pm 1\%$	$\pm 0.005\%$ (typ)	62% (typ)	2.0 \times 2.0 \times 0.38
949	± 15	$\pm 60^{**}$	5	4.65/5.5	0.6 A	$\pm 2\%$	$\pm 0.03\%$	58%	2.0 \times 1.0 \times 0.375
940	± 15	± 150	5	4.75/5.25	1.35 A	$\pm 1\%$	$\pm 0.01\%$	62%	2.0 \times 2.0 \times 0.38
953	± 15	± 150	12	11/13	0.6 A	$\pm 0.5\%$	$\pm 0.01\%$	62%	2.0 \times 2.0 \times 0.38
945	± 15	± 150	28	23/31	250 mA	$\pm 0.5\%$	$\pm 0.01\%$	61%	2.0 \times 2.0 \times 0.38
951	± 15	± 410	5	4.65/5.5	3.7 A	$\pm 0.5\%$	$\pm 0.01\%$	62%	3.5 \times 2.5 \times 0.88

NOTES

¹Models 940 and 941 will deliver up to 120 mA output current (and Model 943 will deliver up to 600 mA) over an input voltage range of 4.65 V dc and 5.5 V dc.

*Consult Analog Devices Power Supplies Catalog for additional information.

**Single-ended or unbalanced operation is permissible such that total output current load does not exceed a total of 120 mA.

Specifications subject to change without notice.

LTS-2020 Component Test Systems

THE LTS CONCEPT

The LTS-2020 is a versatile component test system which tests a multitude of components to the manufacturer's specifications (linear, digital, data conversion, and discrete devices). The system offers such features as RS-232 ports for networking, IEEE for compatibility with handlers and probers, dual disk drives for mass storage of data, automatic self-calibration, and a full statistical analysis software package.

The LTS-2020 provides several data output formats - datalog, yield analysis, and statistical analysis. The console provides the primary measurement and control functions to test a specific class of devices. The socket assembly is the mechanical and electronic interface for the family board and the DUT board. The DUT board plugs directly into the socket assembly and contains the circuitry and socket, specific to the actual device under test.

Analog Devices' component test systems are the first benchtop testers that are programmable in BASIC and fill-in-the-blanks CREATE. CREATE is menu-driven software which prompts the user for data sheet limits and conditions, then builds a completed test program for the specified device. Turnkey program libraries are available for each of the device families.

Far more than just comprehensive production testers, these test systems can handle complex engineering analysis and incoming inspection. They are the first systems that can provide all the capabilities of today's large centralized test systems at a price that is approximately one-third the cost. The LTS-2020 not only provides the flexibility of distributed or decentralized testing, it allows for cost effective multiple system purchases. They increase overall test reliability since the threat of a single big failure is eliminated in a distributed testing environment.

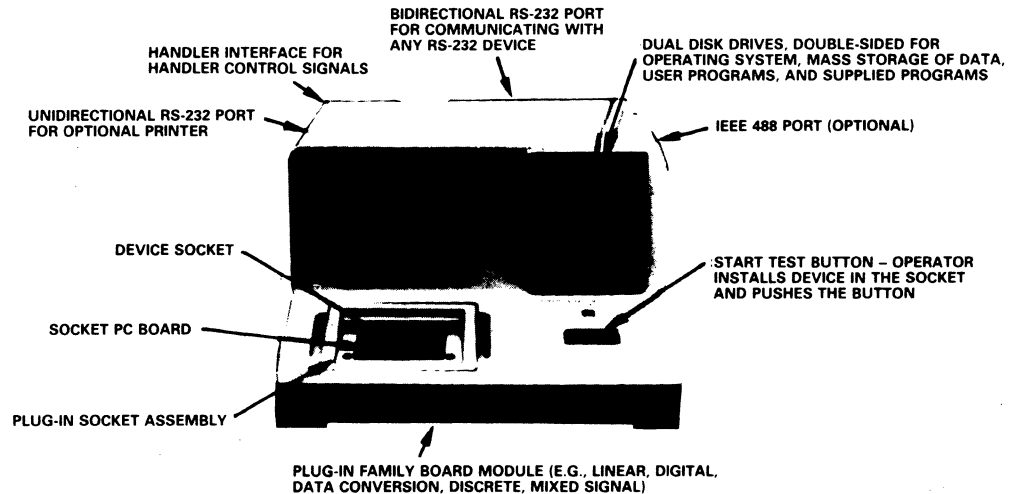
MIXED SIGNAL TEST CAPABILITY

The LTS-2800 Mixed Signal Family Board and LTS-0680 Test Head perform a wide variety of ac and dc parametric tests on devices such as complex hybrids,

octal DACs, ASICs, converters, and pulse width modulators. The family board supplies the dc pin drivers, the dc force and measure system, a V_{CC} buffer, an rms-to-dc conversion circuit, voltage and current sources, and a 24×5 switching matrix. With its 24 programmable pin drivers, the system can provide high and low digital voltages, a three-state (high impedance) output mode, and accurate voltages and currents (V/I source).

The family board incorporates a series of 12-bit calibrated sources, used for programming V_{IL} and V_{IH} voltage levels at the digital inputs of the device under test. A threshold source for programming voltage levels on a comparator is used to detect digital output voltage levels accurately. For forcing and measuring currents, a V/I source provides and measures 10 μ A to 400 mA and voltages to ± 20 V.

A switching matrix provides system flexibility by allowing any one of several capabilities to be switched to any of the pin drivers. These include the measure system, V/I source, V_{IH} and V_{IL} sources, the rms-to-dc circuit,



and BNC input and output connectors for interconnection with external instruments using the IEEE-488 bus.

The LTS-0680 Mixed Signal Test Head contains a precise and versatile time measure unit which provides accurate ac measurement of propagation delays, slew rates, pulse widths, and rise and fall times. It also incorporates a 16-bit user data bus, 16-bit relay driver bus, four 12-bit programmable sources, and a user's expansion board. A square wave source to the DUT provides up to ± 10 volt signals, from 1.22 kHz to 2.5 MHz.

LINEAR DEVICE TEST CAPABILITY

The LTS-2101 Operational Amplifier Family Board tests today's very demanding high precision op amps, comparators, and regulators. This board houses the test loop used in testing op amps and comparators and the pulse load circuitry used in developing the high currents needed for voltage regulator testing.

For testing devices under 100 μV , the LTS-2101 offers a tight offset spec of $\pm(0.25\% + 5 \mu\text{V})$. Use of low thermal Emf relays and a test loop gain of 10,045 ensures superior low level V_{OS} measurement performance for optimum repeatability of low level signals.

Testing of low current devices is achieved with the LTS-0614 Socket Assembly which is designed to test bias and offset currents with an accuracy of $\pm(5\% + 25 \text{ fA})$ for any FET amplifier, including quad devices. Program libraries containing prewritten test programs for many standard op amps, comparators and regulators are available on disk.

ANALOG-TO-DIGITAL TEST CAPABILITY

The LTS-2200 ADC Family Board provides the test circuitry required for testing monolithic, hybrid, or modular ADCs. An on-board 16-bit microprocessor with 8K bytes of memory acts as a slave for the system console and executes preprogrammed test routines such as linearity, all codes existence, transition noise measurements, and conversion time measurements at high speed. Absolute accuracy can be measured within 200 μV . Linearity, differential nonlinearity, offset, gain, and PSSR are tested to ± 0.05 DUT LSB + 200 μV . Turnkey test packages are available for many of the standard ADCs currently in use.

DIGITAL-TO-ANALOG TEST CAPABILITY

The LTS-2302 DAC Family Board utilizes advanced state-of-the-art test techniques to provide comprehensive test capabilities for a wide variety of D/A converters. It will test both voltage and current output DACs, DACs with and without buffer registers, and serial or parallel input DACs to 16-bit accuracy.

High repeatability on low level signals is achieved because of the grounding scheme on the LTS-2302. The incorporation of high level components in the V/I circuits ensures true accuracy. In addition, the methodology for measuring low bit currents allows appropriate testing of this parameter on CMOS DACs.

Output leakage current on the LTS-2302 is measured with the bit drivers to the DAC set to logic 0. Current is measured using the I to V converter. A 1 M Ω resistor within the I to V circuitry ensures sensitivity, thereby measuring current down to $\pm 1 \mu\text{A}$ full scale.

DIGITAL DEVICE TEST CAPABILITY

The LTS-2510 Digital Device Family Board provides 24-pin driver/detectors and a precision, four quadrant V/I source for testing SSI/MSI TTL and CMOS digital devices. This board contains four programmable device supplies and switching circuitry necessary for performing accurate parametric measurements on all device pins.

Together with the LTS-0655 remote ac test fixture, dynamic parametric testing of 24-pin SSI/MSI TTL digital devices can be achieved. Accuracies are achieved down to $\pm 4\% + 1.5 \text{ ns}$ at a resolution of 500 ps. Dynamic parameters tested are propagation delay, setup, and hold times.

DISCRETE DEVICE TEST CAPABILITY

The LTS-2600 Transistor Family Board tests bipolar transistors, JFETs, diodes, and optocouplers. An on-board 16-bit microprocessor with 4K bytes of memory acts as a slave for the LTS system and coordinates the timing and pulse width control of the stimulus and measurement signals. In addition, the microprocessor monitors the interlock circuitry to insure safe handling of high power test signals.

MOSFET software packages support the testing of N and P channel enhancement mode and N channel depletion mode devices. Tests which may be performed on MOSFET devices include I_{dss} , I_{gss} , I_{gssf} , I_{gssr} , I_d (off), I_d (on), $B V_{dss}$, $B V_{gss}$, $B V_{gssf}$, $B V_{gssr}$, V_{ds} (on), V_{gs} (th), V_{gsoff} , V_{sd} , R_{ds} (on), and G_{sf} .

The Smartpower Test Fixture will support fast, accurate testing of devices such as Darlington Arrays, Differential Line Drivers/Receivers, and Transceivers/Repeaters. It contains a matrix board which facilitates the muxing of High Voltage/High Current V/Is, a nonometer, diffamp, 16-bit measure system, and mecca ground reference to any one of eight matrix points at the DUT site and eight dc pin drivers programmable to any one of four modes – V/I, V_{IH} , V_{IL} or Tristate. This configuration allows true digital dc parametric testing of the front-end of smartpower devices while providing the high voltage and high current capability to test the discrete output stage.

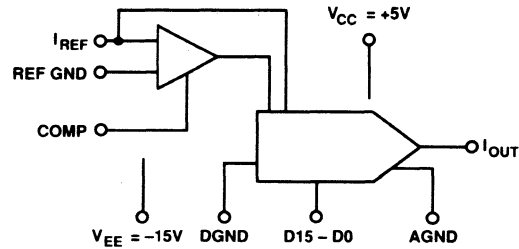
ANALOG SWITCH TEST CAPABILITY

The LTS-2700 Analog Switch Family Board adds switch and multiplexer testing capability to the LTS-2020. This test capability, with CREATE software, allows datalogged device testing at the incoming inspection and semiconductor manufacturing levels and includes software power for use in component evaluation applications.

The LTS-2700 tests on and off drain to source leakage currents with an accuracy of 250 pA while forcing differential voltages up to 50 V ($\pm 25 \text{ V}$ from GND). Other tests performed are drain to source on resistance, greatest change in drain-source on resistance between channels, digital input current and supply current.

Twenty high integrity analog lines are provided – four to be used as drain connections and sixteen for source connections. Also provided are eight programmable digital drivers, four digital control bits, six variable power supplies, and one fixed +5 V supply. These combinations of sources provide testing of devices such as 4-channel switches, 16 to 1 multiplexers, and other combinations of switches and multiplexers.

16-Bit High Speed DAC



DAC-16

FEATURES

±1 LSB DNL

±2 LSB INL

500 ns Settling Time to 1 LSB

Multiplying Range 10:1

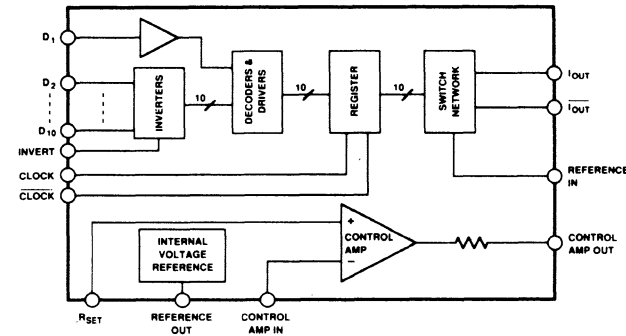
500 kHz Multiplying Bandwidth

Military Temperature Range Grades

TTL/CMOS Compatible

24-Pin Plastic DIP

10-Bit 300 MSPS DACs



AD9720/AD9721

FEATURES

300 MSPS (ECL)/100 MSPS (TTL) Update Rate

Low Glitch Impulse: 15 pV-s

Fast Settling: 10 ns to 1/2 LSB

Low Power: 1.1W

On-Board Quadrature Logic for DDS Application

Differential Clock (ECL)

APPLICATIONS

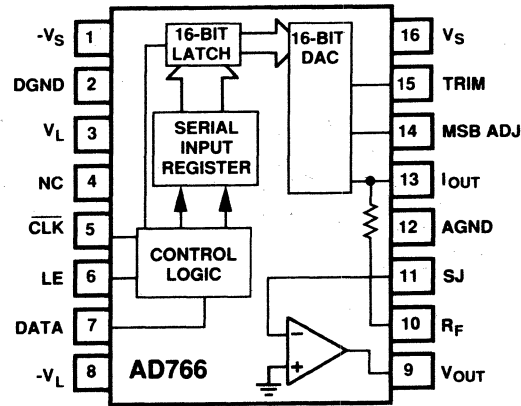
Direct Digital Synthesis

Arbitrary Waveform Synthesis

Waveform Reconstruction

High Speed Imaging

16-Bit Zero-Chip Interface DAC



AD766

FEATURES

Zero-Chip Interface to Popular μ P, μ C and DSPS
Specified Over Commercial and Military
Temperature Ranges

0.0025% THD

Fast Settling Permits 2x, 4x, or 8x
Oversampling

± 3 V Output

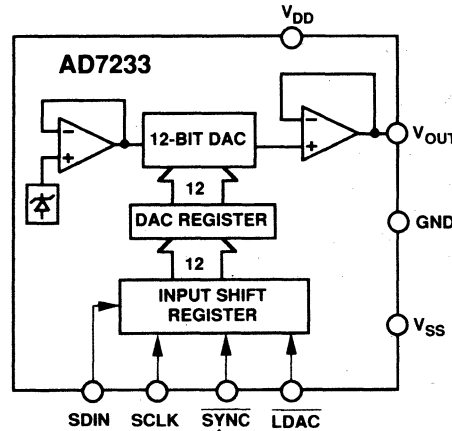
Optional Trim Allows Superlinear Performance

± 5 V to ± 12 V Operation

16-Pin Plastic and Hermetic DIP Package

Serial Input

LC²MOS 12-Bit Serial Input DACPORT



AD7233

FEATURES

12-Bit CMOS DAC with
On-Chip Voltage Reference
Output Amplifier

Serial Interface

Small Size: 8-Pin DIP

Nonlinearity: $\pm 1/2$ LSB T_{min} to T_{max}

Low Power Dissipation: 100 mW typ

APPLICATIONS

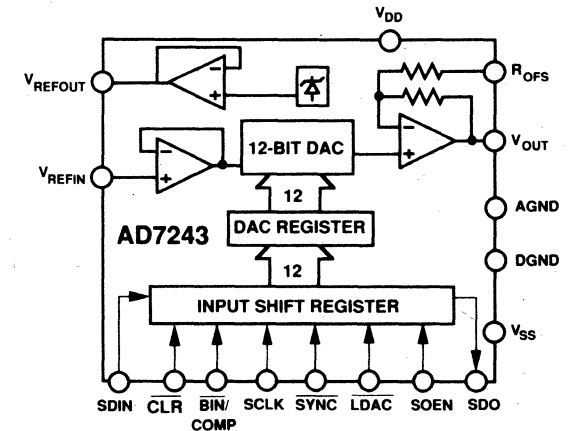
Process Control

Industrial Automation

Digital Signal Processing Systems

Input/Output Ports

12-Bit Serial DACPORT



AD7243

FEATURES

12-Bit CMOS DAC with
On-Chip Voltage Reference
Output Amplifier

Serial Interface

Small Size: 16-Pin DIP or SOIC

Nonlinearity: $\pm 1/2$ LSB T_{min} to T_{max}

Low Power Dissipation: 100 mW typ

APPLICATIONS

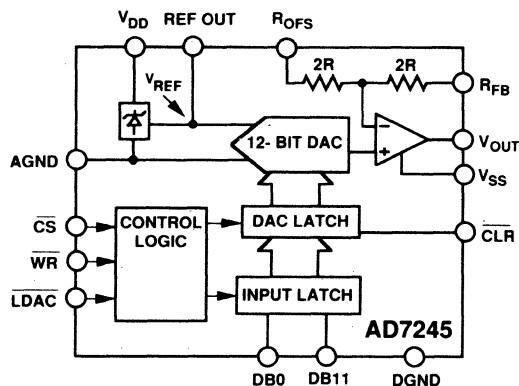
Process Control

Industrial Automation

Digital Signal Processing Systems

Input/Output Ports

LC²MOS 12-Bit DACPORT



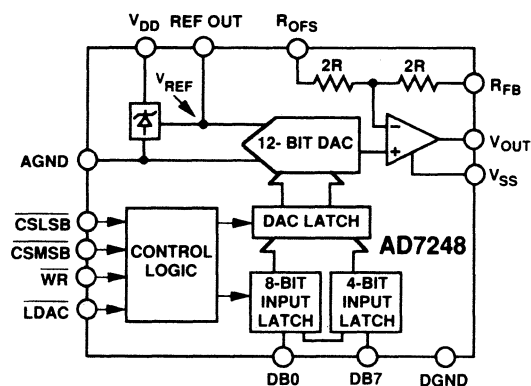
AD7245A

FEATURES

Improved AD7245

- 12 V and 15 V Operation
- ±1/2 LSB Linearity Grade
- Faster Interface: 40 ns typ Data Setup Time
- Extended Plastic Temperature Range (-40°C to +85°C)
- Military Temperature Range Grade
- 12-Bit DAC with Output Amplifier and Reference
- Low Power (65 mW typ)
- Single or Dual Supply Operation
- Parallel Loading Structure

LC²MOS 12-Bit DACPORT



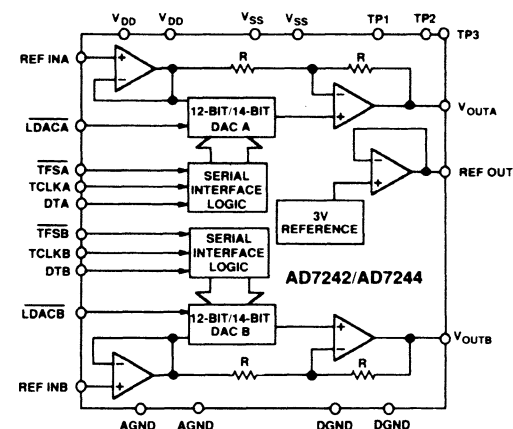
AD7248A

FEATURES

Improved AD7248

- 12 V and 15 V Operation
- ±1/2 LSB Linearity Grade
- Faster Interface: 40 ns typ Data Setup Time
- Extended Plastic Temperature Range (-40°C to +85°C)
- Military Temperature Range Grade
- 12-Bit DAC with Output Amplifier and Reference
- Low Power (65 mW typ)
- Single or Dual Supply Operation
- (8 + 4) Loading Structure

LC²MOS Dual, Complete 12-Bit/14-Bit Serial DACs

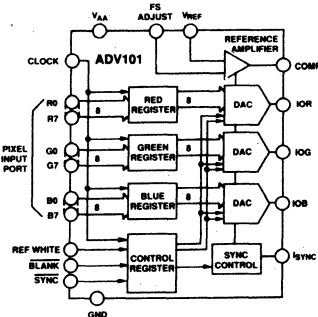


AD7242/AD7244

FEATURES

- Two 12-Bit/14-Bit DACs with Output Amplifiers
- AD7242: 12-Bit Resolution
- AD7244: 14-Bit Resolution
- On-Chip Voltage Reference
- Fast Settling Time
- AD7242: 3 μs to ±1/2 LSB
- AD7244: 4 μs to ±1/2 LSB
- High Speed Serial Interface
- Operates from ±5 V Supplies
- Low Power—130 mW typ

CMOS 80 MHz, Triple 8-Bit Video DAC



ADV101*

FEATURES

- 80 MHz Pipelined Operation
- Triple 8-Bit D/A Converters
- RS-343A/RS-170 Compatible Outputs
- TTL Compatible Inputs
- +5 V CMOS Monolithic Construction
- 40-Pin DIP or 44-Pin PLCC Package
- Plug-In Replacement for BT101
- Power Dissipation: 400 mW

APPLICATIONS

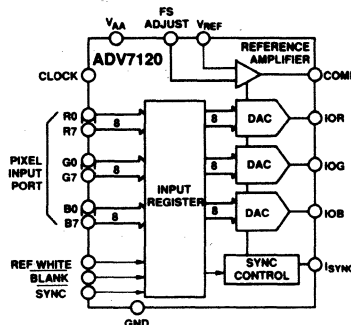
- High Resolution Color Graphics
- CAE/CAD/CAM Applications
- Image Processing
- Instrumentation
- Video Signal Reconstruction
- Desktop Publishing

SPEED GRADES

- 80 MHz
- 50 MHz
- 30 MHz

*ADV is a trademark of Analog Devices, Inc.

CMOS 80 MHz, Triple 8-Bit Video DAC



ADV7120

FEATURES

- 80 MHz Pipelined Operation
- Triple 8-Bit D/A Converters
- RS-343A/RS-170 Compatible Outputs
- TTL Compatible Inputs
- +5 V CMOS Monolithic Construction
- 40-Pin DIP or Small 44-Pin PLCC Package
- Power Dissipation: 400 mW

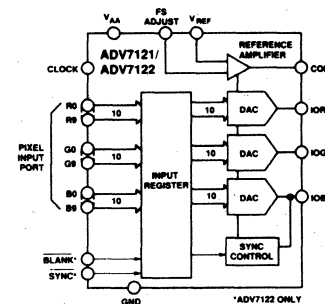
APPLICATIONS

- High Resolution Color Graphics
- CAE/CAD/CAM Applications
- Image Processing
- Instrumentation
- Video Signal Reconstruction
- Desktop Publishing

SPEED GRADES

- 80 MHz
- 50 MHz
- 30 MHz

CMOS 80 MHz, Triple 10-Bit Video DACs



ADV7121/ADV7122

FEATURES

- 80 MHz Pipelined Operation
- Triple 10-Bit D/A Converters
- RS-343A/RS-170 Compatible Outputs
- TTL Compatible Inputs
- +5 V CMOS Monolithic Construction
- 40-Pin DIP Package (ADV7121)
- 44-Pin PLCC Package (ADV7122)
- Power Dissipation: 400 mW

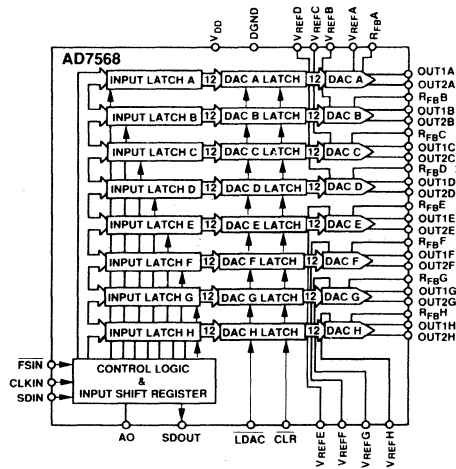
APPLICATIONS

- High Definition Television (HDTV)
- High Resolution Color Graphics
- CAE/CAD/CAM Applications
- Image Processing
- Instrumentation
- Video Signal Reconstruction
- Desktop Publishing

SPEED GRADES

- 80 MHz
- 50 MHz
- 30 MHz

LC²MOS Octal, 12-Bit DAC



AD7568

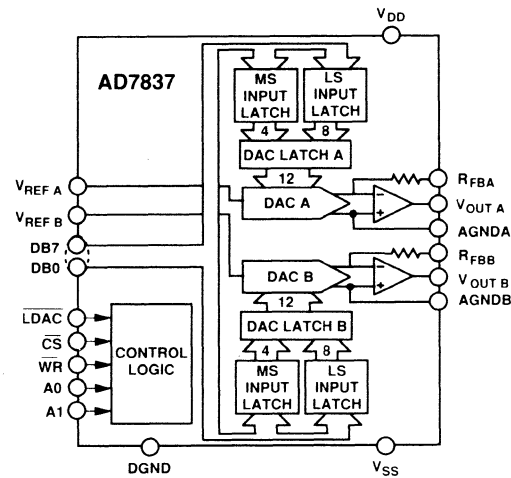
FEATURES

- 8 12-Bit DACs in One Package
- 4-Quadrant Multiplication
- Separate References
- Single +5 V Supply
- Low Power
- Versatile Serial Interface
- Simultaneous Update Capability
- Reset Function
- 44-Pin PQFP

APPLICATIONS

- Process Control
- Automatic Test Equipment
- General Purpose Instrumentation

LC²MOS Complete Dual 12-Bit MDAC

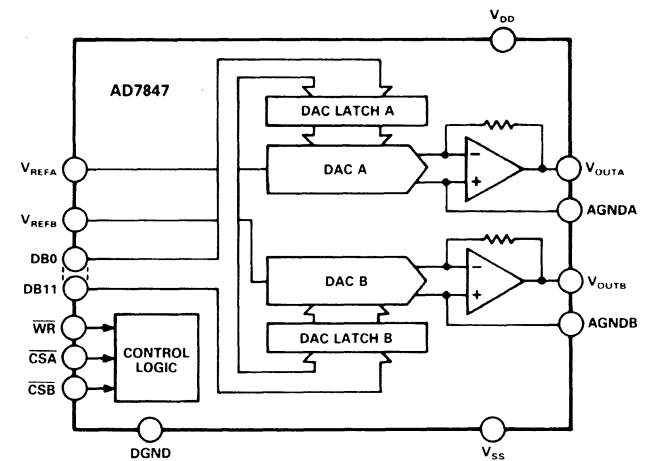


AD7837

FEATURES

- Two Complete 12-Bit MDACS
- On-Chip Output Amplifiers
- 5 μ s Settling Time
- 4-Quadrant Multiplication
- Space-Saving 0.3", 24-Pin DIP and 24-Terminal SOIC Packages
- (8+4) Loading Structure

LC²MOS Complete Dual 12-Bit MDAC

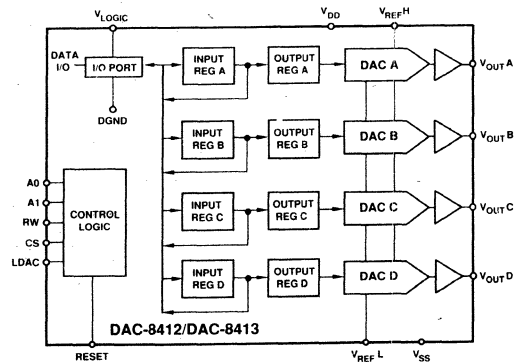


AD7847

FEATURES

- Two Complete 12-Bit MDACS
- On-Chip Output Amplifiers
- 5 μ s Settling Time
- 4-Quadrant Multiplication
- Space-Saving 0.3", 24-Pin DIP and 24-Terminal SOIC Packages
- 12-Bit Parallel Loading Structure

Quad 12-Bit, Voltage Output DAC with Readback

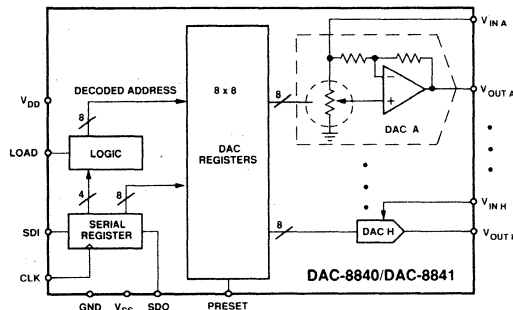


DAC-8412/DAC-8413

FEATURES

- Four Complete 12-Bit DACs
- +5 to ±15 Volt Operation
- True Voltage Output
- Fast Bus Access Time
- Readback
- 28-Pin DIP and LCC
- Reset to Mid Scale – DAC-8412
- Reset to Zero Scale – DAC-8413

8-Bit Octal, 4-Quadrant Multiplying CMOS DAC

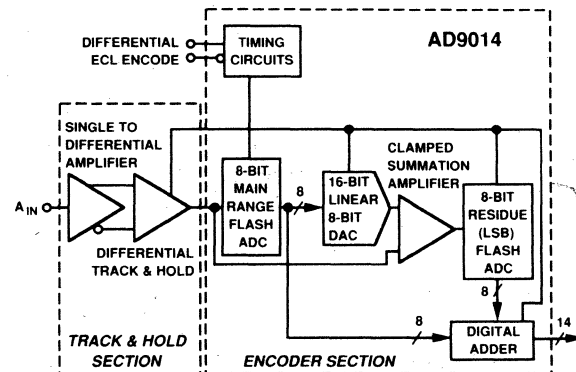


DAC-8840/DAC-8841

FEATURES

- Eight Individual Channels
- 8-Bit Accuracy
- 1 MHz 4-Quadrant Multiplying Bandwidth
- 3 Wire Serial Interface
- ±3 Volt Output Swing
- Midscale Preset, Zero Volts Out
- DAC-8841 (Noninverting Only Version of DAC-8840)
- Single +5 V Only Version
- 1 MHz, 2-Quadrant Multiplying Bandwidth

14-Bit, 10 MSPS A/D Converter

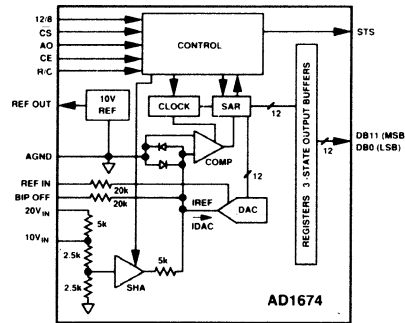


AD9014

FEATURES

- Sample Rate: 10 MSPS
- Spurious Free Dynamic Range: 92 dB @ 2.3 MHz A_{in} ; 88 dB @ 4.3 MHz A_{in} ; 72 dB @ 10 MHz A_{in}
- Low Intermodulation Distortion: -90 dBfs
- SNR: 75 dB
- Differential Encode Clock
- Complete Subsystem
- APPLICATIONS
- Radar Signal Analysis
- Visible & Infrared Imaging
- FFT Spectrum Analysis
- Medical Imaging
- SIGINT/ECM/EW

BiCMOS Complete 12-Bit, 100 kSPS Sampling ADC



AD1674

FEATURES

Complete Monolithic 12-Bit ADC with:

10 μ s Conversion Rate (ADC + SHA)

On-Chip Reference

± 5 V, ± 10 V, 0–10 V, 0–20 V Input Ranges

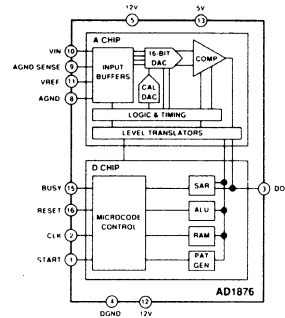
+5 V, ± 12 V/ ± 15 V Supplies

DC and AC Specified

70 dB S/N+D

Industry Standard Pinout

Self-Calibrating Charge Balancing 16-Bit ADC



AD1876

FEATURES

100 kSPS

Inherent Sampling Input with Audio Bandwidth

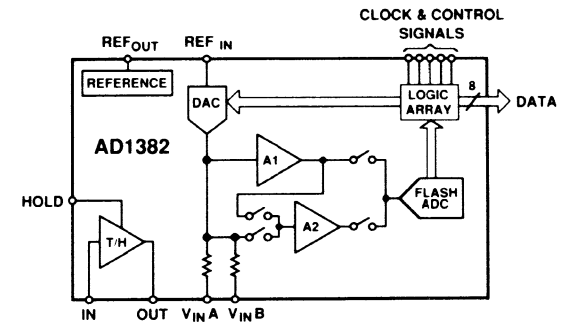
Serial Output

16-Pin DIP Package

± 5 V Input Range

+5, ± 12 V Supplies

16-Bit, 500 kHz Sampling ADC



AD1382

FEATURES

16-Bit Resolution

Single Package

500 kHz Sampling Rate

SNR – 90 dB @ 5.0 kHz min

THD – –90 dB @ 5.0 kHz min

0.0015% FSR INL typ

± 5 , ± 10 V Bipolar Input

Zero Offset Calibration

APPLICATIONS

Medical Imaging

Magnetic Resonance Imaging
CAT

Radar

Parametric Measurement Units

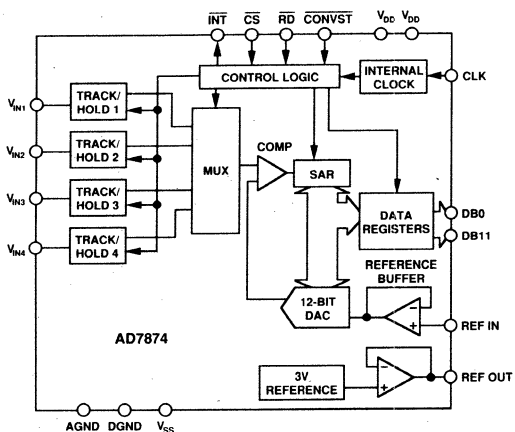
Digital Storage Oscilloscopes

Waveform Recorders

Analytical Instruments

Vibration Analysis

LC²MOS Complete 4-Channel 12-Bit Simultaneous Sampling Data Acquisition

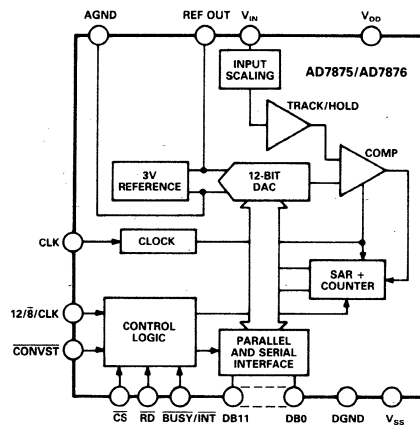


AD7874

FEATURES

- Four On-Chip Track/Hold Amplifiers
- Simultaneous Sampling of 4 Channels
- Matching Aperture Delay Specification
- Fast 12-Bit ADC (8 μ s Conversion Time/Channel)
- 29 kHz Sample Rate for All Four Channels
- Internal/External Reference Option
- ± 10 V Input Range
- ± 5 V Supplies

LC²MOS Complete 12-Bit, 100 kHz Sampling ADCs

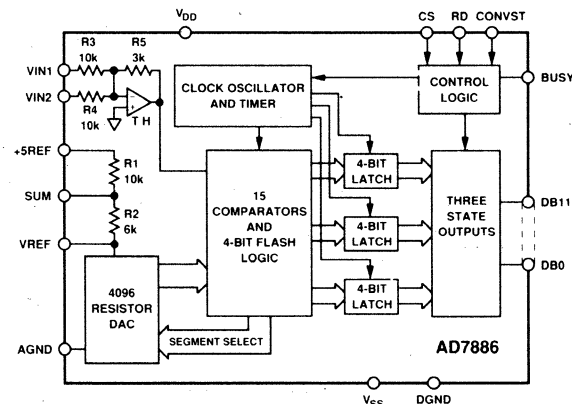


AD7875/AD7876

FEATURES

- Complete Monolithic 12-Bit ADC with:
 - 2 μ s Track/Hold Amplifier
 - 8 μ s A/D Converter
 - On-Chip Reference
 - Laser-Trimmed Clock
 - Parallel, Byte and Serial Digital Interface
- 72 dB SNR at 10 kHz Input Frequency (AD7875)
- 57 ns Data Access Time
- Low Power - 60 mW Typical
- Variety of Input Ranges:
 - 0 to +5 V for AD7875
 - ± 10 V for AD7876

LC²MOS 12-Bit, 1.5 μ s Sampling ADC

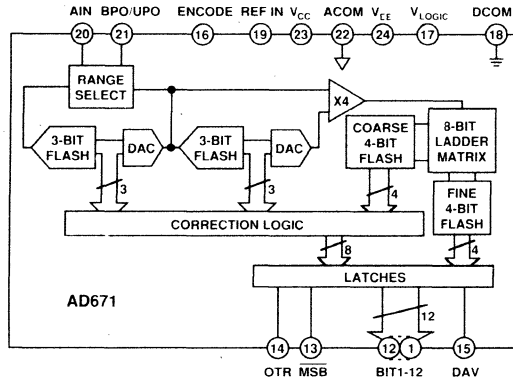


AD7886

FEATURES

- 1.5 μ s Throughput Time
- 12-Bit Monotonic Over Temperature
- 70 dB SNR at 100 kHz Input Frequency
- Low Power: 250 mW typ
- Fast Bus Access Time: 57 ns max
- APPLICATIONS
 - Digital Signal Processing
 - Speech Recognition and Synthesis
 - Spectrum Analysis
 - DSP Servo Control

Monolithic 12-Bit 2 MHz A/D Converter



AD671

FEATURES

12-Bit Resolution

24-Pin "Skinny-DIP" Package

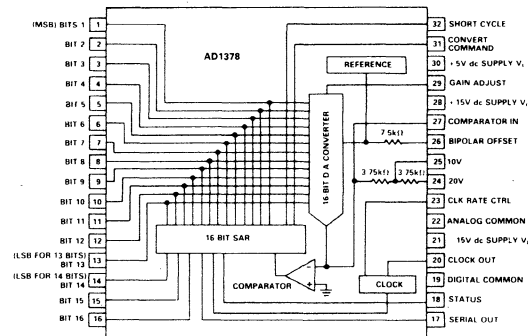
Conversion Time—500 ns max AD671J/K-500
—750 ns max AD671J/K-750

Low Power—475 mW

Unipolar (0 to +10 V, 0 to +5 V) and

Bipolar (± 5 V) Input Ranges

Complete Wide Temperature 16-Bit A/D Converter



AD1378

FEATURES

Complete 16-Bit Converter with Reference and Clock

$\pm 0.003\%$ Maximum Nonlinearity Over Temperature

Available with MIL-STD-883 Screening

Fast Conversion—17 μ s Maximum (16 Bit)

Short Cycle Capability

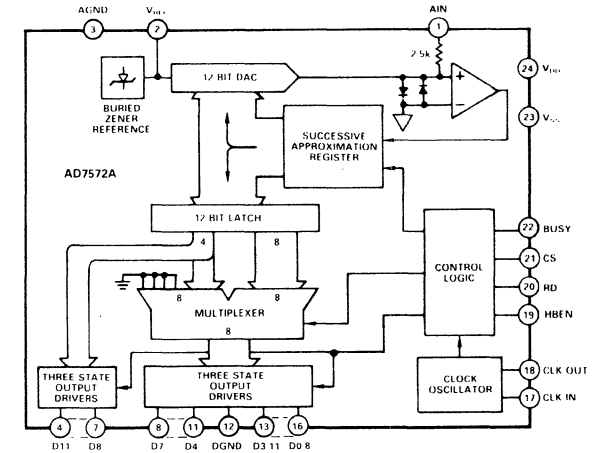
Parallel and Serial Outputs

Low Power: 800 mW Maximum

Industry Standard Pinout

Specified Over Military Temperature Range

LC²MOS Complete High Speed 12-Bit ADC



AD7572A

FEATURES

Improved AD7572

Faster Conversion Time

AD7572AXX03: 3 μ s

AD7572AXX10: 10 μ s

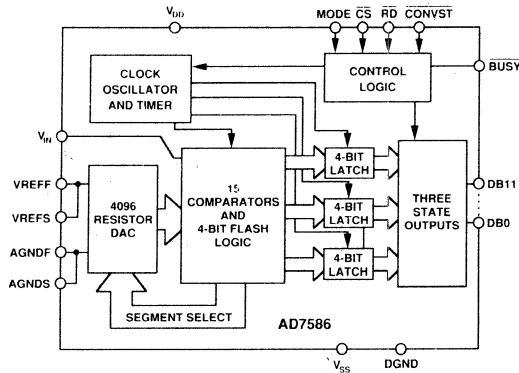
—12 V or —15 V Power Supply Operation
Better Offset and Gain Error Specifications

Extended Plastic Temperature Range
(—40°C to +85°C)

Low Power: 100 mW

Small 24-Pin, 0.3" Wide DIP and SOIC Packages

LC²MOS 12-Bit 1 μ s ADC



AD7586

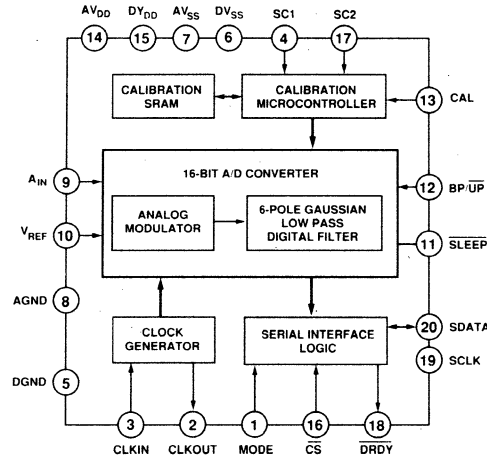
FEATURES

- 1 μ s Conversion Time
- AGND and VREF Force/Sense Connections
- 12-Bit Monotonic Over Temperature
- Low Power—200 mW typ
- Fast Bus Access Time—<57 ns

APPLICATIONS

- Measurement and Control
- Automatic Test Equipment
- Precision Servo Control
- All Data Acquisition Systems

LC²MOS 16-Bit Charge Balancing ADC



AD7701

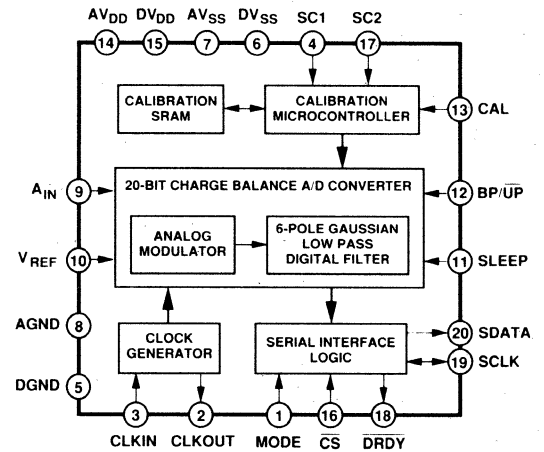
FEATURES

- Monolithic 16-Bit Charge Balancing ADC
- 0.0015% Linearity Error
- On-Chip Self-Calibration Circuitry
- Programmable Low Pass Filter
- 0.1 Hz to 10 Hz Corner Frequency
- 0 to +2.5 V or \pm 2.5 V Analog Input Range
- 4 kSPS Output Data Rate
- Flexible Serial Interface
- Ultralow Power

APPLICATIONS

- Industrial Process Control
- Weight Scales
- Portable Instrumentation
- Remote Data Acquisition

LC²MOS 20-Bit A/D Converter



AD7703

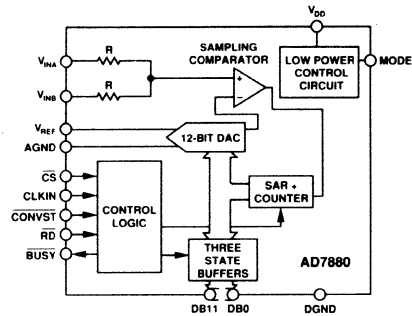
FEATURES

- Monolithic 20-Bit ADC
- 0.003% Linearity Error
- 20-Bit No Missed Codes
- On-Chip Self-Calibration Circuitry
- Programmable Low Pass Filter
- 0.1 Hz to 10 Hz Corner Frequency
- 0 to +2.5 V or \pm 2.5 V Analog Input Range
- 4 kSPS Output Data Rate
- Flexible Serial Interface
- Ultralow Power

APPLICATIONS

- Industrial Process Control
- Weigh Scales
- Portable Instrumentation
- Remote Data Acquisition

LC²MOS, Single +5 V Supply, Low Power, 12-Bit Sampling ADC



AD7880

FEATURES

- 12-Bit Monolithic A/D Converter
- 66 kHz Throughput Rate
- 12 μ s Conversion Time
- 3 μ s On-Chip Track/Hold Amplifier
- Low Power

- Power Save Mode: 2 mW typ
- Normal Operation: 25 mW typ

70 dB SNR

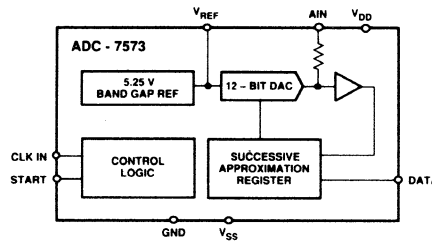
Fast Data Access Time: 57 ns

Small 24-Lead SOIC and 0.3" DIP Packages

APPLICATIONS

- Battery Powered Portable Systems
- Digital Signal Processing
- Speech Recognition and Synthesis
- High Speed Modems
- Control and Instrumentation

Serial Output 12-Bit ADC

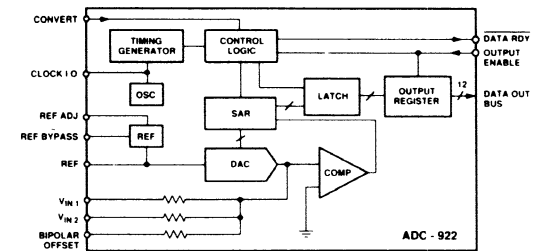


ADC-7573

FEATURES

- 3 μ s Conversion Time
- On-Chip Band Gap Reference
- High Speed Serial Interface
- Second Source Available - MAX170
- 8 Pin Mini-DIP Package

12-Bit, 3 μ s Complete ADC

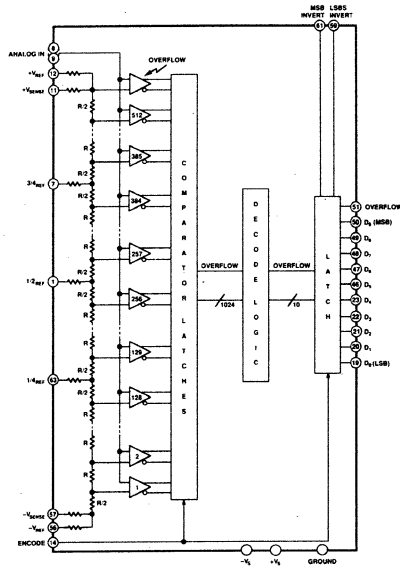


ADC-922

FEATURES

- On-Chip Reference - 10.00 V
- On-Chip Clock
- High Speed Processor Interface
- User Selectable Input Range
- Rad Hard

10-Bit, 60 MSPS A/D Converter



AD9020

FEATURES

Monolithic 10-Bit/60 MSPS Converter

TTL Outputs

Bipolar (± 1.75 V) Analog Input

56 dB SNR @ 2.3 MHz Input

Low (45 pF) Input Capacitance

APPLICATIONS

Digital Oscilloscopes

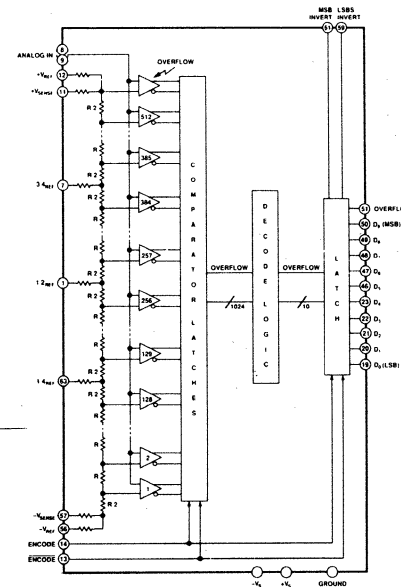
Medical Imaging

Professional Video

Radar Warning/Guidance Systems

Infrared Systems

10-Bit, 75 MSPS A/D Converter



AD9060

FEATURES

Monolithic 10-Bit/75 MSPS Converter

ECL Outputs

Bipolar (± 1.75 V) Analog Input

57 dB SNR @ 2.3 MHz Input

Low (45 pF) Input Capacitance

APPLICATIONS

Digital Oscilloscopes

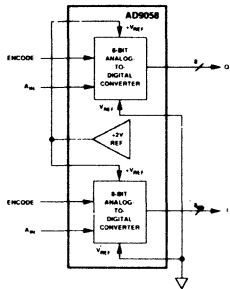
Medical Imaging

Professional Video

Radar Warning/Guidance Systems

Infrared Systems

Dual 8-Bit 60 MSPS ADC



AD9058

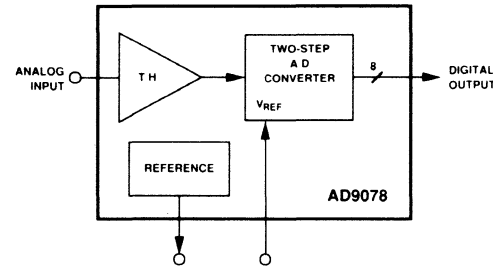
FEATURES

- Two Matched ADCs on Single Chip
- 8-Bit/60 MSPS Conversion Speed
- On-Board Voltage Reference
- Low Power (<1 W)
- Low Input Capacitance (11 pF)
- ±5 V Power Supplies
- Flexible Input Range

APPLICATIONS

- Quadrature Demodulation for Communications
- Digital Oscilloscopes
- Electronic Warfare
- Radar

8-Bit, 30 MSPS Sampling ADC



AD9078

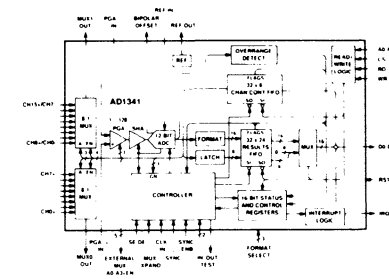
FEATURES

- On-Board Voltage Reference
- Low Power 380 mW
- Small Size: 20-Lead SO or 20-Lead DIP
- 30 MSPS Conversion Rate
- 32 MHz Input Bandwidth

APPLICATIONS

- Video Digitization
- Image Capture
- Instrumentation
- Radar Warning Receivers

16-Channel Data Acquisition System



AD1341

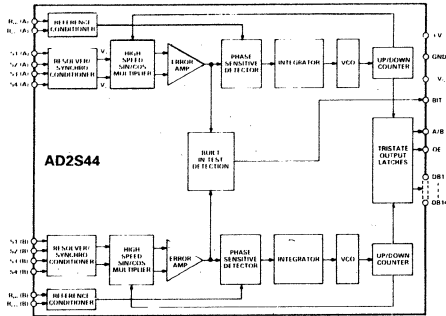
FEATURES

- 150,000 Channels/Second Throughput Rate
- Analog Inputs
 - Single Ended (SE) or 8 Differential (DE);
 - Expandable to 32 SE or 16 DE
- Over Voltage Protected
- Power Supply Loss Protected
- Programmable Gain amplifier (PGA)
- Binary Gains 1 to 128
- Independent Gain Selection per Channel
- 12-Bit Sampling A/D Converter
- Processor Interface
 - FIFOs for Channel Control and Conversion Results
 - Fully Asynchronous 16-Bit Parallel Bus
 - 15 ns Data Access Time
 - Selectable 16-Bit Data Format
 - Programmable Interrupt Structure
- Ceramic Surface Mount Package

APPLICATIONS

- DSP Data Acquisition
- Missile Guidance
- Vibration Analysis
- PC Data Acquisition

Low Cost, 14-Bit, Dual Channel Synchro/Resolver-to-Digital Converter



AD2S44

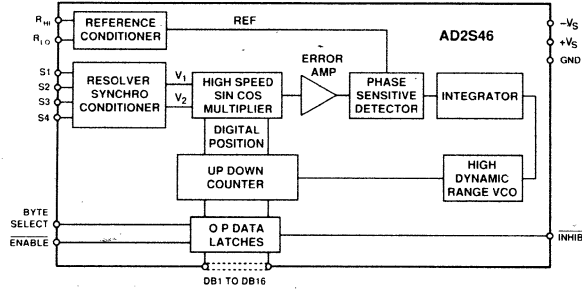
FEATURES

- 1 in.², 32-Pin Flatpack
- 2.6 Arc Minute Accuracy
- 14-Bit Resolution
- On-Board Oscillator
- Independent Reference Inputs
- Independent Velocity Outputs
- High Tracking Rate

APPLICATIONS

- Gimbal/Gyro Control Systems
- Radar/Sonar
- Engine Controllers
- Coordinate Conversion
- Military Servo Control Systems
- Fire Control Systems
- Avionic Systems
- Missile Systems
- Antenna Monitoring
- CNC Machine Tools

Low Cost, 16-Bit Synchro/Resolver-to-Digital Converter



AD2S46

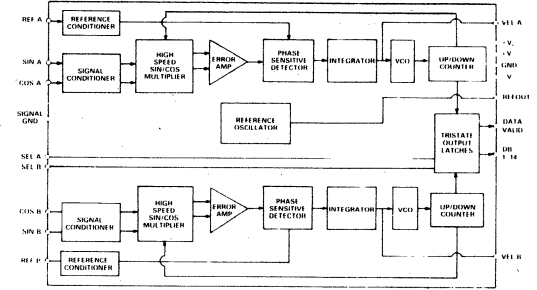
FEATURES

- 1.3 Arc Minute Accuracy
- 16-Bit Resolution
- Small 28-Pin Ceramic DIP
- Low Cost

APPLICATIONS

- Gimbal/Gyro Control Systems
- Radar System
- Engine Controllers
- Sonar
- Military Servo Control Systems
- Fire Control Systems
- Avionic Systems
- Antenna Monitoring
- CNC Machine Tooling

14-Bit, Dual Channel Resolver-to-Digital Converter



AD2S34

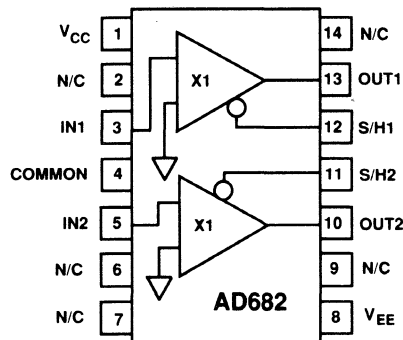
FEATURES

- Low Cost/Channel
- 32-Pin DIL Hybrid Package
- 2.6 Arc Minute Accuracy
- 24-Bit Resolution
- Built-In Test
- Independent Reference Inputs
- High Tracking Rate

APPLICATIONS

- Gimbal/Gyro Control Systems
- Robotics
- Engine Controllers
- Coordinate Conversion
- Military Servo Control Systems
- Fire Control Systems
- Avionic Systems
- Antenna Monitoring
- CNC Machine Tooling

Complete Dual 900 ns Sample-and-Hold Amplifier

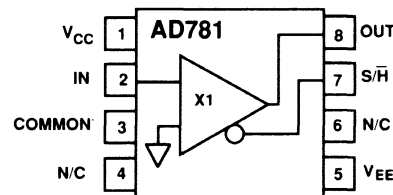


AD682

FEATURES

- Two Matched Sample-and-Hold Amplifiers
- Independent Inputs, Outputs and Control Pins
- Acquisition Time (to 0.01%): 900 ns max
- Fully Specified and Tested Hold Mode Distortion
- Internal Hold Capacitors

Complete 900 ns Sample-and-Hold Amplifier

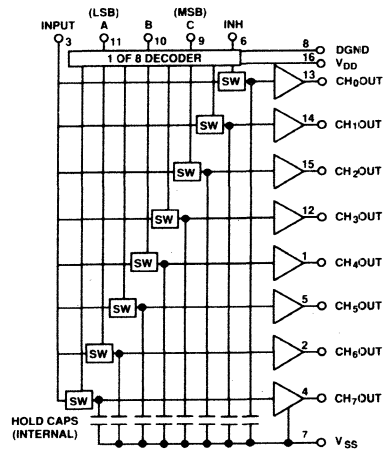


AD781

FEATURES

- Acquisition Time (to 0.01%): 900 ns max
- Low Power Dissipation: 95 mW
- Fully Specified and Tested Hold Mode Distortion
- Complete: Internal Hold Capacitor
- 8-Pin Mini-DIP Package

Sample-and-Hold with Multiplexed Input

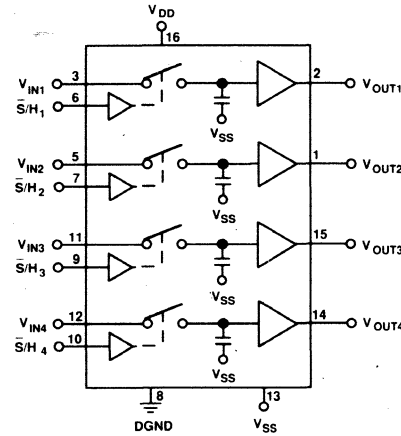


SMP-08

FEATURES

- 7 μ s Acquisition Time
- Single or Dual Supply Operation
- 0.01% Accuracy

Quad Sample-and-Hold Amplifier

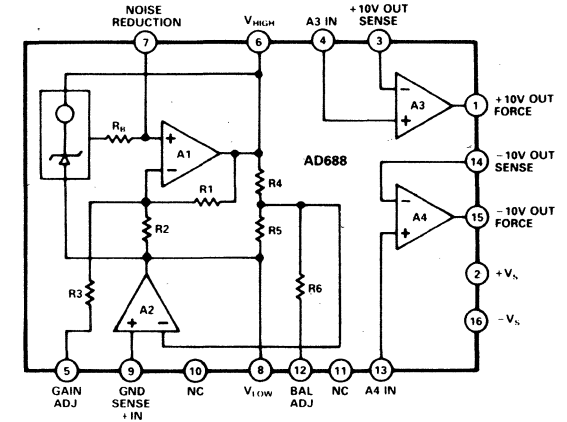


SMP-04

FEATURES

- On-Chip Hold Capacitors
- 12-Bit Accuracy
- Low Power
- Low Cost
- Low Droop Rate—2 mV/s

High Precision ± 10 V Reference

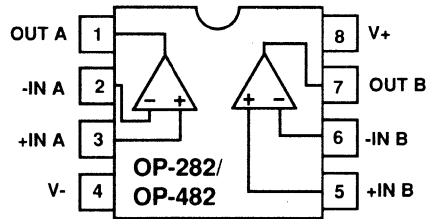


AD688

FEATURES

- ± 10 V Tracking Outputs
- Kelvin Connections
- Low Tracking Error—1.5 mV
- Low Initial Error—2.0 mV
- Low Drift—1.5 ppm/ $^{\circ}$ C
- Flexible Output Force and Sense Terminals
- High Impedance Ground Sense

High Speed, Low Power Dual/Quad Operational Amplifier



OP-282/OP-482

FEATURES

AC PERFORMANCE

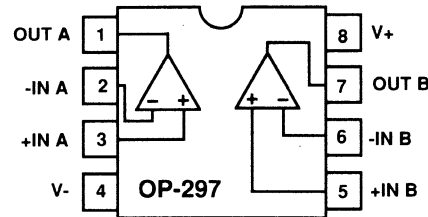
Slew Rate: 10 V/ μ s Typical
7 V/ μ s Minimum

DC PERFORMANCE

Supply Current: 250 μ A max per Amplifier
Input Offset Voltage: 2 mV max (OP-282),
3 mV max (OP-482)

Input Bias Current: 100 pA max
Open-Loop Gain: 25 V/mV min
SO-8 (OP-282) and SO-14 (OP-482) Packages
Also Available in Cerdip and 20-Contact LCC

Dual Low Power, Low Bias Current Precision Operational Amplifier

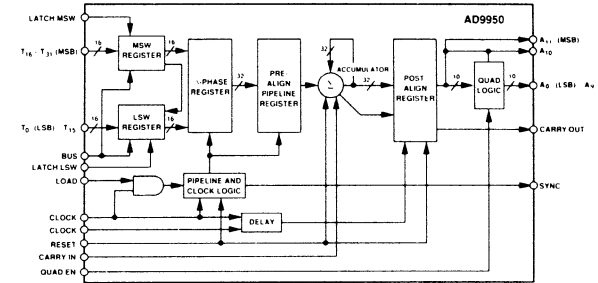


OP-297

FEATURES

Precision Performance in Standard SO-8 Pinout
50 μ V max Offset Voltage
0.6 μ V/ $^{\circ}$ C max Offset Voltage Drift
100 pA max Input Bias Current
2000 V/mV min Open-Loop Gain
625 μ A max of Supply Current per Amplifier
Available in 8-Pin Cerdip, Plastic, SO and
20-Contact LCC Packages

32-Bit, 300 MSPS Phase Accumulator for DDS



AD9950

FEATURES

300 MSPS Clock Rate
32-Bit Frequency Resolution
Low Power: 1.5 W
On-Board Quad Logic
16- or 32-Bit Bus Compatible

APPLICATIONS

Frequency Synthesizers
Waveform Generators
Frequency Hopping Systems
Communications and Radar Receivers

10 MIPS DSP Microcomputer

ADSP-2105

100 ns Instruction Cycle with Sustained 10 MIPS Performance

ADSP-2100 Family Extension; Code-Compatible
ADSP-2101 Pin-Compatible

1 K Words of On-Chip Program Memory RAM

512 Words of On-Chip Data Memory RAM

Memory Expandable Off-Chip for Both Program and Data Memory

ADSP-2100 Base Architecture

Three Independent Computation Units

Two Independent Data Address Generators

Powerful Program Sequencer

One Bidirectional Synchronous Serial Port with Companding Hardware

Programmable 16-Bit Interval Timer with Prescaler

Programmable Wait State Generation

Automatic Boot of Internal Program Memory from Byte-Wide External Memory, e.g., EPROM

Provisions for Multiprecision Computation and Saturation Logic

Single-Cycle Instruction Execution

Multifunction Instructions

Three Edge or Level-Sensitive External Interrupts

On-Chip Clock Generation Circuitry

68-Lead PLCC

APPLICATIONS

Optimized for DSP Algorithms Including

Digital Filtering

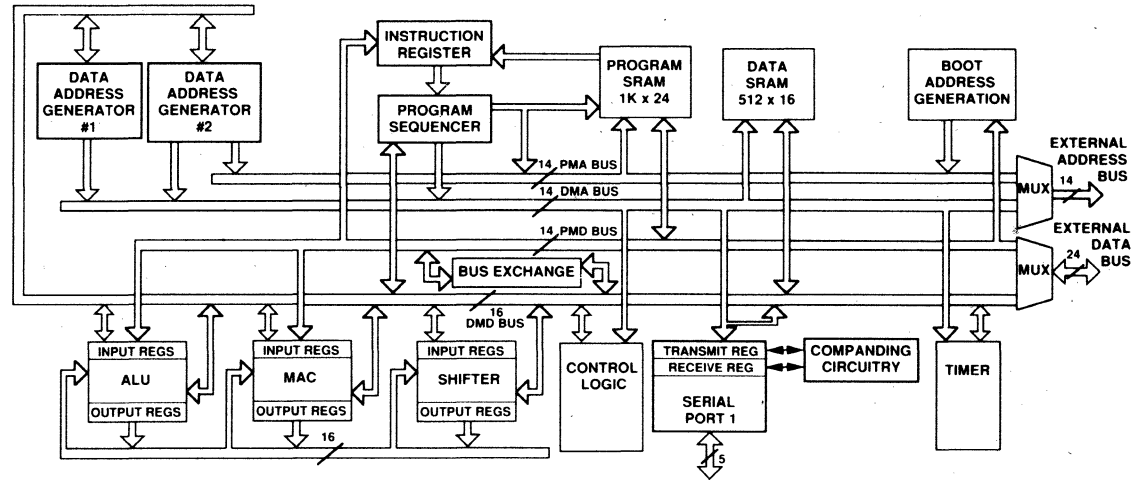
Fast Fourier Transforms

Applications Include

Image Processing

Speech Processing

Telecommunications



DSP Microcomputer with Host Interface Port

ADSP-2111

77 ns Instruction Cycle with Sustained 13 MIPS Performance

ADSP-2100 Code and Function Compatible

2 K Words of Program Memory RAM

1 K Word of Data Memory RAM

Host Interface Port: Simple Interface of 68000, 8051, ADSP-210X and Others

Separate Program and Data Buses On-Chip

Dual Purpose Program Memory for Both Instructions and Data Storage

Three Independent Computational Units: ALU, Multiplier/Accumulator and Barrel Shifter

Two Independent Data Address Generators

Powerful Program Looping

Zero Overhead Looping

Conditional Arithmetic Instruction Execution

Two Double-Buffered Serial Ports with Companding Hardware and Automatic Data Buffering

Input and Output Flags

Programmable Interval Timer

Programmable Wait State Generation

Automatic Booting from Byte-Wide External Memory, e.g., EPROM

Automatic Booting from Host Port

Provisions for Multiprecision Computation and Saturation Logic

Single-Cycle Instruction Execution

Multifunction Instructions

Three Edge or Level-Sensitive External Interrupts

80 mW Maximum Power Dissipation in Standby Mode

100-Pin PGA and 100-Lead PQFP

APPLICATIONS

Optimized for DSP Algorithms Including
Digital Filtering

Fast Fourier Transforms

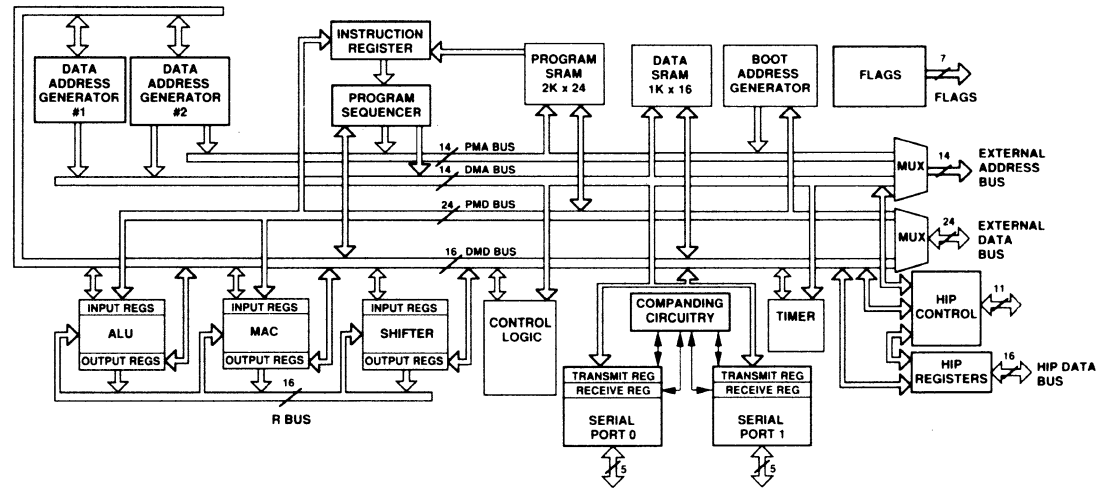
Applications Include

Image Processing

Radar, Sonar

Speech Processing

Telecommunications



DSP Mixed-Signal Processor

ADSP-21msp50

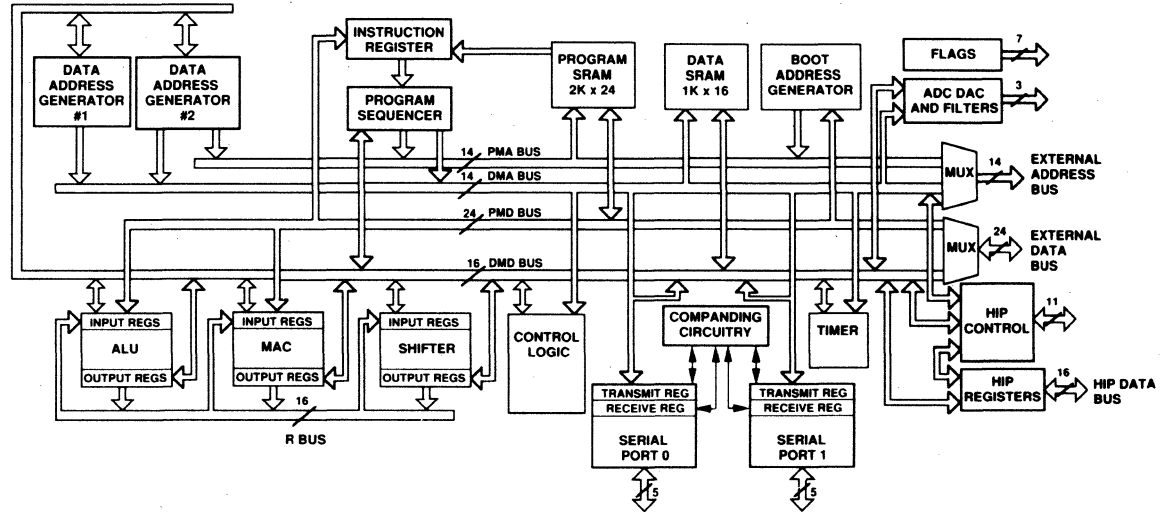
ADSP-2100 Family Extension; Code Compatible
 75 ns Instruction Cycles with Sustained
 13.3 MIPS Performance
 2 K Words of On-Chip Program Memory SRAM
 1 K Word of On-Chip Data Memory SRAM
 Memory Expandable Off-Chip for Both Program
 and Data Memory

ADSP-2100 Base Architecture

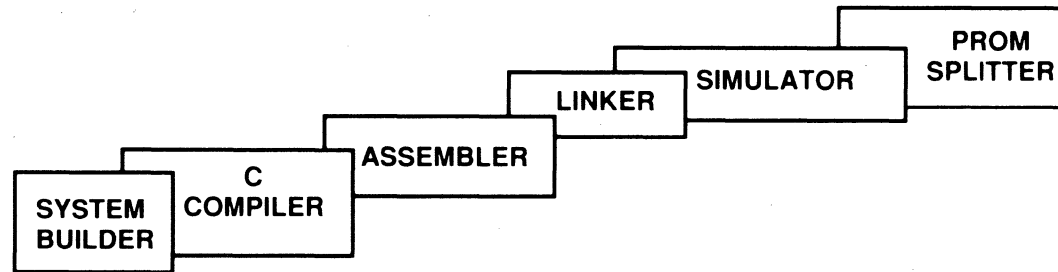
Three Independent Computational Units
 Two Independent Data Address Generators
 Powerful Program Sequencer
 Linear Codec with 8 kHz Sampling Offering 65 dB
 SNR and THD
 Dynamically Reconfigurable 8/16-Bit Host
 Interface Port; Direct Interface to 68000, 8051,
 ADSP-210X and Others
 Two Bidirectional Synchronous Serial Ports
 16-Bit Timer with Prescaler
 Boot of Internal Program Memory via Data Bus
 or Host Interface Port
 Programmable Wait State Generator
 Three Flag-Out Pins for System Control
 Power Down Modes for Low Power Applications
 On-Chip Clock Generation Circuitry
 132-Pin PQFP and 80-Pin JEDEC Metric

APPLICATIONS

Mixed-Signal Processing Including
 Telecommunications
 Speech Processing



ADSP-2100A, 2101, 2105, 2111 Software Development Tools



ADDS-21XX-ASM-PC
System Builder,
Assembler, Linker,
PROM Splitter

SYSTEM BUILDER

Architecture Description File Specifies Target Hardware

ASSEMBLER

Supports High Level Constructs
 Supports Flexible Macro Processing
 Encourages Modular Code Development
 Provides a Full Range of Diagnostics

LINKER

Library Support
 Maps Assembler Outputs to Target Hardware

PROM SPLITTER

Formats ROM Memory Image for Uploading to PROM Programmers

ADDS-21XX-SIM-PC
Simulator

SIMULATOR

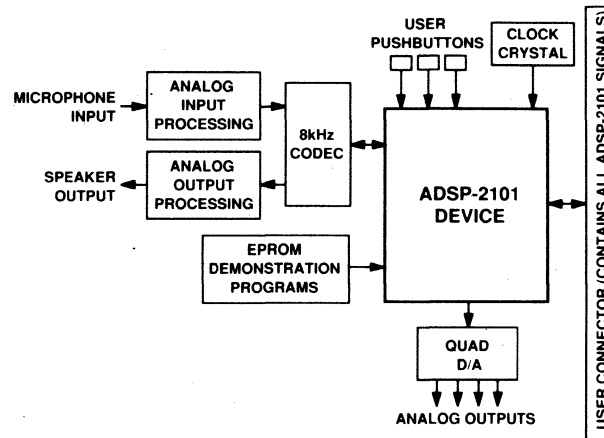
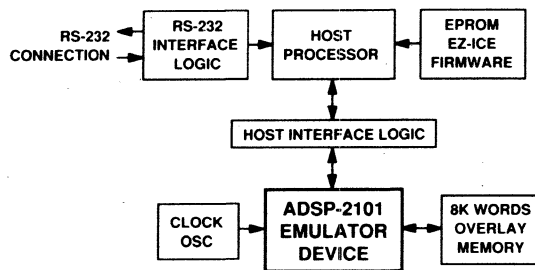
Reconfigurable Windowing Interface
 Full Symbolic Disassembly
 Simulates Hardware Configuration
 Simulates Port and Serial Port I/O Handling
 Flags Illegal Operations
 Advanced Debugging Features
 Profiling for Checking Code Efficiency

ADDS-21XX-BUN-PC
System Builder,
Assembler, Linker,
PROM Splitter,
Simulator and
C Compiler

C COMPILER

Programming in C Eases Development of Applications Software
 Supports In-Line Assembly Code
 Provides FRACT Data Type (1.15 Format) for DSP Algorithms
 Complete Calling Interface to Assembly Language Routines
 Produces ROMable Code
 Floating-Point Emulation Support
 Conforms to ANSI Draft Standard (X3J11)

ADSP-2101 and ADSP-2105 EZ-Tools Support



ADDS-2101-EZ-ICE™ In-Circuit Emulator

3.3" × 3.3" Surface-Mount Board with RS-232 Port
Plugs Directly into ADSP-2101/2105 Socket on Target Board
Full Speed Emulation
Single Step Capability
Sixteen Breakpoints
Memory Upload/Download with a PC
Examine and Alter Registers, Program Memory and Data Memory
8K × 24-Bit High Speed Program/Data Overlay Memory
12.288 MHz Oscillator, Socketed for Easy Change of Clock Speed
Memory Map (MMAP) Pin Control
Stand-Alone Operation for Software Debugging without Target Board
Easy-to-Learn Menus and Displays

ADDS-2101-EZ-LAB™ Demonstration Board

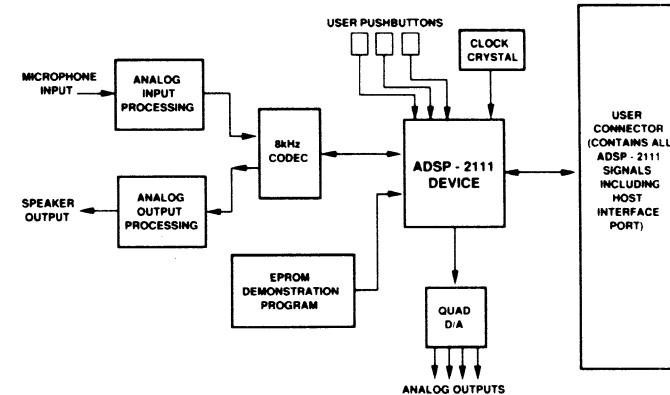
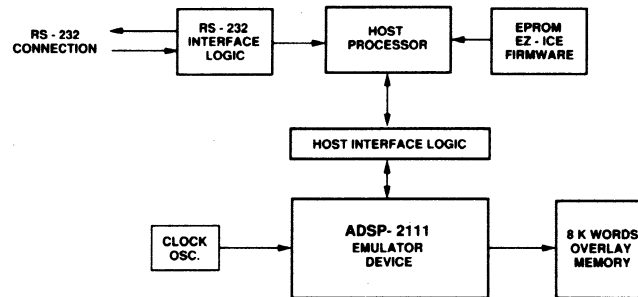
12.5 MHz ADSP-2101 Microcomputer
64K × 8-Bit Boot EPROM Preprogrammed with Demonstrations
Voice I/O Port with Microphone Input Jack and Speaker Output Jack
Four-Channel, 8-Bit Digital-to-Analog Converter (DAC) Port
Bus Expansion Connector Allows Additional I/O and Full Memory Expansion
Serial Port Expansion Available through SPORT Connector
12.288 MHz Crystal, Replaceable with Different Speed Crystals
Three Switches for User Control: Interrupt IR02, Flag In and Reset

ADDS-2101-EZ-KIT™ Development Kit

ADDS-2101-EZ-LAB Demo Board
Cross-Software (Assembler and Simulator)
Digital Signal Processing in VLSI Textbook
Applications Textbook with Example Programs on IBM-PC Disk
ADSP-2100 Processor Family Training Workshop
Discount Coupon

EZ-ICE, EZ-LAB, and EZ-KIT are trademarks of Analog Devices, Inc.

ADSP-2111 EZ-Tools Support



ADDS-2111-EZ-ICE In-Circuit Emulator

- 3.3" x 3.3" Surface-Mount Board with RS-232 Port**
- Plugs Directly into ADSP-2111 Socket on Target Board**
- Full Speed Emulation**
- Single Step Capability**
- Sixteen Breakpoints**
- Memory Upload/Download with a PC**
- Examine and Alter Registers, Program Memory and Data Memory**
- 8K x 24-Bit High Speed Program/Data Overlay Memory**
- 12.288 MHz Oscillator, Socketed for Easy Change of Clock Speed**
- Memory Map (MMAP) Pin Control**
- Stand-Alone Operation for Software Debugging without Target Board**
- Easy-to-Learn Menus and Displays**

ADDS-2111-EZ-LAB Demonstration Board

- 12.5 MHz ADSP-2111 Microcomputer**
- 64K x 8-Bit Boot EPROM Preprogrammed with Demonstrations**
- Voice I/O Port with Microphone Input Jack and Speaker Output Jack**
- Four-Channel, 8-Bit Digital-to-Analog Converter (DAC) Port**
- Bus Expansion Connector Allows Additional I/O and Full Memory Expansion**
- Serial Port Expansion Available through SPORT Connector**
- 12.288 MHz Crystal, Replaceable with Different Speed Crystals**
- Three Switches for User Control: Interrupt IR02, Flag In and Reset**

ADSP-2100A 12.5 MHz In-Circuit Emulator

ADDS-2100A-ICE 12.5 MHz Emulator

Interfaces to IBM-PC Host via RS-232 Interface, at up to 56.7K Baud

Emulates 50 MHz ADSP-2100A, with 12.5 MHz Instruction Rate

User Interface Similar to ADSP-2101 Simulator and Emulator

Custom Window Configuration and Command Aliasing

Stand-Alone Operation Allows Software Debugging before Hardware Prototype

Assembly and Disassembly of ADSP-2100A Instructions

Single-Step As Well As Full-Speed Operation
Overlay RAM Can Replace Target System Memory

Trace Buffer Stores up to 8K Frames of ADSP-2100A Activity

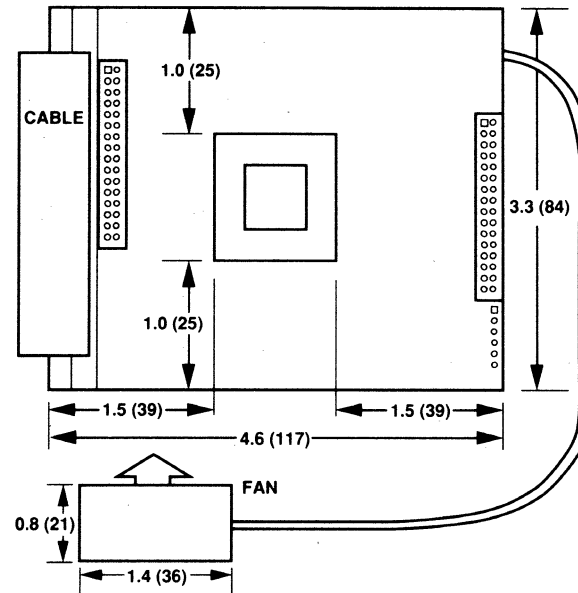
Supports Software Breakpoints

Hardware Break and/or Trace Triggering on an Extensive Set of Bus Conditions

Static User Control of Selected ADSP-2100A Inputs

Software Support for Industry-Standard Mouse
Optional Logic Module Probes Allow Tracing of Additional Signals

Optional Probe-to-Target Umbilical Cord
Facilitates Debug and Testing Work



PROBE
(TOP VIEW)

Dimensions shown in inches and (mm).

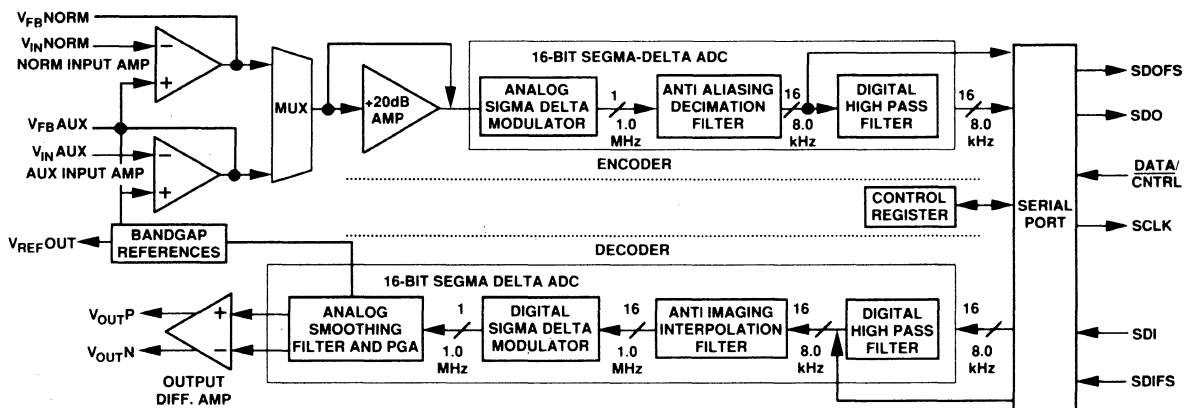
DSP Mixed-Signal Peripheral Linear Codec

ADSP-28msp02

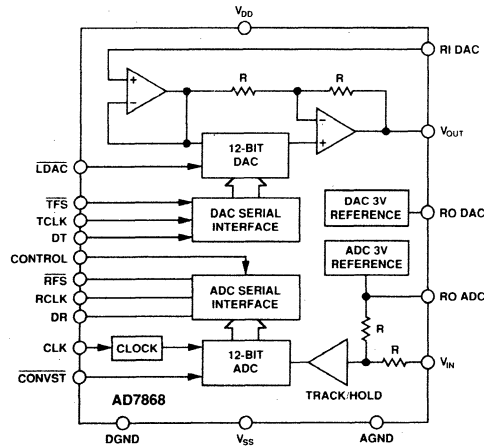
- Complete Linear Coded Codec
- 16-Bit Sigma Delta ADC
- 16-Bit Sigma Delta DAC
- On-Chip Antialiasing and Antiimaging Filters
- On-Chip Voltage Reference
- 8 kHz Sampling Frequency
- Twos Complement Coding
- 65 dB SNR and THD
- Programmable Gain on DAC and ADC
- DSP Compatible Serial Port
- 24-Pin (0.3 inch) DIP/SOIC
- Single 5 V Power Supply

APPLICATIONS

- Mixed-Signal Processing Including
 - Telecommunications
 - Digital Mobile Phones
 - Computers
 - Speech Processing



LC²MOS Complete 12-Bit Analog I/O System



AD7868

FEATURES

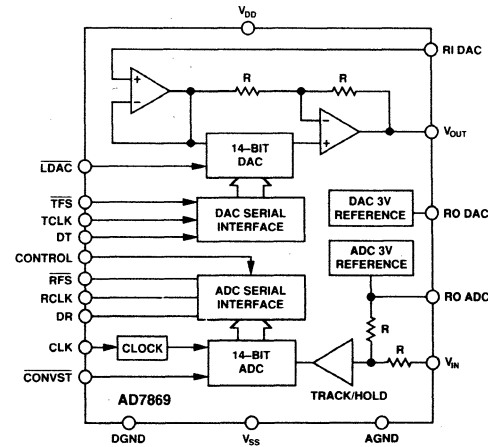
Complete 12-Bit I/O System, Comprising:

- 12-Bit ADC with Track/Hold Amplifier
- 100 kHz Throughput Rate
- 72 dB SNR

- 12-Bit DAC with Output Amplifier
- 3 μ s Settling Time
- 72 dB SNR

Operates from ± 5 V Supplies
Low Power – 130 mW typ
Small 0.3" Wide DIP

LC²MOS Complete 14-Bit Analog I/O System



AD7869

FEATURES

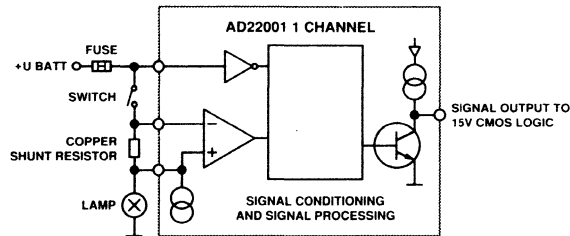
Complete 14-Bit I/O System, Comprising:

- 14-Bit ADC with Track/Hold Amplifier
- 83 kHz Throughput Rate
- 82 dB SNR

- 14-Bit DAC with Output Amplifier
- 4 μ s Settling Time
- 82 dB SNR

Operates from ± 5 V Supplies
Low Power – 130 mW typ
Small 0.3" Wide DIP

5-Channel Monolithic Comparator for Lamp Monitoring

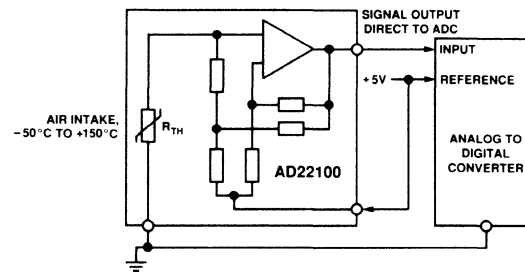


AD22001*

FEATURES

- Continuous Status Checks of Five Bulbs
- Lamp Status Check In "On" and "Off" State
- Status Checks of Two In-Line Fuses
- Very Low Voltage Drop at Sensor Shunt Resistor (Nominal 1.75 mV at 22°C)
- Temperature and Supply Voltage Compensated
- Can Be Powered Directly from Car Battery
- Operating Temperature Range: -40°C to +125°C
- 15 V CMOS Compatible Digital Outputs Signals
- Voltage Limited Power Supply Output for 15 V CMOS Logic ICs

Monolithic Temperature Sensor with Signal Conditioning

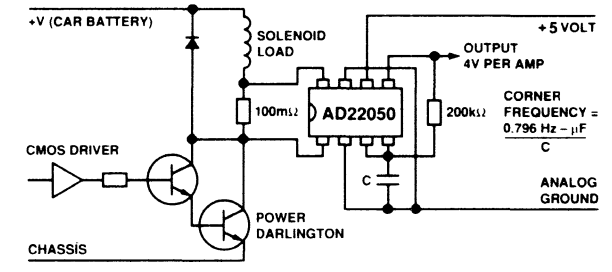


AD22100*

FEATURES

- 200°C Temperature Span
- Accuracy Better Than 2% of Full Scale
- Linearity Better Than $\pm 2^\circ\text{C}$
- Ratiometric Output Voltage – Output Proportional to Temperature \times Supply Voltage
- Reverse Voltage Protection
- Low Quiescent Current – Minimal Self-Heating
- High Level, Low Impedance Output
- 22.5 mV/°C from +5.000 V Supply
- Wide Power Supply Range

Single-Supply Sensor Interface Circuit



SINGLE-POLE LOW PASS FILTERING, GAIN: 40

AD22050*

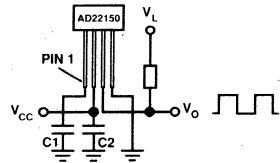
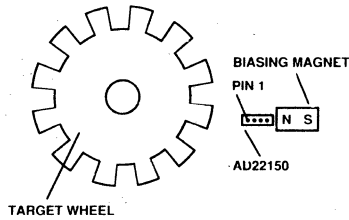
FEATURES

- Gain of $\times 20$ Alterable from $\times 1$ to $\times 160$
- Input CMR from Ground to $6 \times (V_S - 1 \text{ V})$
- Output Span 10 mV to $(V_S - 0.2 \text{ V})$
- 1-, 2-, 3-Pole Low Pass Filtering Available
- Accurate Midscale Offset Capability
- Differential Input Resistance 400 k Ω
- Drives 1 k Ω Load to +4 V Using $V_S = +5 \text{ V}$
- Transient Spike Protection & RFI Filters Included
- Operating Temperature Range -40°C to +125°C

APPLICATIONS

- Current Sensing
- Motor Control
- Interface for Pressure Transducers, Position Indicators, Strain Gages, and Other Low Level Signal Sources

Monolithic Hall Effect Sensor with Signal Conditioning



AD22150*

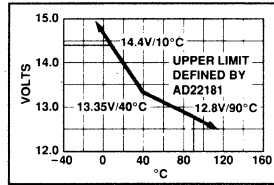
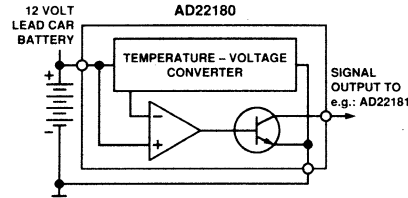
FEATURES

- Sensitive to Small Changes in Field: Operate and Release Points at -12 G and $+12\text{ G}$ Respectively
- Switch Points Moved in Presence of Large Dynamic Fields (Up to $\pm 200\text{ G}$)
- Open Collector Output
- Stable Over -40°C to $+150^\circ\text{C}$ Temperature Range
- Hysteresis Built Into the Output
- Maximum Frequency 50 kHz
- Minimum Frequency User Selectable with One External Capacitor
- Powered Directly by Automobile Battery

*Patents Pending

†Protected by U.S. Patent Re30,586; others pending.

Automotive Battery Monitor Circuit

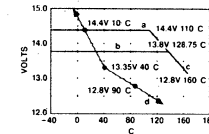
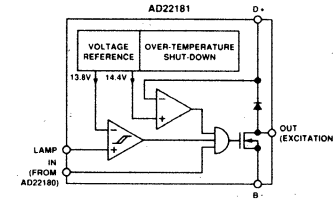


AD22180†

FEATURES

- Measures Automotive Battery Temperature & Voltage
- Built-In Battery Charging Characteristic
- Provides a Signal to Maximize the Battery Charging Without Exceeding the Battery Gassing Voltage at Any Given Temperature
- Signals "Charge Battery" for Battery Voltage Below the Battery Voltage Characteristics of the Figure: $13.35\text{ V @ }40^\circ\text{C}$ $+35\text{ mV}/^\circ\text{C}$ for Temperatures Below 40°C and $-11\text{ mV}/^\circ\text{C}$ Above 40°C
- TTL Compatible Open Collector Output
- Output Short Circuit Protected
- No External Components Required
- Powered Directly by Automobile Battery with Transient and Reverse Voltage Protection
- Operating Temperature Range -55°C to $+125^\circ\text{C}$

Alternator Control Circuit



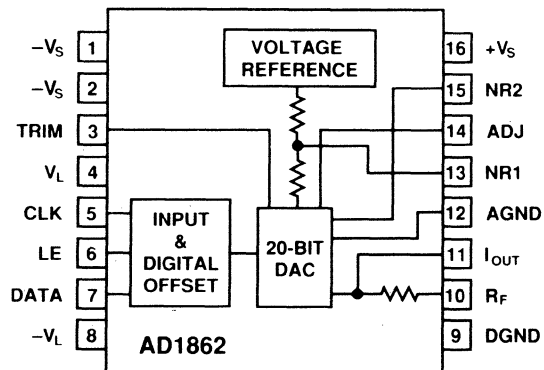
a) FIXED UPPER LIMIT FOR BATTERY VOLTAGE
b) FIXED CHARGING LIMIT HEADLAMP VOLTAGE
c) OVER-TEMPERATURE SHUT-DOWN
d) BATTERY VOLTAGE vs TEMPERATURE CHARGING LIMIT FROM AD22180

AD22181†

FEATURES

- Directly Controls Alternator Excitation
- Temperature Invariant Charging Voltage Limiter
- Over-Temperature Protective Shutdown
- Remote Sensed Headlamp Voltage Charging Limit
- Interface for Battery Temperature - Voltage Charge Control Using AD22180
- Fail-Safe Operation
- Acceleration Cut-Off Model

Low Noise, 20-Bit Audio DAC



AD1862

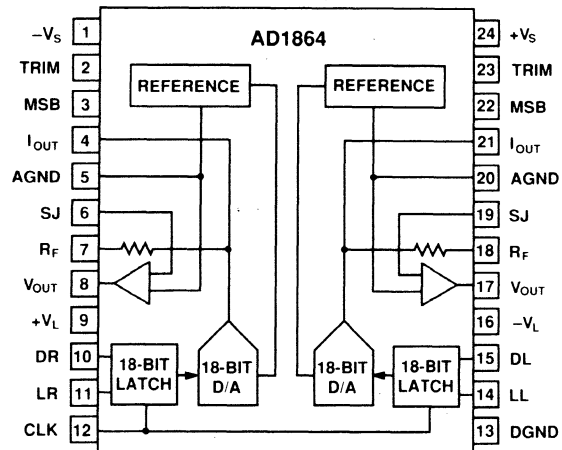
FEATURES

- 119 dB Signal-to-Noise Ratio
- 102 dB D-Range Performance
- ± 1 dB Gain Linearity
- ± 1 mA Output Current
- 16-Pin DIP Package

APPLICATIONS

- High Performance Compact Disc Players
- Digital Audio Amplifiers
- Synthesizer Keyboards
- Digital Mixing Consoles
- High Resolution Signal Processing

Dual 18-Bit Audio DAC



AD1864

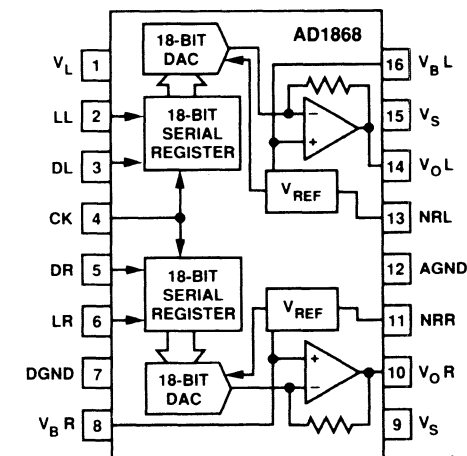
FEATURES

- Dual Serial Input, Voltage Output DACs
- No External Components Required
- Operates at $8 \times$ Oversampling
- ± 5 Volt to ± 12 Volt Operation
- Cophased Outputs
- 115 dB Channel Separation
- $\pm 0.3\%$ Gain Matching Between Channels

APPLICATIONS

- Multichannel Audio Application Such As:
 - Compact Disc Players
 - Multivoice Keyboard Instruments
 - DAT Players and Recorders
 - Digital Mixing Consoles

Single-Supply Dual 18-Bit Audio DAC

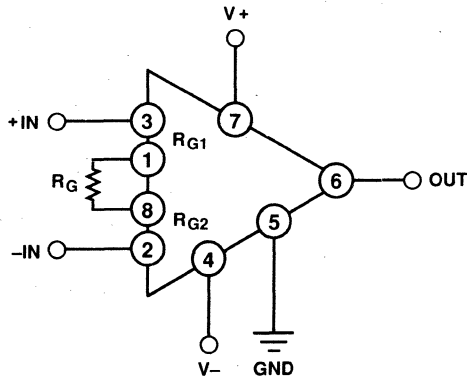


AD1868

FEATURES

- Complete, No External Components Required
- 97.5 dB, 0.004% THD+N
- $8 \times$ Oversampling
- > 115 dB Channel Separation
- Single Supply Operation Range of $+3.5$ V to $+5.25$ V

Self-Contained Audio Preamplifier

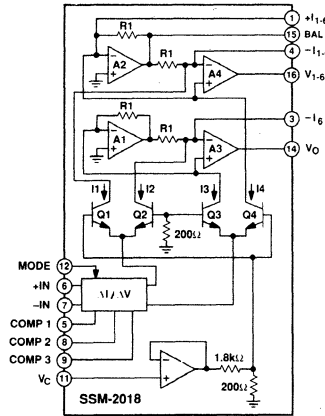


SSM-2017

FEATURES

- Excellent Noise Performance: $850 \text{ pV}/\sqrt{\text{Hz}}$ or 1 dB Noise Figure
- Ultralow THD: 0.01% @ $G = 100$ Over the Full Audio Band
- Wide Bandwidth: 250 kHz @ $G = 100$
- High Slew Rate: $14 \text{ V}/\mu\text{s}$
- True Differential Inputs
- 8-Pin Mini-DIP with Only One External Gain Setting Resistor
- Gain Range of 0 dB to Over 60 dB
- Sub-Audio 1/F Noise Corner

Voltage-Controlled Amplifier/OVCE

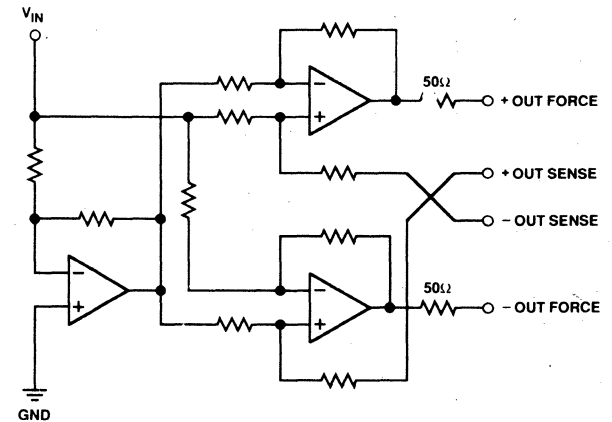


SSM-2018

FEATURES

- Wide Dynamic Range: 118 dB (Class AB typ) 108 dB (Class A typ)
- Excellent THD and IMD Over Gain, Attenuation, and Frequency
- Low Untrimmed Control Feedthrough: 1 mV (Class AB typ)
- Buffered Control Port
- Accepts Low or High Impedance Inputs
- Few External Components
- Class AB THD Rivals That of Class A

Balanced Line Driver



SSM-2142

FEATURES

- Transformer-Like Output
- Drives 10 V rms into a 600Ω Load
- Drives Large Capacitive Loads and Long Cables
- Low Gain Error (Differential or Single-Ended) $< 0.1\%$
- High Slew Rate: $15 \text{ V}/\text{ns}$
- Available in 8-Pin Mini-DIP
- No External Components Required

+5 V Powered CMOS RS-232 Drivers/Receivers

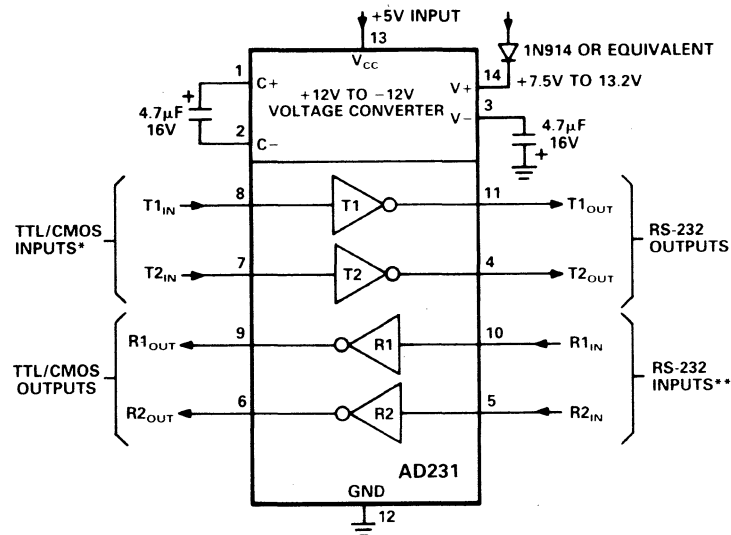
AD230-AD241

FEATURES

- Single 5 V Power Supply
- Meets All RS-232-C and V.28 Specifications
- Multiple Drivers and Receivers
- On-Board DC-DC Converters
- ± 9 V Output Swing with +5 V Supply
- Low Power CMOS: 5 mA Operation
- Low Power Shutdown $\leq 1 \mu\text{A}$
- 3-State TTL/CMOS Receiver Outputs
- ± 30 V Receiver Input Levels
- Plug-In Replacement for MAX230-241

APPLICATIONS

- Computers
- Peripherals
- Modems
- Printers
- Instruments



*INTERNAL 400kΩ PULL-UP RESISTOR ON EACH TTL/CMOS INPUT
 **INTERNAL 5kΩ PULL-DOWN RESISTOR ON EACH RS-232 INPUT

Products Available to Standard Military Drawings

Analog Devices' IC and hybrid products are supplied with processing to the three major levels of military screening, JAN QPL, Standard Military Drawing (SMD) and MIL-STD-883B (Revision C). These products are all produced in facilities which are fully qualified to MIL-M-38510 for integrated circuits, or MIL-STD-1772 for hybrids. In addition to these listings, we also publish a *Military Products Databook* which contains the specification details for designers who specify components for military contracts. The listings here are up-to-date and accurate as of the publication date (10/90), but there is ongoing development in this area by ADI and military procurement agencies. For status of specific parts, please contact your local salesperson. This list will also be updated and published every six months in *Analog Briefings* and in this *Short Form Designers' Guide*.

SMD Part Number	Generic Part Number	Description	SMD Part Number	Generic Part Number	Description
5962-8965501LX	AD7672TQ10/883B	12-Bit High Speed ADC	5962-8680201VA	AD570SD/883B	Complete 8-Bit ADC
5962-8965502LX	AD7672UQ10/883B	12-Bit High Speed ADC	5962-8961601VX	ADC-908AX/MD	CMOS Fast 8-Bit A/D Converter
5962-8965503LX	AD7672TQ05/883B	12-Bit High Speed ADC	5962-89616022X	ADC-908BRC/MD	CMOS Fast 8-Bit A/D Converter
5962-8965504LX	AD7672UQ05/883B	12-Bit High Speed ADC	5962-8961602VX	ADC-908BX/MD	CMOS Fast 8-Bit A/D Converter
5962-8512701XA	AD574AUD/883B	Complete 12-Bit ADC	5962-8961601YX	AD7574SQ/883B	8-Bit ADC
5962-8512702XA	AD574ATD/883B	Complete 12-Bit ADC	5962-8961602YX	AD7574TQ/883B	8-Bit ADC
5962-8759101LX	AD7572SQ12/883B	Complete 12-Bit 12 μ s ADC	5962-8961603VX	PM-7574AX/MD	CMOS 8-Bit A/D
5962-87591013X	AD7572SE12/883B	Complete 12-Bit 12 μ s ADC	5962-89616042X	PM-7574BRC/MD	CMOS 8-Bit A/D
5962-8759102LX	AD7572TQ12/883B	Complete 12-Bit 12 μ s ADC	5962-8961604VX	PM-7574BX/MD	CMOS 8-Bit A/D
5962-87591023X	AD7572TE12/883B	Complete 12-Bit 12 μ s ADC	5962-8776201VX	AD7575SQ/883B	8-Bit ADC with T/H
5962-8759103LX	AD7572UQ12/883B	Complete 12-Bit 12 μ s ADC	5962-8776202VX	AD7575TQ/883B	8-Bit ADC with T/H
5962-87591033X	AD7572UE12/883B	Complete 12-Bit 12 μ s ADC	5962-87762012X	AD7575SE/883B	8-Bit ADC with T/H
5962-9063201RX	AD7870SQ/883B	12-Bit 100 kHz Sampling ADC	5962-87762022X	AD7575TE/883B	8-Bit ADC with T/H
5962-9063202RX	AD7870TQ/883B	12-Bit Sampling ADC	5962-8763501RA	AD670SD/883B	Signal Conditioning 8-Bit ADC
5962-8759104LX	AD7572SQ05/883B	Complete 12-Bit 5 μ s ADC	5962-8850502RA	AD673SD/883B	8-Bit ADC
5962-87591043X	AD7572SE05/883B	Complete 12-Bit 5 μ s ADC	5962-89518012X	AD7821TE/883B	8-Bit, 600 ns ADC with T/H
5962-8759105LX	AD7572TQ05/883B	Complete 12-Bit 5 μ s ADC	5962-8951801RX	AD7821TQ/883B	8-Bit, 600 ns ADC with T/H
5962-87591053X	AD7572TE05/883B	Complete 12-Bit 5 μ s ADC	5962-8865001RX	AD7820TQ/883B	8-Bit 2 μ s ADC with T/H
5962-8759106LX	AD7572UQ05/883B	Complete 12-Bit 5 μ s ADC	5962-88650012X	AD7820TE/883B	8-Bit 2 μ s ADC with T/H
5962-87591063X	AD7572UE05/883B	Complete 12-Bit 5 μ s ADC	5962-8865002RX	AD7820UQ/883B	8-Bit 2 μ s ADC with T/H
5962-8861501XA	AD674AUD/883B	Complete 12-Bit ADC	5962-88650022X	AD7820UE/883B	8-Bit 2 μ s ADC with T/H
5962-8861502XA	AD674ATD/883B	Complete 12-Bit ADC	5962-8876401LX	AD7824TQ/883B	4-Channel 8-Bit ADC
5962-8969801	AD7579SQ/883B	10-Bit Sampling ADC with (8 + 2) Loading	5962-8876402LX	AD7824UQ/883B	4-Channel 8-Bit ADC
5962-8969802	AD7580SQ/883B	10-Bit Sampling ADC	5962-8876403XX	AD7828TQ/883B	8-Channel 8-Bit ADC
5962-8865801XC	AD578SD/883B	Complete 12-Bit ADC	5962-8876404	AD7828UE/883B	8-Channel 8-Bit ADC
5962-8865802XC	AD578TD/883B	Complete 12-Bit ADC	5962-8876404XX	AD7828UQ/883B	8-Channel 8-Bit ADC
5962-8865803XC	AD578SZ/883B	Complete 12-Bit ADC	5962-8962901LX	AD7569SQ/883B	Complete 8-Bit Analog I/O Sys
5962-8865804XC	AD578TZ/883B	Complete 12-Bit ADC	5962-8962902LX	AD7569TQ/883B	Complete 8-Bit Analog I/O Sys
5962-8850501RA	AD573SD/883B	10-Bit ADC	8300201JX	AD DAC87/883B	12-Bit Hybrid DAC
5962-8680202VA	AD571SD/883B	Complete 10-Bit ADC	8300301JA	AD DAC87/883B	12-Bit Monolithic DAC
			5962-8967101LX	DAC-8221AW	Dual 12-Bit Buffered Multiplying CMOS D/A

Products Available to Standard Military Drawings

SMD Part Number	Generic Part Number	Description	SMD Part Number	Generic Part Number	Description
5962-89671023X	DAC-8221BTC	Dual 12-Bit Buffered Multiplying CMOS D/A	5962-87702062X	PM-7545ARC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8967201LX	DAC-8222AW/MD	Dual 12-Bit Double-Buffered Multiplying CMOS D/A	5962-8770205RX	PM-7545BR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8965701LX	AD7547SQ/883B	12-Bit Dual Multiplying DAC	5962-87702052X	PM-7545BRC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8965702LX	AD7547TQ/883B	12-Bit Dual Multiplying DAC	5962-8877801RX	PM-7645AR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8965703LX	AD7547UQ/883B	12-Bit Dual Multiplying DAC	5962-88778012X	PM-7645ARC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8776301LX	AD7537SQ/883B	12-Bit Dual Multiplying DAC	5962-8877802RX	PM-7645BR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-87763013X	AD7537SE/883B	12-Bit Dual Multiplying DAC	5962-88778022X	PM-7645BRC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8776302LX	AD7537TQ/883B	12-Bit Dual Multiplying DAC	5962-8780101XA	AD567SD/883B	12-Bit High Speed DAC
5962-87763023X	AD7537TE/883B	12-Bit Dual Multiplying DAC	5962-8865901A	AD667SD/883B	12-Bit Dual Buffered DAC
5962-8776303LX	AD7537UQ/883B	12-Bit Dual Multiplying DAC	5962-8850901X	AD390SD/883B	12-Bit Quad DAC
5962-87763033X	AD7537UE/883B	12-Bit Dual Multiplying DAC	5962-8850902X	AD390TD/883B	12-Bit Quad DAC
5962-8876501RX	AD7549SQ/883B	12-Bit Dual DAC	5962-8851001X	AD394SD/883B	12-Bit Quad DAC
5962-8876502RX	AD7549TQ/883B	12-Bit Dual DAC	5962-8851002X	AD394TD/883B	12-Bit Quad DAC
5962-8876601LX	AD7245SQ/883B	12-Bit DACPORT	5962-8851003X	AD395SD/883B	12-Bit Quad DAC
5962-8876602RX	AD7248SQ/883B	12-Bit DACPORT	5962-8851004X	AD395TD/883B	12-Bit Quad DAC
5962-89697013X	AD7846SE/883B	16-Bit V_{OUT} Multiplying DAC	5962-89932012X	DAC-08RC/MD	8-Bit High Speed Multiplying D/A Converter
5962-8969701XX	AD7846SQ/883B	16-Bit V_{OUT} Multiplying DAC	5962-8770001EX	AD7524SQ/883B	8-Bit DAC
5962-8876701LX	AD7845SQ/883B	12-Bit V_{OUT} Multiplying DAC	5962-8770002EX	AD7524TQ/883B	8-Bit DAC
5962-8948104VX	PM-7541AAX/MD	CMOS 12-Bit Monolithic Multiplying CMOS D/A	5962-8770003EX	AD7524UQ/883B	8-Bit DAC
5962-8948103VX	PM-7541ABX/MD	CMOS 12-Bit Monolithic Multiplying CMOS D/A	5962-87700012X	AD7524SE/883B	8-Bit DAC
5962-89481032X	PM-7541ABRC/MD	CMOS 12-Bit Monolithic Multiplying CMOS D/A	5962-87700022X	AD7524TE/883B	8-Bit DAC
5962-89481012X	AD7541ASE/883B	12-Bit Multiplying DAC	5962-87700032X	AD7524UE/883B	8-Bit DAC
5962-8948101VX	AD7541ASQ/883B	12-Bit Multiplying DAC	5962-89471012X	AD7111TE/883B	CMOS Logarithmic DAC
5962-89481022X	AD7541ATE/883B	12-Bit Multiplying DAC	5962-8947101EX	AD7111TD/883B	CMOS Logarithmic DAC
5962-8948102VX	AD7541ATQ/883B	12-Bit Multiplying DAC	5962-89471022X	AD7111UE/883B	CMOS Logarithmic DAC
5962-8770201RX	AD7545SQ/883B	12-Bit Multiplying DAC	5962-8947102EX	AD7111UD/883B	CMOS Logarithmic DAC
5962-8770202RX	AD7545TQ/883B	12-Bit Multiplying DAC	5962-8770003EX	PM-7524AQ/MD	CMOS 8-Bit Buffered Multiplying D/A
5962-8770203RX	AD7545UQ/883B	12-Bit Multiplying DAC	5962-87700032X	PM-7524ARC/MD	CMOS 8-Bit Buffered Multiplying D/A
5962-8770204RX	AD7545GUQ/883B	12-Bit Multiplying DAC	5962-87700022X	PM-7524BRC/MD	CMOS 8-Bit Buffered Multiplying D/A
5962-87702012X	AD7545SE/883B	12-Bit Multiplying DAC			
5962-87702022X	AD7545TE/883B	12-Bit Multiplying DAC			
5962-87702032X	AD7545UE/883B	12-Bit Multiplying DAC			
5962-87702042X	AD7545GUE/883B	12-Bit Multiplying DAC			
5962-8770206RX	PM-7545AR/MD	12-Bit Buffered Multiplying CMOS D/A			

Analog Devices

SMD Part Number	Generic Part Number	Description	SMD Part Number	Generic Part Number	Description
5962-8770002EX	PM-7524BQ/MD	CMOS 8-Bit Buffered Multiplying D/A	5962-89581022X	REF-01RC/MD	+10 V Precision Voltage Reference
5962-8770101RX	AD7528SQ/883B	8-Bit Dual Buffered DAC	5962-8958102PX	REF-01Z/MD	+10 V Precision Voltage Reference
5962-87701012X	AD7528SE/883B	8-Bit Dual Buffered DAC	5962-8551401GX	REF-02AJ/MD	+5 V Precision Voltage Reference/ Temp Transducer
5962-8770102RX	AD7528TQ/883B	8-Bit Dual Buffered DAC	5962-85514012X	REF-02ARC/MD	+5 V Precision Voltage Reference/ Temp Transducer
5962-87701022X	AD7528TE/883B	8-Bit Dual Buffered DAC	5962-8551401PX	REF-02AZ/MD	+5 V Precision Voltage Reference/ Temp Transducer
5962-8770103RX	AD7528UQ/883B	8-Bit Dual Buffered DAC	5962-8947901GX	REF-10AJ/MD	+10 V Precision Voltage Reference (Longterm Stability)
5962-87701032X	AD7528UE/883B	8-Bit Dual Buffered DAC	5962-8947902GX	REF-10BJ/MD	+10 V Precision Voltage Reference (Longterm Stability)
5962-8770103RX	PM-7528AR/MD	Dual 8-Bit Buffered Multiplying CMOS D/A	5962-8686101XC	AD580SH/883B	Precision +2.5 V Reference
5962-87701032X	PM-7528ARC/MD	Dual 8-Bit Buffered Multiplying CMOS D/A	5962-8686102XC	AD580TH/883B	Precision +2.5 V Reference
5962-8770102RX	PM-7528BR/MD	Dual 8-Bit Buffered Multiplying CMOS D/A	5962-8757101XC	AD590JF/883B	Temp. Transducer 1 μ A/K
5962-87701022X	PM-7528BRC/MD	Dual 8-Bit Buffered Multiplying CMOS D/A	5962-8757101YC	AD590JH/883B	Temp. Transducer 1 μ A/K
5962-8778901EA	AD558SD/883B	8-Bit DACPORT	5962-8757102XC	AD590KF/883B	Temp. Transducer 1 μ A/K
5962-8778902EA	AD558TD/883B	8-Bit DACPORT	5962-8757102YC	AD590KH/883B	Temp. Transducer 1 μ A/K
5962-86678010X	DAC-8408AT/MD	Quad 8-Bit Multiplying CMOS D/A with Memory	5962-8757103XC	AD590LF/883B	Temp. Transducer 1 μ A/K
5962-86678020X	DAC-8408BT/MD	Quad 8-Bit Multiplying CMOS D/A with Memory	5962-8757103YC	AD590LH/883B	Temp. Transducer 1 μ A/K
5962-8780201RX	AD7226TQ/883B	8-Bit Quad DAC with Amps	5962-8757104XC	AD590MF/883B	Temp. Transducer 1 μ A/K
5962-87802012X	AD7226TE/883B	8-Bit Quad DAC with Amps	5962-8757104YC	AD590MH/883B	Temp. Transducer 1 μ A/K
5962-8866301LX	AD7228TQ/883B	8-Bit Octal Voltage Out DAC	5962-8987101GX	CMP-01J/MD	Fast Precision Comparator
5962-88663013X	AD7228TE/883B	8-Bit Octal Voltage Out DAC	5962-8987101PX	CMP-01Z/MD	Fast Precision Comparator
5962-8866302LX	AD7228UQ/883B	8-Bit Octal Voltage Out DAC	5962-8990403CX	CMP-04BY/MD	Quad Low Power Precision Comparator
5962-88663023X	AD7228UE/883B	8-Bit Octal Voltage out DAC	5962-8990401CX	CMP-404AY/MD	Quad Low Power Precision Comparator
5962-8503001YX	AD2700SD/883B	Precision +10 V Reference	5962-8990402CX	CMP-404BY/MD	Quad Low Power Precision Comparator
5962-8503002YX	AD2700UD/883B	Precision +10 V Reference	5962-7801903EA	AD96687TQ/883B	Voltage Comparator
5962-850305YX	AD2701SD/883B	Precision -10 V Reference	5962-78019032A	AD96687TE/883B	Voltage Comparator
5962-850306YX	AD2701TD/883B	Precision -10 V Reference	5962-8600804EA	AD96685TQ/883B	Voltage Comparator
5962-8503003YX	AD2702SD/883B	Precision \pm 10 V Reference	5962-86008042A	AD96685TE/883B	Voltage Comparator
5962-8503004YX	AD2702UD/883B	Precision \pm 10 V Reference	5962-8600804IA	AD96685TH/883B	Voltage Comparator
5962-8958101GX	REF-01AJ/MD	+10 V Precision Voltage Reference	5962-86877012X	PM-111RC/MD	Precision Voltage Comparator
5962-89581012X	REF-01ARC/MD	+10 V Precision Voltage Reference	5962-8601401CX	PM-119Y/MD	Precision High Speed Dual Comparator
5962-8958101PX	REF-01AZ/MD	+10 V Precision Voltage Reference			
5962-8958102GX	REF-01J/MD	+10 V Precision Voltage Reference			

Products Available to Standard Military Drawings

SMD Part Number	Generic Part Number	Description	SMD Part Number	Generic Part Number	Description
5962-86014012X	PM-119RC/MD	Precision, High Speed, Dual Comparator	5962-8771701XX	MUX-16AT/MD	16-Channel JFET Analog Multiplexer
5962-87739012X	PM-139ARC/MD	Quad Low Power Voltage Comparator	5962-8771702XX	MUX-16BT/MD	16-Channel JFET Analog Multiplexer
5962-8773901CX	PM-139AY-MD	Quad Low Power Voltage Comparator	5962-87717023X	MUX-16BTC/MD	16-Channel JFET Analog Multiplexers
5962-77008012X	PM-139RC/MD	Quad Low Power Voltage Comparator	5962-8771601EX	MUX-08AQ/MD	8-Channel JFET Analog Multiplexers
5962-7700801CX	PM-139Y/MD	Quad Low Power Voltage Comparator	5962-8771602EX	MUX-08BQ/MD	8-Channel JFET Analog Multiplexers
5962-8780201RX	PM-7226AR/MD	Quad 8-Bit CMOS D/A with Voltage Output	5962-87716022X	MUX-08BRC/MD	8-Channel JFET Analog Multiplexers
5962-8754001CA	AD585SQ/883B	High Speed S/H Amp	7705201EX	ADG508ATQ/883B	8-Channel Analog Mux
5962-8954103CX	SMP-10AY/MD	Low Droop Rate Sample-and-Hold Amp	5962-8768901VX	ADG528ATQ/883B	8-Channel Latched Mux
5962-8954104CX	SMP-10BY/MD	Low Droop Rate Sample-and-Hold Amp	5962-90635	ADG528ATE/883B	8-Channel Latched Multiplexer
5962-89541042X	SMP-10BRC/MD	Low Droop Rate Sample-and-Hold Amp	77052012X	ADG508ATE/883B	8-Channel Analog Mux
5962-8954101CX	SMP-11AY/MD	Accurate Sample-and-Hold Amp	5962-8771801EX	MUX-24AQ/MD	Dual 4-Channel JFET Analog Multiplexer
5962-89541022X	SMP-11BRC/MD	Accurate Sample-and-Hold Amp	5962-8771802EX	MUX-24BQ/MD	Dual 4-Channel JFET Analog Multiplexer
5962-8954102CX	SMP-11BY/MD	Accurate Sample-and-Hold Amp	5962-89710023X	ADG527ATE/883B	Dual 8-Channel Latched Multiplexer
5962-87719	AD625/883B	Instrumentation Amp	5962-8971002XX	ADG527ATQ/883B	Dual 8-Channel Latched Multiplexer
5962-88539	AD524/883B	Instrumentation Amp	7705201EX	ADG508ATQ/883B	8-Channel Analog Multiplexer
5962-8863001VX	AMP-01AX/MD	Low Noise, Precision Instrumentation Amp	5962-8671601EX	ADG201HSTQ/883B	Quad SPST Fast Switch
5962-88630023X	AMP-01BTC/MD	Low Noise, Precision Instrumentation Amp	5962-86716012X	ADG201HSTE/883B	Quad SPST Fast Switch
5962-8863002VX	AMP-01BX/MD	Low Noise, Precision Instrumentation Amp	77053022X	ADG201ATE/883B	Quad SPST Analog Switch
5962-8857901XC	HOS-050A/883B	Video Op Amp	7705302EX	ADG201ATQ/883B	Quad SPST Analog Switch
5962-8857902XC	HOS-060SH/883B	Video Op Amp	5962-8966901EX	SW-06BQ/MD	Quad SPST JFET Analog Switch
5962-8873301XC	ADSP-1010BTD/883B	Digital Signal Multiplier	5962-89669012X	SW-06BRC/MD	Quad SPST JFET Analog Switch
5962-8873302XC	ADSP-1010BSD/883B	Digital Signal Multiplier	5962-8773501XC	ADSP-2100SG/883B	6 MHz Digital Signal μ P
5962-8873303XC	ADSP-1010BSD/883B	75 ns Digital Signal Multiplier	5962-8773503XC	ADSP-2100ASG/883B	8 MHz Digital Signal μ P
5962-8873301ZC	ADSP-1010BTG/883B	Digital Signal Multiplier	5962-8773504XC	ADSP-2100ATG/883B	10 MHz Digital Signal μ P
5962-8873302ZC	ADSP-1010BSG/883B	Digital Signal Multiplier	5962-8203601GX	OP-07AJ/MD	Ultralow Offset Voltage Op Amp
5962-8873303ZC	ADSP-1010BSG/883B	75 ns Digital Signal Multiplier	5962-82036012X	OP-07ARC/MD	Ultralow Offset Voltage Op Amp
5962-8971001XX	ADG526ATQ/883B	16-Channel Latched Multiplexer	5962-8203601PX	OP-07AZ/MD	Ultralow Offset Voltage Op Amp
5962-8971003XX	ADG526ATE/883B	16-Channel Latched Multiplexer	5962-8203602GX	OP-07J/MD	Ultralow Offset Voltage Op Amp
			5962-82036022X	OP-07RC/MD	Ultralow Offset Voltage Op Amp
			5962-8203602PX	OP-07Z/MD	Ultralow Offset Voltage Op Amp
			5962-89801012X	OP-11ARC/MD	Quad Matched 741-Type Op Amp
			5962-8980101CX	OP-11AY/MD	Quad Matched 741-Type Op Amp
			5962-89801022X	OP-11BRC/MD	Quad Matched 741-Type Op Amp
			5962-8980102CX	OP-11BY/MD	Quad Matched 741-Type Op Amp
			5962-8771401GX	OP-14AJ/MD	Dual Matched High Performance Op Amp

Analog Devices

SMD Part Number	Generic Part Number	Description	SMD Part Number	Generic Part Number	Description
5962-8771401PX	OP-14AZ/MD	Dual Matched High Performance Op Amp	5962-8688701CX	OP-227AY/MD	Dual Low Noise, Low Offset Instr, Op Amp
5962-8771402GX	OP-14BJ/MD	Dual Matched High Performance Op Amp	5962-9053601GX	OP-260AJ/MD	Dual High Speed, Current Feedback Op Amp
5962-8771402PX	OP-14BZ/MD	Dual Matched High Performance Op Amp	5962-90536012X	OP-260ARC/MD	Dual High Speed, Current Feedback Op Amp
5962-8954201GX	OP-15AJ/MD	Precision JFET-Input Op Amp	5962-9053601PX	OP-260AZ/MD	Dual High Speed, Current Feedback Op Amp
5962-8954201PX	OP-15AZ/MD	Precision JFET-Input Op Amp	5962-88721012X	OP-270ARC/MD	Dual Very Low Noise, Precision Op Amp
5962-8954202GX	OP-15BJ/MD	Precision JFET-Input Op Amp	5962-8872101PX	OP-270AZ/MD	Dual Very Low Noise, Precision Op Amp
5962-8954301GX	OP-16AJ/MD	Precision JFET-Input Op Amp	5962-88721022X	OP-271ARC/MD	High Speed, Dual Op Amp
5962-8954301PX	OP-16AZ/MD	Precision JFET-Input Op Amp	5962-8872102PX	OP-271AZ/MD	High Speed, Dual Op Amp
5962-8954302GX	OP-16BJ/MD	Precision JFET-Input Op Amp	5962-8978301PX	OP-290AZ/MD	Precision, Low Power, Micropower Dual Op Amp
5962-8954302PX	OP-16BZ/MD	Precision JFET-Input Op Amp	5962-89783012X	OP-290ARC/MD	Precision, Low Power, Micropower Dual Op Amp
5962-8954303PX	OP-16CZ/MD	Precision JFET-Input Op Amp	5962-8853701GX	OP-37AJ/MD	Low Noise, Precision, High Speed Op Amp
5962-8770601GX	OP-17AJ/MD	Precision JFET-Input Op Amp	5962-8853701PX	OP-37AZ/MD	Low Noise, Precision, High Speed Op Amp
5962-8770601PX	OP-17AZ/MD	Precision JFET-Input Op Amp	5962-8853702GX	OP-37BJ/MD	Low Noise, Precision, High Speed Op Amp
5962-8770602GX	OP-17BJ/MD	Precision JFET-Input Op Amp	5962-88537022X	OP-37BRC/MD	Low Noise, Precision, High Speed Op Amp
5962-8770602PX	OP-17BZ/MD	Precision JFET-Input Op Amp	5962-8853702PX	OP-37BZ/MD	Low Noise, Precision, High Speed Op Amp
5962-88593012X	OP-200ARC/MD	Dual Low Offset, Low Power Op Amp	5962-8853703GX	OP-37CJ/MD	Low Noise, Precision, High Speed Op Amp
5962-8859301PX	OP-200AZ/MD	Dual Low Offset, Low Power Op Amp	5962-87771013X	OP-400ATC/MD	Quad Low Offset, Low Power Op Amp
5962-8771501CX	OP-207AY/MD	Dual Ultralow V_{OS} Matched Op Amp	5962-8777101CX	OP-400AY/MD	Quad Low Offset, Low Power Op Amp
5962-8853801GX	OP-215AJ/MD	Dual Precision JFET-Input Op Amp	5962-8855901CX	OP-421BY/MD	Quad Low Power Op Amp (Single or Dual Supply)
5962-88538012X	OP-215ARC/MD	Dual Precision JFET-Input Op Amp			
5962-8853801PX	OP-215AZ/MD	Dual Precision JFET-Input Op Amp			
5962-8853802GX	OP-215BJ/MD	Dual Precision JFET-Input Op Amp			
5962-8853802PX	OP-215BRC/MD	Dual Precision JFET-Input Op Amp			
5962-8853802PX	OP-215BZ/MD	Dual Precision JFET-Input Op Amp			

Products Available to Standard Military Drawings

SMD Part Number	Generic Part Number	Description	SMD Part Number	Generic Part Number	Description
5962-8855902CX	OP-421CY/MD	Quad Low Power Op Amp (Single or Dual Supply)	5962-87738012X	OP-77BRC/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-8851301GX	OP-42AJ/MD	High Speed, Fast Settling, Precision Op Amp	5962-8773801PX	OP-77BZ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-88513012X	OP-42ARC/MD	High Speed, Fast Settling, Precision Op Amp	5962-8954401GX	OP-97AJ/MD	Low Power, High Precision Op Amp
5962-8851301PX	OP-42AZ/MD	High Speed, Fast Settling, Precision Op Amp	5962-8954401PX	OP-97AZ/MD	Low Power, High Precision Op Amp
5962-8980401GX	OP-44AJ/MD	High Speed, Precision Op Amp			
5962-8980401PX	OP-44AZ/MD	High Speed, Precision Op Amp			
5962-89804012X	OP-44ARC/MD	High Speed, Precision Op Amp			
5962-9053501GX	OP-64AJ/MD	High Speed, Wide Bandwidth Op Amp			
5962-9053501PX	OP-64AZ/MD	High Speed, Wide Bandwidth Op Amp			
5962-90535012X	OP-64ARC/MD	High Speed, Wide Bandwidth Op Amp			
5962-88565012X	OP-470ARC/MD	Very Low Noise, Quad Op Amp			
5962-88565013X	OP-470ATC/MD	Very Low Noise, Quad Op Amp			
5962-8856501CX	OP-470AY/MD	Very Low Noise, Quad Op Amp			
5962-88565022X	OP-471ARC/MD	High Speed, Low Noise, Quad Op Amp			
5962-88565023X	OP-471ATC/MD	High Speed, Low Noise, Quad Op Amp			
5962-8856502CX	OP-471AY/MD	High Speed, Low Noise, Quad Op Amp			
5962-8967001CX	OP-490AY/MD	Low Voltage, Micropower, Quad Op Amp			
5962-89670013X	OP-490ATC/MD	Low Voltage, Micropower, Quad Op Amp			
5962-8967301CX	OP-50AY/MD	High Output-Current Op Amp (AVCL ≥ 5)			
5962-8967302CX	OP-50BY/MD	High Output-Current Op Amp (AVCL ≥ 5)			
5962-8773802GX	OP-77AJ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)			
5962-8773802PX	OP-77AZ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)			
5962-8773801GX	OP-77BJ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)			

MIL-STD-883 Class B Products

AD2S80	AD570	AD707	AD7225	AD7580	ADSP-1010A	DAC-05	OP-14	OP-490
AD2S80A	AD571	AD708	AD7226	AD7582	ADSP-1010B	DAC-06	OP-15	PKD-01
AD346	AD572	AD711	AD7228	AD7590/1DI	ADSP-1012A	DAC-08	OP-16	PM-108
AD380	AD573	AD712	AD7237	AD7592DI	ADSP-1016A	DAC-10	OP-17	PM-111
AD381	AD574A	AD713	AD7245	AD7628	ADSP-1024A	DAC-100	OP-20	PM-119
AD382	AD578	AD741	AD7247	AD7672	ADSP-1080A/81A	DAC-312	OP-21	PM-139
AD386	AD579	AD744	AD7248	AD7820	ADSP-1101	DAC-888	OP-22	PM-148
AD390	AD580	AD746	AD7501	AD7821	ADSP-1110	DAC-1508	OP-27	PM-155
AD394	AD581	AD767	AD7502	AD7824	ADSP-1401/10	DAC-8012	OP-32	PM-156
AD395	AD582	AD790	AD7503	AD7828	ADSP-1402	DAC-8043	OP-37	PM-157
AD396	AD584	AD834	AD7506	AD7840	ADSP-2100 & A	DAC-8143	OP-41	PM-1008
AD509	AD585	AD840	AD7507	AD7845	ADSP-2101	DAC-8212	OP-42	PM-1012
AD517	AD586	AD841	AD7510DI	AD7846	ADSP-2111	DAC-8221	OP-43	PM-2108
AD518	AD587	AD842	AD7511DI	AD7870	ADSP-3128A	DAC-8222	OP-44	PM-7224
AD521	AD588	AD843	AD7512DI	AD9000	ADSP-3201/02	DAC-8229	OP-50	PM-7226
AD522	AD589	AD844	AD7520	AD9002	ADSP-3210/20	DAC-8248	OP-61	PM-7524
AD524	AD590	AD845	AD7521	AD9012	ADSP-3211	DAC-8408	OP-64	PM-7528
AD526	AD624	AD846	AD7522	AD9048	ADSP-3212/22	DAC-8800	OP-77	PM-7533
AD532	AD625	AD847	AD7524	AD9610	ADSP-3220	MAT-01	OP-90	PM-7541
AD534	AD630	AD848	AD7528	AD96687	ADSP-3221	MAT-02	OP-97	PM-7541A
AD536A	AD632	AD849	AD7533	AD ADC85S-12	ADV453	MAT-03	OP-160	PM-7542
AD537	AD637	AD1330	AD7534	AD ADC85SZ-12	ADVFC32	MAT-04	OP-177	PM-7543
AD538	AD639	AD1332	AD7535	AD DAC87	HDS-1250	MUX-08	OP-200	PM-7545
AD539	AD640	AD1334	AD7536	ADG201A & HS	HOS-050A/060SH	MUX-16	OP-207	PM-7548
AD542	AD642	AD1341	AD7537	ADG202A	HTC-0300A	MUX-24	OP-215	PM-7574
AD544	AD644	AD1362	AD7541 & A	ADG221	ADC-908	MUX-28	OP-220	PM-7628
AD547	AD647	AD1378	AD7542	ADG222	ADC-910	OP-01	OP-221	PM-7645
AD548	AD648	AD2700	AD7543	ADG506A/507A	ADC-912	OP-02	OP-227	REF-01
AD549	AD650	AD2701	AD7545 & A	ADG508A/509A	AMP-01	OP-04	OP-249	REF-02
AD558	AD652	AD2702	AD7547	ADG526A/527A	AMP-02	OP-05	OP-260	REF-05
AD561	AD664	AD3860	AD7548/49	ADG528A/529A	AMP-05	OP-06	OP-270	REF-08
AD562	AD667	AD5200 Series	AD7569	AD OP-07	BUF-03	OP-07	OP-271	REF-10
AD563	AD668	AD5210 Series	AD7572	AD OP-27	CMP-01	OP-08	OP-290	REF-43
AD565A	AD670	AD5240	AD7574	AD OP-37	CMP-04	OP-08	OP-400	SMP-11
AD566A	AD673	AD5539	AD7575	ADREF01	CMP-05	OP-09	OP-420	SW-01
AD567	AD674A	AD7111	AD7576	ADREF02	CMP-08	OP-10	OP-421	SW-06
AD568	AD688	AD7118	AD7578	ADSP-1008A	CMP-404	OP-11	OP-470	SW-201
AD569	AD689	AD7224	AD7579	ADSP-1009A	DAC-01	OP-12	OP-471	SW-7510
								SW-7511

Boldface indicates new MIL-STD-883 Class B Product availability since publication of our most recent Databooks. For status of specific parts, please contact your local salesperson. Due to the nature of slash sheet and MIL drawing development, the availability of parts is difficult to predict. This list will be updated and published in *Analog Briefings* every six months.

Military Products

JAN QPL Class B Products

JAN Part Number	Generic Part Number	Description	JAN Part Number	Generic Part Number	Description
JM38510/14001BXA	AD574AUD	Complete, 12-Bit ADC	38510/11405BGC	LF156/PM156 AJ1	BiFET Op Amp
JM38510/14002BXA	AD574ATD	Complete, 12-Bit ADC	38510/11405BPA	LF156/PM156 AZ5	BiFET Op Amp
JM38510/12101BJC	AD562SD	12-Bit Current Output DAC	38510/11405BPB	LF156/PM156 AZ2	BiFET Op Amp
JM38510/12103BJC	AD565SD	12-Bit Current Output DAC	38510/11402BGA	LF156/PM156 J5	BiFET Op Amp
JM38510/12702BEC	AD7520UD	10-Bit Multiplying DAC	38510/11402BGC	LF156/PM156 J1	BiFET Op Amp
JM38510/13301BEA	AD561SD	10-Bit DAC, I-Out	38510/11402BPA	LF156/PM156 Z5	BiFET Op Amp
38510/11302BEA	DAC08 AQ5	8-Bit D/A Converter	38510/11402BPB	LF156/PM156 Z2	BiFET Op Amp
38510/11302BEB	DAC08 AQ2	8-Bit D/A Converter	38510/11406BGA	LF157/PM157 AJ5	BiFET Op Amp
38510/11301BEA	DAC08 Q5	8-Bit D/A Converter	38510/11406BGC	LF157/PM157 AJ1	BiFET Op Amp
38510/11301BEB	DAC08 Q2	8-Bit D/A Converter	38510/11406BPA	LF157/PM157 AZ5	BiFET Op Amp
JM38510/12801BGC, A	AD584SH	Multi-Tap Reference	38510/11406BPB	LF157/PM157 AZ2	BiFET Op Amp
JM38510/12802BGC, A	AD584TH	Multi-Tap Reference	38510/11403BGA	LF157/PM157 J5	BiFET Op Amp
JM38510/13901BIA	AD534TH	Analog Multiplier, Prog. Scale	38510/11403BGC	LF157/PM157 J1	BiFET Op Amp
JM38510/13901BCA	AD534TD	Analog Multiplier, Prog. Scale	38510/11403BPA	LF157/PM157 Z5	BiFET Op Amp
JM38510/13902BCA	AD534SD	Analog Multiplier, Prog. Scale	38510/11403BPB	LF157/PM157 Z2	BiFET Op Amp
JM38510/13902BIA	AD534SH	Analog Multiplier, Prog. Scale	38510/11201BCB	LM139/PM157 Y2	Quad Low Power Voltage Comparator
JM38510/13903BIA	AD532SH	Analog Multiplier, Fixed Scale	38510/11201BCA	LM139/PM139 Y5	Quad Low Power Voltage Comparator
JM38510/13903BCA	AD532SD	Analog Multiplier, Fixed Scale	38510/10304BCA	LM111/PM111 Y5	Voltage Comparator
38510/13501BGA	OP07 AJ5	Low Offset Op Amp	38510/10304BCB	LM111/PM111 Y2	Voltage Comparator
38510/13501BCG	OP07 AJ1	Low Offset Op Amp	38510/10304BGA	LM111/PM111 J5	Voltage Comparator
38510/13501BPA	OP07 AZ5	Low Offset Op Amp	38510/10101BGA	741A/PM741 AJ5	General Purpose Op Amp
38510/13501BPB	OP07 AZ2	Low Offset Op Amp	38510/10101BCG	741A/PM741 AJ1	General Purpose Op Amp
38510/13502BGA	OP07 J5	Low Offset Op Amp	38510/10104BGA	LM108/PM108 AJ5	Low Input-Current Op Amp
38510/13502BGC	OP07 J1	Low Offset Op Amp	38510/10104BGC	LM108/PM108 AJ1	Low Input-Current Op Amp
38510/13502BPA	OP07 Z5	Low Offset Op Amp	38510/10104BPA	LM108/PM108 AZ5	Low Input-Current Op Amp
38510/13502BPB	OP07 Z2	Low Offset Op Amp	38510/10104BPB	LM108/PM108 AZ2	Low Input-Current Op Amp
38510/13503BGA	OP27 AJ5	Low Noise Precision Op Amp	38510/10106BEA	LH2108A/PM2108AQ5	Dual Op Amp
38510/13503BGC	OP27 AJ1	Low Noise Precision Op Amp	38510/10106BEB	LH2108A/PM2108AQ2	Dual Op Amp
38510/13503BPA	OP27 AZ5	Low Noise Precision Op Amp	38510/11004BCA	4136/PM4136 Y5	Quad Op Amp
38510/13503BPB	OP27 AZ2	Low Noise Precision Op Amp	38510/11004BCB	4136/PM4136 Y2	Quad Op Amp
38510/11404BGA	LF155/PM155 AJ5	BiFET Op Amp			
38510/11404BGC	LF155/PM155 AJ1	BiFET Op Amp			
38510/11404BPA	LF155/PM155 AZ5	BiFET Op Amp			
38510/11404BPB	LF155/PM155 AZ2	BiFET Op Amp			
38510/11401BGA	LF155/PM155 J5	BiFET Op Amp			
38510/11401BGC	LF155/PM155 J1	BiFET Op Amp			
38510/11401BPA	LF155/PM155 Z5	BiFET Op Amp			
38510/11401BPB	LF155/PM155 Z2	BiFET Op Amp			
38510/11405BGA	LF156/PM156 AJ5	BiFET Op Amp			

Gold and tin reflow lead parts will be built to order only. Hot Solder dip is the preferred and stocked lead finish.

JAN QPL Class S Products

Precision Monolithics (PMI) and Analog Devices, Inc. (ADI) have combined resources and offer a full range of products with Class "S" processing:

- MIL-M-38510 QPL "S" reference SEC IV
- ADI will soon be offering the following part types in Class "S" conforming to MIL-STD-883, Para. 1.2.1:

Class "S"	Description
AD590	Monolithic Temperature Transducer
AD534	Precision Analog Multiplier
AD574	12-Bit Analog A/D Converter
AD584	10, 5, 2.5 Voltage Pin Programmable Precision Voltage Reference

- A Standard Class "S" Program has been developed offering Class "S" devices which fully satisfies the customer's needs for full process control, traceability, reliability, lot qualifications, certified line, and the recorded data generally associated with Class "S" processing. ADI Standard Class "S" processing is based on MIL-STD-883, Methods 5004 and 5005, Class "S" flow and can be applied to any SMD or 883 military part listed herein Sec I or Sec II. The electrical parameters and end-points for the ADI Standard Class "S" flow will be as described in the current PMI/ADI 883 data sheet catalog. The factory must be consulted for delta parameters and limits, burn-in circuit, methods, and anomalies for PDA information, until complete ADI Standard Class "S" specification sheets, by product, are available.

The newest additions to the Standard Class "S" are parts listed in Section I, II are the following:

2S80	Resolver to Digital Converter
AD9048	35 MSPS, Video 8-Bit A/D Converter, 550 mW
AD9002	150 MSPS, 8-Bit A/D Converter, ECL, 750 mW
AD9012	100 MSPS, 8-Bit A/D Converter, TTL, 1 W
AD9060	75 MSPS, 10-Bit A/D Converter

Additional devices will be added in 1991-1992.

PMI Division will continue to offer Class "B" and Class "S" processing to Source Control Drawings (SCD) and is also capable of handling Radiation Testing requirements. The radiation data base information gathered from ADI/PMI devices will be managed and distributed by the PMI Division of ADI.

JAN Part Number	Generic Part Number	Description	Part I Qual
38510/13501SGA	OP07 AJ5	Low Offset Op Amp	Yes
38510/13501SPA	OP07 AZ5	Low Offset Op Amp	Yes
38510/13502SGA	OP07 J5	Low Offset Op Amp	Yes
38510/13502SPA	OP07 Z5	Low Offset Op Amp	Yes
38510/13503SGA	OP27 AJ5	Low Noise Precision Op Amp	Yes
38510/13503SPA	OP27 AZ5	Low Noise Precision Op Amp	Yes
38510/11404SGA	LF155/PM155 AJ5	BiFET Op Amp	Yes
38510/11404SPA	LF155/PM155 AZ5	BiFET Op Amp	Yes
38510/11401SGA	LF155/PM155 J5	BiFET Op Amp	Yes
38510/11401SPA	LF155/PM155 Z5	BiFET Op Amp	Yes
38510/11405SGA	LF156/PM156 AJ5	BiFET Op Amp	Yes
38510/11405SPA	LF156/PM156 AZ5	BiFET Op Amp	Yes
38510/11402SGA	LF156/PM156 J5	BiFET Op Amp	Yes
38510/11402SPA	LF156/PM156 Z5	BiFET Op Amp	Yes
38510/11201SEA	LM139/PM139 AY5	Quad Low Power Voltage Comp.	Yes
38510/10101SGA	741 A/PM741 AJ5	General Purpose Op Amp	Nov, 90
38510/10104SGA	LM108/PM108 AJ5	Low Input-Current Op Amp	Jan, 91
38510/11302SEA	DAC08 AQ5	8-Bit D/A Converter	Yes
38510/11301SEA	DAC08 Q5	8-Bit D/A Converter	Yes
38510/12208SGA	OP42 AJ5	High Speed Precision Op Amp	Q3, 91
38510/12208SPA	OP42 AZ5	High Speed Precision Op Amp	Q3, 91
38510/12207SGA	OP44 AJ5	High Speed Precision Op Amp	Q3, 91
38510/12207SPA	OP44 AZ5	High Speed Precision Op Amp	Q3, 91
38510/10304SGA	LM111/PM111 J5	Voltage Comparator	Q2, 91
38510/10304SPA	LM111/PM111 Z5	Voltage Comparator	Q2, 91
38510/135xxSPA**	OP200 AZ5	Dual Low Power/Offset Op Amp	Q3, 91
38510/135xxSCA**	OP400 AY5	Quad Low Power/Offset Op Amp	Q3, 91

**In the future, these parts may identified in the new DESC "One Part, One Part Number" system, i.e.,

Part Number	PMI Part Number
5962-8859301SPA	OP200 AZ5
5962-8777101SCA	OP400 AY5

Product Families Not Included in the Databook

The information published in this *Short Form Designers' Guide* is intended to assist the user in choosing components for the design of *new* equipment, using the most cost-effective products available from Analog Devices. The popular product types listed below may have been designed into your circuits in the past, but they are no longer likely to be the most economic choice for your new designs. Nevertheless, we recognize that it is often a wise choice to refrain from redesigning proven equipment, and we are continuing to make these products available for use in existing designs or in designs for which they are uniquely suitable. Data sheets on these products are available upon request.

Model	Model	Model	Model	Model
AD101	AD7507	DAS1151	2B24	310
AD201	AD7520	DAS1152	2B34	428
AD293	AD7521	DAS1153	2B35	429
AD294	AD7522	DAS1155	2B50	433
AD301	AD7523	DAS1156	2B52	434
AD301AL	AD7525	DAS1157	2B53	435
AD370/371	AD7530	DAS1158	2B56	436
AD503	AD7531	DRC1705	2B57	440
AD504	AD7541	DRC1706	2B58	442
AD506	AD7546	DSC1705	2B59	450
AD510	AD7550	DSC1706	4B Series	451
AD515	AD7552	HDH-1205	40	452
AD518	AD7574	HDS-1240E	44	453
AD533	AD9611	HOS-050/050A/050C	45	458
AD535	AD9686	HOS-060	46	460
AD545	ADC-14I/17I	HOS-200	48	603
AD567	ADC1143	RDC-1700	50	606
AD611	AD DAC-08	RDC-1702	51	610
AD651	ADEB770	RDC-1704	52	756
AD1403	CAV-1210	RDC-1725	118	903
AD2004	DAC-QS	RDC-1726	148	906
AD2006	DAC-QZ	RDC-1768	171	915
AD2008	DAC-10Z	RTM Series	184	926
AD2009	DAC-12M	SDC1700	234	947
AD2016	DAC-12QS	SDC1702	235	948
AD2020	DAC-12QZ	SDC1704	260	950
AD2033	DAC1108	SDC1725	261	959
AD2040	DAC1132	SDC1726	272	968
AD3554	DAC1146	SDC1768	273	
AD3860	DAC1420	SHA-2A	275	
AD7110	DAC1422	SHA-5	276	
AD7118	DAC1423	SHA-1134	277	
AD7240	DAS1128	SHA-1144	285	
AD7506	DAS1150	STM Series	288	

Substitution Guide for Product Families No Longer Available

The products listed in the left-hand column are no longer available from Analog Devices. In many cases, comparable functions and performance may be obtained with newer models, but—as a rule—they are not directly interchangeable. The closest recommended Analog Devices equivalent, physically and electrically, is listed in the right-hand column. If no equivalent is listed, or for further information, contact your local sales office.

ADI Model	Closest Recommended Equivalent	ADI Model	Closest Recommended Equivalent	ADI Model	Closest Recommended Equivalent	ADI Model	Closest Recommended Equivalent
AD108/208/308	AD705	AD1679	AD679	ADC1105	AD7550/AD7552	DTM1716/17	AD2S65/66
AD108A/208A/308A	AD705	AD1779	AD779	ADC1109	AD7572A	HAS-0802	HAS1202A
AD111/211/311	AD790	AD2003	AD2021	ADC1111	AD574A	HAS-1002	HAS1202A
AD345	AD1321/1322	AD2022	None	ADC1121	AD7880	HAS-1202	HAS1202A
AD351	AD790	AD2023	None	ADC1123	AD7880	HDD-1015	AD9712A
AD362	AD1362	AD2024	None	ADC1133	AD574A	HDD-1409	None
AD376	AD1376	AD2025	None	ADC-QM	AD574A/AD674A	HDH-0802	AD9713A
AD501	AD711	AD2027	None	ADC-QU	AD574A/AD674A	HDH-1003	AD9713A
AD502	AD711	AD2028	None	AD DAC100	AD561	HDL-3805	ADV453/ADV478
AD505	AD509	AD2036	None	ADG200	None	HDL-3806	ADV453/ADV478
AD508	AD517	AD2037	None	ADG201	ADG201A	HDM-1210	AD668/AD9713A
AD511	AD711	AD2038	None	ADLH0032G/CG	AD843	HDS-0810E	AD9712A
AD512	AD711	AD5010/6020	AD9000	ADLH0033G/CG	AD9620/AD9630	HDS-0820	AD9713A
AD513	AD711	AD6012	AD565A	ADM501	None	HDS-1015E	AD9712A
AD514	AD711	AD7115	AD7111	ADP501	None	HDS-1025	AD9713A
AD516	AD711	AD7513	ADG201A	ADSHC-85	AD585	HDS-1250	AD668/AD9713A
AD520	AD524	AD7516	AD7510DI	ADSHM-5	HTC-0300A	HOS-100AH/SH	None
AD523	AD549	AD7519	None	API1620/1718	Consult ADI	HTC-0300	HTC-0300A
AD528	AD711/744	AD7527	AD7548	BDM1615/16/17	None	HTC-0500	HTC-0300A
AD530	AD533	AD7544	AD7548	CAV-0920/1020	AD9020/9060	IPA-1751	IPA-1764
AD531	AD532	AD7555	AD1175K	CAV-1202	AD9005	IRDC1730-33	AD2S80A/82A
AD540	AD544	AD7560	None	CAV-1205	AD9005	MAH-0801	AD9005
AD559	AD557/AD558	AD7570	AD7579/AD7580	DAC-10DF	AD568	MAH-1001	AD9005
AD565	AD565A	AD7571	AD7579/7580	DAC-10H	DAC-10Z	MAS-0801	AD9005
AD566	AD566A	AD7583	AD7880+MUX	DAC-14QM	DAC1136	MAS-1001	AD9005
AD612	AD524	AD9011	AD9002	DAC-16QM	DAC1136	MAS-1202	AD9005
AD614	AD524	AD9615	AD9611/AD9617	DAC-1009	AD767	MATV0811	AD9012/48
AD801	AD711	AD9685	AD96685	DAC1106	AD568	MATV-0816	AD9012/48
AD810-813	None	AD9687	AD96686	DAC1112	DAC12QS	MATV-0820	AD9012/48
AD814-816	None	AD9688	AD9002/AD9028	DAC1118	AD767	MCI-1794	AD2S80A/82A
AD818	None	ADADC-816	AD7820/AD7821	DAC1122	AD7541A	MDA Family	AD9712A/13A
AD820-822	None	ADC-8S	AD673	DAC1125	AD7533	MDH Family	AD9712A/13A
AD830-833	None	ADC-10Z	AD574A	ADC-10Z	DRC1705/06;	MDMS Family	AD9712A/13A
AD835-839	None	ADC-12QL	AD7578	DRC1740	SDC1740	MDS Family	AD9712A/13A
AD1145	AD7846	ADC-12QZ	AD574A/AD674A	DRC1765/66	AD2S65/66	MDSL Family	AD9712A/13A
AD1408	AD558	ADC-1100	AD7550/AD7552	DSC1605/06	DSC1705/06;	MOD-1005/20	AD9020/60
AD1508	AD558	ADC11u2	AD7870	DSC1740	SDC1740	OSC-1754	OSC-1758
AD1678	AD678	ADC1103	AD7572A	DSC1765/66	AD2S65/66	RAC1763	None

Substitution Guide for Product Families No Longer Available

ADI Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent	PMI Model	Closest Recommended Equivalent
RDC1602/03	RDC1702/03	THS-Family	HTC-0300A	301 (Module)	52	CMP-01Z	CMP-01J
RDC1711	None	TSL1612	Consult ADI	302	310 (Module)	CMP-05BJ	CMP-05CJ
RDC1721	AD2S46	1S10/20	1S40;	311	AD549	CMP-05BZ	CMP-05CZ
RDC1767	RDC1768		AD2S80A/82A	350	None	CMP-05GJ	CMP-05CJ
RSCT1621	AD2S80A/82A	1S14/24/44/64	1S74	424	435/AD534	CMP-404BY	CMP-404AY
RTI-1200	RTI-711 Series	1S61	1S60; AD2S80A/82A	426	AD534	CMP-404BY/883C	CMP-404AY/883C
RTI-1201	RTI-711 Series	2S20	AD2S80A/82A	427	None	DAC-1408-7Q	DAC-1408-8Q
RTI-1202	RTI-711 Series	9S70/71/72	None	432	None	DAC-02ACX1	DAC-02CCX1
RTM1630-34	RTM1680/83	9S75/76/79	None	454	AD537	DAC-05AX1	DAC-02CCX1
RTM1636	Consult ADI	41	AD515A	456	AD537	DAC-05EX1	DAC-02CCX1
RTM1660/63/71/72	Consult ADI	42	AD549	602J10	AD524	DAC-100AAQ7	DAC-100ACQ7
RTM1679	None	43	AD549	602J100	AD524	DAC-100AAQ8	DAC-100ACQ8
RTM1681/86/87/89	Consult ADI	47	48	602K100	AD524	DAC-100ABQ7	DAC-100ACQ7
RTM1690/96	Consult ADI	102	48	603	AD524	DAC-100ABQ8	DAC-100ACQ8
RTM1697	None	106	118	605	AD524	DAC-100BBQ5/883C	DAC-100ACQ5/883C
RTM1736/37	RDC1740 + CCT	107	118	751	AD640	DAC-100BCQ7	DAC-100BBQ7
SAC1763	None	108	52	752	759	DAC-100DDQ7	DAC-100CCQ7
SBCD1752/53/56/57	None	110	48	901	904	DAC-10BX	DAC-10FX
SCDX1623	None	120	50	907	921	DAC-10CX	DAC-10GX
SCM1677	None	141	40	908	921	DAC-1408-6P	DAC-1408-8P
SDC1602/3/4	SDC1702/03/04/40	142	48	909	921	DAC-1408-7P	DAC-1408-8P
SDC1711	None	143	52	931	None	DAC-1408-GQ	DAC-1408-8Q
SDC1721	AD2S46	146	AD382	932	None	DAC-1508A-8Q	DAC-1408-8Q
SDC1767	SDC1768	149	50	933	None	DAC-312BR	DAC-312ER
SERDEX	μ.MAC-5000	153	AD517	935	None	DAC-888AX	DAC-888EX
SHA-1A	AD585	161	None	942	None	DAC-888BX	DAC-888EX
SHA-3	AD585	163	None	944	None	MAT-01/883C	MAT-01AH/883C
SHA-4	AD585	165	None	946	None	MAT-02BH	MAT-02AH
SHA-6	AD1154	170	None	948	947	MAT-02BH/883C	MAT-02AH/883C
*SHA1114	AD585	180	AD OP-07	950	None	MUX-08AQ	MUX-08BQ
SPA-1695	None	183	184	956	None	MUX-24AQ	MUX-24EQ
SSCT1621	AD2S80A/82A	220	234	971	921	MUX-24BQ	MUX-24FQ
SSCT1622/23	None	230	235			MUX-16AT	MUX-16ET
STM1630-34	STM1680/83	231	233			MUX-16BT	MUX-16FT
STM1636	Consult ADI	232	235			OP-01HZ	OP-01J
STM1660/63/71/72	Consult ADI	233	None			OP-01HZ	OP-01HP
STM1679	None	274J	284J			OP-02BJ	OP-02AJ
STM1681/86/87/89	Consult ADI	279	286J			OP-02BJ/883C	OP-02AJ/883C
STM1690/96	Consult ADI	280	281			OP-02EJ	OP-07DJ
STM1697	None	282J	292A			OP-02EP	OP-177GP
STM1736/37	SDC1740 + CCT	283J	292A			OP-02EZ	OP-177GZ
THC-Family	HTC-0300A	287	None				

PMI Model	Closest Recommended Equivalent
AMP-01BX	AMP-01AX
AMP-01BX/883C	AMP-01AX/883C
AMP-05BX	AMP-05AX
AMP-05BX/883C	AMP-05Z/883C
BUF-03BJ/883C	BUF-03AJ/883C

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PMI Model	Closest Recommended Equivalent
OP-02J	OP-02AJ
OP-02/883C	OP-02AZ/883C
OP-04DY	OP-04CY
OP-04Y/883C	OP-04AY/883C
OP-05Z	OP-05AZ
OP-05/883C	OP-05AZ/883C
OP-06BJ/883C	OP-06AJ/883C
OP-06EZ	OP-06GZ
OP-06FZ	OP-06GZ
OP-08AJ	PM-1008AJ
OP-08AJ/883C	PM-1008AJ/883C
OP-08AZ/883C	PM-1008AZ/883C
OP-08CZ/883C	PM-1008AZ/883C
OP-08EJ	PM-1008EJ
OP-08EZ	PM-1008EZ
OP-09ARC/883C	OP-11ARC/883C
OP-09FY	OP-09EY
OP-12BZ	OP-12AZ
OP-12CZ	OP-12AZ
OP-12GZ	OP-12FZ
OP-14DZ	OP-14CZ
OP-14J/883C	OP-14AJ/883C
OP-15BJ	OP-15AJ
OP-15BZ	OP-15AZ
OP-16BJ	OP-16AJ
OP-17BZ/883C	OP-17AZ/883C
OP-17CJ	OP-17AJ
OP-17FJ	OP-17EJ
OP-17FZ	OP-17EZ
OP-20CJ	OP-20BJ
OP-215BJ	OP-215AJ
OP-215BJ/883C	OP-215AJ/883C
OP-215BZ	OP-215AZ
OP-215CZ/883C	OP-215BZ/883C
OP-21BJ	OP-21AJ
OP-21BZ	OP-21AZ

PMI Model	Closest Recommended Equivalent
OP-21EJ	OP-21AJ
OP-220BJ	OP-220AJ
OP-22AJ	OP-22AJ/883C
OP-22EJ	OP-22AJ/883C
OP-32BZ	OP-32AZ
OP-32BZ/883C	OP-32AZ/883C
OP-32FZ	OP-32EZ
OP-50BY	OP-50AY
OP-50BY/883C	OP-50AY/883C
PKD-01BY	PKD-01AY
PKD-01BY/883C	PKD-01AY/883C
PM-111Y	PM-111J
PM-111Y/883C	PM-111J/883C
PM-139AY	PM-139AY/883C
PM-156AZ	PM-156AZ/883C
PM-157J	PM-175J/883C
PM-157J/883C	PM-157AJ/883C
PM-208AJ	PM-108AJ/883C
PM-208AZ	PM-108AZ
PM-308AZ	PM-1008GZ
PM-308J	PM-1008GJ
PM-4136RC	OP-11ARC/883C
PM-562AV	PM-562HV
PM-562BV	PM-562HV
PM-562FV	PM-562HV
PM-562GV	PM-562HV
PM-741J	OP-02AJ
SMP-10BY	SMP-10AY
SMP-10BY/883C	SMP-10AY/883C
SW-01BQ	SW-01FQ
SW-7510AQ	SW-7510EQ
SW-7510BQ	SW-7510FQ
SW-7511AQ	SW-1577BQ
OP-04GBC	OP-04NBC
OP-14GRBC	OP-14GBC
OP-21GRBC	OP-21GBC

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*New product since publication of the most recent Databooks.

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N = design-in product not contained in databook (contact your nearest sales office for data sheet).

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*New product since publication of the most recent Databooks.

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HIGH POWER SELECTOR GUIDE†

Model	Internal Power Watts Max	Output Current (Cont.) Amps., Min	±Supply Range Volts Min/Max	Saturation @I _o Max (V _s -V _o) Volts, Max	Slew Rate V/μs Typ	V _{os} Initial mV Max	V _{os} vs Temp μV/°C Max	Bias Current nA Max	I _o mA Max	Gain Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max
PA03	500	30	15/75	7	8	2	30	.05	300	1	Thermal	Yes	-25/85
PA03A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA04	200	20	15/100	5.3/8.8 ⁽¹⁾	50	10	50	.05	90	2	Ext Adj	No	-25/85
PA04A	*	*	*	*	*	5	30	.02	*	*	*	*	*
PA77	150	20	10/45	7	30	10	50	100	65	2	Ext Adj	Yes	-25/85
PA77A	*	*	*	*	*	5	30	50	*	*	*	*	*
PA12/12Q	125	10	10/45	6	4	6	65	30	50	4	Ext Adj	No	-25/85
PA12A	*	15	10/50	7	*	3	40	20	*	*	*	*	-55/125
PA12M	*	*	10/45	6	*	6	65	30	*	*	*	*	*
PA12H	*	1	*	4	*	6	*	30	100	*	*	*	-25/200
PA61 ⁽²⁾	97	10	10/45	7	2.8	6	65	30	10	1	Ext Adj	No	-25/85
PA61A ⁽²⁾	*	*	*	6	*	3	40	20	*	*	*	*	*
PA61M ⁽²⁾	*	*	*	7	*	6	65	30	*	*	*	*	-55/125
PA51 ⁽²⁾	97	10	10/36	8	2.6	10	65	40	10	1	Ext Adj	No	-25/85
PA51A ⁽²⁾	*	*	10/40	*	*	5	40	20	*	*	*	*	*
PA51B ⁽²⁾	*	*	10/36	*	*	10	65	40	*	*	*	*	-55/125
PA51C ⁽²⁾	*	*	10/40	*	*	5	40	20	*	*	*	*	*
PA51M ⁽²⁾	*	*	10/36	*	*	10	65	40	*	*	*	*	*
PA07	67	5	12/50	5	5	2	30	.05	30	1.3	Ext Adj	Yes	-25/85
PA07A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA07M	*	*	*	*	*	2	30	.05	*	*	*	*	-55/125
PA10	67	5	10/45	8	5	6	65	30	30	6	Ext Adj	No	-25/85
PA10A	*	*	10/50	6	*	3	40	20	*	*	*	*	-55/125
PA10M	*	*	10/45	8	*	6	65	30	*	*	*	*	*
PA73/73Q ⁽²⁾	67	5	10/30	8	2.6	10	65	40	5	1	Ext Adj	No	-25/85
PA73M ⁽²⁾	*	*	*	*	*	*	*	*	*	*	*	*	-55/125
PA01	67	5	10/28	10	2.6	12	65	50	50	1	Ext Adj	No	-25/85
PA02/02Q	48	5	7/19	4	20	10	50	.2	37	4.5	Ext Adj	No	-25/85
PA02A	*	*	*	*	*	3	25	.1	*	*	*	*	-55/125
PA02M	*	*	*	*	*	10	50	.2	*	*	*	*	*
PA21	36	2.5	2.5/20	3.0	1.2	10	15 typ	1000	90	.6	(3)	Yes	-25/85
PA21A	*	3.0	*	3.5	*	4	10 typ	250	*	*	(4)	*	*
PA21M	*	2.5	*	3.0	*	10	15typ	1000	*	*	(3)	*	-55/125
PB50	35	2	30/100	11	100	1750	7000	—	18	2.5	Ext Adj	No	-25/85
PB58	80	1.5	15/150	11	100	1500	7000	—	12	2.5	Ext Adj	No	-25/85
PB58A	*	2.0	*	*	*	1000	*	—	*	*	*	*	*

†Specifications apply for T_c = 25°C, unless otherwise stated.

*Specification is same as above.

(1) 5.3 w/V Boost = V_s + 5V; 8.8 w/o V Boost

(2) Class "C" output—optimized for low cost—not recommended above 1KHz



HIGH VOLTAGE SELECTOR GUIDE†

Model	±Supply Range Volts Min/Max	Output Current (Cont.) mA, Min	Saturation @I _o Max (V _s -V _o) Volts, Max	Internal Power Watts Max	Slew Rate V/μs Typ	V _{os} Initial mV Max	V _{os} vs Temp μV/°C Max	Bias Current nA Max	I _q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max
PA89	50/600	100	36	36	10	2	30	.05	4	2	Ext Adj	No	-25/85
PA89A	*	*	*	*	*	.5	10	.025	*	*	*	*	*
PA85	15/225	200	10	35	1000	2	30	.05	25	110	Ext Adj	Yes	-25/85
PA85A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA85M	*	*	*	*	*	2	30	.05	*	*	*	*	-55/125
PA88	15/225	100	10	15	30	2	30	.05	2	10	Ext Adj	No	-25/85
PA88A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA08V	15/175	150	15	17.5	30	2	30	.05	8.5	5	Ext Adj	Yes	-25/85
PA08	15/150	*	*	*	*	*	*	*	*	*	*	*	*
PA08A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA08M	*	*	*	*	*	2	30	.05	*	*	*	*	-55/125
PB58	15/150	1500	11	80	100	1500	7000	—	12	2.5	Ext Adj	No	-25/85
PB58A	*	2000	*	*	*	1000	*	—	*	*	*	*	*
PA83/83Q	15/150	75	10	17.5	30	3	25	.05	8.5	5	(.1)	Yes	-25/85
PA83A	*	*	*	*	*	1	10	.01	*	*	*	*	*
PA83M	*	*	*	*	*	3	25	.05	*	*	*	*	-55/125
PA84	15/150	40	7	17.5	200	3	25	.05	7.5	76	(.05)	Yes	-25/85
PA84A	*	*	*	*	*	1	10	.01	*	*	*	*	*
PA84M	*	*	*	*	*	3	25	.05	*	*	*	*	-55/125
PA84S	*	*	*	*	*	*	*	*	*	*	*	*	-25/85
PA82J	70/150	15	5	11.5	20	3	25	.05	8.5	5	(.025)	Yes	0/70
PB50	30/100	2000	11	35	100	1750	7000	—	18	2.5	Ext Adj	No	-25/85
PA81J	32/75	30	5	11.5	20	3	25	.05	8.5	5	(.05)	Yes	0/70

†Specifications apply for T_c = 25°C, unless otherwise stated.

*Specification is same as above.

HIGH SPEED SELECTOR GUIDE†

Model	Slew Rate V/μs Typ	Output Current (Cont.) Amps., Min	±Supply Range Volts Min/Max	Saturation @I _o Max (V _s -V _o) Volts, Max	Internal Power Watts Max	V _{os} Initial mV Max	V _{os} vs Temp μV/°C Max	Bias Current nA Max	I _q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max
WA01	5000	.4	12/16	4	10.5	10	5	20000	30	—	(.6)	No	-25/85
WA01A	*	*	*	*	*	5	25	10000	*	*	*	*	*
WB05	5000	1	5/15	5	15	100	500	30000	30	200	(1.5)	No	-25/85
PA85	1000	.2	15/225	10	35	2	30	.05	25	110	Ext Adj	Yes	-25/85
PA85A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA85M	*	*	*	*	4	2	30	.05	*	*	*	*	-55/125
PA19	900	.4	15/40	5	78	3	30	.2	120	100	Ext Adj	Yes	-25/85
PA19A	*	*	*	*	*	.5	10	.05	*	*	*	*	*
PA09	400	.2	12/40	8	78	3	30	.1	85	150	(4.5)	Yes	-25/85
PA09A	*	*	*	*	*	.5	10	.02	*	*	*	*	*
PA09M	*	*	*	*	*	3	30	.1	*	*	*	*	-55/125

†Specifications apply for T_c = 25°C, unless otherwise stated.

*Specification is same as above.





FEATURES

- High Performance—up to 125 MHz Toggle Rates
- Second Generation User-Programmable Gate Array
 - I/O functions
 - Digital logic functions
 - Interconnections
- Flexible array architecture
 - Compatible arrays, 2000 to 9000 gate logic complexity
 - Extensive register and I/O capabilities
 - High fan-out signal distribution
 - Internal three-state bus capabilities
 - TTL or CMOS input thresholds
 - On-chip oscillator amplifier
- Standard product availability
 - Low power, CMOS, static memory technology
 - Pin-for-Pin to Xilinx[®] XC3000 Family
 - 100% factory pre-tested
 - Selectable configuration modes
- Complete XACT[®] development system
 - Schematic Capture
 - Automatic Place/Route
 - Logic and Timing Simulation
 - Design Editor
 - Library and User Macros
 - Timing Calculator
 - Standard PROM File Interface

rimeter of I/O Blocks, a core array of Logic Blocks and resources for interconnection. The XACT development system provides schematic capture and auto place-and-route for design entry. Logic and timing simulation, and in-circuit emulation are available as design verification alternatives. The design editor is used for interactive design optimization, and to compile the data pattern which represents the configuration program.

The FPGA's user logic functions and interconnections are determined by the configuration program data stored in internal static memory cells. The program can be loaded in any of several modes to accommodate various system requirements. The program data resides externally in an EEPROM, EPROM or ROM on the application circuit board, or on a floppy disk or hard disk. On-chip initialization logic provides for optional automatic loading of program data at power-up. A serial configuration PROM can provide a very simple serial configuration program storage.

Basic Array	Logic Capacity (usable gates)	Configurable Logic Blocks	User I/Os	Program Data (bits)
ATT3020	2000	64	64	14779
ATT3030	3000	100	80	22176
ATT3042	4200	144	96	30784
ATT3064	6400	224	120	46064
ATT3090	9000	320	144	64160

DESCRIPTION

The CMOS ATT3000 series Field-Programmable Gate Array (FPGA) family provides a group of high-performance, high-density, digital, integrated circuits. Their regular, extendable, flexible, user-programmable array architecture is composed of a configuration program store plus three types of configurable elements: a pe-

The ATT3000 series FPGAs are an enhanced family of Field Programmable Gate Arrays, which provide a variety of logic capacities, package styles, temperature ranges and speed grades.

ATT3000 Series Field-programmable Gate Arrays Product Availability

Package Type	Standard	Device Types				
		ATT3020	ATT3030	ATT3042	ATT3064	ATT3090
44PLCC	JEDEC	/	*	/	/	/
68PLCC	JEDEC	*	*	/	/	/
84PLCC	JEDEC	*	*	*	*	*
84CPGA	JEDEC	*	*	*	/	/
100CQFP	JEDEC	*	/	*	/	/
100QFP	EIAJ	*	*	*	/	/
132CPGA	JEDEC	/	/	*	*	/
132PPGA	JEDEC	/	/	*	*	/
160QFP	EIAJ	/	/	/	*	*
164CQFP	JEDEC	/	/	/	/	*
175PPGA	JEDEC	/	/	/	/	*
175CPGA	JEDEC	/	/	/	/	*

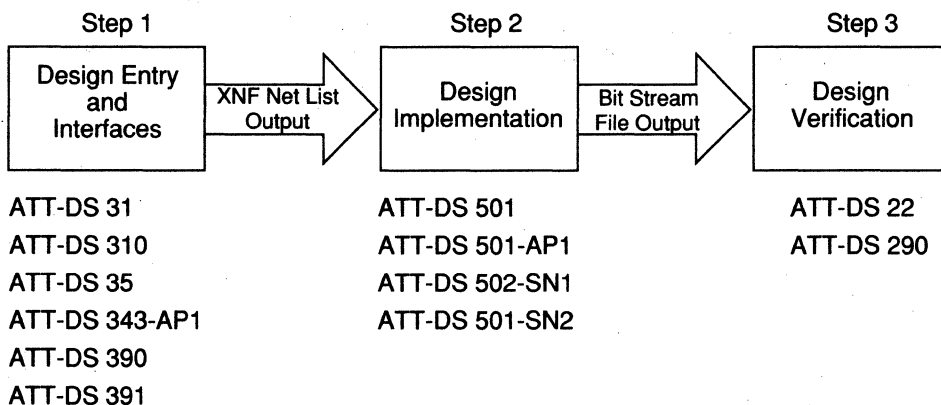
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AT&T Design Flow



AT&T FPGA Design Kits

Design Entry and Interfaces

- ATT-DS 31 *FutureNet DASH*¹ XNF Interface & TTL Library
- ATT-DS 310 *FutureNet DASH-LCA*² Schematic Editor, XNF Interface, & TTL Library
- ATT-DS 35 Schematic Interface for *OrCad*³
- ATT-DS 343-AP1 Schematic and Simulator Interface for *Mentor*⁴ Graphics *Apollo*⁵ Workstation
- ATT-DS 390 *Viewdraw*⁶-LCA Schematic Editor, XNF Interface, and TTL Library
- ATT-DS 391 Schematic and Interface using *Viewdraw* (FPGA's only)

Design Implementation

- ATT-DS 501 Design Implementation System - PC Based
- ATT-DS 501-AP1 Design Implementation System for *Apollo*
- ATT-DS 501-SN1 Design Implementation System for *SUN 3*⁷
- ATT-DS 501-SN2 Design Implementation System for *SUN 4*⁷

Design Verification

- ATT-DS 290 *Viewsim*⁶ Simulator with XNF Timing Delay Interface
- ATT-DS 22 Simulator (Silos 16K Gate) and Timing Delay Interface

¹ *FutureNet* is a registered trademark and *DASH* is a trademark of FutureNet Corporation, a Data I/O Company

² *LCA* is a trademark of Xilinx, Inc.

³ *OrCAD* is a registered trademark of OrCAD Systems Corp.

⁴ *Mentor* is a trademark of Mentor Graphic Corp.

⁵ *Apollo* is a registered trademark of Apollo Computer

⁶ *Viewdraw* and *Viewsim* are trademarks of Viewlogic Systems, Inc.

⁷ *SUN-3* and *SUN-4* are registered trademarks of SUN Microsystems, Inc.

For additional information, contact your AT&T Account Manager, or call:

□ AT&T Microelectronics, Dept. 52AL300240, 555 Union Boulevard, Allentown, PA 18103 1-800-372-2447 (In Canada, 1-800-553-2448)

Burr-Brown Selection Guides

These tables categorize different Burr-Brown product lines. Items in **boldface** are new because they have been introduced since publication of the *Burr-Brown Integrated Circuits Data Book, Vol. 33* in January, 1989. The new products are described in more detail in the *Burr-Brown New Products Guide*, published in September, 1989.

These publications and full length product data sheets of all models are available from your local Burr-Brown salesperson or representative.

OPERATIONAL AMPLIFIERS

LOW DRIFT OPERATIONAL AMPLIFIERS ($\leq 5\mu\text{V}/^\circ\text{C}$) Boldface = NEW

Description	Model	Offset Voltage, max		Bias Current (25°C), max (pA)	Open Loop Gain, min (dB)	Frequency Response		Rated Output, min		Temp Range ⁽¹⁾	Pkg
		At 25°C, (±mV)	Temp Drift, (±μV/°C)			Unity Gain (MHz)	Slew Rate (V/μs)	(±V)	(±mA)		
FET	OPA627M	0.1	0.8	5	112	16	40	11.5	30	Ind	TO-99
	OPA627P	0.25	2	5	112	16	40	11.5	30	Ind	DIP
	OPA637M	0.1	0.8	5	112	80	100	11.5	30	Ind	TO-99
	OPA637P	0.25	2	5	112	80	100	11.5	30	Ind	DIP
	OPA111M	0.25	1	1	120	2	2	11	5	Ind	TO-99
Wideband	OPA156M	2	5	50	94	6	14	10	5	Mil	TO-99
	OPA356M	2	5	50	94	6	14	10	5	Com	TO-99
	OPA602M	0.25	2	1	92	6.5	28	10	15	Ind	TO-99
	OPA602P, U	1	5	2	88	6.5	24	10	15	Ind	DIP, SOIC
	OPA606M	1	10	10	100	13	35	12	5	Com	TO-99
Dual FET	OPA2111M	0.5	2.8	4	114	2	2	11	5	Ind	TO-99
	OPA2107P	1	10	10	80	5	15	11	10	Ind	DIP, SOIC
Low Power (Dual) Single Supply Operation	OPA1013	0.15	2	20nA	123	0.8	0.4	13	5	Com	DIP, TO-99
Bipolar	OPA177Z, P	0.01	0.1	1.5nA	134	0.6	0.3	12	10	Ind	DIP
	OPA177S	0.06	1.2	2.8nA	126	0.6	0.3	12	10	Ind	SOIC
	OPA177Z, P	0.025	0.3	2.0nA	134	0.6	0.3	12	10	Ind	DIP
	OPA27J, Z	0.025	0.6	±40nA	120	8	1.9 ⁽³⁾	12	16.6	Mil	TO-99, DIP
	OPA37J, Z	0.025	0.6	±40nA	120	63 ⁽²⁾	11.9 ⁽³⁾	12	16.6	Mil	TO-99, DIP
	OPA27P	0.100	1.8	±80nA	117	8	1.9 ⁽³⁾	12	16.6	Com	DIP
	OPA37P	0.100	1.8	±80nA	117	63 ⁽²⁾	11.9 ⁽³⁾	12	16.6	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (2) Gain-bandwidth product for OPA37. $A_v = 5$ min. (3) Typical.

For Product Assistance, Call Toll-Free 1-800-548-6132

LOW BIAS CURRENT OPERATIONAL AMPLIFIERS (≤50pA)

Boldface = NEW

Description	Model	Offset Voltage, max		Bias Current (25°C), max (pA)	Open Loop Gain, min (dB)	Frequency Response		Rated Output, min		Temp Range ⁽¹⁾	Pkg
		At 25°C, (±mV)	Temp Drift, (±μV/°C)			Unity Gain (MHz)	Slew Rate (V/μs)	(±V)	(±mA)		
FET	OPA111M	0.25	1	±1	120	2	2	11	5	Ind	TO-99
	OPA627M	0.1	0.8	5	112	16	40	12	30	Ind	TO-99
	OPA627P	0.25	2	5	112	16	40	12	30	Ind	DIP
	OPA637M	0.1	0.8	5	112	80	100	11.5	30	Ind	TO-99
	OPA637P	0.25	2	5	112	80	100	11.5	30	Ind	DIP
Low Noise	OPA101M	0.25	5	-10	94	10	6.5	12	12	Ind	TO-99
	OPA102M	0.25	5	-10	94	40	14	12	12	Ind	TO-99
Ultra-Low Bias Current	OPA128M	0.5	5	±0.075	110	1	3	10	5	Com	TO-99
	AD515H	1	25	0.075	88	0.35	1	10	5	Com	TO-99
Dual FET	OPA2111M	0.5	2.8	±4	114	2	2	11	5	Ind	TO-99
	OPA2111P	2	15	±15	106	2	2	11	5	Com	DIP
	OPA2107P	1	10	10	80	5	15	11	10	Ind	DIP, SOIC
Quad FET	OPA404G	0.75	3 ⁽²⁾	±4	92	6.4	35	12	5	Ind	DIP
	OPA404P, U	2.5	5 ⁽²⁾	±12	88	6.4	35	11.5	5	Com	DIP, SOIC
Low Cost	OPA121M	2	10	±5	110	2	2	11	5	Com	TO-99
	OPA121P, U	3	10	±10	106	2	2	11	5	Com	DIP
	OPA602M	0.25	2	1	92	6.5	28	10	15	Ind	TO-99
	OPA602P	0.5	5	2	88	6.5	24	10	15	Ind	DIP, SOIC
Wideband	OPA606M	0.5	5	±10	100	13	35	12	5	Com	TO-99
	OPA606P	3	10 ⁽²⁾	±25	90	12	30	11	5	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (2) Typical.

Burr-Brown

LOW NOISE OPERATIONAL AMPLIFIERS (Very Low e_n)

Boldface = NEW

Description	Model	Noise Voltage at 10kHz, max (nV/√Hz)	Bias Current (25°C), max (nA)	Offset Voltage, max		Open Loop Gain, min (dB)	Frequency Response		Rated Output, min		Temp Range ⁽¹⁾	Pkg
				at 25°C (±mV)	Temp Drift (±μV/°C)		Gain BW (MHz)	Slew Rate (V/μs)	(±V)	(±mA)		
Bipolar	OPA27J, Z	3.8	±40	0.025	0.6	120	8	1.9 ⁽²⁾	12	16.6	Mil	TO-99, DIP
	OPA37J, Z	3.8	±40	0.025	0.6	120	63	11.9 ⁽²⁾	12	16.6	Mil	TO-99, DIP
	OPA177Z, P	10	1.5	0.01	0.1	134	0.6	0.3	12	10	Ind	DIP
	OPA177S	10	2.8	0.06	1.2	126	0.6	0.3	12	10	Ind	SOIC
	OPA77Z, P	11	2.0	0.025	0.3	134	0.6	0.3	12	10	Ind	DIP
Wide Bandwidth	OPA101M	8	-10	0.25	5	94	20	5	12	12	Ind	TO-99
	OPA102M	8	-10	0.25	5	94	40	10	12	12	Ind	TO-99
FET	OPA111M	8	±1	0.25	1	120	2	1	11	5	Ind	TO-99
	OPA602M	12 ⁽²⁾	1	0.25	2	92	6.5	28	10	15	Ind	TO-99

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For Product Assistance, Call Toll-Free 1-800-548-6132

LOW NOISE OPERATIONAL AMPLIFIERS (Very Low e_n) (Continued)

Boldface = NEW

Description	Model	Noise Voltage at 10kHz, max (nV/√Hz)	Bias Current (25°C), max (pA)	Offset Voltage, max		Open Loop Gain, min (dB)	Frequency Response		Rated Output, min (±V)	Temp Range ⁽¹⁾	Pkg
				at 25°C (±mV)	Temp Drift (±μV/°C)		Gain	Slew Rate, min (V/μs)			
FET	OPA627M	6	5	1	0.8	112	16	45	11.5	30	Ind TO-99
	OPA627P	6	5	0.25	2	112	16	40	11.5	30	Ind DIP
	OPA637M	6	5	1	0.8	112	80	100	11.5	30	Ind TO-99
	OPA637P	6	5	0.25	2	112	80	100	11.5	30	Ind DIP
Low Cost	OPA27P, U	4.5	±80nA	0.100	1.8	117	8	1.9 ⁽²⁾	10	16.6	Com DIP, SOIC
	OPA37P, U	4.5	±80nA	0.100	1.8	117	63	11.9 ⁽²⁾	10	16.6	Com DIP, SOIC
Dual FET	OPA2111M	8	±4	0.5	2.8	114	2	1	11	5	Ind TO-99
	OPA2111P	6 ⁽²⁾	±15	2	15	106	2	1	11	5	Com DIP
Dual Audio Op Amp	OPA2604	10	100	2	5	100	10	15	12	20	Ind DIP, SOIC

NOTES: (1) Ind = -25°C to +85°C, Mil = -55°C to +125°C, Com = 0°C to +70°C. (2) Typical.

UNITY-GAIN BUFFER OPERATIONAL AMPLIFIERS

Boldface = NEW

Description	Model	Rated Output, min		Frequency Response			Gain (V/V)	Input Impedance (Ω)	Temp Range ⁽¹⁾	Pkg
		(±V)	(±mA)	-3dB (MHz)	Full Power (MHz)	Slew Rate (V/μs)				
High Performance	3553AM	10	200	300	32	2000	≈1	10 ¹¹	Ind	TO-3
Low Cost	OPA633H, P	11	80	275	65	2500	≈1	1.5 x 10 ⁶	Ind	TO-8, DIP
Transconductance Amp and Buffer	OPA660	4	8	700	550	2000	≈1	10 ⁵	Ind	DIP, SOIC

NOTE: (1) Ind = -25°C to +85°C.

WIDE BANDWIDTH OPERATIONAL AMPLIFIERS (≥5MHz)

Boldface = NEW

Description	Model	Frequency Response			Comp	Rated Output, min (±V)	Rated Output, min (±mA)	Offset Voltage, max		Open Loop Gain, min (dB)	Temp Range ⁽¹⁾	Pkg
		Gain BW (MHz)	Slew Rate (V/μs)	t _s ±0.1% (ns)				At 25°C (±mV)	Temp Drift (±μV/°C)			
FET	OPA156M	6	10	1.5μs	int	10	5	2	5	94	Mil	TO-99
	OPA356M	6	10	1.5μs	int	10	5	2	5	94	Com	TO-99
	OPA602M	6.5	28	600	int	10	15	0.25	2	92	Ind	TO-99
	OPA602P, U	6.5	24	600	int	10	15	0.5	5	88	Ind	DIP, SOIC
Dual	OPA2107	5	15	1μs	int	11	10	0.5	5	82	Ind, Mil	DIP, TO-99, SOIC
Dual Audio	OPA2604	10	25	2	int	10	20	1	5 typ	82	Ind	DIP, TO-99
	OPA605M	200, A=1000	300 ⁽³⁾	300	ext	10	30	0.5	5	96 ⁽³⁾	Ind	DIP
	OPA606M	13	25	1μs	int	12	5	0.5	5 ⁽²⁾	100	Com	TO-99
	OPA606P	12	20	1μs	int	11	5	3	10 ⁽²⁾	90	Com	TO-99

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For Product Assistance, Call Toll-Free 1-800-548-6132

WIDE BANDWIDTH OPERATIONAL AMPLIFIERS (≥5MHz) (Continued)

Boldface = NEW

Description	Model	Frequency Response			Comp	Rated Output, min		Offset Voltage, max		Open Loop Gain, min	Temp Range ⁽¹⁾	Pkg
		Gain BW (MHz)	Slew Rate (V/μs)	t _S ±0.1% (ns)		(±V)	(±mA)	At 25°C (±mV)	Temp Drift (±μV/°C)			
	OPA627M	16	45	400	int	11.5	30	0.1	0.8	112	Ind	TO-99
	OPA627P	16	40	400	int	11.5	30	0.25	2	112	Ind	DIP
	OPA637M	50	100	300	G>5	11.5	30	0.1	0.8	112	Ind	TO-99
	OPA637P	50	100	300	G>5	11.5	30	0.25	2	112	Ind	DIP
	3554M	1700,	1000	120	ext	10	100	1	15	100	Ind	TO-3
	3551	50,	250	400	ext	10	10	1	50 ⁽²⁾	88	Com	TO-99
	3550	20, A=1	100	400	int	10	10	1	50 ⁽²⁾	88	Com	TO-99
Bipolar	3507	20, A=10	80	200	ext	10	10	10	30 ⁽²⁾	83	Com	TO-99
Current-Feedback	OPA603P	50 (A=1 to 10)	1000	50	NA	10	75	5	8 typ	NA	Ind	DIP
Transconductance Amp and Buffer	OPA660	700	2000	25	NA	4.0	20	20	50	NA	Ind	DIP, SOIC
Quad FET	OPA404G	6.4	28	600	int	11.5	5	0.75	3 ⁽²⁾	92	Ind	DIP
	OPA404P, U	6.4	24	600	int	11.5	5	2.5	5 ⁽²⁾	88	Com	DIP, SOIC
Low Noise Bipolar	OPA27	8, A=1	1.9 ⁽²⁾	—	int ⁽³⁾	12	16.6	0.025	0.6	120	Mil	TO-99, DIP
	OPA37	63, A=5	11.9 ⁽²⁾	—	int ⁽³⁾	12	16.6	0.025	0.6	120	Mil	TO-99, DIP
Low Noise FET	OPA101M	20, A=100	5	2.5μs	int	12	12	0.25	5	94	Ind	TO-99
	OPA102M	40, A=100	10	1.5μs	int	12	12	0.25	5	94	Ind	TO-99
Fast Settling	OPA600M	5000, A=1000	500	80	ext	9	180	4	40	86	Ind	DIP
Very Fast Settling Precision	OPA620	200	175 ⁽²⁾	10	int	3	150 ⁽²⁾	0.5	8 ⁽²⁾	55	Com, Mil	DIP, SOIC
	OPA621	500, A=10	350 ⁽²⁾	15	int	3	150 ⁽²⁾	0.5	12 ⁽²⁾	55	Com, Mil	DIP, SOIC
Very Fast Settling	OPA675G	3000, A=16	240	15	ext	2.1	30 ⁽²⁾	1	5	65	Com, Mil	DIP
Switched Input	OPA676G	3000, A=16	240	15	ext	2.1	30 ⁽²⁾	1	5	65	Com, Mil	DIP
Low Cost	OPA27P, U	8, A=1	1.9 ⁽²⁾	—	int	12	16.6	0.100	1.8	117	Com	DIP, SOIC
	OPA37P, U	63, A=5	11.9 ⁽²⁾	—	int ⁽³⁾	12	16.6	0.100	1.8	117	Com	DIP, SOIC

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (2) Typical. (3) G = 5 min for OPA37.

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HIGH VOLTAGE, HIGH CURRENT OPERATIONAL AMPLIFIERS

Boldface = NEW

Description	Model	Rated Output, min		Offset Voltage, max		Bias Current (25°C), max (pA)	Frequency Response		Open Loop Gain (dB)	Temp Range ⁽¹⁾	Pkg
		(±V)	(±mA)	At 25°C (±mV)	Temp Drift (±µV/°C)		Unity Gain (MHz)	Slew Rate (V/µs)			
High Power	OPA501M	26	10A	5	40	20nA	1	1.35	98	Ind	TO-3
	OPA511M	22	5A	10	65	40	1	1	91	Ind	TO-3
	OPA512BM	35	10A	6	65	30	4	2.5	110	Ind	TO-3
	OPA512SM	35	15A	3	40	20	4	2.5	110	Mil	TO-3
	OPA541M	35	5A	1	30	50	1.6	6	90	Ind	TO-3
	OPA541AP	30	5A	10	40	50	1.6	6	90	Ind	Power Plastic
Dual	OPA2541M	35	5A	1	30	50	1.6	8	90	Ind	TO-3
	3573M	20	2A ⁽⁴⁾	10	65	40nA	1	2.6	94	Ind	TO-3
Wideband	3554M	10	100	1	15	50	1700 ⁽²⁾	1200	100	Ind	TO-3
High Voltage	3584M	145	15	3	25	20	20 ⁽²⁾	150	126	Com	TO-3
	3583M	140	75	3	25	20	5	30	118	Ind	TO-3
	3582	145	15	3	25	20	5	20	118	Com	TO-3
	3581	70	30	3	25	20	5	20	112	Com	TO-3
	3580	30	60	10	30	50	5	15	106	Com	TO-3
	OPA445BM	35	15	3	10	50	2	10	100	Ind	TO-99
Buffer	3553M	10	200	50	300 ⁽⁵⁾	200	300	2000	NA	Ind	TO-3
	OPA633	11	80	15	33 ⁽⁵⁾	35µA	275 ⁽⁵⁾	2500	NA	Ind	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (2) Gain-bandwidth product. (3) 2A peak. (4) 5A peak. (5) Typical.

SPECIAL PURPOSE OPERATIONAL AMPLIFIERS

Boldface = NEW

Description	Model	Offset Voltage, max		Bias Current (25°C), max (nA)	Open Loop Gain, min (dB)	Frequency Response		Rated Output, min (±V)	Temp Range ⁽¹⁾	Pkg	Page	
		At 25°C (±mV)	Temp Drift (±µV/°C)			Unity Gain (MHz)	Slew Rate (V/µs)					
Very Fast	OPA675G	1	5	35µA	65	185⁽²⁾	350	2.1	30	Com, Mil	DIP	22.35
Settling	OPA676G	1	5	35µA	65	185⁽²⁾	350	2.1	30	Com, Mil	DIP	22.35

NOTES: (1) Com = 0°C to +70°C, Mil = -55°C to +125°C. (2) -3dB BW at Gain of +10V/V.

For Product Assistance, Call Toll-Free 1-800-548-6132

INSTRUMENTATION AMPLIFIERS

Boldface = NEW

Description	Model	Gain Range	Gain		Non-Linearity G=100 max(%)	Input Parameters		Dynamic Response, G=100		Pkg
			Accuracy G=100 25°C, max(%)	Gain Drift, G=100 (ppm/°C)		Offset Voltage vs Temp	CMR ⁽⁶⁾ min(dB)	±3dB BW (kHz)	Temp Range ⁽¹⁾	
Very High Accuracy	INA120	1, 10, 100, 1000	0.5	30	±0.01	96	±(0.25±10/G)	20	Ind	DIP
	INA104P	1-1000 ⁽²⁾	0.15	22	±0.003	96	±(0.25±10/G)	25	Com	DIP
	INA104M	1-1000 ⁽²⁾	0.15	22 ⁽³⁾	±0.003	96	±(0.25±10/G)	25	Ind	DIP
	INA101G, M, L	1-1000 ⁽²⁾	0.03	22 ⁽³⁾	±0.003	96	±(0.25±10/G)	25	Ind, Mil	DIP, TO-100, LCC
	INA101P, U	1-1000 ⁽²⁾	0.3	22 ⁽³⁾	±0.007	90	±(2±20/G) typ	25	Com	DIP, SOIC
Low Quiescent Power	INA102G⁽⁸⁾, L⁽⁸⁾	1,10,100, 1000	0.15	15	±0.02	90	±(2±5/G)	3	Ind	DIP, LCC
	INA102P, U	1,10,100, 1000	0.4	20	±0.05	80	±(5±10/G)	3	Com, Ind	DIP, SOIC
Low Noise, Low Distortion	INA103G	1-1000 ⁽²⁾	0.1	25	±0.004	100	±(0.5+10/G) typ	800	Ind	DIP
	INA103P	1-1000 ⁽²⁾	0.25	25	±0.010	90	±(0.5+20/G) typ	800	Com	DIP
Fast Settling FET Input	INA110G ⁽⁸⁾ , L ⁽⁸⁾	1,10,100, 200,500	0.1	20	±0.01	96	±(2±50/G)	470	Ind	DIP, LCC
	INA110P, U	1,10,100, 200, 500	0.2	6 typ	±0.02	87	±(2±20/G) typ	470	Com	DIP, SOIC
Buffer, Unity-Gain Difference	3627M	1V/V, fixed	0.01 ⁽³⁾	5	±0.001 ⁽³⁾	100	20	800 ⁽³⁾	Ind	TO-99
	INA105M ⁽⁸⁾ , L ⁽⁸⁾	1V/V, fixed	0.01 ⁽³⁾	5	±0.001 ⁽³⁾	86 ⁽⁵⁾	10	1000 ⁽³⁾	Ind	TO-99
	INA105P, U	1V/V, fixed	0.025 ⁽³⁾	5	±0.001 ⁽³⁾	72 ⁽⁵⁾	5 typ	1000 ⁽³⁾	Com	DIP, SOIC
Gain of 10 Difference	INA106M	10V/V, fixed	0.01 ⁽⁴⁾	10	±0.001 ⁽⁴⁾	100 ⁽⁵⁾	2	500 ⁽⁴⁾	Ind	TO-99
	INA10C ⁽⁷⁾	10V/V, fixed	0.025 ⁽⁴⁾	4 typ	±0.001 ⁽⁴⁾	86 ⁽⁵⁾	0.2 typ	500 ⁽⁴⁾	Com	DIP
High Com. Mode Volt. Difference (200VDC CMV)	INA117G	1V/V, fixed	0.02 ⁽³⁾	10 ⁽³⁾	±0.001 ⁽³⁾	86 ⁽⁵⁾	20	200 ⁽³⁾	Ind	DIP
	INA117P	1V/V, fixed	0.05 ⁽³⁾	10 ⁽³⁾	±0.001 ⁽³⁾	74 ⁽⁵⁾	40	200 ⁽³⁾	Com	DIP
4-20mA Loop Receiver	RCV420BG	0.3125V/mA	0.05	25	±0.002	86	25 ⁽⁷⁾	150	Ind	DIP
	RCV420KP	0.3125V/mA	0.1	50	±0.002	72	50 ⁽⁷⁾	150	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (2) Set with external resistor. (3) Unity-gain. (4) Gain = 10. (5) No source imbalance. (6) DC to 60Hz, Gain = 10, 1kΩ unbalanced. (7) RTO. (8) BS 9000 Screening is available.

Burr-Brown

For Product Assistance, Call Toll-Free 1-800-548-6132

PROGRAMMABLE GAIN AMPLIFIERS

Boldface = NEW

Description	Model	Gain Range	Gain			Input Parameters		Dynamic Response, G=100		Temp Range ⁽¹⁾	Pkg
			Accuracy, G=100, 25°C, max(%)	Gain Drift, G=100 (ppm/°C)	Non-Linearity G=100 max(%)	Offset Voltage vs Temp max (µV/°C)	CMR ⁽⁶⁾ min (dB)	±3dB BW (kHz)	Temp Range ⁽¹⁾		
Noninverting Input	PGA100G	Gain set word 1, 2, 4, 8...128	0.02	10	±0.005	NA	6 typ	5MHz	Ind	DIP	
	PGA102G	Gain set with 2-bit 100	0.01	20	±0.01		3,G=100	250	Ind	DIP	
	PGA102P		0.02	50	±0.01		3,G=100	250	Com	DIP	
Instrument. Amplifier Input	PGA200G	Gain set word 1, 10, 100, 1000	0.02	10	±0.003	96	0.4,G=100	30	Ind	DIP	
Fast Settling 2µs to 0.01% Differential	PGA202	Gain set word 1, 10, 100, 1000	0.15	5	±0.012	86	±(3+25/G)	1000	Ind, Com	DIP	
	PGA203	Gain set word 1, 2, 4, 8	0.15	5	±0.012	86	±(3+25/G)	1000	Ind, Com	DIP	
Differential	3606M	Gain set word 1, 2, 4, 8...1024	0.02	10	±0.004	90,G=1	±(1+20/G)	40	Ind	DIP	

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C. (2) Set with external resistor. (3) Unity-gain. (4) Gain = 10 (5) No source imbalance. (6) DC to 60Hz, Gain = 10, 1kΩ unbalanced.

PRECISION TRANSMITTERS

Boldface = NEW

Descrip	Model	Error, max (%)	Span		Input Parameters		Output Parameters		Temp Range ⁽²⁾	Pkg		
			Untrimmed	Non-lin- Temp	Offset vs Offset Temp	CMR, DC, Current	Error, Current	Error, FS Output Current				
Two-Wire	XTR101G ⁽⁵⁾ , L ⁽⁵⁾	-5	0.01	±100	±30µV	±0.75	90	4-20	±6	±30	Ind	DIP
	XTR101P, U	-5	0.01	±100	±100µV	±1.5	90	4-20	±19	±60	Ind ⁽³⁾	DIP, SOIC
Two-Wire	XTR103P	-1	0.01	±25	±50	±1	100	4-20	±10	25	Ind ⁽³⁾	DIP
RTD Linearity Compensation	XTR103U	-1	0.01	±50	±100	±2	90	4-20	±20	±50	Ind ⁽³⁾	SOIC
Two-Wire	XTR104P	-1	0.01	±25	±50	±1	100	4-20	±10	±25	Ind ⁽³⁾	DIP
Hi-Z Strain Gage Linearity Compensation	XTR104U	-1	0.01	±50	±100	±2	90	4-20	±20	±50	Ind ⁽³⁾	SOIC
Three-Wire and Current Source	XTR110G	0.2	0.005	30	—	—	—	4-20,	±16	±32	Ind	DIP
	XTR110P, U	0.6	0.025	50	—	—		0-20,	±64	±96	Com	DIP, SOIC

NOTES: (1) With zero TC span resistor. (2) Com = 0°C to +70°C, Ind = -25°C to +85°C. (3) -40°C to +85°C. (4) Many more ranges with appropriate circuit. (5) BS 9000 screening is available.

For Product Assistance, Call Toll-Free 1-800-548-6132

TRANSFORMER-COUPLED AMPLIFIERS

Boldface = NEW

Descrip	Model	Isolation Voltage (V)		Isolation Mode Re-jection, typ DC 60Hz (dB)	Leakage Current at Test Voltage (μA)	Iso Imped-ance (Ω)	Iso (pF)	Gain Non-linearity		Volt-age Drift (±μV/°C)	Bias Current max	±3dB Freq (kHz)	Ext Iso Power Req	Temp ⁽¹⁾
		Cont Peak	Pulse Test, Peak					max	typ					
High Isolation Voltage	3656G	±3500	±8000	160 125	0.5	10 ¹²	6	±0.05	±0.03	5+ (1000/G _i)	100nA	30	No	Ind
Low Cost Self-Powered	ISO212P	±1060	±1697	160 115	2	10¹⁰	12	±0.025	±0.015	±30 (±30/G _i)	50nA	1	No	Com

NOTES: The package for the 3656G is a DIP; the package for the ISO212P is a SIP. (1) Ind = -25°C to +85°C Com = 0°C to +70°C.

OPTICALLY COUPLED AMPLIFIERS

Descrip	Model	Isolation Voltage (V)		Isolation Mode Re-jection, typ DC 60Hz (dB)	Leakage Current at Test Voltage (μA)	Iso Imped-ance (Ω)	Iso (pF)	Gain Non-linearity		Volt-age Drift (±μV/°C)	Bias Current max	±3dB Freq (kHz)	Ext Iso Power Req	Temp ⁽¹⁾
		Cont Peak	Pulse Test, Peak					max	typ					
Balanced Current Input	3650G	±2000	±5000	140 120	0.25 ⁽²⁾	10 ¹²	1.8	±0.05	±0.02	5	10nA	15	Yes ⁽³⁾	Ind
Balanced	3652G	±2000	±5000	140 120	0.25 ⁽²⁾	10 ¹²	1.8	±0.1	±0.05	25	50nA	15	Yes	Ind
Low Drift Wide BW	ISO100P	750	2500	146 ⁽³⁾ 108 ⁽³⁾	0.3	10 ¹²	2.5	0.07	0.02	4 ⁽³⁾	10nA	60	Yes	Ind

NOTES: All packages are DIPs. (1) Ind = -25°C to +85°C. (2) At 240V/60Hz. (3) R_{in} = 10kΩ, Gain = 100.

CAPACITOR COUPLED, HERMETICALLY SEALED AMPLIFIERS

Boldface = NEW

Descrip	Model	Isolation Voltage (V)		Isolation Mode Re-jection, typ DC 60Hz (dB)	Leakage Current at Test Voltage (μA)	Iso Imped-ance (Ω)	Iso (pF)	Gain Non-linearity		Volt-age Drift (±μV/°C)	Bias Current max	±3dB Freq (kHz)	Ext Iso Power Req	Temp ⁽¹⁾
		Cont Peak	Pulse Test, Peak					max	typ					
1500VAC Isolation	ISO102B	±2121	±4000	160 120	1.0	10 ¹⁴	6	±0.003	±0.002	±250	100μA	70	Yes	Ind
	ISO120B	±2121	±3535 ⁽²⁾	160 115	0.5	10 ¹⁴	2	±0.02	±0.005	±150	50μA	60	Yes	Ind
	ISO122P	±2121	±3394	160 140	0.5	10¹⁴	2	±0.02	±0.008	±200	50μA	50	Yes	Com⁽³⁾
3500VAC Isolation	ISO106B	±4950	±8000	160 130	1.0	10 ¹⁴	6	±0.025	±0.007	±250	100μA	70	Yes	Ind
	ISO121B	±4950	±5600 ⁽²⁾	160 115	0.5	10 ¹⁴	2	±0.01	±0.005	±150	50μA	60	Yes	Ind

NOTES: All packages are DIPs. (1) Ind = -25°C to +85°C. Com = 0°C to +70°C. (2) Partial discharge voltage. (3) Not hermetic.

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ISOLATION POWER SUPPLIES⁽¹⁾

Boldface = NEW

Description	Model	Isolation Voltage (V)		Input Voltage (VDC)		Leakage Current 240VAC		Current, Balanced Loads On All Outputs (mA)		Sensitivity To Input Change (V/V)	Temp ⁽²⁾	Pkg	
		Cont Peak	Pulse/ Test Peak	min	max	60Hz (μA)	Isolation Impedance (Ω) (pF)		Rated				Max ⁽¹⁾
							60Hz	(Ω)		(pF)			
Single ±15V	700	1500	4200	10	18	1	10 ¹⁰	5	±3-30	±60	1.08	Ind	Mod
	700U	2000	5000	10	18	1	10 ¹⁰	3	±3-30	±60	1.08	Ind	Mod
Output	PWS725A	2121	4000	7	18	1.2	10 ¹²	9	±15	±40	1.15	Ind	DIP
	PWS726A	4950	8000	7	18	1.2	10 ¹²	9	±15	±40	1.15	Ind	DIP
Dual ±15V	722	4950	8000	5	16	1	10 ¹⁰	6	±3-40	±50	1.13	Ind	Mod
Output	PWS727	1060	1700	10	18	1.5	10¹²	8	±15	±30	1.15	Com	Mod
	PWS728	1060	1700	4.5	5.5	1.5	10¹²	8	±15	±30	3.2	Com	Mod
Quad ±15V	710	1000	3100	10	18	1	10 ¹⁰	8	±9.5	±60	1.08	Ind	Mod
Output													
Quad ±8V	724	1000	3000	5	16	1	10 ¹⁰	6	±3-16	±60	0.63	Ind	Mod
Output													
Multiple Output (1-8)	PWS740	2121	4000	7	20	1.5	10 ¹²	3	30 ⁽³⁾	60 ⁽³⁾	1.20	Ind	Sys ⁽⁴⁾
	PWS745⁽⁵⁾	1060	1700	4.5⁽⁵⁾	18⁽⁵⁾	1.5	10¹²	8	±15	30	⁽⁷⁾	Ind	Comp
	PWS750	1060	1700	4.5⁽⁵⁾	18⁽⁵⁾	1.5	10¹²	8	±15	30	⁽⁷⁾	Ind	Comp

NOTES: (1) See complete Product Data Sheet for full specifications, especially regarding output current capabilities. (2) Ind = -25°C to +85°C. Com = 0°C to +70°C. (3) Per channel. (4) 1 TO-3 driver per 8 channels, plus 2 DIPs per channel. (5) 5V operation. (6) 15V operation. (7) 5V operation: 3.2; 15V operation: 1.15. (8) PWS745-1 driver may also be used with PWS740 and PWS750 components.

CAPACITOR-COUPLED ISOLATION AMPLIFIER, WITH POWER

Boldface = NEW

Description	Model	Isolation Voltage (V)		Isolation Mode Re-jection, typ		Leakage Current at Test (μA)	Iso Impedance (Ω) (pF)		Gain Non-linearity max typ (%) (%)		Voltage Drift (±μV/°C) max	Bias Current max	±3dB Freq (kHz)	Temp ⁽¹⁾
		Cont Peak	Pulse/ Test Peak	DC (dB)	60Hz (dB)		Voltage	Impedance		max					typ
						(Ω)		(pF)						
1500VAC Input Power	ISO103	2121	3394 ⁽²⁾	160	130	1.0	10 ¹²	11	0.025	0.01	400 ⁽¹⁾	50μA	20	Ind
1500VAC Output Power	ISO113	2121	3394 ⁽²⁾	160	130	1.0	10 ¹²	11	0.02	0.012	400 ⁽¹⁾	50μA	20	Ind
2500VAC Input Power	ISO107	3535	8000	160	100	1.2	10 ¹²	13	0.025	0.01	400 ⁽¹⁾	50μA	20	Ind

NOTES: All packages are DIPs. (1) Ind = -25°C to +85°C. (2) Partial discharge voltage.

For Product Assistance, Call Toll-Free 1-800-548-6132

CAPACITIVELY COUPLED VOLTAGE-TO-FREQUENCY CONVERTER
Boldface = NEW

Descrip	Model	Isolation Voltage (V)		Leakage Current at Test Voltage (μA)	Isolation Impedance		Non-linearity at 1MHz (typ)	Bias Current (max) (μA)	Operating Freq (max) (MHz)	External Isolation Power Req	Temp ⁽¹⁾
		Cont Peak	Pulse/ Test Peak		(Ω)	(pF)					
1500Vrms	ISO108	2121	3394⁽²⁾	0.3 typ	10 ¹²	3	0.01	250	3	Yes	Ind
3500Vrms	ISO109	4950	7918⁽²⁾	0.3 typ	10 ¹²	3	0.01	250	3	Yes	Ind

NOTES: Package is DIP. (1) Ind = -25°C to +85°C. (2) Partial discharge voltage.

ANALOG CIRCUIT FUNCTIONS
MULTIPLIERS/DIVIDERS
Boldface = NEW

Model	Transfer Function	Error at +25°C max (%)	Temp Coeff (%/°C)	Feed-through (mV)	Offset Voltage (mV)	1% BW (kHz)	Temp Range ⁽¹⁾	Pkg
MPY100	$[(X_1 - X_2)(Y_1 - Y_2) / 10] + Z_2$	±0.5	0.008	30	7	70	Ind	TO-100
MPY534	$[(X_1 - X_2)(Y_1 - Y_2) / 10] + Z_2$	±0.25	0.008	0.05%	2	3MHz	Com	TO-100
MPY600AP	$[(X_1 - X_2)(Y_1 - Y_2) / 2] + Z_2$	±0.25	0.02	2	5	10MHz	Ind	DIP
MPY634M	$[(X_1 - X_2)(Y_1 - Y_2) / 10] + Z_2$	±0.5	0.015	0.15%	2	10MHz	Ind	TO-100
MPY634P, U	$[(X_1 - X_2)(Y_1 - Y_2) / 10] + Z_2$	±2.0	0.03	0.3%	25	10MHz	Ind	DIP, SOIC
AD632	$[(X_1 - X_2)(Y_1 - Y_2) / 10] + Z_2$	±0.5	0.01	0.15	15	50	Ind	TO-100

NOTE: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C.

For Product Assistance, Call Toll-Free 1-800-548-6132

SPECIAL FUNCTIONS				Boldface = NEW	
Function	Model	Description	Comments	Temp Range ⁽¹⁾	Pkg
Multifunction Converter	4302	Y (Z/X) ^m This function may be used to multiply, divide, raise to powers, take roots and form sine and cosine functions.	Plastic package.	Ind	DIP
	LOG100	K Log (I ₁ /I ₂)	Optimized for log ratio of current inputs. Specified over six decades of input (1nA to 1mA), 55mV total error, 0.25% log conformity.	Com	DIP
Logarithmic Amplifier	4127G	K Log (I ₁ /I _{REF})	A more versatile part that contains an internal reference and a current inverter. 1% and 0.5% accuracy.	Com	DIP
	4341	True rms-to-DC conversion based on a log-antilog occupational approach. Pin compatible with 4340.	Some external trimming required. Lower cost in plastic package.	Ind	DIP
High Speed Window Comparator, ATE Pin Receiver	CMP100	A dual comparator with high common-mode input range. Latched ECL outputs, ±5V supplies.	Propagation delay: 5ns, max for 100mV overdrive.	Ind	DIP, SOIC
Switched Integrator	ACF2101	A dual, integrating, transimpedance amplifier that converts an input current to an output voltage by integrating the current for a user-determined period of time. Eliminates large feedback resistor of traditional I-to-V converters.	Includes HOLD and RESET switches and output multiplexer. $V_{OUT} = -\frac{1}{C} \int i_{IN} dt$	Ind	DIP

NOTE: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C.

DIVIDER

Model	Transfer Function	Input Range	Accuracy D = 250mV max (%)	Temp Coeff (%/°C)	0.5% BW (kHz)	Rated Output, min	Temp Range ⁽¹⁾	Pkg
DIV100P	10 x N/D	250mV to 10V	0.25	0.2	15	±10V, ±5mA	Ind	DIP

NOTE: (1) Ind = -25°C to +85°C.

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FREQUENCY PRODUCTS
Boldface = NEW

Function	Model	Description	Comments	Temp Range ⁽¹⁾	Pkg
Oscillator	4423	Very low cost in plastic package. Provides resistor programmable quadrature outputs (sine and cosine wave outputs simultaneously available).	Frequency range: 0.002Hz to 20kHz. Frequency stability: 0.01%/°C. Quadrature phase error: ±0.1%.	Com	DIP
Universal Active Filter	UAF42 UAF41 UAF21	These filters provide a complex pole pair. Based on state variable approach; low-pass, high-pass, and bandpass outputs are available.	Add only resistors to determine pole location (frequency and Q). Easily cascaded for complex filter responses.	Ind Ind Ind	DIP DIP DIP

NOTE: Com = 0°C to +70°C, Ind = -25°C to +85°C.

VOLTAGE REFERENCE
Boldface = NEW

Model	Output (V)	Min Output (mA)	Max Drift (ppm/°C)	Power Supply		Temp Range ⁽¹⁾	Pkg
				(V)	(mA)		
REF10M	±10.00 ±0.005	10	1	+13.5/35	4.5	Com	TO-99
REF101M	±10.00 ±0.005	10	1	+13.5/35	4.5	Com	TO-99
REF102M	±10.00 ±0.0025	10	2.5	+11.4/36	1.4	Ind, Mil	TO-99
REF102P, U	±10.00 ±0.005	10	5	+11.4/36	1.4	Ind	DIP, SOIC

NOTE: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C.

CURRENT REFERENCE

Model	Output I (μA)	Compliance Voltage	Drift (ppm/°C)	Comments	Temp Range ⁽¹⁾	Pkg
REF200M, P, U	Dual 100 ±0.5	2.5V to 40V	25	Includes 0.5% accurate current mirror.	Ind	DIP, TO-99, SOIC

NOTE: (1) Ind = -25°C to +85°C.

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INSTRUMENTATION DIGITAL-TO-ANALOG CONVERTERS								Boldface = NEW
Description	Model	Resolution (Bits)	Linearity Error (%FSR)	Settling Time (μs)	Output Range	Temp Range ⁽¹⁾	Pkg ⁽²⁾	Q, BI ⁽³⁾ Screen
Very High Resolution	DAC729	18	±0.00075	5	±1mA, -2mA; +5V, +10V, ±5V, ±10V	Com	DDIP	BI
General Purpose	DAC700	16	±0.0015	1	-2mA	Com, Ind, Mil	DDIP	Q, BI
	DAC701	16	±0.0015	8	10V	Com, Ind, Mil	DDIP	Q, BI
	DAC702	16	±0.0015	1	±1mA	Com, Ind, Mil	DDIP	Q, BI
	DAC703	16	±0.0015	8	±10V	Com, Ind, Mil	DDIP, SO	Q, BI
Lowest Cost	DAC1600	16	±0.0015	8 typ	±10V	Com	DDIP	—
Low DLE	DAC710	16	±0.015	8 typ	±1mA	Com	DDIP	—
Around Zero	DAC711	16	±0.015	8 typ	±10V	Com	DDIP	—
Bus Interface:								
16-Bit Parallel	DAC707	16	±0.003	8	±10V	Com, Ind, Mil	DDIP	Q, BI
Serial/8-bit Parallel	DAC708	16	±0.003	1	±1mA, -2mA	Com, Ind, Mil	DDIP	Q, BI
Serial/8-bit Parallel	DAC709	16	±0.003	8	±5V, ±10V, +10V	Com, Ind, Mil	DDIP	Q, BI
Dual, Ser./8-bit Par.	DAC725	16	±0.003	8	±10V	Com, Ind, Mil	DDIP	BI
Industry Standard, General Purpose	DAC70BH	16	±0.003	1	±1mA, -2mA	Ind	DDIP	BI
	DAC71	16	±0.003	8	±1mA, -2mA; +10V, ±10V	Com	DDIP	BI
	DAC72BH	16	±0.003	1		Ind	DDIP	BI
Industry Standard Ind. Std. w/Latch	DAC7541A	12	±0.012	1	0 to 1mA	Com, Ind, Mil	DDIP, SO	Q, BI
	DAC7545	12	±0.012	2	0 to 1mA	Com, Ind, Mil	DDIP, SO	BI
Dual w/Bus Interface:								
Serial Input	DAC7800	12	±0.012	0.8	0 to 1mA	Com	DIP, SO	—
8-bit Port Interface	DAC7801	12	±0.012	0.8	0 to 1mA	Com	DIP, SO	—
12-bit Port Interface	DAC7802	12	±0.012	0.8	0 to 1mA	Com	DIP, SO	—
Flexible Bus Interface:								
Industry Standard Pinout	DAC667	12	±0.006	4	±2.5V, ±5V, ±10V +5V, +10V	Com, Ind, Mil	DDIP, SO	—
	DAC811	12	±0.006	4	±5V, ±10V, +10V	Com, Ind, Mil	DDIP, SO	BI
Small, Low Cost	DAC813	12	±0.006	4	±5V, ±10V, +10V	Com, Ind, Mil	DIP, SO	—
Lowest Cost	DAC1201	12	±0.018	4 typ	±5V, ±10V, +10V	Com	DDIP	—
Industry Standard General Purpose	DAC80	12	±0.012	0.3, ±1mA, -2mA; +5V, 3 typ +10V, ±5V, ±10V		Com	DDIP	BI
	DAC85H	12	±0.012	"	"	Ind	DDIP	Q, BI
	DAC87H	12	±0.012	"	"	Mil	DDIP	Q, BI

NOTES: (1) Temperature Range: Com = 0°C to +70°C, Ind = (-25°C to +85°C) or (-40°C to +85°C), Mil = -55°C to +125°C. (2) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, SO = small outline surface mount. (3) Q indicates that optional reliability screening is available for the model. BI indicates that an optional 160 hour burn-in is available for the model.

For Product Assistance, Call Toll-Free 1-800-548-6132

AUDIO AND COMMUNICATIONS DIGITAL-TO-ANALOG CONVERTERS
Boldface = NEW

Model	Resolution (Bits)	Max THD + N (V _{OUT} = FS)	Output Range	Input Format	Power Supply (V)	Package ⁽¹⁾	Power Dissipation (mW)
PCM53	16	-88dB (JP) -92dB (KP)	±10V, ±1mA	Parallel	±15, +5	DDIP	600
PCM54	16	-82dB (HP) -88dB (JP) -92dB (KP)	±3V, ±1mA	Parallel	±5 to ±12	DDIP	300
PCM55	16	-82dB (HP) -88dB (JP)	±3V, ±1mA	Parallel	±5	SO	125
PCM56	16	-82dB (P) -88dB (P-J) -92dB (P-K)	±3V, ±1mA	Serial Latched	±5 to ±12	DIP	260
PCM60	16	-82dB (P) -88dB (P-J)	2.8Vp-p, 2-Channel	Serial Latched	+5	SO	50
PCM66	16	-82dB (P)	2.8Vp-p, 2-Channel	Serial Latched	+5	SO	50
PCM1700	18	-82dB (P) -88dB (P-J) -92dB (P-K)	±3V, ±0.67mA	Serial Latched	±5	DDIP SO	380
PCM58	18	-92dB (P) -94dB (P-J) -96dB (P-K)	±1mA	Serial Latched	+5, -12	DDIP	400
PCM61	18	-82dB (P) -88dB (P-J) -92dB (P-K)	±3V, ±1mA	Serial Latched	±5 to ±12	DDIP	200
PCM63	20	-88dB (P) -88dB (P-J) -96dB (P-K)	±2mA	Latched	±5	DDIP	200
PCM64	18	-96dB	±1mA	Parallel	+5, -15	DIP	400

NOTES: (1) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, SO = small outline surface mount.

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DIGITAL SIGNAL PROCESSING DIGITAL-TO-ANALOG CONVERTERS
Boldface = NEW

Model	Resolution (Bits)	Linearity Error (%FSR)	Settling Time (ns)	Output Range	Signal-to-Noise + Distortion Ratio (dB)	Total Harmonic Distortion (dB)	Temp Range ⁽¹⁾	Pkg ⁽²⁾
DSP-Compatible Digital Interface (Single—DSP201, Dual—DSP202):								
DSP201	18	±0.006	—	±3V	86 , $f_{OUT} = 2\text{kHz}$	-90	Ind	DDIP
DSP202	18	±0.006	—	±3V	86 , $f_{OUT} = 2\text{kHz}$	-90	Ind	DDIP
Ultra-fast Settling, ECL Input:								
DAC65	12	±0.012	40	±1.2V, ±6.35mA	70, $f_{OUT} = 1\text{MHz}$	-68	Com	DDIP
DAC63	12	±0.012	50	±5mA, 0 to -10mA ±0.5V, 0 to +1.5V with external resistor	—	—	Ind	DDIP
Ultra-Fast Settling, TTL Input:								
DAC812	12	0.012	55	±5mA, 0 to -10mA ±0.5V, 0 to -1.5V with external resistor	—	—	Ind	DDIP

NOTES: (1) Com = 0°C to +70°C, Ind = (-25°C to +85°C) or (-40°C to +85°C). (2) DDIP = 0.6" wide DIP.

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ANALOG MULTIPLEXERS
Boldface = NEW

Description	Model	Channels	Input Range (V)	On Resistance max (Ω)	Settling Time (to 0.01%)	Temp Range ⁽¹⁾	Pkg ⁽²⁾
Protected Inputs	HI3-0506A-5	16-channel single ended	±15	1.8k	3.5μs	Com	28-p PDIP
	HI1-0506A-5	16-channel single ended	±15	1.8k	3.5μs	Com	28-p CDIP
	HI1-0506A-2	16-channel single ended	±15	1.5k	3.5μs	Mil	28-p CDIP
	HI3-0507A-5	8-channel differential	±15	1.8k	3.5μs	Com	28-p PDIP
	HI1-0507A-5	8-channel differential	±15	1.8k	3.5μs	Com	28-p CDIP
	HI1-0507A-2	8-channel differential	±15	1.5k	3.5μs	Mil	28-p CDIP
	HI3-0508A-5	8-channel single ended	±15	1.8k	3.5μs	Com	16-p PDIP
	HI1-0508A-5	8-channel single ended	±15	1.8k	3.5μs	Com	16-p CDIP
	HI1-0508A-2	8-channel single ended	±15	1.5k	3.5μs	Mil	16-p CDIP
	HI3-0509A-5	4-channel differential	±15	1.8k	3.5μs	Com	16-p PDIP
	HI1-0509A-5	4-channel differential	±15	1.8k	3.5μs	Com	16-p CDIP
High Speed	MPC800KG	16 single or 8 differential	±15	750	800ns	Com	CDIP
	MPC800SG	16 single or 8 differential	±15	750	800ns	Mil	CDIP
	MPC801KG	8 single or 4 differential	±15	750	800ns	Com	CDIP
	MPC801SG	8 single or 4 differential	±15	750	800ns	Mil	CDIP

NOTES: (1) Temperature range: Com = 0°C to +70°C, Mil = -55°C to +125°C. (2) CDIP = ceramic DIP, PDIP = plastic DIP.

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SAMPLE/HOLD AMPLIFIERS

Description	Model	Gain Error (%)	Offset Error (mV)	Charge Offset (mV)	Acq Time (μ s max)	Droop Rate (μ V/ms)	Temp Range ⁽¹⁾	Pkg ⁽²⁾	Q, BI ⁽³⁾ Screen
Fast, High Accuracy	SHC76	± 0.02	± 3	± 6 typ	3	1	Ind, Com, Mil	HMD	—
Fast, Industry Std	SHC85	± 0.01	± 2	± 2 max	4.5	125	Com, Mil	HMD	Q
Low Cost, Fast Industry Std	SHC5320	NA	± 0.5	± 1 typ	1.5	0.5	Com, Mil	HCD	BI
Lowest Cost Industry Std	SHC298	± 0.01	± 7	± 25 max	10	100	Com, Ind	PDIP, MC, SOIC	BI

HIGH-SPEED SAMPLE/HOLD AMPLIFIERS

Description	Model	Gain Error (%)	Offset Error (mV)	Lin Error (%FSR max)	Ampl BW -3dB (MHz)	Acq Time (μ s max)	Droop Rate (μ V/ μ s)	Temp Range ⁽¹⁾	Input Range (Vp-p)	Pkg ⁽²⁾	Q ⁽³⁾ Screen
High Speed With Buffer	SHC803	± 0.1	± 3	± 0.005	16	0.35	± 5	Ind	20	HDIP	Q
High Speed	SHC804	± 0.1	± 3	± 0.005	16	0.35	± 5	Ind	20	HDIP	Q
Ultra-High Speed	SHC600	± 0.1	± 5	± 0.01	70	0.05	± 180	Ind	2.5	CDIP	Q
	SHC601	± 2	± 50	± 0.02	100	0.022	± 100	Ind	2.5	CDIP	Q
Very High Accuracy, Fast	SHC702	± 0.1	± 3	± 0.003 typ	3	0.8	± 2	Ind	20	24-p DIP	—

NOTES: (1) Temperature range: Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (2) MC = metal can, PDIP = plastic DIP, HCD = hermetic ceramic DIP, CD = ceramic DIP, HMD = hermetic metal DIP, SOIC = surface-mount package. (3) Q indicates optional reliability screening is available for this model. BI indicates that an optional 160-hour burn-in is available for the model.

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INSTRUMENTATION ANALOG-TO-DIGITAL CONVERTERS
Boldface = NEW

Description	Model	Resolution (Bits)	Linearity Error (%FSR)	Input Range (V) ⁽¹⁾	Conversion Time or Sampling Rate (μs)	NMC Resolution	Temp Range ⁽²⁾	Pkg ⁽³⁾	Q, BI ⁽⁴⁾ Screen
Data-Bus Interface	ADC700	16	±0.003	5, 10, 20 U/B	17	14	Mil, Ind, Com	TDIP	—
Industry Std Pinouts	ADC71	16	±0.003	5, 10, 20 U/B	50	14	Ind, Com	TDIP	—
	ADC76	16	±0.003	5, 10, 20 U/B	17	14	Ind, Com	TDIP	—
Sampling 574 Type	ADS574	12	±0.012	10, 20, U/B	40kHz	12	Ind	DIP, DDIP, SO	—
Sampling 774 Type	ADS774	12	±0.012	10, 20, U/B	100kHz	12	Ind	DIP, DDIP, SO	—
Sampling, Interface	ADS7800	12	±0.012	10, 20, B	333kHz	12	Com, Ind	DIP, SO	—
High-Accuracy, 4-Channel, Auto-Calibration, Sampling	ADC7802	12	±0.012	0 to +5	8.5	12	Ind	DDIP, PLCC	—
Industry Std Pinout and Interface	ADC574A	12	±0.012	10, 20 U/B	25	12	Mil, Ind, Com	DDIP, PLCC	BI
	ADC674A	12	±0.012	10, 20 U/B	15	12	Mil, Ind, Com	DDIP	BI
	ADC774	12	±0.012	10, 20 U/B	8	12	Mil, Ind, Com	DDIP, PLCC	BI
Sampling Sampling	ADS807	12	±0.012	10, 20 U/B	100kHz	12	Mil, Ind, Com	DDIP	BI
	ADS808	12	±0.012	10, 20 U/B	100kHz	12	Mil, Ind, Com	DDIP	BI
Medium Speed Monolithic	ADC80AG	12	±0.012	5, 10, 20 U/B	25	12	Ind	TDIP	BI
	ADC80MAH	12	±0.012	5, 10, 20 U/B	25	12	Ind	TDIP	BI
Medium Speed	ADC84KG	12	±0.012	5, 10, 20 U/B	10	12	Ind	TDIP	BI
	ADC85H	12	±0.012	5, 10, 20 U/B	10	12	Com	TDIP	Q, BI
Mil Temperature Range	ADC87H	12	±0.012	5, 10, 20 U/B	10	12	Mil	TDIP	Q
Serial Output	ADC804	12	±0.012	5, 10, 20 U/B	17	12	Mil, Ind, Com	DDIP	Q, BI

NOTES: (1) U/B indicates the input voltage range for the model: U = unipolar, B = bipolar. (2) Com = 0°C to +70°C, Ind = -25°C to +85°C, Mil = -55°C to +125°C. (3) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, TDIP = 0.9" wide DIP, PLCC = plastic leaded chip carrier, SO = small outline surface mount. (4) Q indicates optional reliability screening is available for this model. BI indicates that an optional 160-hour burn-in is available for this model.

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AUDIO, COMMUNICATIONS, DSP ANALOG-TO-DIGITAL CONVERTERS **Boldface = NEW**

Description	Model	Resolution (Bits)	Linearity Error, max (%FSR)	Input Range (V)	Conversion Time or Sampling Rate (μ s)	THD (dB, typ)	Temp Range ⁽¹⁾	Pkg ⁽²⁾	Q ⁽³⁾ Screen
High Accuracy, High Resolution	ADC701	16	± 0.003	10V/20V	1.5	94w/SHC702	Com	TDIP	—
Sampling, High Resolution	ADC614	14	± 0.003	± 1.25	5MHz	76	Com	DIP	—
	ADC603	12	± 0.018	± 1.25	10MHz	68	Com, Mil	DIP	—
High Spurious-Free Range	ADC604	12	± 0.024	± 1.25	5MHz	83	Com	DIP	—
	ADC803	12	± 0.012	10V/20V	1.5	NA	Ind, Mil	TDIP	—
	ADC601	12	± 0.012	10V/20V	1.0	70w/SHC802	Com	TDIP	—
Sampling	ADS602	12	± 0.03	10V/20V	1MHz	66	Com	TDIP	—

Description	Model	Resolution (Bits)	Typical Linearity Error	Input Range (V)	Conversion Time or Sampling Rate (μ s)	THD + N ($V_m = \pm FS$) (dB, max)	Output Format	Pkg ⁽¹⁾
High Performance	PCM75	16	15-Bit 14-Bit	$\pm 2.5, \pm 5$ $\pm 10V$	17	-84 (J) -88 (K)	Parallel or Serial	TDIP
Low Cost	PCM78	16	14-Bit	± 3	5	-88	Serial	DDIP
Dual	PCM1750	18	14-Bit	± 2.75	5	-90 (P)	Serial	DDIP
Single Channel	DSP101	18	14-Bit	± 2.75	5	-90	Serial	DDIP
Dual Channel	DSP102	18	14-Bit	± 2.75	5	-90	Serial	DDIP

NOTES: (1) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, TDIP = 0.9" wide DIP, PLCC = plastic leaded chip carrier, SO = small outline surface mount.

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VOLTAGE-TO-FREQUENCY CONVERTERS
Boldface = NEW

Description	Model	Frequency Range (kHz)	V _{IN} Range (V)	Linearity, max (% of FSR)	Tempco, max (ppm of FSR/°C)	Temp Range ⁽¹⁾	Pkg
Low-Cost Monolithic	VFC32P, U VFC32M, L	User-selected 500kHz, max	User-selected	±0.01 at 10kHz ±0.05 at 100kHz	75 typ ±100	Com Ind	DIP, SOIC TO-100, LCC
Low-Cost Complete	VFC42 VFC52	0 to 10 0 to 100	0 to +10 0 to +10	±0.01 ±0.05	±100 ±150	Ind Ind	DIP DIP
Precision Monolithic	VFC62 VFC320	User-selected	User-selected 1MHz max	±0.002 at 10kHz ±0.002 at 10kHz	±20 ±20	Ind Ind	DIP TO-100, LCC
Synchronized Monolithic	VFC100G VFC101N	Clock Programmed 2MHz max, Clock Programmed, 2MHz max	0 to +10 0 to +10,	0.1 at 1MHz ±0.02 at 100kHz	±50 ±40	Ind Ind	DIP PLCC
High-Performance	VFC110	User-selected 4MHz max	0 to +10	±0.05 at 1MHz	±50	Ind	DIP, LCC
Single Supply, Low Power	VFC121	User-selected 1.5MHz max	User selected	±0.03 at 100kHz	±40	Ind	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = -25°C to +85°C.

DIGITAL SIGNAL PROCESSING COMPONENTS
ANALOG DSP COMPONENTS AND TEST SYSTEMS
Boldface = NEW

Function	Model	Description	Sample Rate	Resolution	Package
Analog-to-Digital Converters	DSP101	Low-cost, high resolution A-to-D with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	200kHz	16/18 bits	28-pin DIP
	DSP102	Two-channel, low-cost, high resolution A-to-D with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	200kHz	16/18 bits	28-pin DIP
Digital-to-Analog Converters	DSP201	Low-cost, high resolution D-to-A with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	500kHz	16/18 bits	28-pin DIP
	DSP202	Two-channel, low-cost, high resolution D-to-A with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	500kHz	16/18 bits	28-pin DIP
Analogue Input DSP	DSP-SYS603	Complete test system including A-to-D box, digital buffer, DSP processor, and software, designed to run on a PC.	10MHz	12 bits	Hardware and Software
Text Systems	DSP-SYS701	Complete test system including A-to-D box, digital buffer if required, DSP processor, and software, designed to run on a PC.	500kHz	16 bits	Hardware and Software

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DSP PROCESSOR BOARDS

Model	Processor	Quantity	Speed (ns)	SRAM (KB)	Board Form	1024-FFT Execution Time (ms)	FIR Filter Tap Execution Time (ns)	IIR B-Quad Filter Execution Time (μs)
ZPB32	AT&T DSP32	1	250	64	PC	8.9	250	1.25
ZPB32-HS	AT&T DSP32	1	160	64	PC	5.7	160	0.8
ZPB34-001	AT&T DSP32C	1	80	64	PC/AT	3.2	80	0.4
ZPB34-002	AT&T DSP32C	1	80	192	PC/AT	3.2	80	0.4
ZPB34-003	AT&T DSP32C	1	80	320	PC/AT	3.2	80	0.4
ZPB34-004	AT&T DSP32C	1	80	576	PC/AT	3.2	80	0.4
ZPB3201	AT&T DSP32	1	160	64	VME 6U	5.7	160	0.8
ZPB3202	AT&T DSP32	2	160	128	VME 6U	5.7	160	0.8
ZPB3211	AT&T DSP32C	1	80	64	VME 6U	3.2	80	0.4
ZPB3212	AT&T DSP32C	2	80	128	VME 6U	3.2	80	0.4

DSP ANALOG I/O SYSTEMS

Model	Form	Analog Input Channels	Analog Output Channels	Number of Bits	Max Conversion Rate	Anti-Aliasing Filter	Smoothing Filter	On-Board Sample Rate Generator
ZPB100	PC Board	1	1	16	8kHz	300Hz-3kHz	0Hz-3kHz	8kHz
ZPB1100	PC Board	1	1	16	150kHz	User Specified	—	75Hz-150kHz
ZPB2100	PC Board	1	1	16	150kHz	—	User-Specified	—
ZPD1001	External Box	1 or 2	1 or 2	16	150kHz	—	—	4.8kHz-150kHz
ZPD1002	External Box	1 or 2	1 or 2	12	10MHz	—	—	—
ZPB1003	External Box	1	1	16	500kHz	—	—	—

DOS-BASED DSP SOFTWARE

Model	Function
ZPA1000	Emulates (3) test instruments for signal analysis: oscilloscope, spectrum and histogram analyzers.
ZPM50-001 (DSPlay)	DSP algorithm development/simulation.
ZPM32 (DSPlay XL)	DSP algorithm development/code generation for DSP32/DSP32C
ZPO32	AT&T DSP32/32C assembler.
ZPO33	AT&T DSP32-CC "C" compiler.
ZPOFDAS1/DAS2	Momentum Data's filter design.

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- ✓ Founded in 1956.
- ✓ Corporate headquarters: Tucson, Arizona, USA.
- ✓ 1500 employees.
- ✓ Manufacturing and technical facilities: Tucson; Livingston, Scotland; Atsugi, Japan.
- ✓ Sales and distribution subsidiaries in Austria, Belgium, England, France, Germany, Italy, Japan, the Netherlands, Sweden, and Switzerland; 19 international sales representative organizations worldwide.
- ✓ Superior customer service from more than 300 sales and service staff worldwide.
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INTEGRATED CIRCUITS DATA BOOK, Vol. 33 (1/89) — Comprehensive compilation of PDSs featuring product descriptions, applications information, technical specifications, performance graphs, and selection guide tables for Burr-Brown's broad line of high performance, high quality linear products. Free upon request.

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SEMICONDUCTOR

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PRODUCT SELECTION GUIDE

SERIAL EPROMS								
Device	Temp Range	Compatibility	Size (Organization)	Icc (Max/Standby)	Max Clock Freq.	# Pins	Pkg Types	Availability
CAT93C46A	C	National 9346	1K Bit (64x16)	3mA/100µA 4mA/100µA	700KHz	8	P,K	NOW
CAT93C46	C	National 9346	1K Bit (x8 or x16)	3mA/100µA 4mA/100µA	700KHz	8	P,K,J	NOW
CAT33C101	C, I	National 9346 UPGRADE	1K Bit (x8 or x16)	2mA/50µA	700KHz	8	P,K,J	NOW 3Volt
CAT59C11	C,I	G.I. 5911	1K Bit (x8 or x16)	5mA/100µA	250KHz	8	P,K	NOW
CAT33C201	C, I	G.I. 5911 UPGRADE	1K Bit (x8 or x16)	2mA/50µA	700KHz	8	P,K	NOW 3Volt
CAT93C56	C	National 93C56	2K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW
CAT93LC56	C, I	National 93C56 UPGRADE	2K Bit (x8 or x16)	2mA/50µA	250KHz	8	P,K	NOW 3Volt
CAT35C102	C	National 9346 UPGRADE	2K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW
CAT35C202	C	G.I. 5911 UPGRADE	2K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW
CAT24C02	C,I	Xicor	2K Bit	3mA/40µA	100KHz	8 8	P J	4Q90
CAT24LC02	C,I	Xicor	2K Bit	3mA/50µA	100KHz	8 8	P J	4Q90 3-6Volt
CAT33C104	C,I	National 93C66 UPGRADE	4K Bit (x8 or x16)	2mA/50µA	250KHz	8	P,K	NOW 3Volt
CAT35C104	C	National 93C66	4K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW
CAT24C04	C,I	Xicor	4K Bit	3mA/40µA	100KHz	8 14	P J	2Q91
CAT24LC04	C,I	Xicor	4K Bit	3mA/50µA	100KHz	8 14	P J	2Q91 3-6Volt
CAT33C116	C,I	National 9346 UPGRADE	16K Bit (x8 or x16)	2mA/50µA	250KHz	8	P,K	2Q91 3Volt
CAT35C116	C,I	National 9346 UPGRADE	16K Bit (x8 or x16)	3mA/100µA	1MHz	8	P,K	2Q91
CAT24C16	C,I	Xicor	16K Bit	3mA/40µA	100KHz	8 14	P J	2Q91
CAT24LC16	C,I	Xicor	16K Bit	3mA/50µA	100KHz	8 14	P J	2Q91 3-6Volt

*** All Serial E²PROMs offered in High Endurance version ("H"). ***

PARALLEL EPROMS								
Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability	
CAT28C16A	C,I	16K Bit (2Kx8)	200	25mA/100µA	24	P	NOW	
CAT28C16V3	C,I	16K Bit (2Kx8)	700	10mA/50µA	24 32	K N	NOW 3Volt	
CAT28C17A	C,I	16K Bit (2Kx8)	200	25mA/100µA	28 32	P,K N	NOW	
CAT28C64A	C,I	64K Bit (8Kx8)	150/200/250	30mA/100µA	28 32	P,D,J N	NOW	
CAT28C65A	C,I	64K Bit (8Kx8)	150/200/250	30mA/100µA	28 32	P,D,J N	NOW	
CAT28C256	C,I,M	256K Bit (32Kx8)	200/250/300	60mA/100µA	28 32	P,D N	4Q90 1Q91	

FLASH MEMORIES								
Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability	
CAT28F010	C	1M Bit (128Kx8)	120/150/200	30mA/100µA	32	P,N	4Q90	
CAT28F512	C	512K Bit (64Kx8)	200/250	50mA/500µA	32	P,N	1Q91	
CAT28F512V5	C	512K Bit (64Kx8)	200/250	80mA/500µA	32	P,N	1Q91	

Catalyst Semiconductor

EPROMS								
Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability	
CAT27HC256	C	256K Bit (32Kx8)	55/70/90/120	60mA/40mA	28	P (OTP) D	NOW	
	I,M		70/90/120	80mA/45mA				
CAT27HC256L	C	256K Bit (32Kx8)	70/90/120	60mA/500µA	32	E		
	I,M		70/90/120	80mA/1mA				
CAT27HC010	C	1M Bit (128Kx8)	70/90/120	60mA/500µA	32	D N(OTP)	4Q90	
	I,M		70/90/120	80mA/1mA				
CAT27C210	C	1M Bit (64Kx16)	150/170/200/250	50mA/100µA	40	D,P (OTP) N (OTP)	NOW	
	I,M		170/200/250	60mA/100µA				

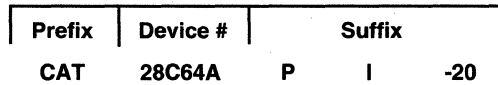
STATIC RAMS							
Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability
CAT71C256L-85	C,I	256K Bit (32Kx8)	85	80mA/100µA	28	P,K	NOW

NVRAMS								
Device	Temp Range	Compatibility	Size (Organization)	Icc (Max/Standby)	Access Time (ns)	# Pins	Pkg Types	Availability
CAT22C10	C,I	Xicor	256 Bit (64x4)	40mA/30µA	200/300	18 20	P J	NOW
								4Q90
CAT22C12	C,I	Xicor	1K Bit (256x4)	50mA/30µA	200/300	18	P	NOW
CAT24C44	C,I	Xicor	256 Bit (16x16) Serial	20mA/30µA	1MHz	8 8	P J	NOW
								4Q90

SECURE ACCESS SERIAL EPROMS								
Device	Protocol	Size (Organization)	Temp Range	Icc (Max/Standby)	Max Clock Freq.	# Pins	Pkg Types	Availability
CAT33C704	Synchronous	4K Bit (x8 or x16)	C,I	3mA/200µA	1 MHz	8	C.O.B	NOW
CAT35C704			C,I	3mA/200µA	3 MHz			3Volt
CAT33C804	UART Compatible		C,I	3mA/200µA	5 MHz	8	P	NOW
CAT35C804			C,I	3mA/200µA	5 MHz	16	J	NOW

ANALOG PRODUCTS								
Device	Temp Range	Function	Resolution	Accuracy	I _{AA}	# Pins	Pkg Types	Availability
CAT104	C	D/A	12 Bits	+/- 1/2 LSB	75mA	24	C	1Q91
CAT105	C	D/A	12 Bits	+/- 1 LSB				
CAT5412	C,I,M	A/D	12 Bits	+/- 2 LSB	90mA	40	C	2Q91
				+/- 1/2 LSB				

ORDERING INFORMATION



Device Part Number may be followed by:

- A = Advanced Device or Special Assembly
- H = High Endurance *
- L = Low Power Device
- V = Special Voltage

Package

- C.O.B.= Chip on Board
- C = Sidebraze
- D = CERDIP
- E = LCC
- J = S.O. (JEDEC)
- K = S.O (EIAJ)
- N = PLCC
- P = Plastic DIP

Temperature Range

- Blank = Commercial (0°C to 70°C)
- I = Industrial (-40°C to 85°C)
- M = Military (-55°C to 125°C)

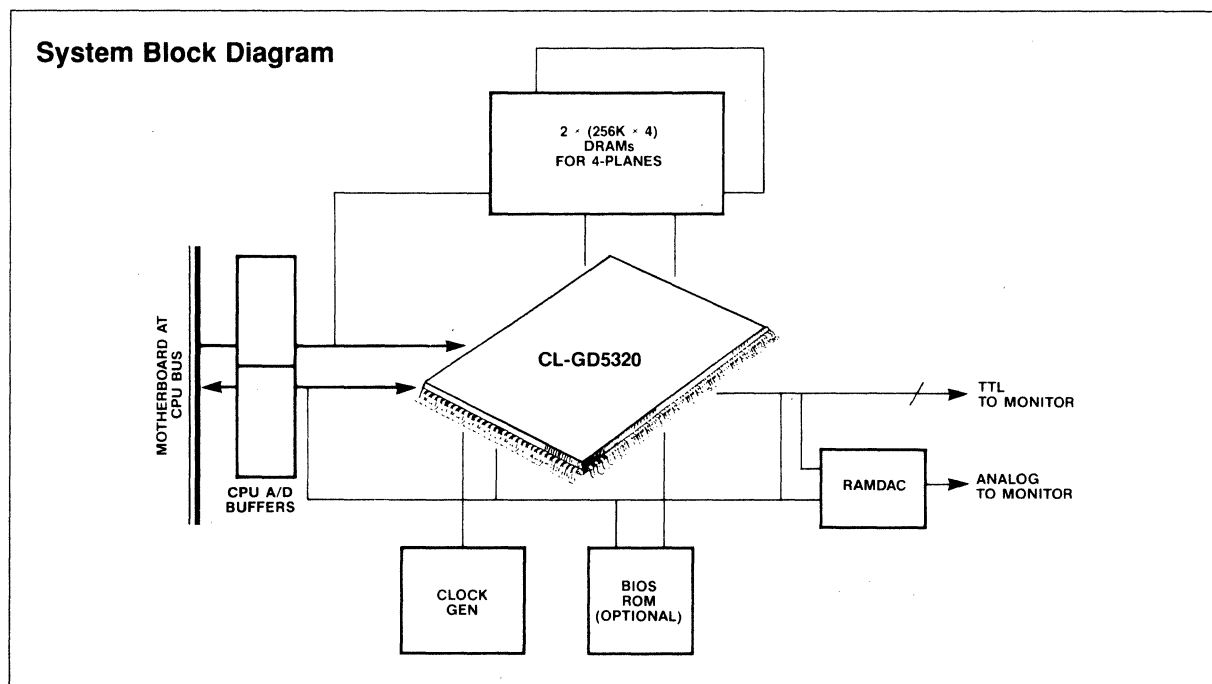
Speed or Program Number (if applicable)

Device used in the example above is a CAT28C64API-20 (Plastic DIP, Industrial temp., 200ns access time).
 * High Endurance Device: minimum 100,000 write/erase cycles and 100 year data retention.

FOR INFORMATION ON OTHER MILITARY TEMPERATURE DEVICES, please contact the factory.

FEATURES

- 100-pin QFP single-chip VGA™
- Two 256K x 4 DRAM interface
- Motherboard VGA solution with only seven ICs
- Equivalent interleave ratio of 1:2.5
- 100% hardware-register and BIOS-compatible with VGA, EGA™, CGA™, MDA™ and Hercules® HGC™
- Fully compatible motherboard VGA solution for IBM® PS/2™ Model 30
- Auto Monitor/Bus Width detection support
- 8/16-bit CPU interface
- Support for high-resolution, variable frequency and PS/2 analog monitors
- Support for high-resolution, graphics and alphanumeric display modes on both monochrome and color monitors
- Page mode access to DRAMs
- Enhanced split-screen capability
- Four pages of memory for mode 13h (320 x 200 resolution mode)
- Low-power CMOS technology
- No external PALs required
- Multiple FIFO sequencer design
- CPU to video memory Read/Write cache
- 800 x 600 x 16 resolution — VESA-compatible
- 132-column support for multi-frequency monitors
- Independent video and DRAM timing
- 36-MHz dot clock
- Hardware graphics cursor
- Text cursor controls include blink disable and replace/invert
- Supports simultaneous, independent scrolling of two separate text screens
- Flexible vertical interrupt mechanism
- Video outputs
 - 4 bits per pixel, all resolutions
 - 8 bits per pixel, 320 x 200, 320 x 240, 360 x 480
- Read-back capability of all registers



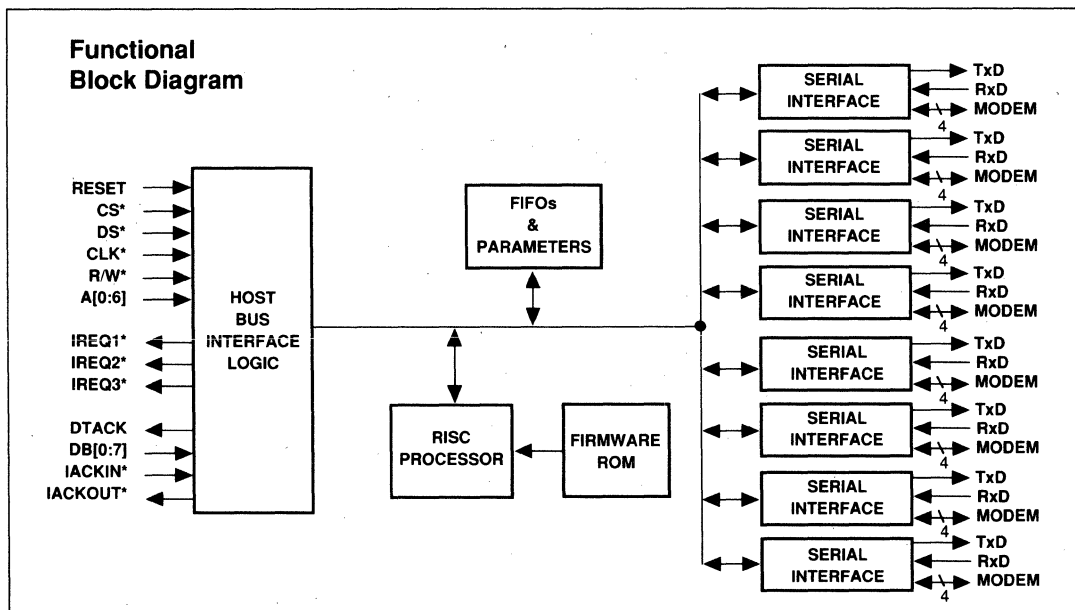
FEATURES

- 8 full-duplex asynchronous channels
- Baud rates to 38.4K baud per transmitter and receiver
- On-chip scanner for handling channel interrupts
- 24-bytes of FIFO for each channel consisting of:
 - 8-byte transmit FIFO
 - 8-byte receive FIFO with programmable threshold
 - 8-byte status FIFO
- Improved interrupt schemes:
 - Vectored interrupts to allow direct jump into proper service routines
 - *Good Data interrupts* to eliminate the need for status checks
 - *Fair Share interrupts* to ensure equal service for all channels
 - External user-defined priorities
- User-programmable and automatic flow control modes
 - In-band (software) via single or double character Xon, Xoff
 - Out-of-band (hardware) via RTS/CTS, DTR/DSR
- Special character recognition and generation
- Line break detection and generation
- Cascadable to multiple CL-CD180s using Fair Share daisy chain scheme
- Insertion of transmit delays in data stream
- Baud rate selection via loading a divisor
- One timer per channel for receive data interrupt generation
- Ability to transmit and receive independently at different baud rates
- Local and remote maintenance loopback modes
- 4 modem control signals per channel — DTR/CD, DSR, RTS, CTS
- Selectable 68000 and 80X86 bus interfaces
- 5- to 8-bit character plus optional parity
- Odd, even, no parity or forced parity
- 1, 1 1/2, and 2 stop bits
- System clock of up to 10 MHz
- S/LA design technology
- Packaged in an 84-pin PLCC
- Advanced low-power CMOS process technology

Application Areas:

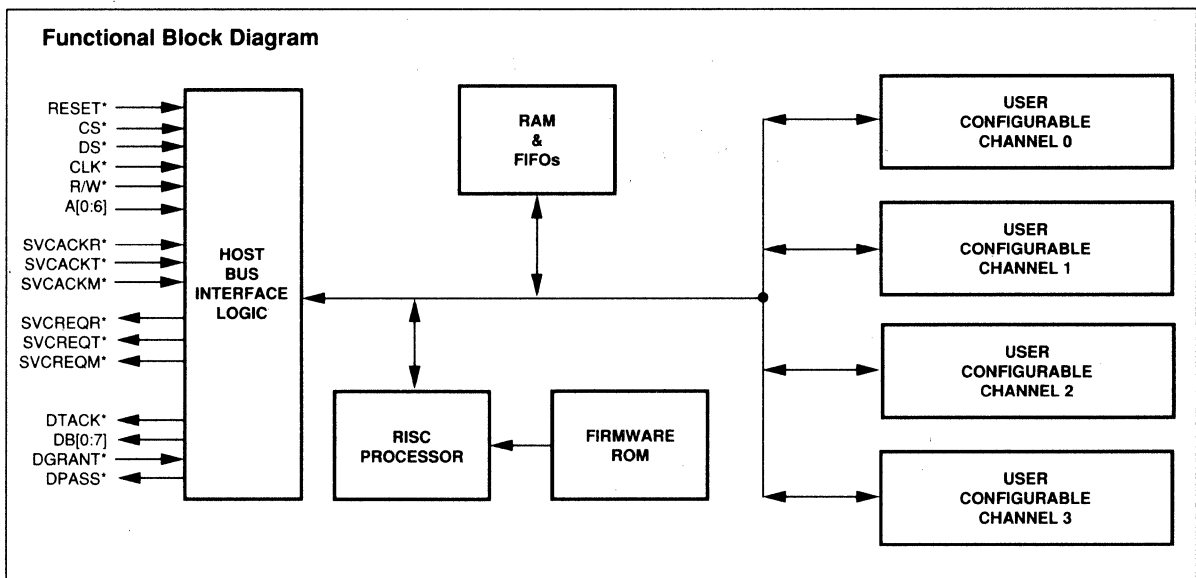
- Communications Processors
- Terminal Servers
- Protocol Converters/Pads
- Statistical/T1 Mux
- Data Concentrators
- Cluster Controllers

Cirrus Logic



FEATURES

- Multiple user-selectable I/O modes
 - All the I/O pins are general-purpose serial or parallel; I/O lines accessible by the host system or the CPU
 - User-configurable examples:
 - Workstation — Example 1*
One serial or bi-directional parallel channel (for printer or scanner), two serial channels (for mouse and keyboard), one serial channel with full modem control
 - Parallel-serial — Example 2*
Bi-directional parallel channel, three serial channels with modem control
 - General-serial — Example 3*
General-purpose I/O channel, four serial channels with modem control
 - Quad-serial — Example 4*
Four serial channels with modem control
- Bit rates up to 115.2 kbps for each transmitter and receiver
- Independent bit rate selection for transmit and receive on each of four channels
- 12 bytes of transmit FIFO and 12 bytes of receive FIFO with programmable receive FIFO threshold; 30 bytes of FIFO for the parallel channel (input or output)
- Flexible host interface, may be interrupt-driven or polled
- Works with 80X86, 680X0, and RISC-type processors
 - Vectored interrupts to allow direct jump into proper service routine
 - *Good Data* interrupts to eliminate the need for status check
 - External user-defined priorities
 - Internal fixed priorities
- Character processing option for UNIX:
 - Auto Expansion of NL to CR-NL
 - LNEXT supported
 - ISTRIP supported
 - Receive exception errors may be:
 - Removed
 - Passed-on as good data
 - Replaced with 00-hex
 - Proceed with FF-hex 00-hex
 - Sending N <SPACE>'s using embedded transmit command
- Packaged in 68-pin PLCC
- User-programmable and automatic flow control modes
 - In-band (software) via XON-XOFF
 - Out-of-band (hardware) via RTS/CTS, DTR/DSR
- Line break detection and generation



FEATURES

- Four full-duplex channels
- All channels support Asynchronous, BISYNC, HDLC, and X.21 protocols
- Bit rates to 64-Kbit transmit and receive NRZ, NRZI, and Manchester data encoding supported
- Digital phase locked loop on each receiver
- Independent bit rate generators for transmit and receive
- Clock sources can be internal or external
- Transmit clock source can be receive DPLL output
- Full on-chip DMA controller
- Data transfer by DMA or Interrupt mechanism selectable per channel per direction
- Vectored interrupts with *Fair Share* mechanism for cascading
- CRC generation and validation
- 32 bytes of data FIFO per channel (16-byte transmit FIFO, plus 16-byte receive FIFO)
- 5 clock/modem control signals per channel on CL-CD2400
- 8 clock/modem control signals per channel on CL-CD2401

Cirrus Logic

Asynchronous

- DMA managed intelligently to minimize Host interaction
 - Transmit block mode buffer
 - Transmit append buffer
 - Receive buffer adjustments for exceptions
 - Receive timeout interrupts

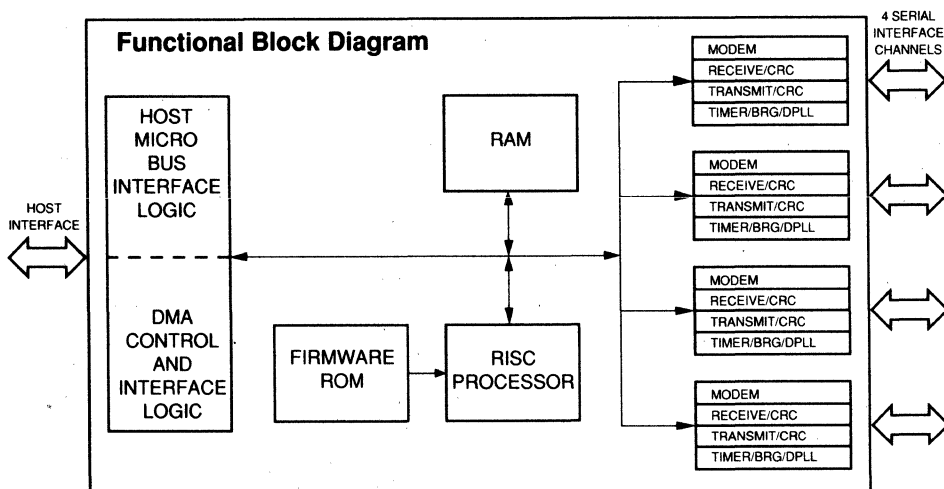
- Receive good data separated from exceptions
- In-band flow control via programmable characters
- Out-of-band flow control
- Line break detection and generation
- Special character recognition and transmission
- Receive and transmit timer supported

Bisync

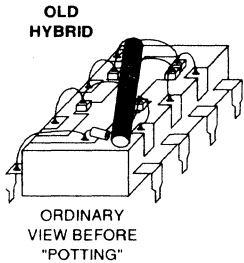
- Programmable for ASCII or EBCDIC encoding
- Recognition of all special characters enabling
 - Block separation
 - CRC generation/validation without user intervention
- Chaining of long receive blocks into multiple buffers
- Unchaining of multiple buffers into long transmit blocks
- Two general timers per channel
- Supports transparent bisync

HDLC

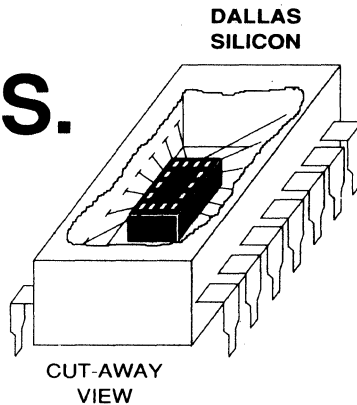
- Address matching of either 2 x 16-bit addresses or 4 x 8-bit addresses
- Idle-in flag or mark
- CRC generation and validation
- Chaining of a long receive frame into multiple buffers
- Unchaining of multiple buffers into a long transmit frame
- Option to send PAD characters before starting flags
- Two general timers per channel



Five Years' Experience Making Silicon Delay Lines



VS.



- All-silicon time delays
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- TTL/CMOS-compatible
- Vapor phase, IR and wave solderability
- Custom delays available
- Quick turn prototypes available

LASER-WRITTEN PRODUCT FAMILIES

DS1000 Pin 5-Tap Silicon Delay Line	14-Pin DIP 14-Pin DIP Sheared NC 8-Pin DIP 14-Pin GULLWING 8-Pin GULLWING 16-Pin SOIC	DS1000-xxx DS1000K-xxx DS1000M-xxx DS1000G-xxx DS1000H-xxx DS1000S-xxx	xxx = 025 to 500ns xxx = 025 to 500ns xxx = 025 to 500ns xxx = 025 to 500ns xxx = 025 to 500ns xxx = 025 to 500ns
DS10005 5-Tap Silicon Delay Line Voltage Compensated	14-Pin DIP 14-Pin DIP Sheared NC 8-Pin DIP 14-Pin GULLWING 8-Pin GULLWING 16-Pin SOIC	DS1005-xxx DS1005K-xxx DS1005M-xxx DS1005G-xxx DS1005H-xxx DS1005S-xxx	xxx = 060 to 250ns xxx = 060 to 250ns xxx = 060 to 250ns xxx = 060 to 250ns xxx = 060 to 250ns xxx = 060 to 250ns
DS1007 7-in-1 Silicon Delay Line	16-Pin DIP 16-Pin GULLWING 16-Pin SOIC	DS1007-xxx DS1007G-xxx DS1007S-xxx	xxx = 003 to 60ns xxx = 003 to 60ns xxx = 003 to 60ns
DS1010 10-Tap Silicon Delay Line	14-Pin DIP 14-Pin GULLWING 16-Pin SOIC	DS1010-xxx DS1010G-xxx DS1010S-xxx	xxx = 050 to 500ns xxx = 050 to 500ns xxx = 050 to 500ns
DS1012 (preliminary) 2-in-1 Silicon Delay Line with Logic	8-Pin DIP 8-Pin GULLWING 8-Pin 150 mil SOIC	DS1012M-xxx DS1012H-xxx DS1012S-xxx	xxx = 003 to 60ns xxx = 003 to 60ns xxx = 003 to 60ns
DS1013 3-in-1 Silicon Delay Line	14-Pin DIP 8-Pin DIP 14-Pin GULLWING 8-Pin GULLWING 16-Pin GULLWING	DS1013-xxx DS1013M-xxx DS1013G-xxx DS1013H-xxx DS1013S-xxx	xxx = 015 to 150ns xxx = 015 to 150ns xxx = 015 to 150ns xxx = 015 to 150ns xxx = 015 to 150ns
DS1020 (preliminary) 8-Bit Programmable Silicon Delay Line	16-Pin DIP 16-Pin DIP 16-Pin DIP 16-Pin SOIC 16-Pin SOIC 16-Pin SOIC 16-Pin SOIC	DS1020-25 DS1020-50 DS1020-100 DS1020-200 DS1020S-25 DS1020S-50 DS1020S-100 DS1020S-200	0.25ns Steps 0.50ns Steps 1.00ns Steps 2.00ns Steps 0.25ns Steps 0.50ns Steps 1.00ns Steps 2.00ns Steps
Specification temp. 0° to 70°C ■ Operating temp. -40°C to +85°C ■ Storage temp. -55°C to +125°C ■ Soldering temp. 260°C for 10 seconds			

Dallas Semiconductor

DALLAS SEMICONDUCTOR

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Dallas Texas, 75244-3292
Telephone 214-450-0448
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SAMPLING A/D CONVERTERS

	Model	Resolution (Bits)	Throughput (MHz)	Linearity Error (Max)	Power Watts (Max)	Case
	ADC-HS12B	12	0.066	±3/4 LSB	1.8	32-Pin DIP
	ADS-111	12	0.500	±3/4 LSB	1.8	24-Pin DIP
	ADS-112	12	1.0	±3/4 LSB	1.7	24-Pin DIP
	ADS-193	12	1.0	±3/4 LSB	1.7	40-Pin DIP
	ADS-21PC	12	1.3	±1 LSB	2.5	46-Pin DIP
	ADS-132	12	2.0	±3/4 LSB	3.2	32-Pin DIP
<i>New</i>	ADS-117	12	2.0	±3/4 LSB	1.8	24-Pin DIP
<i>New</i>	ADS-118	12	5.0	±1 LSB	2.5	24-Pin DIP
	ADS-131	12	5.0	±1 LSB	4.0	40-Pin DIP
	ADS-130	12	10.0	±1 LSB	4.2	40-Pin DIP
<i>Advance</i>	ADS-120	12	20.0	±1 LSB	4.2	40-Pin DIP
	ADS-924	14	0.300	±1 LSB	1.8	24-Pin DIP
	ADS-928	14	0.500	±3/4 LSB	3.4	32-Pin DIP
<i>New</i>	ADS-941	14	1.0	±3/4 LSB	3.3	32-Pin DIP
<i>New</i>	ADS-942	14	2.0	±1 LSB	3.4	32-Pin DIP
<i>Advance</i>	ADS-944	14	5.0	±1 LSB	3.4	32-Pin DIP
<i>Advance</i>	ADS-945	14	10.0	±1 LSB	4.2	40 Pin DIP
<i>Preliminary</i>	ADS-976	16	0.200	±2 LSB	1.8	32-Pin DIP
<i>Preliminary</i>	ADS-930	16	0.500	±1 1/2 LSB	2.4	40-Pin DIP

A/D CONVERTERS

	Model	Resolution (Bits)	Conversion Time (µsec)	Linearity Error	Power (Watts)	Case
	ADC-207	7	0.050	±1/2 LSB	0.25	18-Pin DIP
	ADC-228	8	0.040	±1/2 LSB	1.25	24-Pin DIP
	ADC-208	8	0.050	±3/4 LSB	0.60	24-Pin DIP
	ADC-304	8	0.050	±1/2 LSB	0.39	28-Pin DIP
<i>New</i>	ADC-530	12	0.350	±3/4 LSB	2.10	32-Pin DIP
	ADC-500	12	0.500	±1 LSB	1.70	32-Pin DIP
	ADC-505	12	0.550	±1 LSB	1.70	32-Pin DIP
	ADC-508	12	0.700	±1 LSB	1.70	32-Pin DIP
	ADC-520	12	0.800	±1/2 LSB	1.60	32-Pin DIP
	ADC-521	12	0.800	±1/2 LSB	1.60	32-Pin DIP
	ADC-511	12	1.0	±3/4 LSB	1.25	24-Pin DIP
	ADC-HZ12B	12	8	±1/2 LSB	1.5	32-Pin DIP
	ADC-HX12B	12	20	±1/2 LSB	1.5	32-Pin DIP
	ADC-HC12B	12	300	±1/2 LSB	0.17	32-Pin DIP
	ADC-908	14	1.0	±1/2 LSB	2.70	32-Pin DIP
	ADC-914	14	2.4	±1 LSB	1.20	24-Pin DIP

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D/A CONVERTERS

Model	Resolution (Bits)	Settling Time	Linearity Error	Power (Watts)	Case
DAC-HF8	8	25 ns	±1/2 LSB	0.750	24-Pin DIP
DAC-HF10	10	25 ns	±1/2 LSB	0.900	24-Pin DIP
DAC-HF12	12	50 ns	±1/2 LSB	0.900	24-Pin DIP
DAC-HK12	12	3 µs	±1/2LSB	0.700	24-Pin DIP
DAC-HZ12	12	3 µs	±1/2 LSB	0.390	24-Pin DIP
DAC-HP16	16	15 µs	±0.003% FSR	0.600	24-Pin DIP

HYBRID DATA ACQUISITION SYSTEMS

Model	Resolution (Bits)	Throughput (KHz)	Linearity Error (Max)	Power (Watts Max)	Channels	Case	
HDAS-16	12	50	±3/4 LSB	1.75	16 SE	62-Pin	
HDAS-8	12	50	±3/4 LSB	1.75	8 DE	62-Pin	
HDAS-75	12	75	±3/4 LSB	0.7	8 SE	40-Pin DIP	
HDAS-76	12	75	±3/4 LSB	0.7	4 DE	40-Pin DIP	
HDAS-534	12	250	±3/4 LSB	3.0	4 DE	40-Pin DIP	
HDAS-538	12	250	±3/4 LSB	3.0	8 SE	40-PIN DIP	
HDAS-524	12	400	±3/4 LSB	3.0	4 DE	40-Pin DIP	
HDAS-528	12	400	±3/4 LSB	3.0	8 SE	40-Pin DIP	
<i>Preliminary</i>	HDAS-950	16	100	±1/2 LSB @ 14 BITS	1.4	8 SE	40-Pin DIP
<i>Preliminary</i>	HDAS-951	16	100	±1/2 LSB @ 14 BITS	1.4	4 DE	40-Pin DIP

DateL

SAMPLE HOLD AMPLIFIERS

Model	Linearity (%)	Acquisition Time	Aperture Delay	Aperture Jitter	Bandwidth (MHz)	Hold Mode Droop	Case	
SHM-HU	0.1	25 ns	6 ns	10 ps	50	50 µV/µs	24-Pin DIP	
SHM-7	0.1	40 ns	3 ns	10 ps	40	100 µV/µs	24-Pin DIP	
SHM 40	0.1	40 ns	3 ns	10 ps	40	100 µV/µs	24-Pin DIP	
SHM-6	0.02	2 µs	20 ns	2 ns	5	10 µV/µs	32-Pin DIP	
<i>New</i>	SHM-43	0.01	35 ns	5 ns	1 ps	150	5 µV/µs	24-Pin DIP
<i>Preliminary</i>	SHM-49	0.01	140 ns	6 ns	15 ps	16	1 µV/µs	8-Pin DIP
	SHM-45	0.01	200 ns	6 ns	±50 ps	16	0.5µV/µs	24-Pin DIP
	SHM-4860	0.01	200 ns	6 ns	±50 ps	16	0.5µV/µs	24-Pin DIP
	SHM-30	0.01	500 ns	-25 ns	0.1 ns	4.5	0.01 µV/µs	14-Pin DIP
	SHM-20	0.01	1µs	30 ns	1 ns	2	0.8µV/µs	14-Pin DIP
	SHM-91	0.003	2 µs	15 ns	300 ps	2	5 µV/µs	24-Pin DIP
<i>New</i>	SHM-945	0.0004	500 ns	5ns	10 ps	12	0.5 µV/µs	24-Pin DIP
<i>Preliminary</i>	MSH-840*	0.01	750 ns	6 ns	±1 ns	1	1 µV/µs	32-Pin DIP

* QUAD Simultaneous Sample-Hold with 4-Channel Multiplexer

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MULTIPLEXERS

Model	Channels	Settling Time 20V to 0.01%	Access Time	Input Range	Power (Watts)	Case
MXD-409	4 D	3 μ s	500 ns	\pm 15V	0.105	16-Pin DIP
MX-808	8 SE	3 μ s	500 ns	\pm 15V	0.105	16-Pin DIP
MXD-807	8 D	3 μ s	500 ns	\pm 15V	0.105	28-Pin DIP
MX-1606	16 SE	3 μ s	500 ns	\pm 15V	0.105	28-Pin DIP
MVD-409	4 D	2.8 μ s	350 ns	\pm 15V	0.055	16-Pin DIP
MV-808	8 SE	2.8 μ s	350 ns	\pm 15V	0.055	16-Pin DIP
MVD-807	8 D	2.4 μ s	300 ns	\pm 15V	0.105	28-Pin DIP
MV-1606	16 SE	2.4 μ s	300 ns	\pm 15V	0.105	28-Pin DIP
MX-818C	8 SE/4D	800 ns	125 ns	\pm 15V	0.540	18-Pin DIP
MX-1616C	16 SE/8 D	800 ns	150 ns	\pm 15V	0.900	28-Pin DIP
<i>New</i>	MX-826	8 SE	200 ns	\pm 10.5V	0.395	24-Pin DIP
<i>New</i>	MX-850	4 SE	50 ns	\pm 10V	0.250	14-Pin DIP

OPERATIONAL AMPLIFIERS

Model	DC Open Loop Gain (V/V)	Settling Time (μ sec)	Slew Rate (V/ μ sec)	Gain Bandwidth (MHz)	Case
AM-500	10 ⁶	200 ns/0.01%	1000	100	14-Pin DIP
AM-1435	10 ⁵	70 ns/0.01%	300	1000	14-Pin DIP

INSTRUMENTATION AMPLIFIERS

Model	Gain Range	Settling Time	Case
AM-551	1 to 1000	2 μ s/0.01%	16-Pin DIP

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TUNABLE ACTIVE FILTERS

Model	Poles	Low Pass	High Pass	Band Pass	Band Reject	Rolloff (dB/Oct)	Frequency Cutoff Range (FC)	Filter Type	Gain	Case
FLT-DL41*	4	◆				30	100 to 400KHz	CA	+1	32 DIP
FLT-DL42*	4	◆				30	250 to 1000 KHz	CA	+1	32 DIP
FLT-DL51*	5	◆				50	120 to 470 KHz	CA	+1	32 DIP
FLT-DL52*	5	◆				50	300 to 1200KHz	CA	+1	32 DIP
FLT-DL41/DL51 §*	7	◆				50	100 to 400KHz	CA	+1	2-32 DIP
FLT-DL42/DL52 §*	7	◆				50	0.25 to 1.0MHz	CA	+1	2-32 DIP
FLT-C1	7	◆				52	78 Hz-20 KHz	CH	1, 2, 4, 8	32 DIP
FLJ-DC	2	◆	◆	◆	◆	12	1 Hz-159 KHz	BU,CH,BE	1 ~ 10	40 QDIP
FLJ-D1	2	◆	◆	◆	◆	12	1 Hz-1.599 KHz	BU	1 ~ 10	40 QDIP
FLJ-D2	2	◆	◆	◆	◆	12	100 Hz-159.9 KHz	BU	1 ~ 10	40 QDIP
FLJ-D5LA1	5	◆				60	10 Hz-2 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-D5LA2	5	◆				60	100 Hz-20 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-D6LA1	6	◆				80	10 Hz-2 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-D6LA2	6	◆				80	100 Hz-20 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-VB	2			◆		12	200Hz-20KHz	BU	±1dB	40 QDIP
FLJ-VH	4		◆			24	20Hz-20KHz	BU	±0.5dB	40 QDIP
FLJ-VL	4	◆				24	100Hz-100KHz	BU	±0.5dB	40 QDIP
FLJ-R3BA1	3			◆		—	10Hz-2KHz	CA	0 ±1dB max	40 QDIP
FLJ-R3BA2	3			◆		—	100Hz-20KHz	CA	0 ±1dB max	40 QDIP
FLJ-R8LA1	8	◆				135	10Hz-2KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-R8LA2	8	◆				135	100Hz-20KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-R8LB1	8	◆				100	10Hz-2KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-R8LB2	8	◆				100	100Hz-20KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-UR1BA1	1			◆		—	40Hz-1.6KHz	BU	0 ±1dB	20 SIP
FLJ-UR2BA1	2			◆		--	40Hz-1.6KHz	BU	0 ±1dB	20 SIP
FLJ-UR2EA1	2				◆	—	40Hz-1.6KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR2LH1	2	◆	◆			12	40Hz-1.6KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4HA1	4		◆			24	40Hz-1.6KHz	BU	0 ±1dB	20 SIP
FLJ-UR4HB1	4		◆			42	40Hz-1.6KHz	CH	0 ±1dB	20 SIP
FLJ-UR4LA1	4	◆				24	40Hz-1.6KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4LB1	4	◆				42	40Hz-1.6KHz	CH	0 ±0.3dB	20 SIP
FLJ-UR1BA2	1			◆		—	400Hz-10KHz	BU	0 ±1dB	20 SIP
FLJ-UR2BA2	2			◆		--	400Hz-10KHz	BU	0 ±1dB	20 SIP
FLJ-UR2EA2	2				◆	—	400Hz-10KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR2LH2	2	◆	◆			12	400Hz-20KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4HA2	4		◆			24	400Hz-5KHz	BU	0 ±1dB	20 SIP
FLJ-UR4HB2	4		◆			42	400Hz-5KHz	CH	0 ±1dB	20 SIP
FLJ-UR4LA2	4	◆				24	400Hz-20KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4LB2	4	◆				42	400Hz-20KHz	CH	0 ±0.3dB	20 SIP
FLT-U2	2	◆	◆	◆		12	0.001Hz-200KHz	BU,CH,BE,CA	0.1-1000	16 DIP

BU = Butterworth BE = Bessel
CH = Chebyshev CA = Causer/Elliptical

All Filters operate over the commercial temperature range -20°C to +70°C
Model FLT-U2 also operates at -55°C to +125°C

§ Cascaded Pair * Preliminary

DateL

For complete details on DATEL's versatile, high performance Signal Conditioning Filters send for the Components Handbook, Volume 1

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VMEBUS A/D - D/A BOARDS

Model	A/D Channels	A/D Resolution	A/D Speed	Prog. Gain Amplifier	In/Out Ranges	D/A Channels	D/A Resolution	Notes
DVME-601A	16 S/ 8 D Expandable to 256	12 Bits	20 μ s	x1 to x1K	5, 10V down to 50 mV	None	---	68010 CPU 256K memory RS-232, 5 TTL I/O Counter/Timers "No prgmg" Command Exec., Vectored interrupt
DVME-601B		12 Bits	4 μ s					
DVME-601C		16 Bits	35 μ s					
DVME-601D		16 Bits	400 ms					
DVME-601E		12 Bits	2 μ s					
DVME-611/612A	32 S / 16 D Expandable to 256	12 Bits	20 μ s	x1 to x128 Software Pgmble	5V, 10V down to 50 mV	2 (612)	12 Bits	Short I/O SA:16, SD:16 Vectored interrupt
DVME-611/612B		12 Bits	4 μ s					
DVME-611/612C		16 Bits	35 μ s					
DVME-611/612D		16 Bits	400 ms					
DVME-611/612E		12 Bits	2 μ s					
DVME-611/612F		14 Bits	4 μ s					
DVME-613	16 S/8 D Isolated 500V	12-14-16 Bits	40 μ s	x1 to x100	5V, 10V down to 50 mV	None	---	8 In/8 Out TTL, SA:24, SD:16 Start timer, interrupt
DVME-624	None	---	---	---	2.5 to 10V 4 to 20 mA	4 Isolated	12 Bits	SA:16, SD:16 350V Isolation
DVME-626	None	---	---	---	5V, 10V	6	16 Bits	SA:16, SD:16
DVME-628	None	---	---	---	2.5 to 10V 4 to 20 mA	8	12 Bits	SA:16, SD:16
DVME-641	32 S/16 D	Slave MUX board	6 μ s Settling	---	5V, 10V 4 to 20 mA	---	---	Slave input expander to 601, 611, 612
DVME-643	8D Isolated	Slave MUX board	2.5 ms Settling	x50, x100	5V Down to 50 mV	---	---	Slave input expander to 601, 611, 612
DVME-645	16 S/8D	Slave MUX board	6 μ s Settling	---	5V, 10V	---	---	Simultaneous Sample/Hold Expander to 601, 611, 612
DVME-614A	4 Simul. S/H	12 Bits	1.5 MHz	x1 or x10	1V, 5V, 10V	1	12 Bits	4K-sample FIFO memory Analog trigger Parallel data port Sample counter/timer Simultaneous sampling Vectored interrupt
DVME-614B	4 S	14 Bits	500 KHz	---	5V, 10V			
DVME-614C	4 S	12 Bits	1 MHz		5V, 10V			
DVME-614D	1 S	12 Bits	4 MHz		5V, 10V			
DVME-614E	16 S	12 Bits	400 KHz	x1 to x100	1, 5, 10V, 100mV			
DVME-630A	4 Simul. S/H	12 Bits	1.5 MHz	x1 or x10	1V, 5V, 10V	None	---	Local 32 MHz 320C30 DSP, 512 K Memory, Fast "no prgmg" command Executive, Interrupt DSP library
DVME-630B	4 S	14 Bits	500 KHz	---	5V, 10V			
DVME-630C	4 S	12 Bits	1 MHz		5V, 10V			
DVME-630D	1 S	12 Bits	4 MHz		5V, 10V			
DVME-630E	16 S	12 Bits	400 KHz	x1 to x100	1, 5, 10V, 100mV			
DVME-622	None	---	---	---	5V, 10V	16 Simul. Update	12 Bits	3 μ s settling per channel
DVME-621	None	---	---	---	5V, 10V @ 100 mA or 160 mA	4 Isolated	12 Bits	Power DAC's, voltage or current mode, active drivers, 500V isolation

Date!

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MULTIBUS I

Model	A/D Channels	A/D Resolution	A/D Speed	PGA	In/Out Ranges	D/A Channels	D/A Resolution	Notes
ST-702	8 D Isolated 1 KV	13 Bits	33 ms	x50, x100	5V Down to 50 mV	None	--	Direct thermocouple connections, on board linearize and CJC
ST-711 ST-732	32S / 16D	12 Bits	20 μ s	x1 to x1 K Software	5V, 10V Down to 50 mV	2 (732)	12 Bits	On board start timer, Interrupt
ST-703	None	--	--	--	2.5V to 10V 4 to 20 mA	4 Isolated	12 Bits	350V Isolation per channel
ST-724	None	--	--	--	5V, 10V 4 to 20 mA	4	12 Bits	
ST-728	None	--	--	--	5V, 10V 4 to 20 mA	4 or 8	12 Bits	
ST-716	None	--	--	--	5V, 10V	4 or 8	16 Bits	
ST-705	8 D	13 Bits	33 ms	x1 to x200	4V Down to 20 mV	None	--	RS-232 subsystem and CPU, Direct thermocouple connection, linearize, CJC
ST-519	TTL discrete I/O	--	--	--	TTL	--	--	72 TTL lines, In/Out, Interrupt

PC/AT A/D-D/A BOARDS

Model	A/D Channels	A/D Resolution	A/D Speed	Prog. Gain Amplifier	In/Out Ranges	D/A Channels	D/A Resolution	Notes
PC-414A	4 SE w/simul sampling	12 Bits	1.5 MHz	x1 or x10	5V, 10V, 1V	1	12 Bits	
PC-414B	4 SE	14 Bits	500 KHz	---	5V, 10V	1	12 Bits	4K-sample FIFO memory, analog trigger, parallel data port, counter/timer, DMA Vectored interrupt
PC-414C	4 SE	12 Bits	1 MHz	---	5V, 10V	1	12 Bits	
PC-414D	1 SE	12 Bits	4 MHz	---	1V	1	12 Bits	
PC-414E	16 SE	12 Bits	400 KHz	x1 to x100	10V to 100 mV	1	12 Bits	
PC-430A	4 SE w/simul sampling	12 Bits	1.5 MHz	x1 or x10	5V, 10V, 1V	None	---	Local 32 MHz 320C30 DSP, 512K memory, DMA Fast "no prgm" command executive, DSP library, Vectored interrupt
PC-430B	4 SE	14 Bits	500 KHz	---	5V, 10V	None	---	
PC-430C	4 SE	12 Bits	1 MHz	---	5V, 10V	None	---	
PC-430D	1 SE	12 Bits	4 MHz	---	1V	None	---	
PC-430E	16 SE	12 Bits	400 KHz	x1 to x100	10V to 100 mV	None	---	
PC-462	4 Monitor Channels	12 Bits	25 KHz	---	0 to \pm 15V or 5V, 10V	2 Isolated, V or I mode	12 Bits	Programmable power DAC

DateI

For complete details on DATEL's high performance A/D - D/A boards for Multibus, PC/ATs and VMEbus send for the Data Acquisition Boards Handbook, Volume 2

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WIDE-RANGING, DC-DC POWER CONVERTERS

NEW 20 WATT, WIDE-RANGING, DC-DC POWER CONVERTERS (2" x 2" x 0.45")

Input (Vdc)	Output	Input Current No Load/Full Load	Output Noise & RIPPLE (TYP)	Efficiency (Min @ F.L.)	Line/Load Regulation	Model
4.6 - 13.2V (5V, Nom)	3.3V, 4.25 A	25 mA/3.78 A	50 mV p-p	75%	±0.2% / ±0.5%	UWR-3.3/4250-D5
9.0 - 18V (12V, Nom)	3.3V, 4.85 A	20 mA/1.77 A	50 mV p-p	76%	±0.2% / ±0.5%	UWR-3.3/4850-D12
18 - 72V (48V, Nom)	3.3V, 4.85 A	15 mA/0.843 A	50 mV p-p	79%	±0.2% / ±0.5%	UWR-3.3/4850-D48
4.6-13.2V (5V, Nom)	5.0V, 3.60 A	10 mA/1.875 A	50 mV p-p	80%	±0.2% / ±0.5%	UWR-5/3000-D5
9.0 - 18V (12V, Nom)	5.0V, 4.0 A	15 mA/2.032 A	50 mV p-p	82%	±0.2% / ±0.5%	UWR-5/4000-D12
18 - 72V (48V, Nom)	5.0V, 4.0 A	10 mA/0.505 A	50 mV p-p	82%	±0.2% / ±0.5%	UWR-5/4000-D48
4.6-13.2V (5V, Nom)	±12V, 0.625 A	40 mA/1.829 A	85 mV p-p	82%	±0.2% / ±1%	BWR-12/625-D5
9.0 - 18V (12V, Nom)	±12V, 0.830 A	40 mA/2.00 A	75 mV p-p	84%	±0.2% / ±1%	BWR-12/830-D12
18 - 72V (48V, Nom)	±12V, 0.830 A	10 mA/0.508 A	85 mV p-p	82%	±0.2% / ±1%	BWR-12/830-D48
4.6 - 13.2V (5V, Nom)	±15V, 0.600 A	40 mA/1.829 A	85 mV p-p	82%	±0.2% / ±1%	BWR-15/500-D5
9.0 - 18V (12V, Nom)	±15V, 0.670 A	30 mA/1.587 A	85 mV p-p	84%	±0.2% / ±1%	BWR-15/670-D12
18 - 72V (48V, Nom)	±15V, 0.670 A	10 mA/0.508 A	85 mV p-p	82%	±0.2% / ±1%	BWR-15/670-D48

NEW, 10 WATT, WIDE RANGING, DC-DC POWER CONVERTERS (2" x 1" x 0.375")

4.7 - 7.0V (5V, Nom)	3.3V, 1.8 A	30 mA/1.715 A	50 mV p-p	70%	±0.2% / ±0.5%	UWR-3.3/1800-D5
9.0 - 18V (12V, Nom)	3.3V, 2.5 A	30 mA/0.915 A	50 mV p-p	75%	±0.2% / ±0.5%	UWR-3.3/2500-D12
18 - 72V (48V, Nom)	3.3V, 1.80 A	15 mA/0.170 A	50 mV p-p	75%	±0.2% / ±0.5%	UWR-3.3/1800-D48
4.7 - 7.0V (5V, Nom)	5.0V, 1.60 A	30 mA/2.160 A	50 mV p-p	74%	±0.2% / ±0.5%	UWR-5/1600-D5
9.0 - 18V (12V, Nom)	5.0V, 2.0 A	15 mA/1.03 A	50 mV p-p	81%	±0.2% / ±0.5%	UWR-5/2000-D12
18 - 72V (24/48V)	5.0V, 1.80 A	15 mA/0.240 A	50 mV p-p	78%	±0.2% / ±0.5%	UWR-5/1800-D48
4.7 - 7.0V (5V, Nom)	±5.0V, 0.70 A	30 mA/1.842 A	50 mV p-p	76%	±0.2% / ±1%	BWR-5/700-D5
9.0 - 18V (12V, Nom)	±5.0V, 0.80 A	15mA/0.830 A	50 mV p-p	80%	±0.2% / ±1%	BWR-5/800-D12
4.7 - 7.0V (5V, Nom)	±12V, 0.335 A	40 mA/2.1 A	15 mV p-p	76%	±0.2% / ±1%	BWR-12/335-D5
9.0 - 18 (12V, Nom)	±12V, 0.415 A	35 mA/1.00 A	25 mV p-p	83%	±0.2% / ±1%	BWR-12/415-D12
18 - 72V (24/48V, Nom)	±12V, 0.415 A	15 mA/0.260 A	50 mV p-p	80%	±0.2% / ±1%	BWR-12/415-D48
4.6 - 13.2V (5V, Nom)	±15V, 0.275 A	40 mA/2.142 A	15 mV p-p	77%	±0.2% / ±1%	BWR-15/275-D5
9.0 - 18V (12V, Nom)	±15V, 0.330 A	35 mA/0.992 A	25 mV p-p	84%	±0.2% / ±1%	BWR-15/330-D12
18 - 72V (24/48V, Nom)	±15V, 0.330 A	15 mA/0.257 A	50 mV p-p	81%	±0.2% / ±1%	BWR-15/330-D48

NEW, 3 WATT, WIDE RANGING, DC-DC POWER CONVERTERS (1.25"x0.8"x0.435")

4.5 - 9.0V (5V, Nom)	5.0V, 0.50 A	25 mA/0.714 A	100 mV p-p	70%	±0.2% / ±0.5%	UWR-5/500-D5
9.0 - 18V (12V, Nom)	5.0V, 0.50 A	15 mA/0.278 A	100 mV p-p	70%	±0.2% / ±0.5%	UWR-5/500-D12
18 - 72V (48V, Nom)	5.0V, 0.50 A	10 mA/0.069 A	100 mV p-p	75%	±0.2% / ±0.5%	UWR-5/500-D48
4.5 - 9.0V (5V, Nom)	±12V, 0.105 A	25 mA/0.714 A	75 mV p-p	70%	±0.2% / ±1%	BWR-12/105-D5
9.0 - 18V (12V, Nom)	±12V, 0.125 A	15 mA/0.333 A	75 mV p-p	75%	±0.2% / ±1%	BWR-12/125-D12
18 - 72V (48V, Nom)	±12V, 0.125 A	10 mA/0.076 A	75 mV p-p	82%	±0.2% / ±1%	BWR-12/125-D48
4.5 - 9.0V (5V, Nom)	±15V, 0.085 A	25 mA/0.729 A	75 mV p-p	70%	±0.2% / ±1%	BWR-15/85-D5
9.0 - 18V (12V, Nom)	±15V, 0.100 A	15 mA/0.333 A	75 mV p-p	75%	±0.2% / ±1%	BWR-15/100-D12
18 - 72V (48V, Nom)	±15V, 0.100 A	10 mA/0.076 A	75 mV p-p	82%	±0.2% / ±1%	BWR-15/100-D48

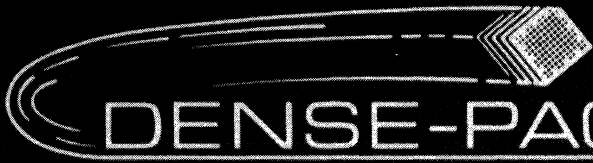
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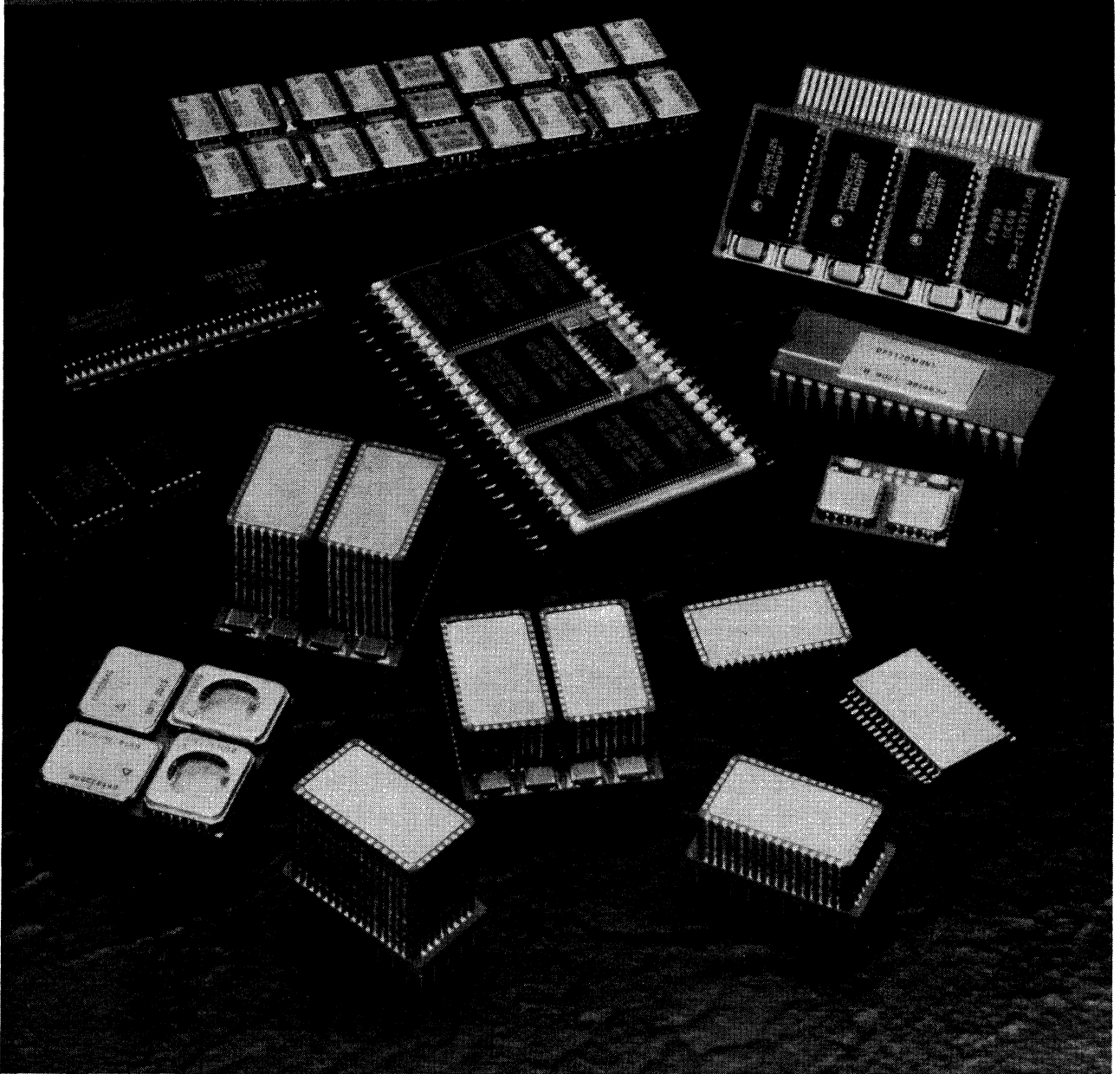
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DENSE-PAC MICROSYSTEMS, INC.

Breaking Space Barriers

SHORT FORM CATALOG-1991



Dense-Pac Microsystems

PRODUCTS

Standard and custom monolithic memories and memory/logic/analog modules manufactured since 1981.

DESIGN CAPABILITY

Dense-Pac digital and analog design engineers are in tune with your custom design requirements. We will work with you from conceptual design, through prototype, until you are satisfied with the custom part in its application. Dense-Pac's CAD system can provide short design cycles. Combined with our designers' experience in optimizing module performance in terms of minimizing parasitic impedances, Dense-Pac can supply a turn key product in an abbreviated turn-around time. Modules may be designed using PCB, thick film or co-fired ceramic substrates in DIP, SIP, ZIP or PGA configurations. Dense-Pac also has 3-dimensional packaging techniques which can be designed into custom applications where board space savings is paramount. With 9 years of custom module design behind us, we are fully prepared to satisfy your every need from circuit design to thermal analysis.

TEST CAPABILITY

Dense-Pac has made major investments in both automated test equipment (ATE) and in test software engineering. Six modern ATE testers are supplemented with two functional testers, all with temperature forcing capabilities. Attention is paid to every detail, such as measuring the exact case temperature of each module under test. To further assure the highest quality parts, limits on critical parameters are not just set at data sheet values but set at product design values to eliminate parts falling outside the normal distribution. All Dense-Pac manufactured monolithic devices are 100% parametrically tested at temperature, standard modules are 100% functionally tested at temperature. All non-standard/custom modules are tested per customer request, and all are functionally tested over temperature and fully warranted to meet specifications.

MILITARY PROCESSING CAPABILITY

Dense-Pac has full test, burn-in and environmental test capabilities to process product in accordance with the following methods from MIL-STD-883C:

Screening Capabilities

Internal Visual per Method 2010, Test Condition B
Temperature Cycle per Method 1010, Test Condition C
Thermal Shock per Method 1011, Test Condition A
Constant Acceleration per Method 2001, Test Condition E; Y1 orientation only
Three-Temperature Testing per Dense-Pac Specification or Customer S.C.D.
P.I.N.D. (optional) per Method 2020, Test Condition A
Burn-In per Method 1015, 160 Hrs. @ +125°C
Seal (Fine and Gross Leak) per Method 1014
External Visual per Method 2009

Qualification and Quality Conformance Inspection Capabilities

Resistance to Solvents per Method 2015
Solderability per Method 2022 or 2003
Bond Strength per Method 2011
Steady State Life Testing per Method 1005
Physical Dimensions per Method 2016
Lead Integrity per Method 2004 Test Condition B2 (Lead Fatigue)
Moisture Resistance per Method 1004
Mechanical Shock per Method 2002, Test Condition B
Vibration, Variable Frequency per Method 2007, Test Condition A
Salt Atmosphere per Method 1009, Test Condition A
Internal Water Vapor Content per Method 1018, 5000 ppm max. H₂O content @ +100°C

QUALITY

Dense-Pac has an absolute commitment to quality which is evident by the results of our 100% pass rate for military vendor quality surveys to MIL-I-45208. Dense-Pac has been approved as a MIL-I-45208 vendor by over 20 major U.S. defense and aerospace prime contractors and by several major overseas corporations. Dense-Pac Quality Assurance reviews all purchase orders, customer specifications, and any other applicable documentation against our drawings, test software, test procedures, travelers, etc. for each customer order. Dense-Pac maintains a complete MIL-I-45208 system for all products produced (Commercial, Industrial, and Military grades). Dense-Pac's quality system, including a complete configuration management system, has been extremely successful, evident by our level of customer satisfaction and an extremely low product return rate.

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DPS128M8 CERAMIC 128K X 8 CMOS MONOLITHIC SRAM

Description

The DPS128M8 is a 128K x 8 asynchronous static RAM fabricated on a monolithic CMOS chip. It is designed for use in high-density, high-speed, low-power applications. All pins are TTL-compatible and a single +5 Volt power supply is required.

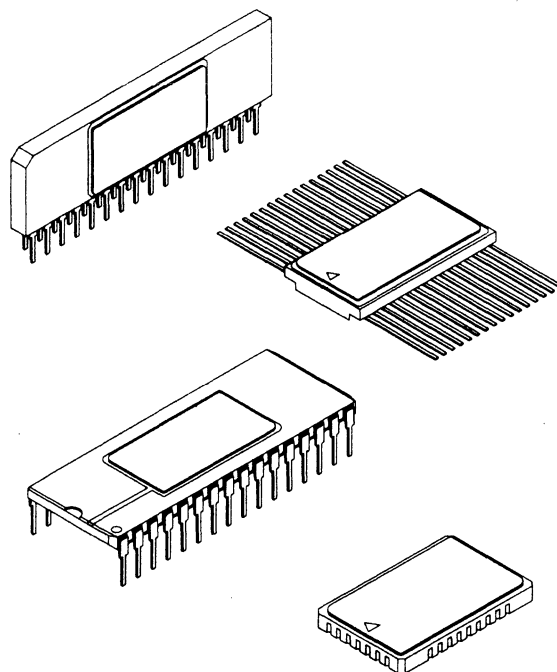
The DPS128M8 has extremely low standby power dissipation making it suitable for battery back up.

The 600-mil wide, 32-pin ceramic, dual-in-line package conforms to the JEDEC standard. Dense-Pac also offers the DPS128M8 as a space saving ceramic ZIP, ceramic leadless chip carrier and ceramic Small Outline Gullwing "flatpack" for surface-mount applications.

All Dense-Pac military monolithic packages are available screened to selected test methods from MIL-STD-883, which are further described in the Military Processing Capability section.

Features

- 131, 072 word by 8-bit organization
- Fast Access Times: 85, 100, 120ns
- Low Power Dissipation - 10 μ W (typ.) standby
75 mW (typ.) operating
- 2-Volt Data Retention
- Output Enable Function
- Two Chip Enables



DPS512S8 512K X 8 CMOS SRAM MODULE (Military and Commercial)

Description

The DPS512S8P/N is a 512K X 8 high-density, low-power static RAM module comprised of four 128K X 8 monolithic SRAM's, advanced, high-speed CMOS decoder and decoupling capacitors surface mounted on a co-fired ceramic substrate having side-brazed leads.

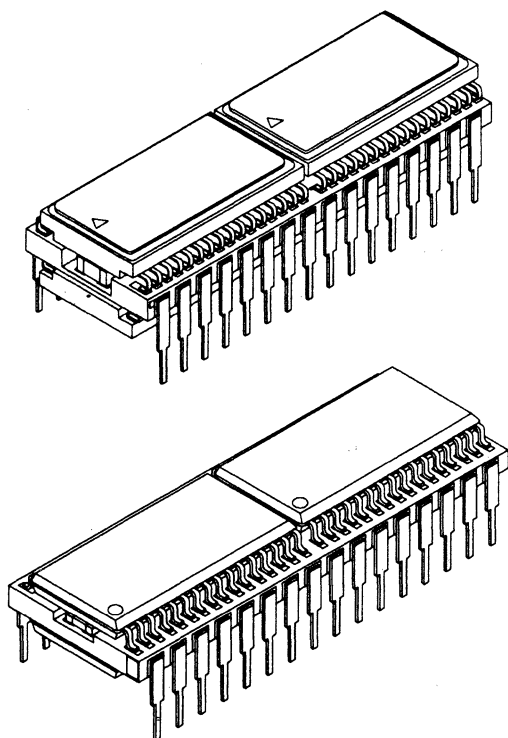
The DPS512S8P/N is available in a 600-mil-wide, 32-pin dual-in-line package that conforms to the same JEDEC standard pin configuration as the future JEDEC four megabit monolithics.

The DPS512S8P/N operates from a single +5V supply and all input and output pins are completely TTL-compatible. The low standby power of the DPS512S8P/N make it ideal for battery-backed applications.

Military modules are available using components screened to selected test methods from MIL-STD-883, which are further described in the Military Processing Capability section.

Features

- 524, 288 word by 8 bit configuration
- Fast Access Times: 100, 120, 150ns
- Low Power Dissipation - 40 μ W (typ.) standby
80 mW (typ.) operating
- 2-Volt data retention
- 600 mil, 32-pin JEDEC standard DIP pinout
- Fully Static Operation - No clock or refresh required
- All Inputs and Outputs are TTL-compatible



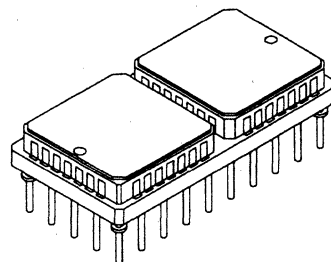
REDUCE YOUR PLD BOARD SPACE DENSE-PAC'S PROGRAMMABLE LOGIC MODULE

The Dense-Pac Programmable Logic Module (DPLD) is a 48-pin Pin Grid Array (PGA) designed to support two "22V10" field programmable array logic, 22 input, 10 macrocell output devices (DPL22V10A), including decoupling capacitor, at a 50% board space savings over conventional through hole (DIP) technology. Standard Electrically Erasable (E²), One Time Programmable (OTP) and UV erasable devices are available. Complete programmability and functional access are maintained for both devices.

The DPLD can be used to save board space with other standard PLD's, typically used in 24-Pin DIP packages and available in 28-pad LCC's, by mounting them on the module.

The DPLD module is available for military use with semiconductor components manufactured in compliance with MIL-STD-883, Class B, making it ideally suited for use in the most demanding applications requiring the highest levels of reliability and performance.

- Adapts Two Standard 22V10 PLD's in One Package
- 50% Board Space Reduction
- Easily Programmable Using Standard Equipment and Program Adapter
- Includes On Board Decoupling Capacitor
- Available in Standard CMOS E², OTP and UV Erasable
- Separate Clock/ Programming Inputs
- Measures Only 0.495 x 0.990 inches
- Speeds as fast as 25ns and faster as those devices become available

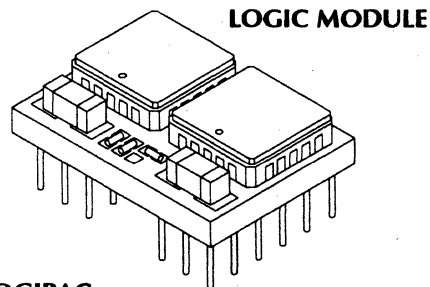


DENSE-PAC LOGIC MODULES SAVE 35% OR MORE BOARD SPACE

The Dense-Pac Logic Module (DPL's) are a family of memory support modules available in 16-bit or dual 8-bit configurations. The DPL family will save from 35% to 50% of the logic board space typically populated by standard 20-pin DIP packages, permitting a tighter, more compact final design. The DPL's are available to support all logic families: "FCT", "F", "ACT", "HC", "HCT", "LS" and others. Various module types include dual buffers/drivers, transceivers, registers, latches, and other types of logic.

The DPL module is available for military use with semiconductor components manufactured in compliance with MIL-STD-883, Class B, making it ideally suited for use in the most demanding applications requiring the highest levels of reliability and performance.

- 35% To 50% Board Space Savings vs. Conventional DIP Packages
- Buffers/Drivers
- Transceivers
- Registers
- Latches
- Other Standard Logic Devices
- Includes On Board Decoupling Capacitors
- Pin Grid Array (PGA) Package
- CMOS and/or TTL Compatible

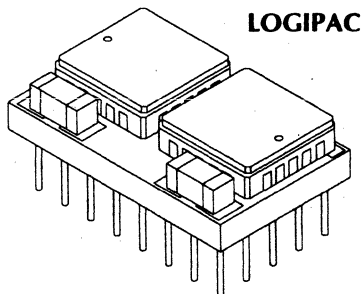


LOGIC MODULE

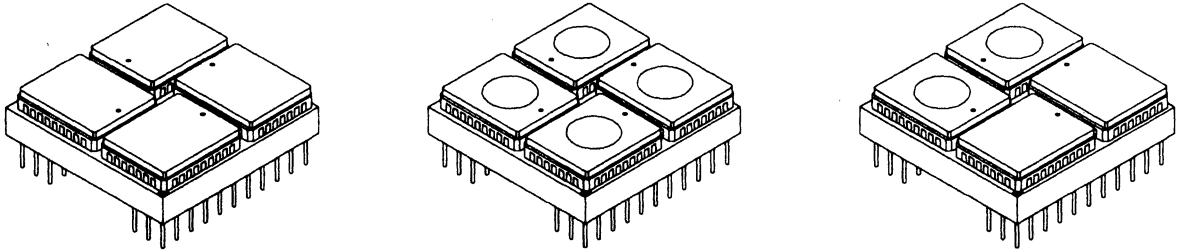
- 16 Bit Logic Support
- 35% (min.) Board Space Savings (0.590" x 0.790")
- Common Clock/Control Lines
- Heat Rail Accomodating Central Gap
- Ideal for 16 and 32 Bit Buffering

LOGIPAC

- 8 and 16 Bit Logic Support
- 50% (min.) Board Space Savings (0.490" x 0.790")
- Homogeneous/Heterogeneous Configurations
- Separate Control/Clock Lines
- Mix Logic for Your Custom Application



VERSAPAC OFFERS 32-BIT WIDE MEMORY IN ONE SQUARE INCH SRAM / EPROM / EEPROM / FLASH EEPROM



The VERSAPAC series of memory modules consist of SRAM, EPROM, EEPROM or Flash EEPROM devices surface mounted on a co-fired ceramic PGA substrate. The VERSAPAC can be a heterogeneous combination of technology such as SRAM/EPROM or SRAM/EEPROM; or a homogeneous configuration of SRAM, EPROM, EEPROM or Flash EEPROM, on one substrate. The 32-bit wide architecture is ideal for use with the latest microprocessors and digital signal processors. The module can also be addressed in 8, 16 or 24 bit words.

Standard components available for use on the Versapac are:

SRAM	128Kx8, 32Kx8 and 8Kx8
EPROM	128Kx8 and 32Kx8 (64Kx8 in homogeneous only)
EEPROM	128Kx8, 32Kx8 and 8Kx8
Flash EEPROM	128Kx8 (64Kx8 in homogeneous only)

Advantages

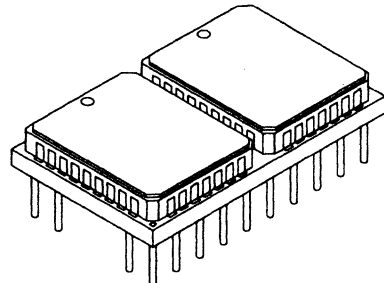
- 32-bit wide architecture.
- Most combinations of SRAM, EPROM, EEPROM or Flash EEPROM can be mixed on the same module while the pin-out connections remain constant.
- 66-PIN PGA
- Includes four 0.1µF on board bypass capacitors.
- Central lower gap can accommodate a heat rail if desired.
- Each memory device on the module can be accessed independently with its own chip enable.
- EPROM programming adaptors are available.

NEW HALF-VERSAPACS FOR 16-BIT WIDE APPLICATIONS

The new Halfpac family of memory modules from Dense-Pac offer the same board densities and flexibility as our Versapacs, but are intended for 8 and 16-bit wide applications. Like the Versapac, a mixture of technology can be integrated on the same module (one 32Kx8 SRAM with one 128Kx8 EPROM for example), as well as 16 bits of a single technology.

Features:

- 16-bit data width.
- Supports a mixture of SRAM, EPROM, EEPROM, or FLASH EEPROM on the same module.
- 40-Pin PGA (1.009" x 0.596")
- Central 0.3" gap on the underside can accommodate a heat rail if desired.
- Each memory device can be accessed individually.

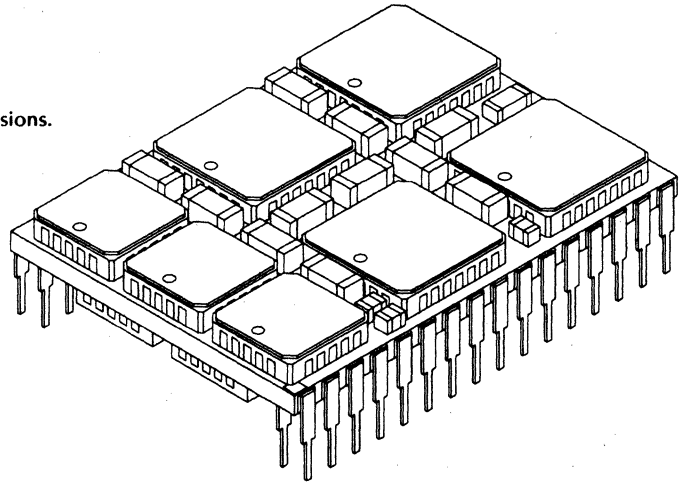


12 - BIT DATA ACQUISITION MODULE HAS 250KHz THROUGHPUT

The DPHDAM8N and DPHDAM16N, data acquisition modules, have been designed to be "expert systems", incorporating capabilities that demand little experience on the part of the user. All signals are digital, with the exception of the analog input channels which are to be digitized, power supplies and DC configuration pins. No special analog trims such as gain, offset, balance, etc. are required. Digitally selectable gain and 10-bit digital offset control allow the DPHDAM user to adapt to a wide variety of inputs. Both gain and offset may be changed dynamically without loss in throughput. No external logic, references or external components are required when driven from an external clock. The DPHDAM uses a unique packaging concept which offers the small physical size of a hybrid, yet maintains the repairability, reliability and low cost of standard LCC packaging.

FEATURES

- 12-Bit resolution
- High throughput - 250KHz
- Analog input ranges: 0 to 5V, 0 to +10V and $\pm 5V$
- 10-Bit digital offset control allows offset range of 50% of full scale
- 16-Channels single-ended or 8-Channels differential versions.
- Provisions to expand multiplexing capabilities
- TTL and HCMOS logic compatible. Three State outputs
- Low Power - 1 Watt typical
- Miniature 64-Pin Quad Inline Package
- Small Size - 1.600 x 1.200 x 0.300 inches

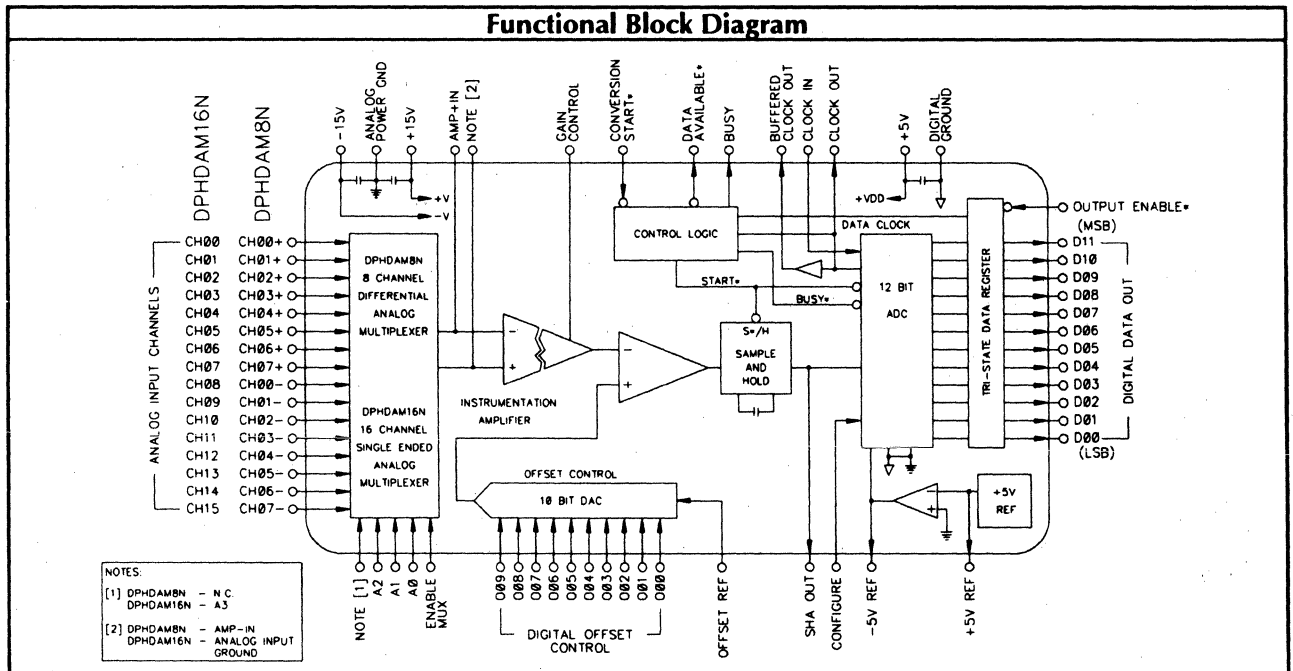


TYPICAL APPLICATIONS

- Digital Signal Processing
- High Speed and Accuracy Test Equipment
- Process Control for High Accuracy and Speed
- Data Acquisition System
- Vibration Analysis
- Waveform Analysis
- High-Speed Servo Systems
- Temperature Control and Monitoring

Dense-Pac Microsystems

Functional Block Diagram



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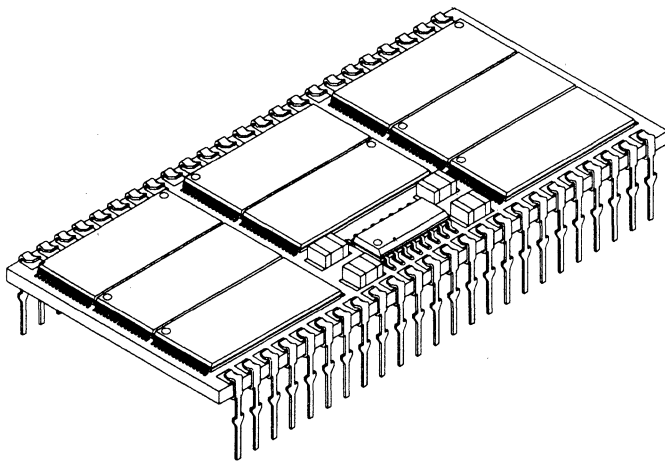
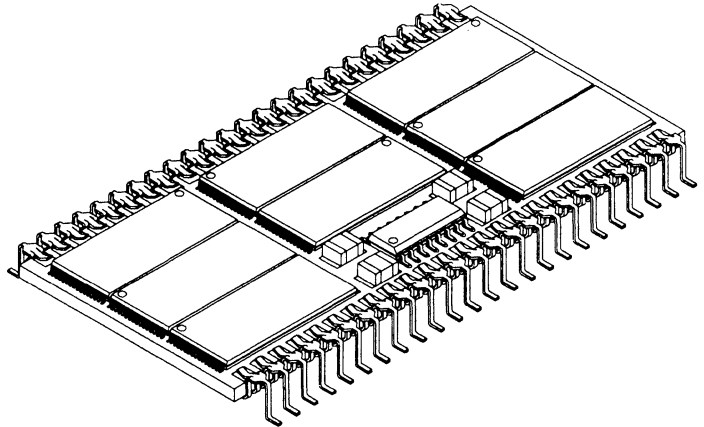
16 Megabit SRAM Module in Surface Mount or DIP Package!

Description

The DPS1MS16P/XP is a 2048K x 8 or 1024K x 16 bit high-density, low-power static RAM module consisting of 16 individual, ultra low-power, 128K x 8 CMOS SRAMs packaged in Thin Small Outline Packages (TSOPs).

By using TSOPs and advanced surface-mount techniques, the Dense-Pac DPS1MS16P/XP memory module offers high density packaging for both surface mount and through-hole applications. The low power RAMs are capable of retaining data at only two volts while drawing typically only 16 μ A of current making the DPS1MS16P/XP ideal for battery backed applications.

The DPS1MS16P/XP is the first in a family of commercial grade memory modules that takes advantage of the space savings gained by employing TSOP packages.

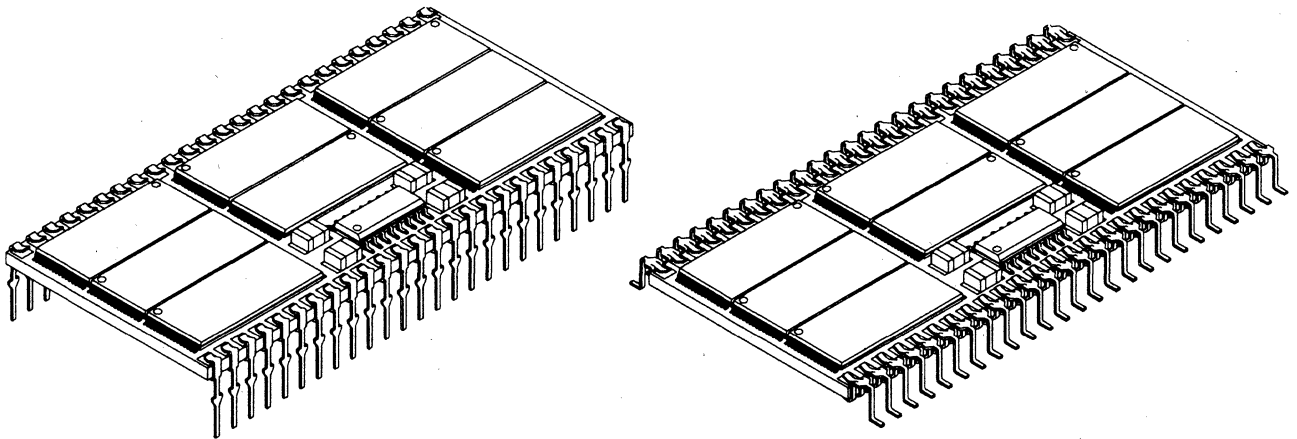


Features

- 1024K by 16 or 2048K by 8 Bit Configuration
- Fast Access Times: 85, 100, 120, 150ns
- Low Power CMOS Design
- 2-Volt Data Retention
- 48-pin Flat Pack or Dual-Inline Package
- All Inputs and Outputs TTL Compatible
- Industrial Screening Available
- 2.50" x 1.20" x 0.22"

NOTE FOR SURFACE MOUNT VERSION: The module's ceramic substrate allows the use of a high temperature solder (240°C for mounting the TSOP components and 300°C for lead attach) in constructing the module. This assures that the module will not itself re-flow during the process of attaching it to a surface mount P.C.B.

16/32 Megabit FLASH EEPROM Module in Surface Mount or DIP Package!



Dense-Pac Microsystems

Description

The DPZ1MS16P and DPZ2MS16P are 16 megabit and 32 megabit respectively, CMOS FLASH Electrically Programmable and Erasable nonvolatile memory modules. The module is built with sixteen, 128K x 8 (DPZ1MS16P) or sixteen 256K x 8 (DPZ2MS16P) FLASH memory devices and 2 high speed decoders. The DPZ1MS16P can be user configurable as 1024K x 16 or 2048K x 8 bits, while the DPZ2MS16P can be user configurable as 2048K x 16 or 4096K x 8 bits.

By using TSOPs and advanced surface-mount techniques, the Dense-Pac DPZ1MS16P is able to attain a density of over 5 Megabits per square inch of board space while maintaining a low profile (0.200" max.) and the DPZ2MS16P is able to attain a density of over 10 Megabits per square inch. The modules are available with either through-hole leads (DPZ1MS16P/DPZ2MS16P), or surface mount leads (DPZ1MS16XP/DPZ2MS16XP).

The DPZ1MS16P and DPZ2MS16P are ideal for use in systems that require periodic code updates, or for use as a high speed nonvolatile storage medium.

Features

- Organizations:
 - 1024K x 16 or 2048K x 8 (DPZ1MS16P/XP)
 - 2048K x 16 or 4096K x 8 (DPZ2MS16P/XP)
- Fast Read Access Times:
 - 150, 200, 250ns (DPZ1MS16P/XP)
 - 200, 250, 300ns (DPZ2MS16P/XP)
- Low Power:
 - 75mA Maximum Active (16 bit Mode)
 - 45mA Maximum Active (8 bit Mode)
 - 1.6mA Maximum Standby
- 10,000 Erase/Program Cycles Minimum
- Command Register Architecture for Microprocessor Compatible Write Interface
- 12.0V \pm 5% V_{pp}
- TTL Compatible Inputs and Outputs
- 50-pin Flat Pack or Dual-Inline Package
- 2.50" x 1.20" x 0.22"

NOTE FOR SURFACE MOUNT VERSION: The module's ceramic substrate allows the use of a high temperature solder (240°C for mounting the TSOP components and 300°C for lead attach) in constructing the module. This assures that the module will not itself re-flow during the process of attaching it to a surface mount P.C.B.

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Dense-Pac Introduces 3-Dimensional Memory Packaging

New from Dense-Pac Microsystems is a family of memory modules using a three dimensional memory packaging technique enabling densities of over 2 Megabytes in less than one square inch. This technique can increase board densities by a factor of 40 to 1 over conventional monolithic packages, and 10 to 1 over standard two-dimensional memory module designs.

Dense-Pac's 3-D packaging technology is based on a Stackable Leadless Chip Carrier or SLCC. By stacking memory vertically, the highest possible densities are achieved while also increasing performance by keeping trace lengths as short as possible. Stacking also allows for expanding memory depth while maintaining the same footprint.

Currently, each SLCC contains a low-power CMOS 128K x 8 static RAM die. In the future Dense-Pac plans to offer SLCC modules with EEPROM and FLASH technology. Because each SLCC is hermetically sealed and environmentally screened, modules built with SLCCs are suitable for high reliability industrial, military and space environments.

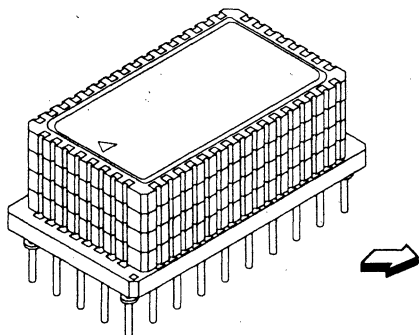
These new stackable modules are designed to be very mechanically rugged and can withstand the harsh environmental test requirements of military programs such as temperature cycling, mechanical shock and vibration testing, constant acceleration testing and operation over the full military temperature range (-55°C to +125°C).

Because the SLCCs and the module substrate are both made of ceramic, there are no problems associated with thermal stress on the module over temperature due to differing thermal coefficients of expansion. Also, because Dense-Pac carefully selects only low-power CMOS devices, the modules run cool (typically 225 mW per megabyte). Modules built with SLCCs, and modules in general, have many advantages over hybrids such as individual device testing, screening and the ability to rework. Dense-Pac offers a family of standard modules using 3-D packaging in a variety of densities and data path widths. Modules for 8, 16, 24, and 32-bit wide applications are available in densities from 128K to 2-Mbit deep as standard products. If one of the standard configurations does not suit a specific application, Dense-Pac can build a custom module with SLCCs to suit individual requirements.

General Dense-Stack Features:

- 16 Megabit per Square Inch Density !
- High Performance Due to Short Trace Lengths (lower capacitance and inductance)
- Memory is Expandable by Adding More Layers While Keeping the Same Footprint
- Modules are Repairable
- Low Power CMOS Design (typ. 225mW per megabyte)
- 8, 16, 24, and 32-Bit Wide Data Paths

Examples of the New Dense-Stack Modules

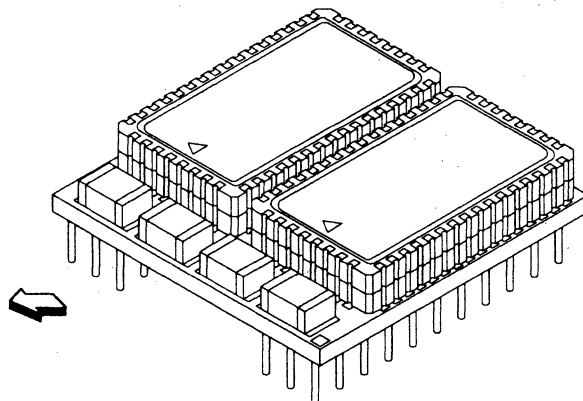


FEATURES:

- Organizations Available: 256K x 16 or 512K x 8
- Access Times: 70*, 85, 100, 120, 150ns
- Fully Static Operation - No clock or refresh required
- Single +5V Power Supply, ±10% Tolerance
- TTL Compatible
- Common Data Inputs and Outputs
- Low Data Retention Voltage: 2.0V min.
- 50-Pin Grid Array "DENSE-STACK" Package
- 0.99" x 0.54" Footprint

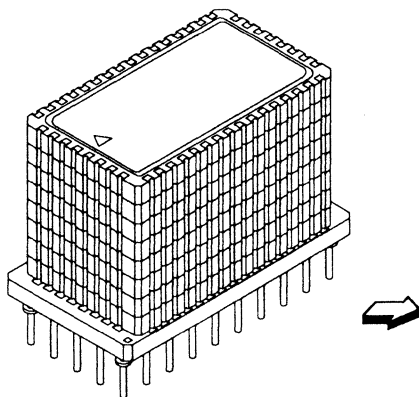
FEATURES:

- Organizations Available:
128K x 32, 256K x 16 or 512K x 8
- Access Times: 70*, 85, 100, 120, 150ns
- Fully Static Operation - No clock or refresh required
- Single +5V Power Supply, ±10% Tolerance
- TTL Compatible
- Common Data Inputs and Outputs
- Low Data Retention Voltage: 2.0V min.
- 66-Pin Grid Array "VERSA-STACK" Package
- 1.10" X 1.10" Footprint



FEATURES:

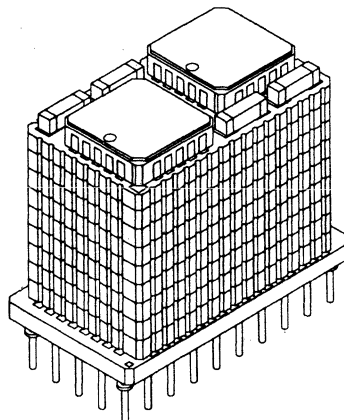
- Organizations Available: 512K x 16, or 1024K x 8
- Access Times: 70*, 85, 100, 120, 150ns
- Fully Static Operation - No clock or refresh required
- Single +5V Power Supply, ±10% Tolerance
- TTL Compatible
- Common Data Inputs and Outputs
- Low Data Retention Voltage: 2.0V min.
- 50-Pin Grid Array "DENSE-STACK" Package
- 0.99" x 0.54" Footprint



FEATURES:

- Organizations Available: 1024K x 8
- Access Times: 100*, 120, 150ns
- Buffered and Decoded
- Fully Static Operation - No clock or refresh required
- Single +5V Power Supply, ±10% Tolerance
- TTL Compatible
- Common Data Inputs and Outputs
- Low Data Retention Voltage: 2.0V min.
- 50-Pin Grid Array "DENSE-STACK" Package
- 0.99" x 0.54" Footprint

* Commercial only.



Answers to the Most Commonly Asked Questions About the Dense-Stack

Q: Are the stack modules mechanically rugged?

A: Yes! The construction is as follows:

The module substrate is a co-fired ceramic substrate. The SLCC's are first soldered to each other via 48 solderpads each 0.030" x 0.025" around the four sides of the package. Additional strength comes from the solder fillet in the rows of the castellations. These individual stacks are later surface mounted to the substrate.

A sample lot of four modules consisting of four stacks of eight SLCCs each were subjected to and passed the following tests:

Temperature Cycling

MIL-STD-883, Method 1010 Condition C

Sine Vibration

MIL-STD-883, Method 2007 Condition A

Mechanical Shock

MIL-STD-883, Method 2002 Condition A, Y1 Orientation

Constant Acceleration

MIL-STD-883, Method 2001 Condition E, Y1 Orientation

Q: What are the thermal characteristics of the Stack Module?

A: This of course depends on the particular configuration. For example, the single 1024K x 8 stack has the following worst case characteristics (5.5 Volt, Military Temp Range):

On the 1024 x 8 stack consisting of eight 128K x 8 devices, only one of the eight devices is ever active at any one time (440mW) the other seven devices are in standby (21mW) for a total of 461mW for the whole megabyte module.

Based on our history of measuring thermal impedances on modules, the expected θ_{CA} of the module should be less than 10°C/W which would give a 5°C stack to ambient temperature rise at full operating power. The worst case "active" chip in the stack at a θ_{JC} of 30°C/W would be approximately 20°C above ambient temperature.

Q: How is the Stack tested?

A: The chips are functionally tested at the wafer level by the manufacturer. Dense-Pac purchases these functionally good chips and assembles them into the SLCC. After assembly, the chips are environmentally screened and electrically tested. After the modules are assembled they are parametrically tested over the intended temperature range. Additional testing such as burn-in and any additional environmental screening can be performed upon customer request.

SRAM Modules/Monolithics



SRAM Modules/Monolithics

Dense-Pac Microsystems

Organization	Part Number	15n	20n	25n	35n	45n	55n	70n	85n	100n	120n	150n	170n	Type	Package Dimension*
256Kx4	DPS1037	x	x	x	x	x	x							42-DIP	2.100 x 0.900 x 0.300
256Kx4	DPS1024	x	x	x	x	x	x							42-DIP	2.125 x 0.900 x 0.280
256Kx4	DPS256P4		x	x	x	x	x							30-SIP	2.990 x 0.220 x 0.500
8Kx8	DPS9264G									x	x	x	x	32-LCC	0.560 x 0.460 x 0.085
16Kx8	DPS8X16A				x	x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.300
32Kx8	DPS16X16				x	x	x							38-DSIP	1.900 x 0.290 x 0.360
32Kx8	DPS32M8A			o	o	o	o	o	o					28-CDIP	1.490 x 0.620 x 0.232
32Kx8	DPS32M8AG			o	o	o	o	o	o					32-LCC	0.560 x 0.460 x 0.085
32Kx8	DPS32M8AN			o	o	o	o	o	o					28-DIP	1.400 x 0.600 x 0.150
32Kx8	DPS832V				x	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.300
32Kx8	DPS92256								x	x	x	x	x	28-CDIP	1.490 x 0.620 x 0.232
32Kx8	DPS92256G								x	x	x	x	x	32-LCC	0.560 x 0.460 x 0.085
32Kx8	DPS92256N								x	x	x	x	x	28-DIP	1.400 x 0.600 x 0.150
64Kx8	DPS32X16A				x	x	x	x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.300
128Kx8	DPS1024	x	x	x	x	x	x							42-DIP	2.125 x 0.900 x 0.280
128Kx8	DPS1037	x	x	x	x	x	x							42-DIP	2.100 x 0.900 x 0.300
128Kx8	DPS128M8AF				o	o	o	o						32-FPK	0.820 x 0.450 x 0.110
128Kx8	DPS128M8AG				o	o	o	o						32-LCC	0.700 x 0.450 x 0.085
128Kx8	DPS128M8AK				o	o	o	o						32-ZIP	1.650 x 0.110 x 0.450
128Kx8	DPS128M8AN				o	o	o	o						32-DIP	1.600 x 0.600 x 0.165
128Kx8	DPS128M8F							x	x	x	x	x		32-FPK	0.820 x 0.450 x 0.110
128Kx8	DPS128M8G							x	x	x	x	x		32-LCC	0.700 x 0.450 x 0.085
128Kx8	DPS128M8K							x	x	x	x	x		32-ZIP	1.650 x 0.110 x 0.450
128Kx8	DPS128M8N							x	x	x	x	x		32-DIP	1.600 x 0.600 x 0.165
128Kx8	DPS3232V			x	x	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.300
128Kx8	DPS41288				x	x	x	x	x	x	x	x		32-DIP	1.580 x 0.610 x 0.300
256Kx8	DPS128X16A3							x	x	x	x	x		50-PGA	0.990 x 0.540 x 0.280
256Kx8	DPS128X16AA3				o	o	o	o						50-PGA	0.990 x 0.540 x 0.280
256Kx8	DPS256P8								x	x	x	x		35-SIP	3.500 x 0.310 x 0.580
256Kx8	DPS256Q8				x	x	x	x	x	x	x	x		42-QIP	1.400 x 1.100 x 0.260
256Kx8	DPS256S8AN					o	o	o	o					32-DIP	1.660 x 0.600 x 0.285
256Kx8	DPS256S8N								x	x	x	x		32-DIP	1.660 x 0.600 x 0.285
256Kx8	DPS256S8P				o	o	o	o	x	x	x	x		32-DIP	1.650 x 0.600 x 0.280
256Kx8	DPS6433				x	x	x	x	x	x	x	x		60-DIP	2.990 x 0.600 x 0.260
256Kx8	DPS6434				x	x	x	x	x	x	x	x		44-ZIP	2.655 x 0.350 x 0.450
256Kx8	DPS8256P8		x	x	x	x	x								
512Kx8	DPS128X32AV3				o	o	o	o						66-PGA	1.090 x 1.090 x 0.250
512Kx8	DPS128X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.250
512Kx8	DPS256X16A3				o	o	o	o						50-PGA	0.990 x 0.540 x 0.450
512Kx8	DPS256X16AA3				o	o	o	o						50-PGA	0.990 x 0.540 x 0.450
512Kx8	DPS45128						x	x	x	x	x	x		48-DIP	2.400 x 1.410 x 0.310
512Kx8	DPS512S8A3								x	x	x	x		50-PGA	0.990 x 0.540 x 0.570
512Kx8	DPS512S8AA3					o	o	o	o					50-PGA	0.990 x 0.540 x 0.570
512Kx8	DPS512S8AN					o	o	o	o					32-DIP	1.660 x 0.600 x 0.385
512Kx8	DPS512S8N								x	x	x	x		32-DIP	1.660 x 0.600 x 0.385
512Kx8	DPS512S8P				o	o	o	o	x	x	x	x		32-DIP	1.650 x 0.600 x 0.385
512Kx8	DPS96122								x	x	x	x		68-DIP	3.400 x 1.200 x 0.310
1024Kx8	DPS1MS8A3								x	x	x	x		50-PGA	0.990 x 0.540 x 0.850
1024Kx8	DPS1MS8AA3													50-PGA	0.990 x 0.540 x 0.850
1024Kx8	DPS256X32AV3				o	o	o	o						66-PGA	1.090 x 1.090 x 0.400
1024Kx8	DPS256X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.400
1024Kx8	DPS512X16A3							x	x	x	x	x		50-PGA	0.990 x 0.540 x 0.750
1024Kx8	DPS512X16AA3				o	o	o	o						50-PGA	0.990 x 0.540 x 0.750
2048Kx8	DPS1MS16P								x	x	x	x		48-DIP	2.500 x 1.200 x 0.200
2048Kx8	DPS1MS16XP								x	x	x	x		48-FPK	2.500 x 1.500 x 0.220
2048Kx8	DPS512X32AV3				o	o	o	o						66-PGA	1.090 x 1.090 x 0.720
2048Kx8	DPS512X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.720
128Kx9	DPS1152	x	x	x	x	x	x							50-DIP	2.495 x 0.900 x 0.260

x - Current Product

o - Advanced Information

* Package Dimension is L x W x H.

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SRAM Modules/Monolithics (CONTINUED)



SRAM Modules/Monolithics (CONTINUED)															
Organization	Part Number	15n	20n	25n	35n	45n	55n	70n	85n	100n	120n	150n	170n	Type	Package Dimension*
8Kx16	DPS8M628					x	x	x	x	x	x	x	x	40-DIP	2.000 x 0.600 x 0.260
8Kx16	DPS8X16A				x	x	x	x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.300
16Kx16	DPS16X16			x	x	x	x							38-DSIP	1.900 x 0.290 x 0.360
16Kx16	DPS16X17			x	x	x	x							36-DSIP	2.800 x 0.600 x 0.500
16Kx16	DPS832V				x	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.300
16Kx16	DPS8M656					x	x	x	x	x	x	x	x	40-DIP	2.000 x 0.600 x 0.260
32Kx16	DPS32X16A			x	x	x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.300
32Kx16	DPS8M612				x	x	x	x	x	x	x	x		40-DIP	2.000 x 0.600 x 0.260
64Kx16	DPS1024	x	x	x	x	x	x							42-DIP	2.125 x 0.900 x 0.280
64Kx16	DPS1037	x	x	x	x	x	x							42-DIP	2.100 x 0.900 x 0.300
64Kx16	DPS3232V			x	x	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.300
64Kx16	DPS8M624				x	x	x	x	x	x	x	x		40-DIP	2.000 x 0.600 x 0.260
128Kx16	DPS128X16A3							x	x	x	x	x		50-PGA	0.990 x 0.540 x 0.280
128Kx16	DPS128X16AA3													50-PGA	0.990 x 0.540 x 0.280
128Kx16	DPS6433				x	x	x	x	x	x	x	x		60-DIP	2.990 x 0.600 x 0.260
128Kx16	DPS6434				x	x	x	x	x	x	x	x		60-DIP	2.990 x 0.600 x 0.260
256Kx16	DPS128X32AV3													66-PGA	1.090 x 1.090 x 0.250
256Kx16	DPS128X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.250
256Kx16	DPS256X16A3							x	x	x	x	x		50-PGA	0.990 x 0.540 x 0.450
256Kx16	DPS256X16AA3													50-PGA	0.990 x 0.540 x 0.450
256Kx16	DPS96122								x	x	x	x		68-DIP	3.400 x 1.200 x 0.310
512Kx16	DPS256X32AV3													66-PGA	1.090 x 1.090 x 0.400
512Kx16	DPS256X32V3							x	x	x	x	x		50-PGA	0.990 x 0.540 x 0.750
512Kx16	DPS512X16A3													50-PGA	0.990 x 0.540 x 0.750
1024Kx16	DPS1MS16P								x	x	x	x		48-DIP	2.500 x 1.200 x 0.200
1024Kx16	DPS1MS16XP								x	x	x	x		48-FPK	2.500 x 1.500 x 0.220
1024Kx16	DPS512X32AV3													66-PGA	1.090 x 1.090 x 0.720
1024Kx16	DPS512X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.720
64Kx18	DPS1152	x	x	x	x	x	x							50-DIP	2.495 x 0.900 x 0.260
128Kx24	DPS128X24AV3													66-PGA	1.090 x 1.090 x 0.250
128Kx24	DPS128X24V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.250
8Kx32	DPS832V				x	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.300
32Kx32	DPS3232V			x	x	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.300
64Kx32	DPS6433				x	x	x	x	x	x	x	x		60-DIP	2.990 x 0.600 x 0.260
64Kx32	DPS6434				x	x	x	x	x	x	x	x		60-DIP	2.990 x 0.600 x 0.260
128Kx32	DPS128X32AV3													66-PGA	1.090 x 1.090 x 0.250
128Kx32	DPS128X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.250
256Kx32	DPS256X32AV3													66-PGA	1.090 x 1.090 x 0.400
256Kx32	DPS256X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.400
512Kx32	DPS512X32AV3													66-PGA	1.090 x 1.090 x 0.720
512Kx32	DPS512X32V3							x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.720

Dense-Pac Microsystems

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* Package Dimension is L x W x H.

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EEPROM Modules



EEPROM Modules													
Organization	Part Number	55n	70n	90n	120n	150n	170n	200n	250n	300n	350n	Type	Package Dimension*
16Kx8	DPE8X16A	x	x	x	x	x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.300
32Kx8	DPE832V	x	x	x	x	x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.300
64Kx8	DPE32X16A	o	x	x	x	x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.300
64Kx8	DPE4648	o	o	x	x	x	x	x	x	x	x	32-DIP	1.600 x 0.600 x 0.295
64Kx8	DPE5648	o	o	x	x	x	x	x	x	x	x	32-DIP	1.600 x 0.600 x 0.295
128Kx8	DPE3232V	o	x	x	x	x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.300
128Kx8	DPE41288	o	o	x	x	x	x	x	x	x	x	32-DIP	1.600 x 0.600 x 0.295
128Kx8	DPE51288	o	o	x	x	x	x	x	x	x	x	32-DIP	1.600 x 0.600 x 0.295
256Kx8	DPE256Q8	o	x	x	x	x	x	x	x	x	x	42-QIP	1.400 x 1.100 x 0.260
256Kx8	DPE256S8N	o				o	x	x	x	x	x	32-DIP	1.660 x 0.600 x 0.285
256Kx8	DPE6434	o	o	x	x	x	x	x	x	x	x	60-DIP	2.990 x 0.600 x 0.260
512Kx8	DPE45128			o	x	x	x	x	x	x	x	48-DIP	2.400 x 1.410 x 0.310
512Kx8	DPE512S8N					o	x	x	x	x	x	32-DIP	1.660 x 0.600 x 0.385
8Kx16	DPE8M628	o	x	x	x	x	x	x	x	x	x	40-DIP	2.000 x 0.600 x 0.260
8Kx16	DPE8X16A	x	x	x	x	x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.300
16Kx16	DPE832V	x	x	x	x	x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.300
16Kx16	DPE8M656	o	x	x	x	x	x	x	x	x	x	40-DIP	2.000 x 0.600 x 0.260
32Kx16	DPE32X16A	o	x	x	x	x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.300
32Kx16	DPE8M612	o	o	x	x	x	x	x	x	x	x	40-DIP	2.000 x 0.600 x 0.260
64Kx16	DPE3232V	o	x	x	x	x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.300
64Kx16	DPE8M624	o	o	x	x	x	x	x	x	x	x	40-DIP	2.000 x 0.600 x 0.260
128Kx16	DPE6434	o	o	x	x	x	x	x	x	x	x	60-DIP	2.990 x 0.600 x 0.260
8Kx32	DPE832V	x	x	x	x	x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.300
32Kx32	DPE3232V	o	x	x	x	x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.300
64Kx32	DPE6434	o	o	x	x	x	x	x	x	x	x	60-DIP	2.990 x 0.600 x 0.260

Dense-Pac Microsystems

EPROM Modules/Monolithic

EPROM Modules/Monolithic													
Organization	Part Number	55n	70n	90n	120n	150n	170n	200n	250n	300n	350n	Type	Package Dimension*
64Kx8	DPV32X16A	x	x	x	x	x	x	x				40-PGA	1.009 x 0.596 x 0.330
128Kx8	DPV27C101						x	x	x	x		32-DIP	1.650 x 0.620 x 0.230
128Kx8	DPV3232V	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
128Kx8	DPV3232VA	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
128Kx8	DPV64X16A						x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPV128X16A				o	x	x	x				40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPV6432V						x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx8	DPV12832V						x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx8	DPV12832VA				o	x	x	x				66-PGA	1.090 x 1.090 x 0.330
1024Kx8	DPV256X32V						o	o	o	o	o	66-PGA	1.090 x 1.090 x 0.330
32Kx16	DPV32X16A	x	x	x	x	x	x	x				40-PGA	1.009 x 0.596 x 0.330
64Kx16	DPV3232V	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx16	DPV3232VA	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx16	DPV64X16A						x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPV128X16A				o	x	x	x				40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPV6432V						x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx16	DPV12832V							x	x			66-PGA	1.090 x 1.090 x 0.330
256Kx16	DPV12832VA				o	x	x	x				66-PGA	1.090 x 1.090 x 0.330
512Kx16	DPV256X32V						o	o	o	o	o	66-PGA	1.090 x 1.090 x 0.330
32Kx32	DPV3232V	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx32	DPV3232VA	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx32	DPV6432V						x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
128Kx32	DPV12832V							x	x			66-PGA	1.090 x 1.090 x 0.330
128Kx32	DPV12832VA				o	x	x	x				66-PGA	1.090 x 1.090 x 0.330
256Kx32	DPV256X32V						o	o	o	o	o	66-PGA	1.090 x 1.090 x 0.330

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FLASH EEPROM Modules



FLASH EEPROM Modules

Organization	Part Number	90n	100n	120n	135n	150n	170n	200n	250n	300n	350n	Type	Package Dimension*
64Kx8	DPZ32X16A	o	o	o		x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.330
128Kx8	DPZ32X32V	o	o	o		x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.330
128Kx8	DPZ64X16A		o	x		x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPZ128X16A			x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPZ64X32V		o	x		x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx8	DPZ128X32V			x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
1024Kx8	DPZ256X32V						o	o	o			66-PGA	1.090 x 1.090 x 0.330
2048Kx8	DPZ1MS16P					x		x	x			48-DIP	2.500 x 1.200 x 0.200
2048Kx8	DPZ1MS16XP							x	x			48-FPK	2.500 x 1.500 x 0.220
4096Kx8	DPZ2MS16P							x	x	x		48-DIP	2.500 x 1.200 x 0.200
4096Kx8	DPZ2MS16XP							x	x	x		48-FPK	2.500 x 1.500 x 0.220
32Kx16	DPZ32X16A	o	o	o		x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.330
64Kx16	DPZ32X32V	o	o	o		x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.330
64Kx16	DPZ64X16A			x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPZ128X16A			x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPZ64X32V		o	x		x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx16	DPZ128X32V			x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx16	DPZ256X32V						o	o	o			66-PGA	1.090 x 1.090 x 0.330
1024Kx16	DPZ1MS16P					x		x	x			48-DIP	2.500 x 1.200 x 0.200
1024Kx16	DPZ1MS16XP					x		x	x			48-FPK	2.500 x 1.500 x 0.220
2048Kx16	DPZ2MS16P							x	x	x		48-DIP	2.500 x 1.200 x 0.200
2048Kx16	DPZ2MS16XP							x	x	x		48-FPK	2.500 x 1.500 x 0.220
32Kx32	DPZ32X32V	o	o	o		x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.330
64Kx32	DPZ64X32V		o	x	x		x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
128Kx32	DPZ128X32V			x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx32	DPZ256X32V						o	o	o			66-PGA	1.090 x 1.090 x 0.330

Dense-Pac Microsystems

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THREE DIMENSIONAL MODULES



THREE DIMENSIONAL Modules

Dense-Pac Microsystems

Organization	Part Number	35n	45n	55n	70n	85n	100n	120n	150n	Type	Package Dimension*
256Kx8	DPS128X16A3				x	x	x	x	x	50-PGA	0.990 x 0.540 x 0.280
256Kx8	DPS128X16AA3	o	o	o	o					50-PGA	0.990 x 0.540 x 0.280
512Kx8	DPS128X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.250
512Kx8	DPS128X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.250
512Kx8	DPS256X16A3				x	x	x	x	x	50-PGA	0.990 x 0.540 x 0.450
512Kx8	DPS256X16AA3	o	o	o	o					50-PGA	0.990 x 0.540 x 0.450
512Kx8	DPS512S8A3							x	x	50-PGA	0.990 x 0.540 x 0.570
512Kx8	DPS512S8AA3			o	o	o	o			50-PGA	0.990 x 0.540 x 0.570
1024Kx8	DPS1MS8A3						x	x	x	50-PGA	0.990 x 0.540 x 0.850
1024Kx8	DPS1MS8AA3			o	o	o	o			50-PGA	0.990 x 0.540 x 0.850
1024Kx8	DPS256X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.400
1024Kx8	DPS256X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.400
1024Kx8	DPS512X16A3				x	x	x	x	x	50-PGA	0.990 x 0.540 x 0.750
1024Kx8	DPS512X16AA3	o	o	o	o					50-PGA	0.990 x 0.540 x 0.750
2048Kx8	DPS512X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.720
2048Kx8	DPS512X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.720
128Kx16	DPS128X16A3				x	x	x	x	x	50-PGA	0.990 x 0.540 x 0.280
128Kx16	DPS128X16AA3	o	o	o	o					50-PGA	0.990 x 0.540 x 0.280
256Kx16	DPS128X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.250
256Kx16	DPS128X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.250
256Kx16	DPS256X16A3				x	x	x	x	x	50-PGA	0.990 x 0.540 x 0.450
256Kx16	DPS256X16AA3	o	o	o	o					50-PGA	0.990 x 0.540 x 0.450
512Kx16	DPS256X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.400
512Kx16	DPS256X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.400
512Kx16	DPS512X16A3				x	x	x	x	x	50-PGA	0.990 x 0.540 x 0.750
512Kx16	DPS512X16AA3	o	o	o	o					50-PGA	0.990 x 0.540 x 0.750
1024Kx16	DPS512X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.720
1024Kx16	DPS512X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.720
128Kx24	DPS128X24AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.250
128Kx24	DPS128X24V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.250
128Kx32	DPS128X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.250
128Kx32	DPS128X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.250
256Kx32	DPS256X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.400
256Kx32	DPS256X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.400
512Kx32	DPS512X32AV3	o	o	o	o					66-PGA	1.090 x 1.090 x 0.720
512Kx32	DPS512X32V3				x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.720

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SRAM VERSAPAC Modules



SRAM VERSAPAC Modules												
Organization	Part Number	25n	35n	45n	55n	70n	85n	100n	120n	150n	Type	Package Dimension*
16Kx8 32Kx8	DPS8X16A DPS832V		x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
64Kx8 128Kx8	DPS32X16A DPS3232V	x	x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
512Kx8 512Kx8	DPS128X32AV3 DPS128X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.250 1.090 x 1.090 x 0.250
1024Kx8 1024Kx8	DPS256X32AV3 DPS256X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.400 1.090 x 1.090 x 0.400
2048Kx8 2048Kx8	DPS512X32AV3 DPS512X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.720 1.090 x 1.090 x 0.720
8Kx16 16Kx16	DPS8X16A DPS832V		x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
32Kx16 64Kx16	DPS32X16A DPS3232V	x	x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
256Kx16 256Kx16	DPS128X32AV3 DPS128X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.250 1.090 x 1.090 x 0.250
512Kx16 512Kx16	DPS256X32AV3 DPS256X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.400 1.090 x 1.090 x 0.400
1024Kx16 1024Kx16	DPS512X32AV3 DPS512X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.720 1.090 x 1.090 x 0.720
128Kx24 128Kx24	DPS128X24AV3 DPS128X24V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.250 1.090 x 1.090 x 0.250
8Kx32 32Kx32	DPS832V DPS3232V	x	x	x	x	x	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.300 1.090 x 1.090 x 0.300
128Kx32 128Kx32	DPS128X32AV3 DPS128X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.250 1.090 x 1.090 x 0.250
256Kx32 256Kx32	DPS256X32AV3 DPS256X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.400 1.090 x 1.090 x 0.400
512Kx32 512Kx32	DPS512X32AV3 DPS512X32V3		o	o	o	o	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.720 1.090 x 1.090 x 0.720

Dense-Pac Microsystems

EEPROM VERSAPAC Modules

EEPROM VERSAPAC Modules													
Organization	Part Number	55n	70n	90n	120n	150n	170n	200n	250n	300n	350n	Type	Package Dimension*
16Kx8 32Kx8	DPE8X16A DPE832V	x	x	x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
64Kx8 128Kx8	DPE32X16A DPE3232V	o	x	x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
8Kx16 16Kx16	DPE8X16A DPE832V	x	x	x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
32Kx16 64Kx16	DPE32X16A DPE3232V	o	x	x	x	x	x	x	x	x	x	40-PGA 66-PGA	1.009 x 0.596 x 0.300 1.090 x 1.090 x 0.300
8Kx32 32Kx32	DPE832V DPE3232V	x	x	x	x	x	x	x	x	x	x	66-PGA 66-PGA	1.090 x 1.090 x 0.300 1.090 x 1.090 x 0.300

x = Current Product

o = Advanced Information

* Package Dimension is L x W x H.

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EPROM VERSAPAC Modules



EPROM VERSAPAC Modules

Organization	Part Number	55n	70n	90n	120n	150n	170n	200n	250n	300n	350n	Type	Package Dimension*
64Kx8	DPV32X16A	x	x	x	x	x	x	x				40-PGA	1.009 x 0.596 x 0.330
128Kx8	DPV3232V	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
128Kx8	DPV3232VA	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
128Kx8	DPV64X16A								x	x		40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPV128X16A				o	x	x	x				40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPV6432V								x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx8	DPV12832V								x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx8	DPV12832VA				o	x	x	x				66-PGA	1.090 x 1.090 x 0.330
1024Kx8	DPV256X32V							o	o	o	o	66-PGA	1.090 x 1.090 x 0.330
32Kx16	DPV32X16A	x	x	x	x	x	x	x				40-PGA	1.009 x 0.596 x 0.330
64Kx16	DPV3232V	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx16	DPV3232VA	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx16	DPV64X16A						x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPV128X16A				o	x	x	x				40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPV6432V						x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx16	DPV12832V								x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx16	DPV12832VA				o	x	x	x				66-PGA	1.090 x 1.090 x 0.330
512Kx16	DPV256X32V							o	o	o	o	66-PGA	1.090 x 1.090 x 0.330
32Kx32	DPV3232V	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
32Kx32	DPV3232VA	x	x	x	x	x	x	x				66-PGA	1.090 x 1.090 x 0.330
64Kx32	DPV6432V						x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
128Kx32	DPV12832V								x	x		66-PGA	1.090 x 1.090 x 0.330
128Kx32	DPV12832VA				o	x	x	x				66-PGA	1.090 x 1.090 x 0.330
256Kx32	DPV256X32V						o	o	o	o	o	66-PGA	1.090 x 1.090 x 0.330

Dense-Pac Microsystems

FLASH EEPROM VERSAPAC Modules

FLASH EEPROM VERSAPAC Modules

Organization	Part Number	90n	100n	120n	135n	150n	170n	200n	250n	300n	350n	Type	Package Dimension*
64Kx8	DPZ32X16A	o	o	o		o	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.330
128Kx8	DPZ32X32V	o	o	o		o	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.330
128Kx8	DPZ64X16A		o	x		x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPZ128X16A			x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
256Kx8	DPZ64X32V		o	x		x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx8	DPZ128X32V			x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
1024Kx8	DPZ256X32V						o	o	o	o		66-PGA	1.090 x 1.090 x 0.330
32Kx16	DPZ32X16A	o	o	o		x	x	x	x	x	x	40-PGA	1.009 x 0.596 x 0.330
64Kx16	DPZ32X32V	o	o	o		x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.330
64Kx16	DPZ64X16A			x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPZ128X16A			x	x	x	x	x	x	x		40-PGA	1.009 x 0.596 x 0.330
128Kx16	DPZ64X32V		o	x		x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx16	DPZ128X32V			x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
512Kx16	DPZ256X32V						o	o	o	o		66-PGA	1.090 x 1.090 x 0.330
32Kx32	DPZ32X32V	o	o	o		x	x	x	x	x	x	66-PGA	1.090 x 1.090 x 0.330
64Kx32	DPZ64X32V		o	x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
128Kx32	DPZ128X32V			x	x	x	x	x	x	x		66-PGA	1.090 x 1.090 x 0.330
256Kx32	DPZ256X32V						o	o	o	o		66-PGA	1.090 x 1.090 x 0.330

x = Current Product

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* Package Dimension is L x W x H.

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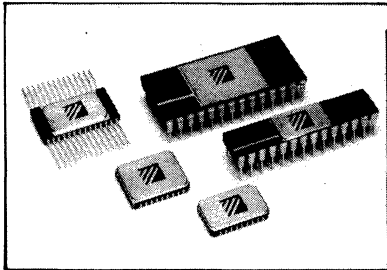
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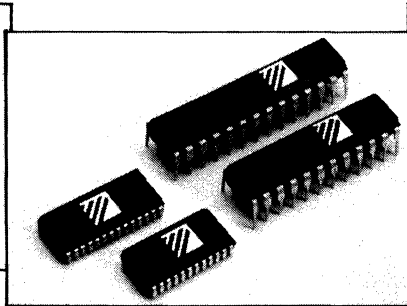
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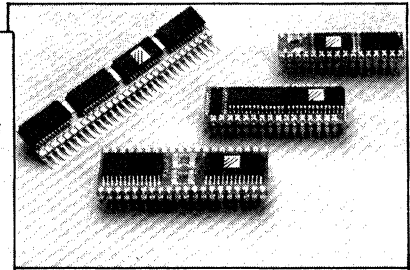
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High Performance Military SRAMs



New High Speed Commercial SRAMs



High Density SRAM Modules

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Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption		
					Style	Dimensions LxWxH (in.)	ICC1 mA	ICC3 mA	IDR µA
64K	8Kx8	EDI8808CBXXDB	20-45	28	DIP, 0.6	1.490x0.600x0.232	TBD	TBD	
64K	8Kx8	EDI8808CBXXFB	20-45	28	Flatpack	0.740x0.420x0.130	TBD	TBD	
64K	8Kx8	EDI8808CBXXLB	20-45	32	LCC	0.560x0.460x0.095	TBD	TBD	
64K	8Kx8	EDI8808CBXXQB	20-45	28	DIP, 0.3	0.910x0.300x0.160	TBD	TBD	
64K	8Kx8	EDI8810HXXDB	55-150	28	DIP, 0.6	1.490x0.600x0.232	70	0.5	200
64K	8Kx8	EDI8810HXXLB	55-150	32	LCC	0.560x0.460x0.095	70	0.5	200
64K	8Kx8	EDI8810LXXDB	55-150	28	DIP, 0.6	1.490x0.600x0.232	70	0.1	50
64K	8Kx8	EDI8810LXXLB	55-150	32	LCC	0.560x0.460x0.095	70	0.1	50
72K	8Kx 9	EDI8908CAXXFB	35-70	28	Flatpack	0.740x0.420x0.130	140	1	
72K	8Kx 9	EDI8908CAXXL28B	35-70	28	LCC	0.560x0.360x0.120	140	1	
72K	8Kx 9	EDI8908CAXXQB	35-70	28	DIP, 0.3	0.910x0.300x0.160	140	1	
72K	8Kx 9	EDI8908LPAXXFB	35-70	28	Flatpack	0.740x0.420x0.130	140	0.6	200
72K	8Kx 9	EDI8908LPAXXL28B	35-70	28	LCC	0.560x0.360x0.120	140	0.6	200
72K	8Kx 9	EDI8908LPAXXQB	35-70	28	DIP, 0.3	0.910x0.300x0.160	140	0.6	200
72K	8Kx 9	EDI8908PAXXFB	35-70	28	Flatpack	0.740x0.420x0.130	140	0.6	
72K	8Kx 9	EDI8908PAXXL28B	35-70	28	LCC	0.560x0.360x0.120	140	0.6	
72K	8Kx 9	EDI8908PAXXQB	35-70	28	DIP, 0.3	0.910x0.300x0.160	140	0.6	
256K	32Kx 8	EDI8832CXXCB	70-150	28	DIP, 0.6	1.414x0.600x0.155	95	3	
256K	32Kx 8	EDI8832CXXLB	70-150	32	LCC	0.560x0.460x0.095	95	3	
256K	32Kx 8	EDI8832CXXQB	70-150	28	DIP, 0.3	0.910x0.300x0.160	95	3	
256K	32Kx 8	EDI8832LPXXCB	70-150	28	DIP, 0.6	1.414x0.600x0.155	95	0.25	150
256K	32Kx 8	EDI8832LPXXLB	70-150	32	LCC	0.560x0.460x0.095	95	0.25	150
256K	32Kx 8	EDI8832LPXXQB	70-150	28	DIP, 0.3	0.910x0.300x0.160	95	0.25	150
256K	32Kx 8	EDI8832PXXCB	70-150	28	DIP, 0.6	1.414x0.600x0.155	95	0.25	
256K	32Kx 8	EDI8832PXXLB	70-150	32	LCC	0.560x0.460x0.095	95	0.25	
256K	32Kx 8	EDI8832PXXQB	70-150	28	DIP, 0.3	0.910x0.300x0.160	95	0.25	
256K	32Kx 8	EDI8833CXXCB	35-55	28	DIP, 0.6	1.414x0.600x0.155	125	3	
256K	32Kx 8	EDI8833CXXFB	35-55	28	Flatpack	0.740x0.420x0.130	125	3	
256K	32Kx 8	EDI8833CXXLB	35-55	32	LCC	0.560x0.460x0.095	125	3	
256K	32Kx 8	EDI8833LPXXCB	35-55	28	DIP, 0.6	1.414x0.600x0.155	125	0.9	350
256K	32Kx 8	EDI8833LPXXFB	35-55	28	Flatpack	0.740x0.420x0.130	125	0.9	350
256K	32Kx 8	EDI8833LPXXLB	35-55	32	LCC	0.560x0.460x0.095	125	0.9	350

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Electronic Designs Europe Ltd. • Shelley House, The Avenue • Lightwater, Surrey GU18 5RF

United Kingdom • 0276 72637 • FAX: 0276 73748 • TELEX: 858325

Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption		
					Style	Dimensions LxWxH (in.)	ICC1 mA	ICC3 mA	IDR µA
256K	32Kx 8	EDI8833PXXCB	35-55	28	DIP, 0.6	1.414x0.600x0.155	125	0.9	
256K	32Kx 8	EDI8833PXXFB	35-55	28	Flatpack	0.740x0.420x0.130	125	0.9	
256K	32Kx 8	EDI8833PXXLB	35-55	32	LCC	0.560x0.460x0.095	125	0.9	
256K	32Kx 8	EDI8834CAXXCB	25-55	28	DIP, 0.6	1.490x0.600x0.232	TBD	TBD	
256K	32Kx 8	EDI8834CAXXFB	25-55	28	Flatpack	0.740x0.420x0.130	TBD	TBD	
256K	32Kx 8	EDI8834CAXXL28B	25-55	28	LCC	0.560x0.360x0.120	TBD	TBD	
256K	32Kx 8	EDI8834CAXXLB	25-55	32	LCC	0.560x0.460x0.095	TBD	TBD	
256K	32Kx 8	EDI8834CAXXMC	25-45	28	SOJ	0.713x0.340x0.146	TBD	TBD	
256K	32Kx 8	EDI8834CAXXRC	25-45	28	DIP, 0.3	1.378x0.300x0.173	TBD	TBD	
256K	32Kx 8	EDI8834CAXXEB	25-55	28	DIP, 0.3	1.490x0.300x0.232	TBD	TBD	
256K	32Kx 8	EDI8834CXXMC	30-45	28	SOJ	0.713x0.340x0.146	165	5	
256K	32Kx 8	EDI8834CXXRC	30-45	28	DIP, 0.3	1.378x0.300x0.173	165	5	
256K	64Kx 4	EDI8464CXXLB	35-55	28	LCC	0.560x0.360x0.120	120	5	
256K	64Kx 4	EDI8464LPXXLB	35-55	28	LCC	0.560x0.360x0.120	120	2	500
256K	64Kx 4	EDI8464PXXLB	35-55	28	LCC	0.560x0.360x0.120	120	2	
256K	64Kx 4	EDI8465CAXXMC	25-35	24	SOJ	0.638x0.340x0.146	150	5	
256K	64Kx 4	EDI8465CAXXRC	25-35	24	DIP, 0.3	1.175x0.300x0.173	150	5	
256K	64Kx 4	EDI8465CBXXFB	15-25	28	Flatpack	0.740x0.420x0.130	TBD	TBD	
256K	64Kx 4	EDI8465CBXXLB	15-25	28	LCC	0.560x0.360x0.120	TBD	TBD	
256K	64Kx 4	EDI8465CBXXMC	15-25	24	SOJ	0.638x0.340x0.146	TBD	TBD	
256K	64Kx 4	EDI8465CBXXQB	15-25	24	DIP, 0.3	1.280x0.300x0.200	TBD	TBD	
256K	64Kx 4	EDI8465CBXXRC	15-25	24	DIP, 0.3	1.175x0.300x0.173	TBD	TBD	
256K	64Kx 4	EDI8465CXXFB	35-55	28	Flatpack	0.740x0.420x0.130	120	10	
256K	64Kx 4	EDI8465CXXQB	35-55	24	DIP, 0.3	1.280x0.300x0.200	120	10	
256K	64Kx 4	EDI8465LPXXFB	35-55	28	Flatpack	0.740x0.420x0.130	100	3	500
256K	64Kx 4	EDI8465LPXXQB	35-55	24	DIP, 0.3	1.280x0.300x0.200	100	3	500
256K	64Kx 4	EDI8465PXXFB	35-55	28	Flatpack	0.740x0.420x0.130	100	3	
256K	64Kx 4	EDI8465PXXQB	35-55	24	DIP, 0.3	1.280x0.300x0.200	100	3	
256K	64Kx 4	EDI8466CAXXLB	25-55	28	LCC	0.560x0.360x0.120	TBD	TBD	
256K	64Kx 4	EDI8466CAXXEB	25-55	28	DIP, 0.3	1.490x0.300x0.232	TBD	TBD	
256K	64Kx 4	EDI8466CAXXMC	25-55	28	SOJ	0.713x0.340x0.146	TBD	TBD	
256K	64Kx 4	EDI8466CAXXRC	25-55	28	DIP, 0.3	1.378x0.300x0.173	TBD	TBD	
256K	64Kx 4	EDI8466CBXXLB	15-25	28	LCC	0.560x0.360x0.120	TBD	TBD	
256K	64Kx 4	EDI8466CBXXMC	15-25	28	SOJ	0.713x0.340x0.146	TBD	TBD	
256K	64Kx 4	EDI8466CBXXRC	15-25	28	DIP, 0.3	1.378x0.300x0.173	TBD	TBD	
256K	64Kx 4	EDI8466CBXXQB	15-25	28	DIP, 0.3	0.910x0.300x0.160	TBD	TBD	
256K	256Kx 1	EDI81256CXXFB	35-55	28	Flatpack	0.740x0.420x0.130	120	3	
256K	256Kx 1	EDI81256CXXLB	35-55	28	LCC	0.560x0.360x0.120	120	3	
256K	256Kx 1	EDI81256CXXQB	35-55	24	DIP, 0.3	1.280x0.300x0.200	120	3	
256K	256Kx 1	EDI81256LPXXFB	35-55	28	Flatpack	0.740x0.420x0.130	100	1.5	500
256K	256Kx 1	EDI81256LPXXLB	35-55	28	LCC	0.560x0.360x0.120	100	1.5	500
256K	256Kx 1	EDI81256LPXXQB	35-55	24	DIP, 0.3	1.280x0.300x0.200	100	1.5	500
256K	256Kx 1	EDI81256PXXFB	35-55	28	Flatpack	0.740x0.420x0.130	100	1.5	
256K	256Kx 1	EDI81256PXXLB	35-55	28	LCC	0.560x0.360x0.120	100	1.5	
256K	256Kx 1	EDI81256PXXQB	35-55	24	DIP, 0.3	1.280x0.300x0.200	100	1.5	
256K	256Kx 1	EDI81256CAXXFB	25-30	28	Flatpack	0.740x0.420x0.130	140	10	
256K	256Kx 1	EDI81256CAXXLB	25-30	28	LCC	0.560x0.360x0.120	140	10	
256K	256Kx 1	EDI81256CAXXQB	25-30	24	DIP, 0.3	1.280x0.300x0.200	140	10	
256K	256Kx 1	EDI81256LPAXXFB	25-30	28	Flatpack	0.740x0.420x0.130	140	2	500
256K	256Kx 1	EDI81256LPAXXLB	25-30	28	LCC	0.560x0.360x0.120	140	2	500
256K	256Kx 1	EDI81256LPAXXQB	25-30	24	DIP, 0.3	1.280x0.300x0.200	140	2	500
256K	256Kx 1	EDI81256PAXXFB	25-30	28	Flatpack	0.740x0.420x0.130	140	2	
256K	256Kx 1	EDI81256PAXXLB	25-30	28	LCC	0.560x0.360x0.120	140	2	
256K	256Kx 1	EDI81256PAXXQB	25-30	24	DIP, 0.3	1.280x0.300x0.200	140	2	

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Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption		
					Style	Dimensions LxWxH (in.)	ICC1 mA	ICC3 mA	IDR µA
256K	256Kx 1	EDI81257CAXXMC	25-35	24	SOJ	0.638x0.340x0.146	150	5	
256K	256Kx 1	EDI81257CAXXRC	25-35	24	DIP, 0.3	1.175x0.300x0.173	150	5	
256K	256Kx 1	EDI81257CBXXFB	15-25	28	Flatpack	0.740x0.420x0.130	TBD	TBD	
256K	256Kx 1	EDI81257CBXXLB	15-25	28	LCC	0.560x0.360x0.120	TBD	TBD	
256K	256Kx 1	EDI81257CBXXMC	15-25	24	SOJ	0.638x0.340x0.146	TBD	TBD	
256K	256Kx 1	EDI81257CBXXQB	15-25	24	DIP, 0.3	1.280x0.300x0.200	TBD	TBD	
256K	256Kx 1	EDI81257CBXXRC	15-25	24	DIP, 0.3	1.175x0.300x0.173	TBD	TBD	
512K	64Kx 8	EDI8M864CXXCB	45-150	32	DIP Module, 0.6	1.616x0.600x0.230	95	3	
512K	64Kx 8	EDI8M864CXXCC	45-150	32	DIP Module, 0.6	1.616x0.600x0.230	95	3	
1Meg	64Kx16	EDH816H64CXXC	35-55	40	DIP Module, 0.9	2.200x0.900x0.270	1380	250	
1Meg	64Kx16	EDH816H64CXXCMHR	35-70	40	DIP Module, 0.9	2.200x0.900x0.270	1380	250	
1Meg	64Kx16	EDI8F1664CAXXM6C	25-45	40	DIP Module, 0.6	2.200x0.600x0.405	TBD	TBD	
1Meg	64Kx16	EDI8F1664CAXXMSC	25-45	40	SIP Module	4.035x0.180x0.675	TBD	TBD	
1Meg	64Kx16	EDI8F1664CXXPC	85-150	40	DIP Module, 0.6	2.020x0.705x0.275	195	8	
1Meg	64Kx16	EDI8M1664CXXCC	45-100	40	DIP Module, 0.6	2.020x0.600x0.320	195	15	
1Meg	64Kx16	EDI8M1664CXXCB	45-70	40	DIP Module, 0.6	2.020x0.600x0.320	280	30	
1Meg	64Kx16	EDI8M1664CXXCB	85-100	40	DIP Module, 0.6	2.020x0.600x0.320	195	15	
1Meg	64Kx16	EDI8M1664LPXXCB	85-100	40	DIP Module, 0.6	2.020x0.600x0.320	195	15	2500
1Meg	64Kx16	EDI8M1664PXXCB	85-100	40	DIP Module, 0.6	2.020x0.600x0.320	195	15	
1Meg	128Kx 8	EDI88128CXXCB*	70-100	32	DIP, 0.6	1.616x0.600x0.155	95	5	
1Meg	128Kx 8	EDI88128CXXCM*	35-55	32	DIP, 0.6	1.616x0.600x0.155	150	10	
1Meg	128Kx 8	EDI88128CXXFB*	70-100	32	Flatpack	0.830x0.420x0.125	95	5	
1Meg	128Kx 8	EDI88128CXXFM*	35-55	32	Flatpack	0.830x0.420x0.125	150	10	
1Meg	128Kx 8	EDI88128CXXLB*	70-100	32	LCC	0.840x0.405x0.096	95	5	
1Meg	128Kx 8	EDI88128CXXLM*	35-55	32	LCC	0.840x0.405x0.096	150	10	
1Meg	128Kx 8	EDI88128CXXNB*	70-100	32	CSOJ	0.840x0.440x0.155	95	5	
1Meg	128Kx 8	EDI88128CXXNM*	35-55	32	CSOJ	0.840x0.440x0.155	150	10	
1Meg	128Kx 8	EDI88128CXXTB*	70-100	32	DIP, 0.4	1.616x0.400x0.155	95	5	
1Meg	128Kx 8	EDI88128CXXTM*	35-55	32	DIP, 0.4	1.616x0.400x0.155	150	10	
1Meg	128Kx 8	EDI88128CXXZB*	70-100	32	ZIP	1.82x0.125x0.500	95	5	
1Meg	128Kx 8	EDI88128CXXZM*	35-55	32	ZIP	1.82x0.125x0.500	150	10	
1Meg	128Kx 8	EDI88128LPXXCB*	70-100	32	DIP, 0.6	1.616x0.600x0.155	95	1	400
1Meg	128Kx 8	EDI88128LPXXCM*	35-55	32	DIP, 0.6	1.616x0.600x0.155	150	1	750
1Meg	128Kx 8	EDI88128LPXXFB*	70-100	32	Flatpack	0.830x0.420x0.125	95	1	400
1Meg	128Kx 8	EDI88128LPXXFM*	35-55	32	Flatpack	0.830x0.420x0.125	150	1	750
1Meg	128Kx 8	EDI88128LPXXLB*	70-100	32	LCC	0.840x0.405x0.096	95	1	400
1Meg	128Kx 8	EDI88128LPXXLM*	35-55	32	LCC	0.840x0.405x0.096	150	1	750
1Meg	128Kx 8	EDI88128LPXXNB*	70-100	32	CSOJ	0.840x0.440x0.155	95	1	400
1Meg	128Kx 8	EDI88128LPXXNM*	35-55	32	CSOJ	0.840x0.440x0.155	150	1	750
1Meg	128Kx 8	EDI88128LPXXTB*	70-100	32	DIP, 0.4	1.616x0.400x0.155	95	1	400
1Meg	128Kx 8	EDI88128LPXXTM*	35-55	32	DIP, 0.4	1.616x0.400x0.155	150	1	750
1Meg	128Kx 8	EDI88128LPXXZB*	70-100	32	ZIP	1.82x0.125x0.500	95	1	400
1Meg	128Kx 8	EDI88128LPXXZM*	35-55	32	ZIP	1.82x0.125x0.500	150	1	750
1Meg	128Kx 8	EDI88128PXXCB*	70-100	32	DIP, 0.6	1.616x0.600x0.155	95	1	
1Meg	128Kx 8	EDI88128PXXCM*	35-55	32	DIP, 0.6	1.616x0.600x0.155	150	1	
1Meg	128Kx 8	EDI88128PXXFB*	70-100	32	Flatpack	0.830x0.420x0.125	95	1	
1Meg	128Kx 8	EDI88128PXXFM*	35-55	32	Flatpack	0.830x0.420x0.125	150	1	
1Meg	128Kx 8	EDI88128PXXLB*	70-100	32	LCC	0.840x0.405x0.096	95	1	
1Meg	128Kx 8	EDI88128PXXLM*	35-55	32	LCC	0.840x0.405x0.096	150	1	
1Meg	128Kx 8	EDI88128PXXNB*	70-100	32	CSOJ	0.840x0.440x0.155	95	1	
1Meg	128Kx 8	EDI88128PXXNM*	35-55	32	CSOJ	0.840x0.440x0.155	150	1	
1Meg	128Kx 8	EDI88128PXXTB*	70-100	32	DIP, 0.4	1.616x0.400x0.155	95	1	
1Meg	128Kx 8	EDI88128PXXTM*	35-55	32	DIP, 0.4	1.616x0.400x0.155	150	1	
1Meg	128Kx 8	EDI88128PXXZB*	70-100	32	ZIP	1.82x0.125x0.500	95	1	
1Meg	128Kx 8	EDI88128PXXZM*	35-55	32	ZIP	1.82x0.125x0.500	150	1	

*Also available with Dual Chip Enable as EDI88130C/LP/P

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Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption		
					Style	Dimensions LxWxH (in.)	ICC1 mA	ICC3 mA	IDR µA
1Meg	128Kx 8	EDI88130CSXXCB†	25-55	32	DIP, 0.6	1.616x0.600x0.155	150	10	
1Meg	128Kx 8	EDI88130CSXXFB†	25-55	32	Flatpack	0.830x0.420x0.125	150	10	
1Meg	128Kx 8	EDI88130CSXXHC†	20-55	32	DIP, 0.4	1.616x0.300x0.160	150	10	
1Meg	128Kx 8	EDI88130CSXXLB†	25-55	32	LCC	0.840x0.405x0.096	150	10	
1Meg	128Kx 8	EDI88130CSXXMC†	20-55	32	SOJ	0.826x0.440x0.142	150	10	
1Meg	128Kx 8	EDI88130CSXXNB†	25-55	32	CSOJ	0.840x0.440x0.155	150	10	
1Meg	128Kx 8	EDI88130CSXXTB†	25-55	32	DIP, 0.4	1.616x0.400x0.155	150	10	
1Meg	128Kx 8	EDI88130CSXXZB†	25-55	32	ZIP	1.82x0.125x0.500	150	10	
1Meg	128Kx 8	EDI88130CSXXZC†	20-55	32	ZIP	1.82x0.125x0.500	150	10	
1Meg	128Kx 8	EDI88130LPSXXCB†	25-55	32	DIP, 0.6	1.616x0.600x0.155	150	1	750
1Meg	128Kx 8	EDI88130LPSXXFB†	25-55	32	Flatpack	0.830x0.420x0.125	150	1	750
1Meg	128Kx 8	EDI88130LPSXXLB†	25-55	32	LCC	0.840x0.405x0.096	150	1	750
1Meg	128Kx 8	EDI88130LPSXXNB†	25-55	32	CSOJ	0.840x0.440x0.155	150	1	750
1Meg	128Kx 8	EDI88130LPSXXTB†	25-55	32	DIP, 0.4	1.616x0.400x0.155	150	1	750
1Meg	128Kx 8	EDI88130LPSXXZB†	25-55	32	ZIP	1.82x0.125x0.500	150	1	750
1Meg	128Kx 8	EDI88130PSXXCB†	25-55	32	DIP, 0.6	1.616x0.600x0.155	150	1	
1Meg	128Kx 8	EDI88130PSXXFB†	25-55	32	Flatpack	0.830x0.420x0.125	150	1	
1Meg	128Kx 8	EDI88130PSXXLB†	25-55	32	LCC	0.840x0.405x0.096	150	1	
1Meg	128Kx 8	EDI88130PSXXNB†	25-55	32	CSOJ	0.840x0.440x0.155	150	1	
1Meg	128Kx 8	EDI88130PSXXTB†	25-55	32	DIP, 0.4	1.616x0.400x0.155	150	1	
1Meg	128Kx 8	EDI88130PSXXZB†	25-55	32	ZIP	1.82x0.125x0.500	150	1	
1Meg	128Kx 8	EDI8F8128CXMM6C*	35-70	32	DIP Module, 0.6	1.770x0.600x0.365	220	20	
1Meg	128Kx 8	EDI8F8128CXXB4C*	35-70	32	DIP Module, 0.4	1.605x0.467x0.265	220	20	
1Meg	128Kx 8	EDI8M8128CXCC*	45-150	32	DIP Module, 0.6	1.616x0.600x0.275	210	20	
1Meg	128Kx 8	EDI8M8128CXXCB*	45-70	32	DIP Module, 0.6	1.616x0.600x0.275	210	20	
1Meg	128Kx 8	EDI8M8128CXXCB*	80-150	32	DIP Module, 0.6	1.616x0.600x0.275	95	3	
1Meg	128Kx 8	EDI8M8128LPXXCB*	80-150	32	DIP Module, 0.6	1.616x0.600x0.275	95	0.9	500
1Meg	128Kx 8	EDI8M8128PXXCB*	80-150	32	DIP Module, 0.6	1.616x0.600x0.275	95	0.9	
1Meg	256Kx 4	EDI84256CSXXHC	20-35	28	DIP, 0.4	1.378x0.400x0.185	150	10	
1Meg	256Kx 4	EDI84256CSXXMC	20-35	28	SOJ	0.736x0.440x0.142	150	10	
1Meg	256Kx 4	EDI84256CSXXTB	25-55	28	DIP, 0.4	1.416x0.400x0.055	150	10	
1Meg	256Kx 4	EDI84256CSXXFB	25-55	28	Flatpack	0.740x0.420x0.130	150	10	
1Meg	256Kx 4	EDI84256CSXXLB	25-55	28	LCC	0.740x0.405x0.096	150	10	
1Meg	256Kx 4	EDI84256CSXXNB	25-55	28	CSOJ	0.740x0.440x0.155	150	10	
1Meg	256Kx 4	EDI84256LPSXXTB	25-55	28	DIP, 0.4	1.416x0.400x0.055	150	1	750
1Meg	256Kx 4	EDI84256LPSXXFB	25-55	28	Flatpack	0.740x0.420x0.130	150	1	750
1Meg	256Kx 4	EDI84256LPSXXLB	25-55	28	LCC	0.740x0.405x0.096	150	1	750
1Meg	256Kx 4	EDI84256LPSXXNB	25-55	28	CSOJ	0.740x0.440x0.155	150	1	750
1Meg	256Kx 4	EDI84256PSXXTB	25-55	28	DIP, 0.4	1.416x0.400x0.055	150	1	
1Meg	256Kx 4	EDI84256PSXXFB	25-55	28	Flatpack	0.740x0.420x0.130	150	1	
1Meg	256Kx 4	EDI84256PSXXLB	25-55	28	LCC	0.740x0.405x0.096	150	1	
1Meg	256Kx 4	EDI84256PSXXNB	25-55	28	CSOJ	0.740x0.440x0.155	150	1	
1Meg	256Kx 4	EDI84258CSXXHC	20-35	32	DIP, 0.4	1.616x0.300x0.160	TBD	TBD	
1Meg	256Kx 4	EDI84258CSXXMC	20-35	32	SOJ	0.826x0.440x0.142	TBD	TBD	
1Meg	256Kx 4	EDI84258CSXXNB	25-55	32	CSOJ	0.840x0.440x0.155	TBD	TBD	
1Meg	256Kx 4	EDI84258CSXXTB	25-55	32	DIP, 0.4	1.616x0.400x0.060	TBD	TBD	
1Meg	256Kx 4	EDI84258LPSXXNB	25-55	32	CSOJ	0.840x0.440x0.155	TBD	TBD	
1Meg	256Kx 4	EDI84258LPSXXTB	25-55	32	DIP, 0.4	1.616x0.400x0.060	TBD	TBD	
1Meg	256Kx 4	EDI84258PSXXNB	25-55	32	CSOJ	0.840x0.440x0.155	TBD	TBD	
1Meg	256Kx 4	EDI84258PSXXTB	25-55	32	DIP, 0.4	1.616x0.400x0.155	TBD	TBD	
1Meg	256Kx 4	EDI8F4258CXMMSC	20-70	30	SIP Module	3.000x0.190x0.560	480	40	
1Meg	256Kx 4	EDI8M4257CXXC4B	35-70	28	DIP Module, 0.4	1.414x0.459x0.337	480	40	
1Meg	256Kx 4	EDI8M4257CXXC4C	35-70	28	DIP Module, 0.4	1.414x0.459x0.337	480	40	

†Also available with Single Chip Enable as EDI88128CS/LPS/IPS

*Also available with Dual Chip Enable as EDI8F/M8130

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Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption		
					Style	Dimensions LxWxH (in.)	ICC1 mA	ICC3 mA	IDR μ A
1Meg	1Mx 1	EDI811024CSXXHC	20-35	28	DIP, 0.4	1.378x0.400x0.185	TBD	TBD	
1Meg	1Mx 1	EDI811024CSXXLB	25-35	28	LCC	0.740x0.405x0.096	TBD	TBD	
1Meg	1Mx 1	EDI811024CSXXMC	20-35	28	SOJ	0.736x0.440x0.142	TBD	TBD	
1Meg	1Mx 1	EDI811024CSXXNB	25-35	28	CSOJ	0.740x0.440x0.155	TBD	TBD	
1Meg	1Mx 1	EDI811024CSXXTB	25-35	28	DIP, 0.4	1.416x0.400x0.115	TBD	TBD	
1Meg	1Mx 1	EDI8M11024CXXC4C	35-70	28	DIP Module, 0.4	1.595x0.461x0.276	210	30	
1Meg	1Mx 1	EDI8M11024CXXC4M	35-70	28	DIP Module, 0.4	1.595x0.461x0.276	210	30	
2Meg	64Kx32	EDI8F3264CXXMZC	20-55	64	ZIP Module	3.660x0.330x0.530	980	25	
2Meg	64Kx32	EDI8M3264CXXC6B	35-55	64	DIP Module, 0.6	3.010x0.600x0.270	TBD	TBD	
2Meg	64Kx32	EDI8M3264CXXC6C	35-55	64	DIP Module, 0.6	3.010x0.600x0.270	TBD	TBD	
2Meg	256Kx 8	EDI8F8257CXXBPC	85-150	32	SOIC Module	0.825x0.535x0.230	90	5	
2Meg	256Kx 8	EDI8F8257LPXXBPC	85-150	32	SOIC Module	0.825x0.535x0.230	90	0.4	125
2Meg	256Kx 8	EDI8F8257PXXBPC	85-150	32	SOIC Module	0.825x0.535x0.230	90	0.4	
2Meg	256Kx 8	EDI8F8258CXXMZC	20-45	60	ZIP Module	3.460x0.350x0.535	TBD	TBD	
2Meg	256Kx 8	EDI8F8259CXXM6C	25-55	32	DIP Module, 0.6	1.605x0.615x0.363	250	5	
2Meg	256Kx 8	EDI8M8256CXXC6C	70-150	32	DIP Module, 0.6	1.676x0.662x0.360	90	5	
2Meg	256Kx 8	EDI8M8256CXXC6B	80-150	32	DIP Module, 0.6	1.676x0.662x0.360	110	10	
2Meg	256Kx 8	EDI8M8256CXXPC	70-150	32	DIP Module, 0.6	1.660x0.600x0.265	90	5	
2Meg	256Kx 8	EDI8M8256LPXXC6B	80-150	32	DIP Module, 0.6	1.676x0.662x0.360	110	10	
2Meg	256Kx 8	EDI8M8256PXXC6B	80-150	32	DIP Module, 0.6	1.676x0.662x0.360	90	5	1100
2Meg	256Kx 8	EDI8M8257CXXC6B	45-150	32	DIP Module, 0.6	1.717x0.600x0.271	110	10	
2Meg	256Kx 8	EDI8M8257CXXC6C	45-150	32	DIP Module, 0.6	1.717x0.600x0.271	110	10	
2Meg	256Kx 8	EDI8M8257CXXM6C	45-70	32	DIP Module, 0.6	1.717x0.600x0.455	190	10	
2Meg	256Kx 8	EDI8M8257CXXP6C	85-150	32	DIP Module, 0.6	1.717x0.678x0.317	90	5	
2Meg	256Kx 8	EDI8M8257LPXXC6B	85-150	32	DIP Module, 0.6	1.717x0.600x0.271	110	5	850
2Meg	256Kx 8	EDI8M8257LPXXP6C	85-150	32	DIP Module, 0.6	1.717x0.678x0.317	90	0.4	125
2Meg	256Kx 8	EDI8M8257PXXC6B	85-150	32	DIP Module, 0.6	1.717x0.600x0.271	110	5	
2Meg	256Kx 8	EDI8M8257PXXP6C	85-150	32	DIP Module, 0.6	1.717x0.678x0.317	90	0.4	
4Meg	256Kx16	EDI8F16257CXXM6C	35-55	40	DIP Module, 0.6	2.020x0.600x0.405	TBD	TBD	TBD
4Meg	256Kx16	EDI8F16257CXXMSC	35-55	40	SIP Module	4.035x0.675x0.180	TBD	TBD	TBD
4Meg	256Kx16	EDI8M16256CXXC9B	25-70	48	DIP Module, 0.9	2.405x0.900x0.312	2000	160	
4Meg	256Kx16	EDI8M16256CXXC9C	25-70	48	DIP Module, 0.9	2.405x0.900x0.312	2000	160	
4Meg	256Kx16	EDI8M16257CXXC6B	35-55	40	DIP Module, 0.6	2.100x0.600x0.335	TBD	TBD	TBD
4Meg	256Kx16	EDI8M16257CXXC6C	35-55	40	DIP Module, 0.6	2.100x0.600x0.335	TBD	TBD	TBD
4Meg	512Kx 8	EDI8F8512CXXB6C	85-150	32	DIP Module, 0.6	1.655x0.600x0.262	110	5	
4Meg	512Kx 8	EDI8F8512CXXBSC	85-150	36	SIP Module	4.025x0.575x0.150	110	5	
4Meg	512Kx 8	EDI8F8512LPXXB6C	85-150	32	DIP Module, 0.6	1.655x0.600x0.262	110	0.4	125
4Meg	512Kx 8	EDI8F8512PXXB6C	85-150	32	DIP Module, 0.6	1.655x0.600x0.262	110	0.4	
4Meg	512Kx 8	EDI8F8513CXXMSC	45-70	36	SIP Module	4.025x0.895x0.430	550	80	
4Meg	512Kx 8	EDI8M8512CXXC6B	45-70	32	DIP Module, 0.6	1.717x0.600x0.405	210	20	
4Meg	512Kx 8	EDI8M8512CXXC6B	85-150	32	DIP Module, 0.6	1.717x0.600x0.405	110	10	
4Meg	512Kx 8	EDI8M8512CXXC6C	45-150	32	DIP Module, 0.6	1.717x0.600x0.405	210	20	
4Meg	512Kx 8	EDI8M8512CXXC6C	85-150	32	DIP Module, 0.6	1.717x0.600x0.405	110	10	
4Meg	512Kx 8	EDI8M8512CXXM6C	45-70	32	DIP Module, 0.6	1.717x0.600x0.455	190	10	
4Meg	512Kx 8	EDI8M8512CXXP6C	85-150	32	DIP Module, 0.6	1.717x0.678x0.405	110	5	
4Meg	512Kx 8	EDI8M8512LPXXC6B	85-150	32	DIP Module, 0.6	1.717x0.600x0.405	110	5	850
4Meg	512Kx 8	EDI8M8512LPXXP6C	85-150	32	DIP Module, 0.6	1.717x0.678x0.405	110	0.4	125
4Meg	512Kx 8	EDI8M8512PXXC6B	85-150	32	DIP Module, 0.6	1.717x0.600x0.405	110	5	
4Meg	512Kx 8	EDI8M8512PXXP6C	85-150	32	DIP Module, 0.6	1.717x0.678x0.405	110	0.4	
8Meg	256Kx32	EDI8F32256CXXMZC	25-55	64	ZIP Module	3.660x0.340x0.570	TBD	TBD	
8Meg	256Kx32	EDI8M32256CXXC6B	35-55	60	DIP Module, 0.6	3.150x0.600x0.270	TBD	TBD	
8Meg	256Kx32	EDI8M32256CXXC6C	35-55	60	DIP Module, 0.6	3.150x0.600x0.270	TBD	TBD	
8Meg	1Mx 8	EDI8F81024CXXBSC	85-150	36	SIP Module	4.025x0.200x0.575	TBD	TBD	

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Introducing EDI's Newest Product Family: Synchronous Static RAMs

Synchronous SRAMs make the system design job easier by pulling system glue logic onto the memory chip. They combine traditional SRAM operations with Input/Output Registers/Latches and on-chip write timing circuitry. This relieves many of the critical timing problems that the system designer

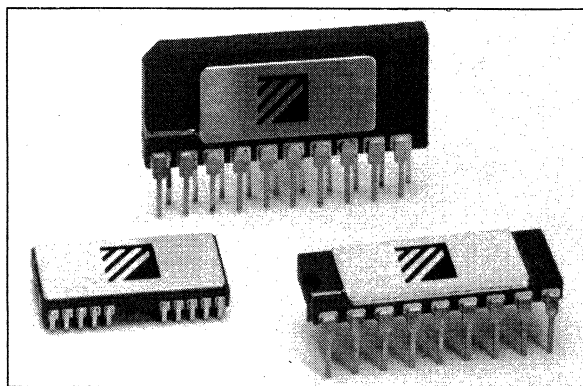
faces. Because of the much tighter coupling between registers/timing circuits and the memory itself, system cycle time can be brought much closer to memory access time. This can produce system throughput improvements of 30-40% for the same speed grade of memory.

Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption	
					Style (Proposed)	Dimensions LxWxH (in.)	ICCA mA	ISB mA
256K	16Kx16	EDI28160CXXAC	17-25	52	PLCC	0.795x0.795x0.180	360	80
256K	16Kx16	EDI28165CXXAC	17-25	52	PLCC	0.795x0.795x0.180	360	80
256K	64Kx4	EDI2840CXXMC	15-25	28	SOJ	0.730x0.340x0.148	170	
256K	64Kx4	EDI2841CXXMC	15-25	32	SOJ	0.830x0.340x0.148	170	
256K	64Kx4	EDI2842CXXMC	15-25	28	SOJ	0.730x0.340x0.148	170	
256K	64Kx4	EDI2843CXXMC	15-25	32	SOJ	0.830x0.340x0.148	170	
1Meg	64Kx18	EDI2018XCXXAC	15-25	52	PLCC	0.795x0.795x0.180	TBD	
1Meg	128Kx9	EDI209XCXXMC	15-25	TBD	SOJ	TBD	TBD	
1Meg	128Kx9	EDI209XCXXXC	15-25	TBD	DIP	TBD	TBD	
1Meg	256Kx4	EDI204XCXXHC	15-25	36	DIP, 0.4	TBD	TBD	
1Meg	256Kx4	EDI204XCXXMC	15-25	36	SOJ	TBD	TBD	

The Industry's Fastest High Density MIL-STD-883, Paragraph 1.2.1 Compliant Dynamic RAMs

In response to the need of our military customers for high-performance, MIL-STD-883 compliant DRAMs, Electronic Designs offers the fastest mega-bit density devices in the widest selection of package styles available in the industry today.

We also anticipate that we will be first to market, again, with the MIL-STD-883 compliant four mega-bit density products.



EDI's Military DRAM Package Options

Density	Org.	Part No.	Speeds Range ns	No. Pins	Package Description		Max Current Consumption		
					Style	Dimensions LxWxH (in.)	ICC1 mA	ICC3 mA	ICC4 mA
1Meg	256Kx4	EDI44256CXXNB	70-150	20/26	CSOJ	0.683x0.344x0.150	80-55	80-55	70-35
1Meg	256Kx4	EDI44256CXXQB	70-150	20	DIP, 0.3	1.010x0.300x0.160	80-55	80-55	70-35
1Meg	256Kx4	EDI44256CXXZB	70-150	20	ZIP	1.07x0.125x0.455	80-55	80-55	70-35
1Meg	1Mx1	EDI411024CXXFB	70-150	20	Flatpack	0.682x0.115x0.336	80-55	80-55	70-35
1Meg	1Mx1	EDI411024CXXNB	70-150	20/26	CSOJ	0.683x0.344x0.150	80-55	80-55	70-35
1Meg	1Mx1	EDI411024CXXQB	70-150	18	DIP, 0.3	0.900x0.300x0.160	80-55	80-55	70-35
1Meg	1Mx1	EDI411024CXXZB	70-150	20	ZIP	1.07x0.125x0.455	80-55	80-55	70-35
4Meg	1Mx4	EDI441024CXXNB	80-150	20/26	CSOJ	0.683x0.344x0.150	TBD	TBD	TBD
4Meg	1Mx4	EDI441024CXXQB	80-150	20	ZIP	1.07x0.125x0.455	TBD	TBD	TBD
4Meg	4Kx1	EDI414096CXXNB	80-150	20/26	CSOJ	0.683x0.344x0.150	TBD	TBD	TBD
4Meg	4Kx1	EDI414096CXXQB	80-150	20	ZIP	1.07x0.125x0.455	TBD	TBD	TBD

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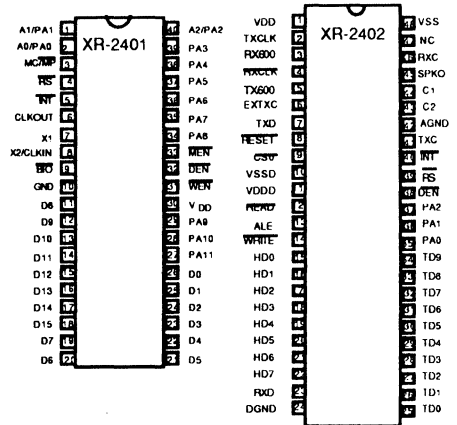
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EXAR V.22bis Chip Set

XR-2400 V.22bis Modem

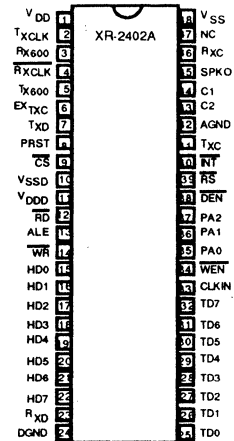
The XR-2400 Chip Set is designed to provide the complete modem function for V.22 bis (2400 BPS) type modems. The chip set consists of the XR-2401 DSP Modem Signal Processor and the XR-2402 Analog Front End (AFE) with microcontroller interface. The XR-2400 set also supports Bell 212A (1200/300 BPS) and CCITT V.22 (1200 BPS) modes for a Bell/CCITT compatible system.

PIN DESCRIPTION



XR-2402A V.22bis High Performance AFE

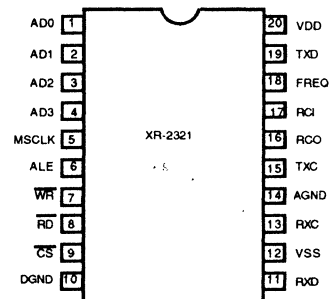
The XR-2402A High Performance AFE (Analog Front End) is designed to directly interface to the XR-2401 DSP Modem Signal Processor to provide the complete V.22bis 2400 BPS modem function. The XR-2401 is described in detail on the XR-2400 datasheet.



EXAR V.23/V.21 Modem IC

XR-2321 V.23/V.21 Modem

The XR-2321 is a single-chip asynchronous continuous phase FSK (Frequency Shift Keying) mode modem. Half or full duplex operation is possible over general switched network or leased line conditions. Modem functions and modes are selected through micro-controller bus structured interfaces. It is compatible with the CCITT recommended standards for V.21 and V.23 type modems.



EXAR V.42/V.42bis/MNP5 Modem Controllers

XR-2942 Fax/Data Microcontroller

The XR-2942 is a dedicated microcontroller that provides command control for the XR-2900 Fax/Data modem chip set. The XR-2942 provides control for CCITT recommended V.42 error detection, including LAPM and MNP 2-4 protocols, with MNP class 5 data compression included for greater compatibility. Also supported is the CLASS 2 (EIA2388) standard 'AT+F' extended command set.

XR-2943 Fax/Data Microcontroller with V.42bis

The XR-2943 is a dedicated microcontroller that provides command control for the XR-2900 Fax/Data modem chip set. The XR-2943 provides control for CCITT recommended V.42 error detection, including LAPM and MNP 2-4 protocols, with V.42bis MNP class 5 data compression included for greater compatibility. Also supported is the TR.29 class 2 (EIA 2388) standard 'AT+F' extended command set.

XR-2442 V.42/MNP® Microcontroller

The XR-2442 is a dedicated microcontroller that provides command control for the XR-2400 V.22bis modem chip set. The XR-2442 provides control for CCITT recommended V.42 error correction, including LAPM and MNP 2-4 protocols, with MNP class 5 data compression included for greater compatibility. Also supported are the standard 'AT' commands.

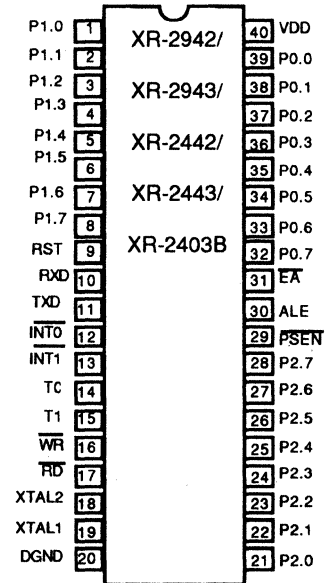
XR-2443 V.42/MNP® Microcontroller with V.42bis

The XR-2443 is a dedicated microcontroller that provides command control for the XR-2400 V.22bis modem chip set. The XR-2443 provides control for CCITT recommended V.42 error correction, including LAPM and MNP 2-4 protocols, with V.42bis BTLZ / MNP 5 data compression. Also supported is the complete AT command set and registers used to control these functions.

XR-2403B MNP® Microcontroller

The XR-2403B is a dedicated microcontroller programmed to provide 'AT' and MNP command control for the XR-2400 V.22bis modem chip set. Coupled with the XR-2400 a modem supporting MNP (Microcom Networking Protocol) class 2-5 operation is easily implemented. The lower classes of MNP (2-4) ensure error free operation, while class 5 adds data compression which basically doubles (4800 BPS) data throughput.

Pin Descriptions

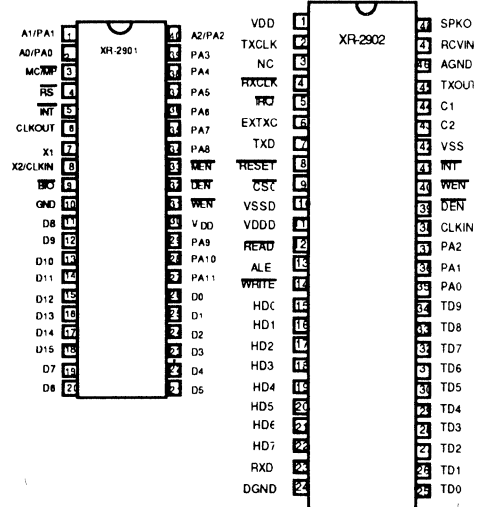


EXAR V.29/V.22bis Fax/Data Combo

Pin Descriptions

XR-2900 Fax/Data Modem Chip Set

The XR-2900 is a two chip set that provides the modem data pump function for 9600 BPS half duplex/2400 BPS full duplex applications. The XR-2900 supplies all the functions for implementing a modem for facsimile or V.29 applications. Also included is a complete V.22 bis/DATA modem.

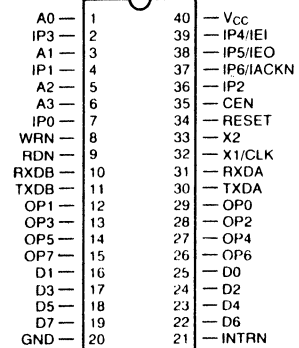


EXAR DUART/QUART Products

XR-88C681/68C681 CMOS Dual Channel UART (DUART)

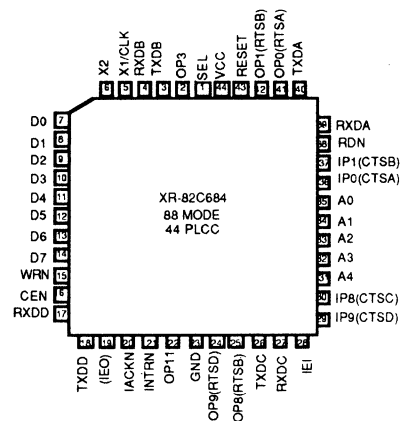
The EXAR Dual Universal Asynchronous Receiver and Transmitter (DUART) is a data communications device that provides two fully independent full duplex asynchronous communications channels in a single package. The DUART is designed for use in microprocessor based systems and may be used in a polled or interrupt driven environment.

XR-88C681/40



XR-82C684 CMOS Quad Channel UART (QUART)

The EXAR Quad Universal Asynchronous Receiver and Transmitter (QUART) is a data communications device that provides four fully independent full duplex asynchronous communications channels in a single package. The QUART is designed for use in microprocessor based systems and may be used in a polled or interrupt driven environment.



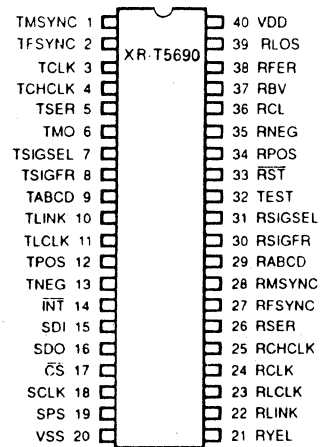
EXAR Corporation 2222 Qume Drive, San Jose, Ca. 95161-9007 Ph. 408 • 434 • 6400 fax • 408 • 943 • 8245

EXAR ISDN Primary Rate Products

Pin Descriptions

XR-T5690 Serial T1 Transceiver

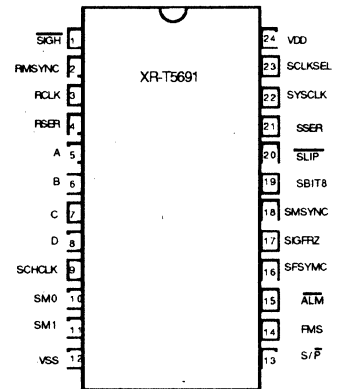
The XR-T5690 is a monolithic CMOS IC designed to implement primary rate PCM (1.544 MHz) T-Carrier transmitter and receiver functions. It is intended to support 193S framing (12 frame per superframe) and also 193E framing which is the extended superframe format (24 frames per superframe). Clear channel capability is provided by selection of appropriate zero suppression and signaling mode.



Exar

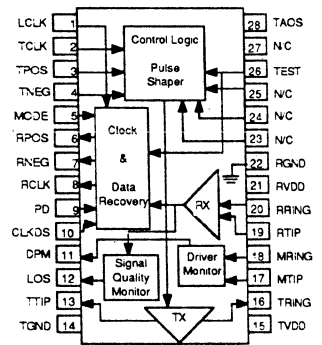
XR-T5691 T1 Receive Buffer

The XR-T5691 is designed to synchronize receive loop-timed T-carrier data streams to system side timing. It is very flexible and allows interfacing of incoming data to parallel or serial TDM backplanes. It is implemented using low power CMOS technology and is available in a "skinny" 24 lead plastic DIP & 24 pin PLCC packages. This device operates in conjunction with the XR-T5690 Frammer and is capable of extracting, buffering and integrating ABCD Signaling.



XR-T5684 CMOS Digital T1 Line Interface

The XR-T5684 is a PCM line transceiver integrated circuit which is intended to interface the DSX-1 digital cross-connect. It combines both transmit and receive circuitry in a 28 pin package and performs the necessary physical layer interface requirements. This device is primarily designed for short loop applications (< -6 dB) such as digital office environments. Internal pulse shaping circuit at the transmitter generates appropriate pulse shape at the DSX-1 cross connect for line lengths ranging from 0 to 655 feet.



Serial, Parallel and PLD E²

XL Product	Size (organization)	Temp Range	Icc (max/stby)	Access Time (nS)	Package Type	Number of Pins	Features
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Parallel E²PROMs

4K NMOS Parallel E²PROM							
XL 2804A	4K (512x8)	S	80mA/40mA	250	PDIP	24	
16K NMOS Parallel E²PROM							
XL 2816A	16K (2Kx8)	S,E	110mA/40mA	200	PDIP	24	
XL 2816A	16K (2Kx8)	S,E	110mA/40mA	200	PLCC	32	
XL 2816A	16K (2Kx8)	S,E,M	110mA/40mA	200	CERDIP	24	
16K CMOS Parallel E²PROM							
XL 28C16A	16K (2Kx8)	S,E	30mA/100µA	100	PDIP	24	Data Polling
XL 28C16A	16K (2Kx8)	S,E	30mA/100µA	100	PLCC	32	
XL 28C16A	16K (2Kx8)	S,E	30mA/100µA	100	SOIC J	24	
XL 28C16A	16K (2Kx8)	S,E,M	30mA/100µA	100	CERDIP	24	
XL 28C16B	16K (2Kx8)	S,E	30mA/100µA	100	PDIP	24	Data Polling; 16 byte page mode
XL 28C16B	16K (2Kx8)	S,E	30mA/100µA	100	PLCC	32	
XL 28C16B	16K (2Kx8)	S,E	30mA/100µA	100	SOIC J	24	
XL 28C16B	16K (2Kx8)	S,E,M	30mA/100µA	100	CERDIP	24	
16K High Speed CMOS Parallel E²PROM							
XL 46C15	16K (2Kx8)	S,E	90mA/35mA	55	PDIP	24	Bipolar PROM Replacement: Pin for Pin
XL 46C15	16K (2Kx8)	S,E	90mA/35mA	55	PDIP(P3)	24	
64K NMOS Parallel E²PROM							
XL 2864A	64K (8Kx8)	S,E	100mA/50mA	250	PDIP	28	Data Polling; 32 byte page mode
XL 2864A	64K (8Kx8)	S,E	100mA/50mA	250	PLCC	32	
XL 2864A	64K (8Kx8)	S,E	100mA/50mA	250	SOIC J	28	
XL 2864A	64K (8Kx8)	S,E,M	100mA/50mA	250	CERDIP	28	
XL 2865A	64K (8Kx8)	S,E	100mA/50mA	250	PDIP	28	Page Mode; Data Polling; Ready/Busy 32 byte page mode
XL 2865A	64K (8Kx8)	S,E	100mA/50mA	250	PLCC	32	
XL 2865A	64K (8Kx8)	S,E	100mA/50mA	250	SOIC J	28	
XL 2865A	64K (8Kx8)	S,E,M	100mA/50mA	250	CERDIP	28	
64K CMOS Parallel E²PROM							
XL 28C64	64K (8Kx8)	S,E	30mA/100µA	150	PDIP	28	Data Polling; 64 byte page mode
XL 28C64	64K (8Kx8)	S,E	30mA/100µA	150	PLCC	32	
XL 28C64	64K (8Kx8)	S,E,M	30mA/100µA	150	CERDIP	28	
XL 28C64B	64K (8Kx8)	S,E	30mA/100µA	150	PDIP	28	Software Mode Control 64 byte Page Mode Industry Standard Interface
XL 28C64B	64K (8Kx8)	S,E	30mA/100µA	150	PDIP (P3)	28	
XL 28C64B	64K (8Kx8)	S,E	30mA/100µA	150	PLCC	32	
XL 28C64B	64K (8Kx8)	S,E,M	30mA/100µA	150	CERDIP	28	
256K CMOS Parallel E²PROM							
XL 28C256	256K (32Kx8)	S,E	30mA/100µA	150	PDIP	28	Software Mode Control 64 byte Page Mode Industry Standard Interface
XL 28C256	256K (32Kx8)	S,E	30mA/100µA	150	PLCC	32	
XL 28C256	256K (32Kx8)	S,E,M	30mA/100µA	150	CERDIP	28	

Flash E²PROMs

XL 28F256	256K (32Kx8)	S,E	25mA/100µA	120	PDIP	28	Flash E ² PROM INTEL Compatible
XL 28F256	256K (32Kx8)	S,E	25mA/100µA	120	PLCC	32	
XL 28F256	256K (32Kx8)	S,E,M	25mA/100µA	120	CERDIP	28	
XL 28F010	1 MEG (128Kx8)	S,E	30mA/100µA	150	PDIP	28	
XL 28F010	1 MEG (128Kx8)	S,E	30mA/100µA	150	PLCC	32	
XL 28F010	1 MEG (128Kx8)	S,E,M	30mA/100µA	150	CERDIP	28	

ERASIC Multi-Level Programmable Logic E²PROMs

XL 78C800	800 Gate Equiv	S,E	35mA	35	PDIP (P3)	24	ERASIC
XL 78C800	800 Gate Equiv	S,E	35mA	35	PLCC	28	
XL 78C800	800 Gate Equiv	S,E,M	35mA	35	CERDIP	24	
XL 78C8240	1800 Gate Equiv	S,E	120mA	15	PDIP	68	ERASIC
XL 78C8240	1800 Gate Equiv	S,E	120mA	15	PLCC	68	
XL 16FV8	PAL Equivalent	S,E	45mA/100µA	15	PDIP	20	FLASHY GAL™

1. Note: Slower versions of all of these devices are also available. Contact Exel for details.

XL Product	Size (organization)	Temp Range	Icc (max/stby)	Max Clock	Package Type	Number of Pins	Features
Serial 256 bit E²PROM Microwire™							
5V CMOS Serial E²PROM with Advanced Features							
XL 93LC06	256 bit (16x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation; Auto Increment VCC Lockout ≥ 3.8V Microwire Serial Interface Low Power Consumption
XL 93LC06	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC06	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC06	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC06	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
3V-5V CMOS Serial E²PROM with Advanced Features							
XL 93LC06-3	256 bit (16x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V-5V Operation; Auto Increment Microwire Serial Interface Low Power Consumption
XL 93LC06-3	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC06-3	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC06-3	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC06-3	256 bit (16x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
Serial 1K E²PROM Microwire™							
1K 5V CMOS Serial E²PROM - 1K Microwire™							
XL 93C46	1K (64x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation; Auto Increment Microwire Serial Interface
XL 93C46	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
3V-5V CMOS Serial E²PROM - 1K Microwire™							
XL 93C46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V-5V Operation; Auto Increment Microwire Serial Interface
XL 93C46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
5V CMOS Serial E²PROM - 1K with Security							
XL 93CS46	1K (64x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation; Auto Increment Hard Security; National Compatible
XL 93CS46	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
3V-5V CMOS Serial E²PROM - 1K with Security							
XL 93CS46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V-5V Operation; Auto Increment Hard Security; National Compatible
XL 93CS46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
5V CMOS Serial E²PROM - 1K with Advanced Features							
XL 93LC46	1K (64x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation; Auto Increment VCC Lockout ≥ 3.8V Microwire Serial Interface Low Power Consumption
XL 93LC46	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC46	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC46	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC46	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
3V-5V CMOS Serial E²PROM - 1K with Advanced Features							
XL 93LC46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V-5V Operation; Auto Increment Microwire Serial Interface Low Power Consumption
XL 93LC46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC46-3	1K (64x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
Serial 2K E²PROM Microwire™							
5V CMOS Serial E²PROM - 2K Microwire™							
XL 93C56	2K (128x16)	S,E	3mA/3μA	1 MHz	PDIP	8	5V Operation Microwire Serial Interface
XL 93C56	2K (128x16)	S,E	3mA/3μA	1 MHz	SOIC J	8	
XL 93C56	2K (128x16)	S,E	3mA/3μA	1 MHz	SOIC JR	8	
5V CMOS Serial E²PROM - 2K Mitsubishi Compatible							
XL 90C21	2K (128x16)	S,E	3mA/3μA	1 MHz	PDIP	8	5V Operation Mitsubishi Compatible Interface Protocol
XL 90C21	2K (128x16)	S,E	3mA/3μA	1 MHz	SOIC J	8	
5V CMOS Serial E²PROM - 2K with Advanced Features							
XL 93LC56	2K (128x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation; Auto Increment VCC Lockout ≥ 3.8V Microwire Serial Interface Low Power Consumption
XL 93LC56	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC56	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC56	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC56	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
3V-5V CMOS Serial E²PROM - 2K with Advanced Features							
XL 93LC56-3	2K (128x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V to 5V Operation Auto Increment Microwire Serial Interface Low Power Consumption
XL 93LC56-3	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC56-3	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC56-3	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC56-3	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
5V CMOS Serial E²PROM - 2K Catalyst Compatible							
XL35LC102	2K (128x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation; Auto Increment VCC Lockout ≥ 3.8V Catalyst Compatible
XL35LC102	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
3V-5V CMOS Serial E²PROM - 2K Catalyst Compatible							
XL33LC102	2K (128x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V to 5V Operation Catalyst Compatible Auto Increment
XL33LC102	2K (128x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	

XL Product	Size (organization)	Temp Range	Icc (max/stby)	Max Clock	Package Type	Number of Pins	Features
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Serial 4K E²PROM Microwire™

5V CMOS Serial E²PROM - 4K Microwire™							
XL 93C66	4K (256x16)	S,E	4mA/4μA	1 MHz	PDIP	8	5V Operation Microwire Serial Interface
XL 93C66	4K (256x16)	S,E	4mA/4μA	1 MHz	SOIC JR	8	
5V CMOS Serial E²PROM - 4K Mitsubishi Compatible							
XL 90C41	4K (256x16)	S,E	4mA/4μA	1 MHz	PDIP	8	5V Operation Mitsubishi Compatible Interface Protocol
XL 90C41	4K (256x16)	S,E	4mA/4μA	1 MHz	SOIC J	8	
5V CMOS Serial E²PROM - 4K with Advanced Features							
XL 93LC66	4K (256x16)	S,E	2mA/2μA	1 MHz	PDIP	8	5V Operation Auto Increment VCC Lockout ≥ 3.8V Microwire Serial Interface Low Power Consumption
XL 93LC66	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC66	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC66	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC66	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	
3V-5V CMOS Serial E²PROM - 4K with Advanced Features							
XL 93LC66-3	4K (256x16)	S,E	2mA/2μA	1 MHz	PDIP	8	3V to 5V Operation Auto Increment Microwire Serial Interface Low Power Consumption
XL 93LC66-3	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC G	8	
XL 93LC66-3	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC GR	8	
XL 93LC66-3	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC J	8	
XL 93LC66-3	4K (256x16)	S,E	2mA/2μA	1 MHz	SOIC JR	8	

Serial 1K E²PROM I²C Bus™

5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC01	1K (128x8)	S,E	2mA/2μA	100 KHz	PDIP	8	Xicor Compatible VCC Lockout; Auto Increment Preliminary Information
XL 24LC01	1K (128x8)	S,E	2mA/2μA	100 KHz	SOIC G	8	
3V-5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC01-3	1K (128x8)	S,E	2mA/2μA	100 KHz	PDIP	8	Xicor Compatible 3V-5V Operation; Auto Increment Preliminary Information
XL 24LC01-3	1K (128x8)	S,E	2mA/2μA	100 KHz	SOIC G	8	

Serial 2K E²PROM I²C Bus™

5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC02	2K (256x8)	S,E	2mA/2μA	100 KHz	PDIP	8	Xicor Compatible VCC Lockout; Auto Increment Preliminary Information
XL 24LC02	2K (256x8)	S,E	2mA/2μA	100 KHz	SOIC G	8	
3V-5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC02-3	2K (256x8)	S,E	2mA/2μA	100 KHz	PDIP	8	Xicor Compatible 3V-5V Operation; Auto Increment Preliminary Information
XL 24LC02-3	2K (256x8)	S,E	2mA/2μA	100 KHz	SOIC G	8	

Serial 4K E²PROM I²C Bus™

5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC04	4K (512x8)	S,E	2mA/2μA	100 KHz	PDIP	8	Xicor Compatible VCC Lockout; Auto Increment Preliminary Information
XL 24LC04	4K (512x8)	S,E	2mA/2μA	100 KHz	SOIC G	8	
3V-5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC04-3	4K (512x8)	S,E	2mA/2μA	100 KHz	PDIP	8	Xicor Compatible 3V-5V Operation; Auto Increment Preliminary Information
XL 24LC04-3	4K (512x8)	S,E	2mA/2μA	100 KHz	SOIC G	8	

Serial 16K E²PROM I²C Bus™

5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC16	16K (2Kx8)	S,E	3mA/3μA	100 KHz	PDIP	8	Xicor Compatible VCC Lockout; Auto Increment Preliminary Information
XL 24LC16	16K (2Kx8)	S,E	3mA/3μA	100 KHz	SOIC G	8	
3V-5V CMOS Serial E²PROM I²C Bus™ Compatible							
XL 24LC16-3	16K (2Kx8)	S,E	3mA/3μA	100 KHz	PDIP	8	Xicor Compatible 3V-5V Operation; Auto Increment Preliminary Information
XL 24LC16-3	16K (2Kx8)	S,E	3mA/3μA	100 KHz	SOIC G	8	

Ordering Information

XL S 93C46 -3 P

Prefix Temperature Range* Part Type Voltage Designator Package Code Package Type

S = 0° to +70°C
E = -40° to +85°C
M = -55°C to +125°C

* Special ranges available by request.

93C46 -3 = 3 to 5 Volt Operation
Blank = 5 Volt Only Operation.

C = CERDIP
D = PLCC
G = Small Outline (JEDEC STD)
GR = Small Outline (JEDEC STD)
J = Small Outline (EIAJ STD)
JR = Small Outline (EIAJ STD)
P = Plastic DIP
P3 = Plastic Skinny DIP

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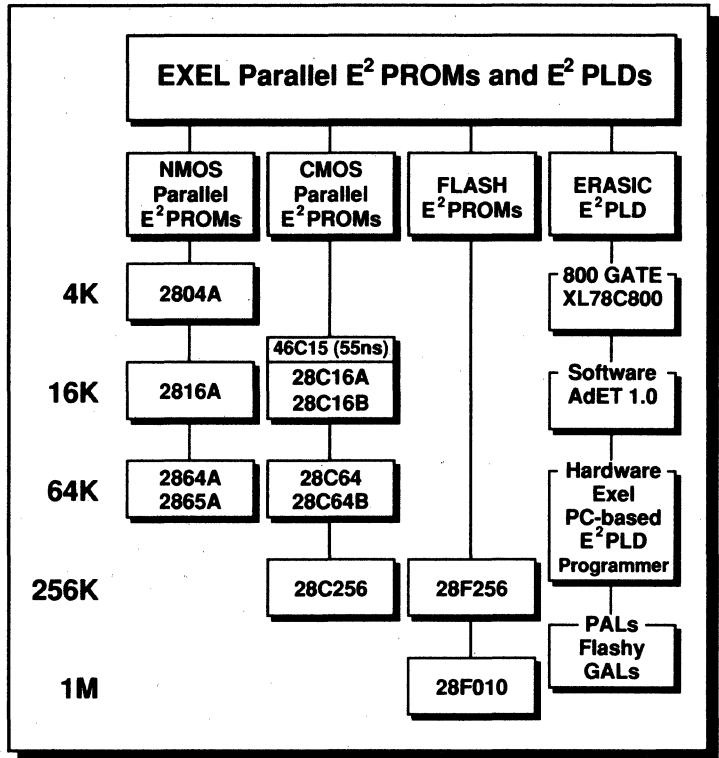
EXEL Microelectronics, a division of ROHM Corporation, designs and manufactures high-quality E² products for the commercial and industrial semiconductor markets. EXEL customers reap the benefits of high-quality, low-cost E² devices, including some of the industry's fastest parallel E²PROMs, a comprehensive array of serial E²PROMs, and the innovative ERASIC E²PLD family.

A Feature-packed Line of E²PROMs

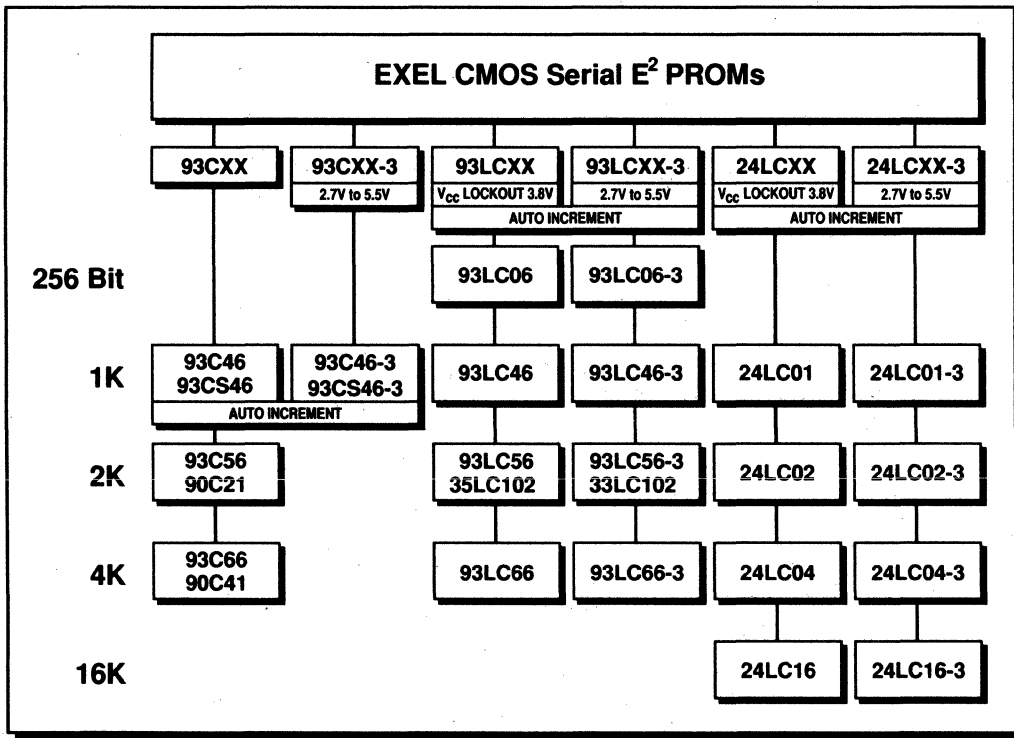
EXEL's E²PROMs offer features to system designers like V_{cc} lockout, auto increment, DATA polling, and page-mode programming. EXEL serial E²PROMs also come in both 3V and 5V operating versions, with the ability to read down to 2.0 volts. This makes EXEL E²PROMs ideal for battery-powered applications.

EXEL Microelectronics - Dedicated to Quality

EXEL is dedicated to being the best supplier of superior-quality, high-volume E²PROMs and E²PLDs. The combination of ROHM's worldwide support and EXEL's innovative U.S. design and manufacturing means we can meet your semiconductor needs. Call EXEL Microelectronics today to put our resources to work for you.



EXEL Microelectronics



SERIAL E²PROM FEATURE OPTIONS

- V_{cc} Lockout 3.8V
- 2.0V-5.5V Read
- 2.7V-5.5V Write (-3 Families)
- Auto Increment
- Hardware Write Protection (CS)
- PDIP and (4) S.O. Packaging Options
- Microwire™ and I²C Protocols
- Low Power CMOS

EXEL MICROELECTRONICS - Excellence in E²

E3000VH ECL Gate Array

FEATURES

- High Performance Logic
 - 80 ps/gate typical at 2.95 mW¹
 - 135 ps/gate typical at 1.11 mW¹
- 38948 Maximum Equivalent Gates²
- High I/O Count
 - 300 I/O available
- 3-level Series Gating
- Loaded Delay Performance
 - 250 ps/gate typical at 4.6 mW³
 - 300 ps/gate typical at 2.95 mW³
 - 350 ps/gate typical at 1.11 mW³
- I/O Options
 - 10KH ECL
 - 100K ECL
- ECL Output Options
 - 25W, 50W, and 100W
 - Series terminated
- Advanced Packaging Solutions
 - 441-pin ceramic pin grid array package
 - Supplied with pre-attached heat sinks
 - Multiple heat sink options available
 - TAB processing used

DESCRIPTION

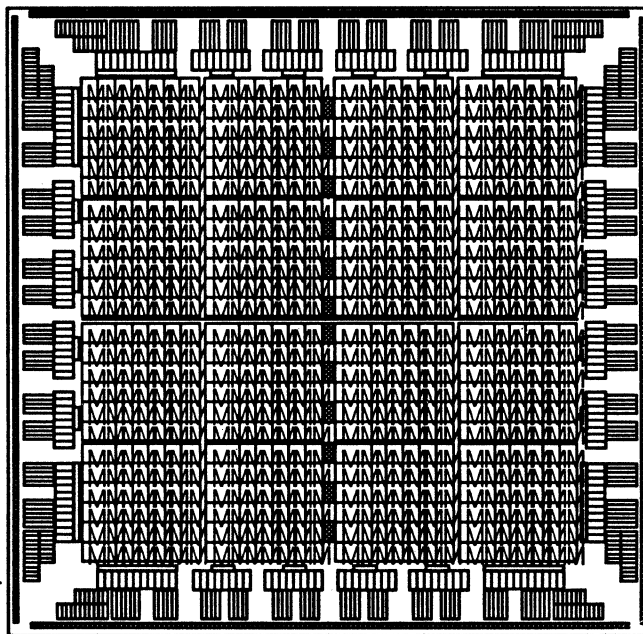
Fujitsu's E3000VH array utilizes advanced technology to produce an array with high I/O capability, high density and speed, and excellent power dissipation. The internal structure allows up to 37,632 internal gates, exclusive of high-drive and I/O macrocells. High-drive internal macrocells allow a maximum fanout of 40. Interconnection is implemented with four layers of metallization. The E3000VH is especially well suited for such high-performance applications as mainframe and supermini computers, high-end workstations, telecommunications, and instrumentation.

VH series ECL arrays are designed using Fujitsu's integrated design system software in conjunction with either an Amdahl 5860 or Fujitsu M-780 mainframe supercomputer. The VH series has an extensive cell library.

E3000VH Gate Array Summary	
Maximum Internal Gates ²	37632
Maximum Equivalent Gates ⁴	38948
Maximum I/O	300
Maximum Outputs	192 ⁵
Basic Cells	5376

Notes:

1. Unloaded F/I = F/O = 1, L = 0 mm.
2. One basic internal cell = seven equivalent gates.
3. Loaded F/I = F/O = 3, L = 3 mm.
4. Includes internal cells, driver, and I/O logic.
5. Single ended; increases to 224 if differential outputs used.



441-pin Ceramic Pin Grid Array Package

Fujitsu Microelectronics

E128H, E32, E128

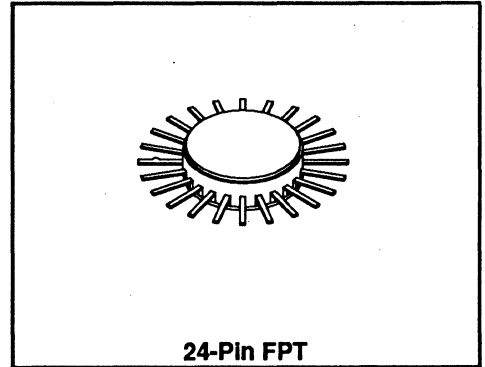
Ultra High Performance ECL Gate Arrays

DESCRIPTION

The Fujitsu Ultra High Performance E128, E32, and E128H ECL gate arrays offer the highest speed performance available from any Fujitsu array. Gate delays of 75 ps are specified for the E128H. The performance of the I/O buffers is equally impressive. Typical edge rates for the E128 are specified at 95 ps for the rising edge and 75 ps for the falling edge.

Developed to meet the need for a high-speed small circuit device with simplified design procedure and speedy turnaround, the Ultra High Performance Series arrays are Fujitsu turnkey designs that use customer-provided performance specifications and logic functions. Device level simulation can be performed using SPICE.

The Ultra High Performance arrays consist of a range of up to 128 equivalent gates, each made up of basic cells which may be designed into functional logic blocks with single-ended or differential outputs.



Basic Cell	Equivalent Gate Count
Flip-flop with Set and Reset	4 gates
Latch or EXOR or AND or 2:1 multiplexer	2 gates
OR/NOR	1 gate

The maximum equivalent gate count for any basic cell is four gates. The typical equivalent gate counts 2.5 gates. Eight basic cells form a major cell.

GENERAL FEATURES

- High-speed signals (up to 3 GB/s)
- Simplified implementation of customer-specified functions
- Device-level circuit simulation with SPICE
- Internal Gate propagation delay = 75 ps (typ. single-ended output)
55 ps (typ. differential output)
- Fast rise/fall times
- Minimum jitter
- Power/speed tradeoffs

E128H FEATURES

- 128 equivalent gates
- 16 I/O pins (maximum 8 outputs)
- $V_{CC} = 6$ pins. $V_{EE} = 2$ pins
- Conductive cooling

E32 FEATURES

- 32 equivalent gates
- 13 I/O pins
- $V_{CC} = 2$ pins. $V_{EE} = 1$ pin
- Air cooling

E128 FEATURES

- 128 equivalent gates
- 23 I/O pins
- $V_{CC} = 4$ pins. $V_{EE} = 1$ pin
- Air cooling

Device	Part No.	Gates	I/O	I/O Level	Gate Speed	Process Technology	Packages
E128	MB1600	128	16/8	10KH, 100K	160 ps	UFOX, 2-metal	16-pin SOP, 24-pin DIP
E32	MB1700	32	13/13	10KH, 100K	160 ps	UFOX, 2-metal	16-pin SOP, 24-pin DIP
E128H	MB1800	128	23/23	10KH	75 ps	ESPER, 2-metal	Round 24-pin FPT

CG10 Series 0.8-micron CMOS Gate Arrays

DESCRIPTION

The CG10 series of 0.8-micron CMOS gate arrays is a highly integrated low-power, ultra high-speed product family that derives its enhanced performance and increased user flexibility from the use of a system-proven, dual-column gate structure and 2-layer metal interconnect technology. The unique dual-column gate structure increases density and speed performance, as well as gate utilization. CG10 architecture is fully compatible with Fujitsu's 1.5-micron UHB arrays.

Internal high-drive clock buffers minimize clock skew across the chip while internal bus performance and integrity is assured by incorporating 3-state transmission gate logic underneath the routing channels. Input buffer options include pull-up and pull-down resistance, Schmitt trigger, CMOS input, and clock driver. Output buffer options include 3-state, bidirectional, edge rate control, and high-drive output. The high-drive output buffers provide highly symmetrical output waveforms.

FEATURES

- High-density silicon gate CMOS technology
 - 3200 to 14,000 usable gates
 - 90% maximum utilization fully autorouted
- Ultra high speed
 - typical 0.5 ns/0.6 ns gate delay (power type/normal type)
 - narrow delay variation
- High sink current capability
 - 3.2 mA, 8 mA, 12 mA, and 24 mA options available
 - selectable edge rate control
- Low-skew clock signal distribution
 - High-performance clock drivers
 - Hierarchical clock distribution
 - Frequency-dependent clock routing
- Automatic test pattern generation
 - complete family of scan design macros available

DEVICE SPECIFICATIONS

Parameter	Value
Supply Voltage (V_{DD})	5 V \pm 0/25 V
Operating Temperature (T_{OP})	0 to 70°C Standard
Output High Voltage (V_{OH})	4.0 V min.
Output Low Voltage (V_{OL})	0.4 V max. (0.5 V max. at $I_{OL} = 24$ mA)
Input High Voltage (V_{IH})	2.2 V min.
Input Low Voltage (V_{IL})	0.8 V min.
Output High Current (I_{OH})	–2 mA, –4 mA, –8 mA
Output Low Current (I_{OL})	3.2 mA, 8 mA, 12 mA, 24 mA
Input Leakage Current (I_{LI})	\pm 10 μ A max. (for input and 3-state output)

Fujitsu Microelectronics

PRODUCT FAMILY

Device Name	Available Gates ¹	Maximum Signal Pins ²	Power Dissipation at 10 MHz	Available Packages ³	
				Plastic	Ceramic
CG10272	3,256	108	150 mW	DIP, SDIP, QFP, PLCC, PGA	DIP, SDIP, QFP, LCC, PGA
CG10342	4,032	123	200 mW	DIP, SDIP, QFP, PLCC, PGA	DIP, SDIP, QFP, LCC, PGA
CG10492	5,572	148	200 mW	DIP, SDIP, QFP, PLCC, PGA	DIP, LCC, PGA
CG10572	6,510	163	200 mW	DIP, SDIP, QFP, PLCC, PGA	QFP, LCC, PGA
CG10692	7,684	163	250 mW	DIP, SDIP, QFP, PLCC, PGA	QFP, LCC, PGA
CG10103	11,080	188	250 mW	DIP, SDIP, QFP, PLCC, PGA	QFP, LCC, PGA
CG10133	14,720	220	250 mW	QFP ⁴	PGA

¹ Gate count based on 2-input NAND

² Maximum signal pin numbers depend on the output drive requirements and the package selected.

³ DIP = Dual in-line package, SDIP = Shrink-type DIP, QFP = Quad Flat Package, LCC = Leadless chip carrier, PLCC = Plastic LCC, PGA = Pin grid array

⁴ Under development

CG21 Series 0.8-micron CMOS Gate Arrays

DESCRIPTION

The CG21 series of 0.8 μm CMOS gate arrays are currently available in five device types with from 30K to 100K gates. Three more CG21 arrays, ranging from 10K to 20K gates, are now under development. These arrays achieve the ultra fast speed of 0.37 ps per gate. Thanks to the channel-free (sea-of-gates) structure of the CG21 gate array, CG21 basic cells can be used for logic cells, memory cells, or wiring area in order to implement the desired functions. The full utilization of the array surface and the three-layer metal interconnect technology produce a 75 percent maximum gate usability ratio.

The logic and I/O cells for the CG21 series are functionally compatible with Fujitsu's AU, UHB, and CG10 series of gate arrays to simplify upgrading. User-specifiable RAM and ROM configurations are also available. These gate arrays facilitate the implementation of large-scale devices such as computer and graphic processors on single chips.

FEATURES

- 0.8 micron CMOS sea-of-gates technology
 - 3 layer metal interconnect
- Ultra high speed
 - 0.37 ns/gate for 2-input NAND with F/O = 2
 - 0.55 ns/gate for power 2-input NAND with F/O = 2
- High basic cell usage
 - 75% maximum for logic with RAM/ROM
 - 45% maximum for logic only
- High sink current capability
 - sink current up to 12 mA, 24 mA planned
- Minimum delay clock buffer true option
- High current clock drivers
 - Low-skew clock signal distribution
- Extensive unit cell library (logic cell, RAM, ROM)
 - Unit cells functionally compatible with Fujitsu's AU, UHB, and CG10 gate array series
- Automatic test pattern generation optional
- On-chip pull-up/pull-down resistors
- High pin count plastic and ceramic packages
- High-density RAM and ROM compilers
 - up to 18K bit RAM compilation
 - up to 64K ROM compilation

Fujitsu Microelectronics

PRODUCT FAMILY

Device	Part Number	BCs on Chip (2-input gate +4 N-ch Tr)	Usable BCs	Max Signal I/O	Available Packages ¹	
					Plastic	Ceramic
CG21103	MBCG21103xxx ³	10,224	75% max. for Logic with RAM,ROM	108	SDIP-64, QFP-64, -80, -100, -120, PLCC-68, -84	PGA-64, 88, -135
CG21153	MBCG21153xxx ³	15,486		142	SDIP-64, QFP-64, -80 -100, -120, -160, PLCC-68, -84	PGA-64, -88, -135
CG21203	MBCG21203xxx ³	20,876		155	SDIP-64, QFP-64, -80, -100, -120, -160, PLCC-68, -84	PGA-64, -88, -135, -179
CG21303	MBCG21303xxx	31,500	45% max. for Logic only	178	QFP-120, -160	PGA-88, -135, -179, 208
CG21403	MBCG21403xxx	41,184	(Preliminary values, to be upgraded)	220	QFP-120, -160 SQFP-176 ² , -208 ²	PGA-135, -179, 208, -256
CG21503	MBCG21503xxx	52,164		245	QFP-120, -160, -196 ² SQFP-176 ² , -208 ²	PGA-135, -179, 208, -256, -299 ²
CG21753	MBCG21753xxx	75,140		284	QFP-196 ² , -232 ² SQFP-176 ² , -208 ²	PGA-135, -179, 208, -256, -299 ² , -321 ² , -361 ²
CG21104	MBCG21104xxx	102,144		332	QFP-196 ² , -232 ² SQFP-208 ² , -256 ²	PGA-135, -179, 208, -256, -299, -321 ² , -361, -401 ²

¹SDIP = Skinny dual in-line package, PGA = Pin grid array, QFP = Quad flat package, PLCC = Plastic leadless chip carrier, SQFP = Skinny quad flat package

²Planned

³Under development

CG31 Series 0.8-micron CMOS Gate Arrays

DESCRIPTION

The CG31 series of 0.8- μ m CMOS gate arrays are currently available in three device types with from 120K to 200K gates. These arrays achieve the ultra fast speed of 0.37 ps per gate. Thanks to the channelless (sea-of-gates) structure of the CG31 gate array, CG31 basic cells can be used for logic cells, memory cells, or wiring area in order to implement the desired functions. The full utilization of the array surface and the three-layer metal interconnect technology produce a 65 percent maximum gate usability ratio.

The logic and I/O cells for the CG31 series are functionally compatible with Fujitsu's AU, UHB, CG10, and CG21 series of gate arrays to simplify upgrading. User-specifiable RAM and ROM configurations are also available. These gate arrays facilitate the implementation of large-scale devices such as computers and graphic processors on single chips.

FEATURES

- 0.8 micron CMOS sea-of-gates technology
 - 3 layer metal interconnect
- Ultra high speed
 - 0.37 ns/gate for 2-input NAND with F/O = 2
 - 0.55 ns/gate for power 2-input NAND with F/O = 2
- High basic cell usage
 - 65% maximum for logic with RAM/ROM
 - 55% maximum for logic only
- High sink current capability
 - sink current up to 12 mA, 24 mA planned
- Minimum delay clock buffer true option
- High current clock drivers
 - Low-skew clock signal distribution
- Extensive unit cell library (logic cell, RAM, ROM, PLA, etc.)
 - Unit cells functionally compatible with Fujitsu's AU, UHB, CG10, and CG21 series gate arrays
- Automatic test pattern generation optional with Fujitsu scan testing
- On-chip pull-up/pull-down resistors
- High pin count ceramic packages
- High-density RAM and ROM compilers
 - up to 18K bit RAM block
 - up to 64K ROM block

PRODUCT FAMILY

Device	Available BCs (2-input gate +4 N-ch Tr)	Usable Logic Basic Cells (55% utilization)	Max Signal I/O
CG31134	129,540	71 K	300
CG31164	160,930	88 K	332
CG31204	210,188	115 K	332*

Note: * Package constrained

AVAILABLE PACKAGES¹

Package	CG31134	CG31164	CG31204	Type
PGA-135	●	●	○	Cavity up
PGA-155	○	○	○	Cavity down
PGA-179	●	●	○	Cavity up
PGA-208	●	●	○	Cavity up
PGA-223	○	○	○	Cavity down
PGA-256	●	●	○	Cavity up
PGA-299	○	○	○	Cavity down ²
PGA-321	○	○	○	Cavity down ²
PGA-361	○	○	○	Cavity down ²
PGA-401	—	○	○	Cavity down ²

- Notes: ¹All packages are ceramic pin grid arrays (PGAs).
²These packages feature 70-mil interstitial pin arrangement and metal heatspreader with optional heatsink
- = available
 - = under development

MB53xxx

FURY™ Series GaAs Gate Arrays

DESCRIPTION

The Fujitsu FURY gate array series incorporates Fujitsu's 0.8-micron GaAs self-aligned gate process to produce a family of devices ideally suited to the highest performance applications. Incorporating very high speed, high density, and low power dissipation, they provide the designers of mainframe and superminicomputers, high end workstations, telecommunications equipment, and fast instrumentation with the "edge" necessary to create unparalleled state-of-the-art products.

Flexible I/O structures allow interconnection between FURY arrays and devices operating at ECL, TTL, or GaAs signal levels. Mixed signals are permissible, allowing optimal interconnect performance. FURY designs are supported on a variety of popular workstations.

Direct Coupled FET Logic (DCFL) is used in the implementation of arrays varying in size from 3584 to 30528 2-input NOR gate equivalents. Like all Fujitsu products, these arrays are built to the highest standards of quality and reliability.

FEATURES

- High performance logic:
80 ps/gate typical at 1.1 mW
- High interconnect performance:
177 ps/gate typical at 1.1 mW
- I/O options:
-ECL: 10K, 10KH or 100K
-TTL
-GaAs
- Low speed power product:
0.025 pJ typical for 2-input NOR
- High speed I/O:
1 GHz for GaAs and ECL interfaces
- Packaging solutions:
Supplied with pre-attached heat sinks

Fujitsu Microelectronics

Device Name	Gate Count	Input Cells			I/O Cells		Total Signal Pins	Package Options
		TTL	ECL GaAs	Hi-drive	TTL	ECL GaAs		
MB53030	3584	40	40	4	52	52	92	132-pin QFP
MB53050	6400	52	52	4	68	68	120	149-pin PGA 164-pin QFP
MB53100	13376	74	74	8	100	100	174	211-pin PGA
		96	96	8	100	100	196	256-pin QFP
MB53150	16896	74	74	8	100	100	174	211-pin PGA
		96	96	8	100	100	196	256-pin QFP
MB53300	30528	100	100	8	156	156	256	344-pin QFP
MB53208 with RAM	20736 with 8K RAM	100	100	8	156	156	256	344-pin QFP

MB81C1000A-60/-70/-80/-10 Series

1M X 1 Bit CMOS Fast Page Dynamic RAM

DESCRIPTION

The Fujitsu MB81C1000A is a CMOS fully decoded fast page dynamic RAM organized as 1,048,576 words x 1 bit. The MB81C1000A has been designed for mainframe memories, buffer memories, and video image memories requiring high speed with low power dissipation.

CMOS peripheral circuits provide low power dissipation and high speed operation.

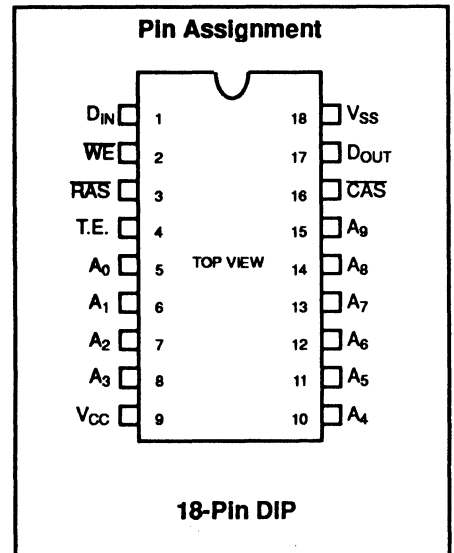
Fujitsu's advanced three-dimensional stacked capacitor cell technology gives the MB81C1000A a high α -ray soft error immunity and long refresh time.

FEATURES

- Fast Page Mode
- Read, Write, Read-write
- RAS-only, hidden refresh
- CAS-before-RAS refresh
- P-sub N-well CMOS
- Stacked capacitor cell (On-chip X4 test function)
- Low input capacitance
- JEDEC approved pinout

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		1048576W X 1bit	
Access Time	T_{RAC}	60/70/80/100	ns
	T_{CAC}	15/20/20/25	ns
	T_{AA}	30/35/40/50	ns
Cycle Time	T_{RC}	130/140/155/180	ns
Power Dissipation (Active)		407/374/341/297	mW (Max.)
Power Dissipation (Standby) (TTL/CMOS Level)		11/5.5	mW
Refresh		8.2	ms
		512	cycle



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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AVAILABLE PACKAGES

- 18 Pin 300-mil DIP, (P)
- 26 Pin 300-mil SOJ, (PJ)
- 20 Pin 400-mil ZIP, (PZ)
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, normal orientation package (PFTN)
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, reverse orientation package (RFTN)

MB81C4256A-60/-70/-80/-10 Series

256K x 4 Bit CMOS Fast Page Dynamic RAM

DESCRIPTION

The Fujitsu MB81C4256A is a CMOS fully decoded dynamic RAM organized as 1,048,576 words x 1 bit. The MB81C4256A has been designed for mainframe memories, buffer memories, and video image memories requiring high speed and high-bandwidth output with low power dissipation.

CMOS peripheral circuits provide low power dissipation and high speed operation.

Fujitsu's advanced three-dimensional stacked capacitor cell technology gives the MB81C4256A a high α -ray soft error immunity and long refresh time.

FEATURES

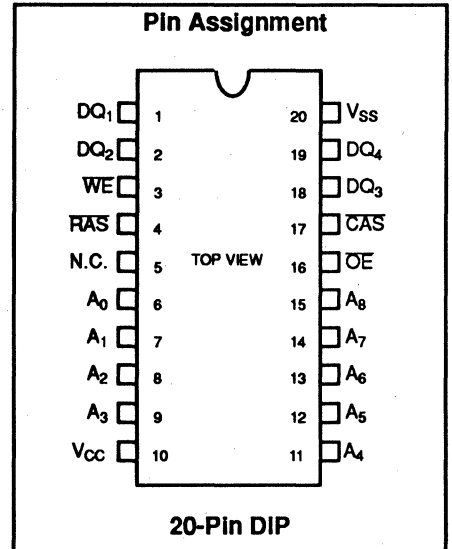
- Fast Page Mode
- Read, Write, Read-write
- $\overline{\text{RAS}}$ -only, hidden refresh
- $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ refresh
- P-sub N-well CMOS
- Stacked capacitor cell
- Low input capacitance
- JEDEC approved pinout

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		262144W X 4bit	
Access Time	T_{RAC}	60/70/80/100	ns
	T_{CAC}	15/20/20/25	ns
	T_{AA}	30/35/40/50	ns
Cycle Time	T_{RC}	130/140/155/180	ns
	T_{PC}	45/50/55/65	ns
Power Dissipation (Active)		407/374/341/297	mW (Max.)
Power Dissipation (TTL/CMOS Level) (Standby)		11/5.5	mW
Refresh		8.2	ms
		512	cycle

AVAILABLE PACKAGES

- 20 Pin 300-mil DIP (P)
- 26 Pin 300-mil SOJ (PJ)
- 20 Pin 400-mil ZIP (PZ)
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, normal orientation package PFTR
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, reverse orientation package PFTR



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB814100A-60/-70/-80 Series

4M x 1 Bit CMOS Fast Page Dynamic RAM

DESCRIPTION

The Fujitsu MB814100A is a fully decoded CMOS Dynamic RAM (DRAM) that contains a total of 4,194,304 memory cells in a x1 configuration. The MB814100A features a fast page mode of operation, in which high speed random access of up to 2,048 bits of data within the same row can be selected. The MB814100A DRAM is ideally suited for mainframes, buffers, hand-held computers, video imaging equipment, and other memory applications where low power dissipation is a basic requirement for the design.

FEATURES

- Fast Page Mode
- Read, Write, Read-write
- RAS-only, hidden refresh
- $\overline{\text{CAS}}$ -before-RAS refresh
- P-sub N-well CMOS
- Stacked capacitor cell (On-chip X8 test function)
- Low input capacitance

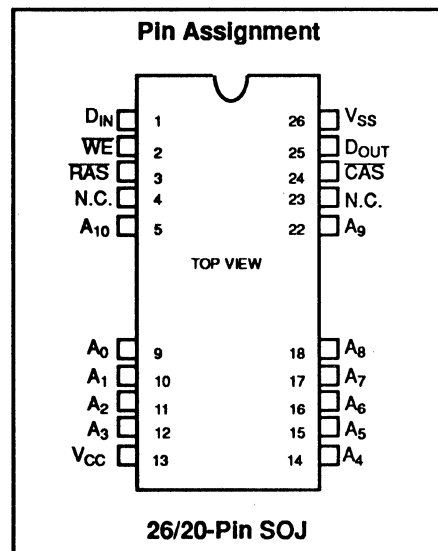
PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		4194304W x 1bit	
Access Time	T_{RAC}	60/70/80	ns
	T_{CAC}	20/20/20	ns
	T_{AA}	30/35/40	ns
Cycle Time	T_{RC}	120/140/155	ns
	T_{PC}	40/45/50	ns
Power Dissipation (Active)		495/424/383	mW (Max.)
Power Dissipation (Standby) (TTL/CMOS Level)		11/5.5	mW
Refresh		16.4	ms
		1024	cycle

AVAILABLE PACKAGES

- 26/20 Pin 300-mil SOJ (PJN)
- 20 Pin 400-mil ZIP (PZ)
- * 26/20 Pin 300-mil TSOP Type II, normal orientation package (PFTN)
- * 26/20 Pin 300-mil TSOP Type II, reverse orientation package (PFTR)

* Coming Soon



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB814400A-60/-70/-80 Series

1M x 4 Bit CMOS Fast Page Mode Dynamic RAM

DESCRIPTION

The Fujitsu MB814400A is a fully decoded CMOS Dynamic RAM (DRAM) that contains 4,194,304 memory cells accessible in 4-bit increments. The MB814400A features a fast page mode of operation in which high-speed random access of up to 1,048 bits of data within the same row can be selected. The MB814400A DRAM is ideally suited for mainframes, buffers, hand-held computers, video imaging equipment, and other memory applications where low power dissipation and high bandwidth are basic requirements of the design.

FEATURES

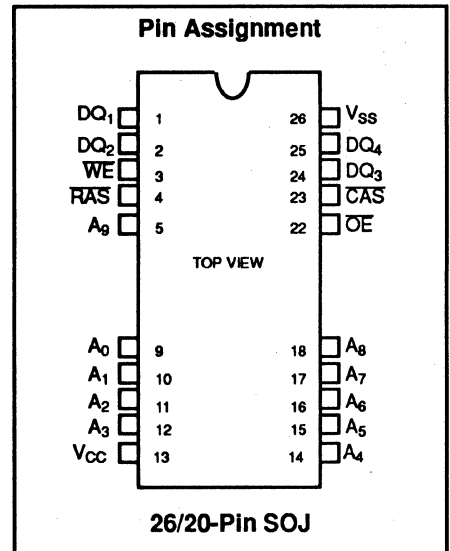
- Fast Page Mode
- Read, Write, Read-write
- RAS-only, hidden refresh
- CAS-before-RAS refresh
- P-sub N-well CMOS
- Stacked capacitor cell (On-chip X8 test function)
- Low input capacitance
- JEDEC approved pinout

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		1048576W x 4bit	
Access Time	T_{RAC}	60/70/80	ns
	T_{CAC}	20/20/20	ns
	T_{AA}	30/35/40	ns
Cycle Time	T_{RC}	120/140/155	ns
	T_{PC}	40/45/50	ns
Power Dissipation (Active)		495/424/383	mW (Max.)
Power Dissipation (Standby) (TTL/CMOS Level)		11/5.5	mW
Refresh		16.4	ms
		1024	cycle

AVAILABLE PACKAGES

- 26/20 Pin 300-mil SOJ (PJ)
- 20 Pin 400-mil ZIP (PZ)
- 20/26 Pin 300-mil TSOP Type II, normal orientation package (PFTN)
- 20/26 Pin 300-mil TSOP Type II, reverse orientation package (PFTR)



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

Fujitsu Microelectronics

MB1501

SERIAL INPUT PLL FREQUENCY SYNTHESIZER

SERIAL INPUT PLL FREQUENCY SYNTHESIZER WITH 1.1GHz PRESCALER

The Fujitsu MB1501, utilizing BI-CMOS technology, is a single chip serial input PLL frequency synthesizer with pulse-swallow function.

The MB1501 contains a 1.1GHz two modulus prescaler that can select either 64/65 or 128/129 divide ratio; control signal generator; 16-bit shift register; programmable reference divider (binary 14-bit programmable reference counter); 1-bit switch counter; phase comparator with phase conversion function; charge pump; crystal oscillator; 19-bit shift register; 18-bit latch; programmable divider (binary 7-bit swallow counter and binary 11-bit programmable counter).

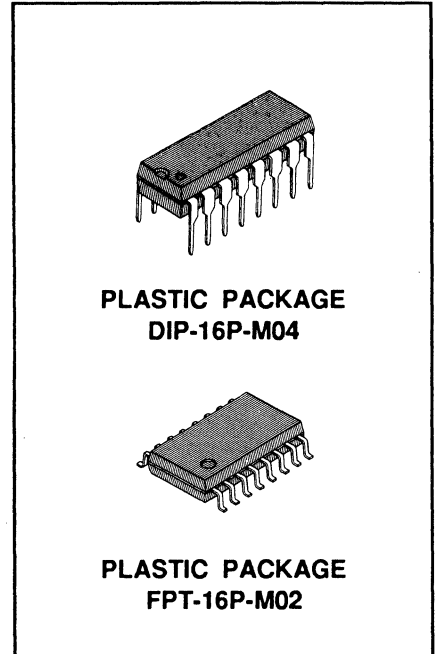
The MB1501 operates on a low supply voltage (3V typ) and consumes low power (45mW at 1.1GHz).

- High operating frequency: $f_{IN\ MAX}=1.1GHz$ ($V_{IN\ MIN}=0.20V_{P-P}$)
- Low power supply voltage: 2.7V to 5.5V (3.0V typ)
- Low power supply consumption: 45mW (3.0V, 1.1GHz operation)
- Serial input 18-bit programmable divider consisting of:
 - Binary 7-bit swallow counter (Divide ratio: 0 to 127)
 - Binary 11-bit programmable counter (Divide ratio: 16 to 2047)
- Serial input 15-bit programmable reference divider consisting of:
 - Binary 14-bit programmable reference counter (Divide ratio: 8 to 16383)
 - 1-bit switch counter (SW) Sets divide ratio of prescaler
- 2types of phase detector output
 - On-chip charge pump (Bipolar type)
 - Output for external charge pump
- Wide operating temperature: $T_A=-40^{\circ}C$ to $+85^{\circ}C$
- 16-pin Plastic DIP Package (Suffix: -P)
- 16-pin Plastic Flat Package (Suffix: -PF)
- Pulse swallow function
 - $f_{VCO} = [(M \times N) + A] \times f_{OSC} + R$
 - f_{VCO} : Output frequency of external voltage controlled oscillator (VCO)
 - N: Preset divide ratio of binary 11-bit programmable counter (16 to 2047)
 - A: Preset divide ratio of binary 7-bit swallow counter ($0 \leq A \leq 127$, $A < N$)
 - f_{OSC} : Output frequency of the external oscillator
 - R: Preset divide ratio of binary 14-bit programmable reference counter (8 to 16383)
 - M: Preset divide ratio of prescaler (64 or 128)

ABSOLUTE MAXIMUM RATINGS (see NOTE)

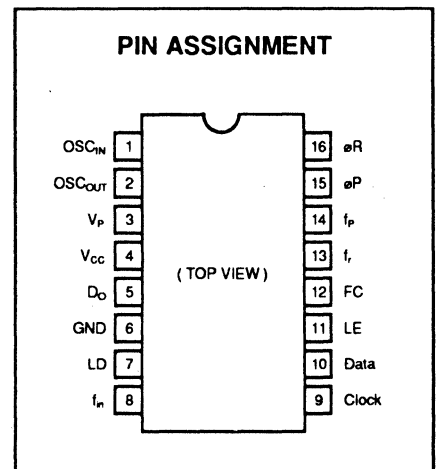
Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	-0.5 to +7.0	V
	V_P	V_{CC} to 10.0	V
Output Voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Open-drain Output	V_{OOP}	-0.5 to 0.8	V
Output Current	I_{OUT}	± 10	mA
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}C$

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



PLASTIC PACKAGE
DIP-16P-M04

PLASTIC PACKAGE
FPT-16P-M02



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB1507 SERIAL INPUT PLL FREQUENCY SYNTHESIZER

LOW POWER SERIAL INPUT PLL SYNTHESIZER WITH 2.0GHz PRESCALER

The Fujitsu MB1507, utilizing Bi-CMOS technology, is a single chip serial input PLL synthesizer with pulse-swallow function.

The MB1507 contains a 2.0 GHz two modulus prescaler that can select of either 128/129 or 256/257 divide ratio, control signal generator, 16-bit shift register, 15-bit latch, programmable reference divider (binary 14-bit programmable reference counter), 1-bit switch counter, phase comparator with phase conversion function, charge pump, crystal oscillator, 20-bit shift register, 19-bit latch, programmable divider (binary 8-bit swallow counter and binary 11-bit programmable counter) and analog switch to speed up lock up time.

It operates supply voltage of 5V typ. and achieves very low supply current of 18mA typ. realized through the use of Fujitsu Advanced Process Technology.

- High operating frequency: $f_{IN\ MAX}=2.0GHz$ ($V_{IN\ MIN}=-4dBm$)
- Pulse swallow function: 128/129 or 256/257
- Low supply current: $I_{CC}=18mA$ typ.
- Serial input 19-bit programmable divider consisting of:
 - Binary 8-bit swallow counter: 0 to 255
 - Binary 11-bit programmable counter: 16 to 2047
- Serial input 15-bit programmable reference divider consisting of:
 - Binary 14-bit programmable reference counter: 8 to 16383
 - 1-bit switch counter (SW) Sets divide ratio of prescaler
- On-chip analog switch achieves fast lock up time
- 2types of phase detector output
 - On-chip charge pump (Bipolar type)
 - Output for external charge pump
- Wide operating temperature: $-40^{\circ}C$ to $+85^{\circ}C$
- 16-pin Plastic Flat Package (Suffix: -PF)
- Pulse swallow function

$$f_{VCO} = [(PxN)+A] \times f_{osc} + R$$

f_{VCO} : Output frequency of external voltage controlled oscillator (VCO)

N: Preset divide ratio of binary 11-bit programmable counter (16 to 2047)

A: Preset divide ratio of binary 8-bit swallow counter ($0 \leq A \leq 255$, $A < N$)

f_{osc} : Output frequency of the external reference frequency oscillator

R: Preset divide ratio of binary 14-bit programmable reference counter (8 to 16383)

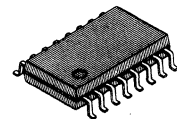
A: Preset modulus of external dual modulus prescaler (128 or 256)

ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	-0.5 to +7.0	V
	V_P	V_{CC} to 10.0	V
Output Voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Open-drain Voltage	V_{OOP}	-0.5 to 0.8	V
Output Current	I_{OUT}	± 10	mA
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}C$

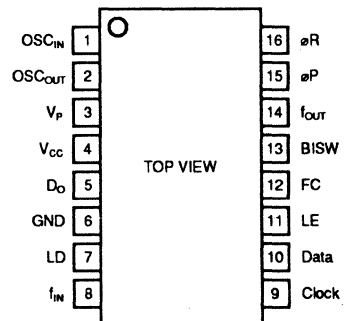
NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PRELIMINARY



PLASTIC PACKAGE
FPT-16P-M02

PIN ASSIGNMENT



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

HYBRID MODULE

CONSTANT-VOLTAGE-DRIVE STEPPER MOTOR DRIVERS

MBH90100 series (MBH90101, MBH90102, MBH90103, MBH90104, MBH90105)

The MBH90100 series consists of hybrid modules for four-phase stepper motor driving.

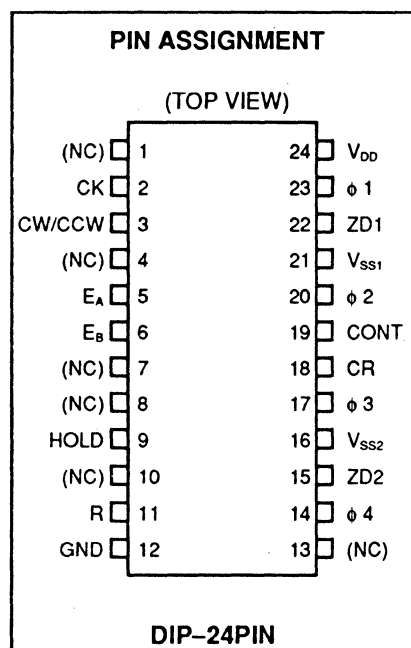
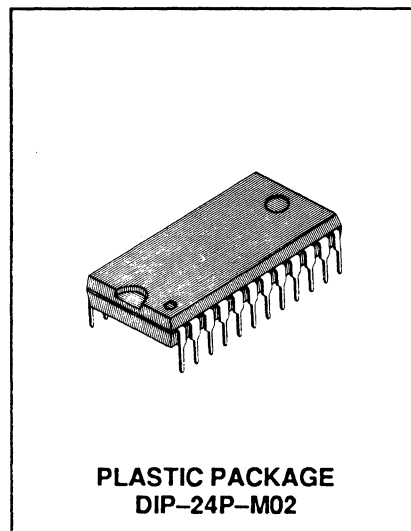
The series includes the MBH90101 to MBH90105, for different rated motor currents. The MBH90100 series four-phase stepper motor drivers are for constant voltage and unipolar drive and applicable to printers, facsimile equipments, copiers, and hard-disk controllers.

- Module configuration
Four-phase universal controller (MB86520)
Power MOSFET (FT60000 series)
Flyback diode
- Drive modes
Four-phase single excitation drive (full-step mode)
Four-phase double excitation drive (full-step mode)
Four-phase single/double excitation drive (half-step mode)
- Schmitt trigger inputs
- Built-in clock input disable
- Built-in delay to prevent abnormal motor currents

SERIES CONFIGURATION

Product	MBH 90101	MBH 90102	MBH 90103	MBH 90104	MBH 90105
Maximum Driver Voltage	120 V			60 V	
Maximum Driver Current	2.5 A	2.0 A	1.3 A	4.2 A	2.4 A
Controller Supply Voltage	5 V				

NOTE : Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

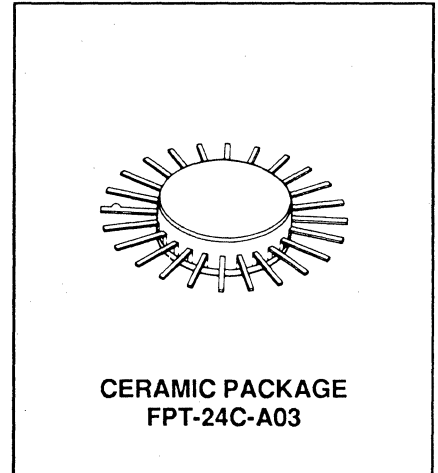
Fujitsu Microelectronics

MB1800 SERIES HIGH SPEED ECL

MB1800 SERIES 3G BIT/S HIGH SPEED ECL

The Fujitsu MB1800 series is high speed ECL fabricated with Fujitsu ESPER (Emitter-base Self-aligned structure with Polysilicon Electrodes and Resistors) process. This series is suitable for applications such as computer, telecom and instrumentation.

- Gate Delay: 75ps typ.
- Input Frequency: 3G Bit/s typ.
- F/F toggle clock Frequency: 4GHz typ.
- Output Rise/Fall Time: 95/75 ps typ.
- Power supply voltage compensation of I/O Levels: 10kH series compatible
- I/O Matching Impedance: 50Ω
- Round 24 pin package : FPT-24C-A03 (Suffix: -CF)
: R_o = 6°C/W (conductive cooling)
- Series Line-up



Fujitsu Microelectronics

Part No.	Function	Propagation Delay Time / Operating Frequency tpd(typ.) / fmax(typ.)	Power Dissipation W (typ.)
MB1801	Dual 2-input OR/NOR Gate	250 ps	0.7
MB1802	Dual Exclusive OR/NOR Gate	260 ps, 310 ps	0.7
MB1803	Dual 2-input 2-output OR/NOR Gate	310 ps	1.4
MB1804	2-input 4-differential Output Clock Distributor	370 ps	1.3
MB1806	4-differential Output Clock Distributor with Duty Control	550 ps	1.5
MB1810	D Flip-Flop with SET and RESET	460 ps/4.9 GHz	0.5
MB1811	Dual D Flip-Flop with SET and RESET	460 ps/4.9 GHz	0.95
MB1812	Quad D Flip-Flop with Common SET and RESET	520 ps/4 GHz	1.8
MB1813	Dual Toggle Flip-Flop with RESET	460 ps/4.7 GHz	0.9
MB1814	4 Stage Ripple Counter with RESET	4.1 GHz	1.25
MB1820	Discrimination Circuit	> 4 GHz (10mV at 2.5 GHz)	0.9
MB1821	4 to 1 Multiplexer	4.2 GHz	1.5
MB1822	1 to 4 Demultiplexer	3.8 GHz	1.7

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB84256A-70/70L/70LL/-10/10L/10LL/-12/12L/12LL/-15/15L/15LL

CMOS 256K-BIT LOW POWER SRAM

32,768 WORD x 8-BIT CMOS STATIC RANDOM ACCESS MEMORY WITH DATA RETENTION

The Fujitsu MB84256A is a 32,768-word by 8-bit static random access memory fabricated with a CMOS silicon gate process. The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single +5V power supply is required.

The MB84256A is ideally suited for use in microprocessor systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high performance.

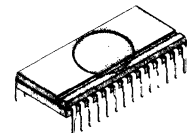
- Organization: 32,768 x 8 bits
- Fast access time: 70 ns max. (MB84256A-70/70L/70LL)
100 ns max. (MB84256A-10/10L/10LL)
120 ns max. (MB84256A-12/12L/12LL)
150 ns max. (MB84256A-15/15L/15LL)
- Completely static operation: No clock required
- TTL compatible inputs/outputs
- Three state outputs
- Single +5V power supply, ±10% tolerance
- Low power standby:
 - CMOS level: 5.5 mW max. (MB84256A-70/10/12/15)
0.55 mW max. (MB84256A-70L/70LL/10L/10LL/12L/12LL/15L/15LL)
 - TTL level: 16.5 mW max. (MB84256A-70/70L/70LL/10/10L/10LL/12/12L/12LL/15/15L/15LL)
- Data retention: 2.0V min.
- Standard 28-pin (600mil) (Suffix: P)
- Standard 28-pin (300mil) (Suffix: P-SK)
- Standard 28-pin Bend-type FPT (450mil) (Suffix: PF)
- Standard 28-pin Bend-type TSOP (Suffix: PFT)

ABSOLUTE MAXIMUM RATINGS (see NOTE)

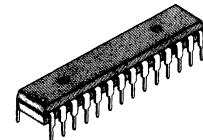
Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5 to +7.0	V
Input Voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	V
Output Voltage	V_{IO}	-0.5 to $V_{CC} + 0.5$	V
Temperature Under Bias	T_{BIAS}	-10 to +85	°C
Storage Temperature	T_{STG}	-40 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

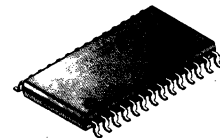
PRELIMINARY



PLASTIC PACKAGE
DIP-28P-M02

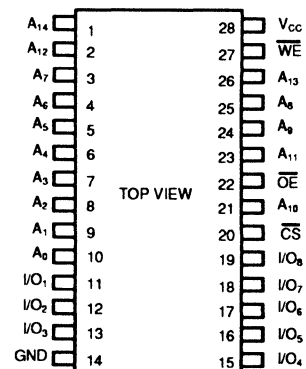


PLASTIC PACKAGE
DIP-28P-M04



PLASTIC PACKAGE
FPT-28P-M02

PIN ASSIGNMENT



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB841000-80/-80L/-10/-10L/-12/-12L CMOS 1M LOW POWER SRAM

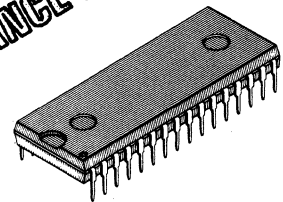
131,072-WORD x 8-BIT CMOS STATIC RANDOM ACCESS MEMORY WITH DATA RETENTION

The Fujitsu MB841000 is a 131,072-word x 8-bit static random access memory fabricated with a CMOS silicon gate process. The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single +5V power supply is required.

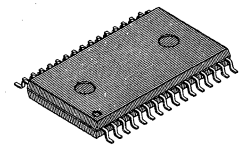
The MB841000 is ideally suited for use in microprocessor systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high performance.

- Organization : 131,072 x 8 bits
- Fast access time : 80 ns max. (MB841000-80/80L)
100 ns max. (MB841000-10/10L)
120 ns max. (MB841000-12/12L)
- Complete static operation : No clock required
- TTL compatible inputs/outputs
- Three state outputs
- Single +5V ±10% power supply
- Low power standby :
CMOS level : 5.5 mW max. (MB841000-80/10/12)
1.1 mW max. (MB841000-80L/10L/12L)
TTL level : 16.5 mW max. (MB841000-80/80L/10/10L/12/12L)
- Data retention voltage : 2.0V min.
- Standard 32-pin DIP (600mil) (Suffix: P)
- Standard 32-pin FPT (525mil) (Suffix: PF)

ADVANCE INFO.

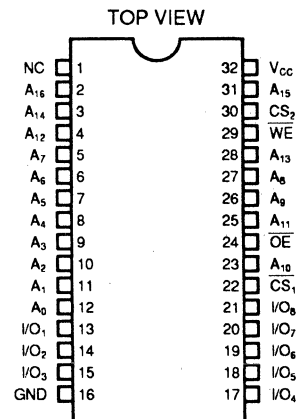


**PLASTIC PACKAGE
(DIP-32P-M01)**



**PLASTIC PACKAGE
(FPT-32P-M03)**

PIN ASSIGNMENT



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

ABSOLUTE MAXIMUM RATINGS (See NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V _{CC}	-0.5 to +7.0	V
Input Voltage	V _{IN}	-0.5 to V _{CC} +0.5	V
Output Voltage	V _{I/O}	-0.5 to V _{CC} +0.5	V
Temperature under Bias	T _{BIAS}	-10 to +85	°C
Storage Temperature	T _{STG}	-40 to +125	°C

NOTE: Permanent device damage may occur if **ABSOLUTE MAXIMUM RATINGS** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

MB82B001-25/-35

1M BIT HIGH SPEED BI-CMOS SRAM

1,048,576 WORDS x 1 BIT HIGH SPEED BI-CMOS STATIC RANDOM ACCESS MEMORY

The Fujitsu MB82B001 is 1,048,576 words x 1 bit static random access memory fabricated with a Bi-CMOS process technology. To make power dissipation lower and high speed, peripheral circuits consist of Bi-CMOS technology, and to obtain smaller chip size, cells consist of NMOS transistors and resistors.

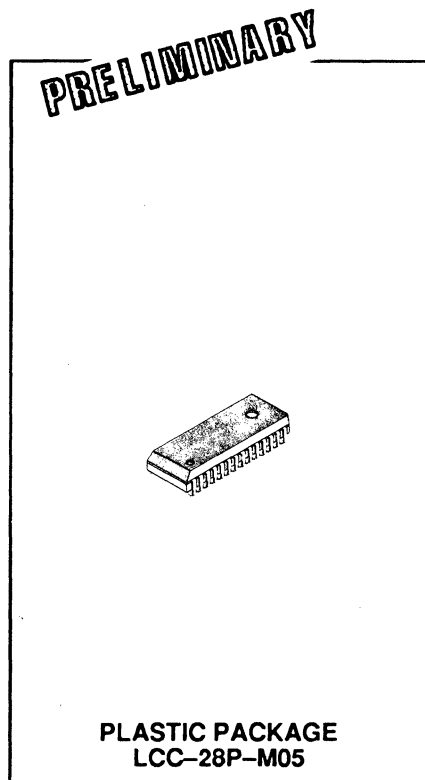
The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single 5 volts power supply is required. The MB82B001 has 400mil plastic small out-line J-lead(SOJ) as package option.

The MB82B001 is ideally suited for use in dataprocessing systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high performance.

- Organization: 1,048,576 words x 1 bit
- Static operation: No clocks or refresh required
- Fast access time: 25ns max. (MB82B001-25)
35ns max. (MB82B001-35)
- Single +5V(±10%) power supply with low current drain

Active operation = 120mA max.
Standby operation = 15mA max. (CMOS level)
Standby operation = 25mA max. (TTL level)

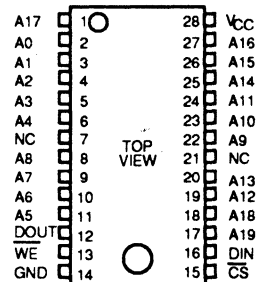
- Separate data input and output
- TTL compatible inputs and output
- Chip select for simplified memory expansion, automatic power down
- All inputs and output have protection against static charge
- 400 mil width 28-pin SOJ package (Suffix: -PJ)



Fujitsu Microelectronics

PLASTIC PACKAGE
LCC-28P-M05

PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5 to +7.0	V
Input Voltage on any pin with to GND	V_{IN}	-0.5 to +7.0	V
Output Voltage on any pin with to GND	V_{OUT}	-0.5 to +7.0	V
Power Dissipation	P_D	1.0	W
Output Current	I_{OUT}	±20	mA
Temperature under Bias	T_{BIAS}	-10 to +85	°C
Storage Temperature	T_{STG}	-40 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB82B005-25/-35

1M BIT HIGH SPEED BI-CMOS SRAM

262,144 WORDS x 4 BITS HIGH SPEED BI-CMOS STATIC RANDOM ACCESS MEMORY

The Fujitsu MB82B005 is 262,144 words x 4 bits static random access memory fabricated with a Bi-CMOS process technology. To make power dissipation lower and high speed, peripheral circuits consist of Bi-CMOS technology, and to obtain smaller chip size, cells consist of NMOS transistors and resistors.

The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single 5 volts power supply is required. The MB82B005 has 400mil plastic small out-line J-lead(SOJ) as package option.

The MB82B005 is ideally suited for use in dataprocessing systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high performance.

- Organization: 262,144 words x 4 bits
- Static operation: No clocks or refresh required
- Fast access time: 25ns max. (MB82B005-25)
35ns max. (MB82B005-35)
- Single +5V(±10%) power supply with low current drain
 - Active operation = 120mA max.
 - Standby operation = 15mA max. (CMOS level)
 - Standby operation = 25mA max. (TTL level)
- Common data input and output
- TTL compatible inputs and outputs
- Chip select for simplified memory expansion, automatic power down
- All inputs and output have protection against static charge
- 400 mil width 28-pin SOJ package (Suffix: -PJ)

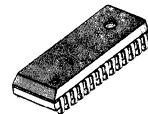
Fujitsu Microelectronics

ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5 to +7.0	V
Input Voltage on any pin with to GND	V_{IN}	-0.5 to +7.0	V
Output Voltage on any pin with to GND	V_{OUT}	-0.5 to +7.0	V
Power Dissipation	P_D	1.0	W
Output Current	I_{OUT}	±20	mA
Temperature under Bias	T_{BIAS}	-10 to +85	°C
Storage Temperature	T_{STG}	-40 to +125	°C

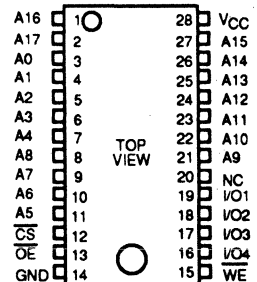
NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PRELIMINARY



**PLASTIC PACKAGE
LCC-28P-M05**

PIN ASSIGNMENT

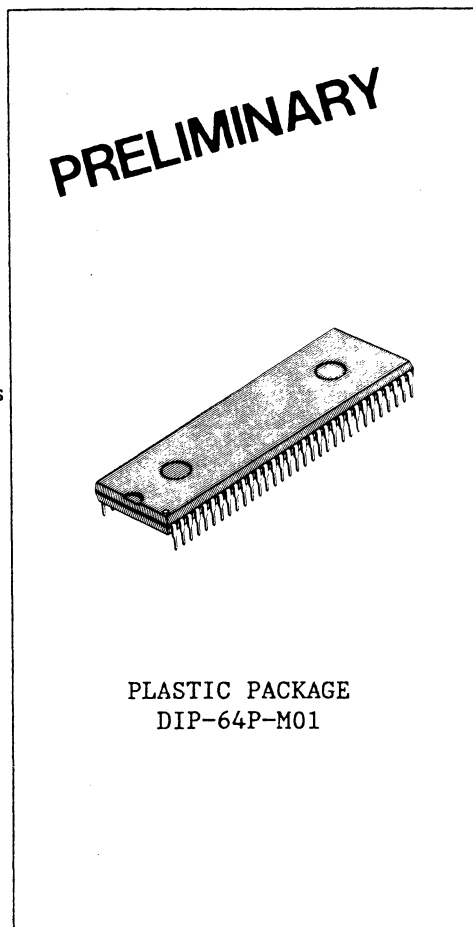


This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

The Fujitsu MB86140, fabricated in CMOS process technology, is a picture in picture controller for TV/VTR applications conform to NTSC mode.

The MB86140 is an exclusive controller of the picture in picture system composed of PLL IC (MB3511), dual port RAM (MB81461) and A/D·D/A converter (MB40176).

- NTSC mode
- Picture in picture function
 - Separate/Compress/Composite function of brightness signal and colour signal
 - Memory control function
 - Selectable motion picture mode (all field) or still mode picture (single field)
 - Selectable sub-picture position: Upper left, lower left, upper right, or lower right
 - AFC (Automatic frequency control) function
- Solarization mode function
- Indication signal output for PIP mode or solarization mode
- Input video signal: NTSC composite video signal (6Bit/4fsc)
- Output video signal for sub-picture: (NTSC) composite video signal (6Bit/4fsc)
- Single supply voltage: +5 V
- 64-pin plastic dual-in-line package



ABSOLUTE MAXIMUM RATINGS (See NOTE)

(VSS=0V)

Rating	Symbol	Condition	Value	Unit	
Supply Voltage	VDD		VSS-0.5 to +6.0	V	
Input Voltage	VI		VSS-0.5 to VDD+0.5	V	
Output Voltage	VO		VSS-0.5 to VDD+0.5	V	
Operating Temperature	TA		-25 to +85	°C	
Storage Temperature	TSTG		-40 to +125	°C	
Output Current	IO	VDD=Max.	VO=VDD	+70	mA
			VO=0V	-40	

NOTE: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB87033B Series

SCSI Protocol Controller (SPC) With On-Chip Drivers/Receivers

GENERAL DESCRIPTION

The MB87033 SCSI Protocol Controller (SPC) is a CMOS LSI circuit specifically designed to control a Small Computer Systems Interface (SCSI). The MB87033 rounds out Fujitsu's SPC family of protocol controllers by providing software enhancements and other functional features that will meet all facets of the SCSI specification (ANSI X 3.131-1986).

To achieve optimum performance and interface flexibility, the MB87033 provides an 8-byte First-In First-Out (FIFO) data buffer register and a 28-bit transfer byte counter which allows burst transfers of up to 256 megabytes. To improve programming requirements, "Attention Detect" and "Arbitration Fail" interrupts are provided and on-chip driver/receiver circuits simplify interface connections. Data transfers can be executed in either the asynchronous or synchronous mode with a maximum offset of 8-bytes.

SCSI Compatibility

- Supports all mandatory commands, many optional commands, and some extended commands of SCSI Specification (ANSI X3.131, 1986)
- Software compatible with MB87030/31
- Serves as either INITIATOR or TARGET

Data Buses

- Independent buses for CPU and DMA controller

Transfer Modes

- Asynchronous
- Synchronous mode transfers with programmable offset of up to eight bytes (8-byte FIFO)

Data Transfer Speed

- Up to a maximum of 5-megabyte/sec

Selectable Operating Modes

- DMA transfers
- Program transfers
- Manual transfers
- Diagnostic

Interface

- On-chip single ended Drivers/Receivers
- Guaranteed to sink 48mA regardless of the number of outputs simultaneously asserted

Enhancements

- On-chip parity generation
- Attention condition detect interrupt
- Arbitration fail interrupt

Clock Requirements

- 10MHz clock

Technology/Power Requirements

- Silicon-gate CMOS
- Single +5V power supply

Available Packaging

- 84-pin plastic leadless chip carrier
- 80-pin plastic flat package

ABSOLUTE MAXIMUM RATINGS¹

Rating	Symbol	Values		Unit
		Min	Max	
Supply Voltage	V _{DD}	V _{SS} ² -0.3	6.0	V
Input Voltage	V _I	V _{SS} ² -0.3	V _{DD} + 0.3	V
Output Voltage ²	V _O	V _{SS} ² -0.3	V _{DD} + 0.3	V
Storage Temperature (Ceramic)	T _{STG}	-65	+125	°C

NOTES:

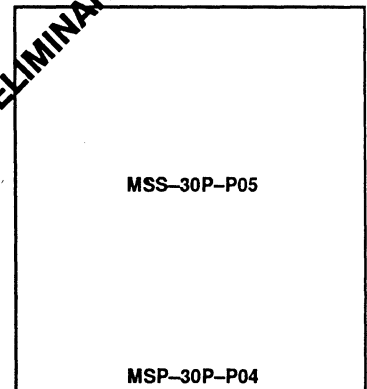
1. Permanent device damage may occur if the above Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. V_{SS} = 0 V
3. Not more than one output may be shorted at a time for a maximum duration of one second.

MB85285-80/-10/-12

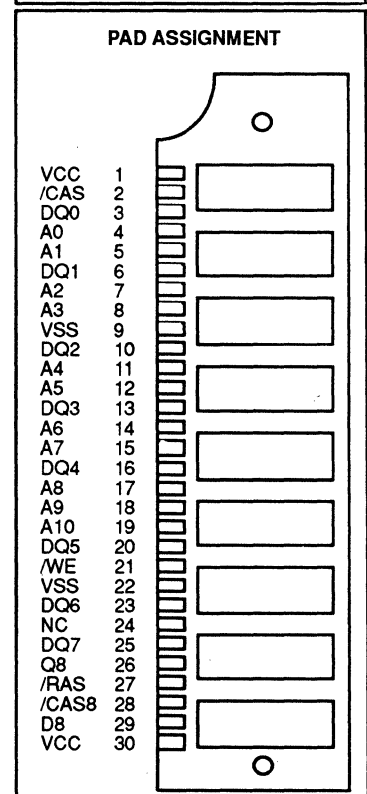
CMOS 4M x 9 Fast Page Mode DRAM Module

The Fujitsu MB85285 is a fully decoded, CMOS dynamic random access memory (DRAM) module consisting of nine MB814100 devices. The MB85285 is optimized for those applications requiring high speed, high performance, and large memory storage. The operation and electrical characteristics of the MB85285 are the same as the MB814100 devices which feature fast page operation. For ease of memory expansion, the MB85285 is offered in a 30-pad and a 30-pin Single In-line Memory Module Package (SIMM/SIP).

PRELIMINARY



- Organization:
4,194,304 words x 9 bit
- **RAS** Access Time:
80 ns max. (MB85285-80)
100 ns max. (MB85285-10)
120 ns max. (MB85285-12)
- **CAS** Access Time:
25 ns max. (MB85285-80)
30 ns max. (MB85285-10)
35 ns max. (MB85285-12)
- Column Address Access Time:
45 ns max. (MB85285-80)
50 ns max. (MB85285-10)
60 ns max. (MB85285-12)
- Fast Page Mode
- Active Power:
3713 mW max. (MB85285-80)
3128 mW max. (MB85285-10)
2723 mW max. (MB85285-12)
- Standby Power:
50 mW max. (CMOS Level)
99 mW max. (TTL Level)
- Single +5 V Supply $\pm 10\%$ Tolerance
- TTL Compatible I/O
- Decoupling Capacitor
0.22 μ F, 9 pcs
- JEDEC Standard Package Outline:
30-pad SIMM (MB85285-XX PS)
30-pad SIMM (MB85285-XX PSG*)
30-pin SIP (MB85285-XX PL)
*PSG = Gold Pad



Fujitsu Microelectronics

ABSOLUTE MAXIMUM RATINGS (See note)

Rating	Symbol	Value	Rating
Supply Voltage	V_{CC}	-1.0 to +7.0	V
Input Voltage	V_{IN}	-1.0 to +7.0	V
Output Voltage	V_{OUT}	-1.0 to +7.0	V
Short Circuit Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	9.0	W
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}$ C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltage to this high impedance circuit.

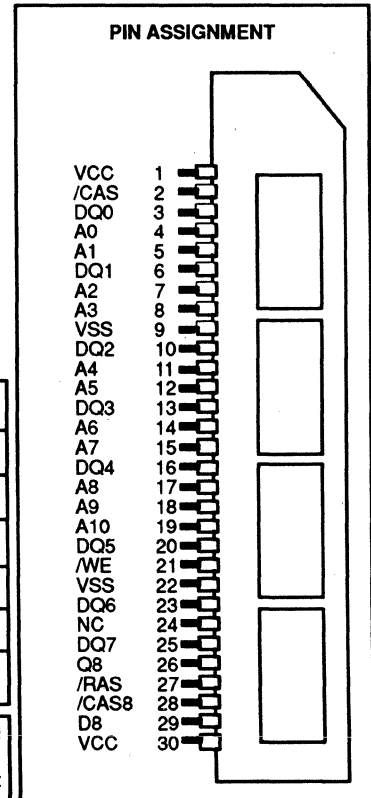
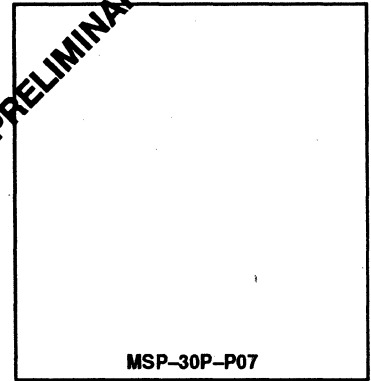
MB85295-80/-10/-12

CMOS 4M x 9 Low Profile DRAM Module

The Fujitsu MB85295 is a fully decoded, CMOS dynamic random access memory (DRAM) module consisting of nine MB814100 devices. The MB85295 is optimized for those applications requiring high speed, high performance, and large memory storage. The operation and electrical characteristics of the MB85295 are the same as the MB8141000 devices which feature fast page operation. For ease of memory expansion, the MB85295 is offered in a low profile 30-pin Single In-line Type Module Package (SIP).

PRELIMINARY

- Organization:
4,194,304 words x 9 bit
- RAS Access Time:
80 ns max. (MB85295-80)
100 ns max. (MB85295-10)
120 ns max. (MB85295-12)
- CAS Access Time:
25 ns max. (MB85295-80)
25 ns max. (MB85295-10)
35 ns max. (MB85295-12)
- Column Address Access Time:
45 ns max. (MB85295-80)
50 ns max. (MB85295-10)
60 ns max. (MB85295-12)
- Fast Page Mode
- Active Power:
3713 mW max. (MB85295-80)
3128 mW max. (MB85295-10)
2723 mW max. (MB85295-12)
- Standby Power:
50 mW max. (CMOS Level)
99 mW max. (TTL Level)
- Single +5 V Supply $\pm 10\%$ Tolerance
- TTL Compatible I/O
- Decoupling Capacitor
0.22 μ F, 9 pcs
- JEDEC Standard Package Outline:
30-pin SIP (MB85295-XX PL)



ABSOLUTE MAXIMUM RATINGS (See note)

Rating	Symbol	Value	Rating
Supply Voltage	V_{CC}	-1.0 to +7.0	V
Input Voltage	V_{IN}	-1.0 to +7.0	V
Output Voltage	V_{OUT}	-1.0 to +7.0	V
Short Circuit Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	9.0	W
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}$ C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltage to this high impedance circuit.

Fujitsu Microelectronics

MB85336-60/-70/-80/-10

CMOS 256K x 36 Fast Page Mode DRAM Module

The Fujitsu MB85336 is a fully decoded, CMOS dynamic random access memory (DRAM) module consisting of eight MB81C4256A devices and four MB81C256A devices. The MB85336 is optimized for those applications requiring high speed, high performance and large memory storage. The operation and electrical characteristics of the MB85336 are the same as the MB81C4256A which features fast page mode operation. For ease of memory expansion, the MB85336 is offered in a 72-pad Single In-Line Memory Module Package (SIMM).

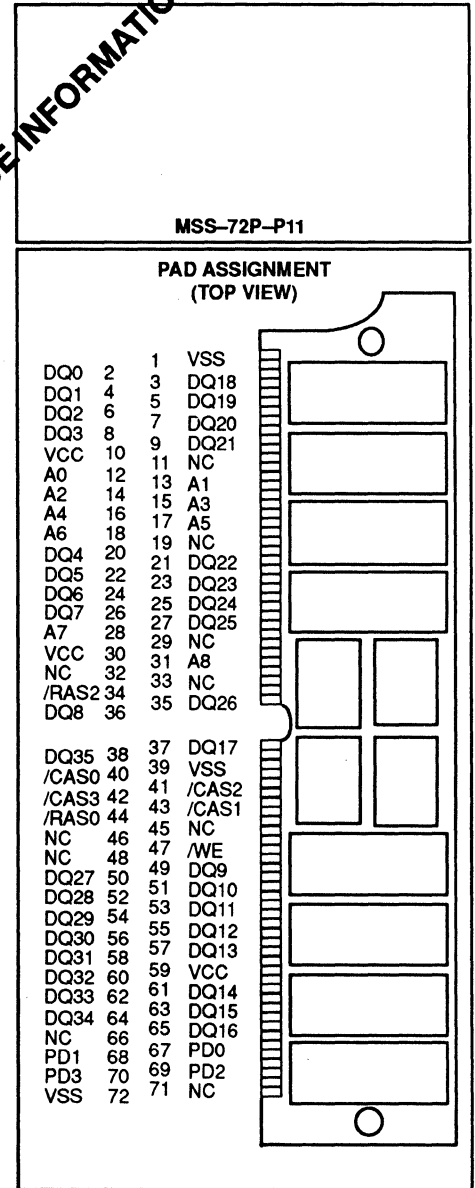
- Organization:
262,144 words x 36 bit
- RAS Access Time
60 ns max. (MB85336-60)
70 ns max. (MB85336-70)
80 ns max. (MB85336-80)
100 ns max. (MB85336-10)
- CAS Access Time:
15 ns max. (MB85336-60)
20 ns max. (MB85336-70)
20 ns max. (MB85336-80)
25 ns max. (MB85336-10)
- Column Address Access Time:
30 ns max. (MB85336-60)
35 ns max. (MB85336-70)
40 ns max. (MB85336-80)
50 ns max. (MB85336-10)
- Fast Page Mode
- Active Power:
4884 mW max. (MB85336-60)
4488 mW max. (MB85336-70)
4092 mW max. (MB85336-80)
3564 mW max. (MB85336-10)
- Standby Power:
66 mW max. (CMOS Level)
132 mW max. (TTL Level)
- Single +5 V Supply $\pm 10\%$ Tolerance
- TTL Compatible I/O
- Decoupling Capacitor:
0.22 μ F, 12 pcs
- JEDEC Standard Package Outline:
72-pad SIMM (MB85336-XXPS)
72-pad SIMM (MB85336-XXPSG*)
*PSG = Gold Pad

ABSOLUTE MAXIMUM RATINGS (See note)

Rating	Symbol	Value	Rating
Supply Voltage	V_{CC}	-1.0 to +7.0	V
Input Voltage	V_{IN}	-1.0 to +7.0	V
Output Voltage	V_{OUT}	-1.0 to +7.0	V
Short Circuit Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	10.0	W
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}C$

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ADVANCE INFORMATION



Fujitsu Microelectronics

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltage to this high impedance circuit.

MB85346-80/-10/-12

CMOS 1M x 36 Fast Page Mode DRAM Module

The Fujitsu MB85346 is a fully decoded, CMOS dynamic random access memory (DRAM) module consisting of eight MB814400 devices and four MB81C1000A devices. The MB85346 is optimized for those applications requiring high speed, high performance and large memory storage. The operation and electrical characteristics of the MB85346 are the same as the MB814400 which features fast page mode operation. For ease of memory expansion, the MB85346 is offered in a 72-pad Single In-Line Memory Module Package (SIMM).

- Organization:
1,048,576 words x 36 bits
- RAS Access Time
80 ns max. (MB85346-80)
100 ns max. (MB85346-10)
120 ns max. (MB85346-12)
- CAS Access Time:
25 ns max. (MB85346-80)
30 ns max. (MB85346-10)
35 ns max. (MB85346-12)
- Column Address Access Time:
45 ns max. (MB85346-80)
50 ns max. (MB85346-10)
60 ns max. (MB85346-12)
- Fast Page Mode
- Active Power:
4664 mW max. (MB85346-80)
4048 mW max. (MB85346-10)
3608 mW max. (MB85346-12)
- Standby Power:
66 mW max. (CMOS Level)
132 mW max. (TTL Level)
- Single +5 V Supply $\pm 10\%$ Tolerance
- TTL Compatible I/O
- Decoupling Capacitor:
0.22 μ F, 12 pcs
- JEDEC Standard Package Outline:
72-pad SIMM (MB85346-XXPS)
72-pad SIMM (MB85346-XXPSG*)
*PSG = Gold Pad

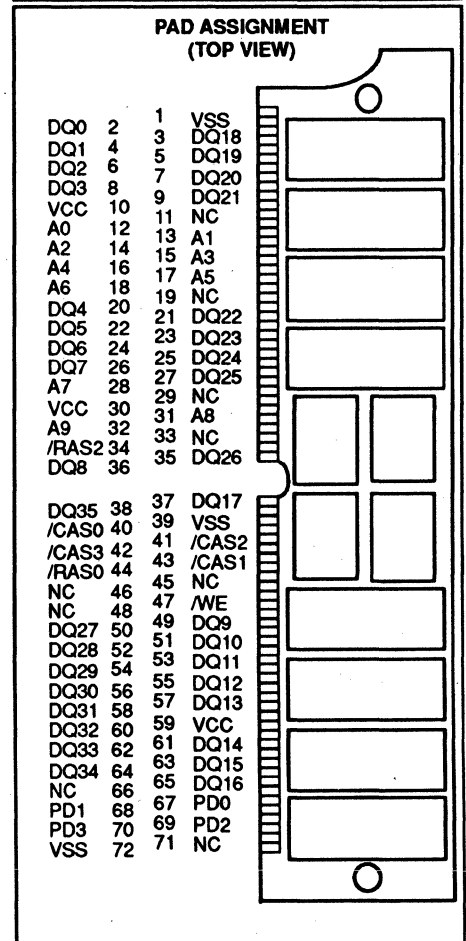
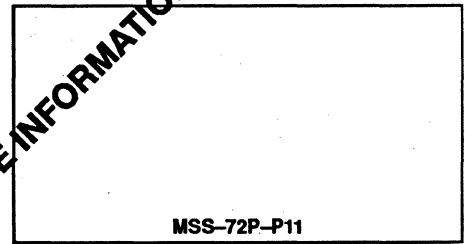
Fujitsu Microelectronics

ABSOLUTE MAXIMUM RATINGS (See note)

Rating	Symbol	Value	Rating
Supply Voltage	V_{CC}	-1.0 to +7.0	V
Input Voltage	V_{IN}	-1.0 to +7.0	V
Output Voltage	V_{OUT}	-1.0 to +7.0	V
Short Circuit Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	10.0	W
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}$ C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ADVANCE INFORMATION



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltage to this high impedance circuit.

MB98A9060-25/9070-25/9080-25/9090-25 SRAM MEMORY CARD

STATIC RANDOM ACCESS MEMORY CARD 64K/128K/256K/512K-BYTE

The Fujitsu MB98A9060/9070/9080/9090 are Static Random Access Memory (SRAM) cards capable of storing and retrieving large amounts of data. Each SRAM card contains a replaceable lithium battery and an on-board rechargeable battery for data retention. Battery can easily be replaced without loss of data, because the on-board cell keeps power applied to the memory circuits at all times.

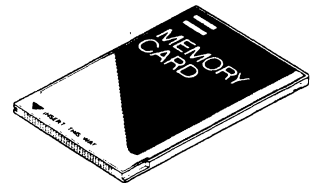
The SRAM memory circuits are housed in a "credit-card" size 68-pin package. Internally circuitry is protected by metal plates on the top and bottom of the card to help reduced chip damage from electro-static discharge.

Fujitsu memory cards offer the unique ability to be organized in either 8-bit or 16-bit bus configuration at the user side.

All cards offer advantages of portable, low power and high speed operation.

- Card Dimension: 85.6 length x 54.0 width x 3.3 thickness (mm)
- Connector Type: 68-pin Two-Piece (Built-in 68-pin receptacle, 2 row type)
- Complete static operation: No clock required
- TTL compatible inputs/outputs
- Three state outputs
- Single + 5.0V $\pm 5\%$ power supply
- Built-in battery backup IC
- Battery alarm function
- Replaceable Battery

PRELIMINARY



CRD-68P-M01

Fujitsu Microelectronics

AVAILABLE ORGANIZATIONS

Part Number	Mounted Memory Device	Access Time	Memory Organization *1
MB98A9060-25	256K SRAM x 2 pcs	250 ns	64K x 8 bit/32K x 16 bit
MB98A9070-25	256K SRAM x 4 pcs	250 ns	128K x 8 bit/64K x 16 bit
MB98A9080-25	256K SRAM x 8 pcs	250 ns	256K x 8 bit/128K x 16 bit
MB9890900-25	256K SRAM x 16 pcs	250 ns	512K x 8 bit/256K x 16 bit

*1: Selected at user side.

ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V _{CC}	-0.5 to +7.0	V
Input Voltage	V _{IN}	-0.5 to V _{CC} +0.5	V
Output Voltage	V _{VO}	-0.5 to V _{CC} +0.5	V
Temperature under Bias	T _{BIAS}	-10 to +60 *2	°C
Storage Temperature	T _{STG}	-10 to +60 *2	°C
Ambient Humidity	HA	37.5 to 62.5	RH

*2: 0°C to +40°C when the card is operated or kept for more than 20 consecutive days.

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB98A608A-25/609A-25/610A-25 EPROM MEMORY CARD

UV ERASABLE READ ONLY MEMORY CARD 256K/512K/1M-BYTE

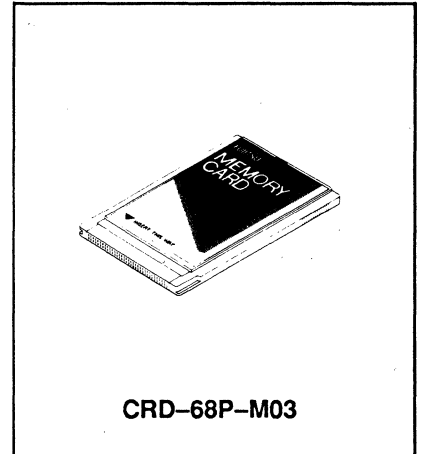
The Fujitsu MB98A608A/609A/610A are UV Erasable Read Only Memory (EPROM) cards capable of storing and retrieving large amounts of data. Each EPROM card contains multiple MBM27C1001 devices.

The EPROM memory circuits are housed in a "credit-card" size 68-pin package. Internally circuitry is protected by metal plates on the top and bottom of the card to help reduced chip damage from electro-static discharge.

A unique feature of the Fujitsu memory cards allows the user to organize the card into either an 8-bit or a 16-bit organization.

All cards are portable and operate at high speed with low power needs.

- Card Dimensions: 85.6 length x 54.0 width x 4.05 thickness (mm)
- Connector Type: 68-pin Two-Piece (Built-in 68-pin receptacle, 2-row type)
- Complete static operation: No clock required
- TTL compatible inputs/outputs
- Three-state outputs
- Single + 5.0V ±5% power supply



Fujitsu Microelectronics

AVAILABLE ORGANIZATIONS

Part Number	Mounted Memory Device	Access Time	Memory Organization *
MB98A608A-25	MBM27C1001 x 2 pcs	250 ns	256K x 8 bits/128K x 16 bits
MB98A609A-25	MBM27C1001 x 4 pcs	250 ns	512K x 8 bits/256K x 16 bits
MB98A610A-25	MBM27C1001 x 8 pcs	250 ns	1 M x 8 bits/512K x 16 bits

* To be configured by user.

ABSOLUTE MAXIMUM RATINGS (see NOTE.)

Rating	Symbol	Value	Unit
Supply Voltage	V _{CC}	-0.3 to +7.0	V
Input Voltage	V _{IN}	-0.5 to V _{CC} +0.5	V
Output Voltage	V _{VO}	-0.5 to V _{CC} +0.5	V
Programming Voltage	V _{CC} /V _{PP1} , V _{CC} /V _{PP2}	-0.5 to +13.5	V
Temperature under Bias	T _{BIAS}	-10 to +60	°C
Storage Temperature	T _{STG}	-30 to +70	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB98A6070-25/6080-25/6090-25/6100-25 OTPROM MEMORY CARD

ONE TIME PROGRAMMABLE READ ONLY MEMORY CARD 128K/256K/512K/1M-BYTE

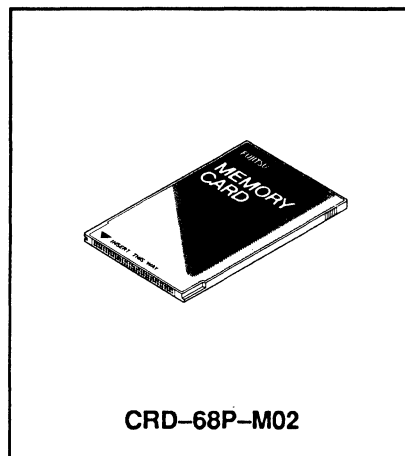
The Fujitsu MB98A6070/6080/6090/6100 are One Time Programmable Read Only Memory (OTP ROM) cards capable of storing and retrieving large amounts of data. Each OTP ROM card contains multiple MBM27C512P devices.

The OTP ROM memory circuits are housed in a "credit-card" size 68-pin package. Internally circuitry is protected by metal plates on the top and bottom of the card to help reduced chip damage from electro-static discharge.

A unique feature of the Fujitsu memory cards allow the user to organize the card into either an 8-bit or a 16-bit organization.

All cards are portable and operate at high speed with low power needs.

- Card Dimensions: 85.6 length x 54.0 width x 3.3 thickness (mm)
- Connector Type: 68-pin Two-Piece (Built-in 68-pin receptacle, 2-row type)
- Complete static operation: No clock required
- TTL compatible inputs/outputs
- Three-state outputs
- Single + 5.0V $\pm 5\%$ power supply



AVAILABLE ORGANIZATIONS

Part Number	Mounted Memory Device	Access Time	Memory Organization *
MB98A6070-25	MBM27C512P x 2 pcs	250 ns	128K x 8 bits/64K x 16 bits
MB98A6080-25	MBM27C512P x 4 pcs	250 ns	256K x 8 bits/128K x 16 bits
MB98A6090-25	MBM27C512P x 8 pcs	250 ns	512K x 8 bits/256K x 16 bits
MB98A6100-25	MBM27C512P x 16 pcs	250 ns	1 M x 8 bits/512K x 16 bits

* To be configured by user.

ABSOLUTE MAXIMUM RATINGS (see NOTE.)

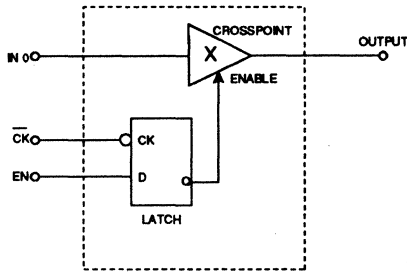
Rating	Symbol	Value	Unit
Supply Voltage	V _{CC}	-0.3 to +7.0	V
Input Voltage	V _{IN}	-0.5 to V _{CC} +0.5	V
Output Voltage	V _{IO}	-0.5 to V _{CC} +0.5	V
Programming Voltage	$\overline{OE}/V_{PP1}, \overline{OE}/V_{PP2}$	-0.5 to +13.5	V
Temperature under Bias	T _{BIAS}	-10 to +60	°C
Storage Temperature	T _{STG}	-30 to +70	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

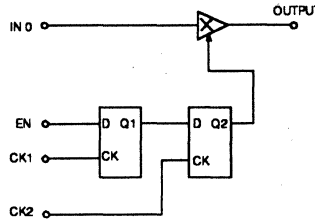


1 x 1 (SPST) SWITCHES



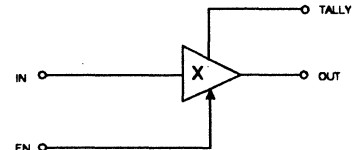
GX401

- used in video routers and switchers
- NTSC/PAL/SECAM/HDTV formats
- 80 dB off isolation at 100 MHz
- <0.05%, <0.05° diff. gain & phase



GX411 GX4301

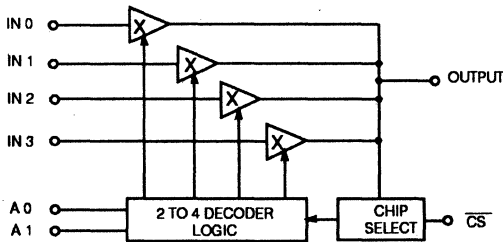
- also suitable for low level RF signal switching, data and PCM switching
- expandable tri-state outputs
- 300 MHz -3 dB bandwidth



GX4201

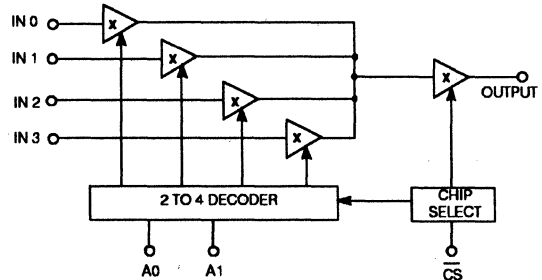
4 x 1 MULTIPLEXERS

**GX414/GX424/GX434 GX414A
GX4324/GX4334**



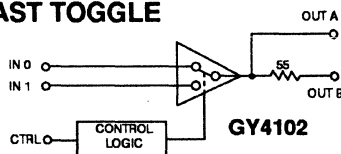
- used in video routers and switchers
- NTSC/PAL/SECAM/HDTV formats
- 110 dB off isolation at 10 MHz
- 200MHz -3 dB bandwidth

GX4304, GX4314



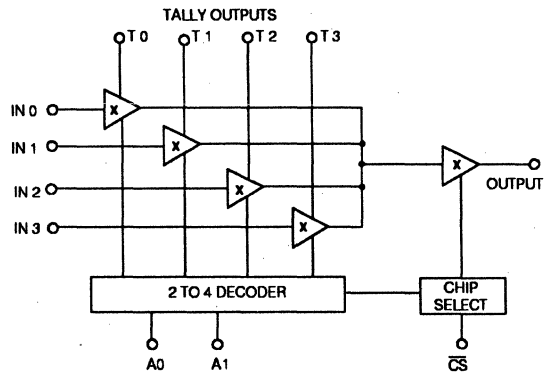
- <0.05%, <0.05° diff. gain & phase
- also suitable for low level RF, PCM and data switching
- expandable inputs and outputs (tri-state)

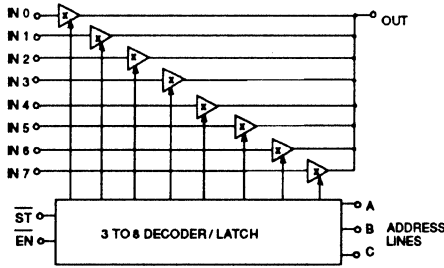
2 x 1 (SPDT) FAST TOGGLE



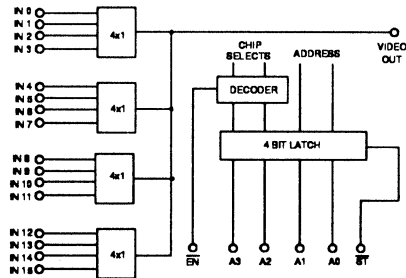
- extremely fast toggle <25ns
- useful for pixel switching, HDTV, A/D, RF and PCM data routing
- 250 MHz -3 dB bandwidth

GX4404, GX4414

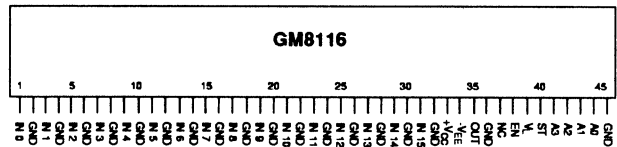
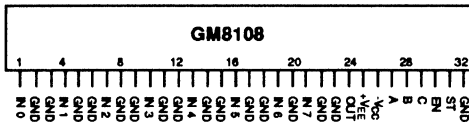




8 x 1 MUX MODULE



16 x 1 MUX MODULE



- stand alone multiplexers
- NTSC/PAL/SECAM and HDTV formats
- 10 x 1 version also available

- expandable for large matrices
- on-board logic decoding/latching
- convenient SIP format PCB

**ANALOG & DIGITAL SIGNAL
PROCESSING**

GT4122 MULTIPLIER

- 2 video inputs
- desktop quality bandwidth to 10 MHz
- "S" curve or linear control laws

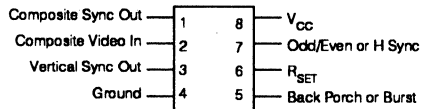
GT4123 MULTIPLIER

- broadcast quality bandwidth to 30 MHz
- 3 video inputs

GS9006 D2 CABLE EQUALIZER

- D2 equalization up to cable lengths of 300 m
- 8 pin DIP package
- balanced or unbalanced inputs
- 750 mV p-p ECL outputs

GS4881 SYNC SEPARATOR



- improved replacement for LM-1881
- scan rates to 110 kHz
- optional odd/even or H sync outputs
- optional back porch or burst outputs (options are enabled with pull-up resistors)
- no capacitor needed on pin 6

GS4882 SYNC SEPARATOR

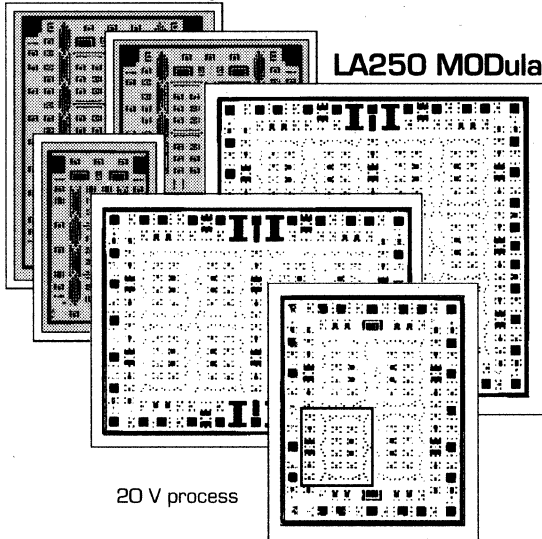
precision sync separator with

- 50% sync slicing
- jitter-free operation
- scan rates to 130 kHz
- all major sync signals provided
- gated flags for back porch and true burst

GENNUM CORPORATION The

Preferred Source for Analog ASICs

LA200 Arrays



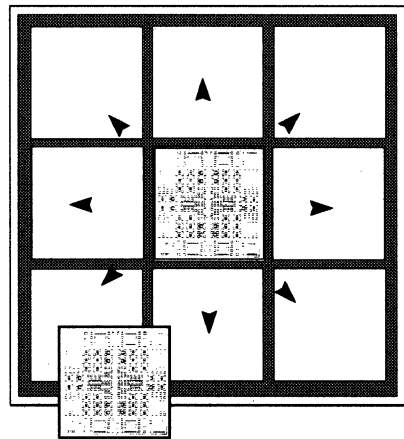
20 V process

LA200 SERIES - THREE SIZES OF ARRAYS
with active & passive components

LA250 SERIES - THREE SIZES OF ARRAYS
with flipped and repeated component modules

NPNs - large 100 - 300 mA, small, Schottky low noise
PNPs - split & multiple collectors
Junction capacitors - 75 pF
Zener diodes
Pinch resistors

GA911 - RF Analog Array for all your communication ICs



GA911 Tile-Based Array — one tile
of active and passive components,
repeatable up to 5 x 5 tiles.

2.5 GHz process
Low power 1- 15 V operation
On a 5 x 5 tile array -
1100 NPN, 460 PNP, 76 bonding pads
PC-based design tools

***for all your communication ICs ...
reduce cost, increase performance and reliability.***



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RESONANT MODE CONTROLLERS

	CONTROL MODE	MAXIMUM FREQUENCY	SINGLE ENDED	PUSH PULL	OUTPUT HI / LO	SYNCHRO. SHUTDOWN	ASYNCHRO. SHUTDOWN
LD405	ZCS	1 MHz	YES	YES	LO	YES	NO
GP605	ZCS	2 MHz	YES	YES	LO	YES	NO
GP6040	ZCS	3 MHz	YES	NO	LO	YES	YES
GP6041	ZCS	3 MHz	YES	NO	HI	YES	YES
GP6140	ZVS	3 MHz	YES	NO	LO	NO	YES
GP6141	ZVS	3 MHz	YES	NO	HI	NO	YES

APPLICATION NOTES

- 510 - 62 - 1 The GP605 in a Variable Frequency Zero Current Switching, Half Bridge Resonant Mode Power Supply.
- 510 - 63 - 1 The GP605 in a Variable Frequency, Zero Current Switching, Forward Mode Resonant Power Supply.
- 510 - 96 Retrofitting the GP6040 into a GP605 Circuit.
- 510 - 98 The GP6040 in a 50W Series Resonant Mode Power Supply.
- 600 - 11 IEEE Spectrum, May 1989, Resonant Mode Power Supplies: a primer
- 600 - 13 Designer's Guide: Resonant Mode Design Techniques Improve Switcher Performance.
- 600 - 14 New High Performance ZVS Resonant Mode Controller.

KITS

- X485 DC/DC Resonant Mode Power Supply - Evaluation Kit
- X486 X486 Evaluation Board and 510 - 68 Assembly Manual

PACKAGING

- Available in:
- Plastic SOIC
 - Plastic DIP
 - Ceramic Hermetic DIP
 - Commercial, Industrial and Hi - Rel Grades

CUSTOM CONTROLLERS

Gennum offers full custom and semicustom PWM and resonant mode controllers, as well as variants on our standard controllers.

Document No. RP2809



FEATURES

- high stability of output level
- 40 dB AGC operating range
- adjustable AGC threshold
- adjustable release time
- levels adjustable with external components
- maximum frequency 200 kHz
- operates from standard 5V power supply

The GC413 is a low cost, high performance, easy to use 8 pin AGC amplifier. In the minimum component configuration it only requires four external capacitors. The output level is maintained constant over 40 dB variation of input signal. The GC413 can drive a 600 Ω load and can be operated with a power supply voltage of 4.6 to 20 volts. No adjustments are necessary.

Some potential applications are:

intercoms
hands-free telephones
P.A. systems
voice recognition systems
ultrasonic remote controls
ultrasonic radars

answering machines
modems
voice control systems
security systems
proximity detectors
sonar systems

infrared remote controls
ground-to-air voice systems
ground-to-ground voice systems
airborne communications
special telephone applications

Gennum Corporation

**GC810 Low Voltage, Low Power
Operational Amplifier**

FEATURES

- low voltage design - operates on 1.0 V supplies
- low power consumption - 200 μ A typ. supply current
- wide range of supply voltage: 1.0 to 24 V
- single or dual supply operation
- low input offset voltage: 1 mV typ.
- class AB output stage swings virtually rail-to-rail

The GC810 is a low voltage, low power 8 pin operational amplifier employing specialized circuit design techniques to achieve operation on supply voltages as low as 1.0 volt. The class AB output stage swings to within a single transistor saturation voltage of either supply rail, and the PNP input stage provides negative supply rail sensing capability.

Some potential applications are:

hand-held communications equipment
battery operated security systems
industrial signal conditioning equipment
medical signal conditioning equipment

telephone sets
wireless microphones
cordless telephones

can be operated from a single cell watch battery



DYNAMIC RAM

CAPACITY	ORG.	PART NO.	ACCESS TIME(ns)	POWER		FEATURE	PACKAGE	AVAIL	
				ACTIVE	S/B				
256K	256×1	GM71C256	- 80	80	60mA	3mA	FAST PAGE MODE	16 DIP	NOW
			- 10	100	50mA				
			- 12	120	45mA				
	64K×4	GM71C256A	- 7	70	70mA	3mA	FAST PAGE MODE	16 DIP	NOW
			- 8	80	60mA				
			- 10	100	50mA				
		GM71C464	- 80	80	70mA	3mA	FAST PAGE MODE	18 DIP	NOW
			- 10	100	65mA				
		- 12	120	60mA					
1M	1M×1	GM71C1000	- 80	80	70mA	1mA	FAST PAGE MODE	18 DIP 20 SOJ 20 ZIP	NOW
			- 10	100	60mA				
			- 12	120	50mA				
		GM71C1000B	- 6	60	90mA	1mA	FAST PAGE MODE	18 DIP 20 SOJ 20 ZIP	NOW
	- 7		70	80mA					
	- 8		80	70mA					
			- 10	100	60mA				
	GM71C1000L	- 80	80	70mA	200µA	FAST PAGE L-POWER	18 DIP 20 SOJ 20 ZIP	NOW	
		- 10	100	60mA					
		- 12	120	50mA					
	GM71C1000BL	- 6	60	90mA	200µA	FAST PAGE L-POWER	18 DIP 20 SOJ 20 ZIP	NOW	
		- 7	70	80mA					
		- 8	80	70mA					
		- 10	100	60mA					
	256K×4	GM71C4256A	- 80	80	70mA	1mA	FAST PAGE MODE	20 DIP 20 SOJ 20 ZIP	NOW
- 10			100	60mA					
- 12			120	50mA					
GM71C4256B		- 6	60	90mA	1mA	FAST PAGE MODE	20 DIP 20 SOJ 20 ZIP	NOW	
		- 7	70	80mA					
		- 8	80	70mA					
			- 10	100	60mA				
GM71C4256AL		- 80	80	70mA	200µA	FAST PAGE L-POWER	20 DIP 20 SOJ 20 ZIP	NOW	
	- 10	100	60mA						
	- 12	120	50mA						
GM71C4256BL	- 6	60	90mA	200µA	FAST PAGE L-POWER	20 DIP 20 SOJ 20 ZIP	NOW		
	- 7	70	80mA						
	- 8	80	70mA						
	- 10	100	60mA						
4M	4M×1	GM71C4100A	- 6	60	110mA	1mA	FAST PAGE MODE	300 SOJ 400 ZIP	3Q/'91
			- 7	70	100mA				
			- 8	80	90mA				
			- 10	100	80mA				
	GM71C4100AL	- 6	60	110mA	200µA	FAST PAGE L-POWER	300 SOJ 400 ZIP	4Q/'91	
		- 7	70	100mA					
		- 8	80	90mA					
		- 10	100	80mA					
1M×4	GM71C4400A	- 6	60	110mA	1mA	FAST PAGE MODE	300 SOJ 400 ZIP	3Q/'91	
		- 7	70	100mA					
		- 8	80	90mA					
		- 10	100	80mA					
GM71C4400AL	- 6	60	110mA	200µA	FAST PAGE L-POWER	300 SOJ 400 ZIP	4Q/'91		
	- 7	70	100mA						
	- 8	80	90mA						
	- 10	100	80mA						

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VIDEO RAM

CAPACITY	ORG.	PART NO.	ACCESS TIME (ns)		FEATURE	PACKAGE	AVAIL	
			RAM	SAM				
256K	64K×4	GM53C261	- 80	80	25	FAST PAGE	24 ZIP	NOW
		- 10	100	30				
		- 12	120	35				



DRAM MODULE

PART NO.	ORG.	ACCESS TIME	FEATURE	PACKAGE	AVAIL
GMM791000S/L	1M×9	80 100	FAST PAGE	30 PIN SOCKET/LEAD	NOW
GMM791000BS/BL	1M×9	60 70 80	FAST PAGE	30 PIN SOCKET/LEAD	2Q/'91
GMM781000S/L	1M×8	80 100	FAST PAGE	30 PIN SOCKET/LEAD	NOW
GMM781000BS/BL	1M×8	60 70 80	FAST PAGE	30 PIN SOCKET/LEAD	2Q/'91
GMM79256S/L	256K×9	70 80 100	FAST PAGE	30 PIN SOCKET/LEAD	NOW
GMM78256S/L	256K×8	70 80 100	FAST PAGE	30 PIN SOCKET/LEAD	NOW
GMM794000AS/AL	4M×9	60 70 80	FAST PAGE	30 PIN SOCKET/LEAD	4Q/'91
GMM784000AS/AL	4M×8	60 70 80	FAST PAGE	30 PIN SOCKET/LEAD	4Q/'91

SRAM

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CAPACITY	ORG.	PART NO.	ACCESS TIME (ns)	CURRENT		PACKAGE	AVAIL	
				ACTIVE	S/B			
16K	2K×8	GM76C28	- 10	100	60mA	50µA	24 DIP 24 SOP	NOW
			- 12	120				
64K	8K×8	GM76C88L	- 15	150	40mA	100µA	28 DIP 28 SOP	NOW
256K	32K×8	GM76C256	- 85	85	70mA	1mA	28 DIP 28 SOP	NOW
			- 10	100				
			- 12	120				
		GM76C256L	- 85	85	70mA	100µA	28 DIP 28 SOP	NOW
			- 10	100				
			- 12	120				
GM76C256LL	- 85	85	70mA	30µA	28 DIP 28 SOP	2Q/'91		
	- 10	100						
	- 12	120						
1M	128K×8	GM76C8128	- 70	70	70mA	1mA	32 DIP 32 SOP	4Q/'91
			- 85	85				
			- 10	100				
		GM76C8128L	- 70	70	70mA	100µA	32 DIP 32 SOP	4Q/'91
			- 85	85				
			- 10	100				

MASK ROM

PROCESS	CAPACITY	ORG.	PART NO.	ACCESS TIME(ns)	CURRENT		PACKAGE	AVAIL
					ACTIVE	S/B		
NMOS	1M	128K×8	GM231000 - 25	250	100mA	20mA	28 DIP	NOW
		128K×8	GM231000 - 30A - 31A - 32A	250	100mA	20mA	28 DIP	NOW
CMOS	4M	512K×8	GM23C4000 - 15 - 20 - 25	150 200 250	60mA	1.5mA	32 DIP 32 SOP	1Q/'91
		256K×16 512K×8	GM23C4100 - 15 - 20 - 25	150 200 250	60mA	1.5mA	40 DIP 44 QFP	2Q/'91



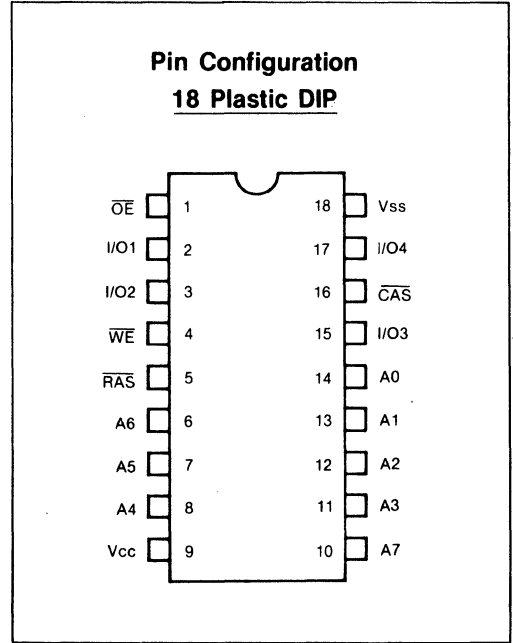
GM71C464/A 64K × 4 BIT
CMOS DYNAMIC RAM

Features

- 65,536 × 4 Bit organization
- Fast access time and cycle time: 70/80/100/120 ns (Max.)
- Single Power Supply of 5V ±10% with a built-in V_{BB} generator
- Performance Range

PARAMETER		GM71C464 (ns)			GM71C464A (ns)		
		- 80	- 10	- 12	- 7	- 8	- 10
trAC	$\overline{\text{RAS}}$ Access Time	80	100	120	70	80	100
tAA	Column Address Access Time	40	45	55	35	40	45
tCAC	$\overline{\text{CAS}}$ Access Time	25	25	30	20	25	25
trC	Cycle Time	145	175	205	130	145	175
tPC	Fast Page Mode Cycle Time	55	60	70	50	55	60

- Low Power
330/440mW Max. Operating (GM71C464-80/GM71C464A-7)
247/330mW Max. Operating (GM71C464-12/GM71C464A-8)
16.5mW Max. Standby
- Read-Modify-Write, $\overline{\text{RAS}}$ -only refresh, $\overline{\text{CAS}}$ Before $\overline{\text{RAS}}$ Refresh and Fast Page Mode Capability
- All input and output TTL compatible
- 256 refresh cycles/4ms
- Industry standard 18 pin Plastic DIP.



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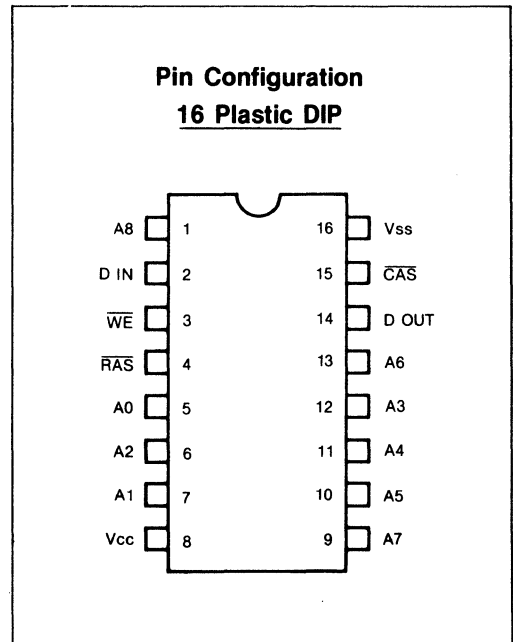
GM71C256/A 256K × 1 BIT
CMOS DYNAMIC RAM

Features

- 262,144 × 1 Bit organization
- Fast access time and cycle time: 70/80/100/120 ns (Max.)
- Single Power Supply of 5V ±10% with a built-in V_{BB} generator
- Performance Range

PARAMETER		GM71C256 (ns)			GM71C256A (ns)		
		- 80	- 10	- 12	- 7	- 8	- 10
trAC	$\overline{\text{RAS}}$ Access Time	80	100	120	70	80	100
tAA	Column Address Access Time	40	45	55	35	40	45
tCAC	$\overline{\text{CAS}}$ Access Time	30	35	40	25	30	35
trC	Cycle Time	145	175	205	130	145	175
tPC	Fast Page Mode Cycle Time	55	65	75	50	55	65

- Low Power
330/385mW Max. Operating (GM71C256-80/GM71C256A-7)
247/330mW Max. Operating (GM71C256-12/GM71C256A-8)
16.5mW Max. Standby
- Read-Modify-Write, $\overline{\text{RAS}}$ -only refresh, $\overline{\text{CAS}}$ Before $\overline{\text{RAS}}$ Refresh and Fast Page Mode Capability
- All input and output TTL compatible
- 256 refresh cycles/4ms
- Industry standard 16 pin Plastic DIP.





GM71C1000/L 1Mx1 BIT CMOS GM71C1000B/BL FAST PAGE DYNAMIC RAM

Description

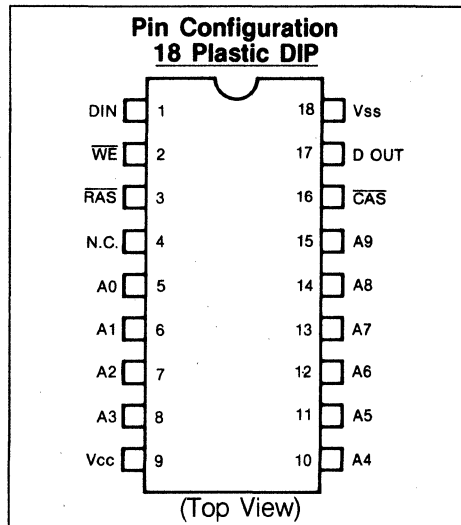
The GM71C1000/L/B/BL is the new generation dynamic RAM organized 1,048,576 words by 1 bit. The GM71C1000/L/B/BL utilizes Goldstar's silicon gate process technology as well as advanced circuit techniques to provide wide operating margins both internally and to the system user. Multiplexed address inputs permit the GM71C1000/L/B/BL to be packaged in a standard 18 pin DIP. This package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of 5V ±10V tolerance direct interfacing capability with high performance logic families such as Schottky TTL.

- Low Power
385/495mW Max. Operating (GM71C1000-80/1000B-6)
330/440mW Max. Operating (GM71C1000-10/1000B-7)
11mW Max. Standby/1.1mW MAX (L-Series)
- Output unlatched at cycle and allows two-dimensional chip selection
- Read-Modify-Write, \overline{RAS} -only refresh, Fast Page Mode capability \overline{CAS} Before \overline{RAS} Refresh, Hidden Refresh
- All input and output TTL compatible
- 512 refresh cycles/8ms, 512/64ms (L-Series)
- Industry standard 18 pin Plastic DIP/20 SOJ/ZIP

Features

- 1,048,576 words by 1 bit organization
- Fast access time and cycle time, 60/70/80/100/120 ns (Max.)
- Single Power Supply of 5V ±10% with a built-in V_{BB} generator
- Performance Range

PARAMETER		GM71C1000 (ns)			GM71C1000B (ns)		
		-80	-10	-12	-6	-7	-8
t _{RAC}	\overline{RAS} Access Time	80	100	120	60	70	80
t _{AA}	Column Address Access Time	40	45	55	30	35	40
t _{CAC}	\overline{CAS} Access Time	25	25	30	20	20	25
t _{RC}	Cycle Time	160	190	220	120	130	160
t _{PC}	Fast Page Mode Cycle Time	55	55	65	45	50	55



GM71C4256A/AL 256Kx4 BIT CMOS GM71C4256B/BL FAST PAGE DYNAMIC RAM

Description

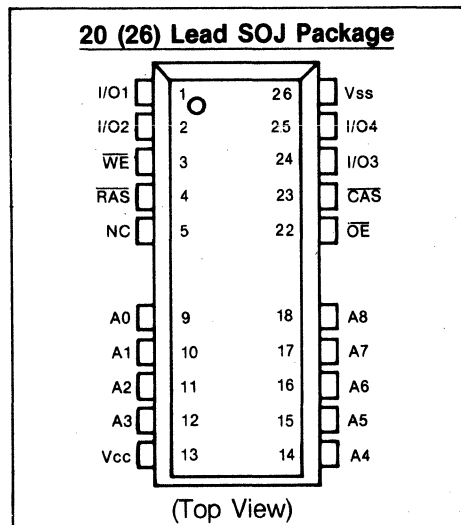
The GM71C4256A/AL/B/BL is the new generation dynamic RAM organized 262,144 x 4 Bit. GM71C4256A/AL/B/BL has realized higher density, higher performance and various functions by utilizing advanced CMOS process technology. The GM71C4256A/AL/B/BL offers Fast Page Mode as a high speed access Mode. Multiplexed address inputs permit the GM71C4256A/AL/B/BL to be packaged in a standard 20 pin DIP. SOJ and ZIP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of 5V ±10% tolerance, direct interfacing capability with high performance logic families such as Schottky TTL.

- Low Power
363/495mW Max. Operating (GM71C4256A-80/4256B-6)
303/440mW Max. Operating (GM71C4256A-10/4256B-7)
259/363mW Max. Operating (GM71C4256A-12/4256B-8)
11mW Max. Standby/1.1mW MAX (L-Series)
- Read-Modify-Write, \overline{RAS} -only refresh, \overline{CAS} Before \overline{RAS} Refresh and Fast Page Mode Capability
- All input and output TTL compatible
- 512 refresh cycles/8ms, 512/64ms (L-SERIES)
- Industry standard 20 pin Plastic DIP/20 (26) SOJ/20 ZIP.

Features

- 262,144 x 4 Bit organization
- Fast access time and cycle time: 60/70/80/100/120 (Max.)
- Single Power Supply of 5V ±10% with a built-in V_{BB} generator
- Performance Range

PARAMETER		GM71C4256A (ns)			GM71C4256B (ns)		
		-80	-10	-12	-6	-7	-8
t _{RAC}	\overline{RAS} Access Time	80	100	120	60	70	80
t _{AA}	Column Address Access Time	40	45	55	30	35	40
t _{CAC}	\overline{CAS} Access Time	25	25	30	20	20	25
t _{RC}	Cycle Time	160	190	220	120	130	160
t _{PC}	Fast Page Mode Cycle Time	55	55	65	45	50	55





GM71C4100A/4400A 4M×1 BIT HIGH PERFORMANCE
GM71C4100AL/4400AL FAST PAGE DYNAMIC RAM

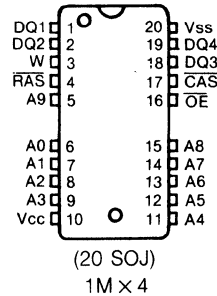
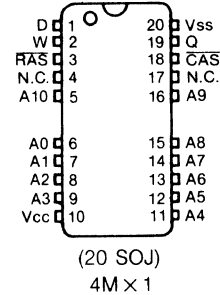
Features

- 4,194,304×1, 1,048,576×4 Bit organization
- Fast access time: 60/70/80/100 ns
- Single ±5V ±10% power supply
- Performance Range

PARAMETER		GM71C4100 (ns)		
		-6	-7	-8
t _{RAC}	$\overline{\text{RAS}}$ Access Time	60	70	80
t _{CAC}	$\overline{\text{CAS}}$ Access Time	15	20	20
t _{RC}	Cycle Time	110	130	150

- Low Power
 - 605mW (Max.) Operating (60 ns)
 - 550mW (Max.) Operating (70 ns)
 - 495mW (Max.) Operating (80 ns)
 - 11mW (Max.) Standby/1.1mW MAX (L-Series)
- Fast Page Mode capability
- $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ Refresh capability
- $\overline{\text{RAS}}$ -only and Hidden Refresh capability
- Fast parallel test mode capability
- TTL compatible inputs and output
- Common I/O capability using Early Write
- 1024 cycles/16ms refresh, 1024 cycles/128ms (L-Series)
- JEDEC standard pinout
- Available in Plastic SOJ 300 MIL/400 ZIP

Pin Configuration



GM23C4000 524,288×8 BITS CMOS
READ ONLY MEMORY

Description

The GM23C4000 high-performance Read Only Memory is organized as 524,288 words by eight bits and has an access time of 150 ns. It is designed to be compatible with all microprocessors and similar applications where high performance large-bit storage and simple interfacing are important considerations.

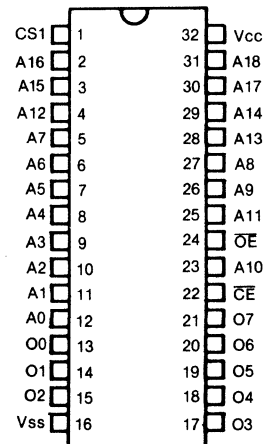
The GM23C4000 offers automatic power down controlled by the Chip Enable ($\overline{\text{CE}}$) input. When $\overline{\text{CE}}$ goes HIGH, the device will automatically power down and remain in a low power standby mode as long as $\overline{\text{CE}}$ remains HIGH. This feature provides system level power savings of as much as 80%. Pin 1 may also be programmed either active HIGH or LOW in order to eliminate bus contention in multiple bus microprocessor systems.

This ROM is packaged in industry-standard 32 pin dual-in-line package and is available in ceramic or low-cost plastic.

Features

- 524,288×8 organization
- Single +5V Supply
- Access time 150 ns (Max.)
- Totally static operation
- Completely TTL compatible
- Operating current 60mA (Max.)
- Standby current 100μA (Max.)
- Automatic power down ($\overline{\text{CE}}$) programmable Chip Select
- 3-state outputs for wired-OR expansion
- 32-pin industry-standard DIP
- EPROMs accepted as program data input

Pin Configuration



CHIP SELECT (CS) IS PROGRAMMABLE
ACTIVE LOW OR ACTIVE HIGH.



**GM76C256/L/LL 32K x 8 BIT LOW POWER
STATIC RAM**

Description

The GM76C256L/LL is 262,144 bit static random access memory organized as 32,768 words by 8 bits using CMOS technology, and operated from a single 5V supply. Advanced circuit techniques provide both high speed and low power features with a typical operating current of 70mA(MAX) and minimum cycle time of 85 ns.

When \overline{CS} is a logical high, the device is placed in low power standby mode in which standby current is 2mA typically.

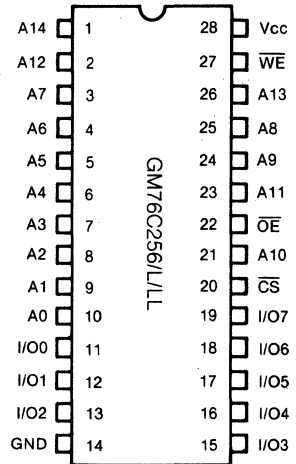
The GM76C256/L/LL has two control inputs. Chip select (CS) allows for device selection and data retention control, and an output enable input (\overline{OE}) provides fast memory access.

Thus the GM76C256/L/LL is suitable for use in various microprocessor application systems where high speed, low power, and battery back up are required. The GM76C256L/LL is offered in 28 pin DIP (600mil) and SOP (330mil).

Features

- High Speed: Fast Access and Cycle Time
85/100/120 ns (Max.)
- Low Power Standby and Low Power Operation;
Stand by: 1mA (Max.)-256
100 μ A (Max.)-256L
30 μ A (Max.)-256LL
Operation: 70mA (Max.)
- Completely Static RAM: No Clock or Timing Strobe Required
- Equal Access and Cycle Time
- Directly TTL Compatible: All Input and Outputs
- Capability of Battery Back up Operation
- Standard 28 DIP and SOP

Pin Configuration



**GM76C8128L 128K x 8 LOW POWER
STATIC RAM**

Description

The GM76C8128L is 1,048,576 bits static random access memory organized as 131,072 words by 8 bits using CMOS technology, and operated a single 5V power supply. Advanced circuit techniques provide both high speed and low power features with a maximum operating current of 5mA/MHz (Typ.), and minimum cycle time of 70/85/100 ns. When $\overline{CE1}$ is a logical high, $\overline{CE2}$ is low, the device is placed in low power standby mode in which standby current is 100 μ A.

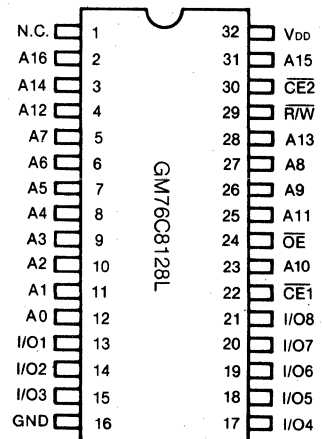
The GM76C8128L has three control inputs. Chip enable inputs ($\overline{CE1}$, $\overline{CE2}$) allows for device selection and data retention control, and an output enable input (\overline{OE}) provides fast memory access.

Thus the GM76C8128L is suitable for use in various microprocessor application systems where high speed, low power, and battery back up are required. The GM76C8128L is offered in both dual-in-line 32 pin standard plastic package and small out-line plastic flat package.

Features

- High Speed: 70/85/100 ns
- Low Power Dissipation
25mW/MHz (Typ.)
- Standby Current: 100 μ A (Max.)
- 5V Single Power Supply
- Power Down Feature: $\overline{CE1}$, $\overline{CE2}$
- Directly TTL Compatible: All Inputs and Outputs
- Plastic DIP and Plastic Flat Package
- Data Retention Supply voltage: 2.0 ~ 5.5V
- Industry Standard 32 PIN DIP and 32 SOP.

Pin Configuration



• Industry standard 32 PIN DIP and 32 SOP.



GM791000BS 1M×9 MEMORY MODULE

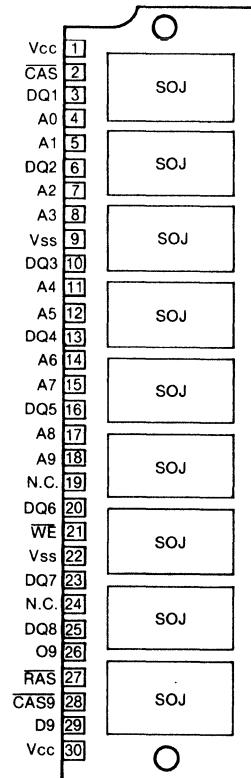
Pin Configuration

Description

The GMM791000BS is a 1M×9 Dynamic RAM MODULE, mounted 9 pieces of 1M bit DRAM (GM71C1000BJ) sealed in SOJ package. The outline of the GMM791000BS is 30 pin single in line package with leads suitable for mounting in a socket. Therefore, The GMM791000BS makes high density mounting possible without surface mount technology. The GMM791000BS provides common data inputs and outputs, and also provides separate I/O on parity bit for parity check. Its module board has decoupling capacitors mounted under each DRAM.

Features

- High density JEDEC standard 30 pin mounting 9 pcs of 1M DRAM GM71C1000BJ (SOJ)
- Single +5V (±10%)
- High speed
 - RAS access time: 60/70/80/100 ns (Max.)
 - CAS access time: 20/20/25/25 ns (Max.)
 - Fast Page cycle time: 45/50/55/65 ns (Max.)
- Low power dissipation
 - Operating current: 1.6W (Typ.)
 - Stand by current: 22mW (Typ.)
- Fast Page mode capability
- Refresh mode
 - RAS only refresh
 - CAS before RAS-refresh
 - Hidden refresh
- All input and output TTL compatible
- 512 refresh cycles/8 ms



GM79256S 256K×9 MEMORY MODULE

Pin Configuration

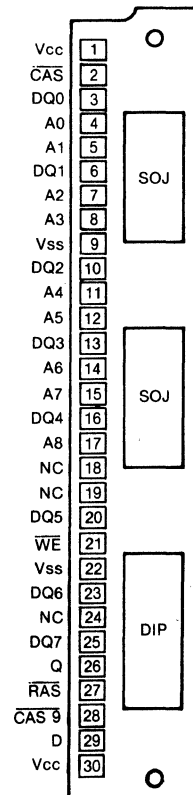
Description

The GMM79256S is a 256K×9 Dynamic RAM MODULE, mounted 2 pieces of 1M bit DRAM (GM71C4256ASJ, 256K×4) sealed in 20 pin SOJ package and 256K bit DRAM (GM71C256, 256K×1) in 16 pin DIP package. The outline of the GMM79256S is 30 pin single in line package with leads suitable for mounting in a socket. Therefore, the GMM79256S makes high density mounting possible without surface mount technology.

The GMM79256 provides common data inputs and outputs, and also provides separate I/O on parity bit for parity check. Its module board has decoupling capacitors mounted under each DRAM.

Features

- High density standard 30 pin mounting 2 pcs of 1M DRAM GM71C4256ASJ (SOJ) and 256K DRAM GM71C256 (DIP)
- Single +5V (±10%)
- High speed: 80/100 ns
- Low power dissipation
 - Operating current: 1.1W (Max.)
 - Stand by current: 38.5mW (Max.)
- Fast page mode capability
- Refresh mode
 - RAS only refresh
 - CAS before RAS refresh
 - Hidden refresh
- All inputs and output TTL compatible
- 512 refresh cycles/8 ms





MPR PRODUCTS

PART NO	PKG	FUNCTION	FEATURES
GM82C50A	40DIP/44PLCC	Asynchronous Communication Element	Easily Interfaces to Most Popular Microprocessors, Independant Receiver Clock Input, False Start Bit Detection
GM16C450	40DIP/44PLCC	Asynchronous Communication Element	Easily Interfaces to Most Popular Microprocessors, Independant Receiver Clock Input, False Start Bit Detection
GM16C451	68PLCC	UART with Parallel port	Parallel/UART, Easily Interfaces to Most Popular Microprocessors, Independant Receiver Clock Input, False Start Bit Detection
GM16C452	68PLCC	DUAL UART with Parallel port	Two Serial port and One Parallel port, Easily Interfaces to Most Popular Microprocessors, Independant Receiver Clock Input
GM82C550	40DIP/44PLCC	UART with FIFO	UART with FIFO, Easily Interfaces to Most Popular Microprocessors, 16 byte FIFO reduces CPU Interrupts
GM6845S	40DIP	CRT Controller	3.7 MHz High Speed Display Operation, TTL Compatible, On Screen, Line Bufferless Refreshing, Single 5 V Power Supply
GM82C765B	40DIP/44PLCC	Floppy Disk Subsystem Controller	IBM PC XT/AT, PS/2 Floppy control and Operations on chip. Drive up to 4 Floppy disk drives. 125, 250, 300, 500 kbits/sec data rates.
GM82C801	100QFP	MEGA I/O	Integrated FDC, Dual UARTs, Parallel port for Centronics type Printer, IDE Interface on chip.
GM8042	40DIP	Key Board Controller	Universal peripheral Interface 8-bit Microcomputer. 2048x8 ROM/ EPROM, 128x8 RAM, 8-bit Timer/Counter, 18 Programmable I/O pins
GM82C600	100QFP	VGA Controller	Support 1024x768x16Color Interlaced Graphic Mode, up to 45MHz Maximum Video Clock Rate
GM82C601	160QFP	VGA Controller	Support 1024x768x16Color 2Byte Mode 24x24 Font & 256Kx 4DRAM.
GM82C210	160PQFP	Single-Chip PC/AT Controller	Very high intergration Chipset for 80286 or 80386SX PC AT compatible system. Supporting clock speeds from 12 to 20MHz

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TELECOM PRODUCTS

PART NO	PKG	FUNCTION	FEATURES
GL6840A	8 DIP	Electronic Two Tone Ringer	Low Current Consumption, Built-in Bridge Zener Diodes, Tone and Switching Frequency Adjustable by External Components
GL6901	16 DIP	Speech Network	Low voltage Operation, High Output Swing On Long Lines, Very Short Start-up Time
GL6965	20 DIP	Low Voltage Speech Network	Low Operating Voltage Provides ane Excellent Branch Performance, Gain is Automatically Controlled according to the Line current
GL6981	16 DIP	Low Voltage Speech Network	Low Voltage Operation Down to 1.3V, Balanced REC Output, AC Voltage Swing Down to 0.4V
GL6801	16 DIP	DTMF Generator	Wide Operating Line Voltage and Current Range, Short Start-up Time, Internal Protection of All Inputs
GM6390	22 DIP	T/P Switchable Dialer with Redial	One 31-Digits for Last Number Redial Memory, Auto Pause Access for PBX Operation;3.1sec per pause
GM6388	22 DIP	15 Memory T/P Switchable Dialer	Store Ten-16 Digits Number for Repertory Dialing, Four Number for One Touch Dialing, One-31 Digits for Last Number Redial Memory
GM6155	20 DIP	Time Slot Assignment Circuit	Controls 4 CODEC/Filters, 4.096MHz Max. Clock Rate, 8 Channel Unidirectional Mode
GM62093	40 DIP	12x8 Crosspoint Switch	12x8 Cross Point Switch with Control Memory, Latch Control, Low ON Resistance
GL6585	20 SOP	IF AMP for Cordless Phone	Low Voltage Operating (2.4 ~ 7V) Compressor MIC. AMP & Bufferamp for Filter & IDC & Data I/O Port on Chip
GL6551	20 SOP	Compander	OSC Mixer & Inverter OP AMP & Squech Trigger Circuit on Chip Detect Rssi & IF AMP FM Signal
GM6569	16 SOP	Dual Phase Locked Loop (DPLL)	20 CH ROM for 46/49MHz Cordless Phone. On Chip OSC Circuit Supports External X-TAL. Lock Detect Signal, Stand by mode for Power Savings



BIPOLAR & CMOS LOGIC FAMILIES

CODE NO.	DESCRIPTION	LS TTL	S TTL	HC/T	Package
00	QUAD 2-INPUT NAND GATE	GD74LS00	GD74S00	GD74HC/T00	14 B, J, D
01	QUAD 2-INPUT NAND GATE with OC (D)	#	#	GD74HC/T01	14 B, J, D
02	QUAD 2-INPUT NOR GATE	GD74LS02	#	GD74HC02	14 B, J, D
04	HEX INVERTER	GD74LS04	GD74S04	GD74HC/T(U)	14 B, J, D
05	HEX INVERTER with OC (D)	GD74LS05	#	#	14 B, J, D
06	HEX INVERTER BUFFER/DRIVER with OC (D)	GD74LS06	#	#	14 B, J, D
07	HEX BUFFER/DRIVER WITH OC (D)	GD74LS07	#	#	14 B, J, D
08	QUAD 2-INPUT AND GATE	GD74LS08	#	GD74HC/T08	14 B, J, D
10	TRIPLE 3-INPUT NAND GATE	GD74LS10	#	#	14 B, J, D
11	TRIPLE 3-INPUT AND GATE	GD74LS11	#	#	14 B, J, D
20	DUAL 4-INPUT NAND GATE	GD74LS20	#	#	14 B, J, D
21	DUAL 4-INPUT AND GATE	GD74LS21	#	#	14 B, J, D
27	TRIPLE 3-INPUT NOR GATE	GD74LS27	#	#	14 B, J, D
30	8-INPUT NAND GATE	GD74LS30	#	#	14 B, J, D
32	QUAD 2-INPUT OR GATE	GD74LS32	GD74S32	GD74HC/T32	14 B, J, D
51	AND-OR INVERT GATE	GD74LS51	GD74S51	#	14 B, J, D
58	AND-OR GATE	#	#	GD74HC58	14 B, J, D
74	DUAL D-POSITIVE EDGE-TRIGGERED F/F	GD74LS74A	GD74S74	GD74HC/T74	14 B, J, D
86	QUAD 2-INPUT EXCLUSIVE OR GATE	GD74LS86	#	#	14 B, J, D
93	4-BIT BINARY RIPPLE COUNTER	GD74LS93	#	#	14 B, J, D
112	DUAL J.K F/F with PRESET & CLEAR	#	GD74S112	#	16 B, J, D
123	DUAL RETRIGGERABLE MONOSTABLE M/V	GD74LS123	#	#	16 B, J, D
125	QUAD 3-STATE NONINVERTING BUFFER (LOW)	GD74LS125A	#	GD74HCT125	14 B, J, D
138	3 to 8 LINE DECODER/DEMULTIPLEXER	GD74LS138	GD74S138	GD74HC/T138	16 B, J, D
139	DUAL 2 to 4 DECODER/DEMULTIPLEXER	GD74LS139	#	GD74HC/T139	16 B, J, D
151	8 to 1 LINE DATA SELECTOR/MULTIPLEXER	GD74LS151	#	#	16 B, J, D
153	4 to 16 LINE SELECTOR	GD74LS153	#	GD74HC153	16 B, J, D
154	4 to 16 LINE DECODER/DEMULTIPLEXER	GD74LS154	#	#	24 B, J, D
157	QUAD 2-INPUT SELECTOR/MULTIPLEXER (N.I)	GD74LS157	#	GD74HC/T157	16 B, J, D
158	QUAD-2-INPUT SELECTOR/MULTIPLEXER (I)	GD74LS158	#	#	16 B, J, D
161	SYNCHRONOUS BINARY COUNTER (ASY-CLEAR)	GD74LS161A	#	GD74HC161	16 B, J, D
163	SYNCHRONOUS BINARY COUNTER (SY-CLEAR)	GD74LS163A	#	#	16 B, J, D
164	8 BIT SIPO SHIFT COUNTER	#	#	GD74HC164	14 B, J, D
165	8 BIT PISO SHIFT COUNTER	GD74LS165	#	#	16 B, J, D
166	8 BIT SISO or PISO SHIFT COUNTER	GD74LS166	#	#	16 B, J, D
174	D-F/F with COMMON CLEAR & CLOCK	GD74LS174	GD74S174	GD74HC/T174	16 B, J, D
175	QUAD D-F/F with CLEAR	GD74LS175	#	#	16 B, J, D
194	4-BIT Bidirectional SHIFT REGISTER	GD74LS194A	#	#	16 B, J, D
240	OCTAL 3-STATE BUFFER (INVERTING)	GD74LS240	#	GD74HC240	20 B, J, D
241	OCTAL 3-STATE BUFFER (NONINVERTING)	GD74LS241	#	#	20 B, J, D
244	OCTAL 3-STATE BUFFER (NONINVERTING)	GD74LS244	#	GD74HC/T244	20 B, J, D
245	OCTAL BUS TRANSCEIVER (NONINVERTING)	GD74LS245	#	GD74HC/T245	20 B, J, D
257	QUAD 2 to 1 MULTIPLEXER, 3-STATE	GD74LS257A	#	#	16 B, J, D
273	OCTAL D-F/F	GD74LS273	#	GD74HC/T273	20 B, J, D
280	9-BIT ODD/EVEN PARITY CHECKER/GENERAT	GD74LS280	#	#	14 B, J, D
365	HEX BUS DRIVER, 3-STATE (6-BIT)	#	#	GD74HC365	16 B, J, D
366	HEX BUS DRIVER, 3-STATE (6-BIT, INVERT)	#	#	GD74HC366	16 B, J, D
367	HEX BUS DRIVER, 3-STATE (4, 2 BIT)	GD74LS367A	#	GD74HC/T367	16 B, J, D
368	HEX BUS DRIVER, 3-STATE (4, 2 BIT, INVERT)	#	#	GD74HC368	16 B, J, D
373	OCTAL LATCH, 3-STATE	GD74LS373	#	GD74HC/T373	20 B, J, D
374	OCTAL D-F/F, 3-STATE	GD74LS374	GD74S374	GD74HC/T374	20 B, J, D
393	DUAL BINARY COUNTER	GD74LS393	#	GD74HC393	14 B, J, D
590	8-BIT BINARY COUNTER (3S, TRANSCEIVER)	GD74LS590	#	#	16 B, J, D
646	OCTAL BUS TRANSCEIVER/REGISTER	#	#	GD74HCT646	24 B, J, D
670	4-WORD x 4-BIT REGISTER FILE, 3 STATE	GD74LS670	#	#	16 B, J, D

GoldStar



CMOS GATE ARRAY

• **GCL5000 Series: 3.0µm Technology**

Device Number	Gate Count	% Max AUR ⁴	Max ³ I/O	VDD Pads	VSS Pads	VSS2 Pads	Max Pads	Gate Speed (ns) ¹	
								Typ	Max ²
GCL5080	880	90	66	2	4	2	74	2.0	3.5
GCL5140	1404	90	84	2	4	2	92	2.0	3.5
GCL5220	2224	90	106	2	4	2	114	2.0	3.5
GCL5320	3192	85	130	2	4	2	138	2.0	3.5
GCL5420	4202	85	144	4	4	4	156	2.0	3.5
GCL5600	5902	80	168	4	4	4	180	2.0	3.5

• **GSG6000 Series: 2.0µm Technology**

Device Number	Gate Count	% Max AUR ⁴	Max ³ I/O	VDD Pads	VSS Pads	VSS2 Pads	Max Pads	Gate Speed (ns) ¹	
								Typ	Max ²
GSG6009	472	95	43	0	0	0	46	0.9	1.3
GSG6017	902	95	56	0	0	0	62	0.9	1.3
GSG6028	1470	90	72	0	0	0	78	0.9	1.3
GSG6047	2448	90	94	0	0	0	100	0.9	1.3
GSG6068	3520	90	110	0	0	0	118	0.9	1.3
GSG6087	4440	85	124	0	0	0	134	0.9	1.3
GSG6119	6076	85	148	0	0	0	158	0.9	1.3
GSG6166	8448	85	172	0	0	0	184	0.9	1.3
GSG6209	10619	80	192	0	0	0	206	0.9	1.3
GSG6267	13524	80	218	0	0	0	232	0.9	1.3

• **GSG8000 Series: 1.2µm Technology**

Device Number	Gate Count	% Max AUR ⁴	Max ³ I/O	VDD Pads	VSS Pads	VSS2 Pads	Max Pads	Gate Speed (ns) ¹	
								Typ	Max ²
GSG8050	2730	95	56	0	0	0	60	0.5	0.8
GSG8070	3950	95	68	0	0	0	72	0.5	0.8
GSG8090	4984	90	74	0	0	0	80	0.5	0.8
GSG8120	6528	90	86	0	0	0	92	0.5	0.8
GSG8170	8880	90	102	0	0	0	108	0.5	0.8
GSG8220	11592	85	116	0	0	0	124	0.5	0.8
GSG8290	14976	85	130	0	0	0	140	0.5	0.8
GSG8360	18550	85	146	0	0	0	156	0.5	0.8
GSG8460	23640	80	166	0	0	0	176	0.5	0.8
GSG8480	34416	80	200	0	0	0	212	0.5	0.8

- Notes: 1. 2-input NAND gate, fanout=2 and statistically necessary interconnection
 2. Ta=0 to 70°C, VDD=5V±5%
 3. It may be necessary to configure additional I/O pads for VDD and VSS depending on the number and drive of the output buffers.
 4. Maximum array usage recommended.
 5. In Case of GSG6000, GSG8000 Series, normal pads can be used as VDD and VSS pads.

CMOS STANDARD CELL

FEATURES

- Up to 40,000 Equivalent Gates
- Allows up 180 MHz Toggle Rates
- RAM and ROM Functions Available
- Ratioed "N" and "P" Devices Minimize Pulse Skew
- Full Simulation Capabilities
- Cell Compaction Software Reduces die Size and Increases Yield
- Wide Range of Packaging Options

PRODUCT DESCRIPTION

GSC 1000 SERIES	GSC 2000 SERIES	GSC 4000 SERIES
Silicon gate 2.5 micron (drawn) p-well CMOS technology. Dual layer metal interconnection. Propagation delay of 1.0 ns through a 2-input NAND gate TA=25°C, fanout=1 VDD=5V Digital, RAM and ROM function on a single chip. Up to 12,000 equivalent gates. Allows 100 MHz toggle rate. Output drive up to 10 mA. Ratioed "N" and "P" devices minimize pulse skew. 100% auto place and route. Proprietary software reduces die size and increases yield. All inputs and outputs protected from over voltage and latch-up	Silicon gate 2 micron (drawn) p-well CMOS technology. Dual layer metal interconnection Propagation delay of 0.8 ns through a 2-input NAND gate, TA=25°C, fanout=1 VDD=5V Digital, RAM and ROM functions on a single chip. Up to 23,000 equivalent gates. Allows 130 MHz toggle rate. Output drive up to 12 mA. Ratioed "N" and "P" devices minimize pulse skew. 100% auto place and route. Proprietary software reduces die size and increases yield. All inputs and outputs protected from over voltage and latch-up.	Silicon gate 1.2 micron (drawn) n-well CMOS technology. Dual layer metal interconnection Propagation delay of 0.6 ns through a 2-input NAND gate, TA=25°C, fanout=-1 VDD=5V. Digital, RAM and ROM functions on a single chip. Up to 40,000 equivalent gates. Allows 180 MHz toggle rate. Output drive up to 16 mA. Ratioed "N" and "P" devices minimize pulse skew. 100% auto place and route. Proprietary software reduces die size and increases yield. All inputs and outputs protected from over voltages and latch-up.



CMOS 4000B SERIES

FUNCTION	PRODUCT NUMBER	FUNCTION	PRODUCT NUMBER
GATES	GD4001B, GD4011B, GD4012B, GD4025B	COUNTERS	GD4024B, GD4017B, GD4020B, GD4022B
COMPLEX GATES	GD4069UB, GD4071B, GD4081 GD4007UB, GD4030B, GD4070B		GD4040B, GD4520B, GD4526B GD40160B, GD40192B
BUFFERS	GD4093B, GD40014B	DECODERS/DEMUX	GD4028B, GD4511B, GD4555B
FLIP-FLOPS/ LATCHES	GD4049B, GD4050B GD4013B, GD4027B, GD4042B	ANALOG SWITCH- ES/MUX/DEMUX	GD4016B, GD4066B, GD4051B, GD4052B
REGISTERS	GD4511B GD4015B, GD4021B	MEMORY	GD4053B
		MULTIVIBRATOR	GD4703B GD4528

NOTE 1: Alphabets in code No. column is serial number of Standard Logic Products.

NOTE 2: Each alphabets in package column indicates plastic DIP (B-blank), Ceramic DIP (J), Small outline package (D).

NOTE 3: For code marked "#" indicates "Not Availabel".

NOTE 4: The followings an abbreviation means...

- O.C (D) : OPEN COLLECTOR (DRAIN)
- I : INVETING
- ASY : ASYNCHRONOUS
- F/F : FLIP/FLOP
- N.I : NONINVERTING
- SY : SYNCHRONOUS
- M/V : MULTIVIBRATOR

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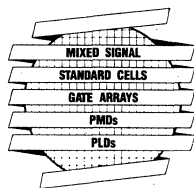
Gould AMI was the first company to recognize the need for custom integrated circuits in the mid-1960's, and to pioneer the development of application-specific integrated circuits (ASICs). With more than twenty years' dedication to providing ASIC system solutions, Gould AMI has more experience than any other vendor of ASICs.

The company now offers a continuum of ASIC products, ranging from CMOS programmable logic devices to complex cell-based custom ICs. This spectrum of offerings provides customers with a full range of ASIC choices, so that the optimum solution for an application can be selected.

Gould AMI's ASIC technology allows system designers to tailor their systems and reduce the number of parts in their products by combining multiple memory and processing functions on a single device, instead of mixing and matching several standard parts. The result: smaller board sizes, lower final product cost and higher reliability. ASIC users also benefit by greater product differentiation due to custom tailoring and higher security ensured by an ASIC's resistance to duplication.

Gould AMI

Originators of the ASIC Continuum



CMOS EPLDs

User-programmable digital devices ideal for small and medium-scale integration

Electrically erasable programmable logic devices are ideal for small and medium-scale integration system design in low-volume production. Our lowest development cost ASICs, these devices deliver plenty of performance and offer a surprising measure of versatility and customer-control.

Built using our unique PEEL™ (Programmable Electrically Erasable Logic) technology, these PLDs are user-programmable, so there's no pre-production customer design and development risk. You may use PC-based or industry-standard PLD programmers to configure the macrocells and, if necessary, to repeatedly erase and reconfigure them.

For complete data sheets, contact Gould AMI at (208) 233-4690.

The table below can help you select the right PLD for you. See the PLD section later in this catalog for detailed data sheets.

For a low-cost, low-risk avenue for conversions of EEPDs to gate arrays, see PALTRANS Flow in ASIC Software Services section.

Gould AMI's CMOS PLD Family

Part No.	Architecture	Complexity	Speed	Replaces
18CV8	20 pin E ² PLD	74 product terms x 36 input array	10/15/25ns Tpd	Bipolar PLDs
20CG10	24 pin E ² PLD	92 product terms x 44 input arrays	15/25ns Tpd	20V8, 20G10
22CV10Z	24 pin E ² PLD	132 product terms x 44 inputs	15/25ns Tpd	Bipolar PLDs Zero power mode
22CV10	24 pin E ² PLD	132 product terms x 44 inputs	15/25ns Tpd	Bipolar PLDs
PEEL153	20 pin E ² PLD	42 product terms x 36 inputs 10 sum terms x 32 product terms	30ns Tpd	Bipolar PLS153
PEEL173	24 pin E ² PLD	42 product terms x 44 inputs 10 sum terms x 32 product terms	15/30ns Tpd	Bipolar PLS173
PEEL253	20 pin E ² PLD	42 product terms x 36 inputs 20 sum terms x 42 product terms	30ns Tpd	Bipolar PLS153 PEEL153
PEEL273	24 pin E ² PLD	42 product terms x 44 inputs 20 sum terms x 42 product terms	15/30ns Tpd	Bipolar PLS173 PEEL173
PA7024	24 pin E ² PMD	Over 80 sum of product terms	13/20ns Tpd	MULTI-PLDs
PA7040	40 pin E ² PMD	Over 120 sum of product terms	13/20ns Tpd	MULTI-PLDs

Gate Arrays

Semi-finished digital chips provide high performance for medium volume production with quick development

- 1-micron triple or double metal and 1.25-micron double metal CMOS processes.
- Basic Logic, interface, MSI, and 7400 functions.
- Compatible with Gould AMI's megacell library.
- Custom RAMs available in both 1-micron and 1.25-micron processes.
- Artificial Intelligence Software Services available for netlist translation, gate reduction, clock-tree insertion, netlist analysis, and NETSCAN technology.

Gate arrays provide solutions for a variety of high performance digital applications--at a low development cost and quick design time. If you need fast turn production runs, gate arrays may be the right ASIC for you.

Gate arrays are semi-finished digital circuits that contain patterns of uncommitted transistors pre-fabricated on silicon base wafers. Using any major CAE workstation at your own facility, you can use Gould AMI libraries to customize your design as a network of logic functions. NETTRANS is also available for conversion of any ASIC supplier's netlist to Gould AMI's bolt netlist format. With only the metal layers to fabricate, gate array development time is fast—typically four weeks.

Gould AMI's arrays are fabricated in a double (or triple) metal, single poly, twin-tub CMOS process. They offer the CMOS advantages of low power dissipation, broad power supply voltage range (2.5 to 5.5 Volts), and high noise immunity.

Over 600 macros in the process families include:

Basic functions: Sequential and combinational logic.

Interface functions: TTL and CMOS level inputs, TTL and CMOS Schmitt trigger inputs, pull-ups and pull-downs, TTL and CMOS output drivers, and output drivers with a controlled slew rate for lower noise operation.

MSI functions: Counters, multiplexers, decoders, adders.

7400 functions: Over 160 TTL compatible functions.

Digital megacells: Megacells and compilers include 82xx, 29xx, core processors, RAM, FIFOs, DSP megacells, and many more.

1-micron Gate Arrays

Array	Useable Gates		Programmable Pads		Power Pins
	Triple-metal	Double-metal	TAB	Wire-bond	
GD200K	150,000	100,000	492	360	12
GD100K	75,000	50,000	348	252	12
GD 70K	49,000	35,000	288	208	12
GD 50K	35,000	25,000	256	184	12
GD 35K	24,500	17,500	208	152	12
GD 25K	17,500	12,500	180	128	12
GD 20K	14,000	10,000	156	112	12
GD 16K	11,200	8,000	140	100	12
GD 12K	8,400	6,000	120	84	12
GD 9K	6,300	4,500	100	72	12
GD 7K	4,900	3,500	92	64	12
GD 5K	3,500	2,500	76	52	12
GD 3K	2,100	1,500	56	40	12

1.25-micron Gate Arrays

Array	Useable Gates	Programmable		Power Pins	
		TAB	Fine Pitch		Standard Pitch
GC100K	51,320	436	330	260	12
GC 50K	26,266	312	232	184	12
GC 40K	17,496	260	194	154	12
GC 30K	16,280	246	182	142	12
GC 25K	13,122	220	166	134	12
GC 20K	10,714	196	144	116	12
GC 15K	7,560	168	128	100	12
GC 10K	5,264	136	104	84	12
GC 7K	3,526	116	86	68	12
GC 5K	2,692	98	72	56	12
GC 3K	1,286	72	52	40	12

For complete data sheets, contact Gould AMI at (208) 233-4690.

Standard Cell Circuits

Analog and digital building blocks offer higher density and smaller size for medium to high volume needs

- 1.0 and 1.25-micron Double Metal CMOS Families.
- 3-micron and 2-micron Double Poly, Double Metal CMOS Families
- Cells Created by Expert-based Cell Generator
- Basic Logic, Interface, MSI, 7400 and Megacell Functions
- 2-micron Process includes Analog Functions
- Tailor-made RAMs, ROMs and PLAs Available
- Artificial Intelligence Software Services Available for Digital Netlist Translation and Gate Reduction

Chips designed with these cells, offered in analog and digital formats, surpass gate array density and approach that of cell-based custom designs at half the development cost and development time. They're cost effective for medium to high-volume production.

Standard cells are pre-designed circuit building blocks whose functional, timing and performance parameters exist in Gould AMI's libraries. As with a gate array, you design a standard cell circuit by choosing logic functions from a library installed on a CAE workstation. But while a gate array design specifies only the final metal layers of a pre-fabricated silicon base, all of a standard cell's base and metal layers are custom fabricated from pre-characterized cells. This feature gives standard cells greater design flexibility, but requires an eight week development time.

A standard cell circuit also uses only the number of cells required for a design, whereas gate arrays seldom utilize all of the available cells. This means a smaller die size and lower cost to you for a given circuit function.

Gould AMI offers over 850 cells in its four standard cell families:

- 1.0-micron digital CMOS (CYX Family).
- 1.25-micron digital CMOS (CAB Family).
- 3-micron analog and digital CMOS (CCI Family).
- 2-micron analog and digital CMOS (ABX Family).

Digital Standard Cells

Both the CAB and CYX families use a double metal, single poly, twin tub CMOS process. They are intended primarily for 5 Volt operation but will operate down to 2.5 Volts.

Cells in these libraries include:

- Basic functions: simple gates, clock drivers, flip/flops, latches
- Interface functions: TTL, CMOS, Schmitt trigger, slew rate buffers, TTL with hysteresis
- MSI functions: counters, multiplexers, decoders, adders
- 7400 functions: over 160 TTL compatible functions
- Digital megacells: barrel shifter, funnel shifter, RAM, ROM and PLA

Digital Megacell List

MG53C80	SCSI Interface Controller
MG80C85	8-Bit CMOS Microprocessor
MG82C12	8-Bit Input/Output Port
MG82C37A	Programmable DMA Controller
MC82C50A	Asynchronous Comm. Element
MG82C52	Serial Controller Interface
MG82C54	Programmable Interval Timer
MG82C55A	Programmable Peripheral Interface
MG82C59A	Programmable Interrupt Controller
MG82C84A	Clock Generator and Driver
MG82C88	Microprocessor Bus Controller
MG85C30	Serial Communications Controller
MGM1616A	16x16 Fast Multiplier
MGA1616A	16x16 Fast Adder/Subtractor

Gould AMI

Analog/Digital Standard Cells

The CCI family uses a 3-micron double metal, double poly, p-well CMOS process. It is intended primarily for analog and/or digital applications running at 10 Volts analog with 5 Volts digital operation.

Gould AMI's new ABX process is a 2-micron double poly, double metal process. This is Gould AMI's most flexible process, built on N or P-type starting material, with a range of 13 to 17 process layers. Ideal for mixed signal analog and digital applications, it can operate from 5 to 12 volts. Functions include electrically erasable ROMs, implant programmable ROMs and NPN and PNP bipolar transistors on board.

Cells in the CCI and ABX libraries include:

- Basic functions: simple gates, clock drivers, flip/flops, latches
- Interface functions: TTL, CMOS, Schmitt trigger

- MSI functions: counters, multiplexers, decoders, adders
- 7400 functions: over 160 TTL compatible functions
- Analog functions: Op amps, A/D, D/A, comparators, switches, voltage references, input buffer and output buffer

Cell-based Custom

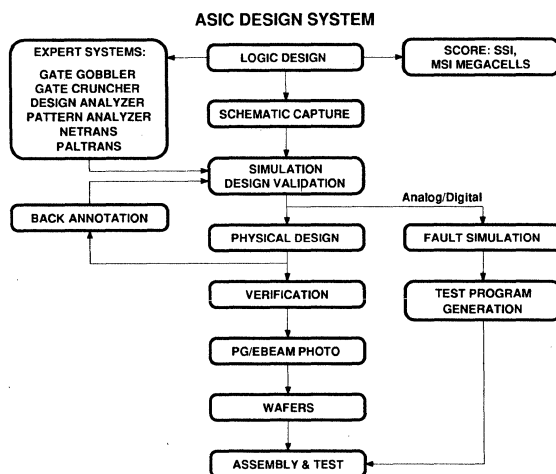
Most tailored ASIC solution--best for high performance, mixed signal or high volume needs

Cell-based custom chips use a combination of Gould's megacells, custom cells and standard cells to provide you with the ultimate in design tailoring and performance. This approach is ideal when you have a requirement for high speed, special interfaces, mixed analog/digital, or very high volume production runs.

Though their development costs and time are longer than with standard cells, cell-based custom circuits pack the most functions into the smallest area. Fewer custom chips need be used in a given design, thus saving board space. Custom devices also provide greater security because they are nearly impossible to copy.

Over twenty years' experience in custom design have given Gould AMI's design team the kind of engineering expertise that complex solutions demand. Particular areas of expertise are analog, mixed signal, high voltage and E2 applications. The following illustrate some examples of Gould AMI's answers to our customers' technical challenges.

Typical ASIC Development Flow



For complete data sheets, contact Gould AMI at (208) 233-4690.

ASIC Software Services

Optional design services give you the power of choice and ease your designs

Unlike many ASIC vendors that accept only completed designs or finished netlists, Gould AMI is able to pick up an ASIC design at any stage, whether customers submit a partially finished design, a foundry-ready database tape, or a simple set of specifications. In order to ease logic design for its customers, Gould AMI has installed its analog and digital cell libraries on popular engineering workstations including Mentor Graphics, Daisy Systems, Intergraph, VALID Logic Systems, FutureNet and Viewlogic.

Gould AMI uses several advanced expert systems in-house, each of which taps the combined experience of Gould AMI's engineers to accelerate device layout and design optimization.

ASIC Netlist Translation Services:

If a client has already designed a digital chip using another vendor's or their own proprietary tools, Gould AMI's NETTRANS™ expert system will "translate" the netlist into Gould AMI-compatible form in just a few hours. This automated design transfer works independently of workstation libraries or processes, and can save customers thousands of dollars and weeks of precious time. For turning programmable logic device into gate arrays or standard cells, PALTRANS™ is the answer.

PALTRANS converts standard programmable array logic (PAL), programmable electrically erasable logic (PEEL) and field programmable gate arrays (FPGAs) into netlists used to design gate array or standard cell ASICs. You can use an off-the-shelf PLD as a prototype for programming, debugging, and beta-testing logic designs, instead of first requiring the production of an ASIC. Engineers then use PALTRANS to convert the data into a netlist. In about eight hours, mask production can begin and an ASIC design is produced in two to three weeks.

Tools Speed Layout and Optimization

The SCORE™ cell compiler generates and tailors cells to a client's specific requirements in one-tenth the time required for hand-built cells.

Gate Gobbler, Gate Cruncher, Design Analyzer and Pattern Analyzer are artificial intelligence (AI) tools that as-

sist with the conversion of conventional standard devices to CMOS ASICs.

Gould AMI offers an Automatic Test Generation tool, NETSCAN, that generates test vectors in a matter of hours, relieving designers of the task and saving at least six weeks for manual test generation. This tool automatically partitions a circuit into a set of combinatorial functions and inserts a scan path. Each function, seen as a distinct circuit, can be quickly and easily tested with an automatic test program generator employing the D-Algorithm.

Transitioning from standard TTL parts to ASICs can be fraught with difficulty, and when ASIC prototypes don't work, design re-work through traditional analysis and optimization techniques can take weeks or months. Gould AMI's AI tools minimize the delays caused by having to re-work a design through traditional analysis and optimization techniques. The tools incorporate a continually expanding knowledge base, applying Gould AMI's hundreds of engineering man-years to every job.

Gould AMI: Your Mixed-Signal Solution

Gould AMI pioneered the development of the application specific integrated circuit in the late 1960's, and was one of the first companies to implement analog functions in ASICs. When you work with the engineers at Gould AMI, you tap into true in-depth expertise in analog and mixed-signal design. The engineers at Gould AMI have implemented hundreds of analog and mixed-signal ASICs over the past *twenty* years.

Cell-Based Custom Design— Flexibility, Efficiency and Security

Cell-based custom chips integrate the greatest possible number of functions into a given area, contribute to product differentiation, and enhance security, since they are difficult to copy. Cell-based custom circuits are ideal for high-speed requirements, special interfaces, very high volume production, and mixed-signal applications.

Gould AMI's cell-based custom design methodology allows system designers ultimate flexibility in realizing mixed-signal ASICs. Gould AMI's Mixed-Signal Design Solution (MSDS) enables customers to design and simulate mixed-signal ASICs at their own facilities. MSDS can also be used in combination with Gould AMI designed megacells, custom cells and existing standard cells.

For complete data sheets, contact Gould AMI at (208) 233-4690.

ABx Process

Gould AMI's CMOS, 1.5 micron digital, 3.5 micron analog, ABx Process is the industry's most flexible mixed-signal manufacturing process, allowing the system designer to produce complete systems on a chip. The process allows integration of 12v analog with 5v digital, and will accommodate a wide combination of functions, including 40v digital output drivers, electrically erasable

programmable memory cells, Gould AMI's full standard cell library, mask programmable ROM and uncommitted collector bipolar capability. In addition, the analog voltage can run from -6v to +6v or from 0 to 12v. The 1.5 micron digital geometries allow high speed performance and reduced chip area.

Technology: 1.5 μ Digital/3.5 μ Analog Double Metal/Double Poly, P-well or N-well

Power Supply: 2.5v to 12v

- Digital 2.5v to 12v
- Analog 5v to 12v
- Single Ended or split
- On split supply, digital can be -V to +V, 0 to +V or -V to 0V

Temperature Range: -55°C to 125°C

Standard Cells:

- 183 cell digital library
- 5v and 12v libraries available
- Analog—Parameterized Analog Building Block
- Generator software
- Compiled RAM, ROM and PLA. Optimized to customer requirements

Resistors:	Type	ohms/sq.	Matching	Tempco (abs)
	p+	65-95	$\pm 0.4\%*$	.2%/°C
	n+	30-60	$\pm 0.4\%*$	.2%/°C
	poly	20-40	$\pm 0.4\%$	.1%/°C
	p-well	2k-4k	$\pm 0.12%**$	.8%/°C
	n-well	1.5k-4k	$\pm 0.12%**$	.8%/°C

* plus .02%/volt ** plus 1%/volt

Capacitors:

Type: poly to poly

Value: .69 fF/ μ^2 $\pm 6\%$

Matching: $\pm 0.08\%$ (+.001%/volt)

Tempco (abs): 0.003%/°C

Digital Logic:

Prop Delay: Typical NAND Gate - 0.8ns (.5pf, 5 volt operation, fan out = 2)

Clock Speed: Approx. 50MHz operation

EEPROM: Five arrays available:

- 2 words by 16 bits
- 4 words by 16 bits
- 8 words by 16 bits
- 16 words by 16 bits
- 32 words by 16 bits
- Single bit cells

Other sizes of arrays available on custom basis

Other Processes

Other processes are available for mixed-signal design using 3 μ and 5 μ feature sizes. Using a full custom approach, the 5 micron process offers the advantage of 16 volt operation.

For complete data sheets, contact Gould AMI at (208) 233-4690.

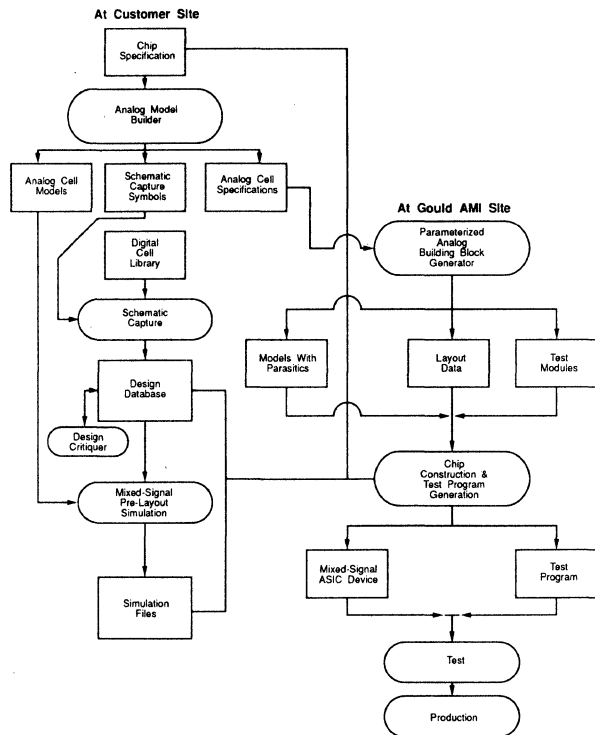
Mixed-Signal Design Solution

Gould AMI's MIXED-SIGNAL DESIGN SOLUTION (MSDS)



consists of a suite of software tools for use both on customers' design work stations and at Gould AMI. MSDS is the first mixed-signal design system to deliver a total design-to-manufacturing solution for the swift creation of cost-effective, analog/digital ASICs with first-time silicon success. The system incorporates three capabilities critical to the cost-effective development of mixed-signal ASICs: 1) Automatic generation of custom analog cells and behavioral level analog simulation models; 2) Simulation software that enables customers to perform behavioral-level, concurrent analog/digital simulations of their designs early in the ASIC design cycle; and 3) Mixed-signal test generation. Used in tandem with Gould AMI's mixed-signal fabrication processes, MSDS offers a comprehensive design-to-manufacturing solution to the challenge of complex mixed-signal ASIC design.

Mixed-Signal Design Solution II System Flow



Silicon Foundry Approach

Gould AMI is proud of the leadership position it occupies in today's fast-paced world of process and technology. Our Silicon Foundry services and capabilities are truly world class. We provide consulting services to our customers in the design, fabrication, packaging and testing of state-of-the-art digital, analog, and mixed-signal integrated circuits. All AMI manufacturing is performed under one of the most highly advanced real-time SPC environments in the semiconductor industry today.

Gould AMI's approach to Silicon Foundry services is your road to success. Whether you are a highly sophisticated circuit designer with your own design resources and facilities, utilize outside third-party design resources, or are simply seeking a second source to manufacture your already existing circuit, Gould AMI can provide you with cost-effective and timely semiconductor solutions. Gould AMI is a complete VLSI integrated circuit manufacturing facility with the capability to help you develop, produce and deliver CMOS and NMOS circuits.

At Gould AMI you will receive the very best in service, product quality, and cost-effective manufacturing available in the industry today. It is as simple as providing Gould AMI with a data base tape of your circuit in standard GDSII format. Digital, analog, or mixed-signal designs can be made to match any of the wide variety of Gould AMI's CMOS processes presently in use or under development. Our company-wide drive for improvement encourages continuous advances in processing technology and development. With over two decades of experience in custom and semi-custom integrated circuit manufacturing, Gould AMI provides a highly flexible and responsive team capable of meeting the rapidly changing needs of our customers in a world class manufacturing environment.

Gould AMI

GOULD AMI CMOS PROCESS FAMILY

Process Family	Geometry	Maximum Voltage	Characteristics
CMOS	1.0	5.5 Volts	Digital
CMOS	1.25	5.5 Volts	Digital
CMOS	1.5	5.0 to 12.0 Volts	Mixed Signal
CMOS	2.0	5.5 Volts	Digital
CMOS	3.0	5.0 to 10.0 Volts	Analog and Digital
CMOS	1.2	5.5 Volts	Digital
CMOS	5.0	5.5 to 12.0 Volts	Digital
CMOS	7.0	5.5 Volts	Analog and Digital
NMOS	3.0	5.5 Volts	Digital
NMOS	4.0	5.5 Volts	Digital
NMOS	5.	5.5 Volts	Digital

For complete data sheets, contact Gould AMI at (208) 233-4690.

CMOS ROMs General Description

The Gould AMI family of ROMs are static mask programmable and organized by 8 bits. The device is fully TTL compatible on all inputs and outputs and uses a single +5V power supply. There are no requirements for clocks or refreshing, because they are static in operation. The three-state outputs facilitate memory expansion by allowing the outputs to be OR-tied to other devices. The control pin function and active level, as well as the memory contents, are user-defined.

Features

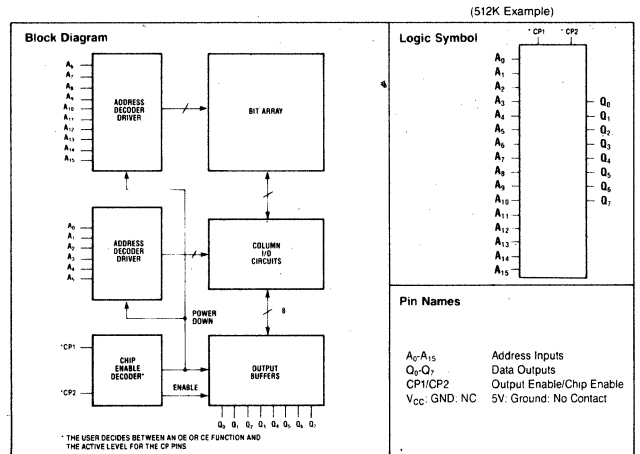
- 16K, 32K, 64K, 128K, 256K, 512K, 1M, 2M, 4M Selections
- Fast Access Time
- Mate With State-Of-The-Art 32 Bit Microprocessors
- Low Standby Power CMOS
- Fully Static Operation
- Single +5V $\pm 10\%$ Power Supply
- Directly TTL Compatible For Clean Interface
- Three-State TTL Compatible Outputs
- EPROM Pin Compatible
- Late Mask Programmable For Quick Turn Times
- Programmable Control Pins

Application of Gould ROMs

All of the ROMs offered by Gould are fully static, asynchronous, non-multiplexed devices. No matter what microprocessor you're using in your system, careful planning will give you the greatest flexibility in using our ever-expanding family of ROMs.

No Clocks Are Required

A clock is *not* required by our ROMs to latch addresses, precharge internal circuitry, or perform any other function. All control lines (CE, or OE) may remain in a valid read state for an indefinite period of time, during which the address inputs may be changed as desired to access various stored data.



Telecommunications Products

Station Products

- DTMF Tone Generators
- Pulse Dialers
- Digital Time/Space Crosspoint Switches

Modems, Filters and PCM Products

- 212A/V.22 MODEM Filter (with or without equalizers)
- BELL 103/V.21 Single Chip MODEM
- Single Frequency Tuneable Bandpass Filter
- Programmable Low Pass Filter
- Programmable High Pass Filter
- A-LAW Synchronous Combo CODEC w/Filters
- μ -LAW Synchronous Combo CODEC w/Filters
- Digital C Message Weighted/1 KHz Notch Filter
- Single Chip Conference Trunk
- Digital Signal Processor
- CMOS Digital Signal Processor

Display Driver Circuits

- 30-Volt Dichroic LCD Driver
- 32 Bit Driver

A/D Converters

- 12-Bit, 7 μ S, 100KHz A/D Converter
- 14-Bit, 14 μ S, 56KHz A/D Converter
- 16-Bit, 16 μ S, 50KHz A/D Converter
- 12-Bit, 1MHz, 2-Step Flash A/D Converter

For complete data sheets, contact Gould AMI at (208) 233-4690.

January 1991

Features

- Very High Frequency (VHF) Process
- Dielectric Isolation Significantly Reduces Parasitic Capacitance
- Double Level Metal
- 20 Volt BV_{CEO}
- $F_T \approx 1.0\text{GHz}$
- Wide Range of Process Options Allowing Design Flexibility
 - Vertical NPN Bipolar Transistors
 - Vertical PNP Bipolar Transistors
 - Various Diffused Resistors
 - Laser Trimmable NiCr Resistors
 - MOS Capacitors
 - PJFETs
 - Buried and Surface Zener Diodes

Description

The Harris VHF Process is a Dielectrically Isolated bipolar process which operates at a nominal 20V supply voltage. The HARRIS FASTRACK™ Design Toolset contains CAE tools which allow analog designers to efficiently design analog integrated circuits regardless of previous IC design experience. The design toolset uses a parametric device library which contains four NPN and four PNP device types. The designer uses proprietary Harris CAE tools to automate device level design and layout. For each transistor in the HDI2000 parametric device library, the device dimensions are fully adjustable. This data sheet provides device characteristics of the minimum sized devices in the library. All devices may be made larger to provide for higher currents, lower base resistance (R_B), or lower collector resistance (R_C). FASTRACK automatically calculates model parameter values for devices which differ from the minimum size.

Applications

- Bipolar IC's for Analog Signal Processing and Control

Harris Semiconductor

TABLE 1. NOMINAL DEVICE CHARACTERISTICS

PARAMETER	NPN	PNP	PJFET	BURIED ZENER	UNITS
BV_{CEO}	20	20	-	-	V
BV_{DSS}	-	-	20	-	V
H_{FE}	150	120	-	-	-
F_T	1.0*	0.9*	-	-	GHz
V_P	-	-	1.0	-	V
V_A	90	18	-	-	V
V_Z	-	-	-	5.4	V

* VHFLN4, VHFLP4 peak F_T at $V_{CE} = 5V$

January 1991

Features

- High Frequency (EBHF) Process
- Dielectric Isolation Significantly Reduces Parasitic Capacitance
- 40 Volt BV_{CEO}
- $F_T = 0.5\text{GHz}$
- Wide Range of Process Options Allowing Design Flexibility
 - Vertical NPN Bipolar Transistors
 - Vertical PNP Bipolar Transistors
 - Various Diffused Resistors
 - Laser Trimmable NiCr Resistors
 - MOS Capacitors
 - PJFETs
 - Surface Zener Diodes

Description

The Harris EBHF Process is a Dielectrically Isolated bipolar process which operates at a nominal 30V supply voltage. The HARRIS FASTRACK™ Design Toolset contains CAE tools which allow analog designers to efficiently design analog integrated circuits regardless of previous IC design experience. The design toolset uses a parametric device library which contains six NPN and six PNP device types. The designer uses proprietary Harris CAE tools to automate device level design and layout. For each transistor in the HDI1000 parametric device library, the device dimensions are fully adjustable. This data sheet provides device characteristics of the minimum sized devices in the library. All devices may be made larger to provide for higher currents, lower base resistance (R_B), or lower collector resistance (R_C). FASTRACK automatically calculates model parameter values for devices which differ from the minimum size.

Applications

- Bipolar IC's for Analog Signal Processing and Control

Harris Semiconductor

TABLE 1. NOMINAL DEVICE CHARACTERISTICS

PARAMETER	NPN	PNP	PJFET	SURFACE ZENER	UNITS
BV_{CEO}	40	40	-	-	V
BV_{DSS}	-	-	35	-	V
H_{FE}	200	130	-	-	-
F_T	0.5*	0.5*	-	-	GHz
V_P	-	-	1.5	-	V
V_A	130	75	-	-	V
V_Z	-	-	-	5.2	V

* EBHN4, EBHP4 peak F_T at $V_{CE} = 5V$

June 1990

Features

- Supported on Harris Bipolar Analog FASTRACK™ Design System
- Very High Frequency (VHF) Dielectrically Isolated 20 Volt Complementary Bipolar Process
- High Performance Cell Library
- Cell Macromodels Available for Fast Simulation
- Transistor Level Design Also Supported
- NPN and PNP F_T 's of 1.2 and 1.0 GHz, Respectively.
- User Definable NiCr Resistors
- Devices Include PJFET's, Buried Zeners, and MOS Capacitors
- Personalized by Two Metal Interconnect and One NiCr Resistor Level
- Reduced NRE Charges Compared to Full Custom
- Minimum Turnaround Times for First Silicon

Applications

- General Analog System Implementation
- Consolidation of Discrete Components and Analog IC's
- Reduce Size and Cost, Increase Reliability and Performance
- Quick-turn, Low Cost, IC Design Verification
- Design Feasibility Units or System Demonstration Units
- Development of Production Units for Low Volume Systems

Overview

The Harris HTA2000 Tile Array provides the analog system designer with a fast turn, low cost tile array methodology for the design of high performance, high speed analog circuits and systems. The HTA2000 is supported on the Harris Bipolar Analog FASTRACK Design System, and is implemented using the Harris dielectrically isolated VHF production process. Simulation capability on Bipolar Analog FASTRACK is available to the designer, including a combination of deterministic and statistical analysis modes. These modes provide the designer with a statistical analysis of circuit performance capability which and a detailed investigation of parametric yield.

The HTA2000 Tile Array incorporates an extensive library of high performance analog cells. This library includes op amps, comparators, sample/holds, buffers, references, and differential video circuits. Each cell has a companion macromodel which, when substituted, will significantly reduce circuit simulation time for preliminary system level analysis. Interconnect of the cells is implemented by personalizing two levels of interconnect and custom design of NiCr resistors. Utilizing the electrical and physical design tools of the Bipolar Analog FASTRACK System, transistor level design is supported using portions of the array not dedicated to implement tile array cells. Final circuit simulations may include cells represented at the device level and/or macromodel level in order to obtain any desired combination of simulation speed and accuracy.

Base wafers are processed up to the resistor and interconnect levels and then inventoried at the factory, providing rapid silicon turn-around upon receipt of a customer's design.

Table 1. Cell Family

Quantity	Cell Type	Description/Application
8	Operational Amplifiers	Stabilized for nominal closed loop gain of 1,2,5 or 10 with choice of bipolar or JFET inputs. Outputs short circuit protected.
4	Voltage Comparators	General purpose or low power voltage comparators with choice of bipolar or JFET inputs. Output logic level is set by user.
3	Voltage References	5.0 Volt, 2.5 Volt and 1.5 Volt references
2	High Speed Unity Gain Buffers	Choice of bipolar or JFET inputs.
2	Sample & Hold Devices	Choice of bipolar or JFET inputs. Self contained S/H capacitor.
2	Video Amplifiers	Gain of 10X or 40X. Differential circuits intended for video applications.
1	Mixer	Differential circuit intended for video applications.
2	Multipliers	Offered with and without internal op amp. Differential circuits intended for video applications.

Harris ASIC Technology Selection Guide

Harris Semiconductor offers mixed-signal, analog and digital ASICs in a wide range of processes and libraries for both military and commercial applications. These processes and libraries are available to meet your needs: from foundry of your designs to Harris designed ASICs. The following design systems are supported:

- HARRIS FASTRACK™ — Mentor/Silicon Compiler Systems
- Mentor

HARRIS FASTRACK™ is a Cadence Design Framework based system into which a variety of analog and digital CAE tools are integrated. HARRIS FASTRACK™ is constantly undergoing enhancements to address a broad range of design problems including:

- Radiation Hardness
- Bipolar Analog
- Mixed Signal Power ASIC™
- Digital Signal Processing (DSP)
- Sampled Data

Harris Processes

Bipolar Analog

The Harris bipolar analog processes are used for high performance analog circuits (op amps, S/Hs, references) with limited digital integration (<100 gates). The dielectrically isolated (DI) processes are used in both non rad hard and rad hard designs. These processes are supported on HARRIS FASTRACK™ which facilitates transistor level and tile array design.

Process	Supply Voltage	Minimum Emitter	Metal Levels	NPN f_T	PNP f_T	Capacitor	Metal Resistor	JFETS	Integration Capability (Devices)	Isolation	Status	Design System	Library
LHF	10	2.0	DLM	8 GHz	4 GHz	MOS	NiCr	yes	5000	DI	Qual 6/91	FASTRACK™	HDI3000
VHF	20	10.0	DLM	1.2 GHz	1 GHz	MOS	NiCr	yes	1500	DI	Qual 11/90	FASTRACK™	HDI2000
EBHF	40	10.0	SLM/DLM	750 MHz	400 MHz	MOS	NiCr	yes	750	DI	Prod/Dev	FASTRACK™	HDI1000

CMOS Analog/Digital

The CMOS analog/digital processes combine dense CMOS digital and moderate performance analog functions. The CMOS 3.5 MP process supports dense CMOS logic in conjunction with switched capacitor circuit applications. The S4A is a mature ten volt process with a complete analog cell library. The LN77 is a dense, cryogenic, rad hard process used in custom analog processing circuits. The CAE tool SWITCAP™ has been used extensively to design area efficient, accurate switched capacitor filters.

Process	Supply Voltage	Minimum Geometry	Metal Levels	Capacitor	Standard Cell	Integration Capability	Status	Comments
LN77	5	1.2	DLM	Substrate-Poly	—	—	Qual 4/91	Radiation hardened 100K Rad (si) (77°K)
S4A	10	3.0	SLM	DLP	HAC1500	1000 gates + 50 op amps	Production	Advancell Compatible with Analog Functions
CMOS3.5 MP	5	1.5	DLM	DLP	HSC4000	10K gates + 75 op amps	Qual 12/90	
CMOS3.5M	5	1.5	DLM	MOS	HSC4000	30K gates	Production	

CMOS Digital

Harris CMOS Digital processes nominally operate at 5 volts. Higher voltage operation is available with the BiCMOS/Bipolar processes listed below. They are used for logic and memory functions, and SSI/MSI replacement. The processes listed below have been used in digital standard products and ASICs. Several Harris facilities support classified design and manufacturing.

Processes	Minimum Geometry	Metal Levels	Design Methodologies				Second Source	Silicon Compiler	Status	Comments
			Standard Cell	Second Source	Gate Array	Gate Array				
AVLSI	1.2	DLM	CMOSN	—	—	—	Genesil	Production	Pandora Qualified	

Processes	Minimum Geometry	Metal Levels	Design Methodologies				Second Source	Silicon Compiler	Radiation Characteristics				
			Standard Cell	Second Source	Gate Array	Gate Array			Total Dose	Dose Rate	SEU	Neutrons	Substrate Material	Status
AVLSIR	1.2	DLM	—	1	TAGC40K	1	—	10 ⁶	3x10 ⁶	2.5x10 ⁻⁷	10 ¹⁴	Epi-Bulk	Qual
TSOS4	1.2	DLM	AUASC	1	AUA	1	Genesil	10 ⁶	10 ¹¹	10 ⁻¹¹	10 ¹⁴	SOS	Qual
RH EE PROM	2.0	DLM	—	—	—	—	—	3x10 ⁶	5x10 ⁶	TBD	10 ¹²	Epi-Bulk	Dev
RHD1	0.8	DLM	—	—	HSC5000GA	—	—	TBD	TBD	TBD	TBD	SOI	Dev

Second Source: 1 — Advancell symbol compatible

BiCMOS Analog/Digital

Harris BiCMOS analog/digital processes offer a balanced combination of dense CMOS digital logic and high performance analog technology. The HBC process is a versatile high performance process while BiMOS SC is a lower cost technology. The BiMOS E process has a library of 60 analog and 60 digital cells. Harris BiCMOS processes allow the designer to mix continuous time analog, switched capacitor analog, CMOS digital, and high voltage (up to 16V) functions on one ASIC. They are used in applications such as high drive, automotive, codecs, PCM repeaters, small motor controllers, power MOSFET drivers, and camera state machines.

Process	Supply Voltage(s)	Minimum Geometry	Metal Levels	NPN f_T	PNP f_T	Capacitor	Metal Resistor	Library	Integration Capability	Status	Notes
HBC	5/16	1.5	DLM	5 GHz	800 MHz	DLP	—	HBC4000 ₂	20K gates + 100 analog cells	Qual 8/91	Isolated PNP/NPN, I.O.A
BiMOS E	5/16	3.0	DLM	600 MHz	350 MHz	DLP	—	HBC2500	1500 gates + 50 analog cells	Production	0.5 A
BiMOS SC	10	4.0	SLM	1.5 GHz	5 MHz	yes	yes	—	1000 gates + 50 analog cells		

Notes: 1 — NPN Collector Committed to substrate, 2 — Advancell compatible

Harris ASIC Technology Selection Guide

Power

Harris Power ASIC™ processes are used to perform digital logic, analog, and power functions in a single ASIC. The two major types of power processes are junction isolated BiCMOS/DMOS and dielectrically isolated bipolar. The Harris power processes are used in applications such as dc, ac, and stepper motors, linear and switching power supplies, dc-dc converters, non impact printer heads, automotive functions, relays, and telecommunication line cards.

Junction Isolated												
	Logic	Supply Voltages			Minimum Geometry	Metal Levels	NPN f_T	PNP f_T	DMOS	Design System	Library	Status
		Analog	Power									
POWER BIMOS	5	20	100	3.0	DLM/DLP	200 MHz	5 MHz	5A	FASTRACK™	HPA2000	Production	
PASIC-1	15	15	60	4.0	DLM			5A				
HVIC	5/15	15	600	4.0	SLM	100 MHz	10 MHz	2A				
POWER BIPOLAR	40	40	100	5.0	SLM/DLM	300 MHz	7 MHz	2A(BJT)				
Dielectric Isolation Bipolar												
	Supply Voltage	Geometry	Metal Levels	Resistors	Capacitors	NPN f_T	Status	Comments				
HV-500	500	5.0	SLM	SiCr	MOS	320 MHz	Production	Subscriber Line Interface Circuits (SLICs) use the LCSLIC process.				
LCSLIC	200	5.0	SLM	SiCr	MOS	320 MHz	Production					

Harris ASIC Libraries

Bipolar Analog Library

Library	Process	Supply Voltage	Maximum Transistor Count	NPN f_T	PNP f_T	Availability	Comments
HDI2000	VHF	20	1500	1.2 GHz	1.0 GHz	Now	Contact factory for standard cell availability
HDI1000	EBHF	40	750	750 MHz	400 MHz	Now	Contact factory for standard cell availability
HTA2000	VHF	20	600	1.2 GHz	1.0 GHz	Now	Tile Array
HTA1000	EBHF	40	600	750 MHz	400 MHz	Now	Tile Array

Analog/Digital Standard Cells

Library	Process	Supply Voltage	Drawn Channel Length	Metal/Poly Levels	Delay 2-NAND	Maximum Integration Capability	Availability
HAC1500	S4A	10	3.0	SLM/DLP	1600 ps	1000 gates + analog	Now
HBC2500	BIMOS E	5/16	3.0	DLM/DLP	1600 ps	1500 gates + analog	Now
HSC4000	CMOS 3.5 MP	5	1.5	DLM/DLP	1000 ps	15K gates + analog	12/90
HSC4000	CMOS3.5	5	1.5	DLM	1000 ps	30K gates	Now
HPA2000	PASIC-1	15/15/60	4.0	DLM	2000 ps	750 gates + analog + DMOS	Now
HBC4000	HBC	5/16	1.5	DLM/DLP	1000 ps	20K gates + analog	8/91

Radiation Hardened CMOS Digital Standard Cells

Library	Process	Drawn Channel Length	Metal Levels	Maximum Gate Count	Delay 2-NAND	Availability
AUASC	TS0S4	1.2	DLM	20K	610 ps	Now

Radiation Hardened Gate Arrays

Product	Process	Drawn Channel Length	Metal Levels	Maximum Usable Gate Count	Delay 2-NAND	Availability	Radiation Hard
AUA	TS0S4	1.2	DLM	15K	610 ps	Now	yes
TAGC40K	AVLSIR	1.2	DLM	10K	780 ps	Now	yes

Harris Macrocells

Analog		Digital			
Op Amps	Filters	RTX Microprocessors	Compatible RAM	DMA Controller (82C37A)	
Comparators	Analog/Digital Converter (7151, 7152)	6805 Microcomputer	UARTs (82C50, 82C52)	Multipliers	
References	Programmable Gain Stages	20C51 Microcomputer	Interrupt Controller (82C59A)	Convolvers	
S:HS	Low Offset Integrator	Compatible ROM	1553 Manchester Encoder Decoder	Digital Filters (43881/91)	
Rectifiers	Digital/Analog Converter	Dual Port RAM	ARINC		
		2901/2910			

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PRELIMINARY

July 1990

**Radiation Hardened
64K x 1 SOS CMOS Static RAM**

Features

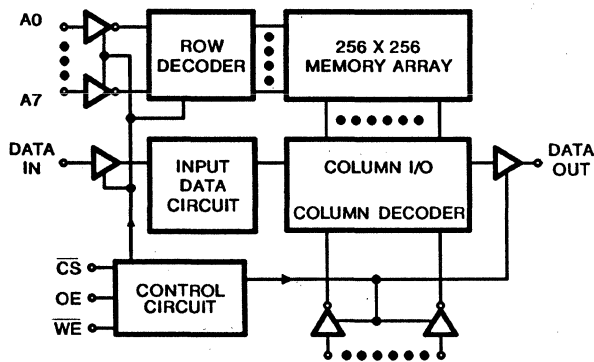
- 1.2 Micron Radiation Hardened SOS CMOS
 - ▶ Total Dose 1×10^6 RAD (Si)
 - ▶ Transient Upset 1×10^{11} RAD (Si)/s
 - ▶ Single Event Upset 1×10^{-12} Errors/bit-day
- Latch-up Free
- LET Threshold 120 Mev/mg/cm²
- Low Standby Supply Current 2mA (Max)
- Low Operating Supply Current... 3mA/MHz (Max)
- Fast Access Time 40ns (Max)
- High Output Drive Capability..... ± 8 mA
- Gated Input Buffers
- Six Transistor Memory Cell
- Fully Static Design
- Asynchronous Operation
- CMOS Inputs
- 5V Single Power Supply
- Military Temperature Range -55°C to +125°C

Description

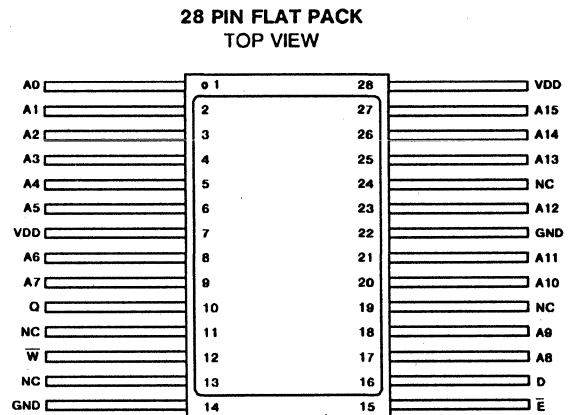
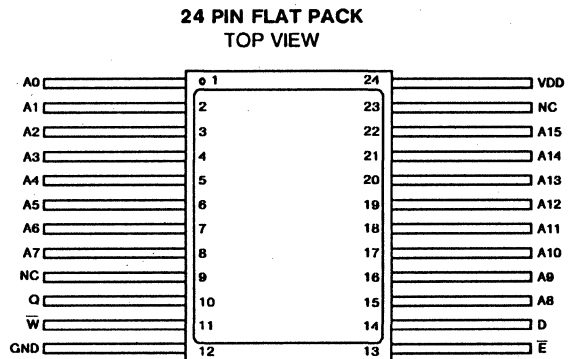
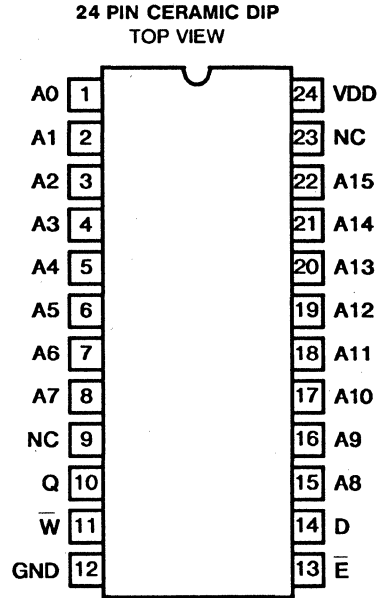
The Harris HS-65643RH is a fully asynchronous 64K x 1 radiation hardened static RAM. This RAM is fabricated using the Harris 1.2 micron silicon-on-sapphire CMOS technology. This technology gives exceptional hardness to all types of radiation, including neutron fluence, total ionizing dose, high intensity ionizing dose rates, and cosmic rays.

Low power operation is provided by a fully static design. Low standby power can be achieved without pull-up resistors, due to the gated input buffer design.

Functional Diagram



Pinouts



Harris Semiconductor

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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ADVANCED INFORMATION

July 1990

Radiation Hardened
256K Bit SOI SRAM

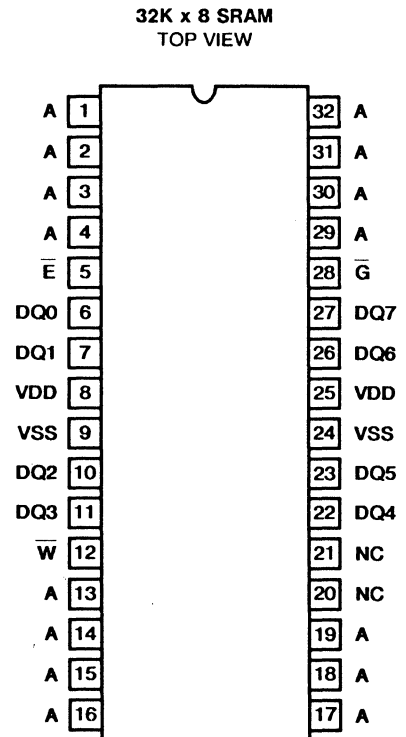
Features

- 0.9µm Radiation Hardened SOI CMOS
 - ▶ Total Dose 1 x 10⁶ RADs
 - ▶ Data Upset 1 x 10¹¹ RAD/Sec
 - ▶ Latch Up Free SOI Process
 - ▶ SEU Error Rate < 1 x 10⁻¹² Errors/Bit Day
- Available in 3 Organizations
 - ▶ 256K x 1
 - ▶ 32K x 8
 - ▶ 64K x 4
- Fast Access Time < 25ns Over Voltage, Temperature and Radiation
- Single 5V Power Supply
- Low Power Consumption
 - ▶ IDDSB < 500µA Pre RAD
 - ▶ IDDSB < 2mA Post 1MRAD
 - ▶ IDDOP 145mA (x 1, 40MHZ)
 - ▶ IDDOP 220mA (x 8, 40MHZ)
- Fully Static 6T Memory Cell

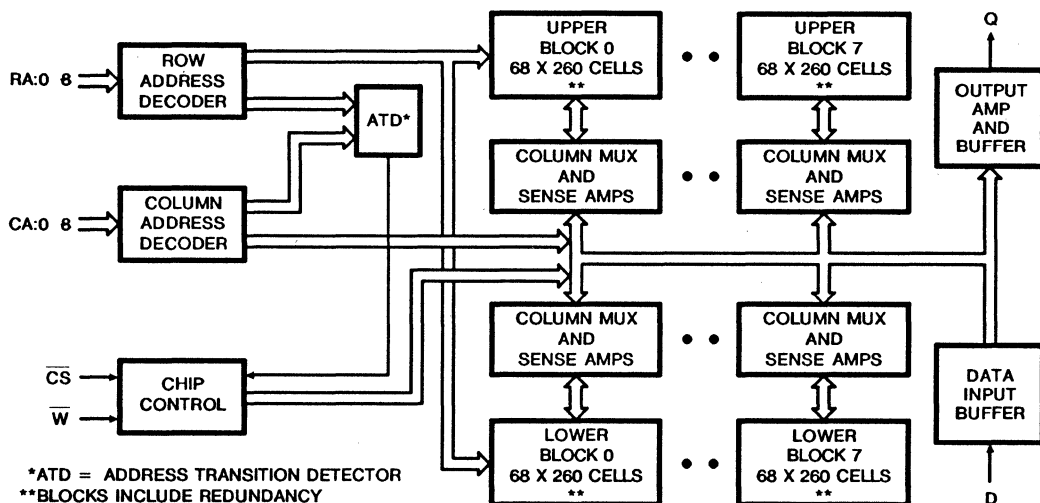
Description

The HS-65758RH is an asynchronous, fully static RAM fabricated with the Harris SIMOX (Silicon Isolated by Implanted Oxygen) radiation hardened process. The use of this process provides excellent total dose, dose rate and single event immunity. As with any oxide isolated circuits, the HS-65758RH will not latch-up under any conditions. This high speed SRAM is available in 256 x 1, 64K x 4 and 32K x 8 organizations.

Pinout



Functional Diagram



CAUTION: Electronic devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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Harris Semiconductor

July 1990

Features

- Total Dose 1 x 10⁵ RAD (Si)
- Latch-Up Free >1 x 10¹² RAD (Si)/s
- Field Programmable
- Functionally Equivalent to HM-6617
- Pin Compatible with Intel 2716
- Low Standby Power 550µW Max.
- Low Operating Power 137.5mW/MHz Max.
- Fast Access Time 100ns Max.
- TTL Compatible Inputs/Outputs
- Synchronous Operation
- On Chip Address Latches
- Three-State Outputs
- Nicrome Fuse Links
- Easy Microprocessor Interfacing
- Military Temperature Range -55°C to +125°C

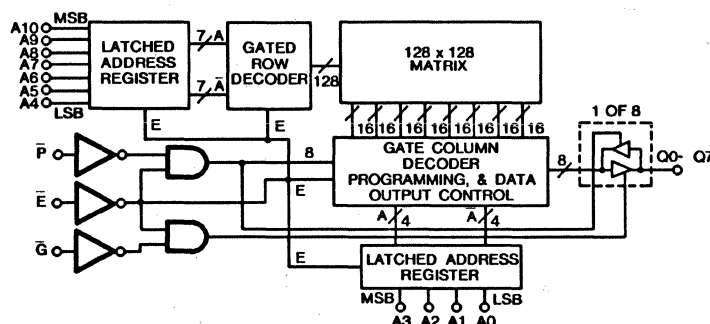
Description

The Harris HS-6617RH is a radiation hardened 16K CMOS PROM, organized in a 2K word by 8-bit format. The chip is manufactured using a radiation hardened CMOS process, and is designed to be functionally equivalent to the HM-6617. Synchronous circuit design techniques combine with CMOS processing to give this device high speed performance with very low power dissipation.

On chip address latches are provided, allowing easy interfacing with recent generation microprocessors that use multiplexed address/data bus structure, such as the HS-80C85RH or HS-80C86RH. The output enable control (G) simplifies microprocessor system interfacing by allowing output data bus control, in addition to, the chip enable control. Synchronous operation of the HS-6617RH is ideal for high speed pipelined architecture systems and also in synchronous logic replacement functions.

Applications for the HS-6617RH CMOS PROM include low power microprocessor based instrumentation and communications systems, remote data acquisition and processing systems, processor control store, and synchronous logic replacement. A high reliability version is available for satellite and other critical applications. Contact your nearest Harris representative.

Functional Diagram

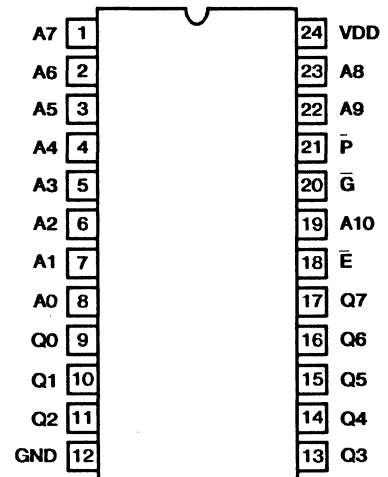


ALL LINES POSITIVE LOGIC:
ACTIVE HIGH
THREE STATE BUFFERS:
A HIGH → OUTPUT ACTIVE

ADDRESS LATCHES & GATED DECODERS:
LATCH ON FALLING EDGE OF \bar{E}
GATE ON FALLING EDGE OF \bar{G}
 \bar{P} = HARDWIRED TO VDD EXCEPT DURING PROGRAMMING

Pinouts

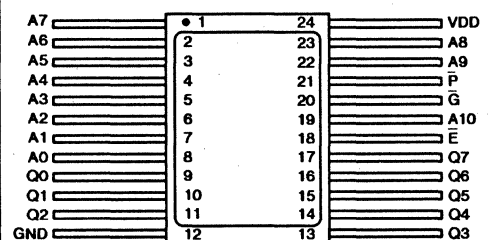
24 PIN BRAZE SEAL DIP
TOP VIEW



PIN NAMES

- | | | | |
|-----------|---------------|-----------|--|
| A | Address Input | \bar{P} | Program Enable
(\bar{P} Hardwired to VDD, except during programming) |
| Q | Data Output | | |
| \bar{E} | Chip Enable | | |
| G | Output Enable | | |

24 PIN FLATPACK CARRIER
TOP VIEW



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DESIGN INFORMATION
2K x 8 CMOS PROM

The information contained in this section has been developed through characterization by Harris Semiconductor and is for use as application and design information only. No guarantee is implied.

Background Information HS-6617RH Programming
PROGRAMMING SPECIFICATIONS

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
V _{IL}	Input "0"	0.0	0.2	0.8	V	
V _{IH}	Voltage "1"	V _{DD} -2	V _{DD}	V _{DD} +0.3	V	6
V _{DDPROG}	Programming V _{DD}	10.0	10.0	10.0	V	2
V _{DD1}	Operating V _{DD}	4.5	5.5	5.5	V	
V _{DD2}	Special Verify	4.0	-	6.0	V	3
t _d	Delay Time	1.0	1.0	-	μs	
t _r	Rise Time	1.0	10.0	10.0	μs	
t _f	Fall Time	1.0	10.0	10.0	μs	
TEHEL	Chip Enable Pulse Width	50	-	-	ns	
TAVEL	Address Valid to Chip Enable Low Time	20	-	-	ns	
TELQV	Chip Enable Low to Output Valid Time	-	-	120	ns	
t _{pw}	Programming Pulse Width	90	100	110	μs	4
t _{lp}	Input Leakage at V _{DD} = V _{DDPROG}	-10	+1.0	10	μA	
I _{OP}	Data Output Current at V _{DD} = V _{DDPROG}	-	-5.0	-10	mA	
R _n	Output Pull-Up Resistor	5	10	15	kΩ	5
T _A	Ambient Temperature	-	25	-	°C	

NOTES:

- All inputs must track V_{DD} (pin 24) within these limits.
- V_{DDPROG} must be capable of supplying 500mA. V_{DDPROG} Power Supply tolerance ±3% (Max.)
- See Steps 22 through 29 of the Programming Algorithm.
- See Step 11 of the Programming Algorithm.
- All outputs should be pulled up to V_{DD} through a resistor of value R_n.
- Except during programming (See Programming Cycle Waveforms).

DESIGN INFORMATION (Continued)

The information contained in this section has been developed through characterization by Harris Semiconductor and is for use as application and design aid only. These characteristics are not 100% tested and no product guarantee is implied.

Background Information Programming Algorithm

The HS-6617 CMOS PROM is manufactured with all bits containing a logical zero (output low). Any bit can be programmed selectively to a logical one (output high) state by following the procedure shown below. To accomplish this, a programmer can be built that meets the specifications shown, or use of an approved commercial programmer is recommended.

PROGRAMMING SEQUENCE OF EVENTS

- 1) Apply a voltage of V_{DD1} to V_{DD} of the PROM.
- 2) Read all fuse locations to verify that the PROM is blank (output low).
- 3) Place the PROM in the initial state for programming:
 $\bar{E} = V_{IH}$, $\bar{P} = V_{IH}$, $\bar{G} = V_{IL}$.
- 4) Apply the correct binary address for the word to be programmed. No inputs should be left open circuit.
- 5) After a delay of t_d , apply voltage of V_{IL} to \bar{E} (pin 18) to access the addressed word.
- 6) The address may be held through the cycle, but must be held valid at least for a time equal to t_d after the falling edge of \bar{E} . None of the inputs should be allowed to float to an invalid logic level.
- 7) After a delay of t_d , disable the outputs by applying a voltage of V_{IH} to \bar{G} (pin 20).
- 8) After a delay of t_d , apply voltage of V_{IL} to \bar{P} (pin 21).
- 9) After delay of t_d , raise V_{DD} (pin 24) to V_{DDPROG} with a rise time of t_r . All outputs at V_{IH} should track V_{DD} within $V_{DD}-2.0V$ to $V_{DD}+0.3V$. This could be accomplished by pulling outputs at V_{IH} to V_{DD} through pull-up resistors of value R_n .
- 10) After a delay of t_d , pull the output which corresponds to the bit to be programmed to V_{IL} . Only one bit should be programmed at a time.
- 11) After a delay of t_{pw} , allow the output to be pulled to V_{IH} through pull-up resistor R_n .
- 12) After a delay of t_d , reduce V_{DD} (pin 24) to V_{DD1} with a fall time of t_f . All outputs at V_{IH} should track V_{DD} with $V_{DD}-2.0V$ to $V_{DD}+0.3V$. This could be accomplished by pulling outputs at V_{IH} to V_{DD} through pull-up resistors of value R_n .
- 13) Apply a voltage of V_{IH} to \bar{P} (pin 21).
- 14) After a delay of t_d , apply a voltage of V_{IL} to \bar{G} (pin 20).
- 15) After a delay of t_d , examine the outputs for correct data. If any location verifies incorrectly, it should be considered a programming reject.
- 16) Repeat steps 3 through 15 for all other bits to be programmed in the PROM.

POST-PROGRAMMING VERIFICATION

- 17) Place the PROM in the post-programming verification mode:
 $\bar{E} = V_{IH}$, $\bar{G} = V_{IL}$, $\bar{P} = V_{IH}$, V_{DD} (pin 24) = V_{DD1} .
- 18) Apply the correct binary address of the word to be verified to the PROM.
- 19) After a delay of t_d , apply a voltage of V_{IL} to \bar{E} (pin 18).
- 20) After a delay of t_d , examine the outputs for correct data. If any location fails to verify correctly, the PROM should be considered a programming reject.
- 21) Repeat steps 17 through 20 for all possible programming locations.

POST-PROGRAMMING READ

- 22) Apply a voltage of $V_{DD2} = 4.0V$ to V_{DD} (pin 24).
- 23) After a delay of t_d , apply a voltage of V_{IH} to \bar{E} (pin 18).
- 24) Apply the correct binary address of the word to be read.
- 25) After a delay of T_{AVEL} , apply a voltage of V_{IL} to \bar{E} (pin 18).
- 26) After a delay of $TELQV$, examine the outputs for correct data. If any location fails to verify correctly, the PROM should be considered a programming reject.
- 27) Repeat steps 23 through 26 for all address locations.
- 28) Apply a voltage of $V_{DD2} = 6.0V$ to V_{DD} (pin 24).
- 29) Repeat steps 23 through 26 for all address locations.

Ordering Information

Harris products are represented by an extensive network of factory sales personnel, sales representatives, and selected distributors in the United States of America. In addition, certain M&AD products are available internationally* via European and Far East factory sales, distributor, and sales representative personnel. Please contact your closest sales office or representative to place an order, obtain price and delivery information, or additional product information.

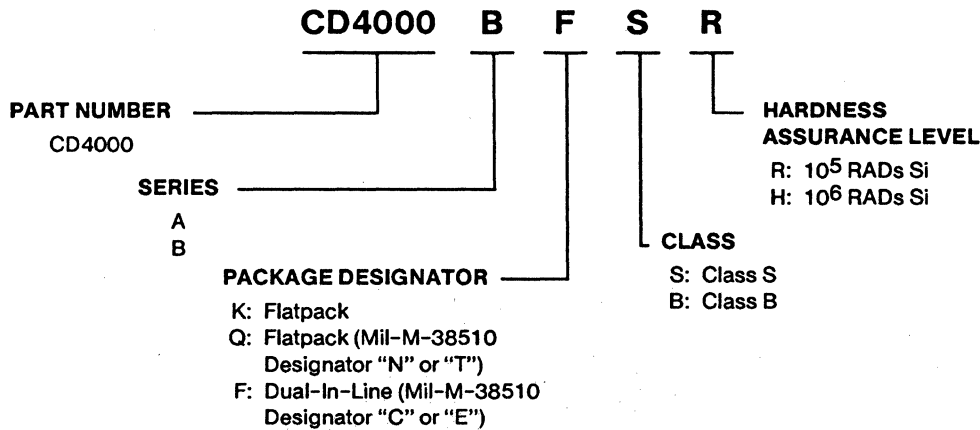
Because such a broad line of product is offered by Harris you may find it necessary to contact the factory in Melbourne, Florida. Please call your factory representative if additional factory information is required.

* Product and/or technology shipment out of the United States is subject to control by the U.S. Commerce Department and the DOD and may require a special export license.

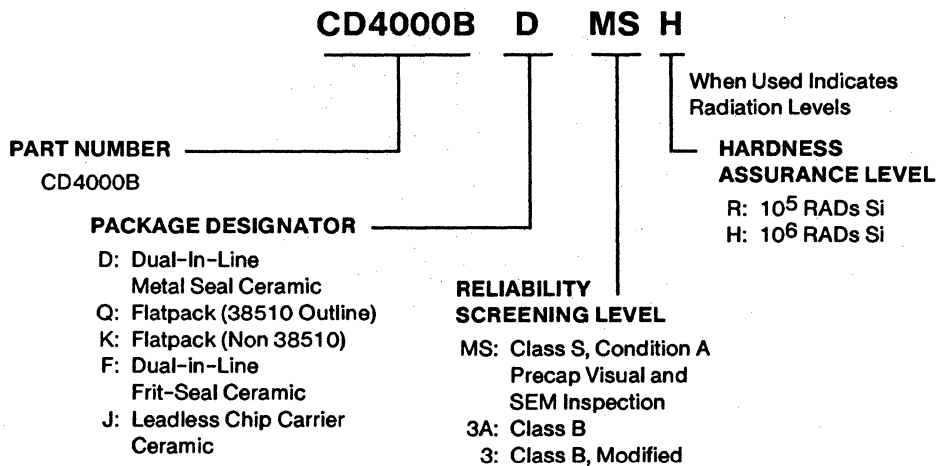
Product Code Examples & Definitions

High Reliability CD4000-Series CMOS Logic ICs

CD4000 LOGIC STANDARD NOMENCLATURE GUIDE



CD4000 MIL-STD-883 NOMENCLATURE GUIDE



"D" Package has a solder dipped lead finish (38510 lead finish "A")

"Q" Package has a gold plated lead finish (38510 lead finish "C")

"K" Package has a solder dipped lead finish (38510 lead finish "A")

"F" Package has a solder dipped tin plate (38510 lead finish "A")

"MS" devices are in full compliance with Mil-Std-883C, paragraph 1.2.1 when the optional Group B and Group D conformance tests are performed.

/3A and /3 product is not available in Rad-Hard versions

/3A is in full compliance with Mil-Std-883C, paragraph 1.2.1

/3 are non-compliant to Mil-Std-883, Class B and are available as special orders only

Ordering Information

High-Reliability, Rad-Hard High Speed CMOS/SOS ICs

The HCS/HCTS CMOS/SOS Family

A Rad-Hard CMOS Alternative to Bipolar LS Logic

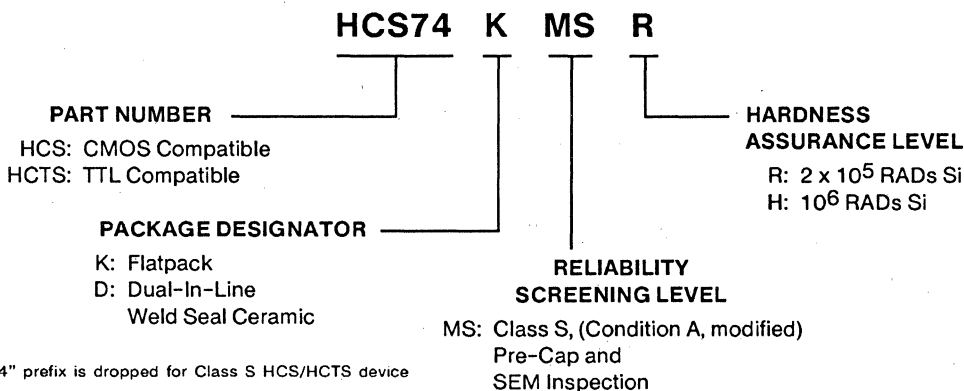
The HCS/HCTS parts are a new family of higher speed, low power, radiation hardened CMOS logic devices that are 20 times faster than the 4000 series. They are SOS based, and are available in a wide choice of logic functions based on the bulk high speed HC/HCT CMOS family.

CMOS/SOS structure uses a sapphire substrate to insulate the n- and p-transistors from each other. This structure is highly resistant to transient radiation, total dose radiation, and single event upsets.

CMOS/SOS technology offers superior radiation tolerance, high speed, low power, good noise immunity, and neutron resistance over the full military temperature range (-55°C to +125°C).

High reliability HCS/HCTS CMOS/SOS devices are manufactured in our continually recertified JAN Class S state-of-the-art factory to Mil-Std-883, Method 5004 standards.

HIGH SPEED CMOS/SOS LOGIC NOMENCLATURE GUIDE

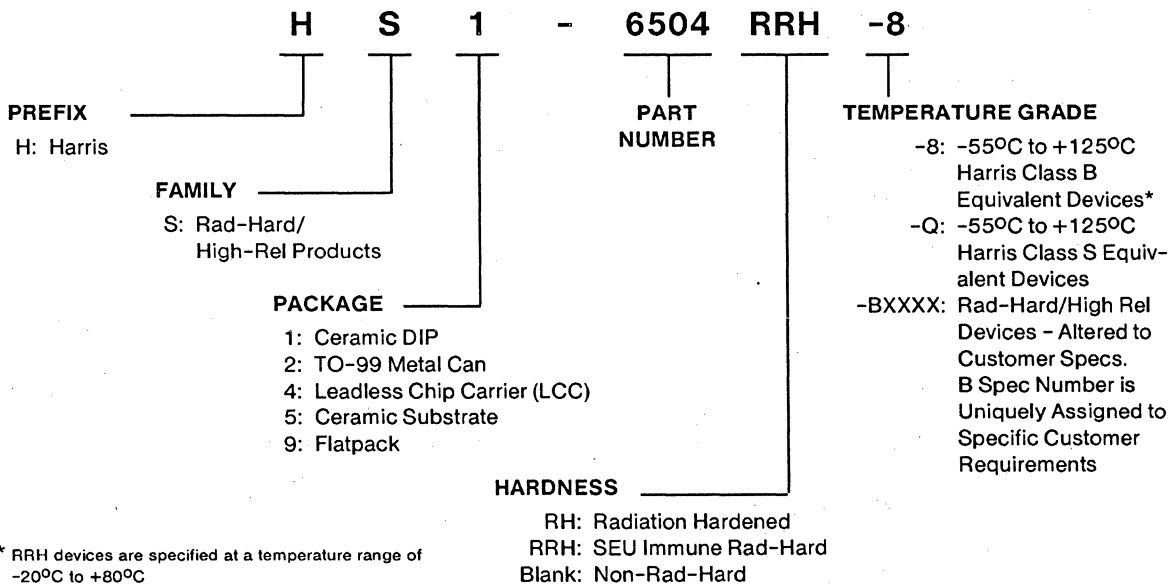


NOTES:

1. The "CD54" prefix is dropped for Class S HCS/HCTS device types
2. Both the "K" and "D" packages have gold plated lead finish (38510 lead finish "C")

H-Series High Reliability Rad-Hard Products

RAD-HARD HIGH RELIABILITY NOMENCLATURE GUIDE



* RRH devices are specified at a temperature range of -20°C to +80°C

Harris Semiconductor

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HOW TO USE THE IC MASTER

The 1991 edition of the IC MASTER is arranged in three volumes. Each volume serves a specific purpose to help you find the integrated circuit or related product you need. The table of contents on page 1 describes what is in each volume. The table also includes the starting page number for each advertiser.

The IC MASTER is a functional work. You know what you need. The MASTER helps you find it.

Here are typical problems.

Q. What kinds of functions does the MASTER cover?

A. Turn to page 10 in Volume One. Here is a complete list of the devices covered. The page and line numbers refer you to the exact Section in which a particular function appears.

Q. Who makes a 16384 x 1 static RAM with an access time of 70 ns or faster? What are my technology choices?

A. Pick up Volume 1. Turn to the MEMORY section. The first page of the section tells you where the listings of your device begin. See this under:

- Static RAMs — General Purpose Modules
- Multiport
- NOVRAMS
- Cache RAMs

Turn to Static RAMs — General Purpose.

In the first column you see the Organization. Browse through the pages until you reach the 16384 x 1 listings. Now look through the listings until you find the access time and characteristics you need. Device numbers are shown by manufacturer. The device numbers of advertisers in the 1991 IC MASTER appear in bold face. The page number following the device number is where additional information may be found in Volume Two. At the extreme right you will see line numbers. These are the specific lines where a device appears.

Q. Which microprocessors are listed in the MASTER? How do I find the microprocessor I need?

A. All commercially available microprocessors are listed in the MASTER. Start with the **microprocessor** listing in the **Master Selection Guide Function Index** (starts on page 10). Here you will find the various kinds of products you will need listed according to function. Turn to the various pages shown and then to the advertisers' page where more detail may be available.

POWER DRIVERS FOR ASIC APPLICATIONS INTERFACING LOW-LEVEL LOGIC TO INDUCTIVE AND RESISTIVE LOADS

- RELAYS
- SOLENOIDS
- AC and DC MOTORS
- HEATERS
- INCANDESCENT and VACUUM FLUORESCENT DISPLAYS

CURRENT PRODUCTS:

TYPE NUMBER	CA3242	CA3252	CA3262	CA3262A	CA3272
TYPE OF CIRCUIT	INVERTING	NON-INVERTING	INVERTING	INVERTING	INVERTING
Output Current Rating Vsat @ Current Rating	0.6A 0.8V	0.6A 0.7V	0.7A 0.6V	0.7A 0.5V	0.4A 0.4V
Voltage Rating (Vcc)sus	35Vdc	35Vdc	35Vdc	40Vdc	40Vdc
Load Dump Voltage (Vpeak)	80Vpk	80Vpk	80Vpk	80Vpk	80Vpk
Output Current Limiting	No	No	@1.4A	@1.2A	@1.0A
Short-Circuit Protection	Yes	No	No	No	No
Thermal Limiting	No	No	@Tj = +155°C	@Tj = +155°C	No
Thermal Shutdown	No	No	No	No	@Tj = +165°C
Fault Indicator Flag	No	No	No	No	Yes
Temperature Range -40°C to +85°C -40°C to +125°C	X	X	X	X	X
Package Options 16 DIP (Std) 15 SIP 28 PLCC	X X	X	X	X X	X

HIGH VOLTAGE ICs

SP600/SP601 500Vdc HALF BRIDGE DRIVERS

These 22 pin PDIP devices interface low voltage logic level control and high power MOSFET and IGBT switches connected in a half-bridge configuration. These devices feature overcurrent and undervoltage shutdown linked to a FAULT flag terminal. Features important for motor controls such as automatic bootstrap capacitor refresh and shoot-through protection are included. Mask options allow customization of input filter delay, output source/sink impedance and shoot-through-dead-band delay.

Features

- Full Control of Bootstrap Supply
- Single Low Current Bias Supply
- Latch Immune CMOS Logic
- Peak Drive of 0.5 Amp

Applications

- Motor Control Inverters and Converters
- Power Supply Inverters

SP606 600Vdc HIGH VOLTAGE SWITCH DRIVER

This driver is a 14 pin PDIP device incorporating a subset of the features of the SP600/SP601 devices. Consequently the SP606 is smaller, less expensive and can drive Half bridges as well as Double forward converters.

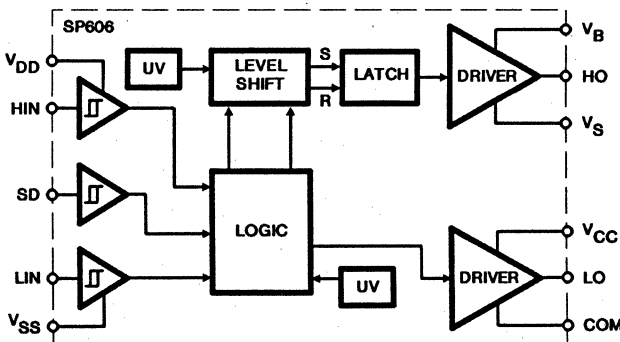
Features

- 600Vdc Maximum Rating
- Floating Bootstrap Upper Drive Supply
- CMOS Schmitt Inputs with Hysteresis and Pull-Down
- 1MHz Operation
- Single 300µA Supply
- Peak Drive in Excess of 2 Amps
- Separate Drivers for Double Forward Converter Operation
- Separate Shutdown Pin

Applications

- Motor Control Inverters and Converters
- Power Supply Inverters

Functional Block Diagram



SP306 INTELLIGENT 60V/30A HIGH SIDE SWITCH

This 5-lead grounded case TO-220 device is a smart high side switch incorporating soft-start, overtemperature and overcurrent protection, missing load detection and over voltage lockout. Fully ESD protected, it operates from 5Vdc logic and includes a diagnostic flag.

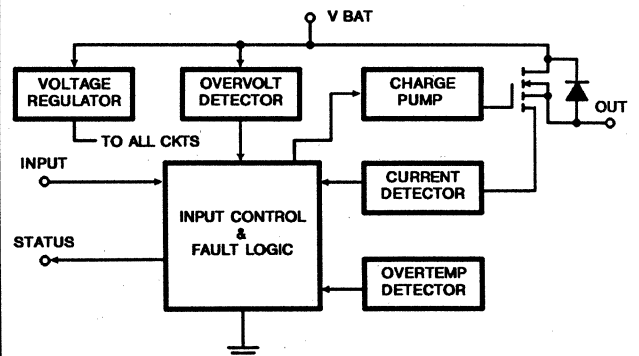
The SP306 is designed for driving harsh loads such as lamp filaments and capacitive loads, as well as inductive loads associated with solenoids.

Pinout

TO220 SL PACKAGE



Functional Schematic



062303

Harris Semiconductor

HARRIS ASIC TECHNOLOGY SELECTION GUIDE

Bipolar Analog

The Harris bipolar analog processes are used of high performance analog circuits (op amps, S/Hs, references) with limited digital integration (<100 gates). The dielectrically isolated (DI) processes are used in both non rad hard and rad hard designs. These processes are supported on HARRIS FASTRACK™ which facilitates transistor level and tile array design.

Process	Supply Voltage	Minimum Emitter	Metal Levels	NPN f_T	PNP f_T	Capacitor	Metal Resistor	JFETs	Integration Capability (Devices)	Isolation	Status	Design System	Library
UHF	10	2.0	DLM	8GHz	4GHz	MOS	NiCr	Yes	5000	DI	Qual 6/91	FASTRACK	HDI3000
VHF	20	10.0	DLM	1.2GHz	1GHz	MOS	NiCr	Yes	1500	DI	Qual 11/91	FASTRACK	HDI2000
EBHF	40	10.0	SLM/DLM	750MHz	400MHz	MOS	NiCr	Yes	750	DI	Prod/Dev	FASTRACK	HDI1000

CMOS Analog/Digital

The CMOS analog/digital processes combine dense CMOS digital and moderate performance analog functions. The CMOS 3.5 MP process supports dense CMOS logic in conjunction with switched capacitor circuit applications. The S4A is a mature ten volt process with a complete analog cell library. The LN77 is a dense, cryogenic, rad hard process used in custom analog processing circuits. The CAE tool SWITCAP™ has been used extensively to design area efficient, accurate switched capacitor filters.

Process	Supply Voltage	Minimum Geometry	Metal Levels	Capacitor	Standard Cell	Integration Capability	Status	Comments
LN77	5	1.2	DLM	Substrate-Poly	-	-	Qual 4/91	Radiation Hardened 100K Rad(si) (77°K)
S4A	10	3.0	SLM	DLP	HAC1500	1000 gates + 50 op amps	Production	} Advancell Compatible with Analog Functions
CMOS3.5MP	5	1.5	DLM	DLP	HSC4000	10K gates + 75 op amps	Qual 12/90	
CMOS3.5M	5	1.5	DLM	MOS	HSC4000	30K gates	Production	

CMOS Digital

The CMOS Digital processes nominally operates at 5 volts. Higher voltage operation is available with the BiCMOS/Bipolar processes listed below. They are used for logic and memory functions, and SSI/MSI replacement. The processes listed below have been used in digital standard products and ASICs. Several Harris facilities support classified design and manufacturing.

Non Rad Hard			Design Methodologies					Radiation Characteristics						
Process	Minimum Geometry	Metal Levels	Standard Cell	Second Source	Gate Array	Second Source	Silicon Compiler	Status	Comments					
AVLSI	1.2	DLM	CMOSN	-	-	-	Genesil	Production	Pandora Qualified					
Rad Hard			Design Methodologies					Radiation Characteristics						
Processes	Minimum Geometry	Metal Levels	Standard Cell	Second Source	Gate Array	Second Source	Silicon Compiler	Total Dose	Dose Rate	SEU	Neutrons	Substrate Material	Status	
AVLSIR	1.2	DLM	-	1	TAGC40K	1	-	10 ⁶	3x10 ⁹	2.5x10 ⁻⁷	10 ¹⁴	Epi-Bulk	Qual.	
TSOS4	1.2	DLM	AUASC	1	AUA	1	Genesil	10 ⁶	10 ¹¹	10 ⁻¹¹	10 ¹⁴	SOS	Qual.	
RH EE PROM	2.0	DLM	-	-	-	-	-	3x10 ⁵	5x10 ⁸	TBD	10 ¹²	Epi-Bulk	Dev.	
RHD1	0.8	DLM	-	-	HSC5000GA	-	-	TBD	TBD	TBD	TBD	SOI	Dev.	

Second Source: 1 - Advancell Symbol Compatible



HARRIS ASIC TECHNOLOGY SELECTION GUIDE (Continued)

BICMOS Analog/Digital

Harris BiCMOS Analog/Digital processes offer a balanced combination of dense CMOS digital logic and high performance analog technology. The HBC process is a versatile high performance process while BiMOS SC is a lower cost technology. The BiMOS E process has a library of 60 analog and 60 digital cells. Harris BiCMOS processes allow the designer to mix continuous time analog, switched capacitor analog, CMOS digital, and high voltage (up to 16V) functions on one ASIC. They are used in applications such as high drive, automotive, codecs, PCM repeaters, small motor controllers, power MOSFET drivers, and camera state machines.

Process	Supply Voltage(s)	Minimum Geometry	Metal Levels	NPN f_T	PNP f_T	Capacitor	Metal Resistor	Library	Integration Capability	Status	Notes
HBC	5/16	1.5	DLM	5GHz	800MHz	DLP	-	HBC4000 ₂	20K gates + 100 analog cells	Qual. 8/91	Isolated PNP/NPN,
BiCMOS	5/16	3.0	DLM	600MHz ₁	350MHz	DLP	-	HBC2500	1500 gates + 50 analog cells	Production	I.OA 0.5A
BiCMOS SC	10	4.0	SLM	1.5GHz	5MHz	Yes	Yes	-	1000 gates + 50 analog cells		

NOTES: 1 - NPN Collector Committed to Substrate 2 - Advantec Compatible

Power

Harris Power ASIC™ processes are used to perform digital logic, analog, and power functions in a single ASIC. The two major types of power processes are junction isolated BiCMOS/DMOS and dielectrically isolated bipolar. The Harris power processes are used in applications such as DC, AC, and stepper motors, linear and switching power supplies, DC-DC converters, non impact printer heads, automotive functions, relays and telecommunication line cards.

Junction Isolated	Supply Voltages			Minimum Geometry	Metal Levels	NPN f_T	PNP f_T	DMOS	Design System	Library	Status
	Logic	Analog	Power								
Power BiMOS	5	20	100	3.0	DLM/DLP	200MHz	5MHz	5A			Production
PASIC-1	15	15	60	4.0	DLM			5A	FASTRACK™	HPA2000	Production
HVIC	5/15	15	600	4.0	SLM	100MHz	10MHz	2A			Production
Power Bipolar	40	40	100	5.0	SLM/DLM	300MHz	7MHz	2A(BJT)			Production
Dielectric Isolation Bipolar											
	Supply Voltage	Geometry	Metal Levels	Resistors	Capacitors	NPN f_T	Status	Comments			
HV-500	500	5.0	SLM	SiCr	MOS	320MHz	Production	Subscriber Line Interface Circuits (SLICs) use the LCSLIC process.			
LCSLIC	200	5.0	SLM	SiCr	MOS	320MHz	Production				



CDP6805/CDP68HC05 FAMILY OF MICRO'S SIMPLIFIES DESIGN CHOICES

FEATURES	CDP																
	6805E2	6805E3	6805F2	6805G2	68HC05C0	68HC05C4	68HCL05C4	68HSC05C4	68HC05C7	68HCL05C7	68HSC05C7	68HC05C8	68HCL05C8	68HSC05C8	68HC05D2	68HC05J3	68HC05W4
Technology	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS	CMOS
Package(s)	E Q	E Q	E Q	E	E Q N	E Q N	E Q N	E Q N	E Q N	E Q N	E Q N	E Q N	E Q N	E Q N	E Q N	E M	E Q N
Pins	40 44	40 44	28 28	40	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	40 44 44	20 20	40 44 44
On-Chip RAM (Bytes)	112	112	64	112	176	176	176	176	256	256	256	176	176	176	96	128	192
External Address Space	8K	64K	-	-	60/64	-	-	-	-	-	-	-	-	-	-	-	-
On-Chip User ROM (Bytes)	0	0	1089	2106	3840	4160	4160	4160	12096	12096	12096	7744	7744	7744	2176	2112	3840
Bidirectional I/O Lines	16	13	16	32	24	24	24	24	24	24	24	24	24	24	28	12	24
Unidirectional I/O Lines	0	0	4 in	0	7 in	7 in	7 in	7 in	7 in	7 in	7 in	7 in	7 in	7 in	3 in	0	1 in, 1 out
Memory Mapped I/O	Yes	Yes	Yes	Yes	Yes; expnd	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Timer Size (bits)	8	8	8	8	16	16	16	16	16	16	16	16	16	16	16	16	8
Prescaler Size (bits)	7	7	7	7	*	*	*	*	*	*	*	*	*	*	*	*	7
External Timer Oscillator	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Serial Peripheral Interface	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Master SPI
Serial Comm. Interface	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Keypad Scan Interface	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
I/O Port Handshaking	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Interrupts:	Extrnl Timer SWI	Extrnl Timer SWI	Extrnl Timer SWI	Extrnl Timer SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SCI SPI SWI	Extrnl Timer SPI Port B SWI	Extrnl Timer Prt C Tmr Pwm SPI NMI SWI
Computer Operating Properly (COP)	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	Yes
Illegal Opcode Trap (IOT)	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
8x8 Unsigned Mult. Instruc	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PWM	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	2
Self-Check Mode	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Oscillator Mode	Quartz	Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz	RC or Quartz
Oscillator Startup Delay Msk Option	-	-	No	No	Yes	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Typical Power Dissipation at Max Frequency and 5V: (HCL shown at 2.4V and FOSC = 1MHz)																	
Run	35mW	35mW	10mW	12mW	TBE	25mW	1.8mW Max	33.5mW	25mW	1.8mW Max	33.5mW	25mW	1.8mW Max	33.5mW	25mW	TBE	TBE
Wait Mode	5mW	5mW	3mW	4mW	TBE	7.5mW	960µW Max	15.0mW	7.5mW	960µW Max	15.0mW	7.5mW	960µW Max	15.0mW	7.5mW	TBE	TBE
Stop Mode	25µW	25µW	25µW	5µW	TBE	5µW	12µW Max	700µW Max	5µW	12µW Max	700µW Max	5µW	12µW Max	700µW Max	5µW	TBE	TBE

* Prescaler fixed as divide by 4.

ADVANCED INFORMATION

July 1990

8-Channel 10 Bit High Speed A/D Converter with Track and Hold

Features

- 5 μ s Conversion Time
- 8-Channel Multiplexer
- 200,000 Channels/second Continuous Throughput Rate
- No Offset or Gain Adjustments Necessary
- Internal Track and Hold Amplifier
- Analog and Reference Inputs Fully Buffered
- μ P Compatible Outputs
- Low Power Consumption (150mW)
- Requires Single 2.5V Reference for a $\pm 2.5V$ Input Range

Applications

- μ P Controlled Data Acquisition Systems
- DSP
 - ▶ Avionics
 - ▶ Sonar
- Process Control
 - ▶ Automotive Transducer Sensing
 - ▶ Industrial
- Robotics
- Digital Communications

General Description

The HI-7153 is an 8-channel high speed 10 bit A/D converter which uses a Two Step Flash algorithm to achieve throughput rates of 200kHz. The converter features an 8-channel CMOS analog multiplexer with random channel addressing. A unique switched capacitor technique allows a new input voltage to be sampled while a conversion is taking place.

A Track and Hold amplifier is included on the chip, consisting of two high speed amplifiers and an internal hold capacitor.

Microprocessor bus interfacing is simplified by the use of standard Chip Select, Read, and Write control signals. The digital three-state outputs are byte organized for bus interface to 8 or 16 bit systems. An Out-of-Range pin, together with the MSB, can be used to indicate an under or over-range condition.

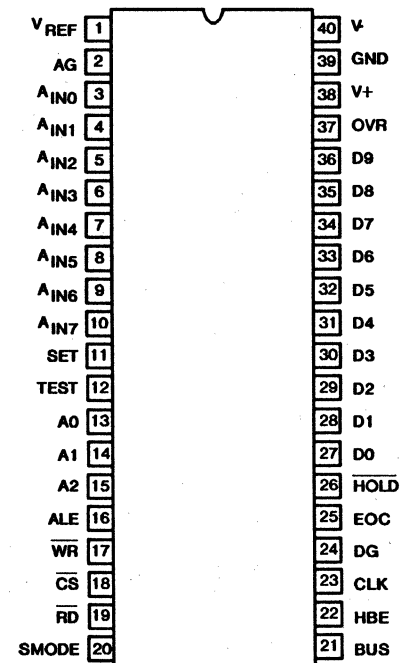
The HI-7153 operates with $\pm 5V$ supplies. A single +2.5V reference is required to provide a bipolar input range from -2.5V to +2.5V.

Internal high speed CMOS buffers at both the analog and reference inputs simplifies external drive requirements.

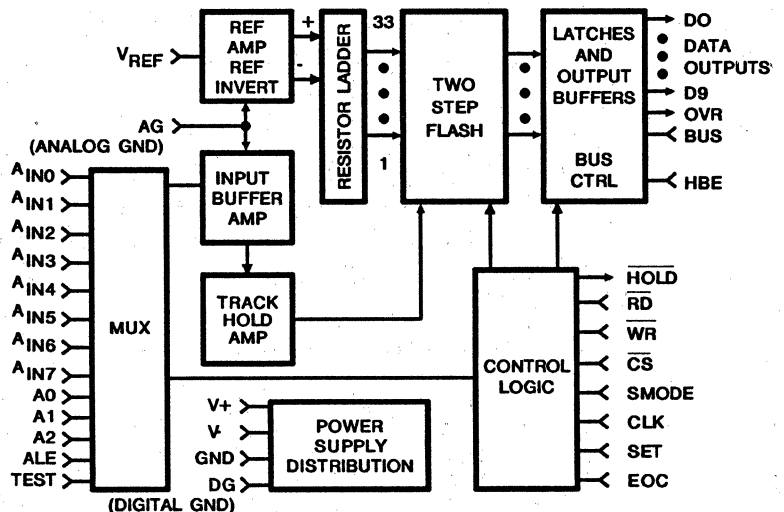
Ordering Information

PART NO.	LINEARITY (MAX ILE)	TEMP. RANGE	PACKAGE
HI3-7153J-6	± 1.0 LSB	0 to +75°C	40 Pin Plastic DIP
HI3-7153K-6	± 0.5 LSB	0 to +75°C	40 Pin Plastic DIP
HI3-7153A-9	± 1.0 LSB	-40 to +85°C	40 Pin Plastic DIP
HI3-7153B-9	± 0.5 LSB	-40 to +85°C	40 Pin Plastic DIP

Pinout



Functional Diagram



NOTE: All typical values have been characterized but are not tested.
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High Slew Rate Operational Amplifier

May 1990

Features

- Unity Gain Bandwidth300MHz
- Full Power Bandwidth 22MHz
- High Slew Rate 420V/ μ s
- High Output Drive \pm 50mA
- Monolithic Bipolar Construction

Applications

- RF/IF Processors
- Video Amplifiers
- Radar Systems
- Pulse Amplifiers
- High Speed Communications
- Fast Data Acquisition Systems

Description

The HFA-0005 is an all bipolar op amp featuring high slew rate (420V/ μ s), and high unity gain bandwidth (300MHz). These features combined with fast settling time (20ns) make this product very useful in high speed data acquisition systems as well as RF, video, and pulse amplifier designs.

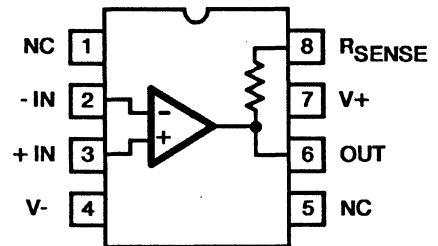
Other outstanding characteristics include low bias currents (15 μ A), low off-set current (6 μ A), and low offset voltage (6mV). These high performance characteristics are achieved with only 40mA of supply current.

The HFA-0005 offers high performance at low cost. It can replace hybrids and RF transistor amplifiers, simplifying designs while providing increased reliability due to monolithic construction. To enhance the ease of design, the HFA-0005 has a 50 Ω \pm 20% resistor connected from the output of the op amp to a separate pin. This can be used when driving 50 Ω strip line, microstrip, or coax cable.

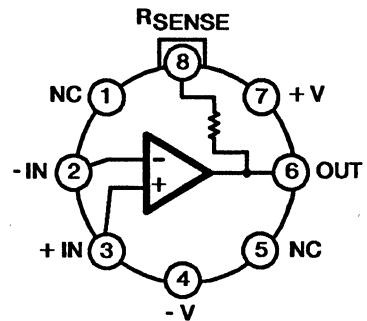
The performance of the HFA-0005-9 is guaranteed from -40 $^{\circ}$ C to +85 $^{\circ}$ C, while the HFA-0005-5 is guaranteed from 0 $^{\circ}$ C to +75 $^{\circ}$ C. The HFA-0005 is available in 8 pin SOIC, 8 pin Sidebraze, 8 pin Epoxy Mini-Dip, and 8 pin TO-99 Metal Can packages. For MIL-STD-883 compliant product and Ceramic LCC package consult the HFA-0005/883 datasheet.

Pinouts

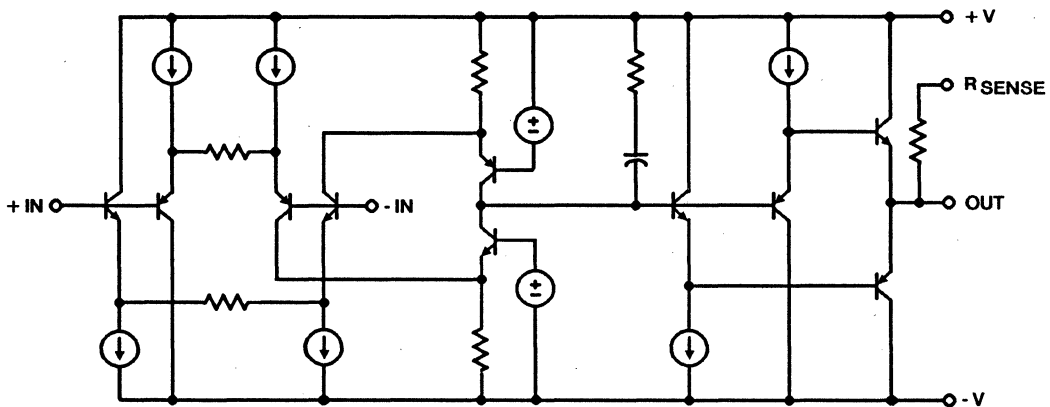
HFA9P0005-5/-9 (SOIC)
 HFA7-0005-5/-9
 (CERAMIC SIDEBRAZE DIP)
 HFA3-0005-5/-9 (PLASTIC MINI-DIP)
 TOP VIEW



HFA2-0005 (TO-99 METAL CAN)
 TOP VIEW



Simplified Schematic



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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Harris Semiconductor

May 1990

Features

- Wide Gain Bandwidth Product 1GHz
- High Slew Rate 250V/ μ s
- High Open Loop Gain 105V/mV
- Low Offset Voltage 0.45mV
- Low Power Consumption 143mW
- Low Input Voltage Noise @ 1KHz 2.7nV/ $\sqrt{\text{Hz}}$
- Monolithic Construction

Applications

- RF/IF Processors
- Video Amplifiers
- Radar Systems
- Pulse Amplifiers
- High Speed Communications
- Fast Data Acquisition Systems

Description

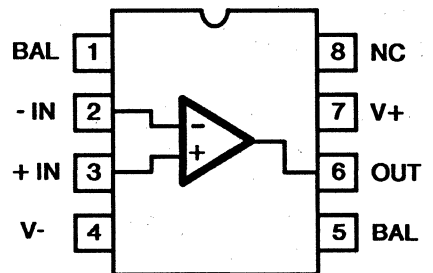
The HFA-0002 is a very wideband, high slew rate, op amp, featuring precision DC characteristics. Stable in gains of 10 or greater this all bipolar op amp offers a combination of AC and DC performance never seen before in monolithic form.

The high gain bandwidth product (1GHz) and high slew rate (250V/ μ s) make this op amp ideal for use in video and RF circuits. The low offset voltage (0.45mV), low bias current (0.23 μ A), and low voltage noise (2.7nV/ $\sqrt{\text{Hz}}$) specifications combined with the excellent AC characteristics make this op amp ideal for high speed data acquisition systems with high accuracy.

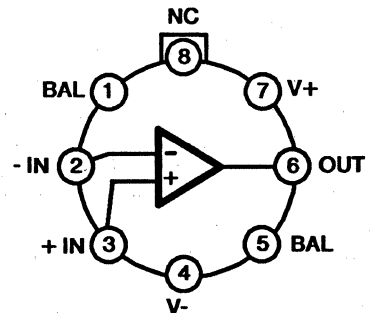
The HFA-0002-9 operates over the -40°C to +85°C temperature range, while the HFA-0002-5 operates over 0°C to +75°C. The HFA-0002 is available in 8 pin SOIC, 8 pin Ceramic Sidebrazed DIP, 8 pin Plastic DIP, and 8 pin TO-99 Metal Can packages. For MIL-STD-883 compliant product and Ceramic LCC package consult the HFA-0002/883 datasheet.

Pinouts

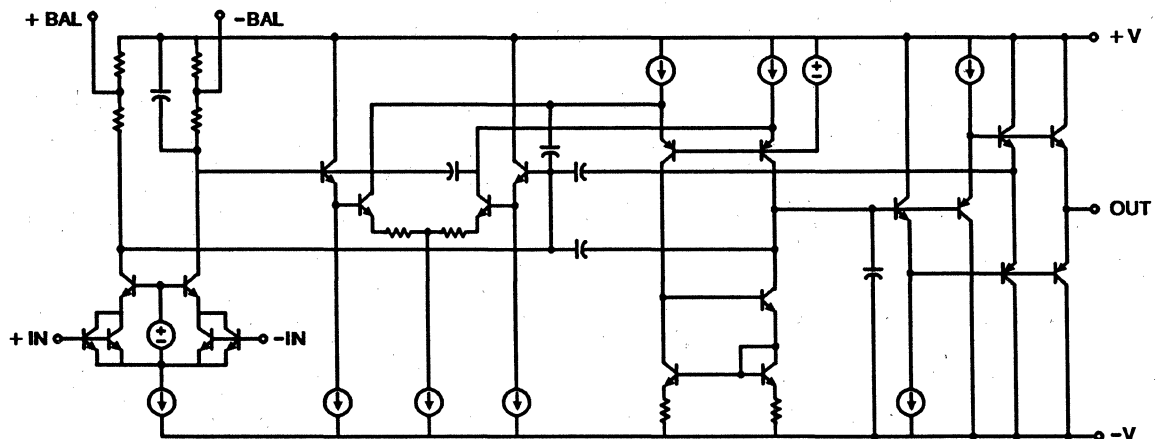
HFA9P0002-5/-9 (SOIC)
HFA7-0002-5/-9
(CERAMIC SIDEBRAZE DIP)
HFA3-0002-5/-9 (PLASTIC MINI-DIP)
TOP VIEW



HFA2-0002-5/-9 (TO-99 METAL CAN)
TOP VIEW



Simplified Schematic



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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Harris Semiconductor

May 1990

Features

- Unity Gain Bandwidth 350MHz
- Full Power Bandwidth 53MHz
- High Slew Rate 1000V/ μ s
- High Output Drive \pm 50mA
- Monolithic Construction

Applications

- RF/IF Processors
- Video Amplifiers
- High Speed Cable Drivers
- Pulse Amplifiers
- High Speed Communications
- Fast Data Acquisition Systems

Description

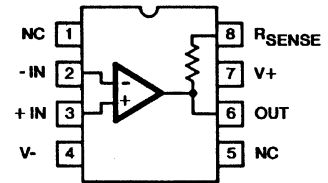
The HFA-0001 is an all bipolar op amp featuring high slew rate (1000V/ μ s), and high unity gain bandwidth (350MHz). These features combined with fast settling time (25ns) make this product very useful in high speed data acquisition systems as well as RF, video, and pulse amplifier designs. Other outstanding characteristics include low bias currents (15 μ A), low offset current (18 μ A), and low offset voltage (6mV).

The HFA-0001 offers high performance at low cost. It can replace hybrids and RF transistor amplifiers, simplifying designs while providing increased reliability due to monolithic construction. To enhance the ease of design, the HFA-0001 has a 50 Ω \pm 20% resistor connected from the output of the op amp to a separate pin. This can be used when driving 50 Ω strip line, microstrip, or coax cable.

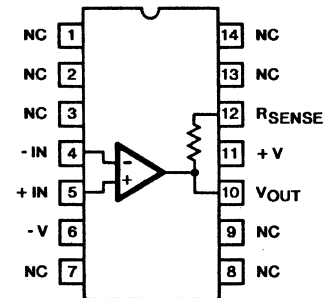
The performance of the HFA-0001-9 is guaranteed from -40 $^{\circ}$ C to +85 $^{\circ}$ C, while the HFA-0001-5 is guaranteed from 0 $^{\circ}$ C to +75 $^{\circ}$ C. The HFA-0001 is available in 8 pin SOIC, 8 pin Plastic Mini-Dip and 14 pin Sidebraze packages. For MIL-STD-883 compliant product and Ceramic LCC package consult the HFA-0001/883 datasheet.

Pinouts

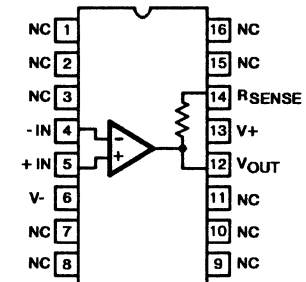
HFA3-0001-5 (PLASTIC MINI-DIP)
TOP VIEW



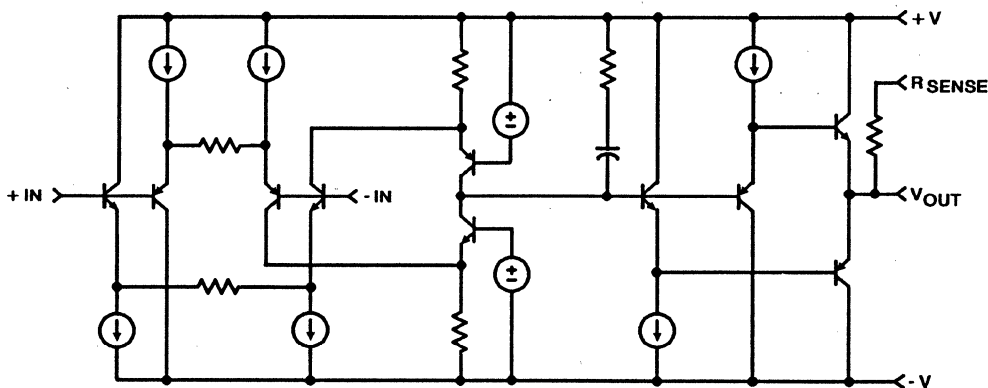
HFA1-0001-5/-9 (CERAMIC SIDEBRAZE DIP)
TOP VIEW



HFA9P0001-5/-9 (SOIC)
TOP VIEW



Simplified Schematic



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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PRELIMINARY

August 1990

Digital Decimation Filter

Features

- 35MHz Input clock rate
- 16 bit Inputs (2's complement)
- 24 bit Outputs (2's complement)
- Programmable decimation up to 16,384
- Out of Band attenuation up to 96 dB
- 84-pin PGA
- Low power CMOS

Applications

- Communications
- Instrumentation
- RADAR
- SONAR
- Large Order Sample Rate Reduction
- Narrow Band Filtering

Description

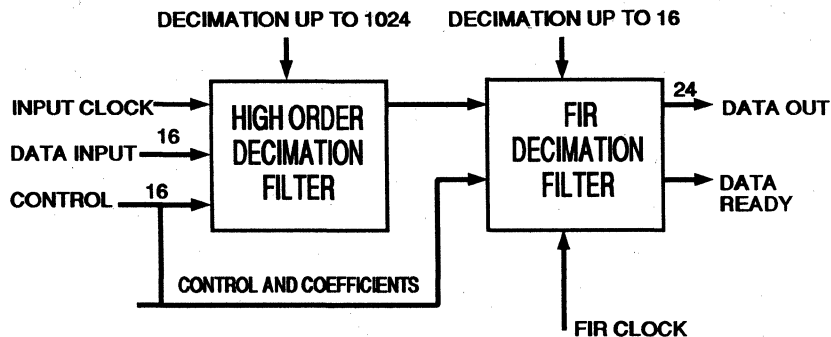
The Harris HSP43220 Digital Decimation Filter is a linear phase low pass decimation filter which is optimized for filtering narrow band signals in a broad spectrum of signal processing applications. The HSP43220 offers a single chip solution to signal processing applications which have historically required several boards of IC's. This reduction in component count requirements results in faster development times as well as reduction of hardware costs.

The HSP43220 is implemented in a two stage filter structure. As seen in the block diagram, the first stage is a high order decimation filter (HDF) which utilizes an efficient decimation (sample rate reduction) technique to obtain decimation up to 1024 through a coarse low-pass filtering process. The HDF provides up to 96 dB aliasing rejection in the signal passband. The second stage consists of a finite impulse response decimation filter (FDF) structured as a transversal FIR filter with up to 512 symmetric taps which can implement filters with sharp transition regions. The FDF can perform further decimation by up to 16 if required while preserving the 96 dB aliasing attenuation obtained by the HDF. The combined total decimation capability is 16,384.

The HSP43220 accepts 16 bit parallel data in 2's complement format at sampling rates up to 35 MSPS. It provides a microprocessor compatible interface to simplify the task of programming and three-state outputs to allow the connection of several IC's to a common bus. The HSP43220 also provides the capability to bypass either the HDF or the FDF for additional flexibility.

Harris Semiconductor

Block Diagram



CAUTION: These devices are sensitive to electrostatic discharge. Proper IC handling procedures should be followed.
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PRELIMINARY

August 1990

Numerically Controlled Oscillator/Modulator

Features

- NCO and CMAC on one chip
- 15,25.6,33 MHz versions
- 32-bit frequency control
- 16-bit phase modulation
- 16-bit CMAC
- < .01 Hz tuning resolution at 30 MHz
- Spurious frequency components < -90 dBc
- Fully static CMOS
- 144-pin PGA

Applications

- Frequency Synthesis
- Modulation — AM, FM, PSK, FSK, QAM
- Demodulation, PLL
- Phase Shifter
- Fast Fourier Transforms (FFT)

Description

The Harris HSP45116 combines a high performance quadrature numerically controlled oscillator (NCO) and a high speed 16 bit complex multiplier/accumulator (CMAC) on a single IC. This combination of functions allows a complex vector to be rotated by the internally generated (cos, sin) vector for quadrature modulation and demodulation.

As shown in the block diagrams, the HSP45116 is divided into three main sections. The Phase/Frequency Control Section and the sin/cos ROM section together form a quadrature NCO. The CMAC section multiplies the output of the ROM section with an external complex vector.

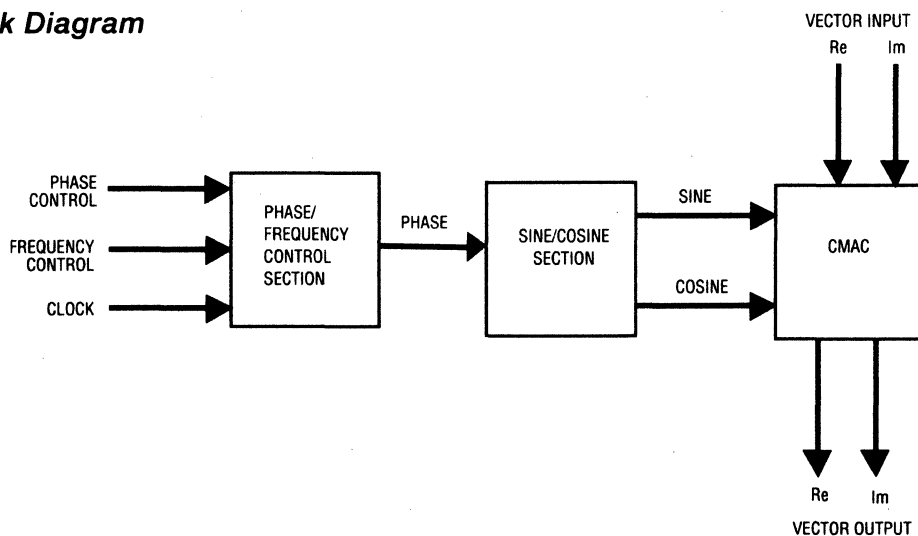
The input frequency control section has 32 bits which results in frequency resolution better than .01 Hz at 33 Mhz. The output (cos,sin) vector from the ROM section is one of the inputs to the CMAC section. The error in the sinusoidal vector is less than -90 dB. The CMAC section multiplies this (cos, sin) vector by an external complex vector and can accumulate the result. The Resulting complex vectors are available through two 20 bit output ports.

A quadrature down-converter can be implemented by loading a LO frequency into the phase/frequency control section. The data to be down converted is the external vector input into the CMAC. The resulting complex output is the down-converted signal.

Additional circuitry is included in the CMAC section to support Radix-2 decimation in frequency FFT butterflies.

Harris Semiconductor

Block Diagram



CAUTION: These devices are sensitive to electrostatic discharge. Proper IC handling procedures should be followed.
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File Number **2485**

September 1990

3 x 3 Image Filter

Features

- DC to 30MHz Clock Rate
- Configurable for 1-D and 2-D Correlation/Convolution.
- Dual Coefficient Mask Registers, Switchable in a Single Clock Cycle
- Two's Complement or Unsigned 8-Bit Input Data and Coefficients
- 20 Bit Extended Precision Output
- Standard μ P Interface
- TTL Compatible Inputs/Outputs
- Low Power CMOS
- Available in 68 Pin PGA and PLCC Packages

Applications

- Image Filtering
- Edge Detection/Enhancement
- Pattern Matching
- Real Time Video Filters

Description

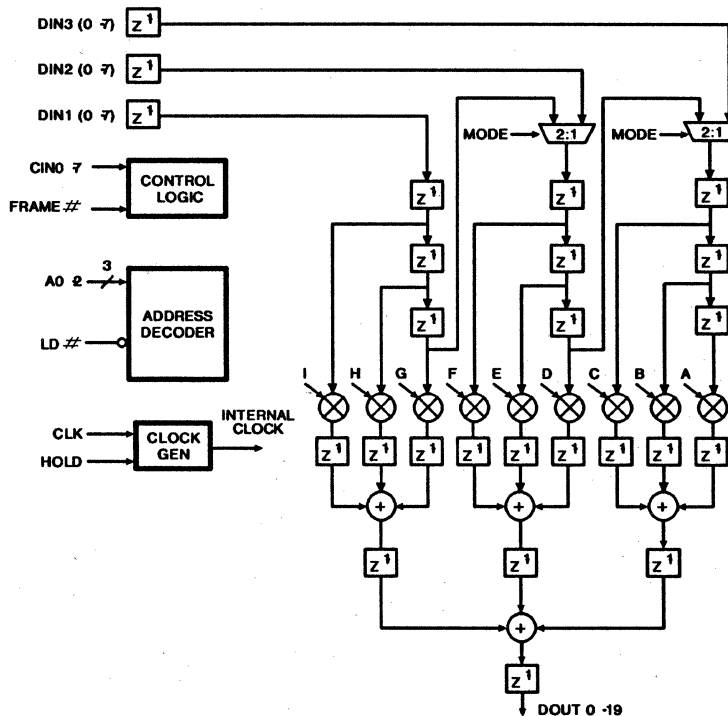
The Harris HSP48901 is a high speed 9-Tap FIR Filter which utilizes 8-bit wide data and coefficients. It can be configured as a one dimensional (1-D) 9-Tap filter for a variety of signal processing applications, or as a two dimensional (2-D) filter for image processing. In the 2-D configuration, the device is ideally suited for implementing 3 x 3 kernel convolution. The 30MHz clock rate allows a large number of image sizes to be processed within the required frame time for real-time video.

Data is provided to the HSP48901 through the use of programmable data buffers such as the HSP9500 or any other programmable shift register. Coefficient and pixel input data are 8-bit signed or unsigned integers, and the 20 bit extended output guarantees no overflow will occur during the filtering operation.

There are two internal register banks for storing independent 3 x 3 filter kernels, thus facilitating the implementation of adaptive filters and multiple filter operations on the same data.

The configuration of the HSP48901 Image Filter is controlled through a standard microprocessor interface and all inputs and outputs are TTL compatible. The HSP48901 is available in 68 pin PGA and PLCC packages.

Block Diagram



CAUTION: Electronic devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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 File Number **2459**

December 1990

Two Dimensional Convolver

Features

- Single Chip 3x3 Kernel Convolution
- Programmable On-chip Row Buffers
- DC to 32 MHz Clock Rate
- Cascadable for Larger Kernels and Images
- On-Chip 8-Bit ALU
- Dual Coefficient Mask Registers, Switchable in a Single Clock Cycle
- 8-Bit Signed or Unsigned Input and Coefficient Data
- 20 Bit Extended Precision Output
- Standard μ P Interface
- TTL Compatible Inputs/Outputs
- Low Power CMOS
- Available in 84 Pin PGA and PLCC Packages

Applications

- Image Filtering
- Edge Detection
- Adaptive Filtering
- Real Time Video Filters
- Image Warping

Description

The Harris HSP48908 is a high speed Two Dimensional Convolver which provides a single chip implementation of a video data rate 3 x 3 kernel convolution on two dimensional data. It eliminates the need for external data storage through the use of the on-chip row buffers which are programmable for row lengths up to 1024 pixels.

There are internal register banks for storing two independent 3 x 3 filter kernels, thus facilitating the implementation of adaptive filters and multiple filter operations on the same data. The pixel data path also includes an on-chip ALU for performing real-time arithmetic and logical pixel point operations.

Data is provided to the HSP48908 in a raster scan non-interlaced fashion, and is internally buffered on images up to 1024 pixels wide for the 3 x 3 convolution operation. Images with larger rows and convolution with larger kernel sizes can be accommodated by using external row buffers and/or multiple HSP48908s. Coefficient and pixel input data are 8-bit signed or unsigned integers, and the 20 bit convolver output guarantees no overflow for kernel sizes up to 4 x 4. Larger kernel sizes can be implemented however, since the filter coefficients will normally be less than their maximum 8-bit values.

The HSP48908 is manufactured using an advanced CMOS process, and is a low power fully static design. The configuration of the device is controlled through a standard microprocessor interface and all inputs/outputs are TTL compatible. The 2-D convolver is available in 84 pin PGA and PLCC packages.

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HYUNDAI PRODUCT AVAILABILITY

DEVICE	DESCRIPTION	PART NO.	PACKAGE OPTIONS	ACCESS TIMES (NS)	OPERATING CURRENT		STANDBY CURRENT		PRODUCTION
					Icc (Max, mA)	Isb (MAX, mA)			
						STB	LOW		
SRAM	2K x 8	HY6116A	DIP	85/100/120/150	60	50	0.002	NOW	
	8K x 8	HY6264	DIP SOP	85/100/120/150	50	2	0.1	NOW	
	32K x 8	HY62C256	DIP SOP	100/120/150	70	1	0.1	NOW	
	32K x 8, FAST	HY62C256A	DIP, SOP	70/85/100/120	70	1	0.1	Q4'90 OR, Q1'91	
	128K x 8	HY63C256	DIP SOP	25/35/45/55	100/95	2	0.1	Q3'91	
	128K x 8	HY62C1000	DIP, SOP	70/85	80	15	0.1	Q4'91	
DRAM	256K x 1, FAST PAGE	HY53C256	DIP PLCC	70/85/100/120	70/60/50/45	3	2	NOW NOW	
	64K x 4, FAST PAGE	HY53C464	DIP PLCC	70/80/100/120	70/60/50/45	3	2	NOW NOW	
	1M x 1, FAST PAGE	HY51C1000	DIP SOJ	80/100/120	95/75/70	2.5	-	NOW NOW	
	256K x 4, FAST PAGE	HY51C4256	DIP SOJ	80/100/120	95/75/70	2.5	-	NOW NOW	
	1M x 1, FAST PAGE	HY53C1000	DIP SOJ	70/80/100	80/70/60	2		Q1'91	
	256K x 4, FAST PAGE	HY53C4256	DIP SOJ	70/80/100	80/70/60	2		Q1'91	
EEPROM	1K SERIAL (64 x 16)	HY93C46	DIP, SOIC	250 KHz	3	1		NOW	
EEPLD	10 INPUT 8 I/O 8 REGISTERS	HY18CV8	DIP	25/30/35	41 (10 MHz)	20		NOW	
	12 INPUT 10 I/O	HY22CP210	DIP	30/35/40	45 (10 MHz)	35		NOW	

Hyundai

DEVICE	DESCRIPTION	PART NO.	COMPLEXITY (GATE)	USABLE GATE	GATE SPEED TYPE (NS)	I/O PADS MAX	PACKAGE OPTION	PRODUCTION
ASIC	CHANNELED GATE ARRAY	HGA7000	880 10013	UP TO 7,000	1.4	218	DIP/PLCC/ LCC/QFP/PGA	NOW
	SEA OF GATE	HSG10K	31680 215364	UP TO 85,000	0.5	348		NOW

HYUNDAI ELECTRONICS AMERICA

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32K x 8 Static RAM

Key Parameters S32K8 and S32K8L	Device Types				Unit
	55IC 55CC	70MC 70IC 70CC	85MC 85IC 85CC	100MC 100IC	
Access Time	55	70	85	100	nS
Cycle Time	55	70	85	100	nS
Output Enable Access	20	25	30	50	nS

Features

- S32K8L is compliant to DESC Standardized Military Drawing 5962-88552 (Standard power part compliant to 5962-88662)
- 2.0V Low-Power Data Retention Option (S32K8L)
- Military, industrial, and commercial temperature range
- Military grades compliant to MIL-STD-883C
- 28 pin JEDEC standard pinout

General Description

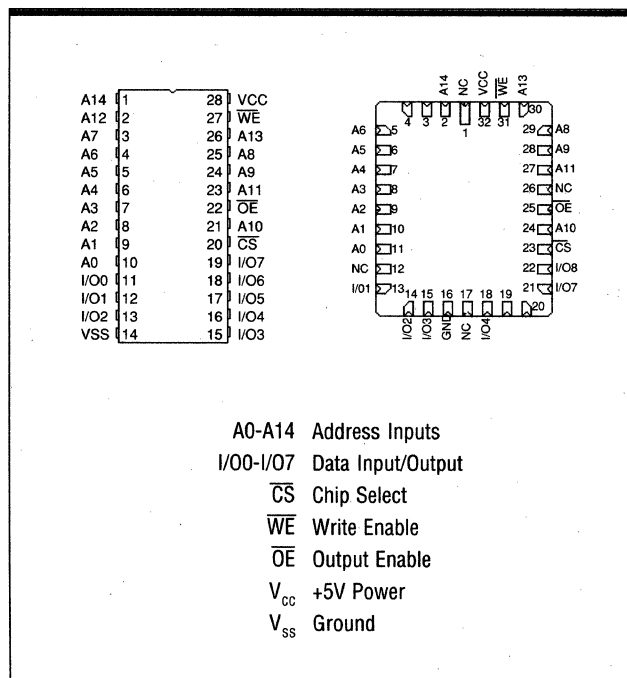
The Inova S32K8 is a high performance 256K bit Static Random Access Memory (SRAM), organized as 32K eight bit bytes.

The S32K8 is manufactured using a highly reliable, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs and outputs are fully TTL compatible. Operation is fully static, so there is no need for extra control logic to generate clocks and timing strobes.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are produced in the same production line which ensures that they are also of the highest quality.

Package Options



Inova Microelectronics

Memory Scale

Access Time	55	70	85	100	Unit
S32K8	4.7	3.7	3.0	2.6	kbits/ns

Truth Table

Mode	CS	OE	WE	I/O Operation	Supply Current
Standby	H	X	X	High Z	I_{SB}/I_{FSB}
Read	L	L	H	Output	I_{CC2}
Write	L	X	L	Input	I_{CC2}
Output Disable	L	H	H	High Z	I_{CC2}



128K x 8 Static RAM

Key Parameters S128K8 and S128K8L	Device Types							Unit
	25C	35M 35I 35C	45M 45I 45C	55M 55I 55C	70M 70I 70C	85M 85I 85C	100M 100I 100C	
Access Time	25	35	45	55	70	85	100	nS
Cycle Time	25	35	45	55	70	85	100	nS
Output Enable Access	10	15	15	20	25	30	50	nS

Features

- 32 pin DIP, LCC, SOJ, Flatpack
- Advanced 4-T CMOS technology
- S128K8 is compliant to DESC Standardized Military Drawing No. 5962-89598
- 300 mil DIP for 25, 35, 45 ns parts
- Military, industrial, and commercial temperature range
- Military grades compliant to MIL-STD-883C

General Description

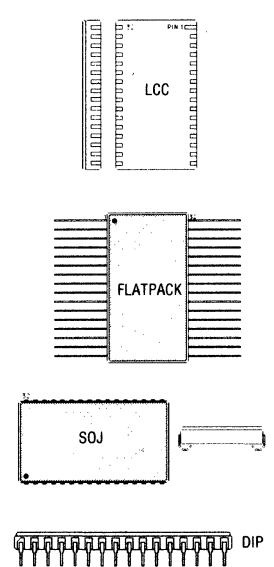
The Inova S128K8 is a high performance one megabit Static Random Access Memory (SRAM) organized as 128K eight-bit bytes.

The S128K8 is manufactured using a highly reliable, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs are fully TTL-compatible. Operation is fully static, without need for extra control logic to generate clock signals.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are fabricated in the same production line which assures that they are also of the highest quality.

Package Options Pinout



1	NC	32	VCC
2	A16	31	A15
3	A14	30	NC
4	A12	29	WE
5	A7	28	A13
6	A6	27	A8
7	A5	26	A9
8	A4	25	A11
9	A3	24	OE
10	A2	23	A10
11	A1	22	CS
12	A0	21	I/O7
13	I/O0	20	I/O6
14	I/O1	19	I/O5
15	I/O2	18	I/O4
16	VSS	17	I/O3

A0-A16 Address Inputs
I/O0-I/O7 Data Input/ Output
WE Write Enable
OE Output Enable
CS Chip Select
VCC +5V Power
VSS Ground

Inova Microelectronics

Memory Scale

Access Time	25	35	45	55	70	85	100	Unit
S128K8	40	29	22	18	14	11	10	kbits/ns

Truth Table

Mode	CS	OE	WE	I/O Operation	Supply Current
Standby	H	X	X	High Z	I _{SB} /I _{FSB}
Read	L	L	H	Output	I _{CC2}
Write	L	X	L	Input	I _{CC2}
Output Disable	L	H	H	High Z	I _{CC2}



128K x 8 Static RAM

Key Parameters S128K8T and S128K8TL	Device Types							Unit
	25C	35M 35I 35C	45M 45I 45C	55M 55I 55C	70M 70I 70C	85M 85I 85C	100M 100I 100C	
Access Time	25	35	45	55	70	85	100	nS
Cycle Time	25	35	45	55	70	85	100	nS
Output Enable Access	10	15	15	20	25	30	50	nS

Features

- Two Chip Selects for Increased Flexibility
- Fully static 128Kx8 SRAM
- Advanced 4-T CMOS technology
- 32 pin DIP, LCC, SOJ, and Flatpack
- 300 mil DIP for 25, 35, 45 ns parts
- Military, industrial, and commercial temperature range
- Military grades compliant to MIL-STD-883C

General Description

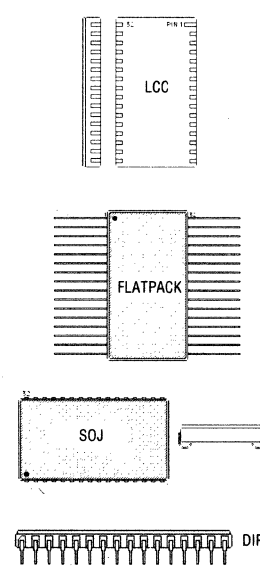
The Inova S128K8T is a high performance one megabit Static Random Access Memory (SRAM) organized as 128K eight-bit bytes.

The S128K8T is manufactured using a highly reliable, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs are fully TTL-compatible. Operation is fully static, without need for extra control logic to generate clock signals.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are fabricated in the same production line which assures that they are also of the highest quality.

Package Options Pinout



1	NC	32	VCC
2	A16	31	A15
3	A14	30	CS2
4	A12	29	WE
5	A7	28	A13
6	A6	27	A8
7	A5	26	A9
8	A4	25	A11
9	A3	24	OE
10	A2	23	A10
11	A1	22	CS1
12	A0	21	I/O7
13	I/O0	20	I/O6
14	I/O1	19	I/O5
15	I/O2	18	I/O4
16	VSS	17	I/O3

A0-A16 Address Inputs
I/O0-I/O7 Data Input/Output
WE Write Enable
OE Output Enable
CS1 Chip Select 1
CS2 Chip Select 2
VCC +5V Power
VSS Ground

Memory Scale

Access Time	25	35	45	55	70	85	100	Unit
S128K8	40	29	22	18	14	11	10	kbits/ns

Truth Table

Mode	CS1	CS2	OE	WE	I/O Operation	Supply Current
Standby	H	X	X	X	High Z	I _{SB} /I _{FSB}
Standby	X	L	X	X	High Z	I _{SB} /I _{FSB}
Read	L	H	L	H	Output	I _{CC2}
Write	L	H	X	L	Input	I _{CC2}
Output Disable	L	H	H	H	High Z	I _{CC2}



64K x 16 Static RAM

Key Parameters S64K16 and S64K16L	Device Types						Unit
	45CC	55MC 55 IC 55 CC	70 MC 70 IC 70 CC	85 MC 85 IC 85 CC	100 MC 100 IC 100 CC	120 MC 120 IC	
Access Time	45	55	70	85	100	120	nS
Cycle Time	45	55	70	85	100	120	nS
Output Enable Access	20	20	25	30	50	50	nS

Features

- Monolithic 64K x 16 SRAM
- Advanced 4-T CMOS technology
- 40 pin JEDEC standard pinout
- S64K16 is compliant to DESC Standardized Military Drawing No. 5962-90858
- Military, industrial, and commercial temperature range
- Military grade compliant to MIL-STD-883C
- 2.0V Low-Power Data Retention Option (S64K16L)

General Description

The Inova S64K16 is a high performance one megabit Static Random Access Memory (SRAM), organized as 64K sixteen-bit bytes.

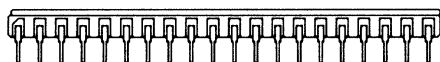
The S64K16 is manufactured using a highly re-liaible, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs and outputs are fully TTL compatible. Operation is fully static, so there is no need for extra control logic to generate clocks and timing strobes.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are produced in the same production line which ensures that they are also of the highest quality.

Pinout / Package Options

1	A15	40	VCC	A0-A15 Addresses I/O0-I/O15 Data Input/Output CS Chip Select WE Write Enable OE Output Enable UB Upper Byte Control LB Lower Byte Control VCC Power GND Ground
2	CS	39	WE	
3	I/O15	38	UB	
4	I/O14	37	LB	
5	I/O13	36	A14	
6	I/O12	35	A13	
7	I/O11	34	A12	
8	I/O10	33	A11	
9	I/O9	32	A10	
10	I/O8	31	A9	
11	GND	30	GND	
12	I/O7	29	A8	
13	I/O6	28	A7	
14	I/O5	27	A6	
15	I/O4	26	A5	
16	I/O3	25	A4	
17	I/O2	24	A3	
18	I/O1	23	A2	
19	I/O0	22	A1	
20	OE	21	A0	



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Truth Table

Mode	CS	UB	LB	OE	WE	I/O Operation	Supply Current
Standby	H	X	X	X	X	High Z	I _{SB}
Standby	L	H	H	X	X	High Z	I _{SB}
Standby	≥ V _{CC} - 0.2 V	≥ V _{CC} - 0.2 V	≥ V _{CC} - 0.2 V	X	X	High Z	I _{FSB}
Read	L	L	L	L	H	Data Out	I _{CC2}
Write	L	L	L	X	L	Data In	I _{CC2}

Memory Scale

Access Time	55	70	85	100	120	Unit
S64K16	18	14	12	10	8	kbits/ns



1M x 1 Static RAM

Key Parameters S1M1 and S1M1L	Device Types			Unit
	25C	35M 35I 35C	45M 45I 45C	
Access Time	25	35	45	nS
Cycle Time	25	35	45	nS
Output Enable Access	10	15	20	nS

Features

- 300 mil 28 pin DIP
- Advanced 4-T CMOS technology
- SOJ, LCC, and Flatpack Available
- Military, industrial, and commercial temperature range
- Military grades compliant to MIL-STD-883C

Inova Microelectronics

General Description

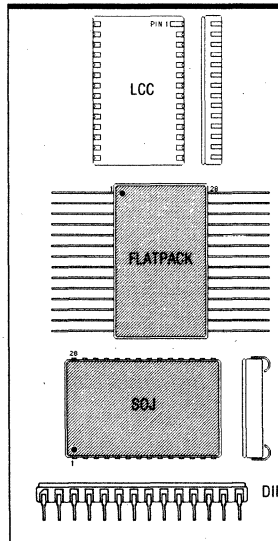
The Inova S1M1 is a high performance one megabit Static Random Access Memory (SRAM) organized as 1,024 K by one bit.

The S1M1 is manufactured using a highly reliable, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs are fully TTL-compatible. Operation is fully static, without need for extra control logic to generate clock signals.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are fabricated in the same production line which assures that they are also of the highest quality.

Package Options



Pinout

1	A9	28	VCC
2	A8	27	A1
3	A7	26	A11
4	A6	25	A12
5	A5	24	A13
6	A4	23	A14
7	NC	22	A15
8	A3	21	NC
9	A2	20	A16
10	A1	19	A17
11	A0	18	A18
12	D-OUT	17	A19
13	WE	16	D-IN
14	VSS	15	CS

- A0-A19 Address Inputs
- D-In Data Input
- D-Out Data output
- WE Write Enable
- CS Chip Select
- VCC +5V Power
- VSS Ground

Memory Scale

Access Time	25	35	45	Unit
S1M1	40	29	22	kbits/ns

Truth Table

Mode	CS	WE	I/O Operation	Supply Current
Standby	H	X	High Z	$I_{SB} - I_{FSR}$
Read	L	H	Data Out	I_{CC}
Write	L	L	Input	I_{CC}



512K x 8 Static RAM

Key Parameters S512K8 and S512K8L	Device Types			Unit
	45CC	55MC 55IC 55CC	70MC 70IC 70CC	
Access Time	45	55	70	nS
Cycle Time	45	55	70	nS
Output Enable Access	25	30	35	nS

Features

- Advanced 4-T CMOS technology
- 32 pin 600 mil DIP
- Monolithic
- Military, industrial, and commercial temperature range
- Military grades compliant to MIL-STD-883C

General Description

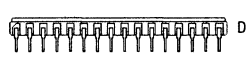
The Inova S512K8 is a high performance four megabit Static Random Access Memory (SRAM) organized as 512K eight-bit bytes.

The S512K8 is manufactured using a highly reliable, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs are fully TTL-compatible. Operation is fully static, without need for extra control logic to generate clock signals.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are fabricated in the same production line which assures that they are also of the highest quality.

Package Options Pinout



1	A18	32	VCC
2	A16	31	A15
3	A14	30	A17
4	A12	29	WE
5	A7	28	A13
6	A6	27	A8
7	A5	26	A9
8	A4	25	A11
9	A3	24	OE
10	A2	23	A10
11	A1	22	CS
12	A0	21	I/O7
13	I/O0	20	I/O6
14	I/O1	19	I/O5
15	I/O2	18	I/O4
16	VSS	17	I/O3

A0-A17 Address Inputs
I/O0-I/O7 Data Input/ Output
WE Write Enable
OE Output Enable
CS Chip Select
VCC +5V Power
VSS Ground

Inova Microelectronics

Truth Table

Mode	CS	OE	WE	I/O Operation	Supply Current
Standby	H	X	X	High Z	I_{SB}/I_{FSB}
Read	L	L	H	Output	I_{CC2}
Write	L	X	L	Input	I_{CC2}
Output Disable	L	H	H	High Z	I_{CC2}

Memory Scale

Access Time	45	55	70	Unit
S512K8	89	73	57	kbits/ns



256K x 4 Static RAM

Key Parameters S256K4 and S256K4L	Device Types			Unit
	25C	35M 35I 35C	45M 45I 45C	
Access Time	25	35	45	nS
Cycle Time	25	35	45	nS
Output Enable Access	10	15	20	nS

Features

- 300 mil wide 28 pin DIP
- Advanced 4-T CMOS technology
- SOJ, LCC, and Flatpack Available
- Military, industrial, and commercial temperature range
- Military grades compliant to MIL-STD-883C

General Description

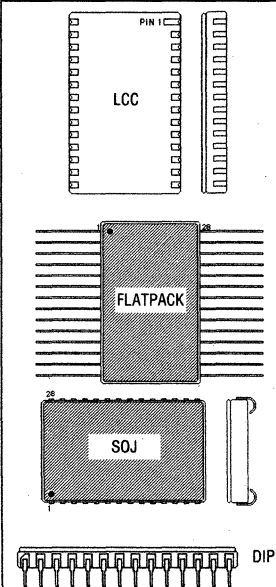
The Inova S256K4 is a high performance one megabit Static Random Access Memory (SRAM) organized as 256K by four bits.

The S256K4 is manufactured using a highly reliable, four transistor cell CMOS process. This provides a component which combines low active and standby power characteristics with high performance.

All inputs are fully TTL-compatible. Operation is fully static, without need for extra control logic to generate clock signals.

Every military grade device is fully compliant to MIL-STD-883C, paragraph 1.2.1. Industrial and commercial grade devices are fabricated in the same production line which ensures that they are also of the highest quality.

Package Options / Pinout



1	A10	28	VCC
2	A9	27	A11
3	A8	26	A12
4	A7	25	A13
5	A6	24	A14
6	A5	23	A15
7	A4	22	A16
8	A3	21	A17
9	A2	20	NC
10	A1	19	I/O3
11	A0	18	I/O2
12	CS	17	I/O1
13	OE	16	I/O0
14	VSS	15	WE

A0-A17 Address Inputs
I/O0-I/O7 Data Input/ Output
WE Write Enable
OE Output Enable
CS Chip Select
VCC +5V Power
VSS Ground

Memory Scale

Access Time	25	35	45	Unit
S256K4	40	29	22	kbits/ns

Truth Table

Mode	CS	OE	WE	I/O Operation	Supply Current
Standby	H	X	X	High Z	I _{SB} / I _{FSB}
Read	L	L	H	Output	I _{CC2}
Write	L	X	L	Input	I _{CC2}
Output Disable	L	H	H	High Z	I _{CC2}



16K x 32 Cache Memory and Controller

Features

- **Broad Spectrum of Microprocessor Support**
 - MC68040 Cache Burst Fill, Synchronous Operations to 33.3 MHz
 - MC68030 Cache Burst Fill, Synchronous, Asynchronous Operations to 33.3 MHz
 - MC68020 Operations to 33.3 MHz
 - Byte, Word, Three Byte and Long Word Writes
- **Flexible Cache Expansion and Mapping**
 - Integrates Complete Cache Function into a Single Device
 - 64K Byte Direct Mapping Cache
 - Full 32-bit Address Mapping Range
 - Multiple Cache Devices Supported
 - Maps Four Long Words per Tag Entry
 - Maps Four Gigabyte Address Space
- **Dual Bus Architecture Creates Very High Performance Systems**
 - C16K32 Placed Between CPU and System Bus Allows Concurrent Operations on Each Bus
 - System Bus Performs Independent Block Transfers of Sixteen Long Words
 - C16K32 Will Store Four Successive Writes Until System Bus Traffic Clears Up
 - Read Byte Word Tracking allows Caching of Byte or Word Devices
- **Versatile Internal Control Register Configures Cache**
 - Resettable During Operation or During Power Up
 - Sets Synchronous or Asynchronous Operation on CPU Bus
 - Permits or Inhibits Caching of References by Function Codes
 - Permits or Inhibits System Bus Watching (Snooping)
 - Permits or Inhibits Freezing Cache
 - Permits or Inhibits System Bus Block Transfers Mode of 4, 8, or 16 Long Words
 - Permits or Inhibits Burst Fill Operations from Cache to the CPU
 - Permits or Inhibits Write Posting
 - Includes Cache Inhibit for System Troubleshooting

General Description

The Inova C16K32 Cache Memory and Controller is a high performance 64K byte, direct mapping cache memory designed to improve the performance of systems utilizing the Motorola 68000 series of 32-bit microprocessors. The single chip architecture of the C16K32 incorporating the data RAM, valid RAM, tag RAM, and cache controller increases the system performance to a "near zero wait state," and reduces the overall chip count dramatically.

The C16K32 was designed with both performance and versatility in mind. It may be used in the normal three-cycle asynchronous operations of the MC68020 and MC68030, or the faster two-cycle synchronous operations of the MC68030 and MC68040. It services the MC68040 and 68030 CACHE BURST FILL request on a 2-1-1-1 cycle basis if the information is cached. The C16K32 will also allow the CPU direct access to the system bus whenever it receives a CACHE DISABLE, non-cacheable function code, or a reference that is not in the cache when the cache is frozen.



Digital Neural Network Processor

Features

- 64 Processor SIMD Architecture
- Vector Processing at Each Processor
- 25 MHz Clock Operation
- Fully Cascadable
- Single Clock Instruction Execution for Multiplication and Addition
- Hardware Support for Neural Algorithms
 - High Speed Digital Maximization System
 - Hardware Support for Functions such as One's Tally
- Emulates Thousands of Neurons in Arbitrary Configurations
- On-Chip Learning Architecture
- Vector Mode Support via Simultaneous Execution of Multiplication and Addition
- Virtual Processor Node Supported with Large Local Memory for Weight Storage, Independent Input/Output Connections
- Systolic Conductivity Supported for Nearest Neighbor Communication

General Description

The N64000 is a parallel ULSI execution engine for neural network algorithms. The device architecture consists of 64 separate processing nodes which can attain peak execution rates of 3.2 billion operations per second when functioning in vector operations. Any number of N64000's may be connected in parallel to attain a combined peak performance of 25.6 billion operations per second. The N64000 is controlled by an off-board sequencer driven by firmware.

Pin Identification

PNC(30:0)	PN Control Signals
IB(7:0)	Input bus
OB(7:0)	Output Bus
OBE	Output Bus Enable
RST	Reset Input
CLK2X	Clock Input (2X)
RFR	Refresh Input
PN0(3:0)	LSP Pathway
PN63(3:0)	MSP Pathway
PNID	PN 0 Identify
VCC	+5V Power
VSS	Ground

Absolute Maximum Ratings ⁽²⁾

Case Temperature Under Bias	-65°C to +110°C
Storage Temperature	-65°C to 150 °C
Supply Voltage ⁽¹⁾	-0.5 V to +6.5 V
Voltage on Any Other Pin	-0.5 V to $V_{cc}+5.5 V$

Notes:

1. All voltages referenced to V_{ss} (GND).
2. Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

28F020

2048K (256K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
 - 2 Second Typical Chip-Erase
- **Quick-Pulse Programming™ Algorithm**
 - 10 μ s Typical Byte-Program
 - 4 Second Chip-Program
- **10,000 Erase/Program Cycles Minimum**
- **12.0V \pm 5% V_{pp}**
- **High-Performance Read**
 - 150 ns Maximum Access Time
- **CMOS Low Power Consumption**
 - 10 mA Typical Active Current
 - 50 μ A Typical Standby Current
 - 0 Watts Data Retention Power
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
 - \pm 10% V_{CC} Tolerance
 - Maximum Latch-Up Immunity through EPI Processing
- **ETOX™ II Nonvolatile Flash Technology**
 - EPROM-Compatible Process Base
 - High-Volume Manufacturing Experience
- **JEDEC-Standard Pinouts**
 - 32-Pin Plastic Dip
 - 32-Lead PLCC
 - 32-Lead TSOP
- **Integrated Program/Erase Stop Timer**
(See Packaging Spec., Order #231369)

Intel's 28F020 CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F020 adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F020 increases memory flexibility, while contributing to time- and cost-savings.

The 28F020 is a 2048-kilobit nonvolatile memory organized as 262,144 bytes of 8 bits. Intel's 28F020 is offered in 32-pin plastic DIP, 32-lead PLCC, and 32-lead TSOP packages. Pin assignments conform to JEDEC standards for byte-wide EPROMs.

Extended erase and program cycling capability is designed into Intel's ETOX™ II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{pp} supply, the 28F020 performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming™ and Quick-Erase™ algorithms.

Intel's 28F020 employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 150 nanosecond access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 100 μ A translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from -1 V to V_{CC} + 1V.

With Intel's ETOX II process base, the 28F020 levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.



28F010 1024K (128K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
 - 1 Second Typical Chip-Erase
- **Quick-Pulse Programming™ Algorithm**
 - 10 μ s Typical Byte-Program
 - 2 Second Chip-Program
- **10,000 Erase/Program Cycles Minimum**
- **12.0V \pm 5% V_{pp}**
- **High-Performance Read**
 - 120 ns Maximum Access Time
- **CMOS Low Power Consumption**
 - 10 mA Typical Active Current
 - 50 μ A Typical Standby Current
 - 0 Watts Data Retention Power
- **Integrated Program/Erase Stop Timer**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
 - \pm 10% V_{CC} Tolerance
 - Maximum Latch-Up Immunity through EPI Processing
- **ETOX™ II Nonvolatile Flash Technology**
 - EPROM-Compatible Process Base
 - High-Volume Manufacturing Experience
- **JEDEC-Standard Pinouts**
 - 32-Pin Plastic Dip
 - 32-Lead PLCC
 - 32-Lead TSOP

(See Packaging Spec., Order # 231369)

Intel's 28F010 CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F010 adds electrical chip-erase and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F010 increases memory flexibility, while contributing to time- and cost-savings.

Intel

The 28F010 is a 1024-kilobit nonvolatile memory organized as 131,072 bytes of 8 bits. Intel's 28F010 is offered in 32-pin plastic dip or 32-lead PLCC and TSOP packages. Pin assignments conform to JEDEC standards for byte-wide EPROMs.

Extended erase and program cycling capability is designed into Intel's ETOX II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{pp} supply, the 28F010 performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming™ and Quick-Erase™ algorithms.

Intel's 28F010 employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 nanosecond access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 100 μ A translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

With Intel's ETOX II process base, the 28F010 levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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28F512 512K (64K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
 - 1 Second Typical Chip-Erase
- **Quick-Pulse Programming™ Algorithm**
 - 10 μ s Typical Byte-Program
 - 1 Second Chip-Program
- **10,000 Erase/Program Cycle Minimum**
- **12.0V \pm 5% V_{pp}**
- **High-Performance Read**
 - 120 ns Maximum Access Time
- **CMOS Low Power Consumption**
 - 10 mA Typical Active Current
 - 50 μ A Typical Standby Current
 - 0W Data Retention Power
- **Integrated Program/Erase Stop Timers**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
 - \pm 10% V_{CC} Tolerance
 - Maximum Latch-Up Immunity through EPI Processing
- **ETOX™ II Nonvolatile Flash Technology**
 - EPROM-Compatible Process Base
 - High-Volume Manufacturing Experience
- **JEDEC-Standard Pinouts**
 - 32-Pin Plastic Dip
 - 32-Lead PLCC

(See Packaging Spec., Order #231369)

Intel's 28F512 CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F512 adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F512 increases memory flexibility, while contributing to time- and cost-savings.

The 28F512 is a 512-kilobit nonvolatile memory organized as 65,536 bytes of 8 bits. Intel's 28F512 is offered in 32-pin plastic dip or 32-lead PLCC packages. Pin assignments conform to JEDEC standards for byte-wide EPROMs.

Extended erase and program cycling capability is designed into Intel's ETOX II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{pp} supply, the 28F512 performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming™ and Quick-Erase™ algorithms.

Intel's 28F512 employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 nanosecond access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 100 μ A translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to V_{CC} + 1V.

With Intel's ETOX II process base, the 28F512 levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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28F256A 256K (32K x 8) CMOS FLASH MEMORY

- Flash Electrical Chip-Erase
 - 1 Second Typical Chip-Erase
- Quick-Pulse Programming™ Algorithm
 - 10 μ s Typical Byte-Program
 - 0.5 Second Chip-Program
- 10,000 Erase/Program Cycles Minimum
- 12.0V \pm 5% V_{pp}
- High-Performance Read
 - 120 ns Maximum Access Time
- CMOS Low Power Consumption
 - 10 mA Typical Active Current
 - 50 μ A Typical Standby Current
 - 0 Watts Data Retention Power
- Integrated Program/Erase Stop Timer
- Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface
- Noise Immunity Features
 - \pm 10% V_{CC} Tolerance
 - Maximum Latch-Up Immunity through EPI Processing
- ETOX™ II Flash Nonvolatile Technology
 - EPROM-Compatible Process Base
 - High-Volume Manufacturing Experience
- JEDEC-Standard Pinouts
 - 32-Pin Cerdip
 - 32-Lead PLCC

(See Packaging Spec., Order #231369)

Intel's 28F256A CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F256A adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F256A increases memory flexibility, while contributing to time and cost savings.

The 28F256A is a 256-kilobit nonvolatile memory organized as 32,768 bytes of 8 bits. Intel's 28F256A is offered in 32-pin plastic dip and 32-lead PLCC. Pin assignments conform to JEDEC standards.

Extended erase and program cycling capability is designed into Intel's ETOX™ II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{pp} supply, the 28F256A performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming™ and Quick-Erase™ algorithms.

Intel's 28F256A employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 ns access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Typical standby current of 50 μ A translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

With Intel's ETOX II process base, the 28F256A levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

SM28F001AX

1 MBYTE (512K x 16) CMOS FLASH SIMM

- **High-Performance**
 - 120 ns Maximum Access Time
 - 16.67 MB/s Read Transfer Rate
- **10,000 Rewrite Cycles Minimum/Component**
- **Flash Electrical Chip-Erase**
 - 1 Second Typical Chip-Erase
- **16 μ s Typical Word Write**
 - Up to 1 Mb/s Write Transfer Rate
- **Inherent Non-volatility**
 - No Batteries or Disk Required for Back-up
 - 0W Data Retention Power
- **CMOS Low Power Consumption**
 - 20.3 mA Typical Active Current
 - 0.4 mA Typical Standby Current
- **Standard 80-Pin Insertable Module**
 - 0.050 Centerline Lead Spacing
 - Upgrade Path through 128M bytes
- **Hardware Presence Detect**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
 - $\pm 10\%$ V_{CC} Tolerance
 - Maximum Latch-Up Immunity Through EPI Processing
- **12.0V $\pm 5\%$ V_{pp}**
- **Integrated Program/Erase Stop Timer**
- **ETOX™ II Nonvolatile Flash Technology**
 - High-Volume Manufacturing Experience

Intel's SM28F001AX flash SIMM (Single In-Line Memory Module) is targeted at high-density read/write non-volatile memory. The SM28F001AX enables you to optimize board space; to offer incremental memory expansion similar to today's DRAM; and to assure continued access to today's and tomorrow's surface-mount technologies. Intel's SM28F001AX offers a reliable sold-state alternative for mass storage. The flash memory module is also ideal for high performance code and data storage as well as data recording and accumulation.

The SM28F001AX, composed of eight 1 Mb flash memories in plastic leaded chip carrier (N28F010), is organized as 524,288 words of 16 bits. The PLCCs are mounted, four to a side, together with 0.1 μ F decoupling capacitors on an 80-pin standard, low-profile module.

Extended erase and program cycling capability is designed into Intel's ETOX™ II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional nonvolatile memory.

Intel's SM28F001AX flash SIMM employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 ns access time provides no WAIT state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 0.8 mA translates into power savings when the memory module is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

27C040 4M (512K x 8) CHMOS EPROM

- JEDEC Approved EPROM Pinout
 - 32-Pin DIP
 - Simple Upgrade from Lower Densities
- Easy Upgrade Capability to 8 Mbit Density
- Versatile EPROM Features
 - CMOS and TTL Compatibility
 - Two Line Control
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Time as Fast as 60 Seconds
- High-Performance
 - 150 ns, $\pm 10\%$ V_{CC}
 - 50 mA I_{CC} Active

The Intel 27C040 is a 5V-only, 4,194,304-bit Erasable Programmable Read Only Memory, organized as 524,288 words of 8 bits each. It is pin compatible with lower density DIP EPROMs (JEDEC) and provides for simple upgrade to 8 Mbits in the future.

The 27C040 represents state-of-the-art 1 micron CMOS manufacturing technology while providing unequalled performance. Its 150 ns speed (T_{ACC}) offers no-wait-state operation with high performance CPUs in applications ranging from numerical control to office automation to telecommunications.

The 27C040 is equally at home in both a TTL or CMOS environment. It programs as fast as 60 seconds using Intel's industry leading Quick-Pulse Programming algorithm.

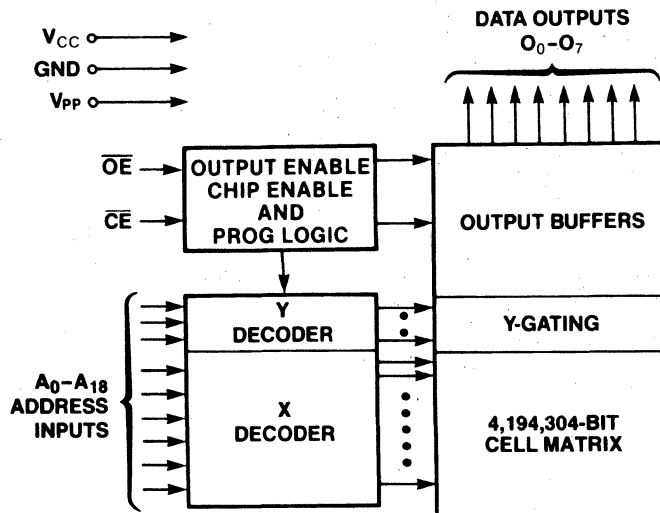


Figure 1. Block Diagram

290239-1

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27C400

4M (256K x 16 or 512K x 8) CHMOS EPROM

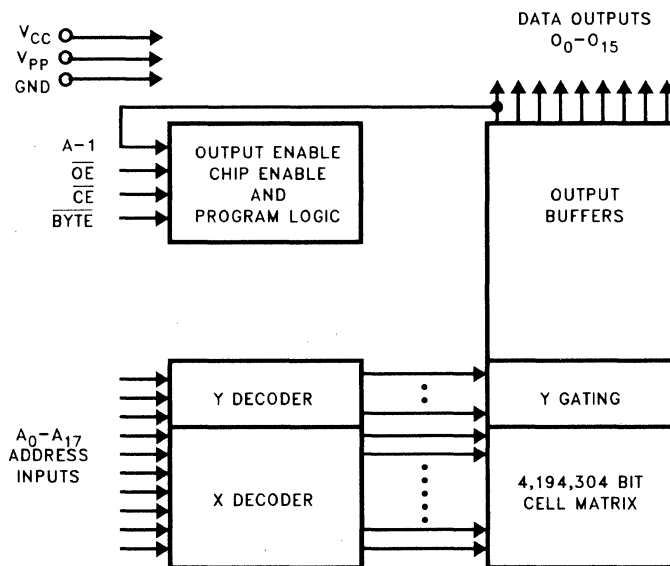
- **Word-Wide or Byte-Wide Configurable**
- **4M 40-Pin Mask ROM Compatible**
— 40-Pin CERDIP Package
- **Low Power Dissipation**
— 50 mA Max Active @ 5 MHz
— 100 μ A Max Standby
- **High Performance**
— 150 ns Maximum Access Time
— $V_{CC} = 5V \pm 10\%$
- **Quick-Pulse Programming™ Algorithm**
— Programming as Fast as 28 Seconds
- **UV Erasable**

Intel's 27C400 is a 5V-only, 4,194,304 bit, Erasable Programmable Read Only Memory. It employs advanced CHMOS* III-E circuitry for systems requiring low power, high speed performance and noise immunity.

The device is organized as 262,144 words of 16 bits or 524,288 bytes of 8 bits through use of a byte enable switch on pin 31. The 27C400 is pinout and functionally compatible with 40-pin 4M Mask ROMs, providing a solution for both prototyping and production applications.

The 27C400 is offered in a ceramic DIP package. The UV-erasable CERDIP package facilitates fast time-to-market in minimum quantities with migration to mask ROMs for volume production. The Quick-Pulse Programming algorithm provides fast, reliable programming.

*CHMOS is a patented process of Intel Corporation.



290273-1

Figure 1. 27C400 Block Diagram

Intel

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27C240 4M (256K x 16) CHMOS EPROM

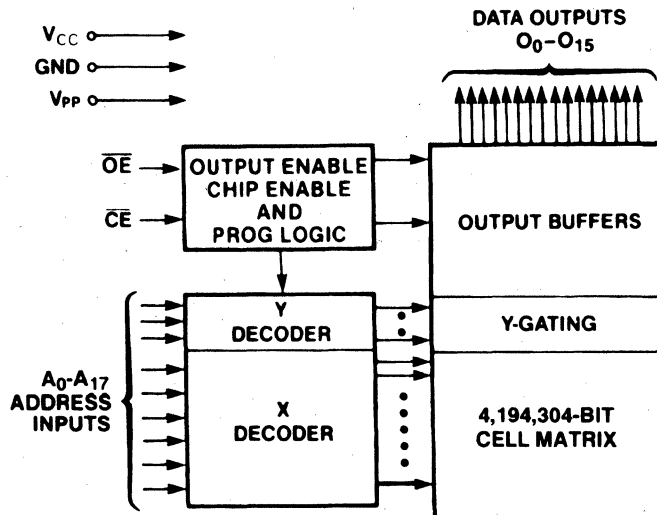
- JEDEC Approved EPROM Pinout
 - 40-Pin DIP
- Versatile EPROM Features
 - CMOS and TTL Compatibility
 - Two Line Control
- High-Performance
 - 170 ns \pm 10% V_{CC}
 - 50 mA I_{CC} Active
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Times as Fast as 30 Seconds

Intel's 27C240 is a 5V only, 4,194,304-bit Erasable Programmable Read Only Memory, organized as 262,144 words of 16 bits each. It provides for a simple upgrade from 1 and 2 Mbits.

The 27C240 represents state-of-the-art 1 micron CMOS manufacturing technology while providing unequalled performance. Its 170 ns speed (t_{ACC}) optimizes operation with high performance CPUs in applications ranging from numerical control to office automation to telecommunications.

The 27C240 is equally at home in both a TTL or CMOS environment. And like Intel's other high density EPROMs, the 27C240 programs quickly using Intel's industry leading Quick-Pulse Programming™ algorithm.

CHMOS is a patented process of Intel Corporation.



290229-1

Figure 1. Block Diagram

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27C020 2M (256K x 8) CHMOS EPROM

- JEDEC Approved EPROM Pinouts
 - 32-Pin DIP, 32-Pin PLCC
 - Simple Upgrade from Lower Densities
- Complete Upgrade Capability to Higher Densities
- Versatile EPROM Features
 - CMOS and TTL Compatibility
 - Two Line Control
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Time as Fast as 30 Seconds
- High-Performance
 - 150 ns, $\pm 10\%$ V_{CC}
 - 30 mA I_{CC} Active
- Surface Mount Packaging Available
 - Smallest 1 Mbit Footprint in SMT

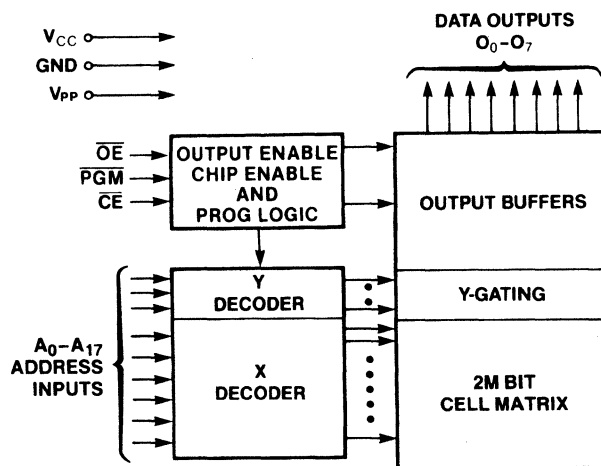
Intel's 27C020 is a 5V-only, 2,097,152-bit Erasable Programmable Read Only Memory, organized as 262,144 words of 8 bits each. It is pin compatible with lower density DIP EPROMs (JEDEC) and provides for simple upgrades to 8 Mbits in the future in both DIP and PLCC.

The 27C020 represents state-of-the-art 1 micron CMOS manufacturing technology while providing unequalled performance. Its 150 ns speed (t_{ACC}) offers no-wait-state operation with high performance CPUs in applications ranging from numerical control to office automation to telecommunications.

Intel offers two DIP profile options to meet your prototyping and production needs. The windowed ceramic DIP (CERDIP) package provides erasability and reprogrammability for prototyping and early production. Once the design is in full production, the plastic DIP (PDIP) one-time programmable part provides a lower cost alternative that is well adapted for auto insertion.

In addition to the JEDEC 32-lead DIP package, Intel also offers a 32-lead PLCC version of the 27C020. This one-time-programmable surface mount device is ideal where board space consumption is a major concern or where surface mount manufacturing technology is being implemented across an entire production line.

The 27C020 is equally at home in both a TTL or CMOS environment. It programs as fast as 30 seconds using Intel's industry leading Quick-Pulse Programming algorithm.



290226-1

Figure 1. Block Diagram

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27C220 2M (128K x 16) CHMOS EPROM

- JEDEC Approved EPROM Pinouts
 - 40-Pin DIP
 - 44-Pin PLCC
- Versatile EPROM Features
 - CMOS and TTL Compatibility
 - Two Line Control
- High-Performance
 - 150 ns \pm 10% V_{CC}
 - 50 mA I_{CC} Active
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Times As Fast As 15 Seconds
- Surface Mount Packaging Available
- Complete Upgrade to Higher Densities

Intel's 27C220 is a 5V only, 2,097,152-bit Erasable Programmable Read Only Memory. Organized as 131,072 words of 16 bits each. It is pin compatible with Intel's 1 Mbit 27C210 and provides for a simple upgrade to 4 Mbits in the future.

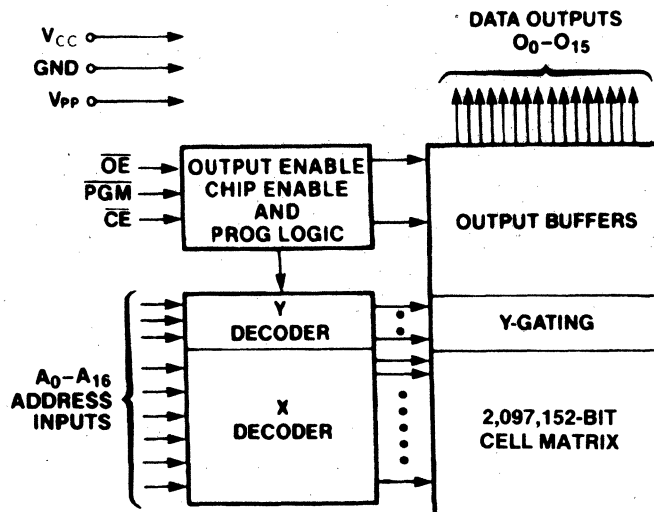
The 27C220 represents state-of-the-art 1 micron CMOS manufacturing technology while providing unequalled performance. Its 150 ns speed (t_{ACC}) offers no-wait-state operation with high performance CPUs in applications ranging from numerical control to office automation to telecommunications.

Intel offers two DIP profile options to meet your prototyping and production needs. The windowed ceramic dip (CERDIP) package provides erasability and reprogrammability for prototyping and early production. Once the design is in full production, the plastic dip (PDIP) one-time programmable part provides a lower cost alternative that is well adapted for auto insertion.

In addition to the JEDEC 40-pin DIP package, Intel also offers a 44-lead PLCC version of the 27C220. This one-time-programmable surface mount device is ideal where board space consumption is a major concern or where surface mount manufacturing technology is being implemented across an entire production line.

The 27C220 is equally at home in both a TTL or CMOS environment. And like Intel's other high density EPROMs, the 27C220 programs quickly using Intel's industry leading Quick-Pulse Programming algorithm.

Intel



290217-1

Figure 1. Block Diagram

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27C210 1M (64K x 16) CHMOS EPROM

- JEDEC Approved EPROM Pinouts
 - 40-Pin DIP
 - 44-Pin PLCC
- Complete Upgrade to Higher Densities
- Versatile EPROM Features
 - CMOS and TTL Compatibility
 - Two Line Control
- High-Performance
 - 120 ns $\pm 10\%$ V_{CC}
 - 50 mA I_{CC} Active
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Times As Fast As 8 Seconds

Intel's 27C210 is a 5V only, 1,048,576-bit Erasable Programmable Read Only Memory, organized as 65,536 words of 16 bits each. Its standard pinouts provide for simple upgrades to 4 Mbits in the future.

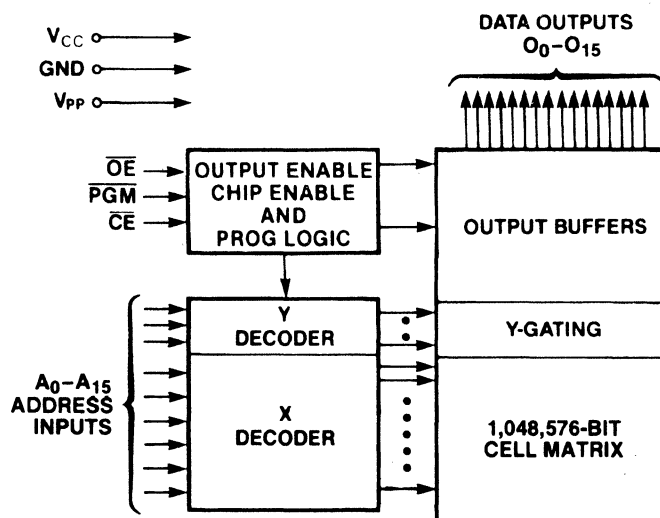
The 27C210 represents state-of-the-art 1 micron CMOS manufacturing technology while providing unequalled performance. Its 120 ns speed (t_{ACC}) offers no-wait-state operation with high performance CPUs in applications ranging from numerical control to office automation to telecommunications.

Intel offers two DIP profile options to meet your prototyping and production needs. The windowed ceramic dip (CERDIP) package provides erasability and reprogrammability for prototyping and early production. Once the design is in full production, the plastic dip (PDIP) one-time programmable part provides a lower cost alternative that is well adapted for auto insertion.

In addition to the JEDEC 40-pin DIP package, Intel also offers a 44-lead PLCC version of the 27C210. This one-time-programmable surface mount device is ideal where board space consumption is a major concern or where surface mount manufacturing technology is being implemented across an entire production line.

The 27C210 is equally at home in both a TTL or CMOS environment. And like Intel's other 1 Mbit EPROMs, the 27C210 programs quickly using Intel's industry leading Quick-Pulse Programming algorithm.

Intel



290193-1

Figure 1. Block Diagram



27C010

1M (128K x 8) CHMOS EPROM

- JEDEC Approved EPROM Pinouts
 - 32-Pin DIP, 32-Pin PLCC
 - Simple Upgrade from Lower Densities
- Complete Upgrade Capability to Higher Densities
- Versatile EPROM Features
 - CMOS and TTL Compatibility
 - Two Line Control
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Time as Fast as 15 Seconds
- High-Performance
 - 120 ns, $\pm 10\%$ V_{CC}
 - 30 mA I_{CC} Active
- Surface Mount Packaging Available
 - Smallest 1 Mbit Footprint in SMT

Intel's 27C010 is a 5V only, 1,048,576-bit, Erasable Programmable Read Only Memory, organized as 129,536 words of 8 bits. It is pin compatible with lower density DIP EPROMs (JEDEC) and provides for simple upgrades to 8 Mbits in the future in both DIP and PLCC.

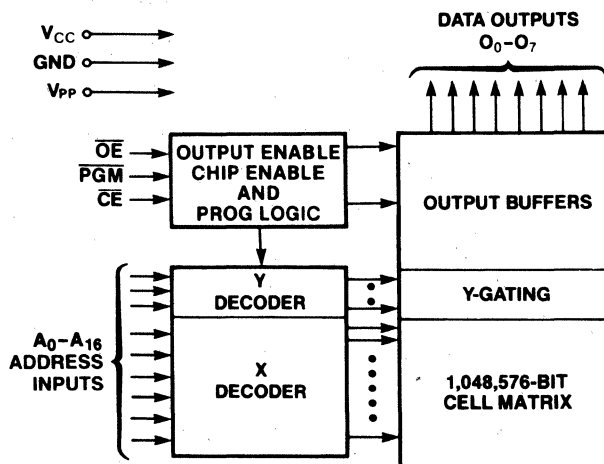
The 27C010 represents state-of-the-art 1 micron CHMOS manufacturing technology while providing unequaled performance. Its 120 ns speed (t_{ACC}) offers no-wait-state operation with high performance CPUs in applications ranging from numerical control to office automation to telecommunications.

Intel offers two DIP profile options to meet your prototyping and production needs. The windowed ceramic DIP (CERDIP) package provides erasability and reprogrammability for prototyping and early production. Once the design is in full production, the plastic DIP (PDIP) one-time programmable part provides a lower cost alternative that is well adapted for auto insertion.

In addition to the JEDEC 32-pin DIP package, Intel also offers a 32-lead PLCC version of the 27C010. This one-time-programmable surface mount device is ideal where board space consumption is a major concern or where surface mount manufacturing technology is being implemented across an entire production line.

The 27C010 is equally at home in both a TTL or CMOS environment. It programs as fast as 15 seconds using Intel's industry leading Quick-Pulse Programming algorithm.

Intel



290174-1

Figure 1. Block Diagram

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 © INTEL CORPORATION, 1990 Order Number: 290174-004

27C100 1M (128K x 8) CHMOS EPROM

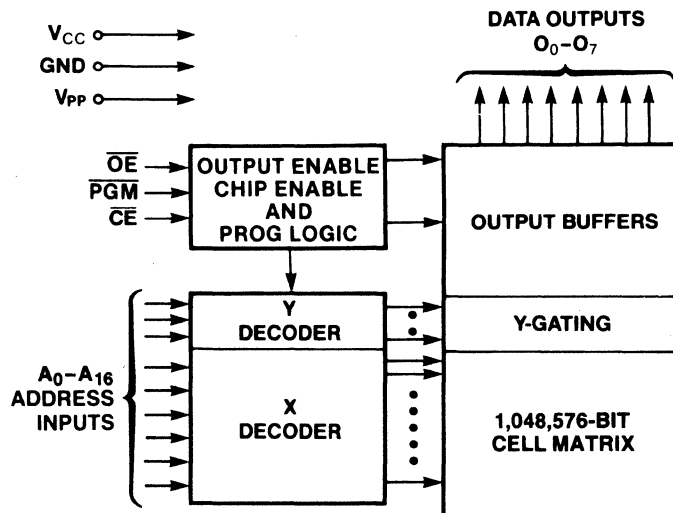
- Pin Compatible with 28-Pin 1 Mbit MASK ROM
 - Low Power Consumption
 - 30 mA Max. Active
 - 100 μ A Max. Standby
 - CMOS and TTL Compatibility
- High Performance
 - $\pm 10\%$ V_{CC}
 - 120 ns Maximum Access Time
 - Quick-Pulse Programming™ Algorithm
 - Programming as Fast as 15 Seconds
 - 32-Pin CERDIP and PDIP Packages

Intel's 27C100 is a 5V-only, 1,048,576 bit, Erasable Programmable Read Only Memory organized as 131,072 bytes of 8 bits. It employs advanced CHMOS* III E circuitry for systems requiring low power, high speed performance and noise immunity. This device is pin compatible with 28-pin 1 Mbit MASK ROMs.

The 27C100's 120 ns speed (t_{ACC}) offers no-wait-state operation with high-performance CPUs in applications ranging from numerical control to office automation and telecommunications. The 27C100 is equally at home in both TTL and CMOS environments.

Intel offers two DIP profile options to meet your prototyping and production needs. The windowed ceramic DIP (CERDIP) package provides erasability and reprogrammability for prototyping and early production. Once the design is in full production, the plastic DIP (PDIP) one-time programmable part provides a lower cost alternative that is well adapted for auto insertion. This EPROM solution is particularly well-suited for "Just-In Time" code customization to meet specific geographic or application needs in your product line. The Quick-Pulse Programming™ Algorithm provides fast, reliable programming.

*CHMOS is a patented process of Intel Corporation.



290270-1

Figure 1. Block Diagram

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27C011

PAGE-ADDRESSED 1M (8 x 16K x 8) EPROM

- **Paged Organization**
 - Reduced Physical Address Requirement
- **Compatible with 28-Pin JEDEC EPROMs**
 - Single-Trace Modification for Retrofitting 27128-Based Designs
- **No-Hardware-Change Upgrades**
 - Drop-In 27513 Replacement
- **Fast Programming**
 - Quick-Pulse Programming™ Algorithm
 - Programming Time as Fast as 15 Seconds
- **Automatic Page Clear**
 - Resets to Page 0 on Power-Up and On Demand with RST Signal
- **High-Performance**
 - 200 ns Access Time
 - Low 30 mA Active Power
- **Standard EPROM Features**
 - TTL Compatibility
 - Two Line Control
 - intelligent Identifier™ for Automated Programming
- **Smallest Megabit DIP Package**
 - 28-Pin DIP, Minimal Footprint without Address/Data Multiplexing

The Intel 27C011 is a 5V-only, 1,048,576-bit Erasable Programmable Read Only Memory. It is organized as 8 pages of 16K 8-bit words. Its pin-compatibility with byte-wide JEDEC EPROMs allows retrofitting existing designs to the greater storage capacity afforded by the page-addressed organization. Its 16 K-byte physical address space requirement allows the 27C011 to be utilized in address-constrained system designs.

When a 28-pin DIP socket is configured for 27C64 or 27C128 EPROMs, it is easily retrofitted to the 27C011. By adding a WRITE ENABLE signal to pin 27 (DIP) (unused on 27C64 and 27C128), the 27C011 can be used in an existing design. Thus, the 27C011 enables product enhancements via additional feature sets and firmware-intensive performance upgrades.

The page-addressed organization allows the use of 28-pin DIP packages, the smallest megabit EPROM footprint with applicability to all microprocessors. This provides very efficient circuit board layouts.

The 27C011 is part of a multi-product megabit EPROM family. The other members are standard-addressed byte-wide and word-wide versions, the 27C010 and 27C210, respectively. The 27C010 is organized as 128K x 8 in a 32-pin DIP package which is pin-compatible with JEDEC-standard 28-pin 512K EPROMs. The 27C210 is packaged in a 40-pin DIP with a 64K x 16 organization.

The 27C011 has an automatic page clear circuit for ease of use of its paged organization. The page-select latch is automatically cleared to the lowest order page upon system power-up. The 27C011 also contains many industry-standard features such as two-line output control for simple interfacing and the intelligent Identifier™ feature for automated programming. It also can be programmed rapidly using Intel's Quick-Pulse Programming™ Algorithm.



27C513 PAGE-ADDRESSED 512K (4 x 16K x 8) UV ERASABLE PROM

- **Paged Organization**
 - Reduced Physical Address Requirement
 - No Bank Switching Logic Needed
- **Software Carrier Capacity**
- **Automatic Page Clear**
 - Resets to Page 0 on Power Up and On Demand with RST Signal
- **TTL and CMOS Compatible**
- **170 ns Access Time**
- **Two Line Control**
- **Low Power**
 - 30 mA max. Active
 - 100 μ A max. Standby
- **Compatible with Industry Standard EPROM Pinouts**
 - Direct 27128A Compatibility
 - 28-Pin Cerdip

The Intel 27C513 is a 5V-only, 524,288-bit ultraviolet Erasable and Electrically Programmable Read Only Memory. It is organized as 4 pages of 16K 8-bit words. The 27C513's paged organization brings 64 Kbyte storage capacity to existing 128K EPROM-based designs and to popular 8-bit microprocessor or microcontroller systems that have 64 Kbyte total addressing capability. The 27C513 provides an ideal means of quadrupling current 16 Kbyte code space.

The 27C513's large storage capability of 64 Kbytes and 170 ns access time enables it to function as a high density software carrier. Entire operating systems, diagnostics, high-level language programs and specialized application software can reside in a 27C513 EPROM directly on a system's memory bus. This permits immediate microprocessor access and execution of software and eliminates the need for time-consuming disk accesses and downloads.

The 27C513 has an automatic page clear circuit for ease of use of the page-addressed organization. The page-select latch is automatically cleared to the lowest order page upon system power up.

Two-line control and industry standard 28-pin packaging are features common to all Intel high-density EPROMs. This assures easy microprocessor interfacing and minimum design efforts when upgrading, adding, or choosing between nonvolatile memory alternatives.

The 27C513 is manufactured using Intel's 1 micron CHMOS* III-E technology.

Intel

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© INTEL CORPORATION, 1990 **Order Number: 290231-002**



27C512 512K (64K x 8) CHMOS EPROM

- Software Carrier Capability
- 120 ns Access Time
- Two-Line Control
- Int_eelligent Identifier™ Mode
 - Automated Programming Operations
- CMOS and TTL Compatible
- Low Power
 - 30 mA Max. Active
 - 100 μA Max. Standby
- Fast Programming
 - Quick-Pulse Programming™ Algorithm
 - Programming Time as Fast as 8 Seconds

The Intel 27C512 is a 5V-only, 524, 288-bit Erasable Programmable Read Only Memory (EPROM), organized as 65,536 words of 8 bits. Individual bytes are accessed in 120 ns. This ensures compatibility with high-performance microprocessors, such as the Intel 12 MHz iAPX 286, allowing full speed operation without the addition of performance-degrading WAIT states. The 27C512 is also directly compatible with Intel's 80C51 family of microcontrollers.

The 27C512 enables implementation of new, advanced systems with firmware intensive architectures. The combination of the 27C512's high-density, cost-effective EPROM storage, and new advanced microprocessors having megabyte addressing capability provides designers with opportunities to engineer user-friendly, high-reliability, high-performance systems.

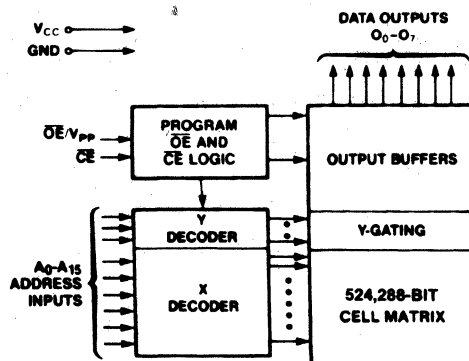
The 27C512's large storage capability of 64 K-bytes enables it to function as a high-density software carrier. Entire operating systems, diagnostics, high-level language programs and specialized application software can reside in a 27C512 directly on a system's memory bus. This permits immediate microprocessor access and execution of software and eliminates the need for time-consuming disk accesses and downloads.

Intel's Quick-Pulse Programming™ algorithm enables the 27C512 to be programmed as fast as eight seconds (plus programmer overhead). Programming equipment which takes advantage of the int_eelligent Identifier™ will electronically identify the EPROM and automatically program it using a superior programming method.

Two-line control and JEDEC-approved, 28-pin packaging are standard features of the 27C512. This assures easy microprocessor interfacing and minimum design efforts when upgrading, adding, or choosing between nonvolatile memory alternatives.

CHMOS is a patented process of Intel Corporation.

Intel



290228-1

Figure 1. Block Diagram

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27C256

256K (32K x 8) CHMOS EPROM

- **High Speed**
— 120 ns Access Time
 - **Low Power Consumption**
— 100 μ A Standby, 30 mA Active
 - **Fast Programming**
— Quick-Pulse Programming™ Algorithm
— Programming Time as Fast as 4 Seconds
 - **EPI Processing**
— Maximum Latch-up Immunity
 - **Simple Interfacing**
— Two Line Control
— CMOS and TTL Compatible
 - **Versatile JEDEC-Approved Packaging**
— Standard 28-Pin CERDIP
— Compact 32-Lead PLCC
— Cost Effective Plastic DIP
- (See Packaging Spec., Order # 231369)

Intel's 27C256 is a 5V only, 262,144-bit Erasable Programmable Read Only Memory, organized as 32,768 words of 8 bits. Its standard pinouts provide for simple upgrades to 512 Kbits in the future in both DIP and SMT.

The 27C256 is ideal in embedded control applications based on advanced 16-bit CPUs. Fast 120 ns access times allow no-wait-state operation with the 12 MHz 80286. The 27C256 also excels in reprogrammable environments where the system designer must strike an optimal density/performance balance. For example, bootstrap and diagnostic routines run 1-wait-state on a 16 MHz 386™ microprocessor.

Intel offers two DIP profile options to meet your prototyping and production needs. The windowed ceramic dip (CERDIP) package provides erasability and reprogrammability for prototyping and early production. Once the design is in full production, the plastic dip (PDIP) one-time programmable part provides a lower cost alternative that is well adapted for auto insertion.

In addition to the JEDEC 28-pin DIP package, Intel also offers a 32-lead PLCC version of the 27C256. This one-time-programmable surface mount device is ideal where board space consumption is a major concern or where surface mount manufacturing technology is being implemented across an entire production line.

The 27C256 is equally at home in both TTL and CMOS environments. The Quick-Pulse programming™ algorithm improves speed as much as 100 times over older methods, further reducing cost for system manufacturers.

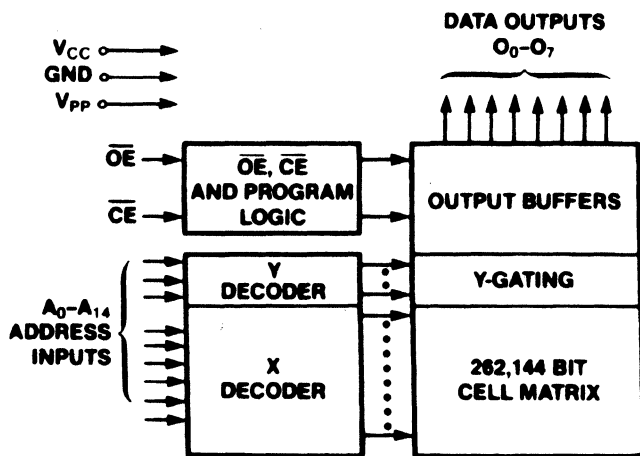


Figure 1. Block Diagram

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87C257 256K (32K x 8) CHMOS EPROM

- CHMOS/NMOS Microcontroller and Microprocessor Compatible
 - 87C257-Integrated Address Latch
 - Universal 28 Pin Memory Site, 2-line Control
- Low Power Consumption
- High Performance Speeds
 - 150 ns Maximum Access Time
- Noise Immunity Features
 - $\pm 10\%$ V_{CC} Tolerance
 - Maximum Latch-up Immunity Through EPI Processing
- New Quick-Pulse Programming™ Algorithm
 - 4 Second Programming
- 28-Pin Cerdip and 32-Lead PLCC Packages

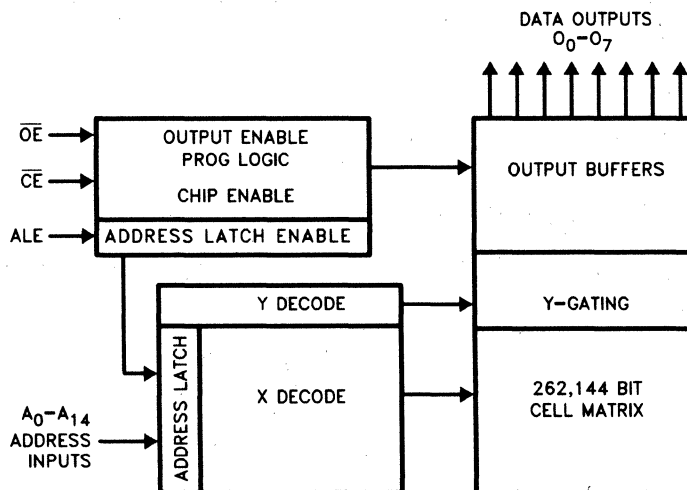
(See Packaging Spec., Order # 231369)

Intel's 87C257 EPROM is a 5V-only, 262,144-bit Erasable Programmable Read Only Memory, organized as 32,768 words of 8 bits. It employs advanced CHMOS*III-E circuitry for systems requiring low power, high speed performance, and noise immunity. The 87C257 is optimized for compatibility with multiplexed address/data bus microcontrollers such as Intel's 16 MHz 8051- and 8096- families.

The 87C257 incorporates latches on all address inputs to minimize chip count, reduce cost, and simplify design of multiplexed bus systems. The 87C257's internal address latch allows address and data pins to be tied directly to the processor's multiplexed address/data pins. Address information (inputs A_0-A_{14}) is latched early in the memory-fetch cycle by the falling edge of the ALE input. Subsequent address information is ignored while ALE remains low. The EPROM can then pass data (from pins O_0-O_7) on the same bus during the last part of the memory-fetch cycle.

The 87C257 is offered in ceramic DIP (CERDIP) and Plastic Leaded Chip Carrier (PLCC) packages. The CERDIP package provides flexibility in prototyping and R&D environments while the PLCC version is used in surface mount and automated manufacturing. The 87C257 employs the Quick-Pulse Programming™ Algorithm for fast and reliable programming.

*CHMOS is a patented process of Intel Corporation.



290135-1

Figure 1. Block Diagram

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Order Number: 290135-007

27960CX PIPELINED BURST ACCESS 1M (128K x 8) CHMOS EPROM

- Synchronous 4 Byte Data Burst Access
- No Glue Interface to 80960CA
- High Performance Clock to Data Out
 - Zero Wait State Data to Data Burst
 - Up to 33 MHz 80960CA Performance
- Asynch Microcontroller Reset Function
 - Returns to Known State with High-Z Outputs
- Pipelined Addressing for Optimal Bus Bandwidth on 80960CA
 - Next Addressing Overlaps Last Data Byte
- CHMOS III-E for High Performance and Low Power
 - 125 mA Active, 30 mA Standby
 - TTL Compatible Inputs
- 1 Mbit Density Configures as 128K x 8
 - Upgrade Path to 512K x 8

Intel's 27960CX is a 5V only, 1,048,576 bit, Erasable Programmable Read Only Memory, organized as 128K words of 8 bits. It is a member of a new family of high performance EPROMs with synchronous burst access.

The 27960CX provides a no glue synchronous burst interface to the 80960CA bus. Internally the 27960CX is organized in 4 byte blocks, each byte is accessed sequentially. The internal state machine is factory configured to generate either 1 or 2 wait-states between the address and first data byte. High performance outputs provide zero wait-state data to data accesses at clock frequencies up to 33 MHz.

Pipelining capability allows addresses to overlap previous data, further optimizing bus bandwidth in 80960CA applications. An asynchronous microcontroller RESET feature puts the outputs in the high impedance state and takes the internal state machine to a known state where a new burst access can begin.

The 27960CX is available in either 44-lead Cerquad (reprogrammable) or PLCC packages. Cerquad allows for code changes in the R & D environment while PLCC provides optimum cost effectiveness during production. Two No Connects (NC) on the package allow for an upgrade to 4 Mbits (512K x 8).

The 27960CX is manufactured on Intel's 1 micron CHMOS III-E technology. The Quick-Pulse Programming™ algorithm provides fast, reliable programming with throughput under 17 seconds for optimized equipment.

*CHMOS is a Patented Process of Intel Corporation.

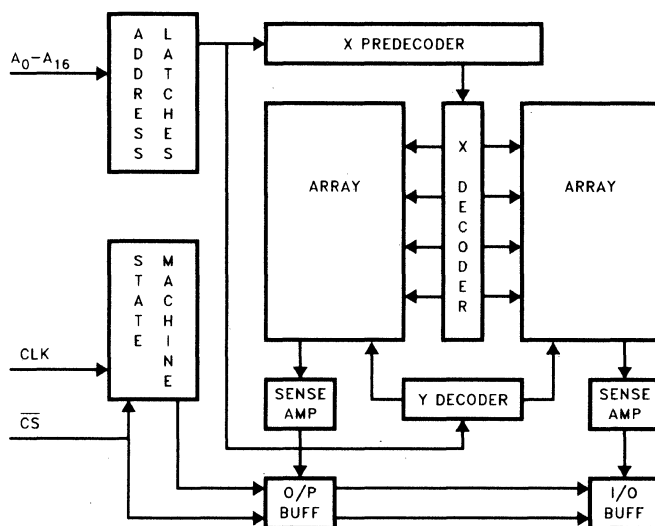


Figure 1. 27960CX Burst EPROM Block Diagram

290236-1

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27960KX BURST ACCESS 1M (128K x 8) CHMOS EPROM

- Synchronous 4-Byte Data Burst Access
- Simple Interface to the 80960KA/KB
- High Performance Clock to Data Out
 - Zero Wait State Data-to-Data Burst
 - Supports 16, 20 and 25 MHz 80960KA/KB Devices
- Asynch Microcontroller Reset Function
 - Returns to Known State with High Z Outputs
- CHMOS* III-E for High Performance and Low Power
 - 125 mA Active, 30 mA Standby
 - TTL Compatible Inputs
- 1 Mbit Density Configures as 128K x 8
 - Upgrade Path to 512K x 8

Intel's 27960KX is a 5V only, 1,048,576 bit, Erasable Programmable Read Only Memory, organized as 128K words of 8 bits. It is a member of a new family of high performance EPROMs with synchronous burst access.

The 27960KX provides a simple synchronous burst interface to the 80960KA/KB bus. Internally the 27960KX is organized in 4 byte blocks, in which each byte is accessed sequentially. The internal state machine is factory configured to generate either 1 or 2 wait-states between the address and first data byte. High performance outputs provide zero wait-state data to data accesses at clock frequencies up to 25 MHz.

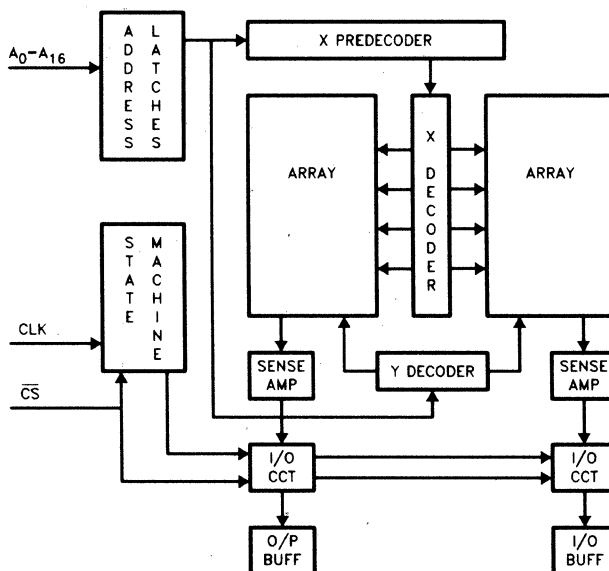
An asynchronous microcontroller $\overline{\text{RESET}}$ feature puts the outputs in the high impedance state and takes the internal state machine to a known state where a new burst access can begin.

The 27960KX is available in either 44 lead Cerquad (reprogrammable) or PLCC packages. Cerquad allows for code changes in the R & D environment while PLCC provides optimum cost effectiveness during production. Two No Connects (NC) on the package allow for an upgrade to 4 Mbits (512K x 8).

The 27960KX is manufactured on Intel's 1 micron CHMOS III-E technology. The Quick-Pulse Programming™ algorithm provides fast, reliable programming with throughput under 17 seconds for optimized equipment.

Cerquad is available in a socket only version.

*CHMOS is a patented process of Intel Corporation.



290237-1

Figure 1. 27960KX Burst EPROM Block Diagram



CMOS Serial EEPROMs

Features

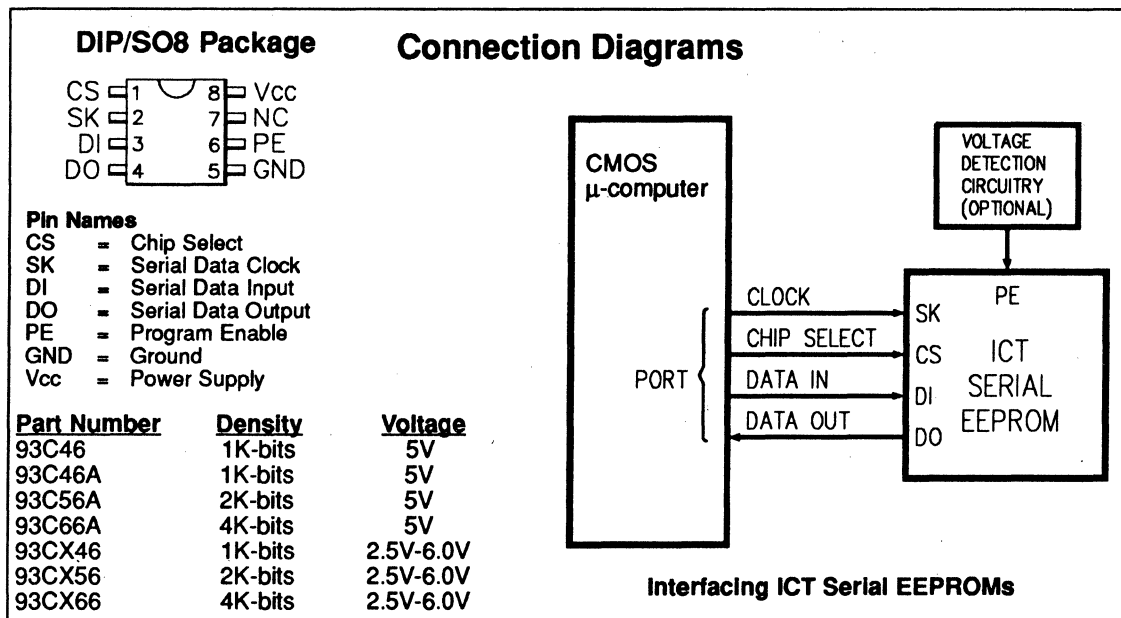
- **Advanced CMOS EEPROM Technology**
- **Read/Write Non-volatile Memory**
 - Single 5V supply operation (93C46, 93C46A, 93C56A, 93C66A)
 - Extended Voltage supply operation (93CX46, 93CX56, 93CX66)
 - Versatile easy-to-use serial data interface
- **Low Power Consumption**
 - 3mA to 4mA max Active
 - 1mA max Standby, TTL interface
 - 50/100µA max Standby, CMOS interface
- **Special Features**
 - Automatic-erase write instruction
 - Ready/Busy status signal
 - Hardware/software controlled write protection
- **Ideal For Low-Density Data Storage**
 - Low cost, space-saving, 8-pin package (Plastic/Ceramic DIP and SO8 packaging)
 - Interfaces with popular microcomputers (ie., COP4XX, 8048, 8049, 8051, 8096, 6805, 6801, TMS1000, Z8)
 - Commercial, industrial, military versions
- **Application Versatility**
 - Alarms, Electronic Locks, Appliances, Terminals, Smart Cards, Robotics, Meters, Telephones, Tuners, etc
 - Extended-voltage operation is ideal for battery-powered applications.
- **Reliability**
 - 10,000 and 100,000 erase/write cycles
 - Over 40 year data retention (at 55°C)

General Description

The ICT EEPROMs are serial read/write, non-volatile memory device fabricated using an advanced CMOS EEPROM technology. Its 1,024, 2,048, and 4,096 bits of memory are organized into 64 registers each. Each register is individually addressable for serial read or write operations. A versatile serial interface consisting of chip select, clock, data-in and data-out, can easily be controlled by popular microcomputers (ie., COP4XX, 8048, 8049, 8051, 6805, 6801, TMS1000,Z8) or standard microprocessors. The extended voltage operation of the 93CX46, 93CX56, and 93CX66 allow operation with true CMOS microcontrollers.

Low power consumption, low cost, and space efficiency make the ICT serial EEPROMs an ideal candidate for high volume, low density data storage applications. Special features include: automatic-erase write instruction, ready/busy status signal, hardware controlled write protection, and ultra-low standby power mode when deselected (CS low). Additionally, the serial EEPROMs offers functional compatibility with existing NMOS and CMOS serial EEPROMs. All versions are designed for applications requiring 10,000 or 100,000 erase/write cycles per register over the extreme temperature range, and 40 years of data retention at 55°C.

International CMOS Technology





CMOS High-Speed PROMs and EPROMs

PROM Features

- **High Speed CMOS PROM Technology**
 - 35-55ns access times
- **Low Power Consumption**
 - Less than 1/3 power of bipolar devices
 - Special standby mode (27CX321/322)
- **TTL-Compatible I/O**
- **Bipolar PROM replacement**
 - Pin-compatible with Bipolar PROMs
 - 300-mil and 600-mil 24-pin packages
- **Commercial and Industrial Versions**
- **Reprogrammability**
 - Adds convenience, reduces costs
 - Windowed package for UV erasure
 - Allows 100% factory testing

EPROM Features

- **High Speed CMOS EPROM Technology**
 - 35-70ns access times
- **Low Power Consumption**
 - 90mA Icc Active
 - 1mA Icc CMOS Standby
- **TTL-Compatible I/O**
- **JEDEC-Standard Pin Compatibility**
 - Pin-compatible upgrades through 8M-bits
 - 600-mil 28-pin and 32-pin packages
- **Auto Select Mode Feature**
- **Reprogrammability**
 - Adds convenience, reduces costs
 - Windowed package for UV erasure
 - Allows 100% factory testing

PROM General Description

ICT's CMOS high-speed PROMs provide a low-power reprogrammable alternative to bipolar fuse-link PROMs. Available in both 600mil (27CX641/321) and 300mil (27CX642/322) packages, these devices are pin/socket-compatible with many popular bipolar PROMs.

These memories are designed in an advanced CMOS EPROM technology and use differential memory cell techniques to provide access times comparable to high-speed bipolar PROMs (as fast as 35ns) with a significant improvement in power consumption. Reprogrammability not only adds convenience and reduces development and field retrofit costs, but enhances factory testability, allowing for 100% field programmability and function.

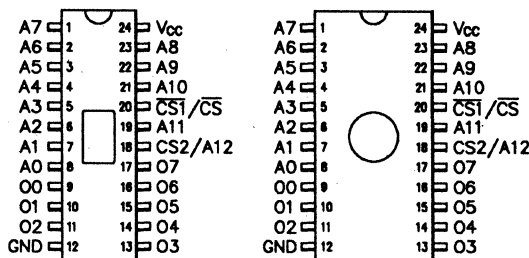
EPROM General Description

The high-speed and high-density EPROMs are ideal for operation with fast 16-bit and 32-bit microprocessors, eliminating the necessity of wait states without using cache static RAM. Available in JEDEC-standard 28-pin and 32-pin packages, the 27CX256 and 27CX010 allow pin-compatible upgrades through 8M-bit EPROMs with minimal or no hardware changes.

The 27CX256 and 27CX010 are designed using advanced CMOS EPROM technology which provides ultra-fast access times (35-70ns max) and a low active power consumption (90mA max). The power consumption is further reduced (1mA max) with its special CMOS standby mode, when pin CE is deselected.

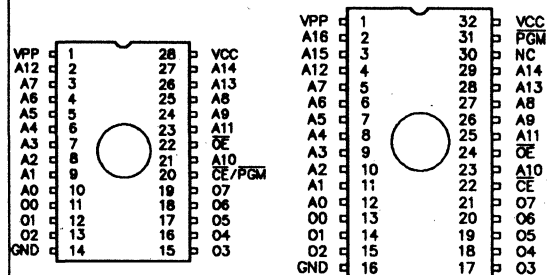
PROM Pin Configurations

27CX322/642 (300mil) 27CX321/641 (600mil)



EPROM Pin Configuration

27CX256 (600mil) 27CX010 (600mil)





PEEL™ Family of EEPDs

PEEL™ devices (Programmable Electrically Erasable Logic devices), combine CMOS and EEPROM technologies to offer an attractive alternative to early-generation PLDs. PEEL devices eliminate PLD design tradeoffs by providing a balance of features most needed by logic designers today.

■ **PEEL CMOS Performance** provides lower power consumption, lower operating temperature, and higher reliability than bipolar PLDs.

■ **PEEL Architectural Flexibility** allows a few PEEL devices to replace over 40 different PLD architectures, simplifying inventory management. Enhancements, including more product terms, independent output enables, and a 12-configuration I/O macrocell make it possible to put more logic in each package.

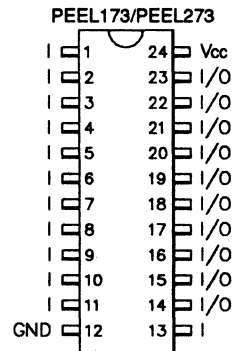
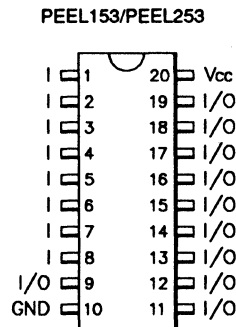
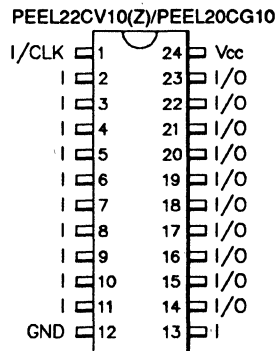
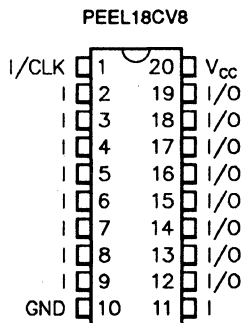
■ **PEEL Ease of Design** is provided by ICT's free PEEL development software, a low cost PEEL development system (PDS-1) and support from popular programmers.

■ **PEEL EE-Reprogrammability** provides the convenience of in-stant reprogramming for development. There is no waste, as with one-time-programmable PLDs, and no wait, as with UV-erasable PLDs. It also provides a risk-free reusable production inventory minimizing the impacts of programming changes or errors.

■ **PEEL High Quality** is a result of 100 percent testable PEEL technology. PEEL devices are shipped with a 50ppm Average Outgoing Quality Level (including programming and function) as compared to greater than 10,000ppm with bipolar PLDs.

■ **PEEL Cost Effectiveness** because there are no hidden overhead costs as with bipolar PLDs, such as program/test yield loss, mUL multiple-device inventories, reject administration, and board and field failure rework.

PEEL™ is a trademark of International CMOS Technology



Superset	ARCHITECTURE							SPEED	POWER
	Pins	Inputs	I/Os	Registers	Macro Configs	Prog. Arrays	Product / Sum Terms	Prop Delay (ns) tpd	Supply Current
PEEL 18CV8-10/15/20	20	10	8	8	12	AND	74	10/15/20	80+0.7/MHz
PEEL18CV8-25/35	20	10	8	8	12	AND	74	25/35	20+0.5/MHz
PEEL20CG10A-12/15	24	12	10	10	12	AND	92	10/12/15	100+0.5/MHz
PEEL20CG10-20/25/35	24	12	10	10	12	AND	92	20/25/35	55+0.5/MHz
PEEL22CV20A-12/15	24	12	10	10	4/12	AND	132	10/12/15	100+0.5/MHz
PEEL22CV10-20/25/35	24	12	10	10	4/12	AND	132	20/25/35	55+0.5/MHz
PEEL22CV10Z-20/25/35	24	12	10	10	12	AND	132	20/25/35	55+0.5/MHz
PEEL153-30/35	24	12	10	N/A	N/A	AND/OR	42/10	30/35	35+1.0/MHz
PEEL173-15	24	12	10	N/A	N/A	AND/OR	42/10	15	60+0.5/MHz
PEEL253-30/35	24	12	10	N/A	N/A	AND/OR	42/10	30/35	35+0.5/MHz
PEEL273-15	24	12	10	N/A	N/A	AND/OR	42/10	15	60+0.5/MHz
	24	12	10	N/A	N/A	AND/OR	42/10	30/35	35+1.0/MHz

The PEEL22CV10Z offers a user-selectable "zero-power" standby mode where $I_{CC} = 200\mu A$

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PA7024 and PA7040 PEEL™ Arrays CMOS Programmable Electrically Erasable Logic Arrays

Features

User-Configurable High Density Logic Arrays

- Create multi-level I/O-buried logic circuits
- 24/40 pin packages (PA7024/PA7040)
- Over 80/96 sum-of-products functions
- 1200/1700 gate equivalency

CMOS EE-Technology

- Low power, ICC=100-120mA+0.5mA/MHz
- Reprogrammable in plastic package
- Low risk inventory, superior factory testing

High Performance

- Wide-gate functions in single level delays
- tpd= 13ns (internal), 20ns (external)
- Freq= up to 58.8MHz

Flexible Architecture

- Input registers and latches
- I/O buried D, T and JK registers with independent clock, preset and reset
- Separate output enables per I/O

Logic Integration and Customization of:

- PLDs, SSI/MSI, random logic, decoders, encoders, muxs, comparators, shifters, counters, state machines, etc.

Simplified Development Methodology

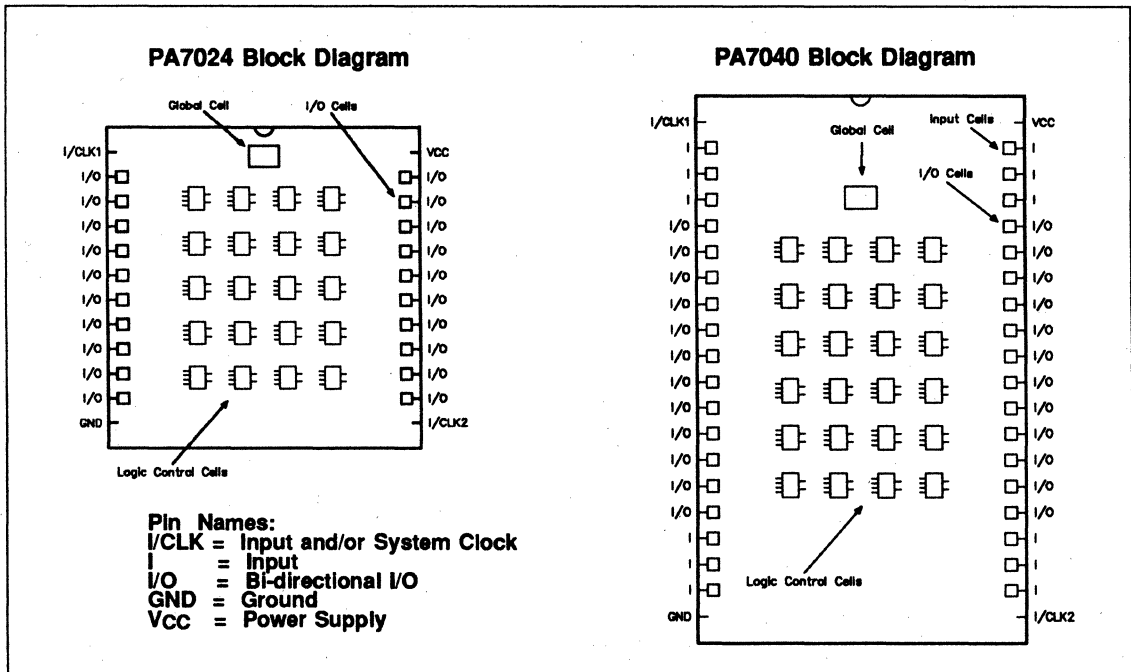
- Predictable symmetrical timing, no routing
- Complete support with PLACE Software and PEEL Development System from ICT

General Description

The PA7024 and PA7040 are a user-configurable high-density Programmable Electrically Erasable Logic (PEEL) Arrays for creating multi-level, I/O-buried, logic circuits. Designed in ICTs advanced 1-micron CMOS EE-technology, the PA7024/40 offer low power consumption, high speed performance, and reprogrammability in plastic packaging allowing superior factory testing and a low risk reusable inventory. The PA7024/40s wide-gate architecture can implement complex combinatorial and sequential functions with-in single-level delays of 13nS (internal) and at clock rates of 58.8MHz.

Flexible architectures offer; input reg/latches, buried D, T, or JK registers with independent clock, preset and reset, and separate output enables. This versatility makes the PA7024 ideal for integrating SSI/MSI, multiple PLDs and customizing random logic, decoders, muxs, comparitors, shifters, counters, state machines, etc.. Extensive signal interconnectivity makes all timing paths symmetrical, simplifying design with predictable performance and the elimination of gate-array-like routing. Complete development and programming support is provided by ICTs PACE Software and PEEL Development System.

International CMOS Technology



INTRODUCTION

Integrated Silicon Solution, Inc., *ISSI* was founded in 1988 to design, manufacture, and market a family of ultra-high-performance CMOS Integrated Circuits. *ISSI* is committed to providing consistent, high-quality, state-of-the-art products to a world-wide customer base using advanced technologies.

ISSI's first product offering was a family of high performance standard application CMOS STATIC RAMs. This family was designed with special consideration to those specifications, such as output enable and write pulse width, which optimize their use in high speed applications. The same is true of *ISSI*'s family of CACHE MEMORY devices, designed to support high speed CISC (386/486, 68030/40) and RISC (860, 29000, R3000, and Sun) microprocessors.

1991 will be an exciting year for *ISSI*. As well as expanding our offerings in the SRAM, Main Cache, and Secondary Cache areas, *ISSI* will be introducing EEPROM products to the marketplace. Our first devices will be Serial I/O 1K, 2K and 4K bit EEPROMs with the 1Megabit and 4Megabit densities of our Flash EEPROM family following in late 1991.

As a dynamic and growing company, *ISSI* prides itself in being at the leading edge of Semiconductor Technology. *ISSI* continues to rely on the partnerships formed with system designers and our valued customers to provide inputs and to assist our design and manufacturing team in developing useful products in a timely fashion. Together we feel we can help guarantee greater success for you and *ISSI*.

Density	Organization/Description	ISSI Part Number	Address / Cycle Time (ns Max)	Pin Count & Packaging	Introduction	Comments
CACHE TAG RAMS						
16K	4K x 4 with Comparator	IS61C180	12, 15, 20	(22) N	Now	Compatible with IDT
64K	8K x 8 with Comparator	IS61C81	20, 25, 30	(28) N, J	Now	To support 386 and 486 MPU chip sets
CACHE DATA RAMS						
64K	2 x 2K x 16	IS61C308	25, 35, 45	(44) L	Nov/90	Directly interfaces with 82C307 and 82C327
	4K x 16	IS61C416	25, 35, 45	(44) L	Nov/90	Directly interfaces with 82385 Cache Controller
72K	8K x 9 for parity	IS61C89	20, 25, 30	(28) N, J	*	Highend P.C. system applications
288K	16K x 18 for parity	IS61C618	24, 35	(52) L	*	Intel Specific 486 Secondary Cache
128K	8K x 16 2 x 4K x 16	IS61C816	25, 35, 45	(52) L	Q1/91	Directly interfaces with 82385 Cache Controller
144K	2 x 4K x 18/8K x 18	IS61C818	25, 35, 45	(52) L	Q1/91	Directly interfaces with 82485 Cache Controller

Package Notes: (N) 300 Mil PDIP, (W) 600 Mil PDIP, (J) SOJ, (P) SOP, (L) PLCC, (SP) Small PDIP, and (SJ) Small SOIC.

Density	Organization/Description	ISSI Part Number	Address / Cycle Time (ns Max)	Pin Count & Packaging	Introduction	Comments
FAST STATIC RAMS						
16K	4K x 4 Common I/O	IS61C68	20, 25	(20) N, J	Now	Very fast (\overline{OE}) speeds
	4K x 4 Common I/O, Low Power	IS61C68L	20, 25	(20) N, J	Now	
	4K x 4 Common I/O, w/ \overline{OE}	IS61C70	20, 25	(22) N	Now	
	4K x 4 Common I/O, w/ \overline{OE} , Low Power	IS61C70L	20, 25	(22) N	Now	
	2K x 8 Common I/O	IS61C16	15, 25, 35	(24) N, J	Q4/90	Designed to support Workstation applications
	2K x 8 Common I/O, Low Power	IS61C16L	15, 25, 35	(24) N, J	Q4/90	
	16K x 1	IS61C67	15, 20, 25	(20) N	Q4/90	Used as parity for 16K x 4 chip set Cache application
	16K x 1 Low Power	IS61C67L	15, 20, 25	(20) N	Q4/90	
64K	8K x 8 Common I/O	IS61C64	15, 20, 25, 30	(28) N, W, P, J	Now	Very fast (\overline{OE}) speeds
	8K x 8 Common I/O, Low Power	IS61C64L	15, 20, 25, 30	(28) N, W, P, J	Now	
	16K x 4 Common I/O	IS61C66	15, 20, 25	(22) N	Now	
	16K x 4 Common I/O, Low Power	IS61C66L	15, 20, 25	(22) N	Now	
	16K x 4 Common I/O, w/ \overline{OE}	IS61C88	15, 20, 25	(24) N, P, J	Now	
	16K x 4 Common I/O, w/ \overline{OE} , Low Power	IS61C88L	15, 20, 25	(24) N, P, J	Now	
	16K x 4 Separate I/O, Read follows Write	IS61C61	15, 20, 25	(28) N, J	Now	Fast Output Enable (tDOE) for Cache applications.
	16K x 4 Read follows Write, Low Power	IS61C61L	15, 20, 25	(28) N, J	Now	
	16K x 4 Separate I/O, Tristate	IS61C62	15, 20, 25	(28) N, J	Now	
	16K x 4 Tristate, Low Power	IS61C62L	15, 20, 25	(28) N, J	Now	
256K	32K x 8	IS61C256	20, 25, 35	(28) N, P, J	Q1/91	
	32K x 8 Low Power	IS61C256L	20, 25, 35	(28) N, P, J	Q1/91	
	32K x 8	IS62C256	100	(28) W	Now	
288K	32K x 9	IS61C259	20, 25, 35	(32) N, P, J	Q3/91	With Burst Mode - alternate source to IDT
	32K x 9 Low Power	IS61C259L	20, 25, 35	(32) N, P, J	Q3/91	
1 MEG	128K x 8	IS61C1024	25, 35, 45	(32) W	Q3/91	High Speed Applications
	128K x 8 Low Power	IS61C1024L	25, 35, 45	(32) W	Q3/91	
	128K x 8 Slow	IS62C1024	70, 85, 100	(32) W	Q1/91	Very Low Power Battery Backup Applications
	128K x 8 Slow, Low Power	IS62C1024L	70, 85, 100	(32) W	Q1/91	
EEPROM						
EE-PROM	1K - Bit 3V to 5V	IS93C46-3		(8) SP, SJ	Now	Available in Commercial, Industrial and Military
	1K - Bit	IS93C46		(8) SP, SJ	Now	
	2K - Bit	IS93C56		(8) SP, SJ	Now	Available in Commercial, Industrial and Military
	4K - Bit	IS93C66		(8) SP, SJ	Q1/91	

Notes: (-L) designator ideal for battery backup. Consult factory for special requests

4K X 4-BIT CACHE-TAG CMOS STATIC RAM

FEATURES

- Very High Speed - 12, 15, 20ns (Max.)
- **Fast output enable (tOE) for cache applications**
- CMOS Low Power Operation
 - 300 mW (Typical) Operating
- TTL compatible interface levels
- Single 5V power supply
- Fully static operation-no clock refresh required
- Three state outputs

DESCRIPTION

The ISSI IS61C180 is a high-speed, low power 4096 words by 4 bit static RAM. It is fabricated using ISSI's high performance CMOS double metal technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 12ns with low power consumption.

Cycle Time and Compare Access Time are equal. The IS61C180 features an onboard 4 bit comparator that compares RAM contents and current input data. The result is an active high on the MATCH pin. All inputs and outputs of the IS61C180 are TTL- compatible and the device operates from a single 5V supply. Fully static asynchronous circuitry is used, requiring no clocks or refreshing for operation.

The IS61C180 is packaged in a 22 pin, 300 mil plastic DIP package.

8K X 8 - BIT CACHE TAG CMOS STATIC RAM

FEATURES

- Very High Speed - 20, 25, 30ns (Max.)
- Fast output enable (tOE) for cache applications
- Automatic power-down when chip is deselected
- CMOS Low Power Operation
 - 500mW (Typical) Operating
 - 55mW (Typical) Standby
 - 25µW (Typical) Power-down
- TTL compatible interface levels
- Single 5V power supply
- Fully static operation-no clock refresh required
- Three state outputs
- Two chip enables ($\overline{CE}1$ and $CE2$) for simple memory expansion
- Data retention as low as 2V for battery back-up]
- Designed to support OPTi chip sets 82C281 - 82C381 - 82C481 on board FACT521A comparator

DESCRIPTION

The ISSI IS61C81 is a very high speed cache address comparator sub-system consisting of a 65,536-bit static RAM organized as 8K x 8. Cycle Time and Compare Access Time are equal. The IS61C81 features an onboard 8 bit comparator that compares RAM contents and current input data. The result is an active Low on the MATCH pin.

The IS61C81 is fabricated using ISSI's high performance, high-reliability technology. Address to compare and Data to compare access times as fast as 20ns.

When $\overline{CE}1$ is high or $CE2$ is low (de-selected), the device assumes a standby mode at which the power dissipation can be reduced down to 25µW (typical) with CMOS input levels.

Easy memory expansion is provided by using two chip Enable Inputs, $\overline{CE}1$ and $CE2$. The active low Write Enable (\overline{WE}) controls both writing and reading of the memory.

The IS61C81 is packaged in the JEDEC standard 28 pin, 600mil DIP, the space saving 300mil DIP and SOP surface mount packages.

2 x 4K x 16, 8K X 16 HIGH SPEED CMOS CACHE RAM

FEATURES

- High speed access time - 25, 35, 45ns (Max.)
- Designed for 80386 Cache system:
 - 25ns - 33MHz
 - 35ns - 25MHz
 - 45ns - 20MHz
- Directly interfaces with 82385 cache controller
- All address pins are latched internally
- TTL compatible inputs and outputs
- Single 5V power supply
- Operates as two 4K x 16 SRAMs with common addresses and data; also configurable as a single 8K x 16 SRAM

DESCRIPTION

The ISSI IS61C816 is fabricated by the double layer polysilicon, double layer metal CMOS technology. It is specifically designed to provide direct interface to the 80386 32-bit CPU and the 82385 Cache controller in either the direct mapped or two-way set associative mode. The configurations can be easily achieved by the (mode) pin. When the mode pin is held Low, the device functions as 8K x 16. When the mode pin is held High, the device functions as 2 x 4K x 16.

In the 8K x 16 mode, the $\overline{OE}A$ and $\overline{OE}B$ should be connected together externally, as the $\overline{WE}A$ and $\overline{WE}B$ are. The Bank A and Bank B are selected by A12 address pin.

In the dual 4K x 16 mode, the Bank A is controlled by the $\overline{OE}A$ and $\overline{WE}A$. The Bank B is controlled by the $\overline{OE}B$ and $\overline{WE}B$.

In either mode the \overline{CE} is a global chip enable pin, while $CS0$ and $\overline{CS}1$ control the lower and upper byte of read and write operations.

The IS61C816 is operated by the single 5V power supply, is fully TTL compatible, and is packaged in the JEDEC standard 52 pin PLCC package.

16K X 4 HIGH SPEED CMOS STATIC RAM

FEATURES

- Very High Speed - 15, 20, 25, 30 ns (Max.)
- **Fast output enable (tDOE) for cache applications**
- Automatic power-down when chip is deselected
- CMOS Low Power Operation
 - 400mW (Typical) Operating
 - 55mW (Typical) TTL standby
 - 25µW (Typical) CMOS standby (L-version)
- TTL compatible interface levels
- Single 5V power supply
- Fully static operation-no clock refresh required
- Three state outputs
- Chip enable \overline{CE} for simple memory expansion
- Data retention as low as 2V for battery back-up (L-version)

DESCRIPTION

The ISSI IS61C88 is a very high speed, low power, 16384 words by 4 bit static RAM. The device is fabricated using ISSI's high performance CMOS double metal technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 15ns with low power consumption.

When \overline{CE} is high the device assumes a standby with low power consumption mode at which the power dissipation can be reduced down to 25µW (typical) with CMOS input levels.

Easy memory expansion is provided by using an active low Chip Enable, \overline{CE} and three-state drivers. The IS61C88 has an active low Output Enable (\overline{OE}) feature.

The IS61C88 is packaged in the JEDEC standard 24 pin, 300 mil DIP and SOJ surface mount packages.

32K X 8 HIGH SPEED CMOS STATIC RAM

FEATURES

- High speed access time-25, 30, 35ns (Max.)
- **Fast output enable (tDOE) for cache applications**
- Low active power- 400mW (Typical)
- Low standby power
 - 10µW (Typical) CMOS standby (L-version)
 - 55mW (Typical) TTL standby
- Fully static operation-no clock or refresh required
- TTL compatible inputs and outputs
- 2V data retention for battery backup (L-version)
- Single 5V power supply

DESCRIPTION

The ISSI IS61C256 is a high speed, low power, 32,768- word by 8-bit CMOS static RAM. It is fabricated using ISSI's high performance CMOS double metal technology. This highly reliable process coupled with innovative circuit design techniques, yields access times as fast as 25ns maximum.

When \overline{CE} is high (de-selected), the device assumes a standby mode at which the power dissipation can be reduced down to 10µW typical at CMOS input levels (L-version).

Easy memory expansion is provided by using active low Chip Enable Inputs, and active low Output Enable Input. The active low Write Enable controls both writing and reading of the memory.

The IS61C256 is pin compatible with other 32K X 8 SRAMs in the PDIP package.

128K X 8 HIGH SPEED CMOS STATIC RAM

FEATURES

- High speed access time-35, 45, 55ns (Max.)
- Low active power-400mW (Typical)
- Low standby power-50µW (Typical) CMOS standby (L-version)
- Output enable and two chip enable inputs for ease in applications
- Fully static operation-no clock or refresh required
- TTL compatible inputs and outputs
- 2V data retention for battery backup (L-version)
- Single 5V ($\pm 10\%$) power supply

DESCRIPTION

The ISSI IS61C1024 is a high speed, low power, 131,072- word by 8-bit CMOS static RAM. It is fabricated using ISSI's high performance CMOS double metal technology. This highly reliable process coupled with innovative circuit design techniques, yields higher performance and low power consumption devices.

When $\overline{CE}1$ is high or $\overline{CE}2$ is low (de-select), the device assumes a standby mode at which the power dissipation can be reduced down to 50µW (typical) at CMOS input levels.

Easy memory expansion is provided by using two Chip Enable Inputs, $\overline{CE}1$ and $\overline{CE}2$. The active low Write Enable controls both writing and reading of the memory.

The IS61C1024 is supplied in a 32 pin DIP package.



The Krueger Company

1544 WEST MINERAL ROAD
TEMPE, ARIZONA 85283

(602) 820-5330 • (800) 245-2235
FAX (602) 820-1707

The KRUEGER COMPANY developed a patented process (*the KRUEGER infrared process*) to remove integrated circuits from PC boards without thermally damaging or degrading them. After removal ICs are completely refurbished and the customer is provided a product as good as new. The KRUEGER process minimizes the rate of change of temperature actually experienced by the silicon device. The refurbishment includes removal of oxidation, corrosion or contamination from the leads of the device, retinning the leads, straightening the leads and orienting the ICs in new antistatic tubes. EPROMs are cleaned and erased. Parts are sorted by commercial part number and manufacturer. Surface mount, DIP and ZIP packages are all routinely processed. DIP and ZIP packages with trimmed leads can be recovered as good usable parts for manual insertion into boards or sockets.

The KRUEGER COMPANY has provided the

electronics industry with the benefits of the KRUEGER process in the form of high quality refurbished ICs in two ways.

1. The KRUEGER COMPANY offers a component retrieval service which enables the IC user to recover and reuse any IC or other component on existing PC boards. The KRUEGER COMPANY retrieval service offers the electronics industry a way to obtain needed parts at a small fraction of their cost and lead time while helping gain maximum value from obsolete boards.
2. The KRUEGER COMPANY also obtains boards from which parts are retrieved, refurbished and made available to IC purchasers worldwide. The KRUEGER COMPANY maintains an inventory of refurbished ICs and may well be able to supply your immediate needs for any category of IC.

Krueger Company

The list below is a typical example of parts commonly available from KRUEGER COMPANY.

Dynamic RAMs	PseudoStatic RAMs		EPROMs	Processors/other	
511000	658128	65256	27210	68020	8088
514256	Static RAMs		27010	68010	8087
41256			27512	68000	8086
41264 VIDEO	62256 6288		27256	68030	8085
4464			27128	68882	8080
4164	6264	4801	68766	68881	Z80
4416	6116	2147	2764	80286	146818
4116	2128	2148	2732	80186	48C02
ALL MODES	6167	2149	2532	80287	16450
AVAILABLE	6168	2114	2716	80386	8250
			2708		



Lansdale Semiconductor, Inc.

2929 S. 48th St. Suite #2, Tempe, AZ 85282
 Phone: (602) 438-0123 Fax: (602) 438-0138

Lansdale manufactures older technology integrated circuits and has complete foundry facilities. Following is a summary of the current product line, showing the original manufacturer and product type.

Lansdale Semiconductor

ORIGINAL MANUFACTURER	PRODUCT	PART NUMBER
AMD	Bipolar Digital	2506, 2905, 2906, 2915
HARRIS	Bipolar PROM Quad Power Strobe Monolithic Diode Bipolar PROM	0512 6600 0168, 0186 0410, 0104, 0198 7600 Series
INTEL	Microprocessor Peripherals Octal	8080A 8200 Series 8282, 8283, 8286, 8287
MOTOROLA	SUHL/TTL HTL RTL DTL SUHL/TTL II TTL III TTL SUHL/TTL TTL TTL III TTL TTL	400/500 Series 660T Series 800/900 Series 830/930 Series 2000/2100 Series 3000/3100 Series 4000/4300 Series 5000/5100 Series 5400/7400 Series 54H00/74H00 Series 7200/8200 Series 8300/9300 Series
NATIONAL/FAIRCHILD	PMOS	3300 Series
RAYTHEON	PMOS	3262, 2466, 3708, 3844, 3845
SIGNETICS	DTL	200 Series
	DTL	100, 400, 700 Series
	UTILOGIC II	300 Series
	DTL	600 Series
	TTL	5400/7400 Series
	TTL III	54H00/74H00 Series
	TTL - Interface	8T00 Series
	TTL	8200 Series
TTL	8800 Series	
TTL - Interface	8H00 Series	

·883C Compliant Products Available

· Complete Foundry Service

- Mask Provided

-Custom, Semi-custom

·Reverse Engineering and Emulation Available

·Dedicated to TQC



LANSDALE

Semiconductor, Inc.

2929 S. 48th St., Suite #2
 Tempe, AZ 85282
 Phone: (602)438-0123
 Fax: (602)438-0138

FOUNDRY SERVICE

Lansdale Semiconductor, Inc., offers flexibility in wafer processing. We manufacture 3- and 4-inch wafers to standard processes, designed from 6- to 36-volts (greater for custom products) utilizing 3-micron technology. The foundry is a complete bipolar and MOS wafer processing service for Digital, Linear, and Discrete devices. Our technologies include standard (non-gold doped) processing, gold-doped, Schottky (aluminum or TiW/PtSi), ion implanted resistors, 2-layer metal and Dielectric Isolated Circuits.

IC MANUFACTURING TECHNOLOGIES:		SERVICES AVAILABLE:
<ul style="list-style-type: none"> ☛ Digital/Linear ☛ Full Custom 	<ul style="list-style-type: none"> ☛ Wafer Foundry Services ☛ Mil-Std-883C 	<ul style="list-style-type: none"> ☛ Parametrically tested wafers ☛ Die in Waffle Packs ☛ Packaged parts

TYPICAL PROCESS CHARACTERISTICS		RANGES		UNIT
		6-20 VOLT PROCESS	20-36 VOLT PROCESS	
Buried Layer	Rs. Xj.	14 5	14 5	Ohms/SQ Microns
Epi	Res. Thk.	0.15 - 3.0 4.5 - 10.0	1.0 - 5.0 9.0 - 16.0	Ohm-Cm Microns
Isolation	Rs.	6 - 12	6 - 12	Ohms/SQ
N+ Plug	Rs.	2 - 6	2 - 6	Ohms/SQ
Base	Rs. Xj.	100 - 400 0.7 - 2.5	100 - 400 1.5 - 3.5	Ohms/SQ Microns
Emitter	Rs.	2.5 - 9.0	2.5 - 9.0	Ohms/SQ
Cap. Oxide	Tox.	500 - 1500	500 - 1500	Angstroms
Metalization (Aluminum)	Thk.	1.1 - 2.0	1.1 - 2.0	Microns
Passivation (Vapox or PEO)	Tox.	1.0 - 2.0	1.0 - 2.0	Microns
LV _{ceo}		8 - 23	23 - 38	Volts
BV _{co}		>30	>70	Volts
Beta (NPN)		>40	>60	-
Beta (Lateral PNP)		>10	10 - 45	-
Beta (Vertical PNP)		>20	50 - 100	-

Lansdale Semiconductor

Original P/N	Lansdale P/N	Original P/N	Lansdale P/N	Original P/N	Lansdale P/N
MC524	ML524	RTL		MC911	ML911
MC525	ML525			MC912	ML912
MC526	ML526	MC800	ML800	MC913	ML913
MC527	ML527	MC801	ML801	MC914	ML914
MC528	ML528	MC802	ML802	MC915	ML915
MC529	ML529	MC803	ML803	MC916	ML916
MC550	ML550	MC804	ML804	MC917	ML917
MC551	ML551	MC805	ML805	MC918	ML918
MC552	ML552	MC806	ML806	MC919	ML919
MC553	ML553	MC807	ML807	MC920	ML920
MC554	ML554	MC808	ML808	MC921	ML921
MC555	ML555	MC809	ML809	MC922	ML922
MC556	ML556	MC810	ML810	MC924	ML924
MC557	ML557	MC811	ML811	MC925	ML925
MC558	ML558	MC812	ML812	MC926	ML926
MC559	ML559	MC813	ML813	MC927	ML927
MC560	ML560	MC814	ML814	MC928	ML928
MC561	ML561	MC815	ML815	MC929	ML929
MC562	ML562	MC816	ML816	MC971	ML971
MC563	ML563	MC817	ML817	MC974	ML974
MC564	ML564	MC818	ML818	MC975	ML975
MC565	ML565	MC819	ML819	MC976	ML976
MC566	ML566	MC820	ML820	MC978	ML978
MC569	ML569	MC821	ML821	MC981	ML981
MC570	ML570	MC822	ML822	MC982	ML982
MC571	ML571	MC824	ML824	MC983	ML983
MC572	ML572	MC825	ML825	MC984	ML984
MC573	ML573	MC826	ML826	MC985	ML985
MC574	ML574	MC827	ML827	MC986	ML986
MC575	ML575	MC828	ML828	MC988	ML988
MC576	ML576	MC829	ML829	MC989	ML989
MC577	ML577	MC864	ML864	MC990	ML990
MC578	ML578	MC867	ML867	MC991	ML991
MC579	ML579	MC870	ML870	MC992	ML992
		MC871	ML871	MC993	ML993
		MC874	ML874	MC996	ML996
		MC875	ML875	MC997	ML997
		MC876	ML876	MC998	ML998
		MC877	ML877	MC999	ML999
		MC878	ML878	MC9801	ML9801
		MC879	ML879	MC9802	ML9802
		MC880	ML880	MC9804	ML9804
		MC881	ML881	MC9807	ML9807
		MC882	ML882	MC9809	ML9809
		MC883	ML883	MC9813	ML9813
		MC884	ML884	MC9814	ML9814
		MC885	ML885	MC9815	ML9815
		MC886	ML886	MC9818	ML9818
		MC887	ML887	MC9819	ML9819
		MC888	ML888	MC9820	ML9820
		MC889	ML889	MC9821	ML9821
		MC890	ML890	MC9822	ML9822
		MC891	ML891	MC9823	ML9823
		MC892	ML892	MC9824	ML9824
		MC893	ML893	MC9825	ML9825
		MC894	ML894		
		MC896	ML896	DTL	
		MC897	ML897	MC830	ML830
		MC898	ML898	MC831	ML831
		MC899	ML899	MC832	ML832
		MC900	ML900	MC833	ML833
		MC901	ML901	MC834	ML834
		MC902	ML902	MC835	ML835
		MC903	ML903	MC836	ML836
		MC904	ML904	MC837	ML837
		MC905	ML905	MC838	ML838
		MC906	ML906	MC839	ML839
		MC907	ML907	MC840	ML840
		MC908	ML908	MC841	ML841
		MC909	ML909	MC843	ML843
		MC910	ML910	MC844	ML844

Original P/N	Lansdale P/N	Original P/N	Lansdale P/N	Original P/N	Lansdale P/N
MC3112	ML3112	MC4055	ML4055	MC5193	ML5193
MC3115	ML3115	MC4056	ML4056	TTL	
MC3116	ML3116	MC4058	ML4058	MC5400	ML5400
MC3118	ML3118	MC4060	ML4060	MC5401	ML5401
MC3119	ML3119	MC4062	ML4062	MC5402	ML5402
MC3120	ML3120	MC4064	ML4064	MC5403	ML5403
MC3121	ML3121	MC4068	ML4068	MC5404	ML5404
MC3122	ML3122	MC4300	ML4300	MC5405	ML5405
MC3123	ML3123	MC4301	ML4301	MC5406	ML5406
MC3124	ML3124	MC4302	ML4302	MC5407	ML5407
MC3125	ML3125	MC4304	ML4304	MC5408	ML5408
MC3126	ML3126	MC4305	ML4305	MC5409	ML5409
MC3128	ML3128	MC4306	ML4306	MC5410	ML5410
MC3129	ML3129	MC4307	ML4307	MC5412	ML5412
MC3130	ML3130	MC4308	ML4308	MC5413	ML5413
MC3131	ML3131	MC4310	ML4310	MC5414	ML5414
MC3132	ML3132	MC4312	ML4312	MC5416	ML5416
MC3133	ML3133	MC4315	ML4315	MC5417	ML5417
MC3134	ML3134	MC4316	ML4316	MC5420	ML5420
MC3150	ML3150	MC4317	ML4317	MC5423	ML5423
MC3151	ML3151	MC4318	ML4318	MC5425	ML5425
MC3152	ML3152	MC4319	ML4319	MC5426	ML5426
MC3153	ML3153	MC4321	ML4321	MC5427	ML5427
MC3154	ML3154	MC4322	ML4322	MC5428	ML5428
MC3155	ML3155	MC4323	ML4323	MC5430	ML5430
MC3160	ML3160	MC4326	ML4326	MC5437	ML5437
MC3161	ML3161	MC4327	ML4327	MC5438	ML5438
MC3162	ML3162	MC4328	ML4328	MC5440	ML5440
MC3163	ML3163	MC4329	ML4329	MC5441A	ML5441A
MC3164	ML3164	MC4330	ML4330	MC5442	ML5442
TTL		MC4331	ML4331	MC5442A	ML5442A
MC4000	ML4000	MC4332	ML4332	MC5443	ML5443
MC4001	ML4001	MC4335	ML4335	MC5444	ML5444
MC4002	ML4002	MC4337	ML4337	MC5445	ML5445
MC4004	ML4004	MC4338	ML4338	MC5446	ML5446
MC4005	ML4005	MC4339	ML4339	MC5447	ML5447
MC4006	ML4006	MC4340	ML4340	MC5448	ML5448
MC4007	ML4007	MC4341	ML4341	MC5449	ML5449
MC4008	ML4008	MC4342	ML4342	MC5450	ML5450
MC4010	ML4010	MC4343	ML4343	MC5451	ML5451
MC4012	ML4012	MC4344	ML4344	MC5453	ML5453
MC4015	ML4015	MC4346	ML4346	MC5454	ML5454
MC4016	ML4016	MC4347	ML4347	MC5460	ML5460
MC4017	ML4017	MC4348	ML4348	MC5470	ML5470
MC4018	ML4018	MC4349	ML4349	MC5472	ML5472
MC4019	ML4019	MC4350	ML4350	MC5473	ML5473
MC4021	ML4021	MC4351	ML4351	MC5474	ML5474
MC4022	ML4022	MC4352	ML4352	MC5475	ML5475
MC4023	ML4023	MC4353	ML4353	MC5476	ML5476
MC4026	ML4026	MC4354	ML4354	MC5477	ML5477
MC4027	ML4027	MC4355	ML4355	MC5479	ML5479
MC4028	ML4028	MC4356	ML4356	MC5480	ML5480
MC4029	ML4029	MC4358	ML4358	MC5481	ML5481
MC4030	ML4030	MC4360	ML4360	MC5483	ML5483
MC4031	ML4031	MC4362	ML4362	MC5484	ML5484
MC4032	ML4032	MC4364	ML4364	MC5485	ML5485
MC4035	ML4035	MC4368	ML4368	MC5486	ML5486
MC4037	ML4037	TTL-SUHL II		MC5490	ML5490
MC4038	ML4038	MC5090	ML5090	MC5490A	ML5490A
MC4039	ML4039	MC5092	ML5092	MC5491A	ML5491A
MC4040	ML4040	MC5092	ML5092	MC5492	ML5492
MC4041	ML4041	MC5111	ML5111	MC5492A	ML5492A
MC4042	ML4042	MC5113	ML5113	MC5493	ML5493
MC4043	ML4043	MC5113	ML5113	MC5493A	ML5493A
MC4048	ML4048	MC5121	ML5121	MC5494	ML5494
MC4050	ML4050	MC5123	ML5123	MC5495	ML5495
MC4051	ML4051	MC5131	ML5131	MC5495A	ML5495A
MC4052	ML4052	MC5133	ML5133	MC5496	ML5496
MC4053	ML4053	MC5141	ML5141	MC5497	ML5497
MC4054	ML4054	MC5143	ML5143	MC54100	ML54100
		MC5151	ML5151		
		MC5153	ML5153		
		MC5163	ML5163		
		MC5171	ML5171		
		MC5181	ML5181		
		MC5183	ML5183		
		MC5191	ML5191		

Original P/N	Lansdale P/N	Original P/N	Lansdale P/N	Original P/N	Lansdale P/N
RC8260	SL8260	RG180	ML511	SE161	SL161
RC8261	SL8261	RG181	ML561	SE162	SL162
RC8263	SL8263	RG190	ML512	SE170	SL170
RC8264	SL8264	RG191	ML562	SE180	SL180
RC8267	SL8267	RG200	ML2111	SE181	SL181
RC8270	SL8270	RG201	ML2161	SE415	SL415
RC8274	SL8274	RG210	ML2100	SE416	SL416
RC8275	SL8275	RG211	ML2150	SE417	SL417
RC8277	SL8277	RG220	ML2101	SE440	SL440
RC8280	SL8280	RG221	ML2151	SE455	SL455
RC8281	SL8281	RG230	ML2102	SE470	SL470
RC8284	SL8284	RG231	ML2152	SE471	SL471
RC8285	SL8285	RG240	ML2103	SE480	SL480
RC8290	SL8290	RG241	ML2153	SE481	SL481
RC8291	SL8291	RG250	ML2104	SE490	SL490
RC8293	SL8293	RG251	ML2154	SE511	SL511
TTL - SUHL		RG260	ML2105	SE526	SL526
RF30	ML521	RG261	ML2155	SE616	SL616
RF31	ML571	RG270	ML2106	SE620	SL620
RF50	ML515	RG271	ML2156	SE629	SL629
RF51	ML565	RG280	ML527	SE631	SL631
RF60	ML516	RG281	ML577	SE659	SL659
RF61	ML566	RG290	ML528	SE670	SL670
RF100	ML523	RG291	ML578	SE680	SL680
RF101	ML573	RG300	ML2112	SE690	SL690
RF110	ML524	RG301	ML2162	CS700	SL700
RF111	ML574	RG310	ML2113	CS701	SL701
RF120	ML2123	RG311	ML2163	CS704	SL704
RF121	ML2173	RG320	ML2107	CS709	SL709
RF130	ML2124	RG321	ML2157	CS716	SL716
RF131	ML2174	RG370	ML529	CS720	SL720
RF200	ML2125	RG371	ML579	CS721	SL721
RF201	ML2175	RG380	ML2116	CS727	SL727
RF210	ML2126	RG381	ML2166	CS729	SL729
RF211	ML2176	RG7520	ML2165	CS730	SL730
RF250	ML2109	TTL-SUHL		CS731	SL731
RF251	ML2159	RL10	ML4326	CS732	SL732
RF260	ML2110	RL11	ML4327	S8162	SL8162
RF261	ML2160	RL20	ML4328	S8415	SL8415
RF9601	ML9601	RL21	ML4329	S8416	SL8416
TTL-SUHL		RL30	ML4330	S8417	SL8417
RG40	ML500	RL31	ML4331	S8440	SL8440
RG41	ML550	RL40	ML4332	S8455	SL8455
RG50	ML501	RL61	ML4335	S8470	SL8470
RG51	ML551	RL71	ML4337	S8471	SL8471
RG60	ML502	RL80	ML4304	S8480	SL8480
RG61	ML552	RL81	ML4305	S8481	SL8481
RG70	ML520	SIGNETICS		S8490	SL8490
RG71	ML570	DTL		UTILOGIC II	
RG80	ML526	SE101	SL101	SE300	SL300
RG81	ML576	SE102	SL102	SE301	SL301
RG90	ML503	SE105	SL105	SE302	SL302
RG91	ML553	SE106	SL106	SE304	SL304
RG110	ML505	SE110	SL110	SE305	SL305
RG111	ML555	SE111	SL111	SE306	SL306
RG120	ML506	SE112	SL112	SE314	SL314
RG121	ML556	SE113	SL113	SE315	SL315
RG130	ML507	SE115	SL115	SE316	SL316
RG131	ML557	SE116	SL116	SE317	SL317
RG140	ML508	SE124	SL124	SE320	SL320
RG141	ML558	SE125	SL125	SE321	SL321
RG150	ML509	SE150	SL150	SE322	SL322
RG151	ML559	SE155	SL155	SE328	SL328
RG160	ML519	SE156	SL156	SE331	SL331
RG161	ML569	SE157	SL157	SE332	SL332
RG170	ML510	SE160	SL160	SE333	SL333
RG171	ML560			SE334	SL334
				SE337	SL337
				SE352	SL352

Original P/N	Lansdale P/N	Original P/N	Lansdale P/N	Original P/N	Lansdale P/N
SE356	SL356	S54H72	SL54H72	S8250	SL8250
SE357	SL357	S54H73	SL54H73	S8251	SL8251
SE358	SL358	S54H74	SL54H74	S8252	SL8252
SE362	SL362	S54H76	SL54H76	S8260	SL8260
SE363	SL363	S54H101	SL54H101	S8261	SL8261
SE370	SL370	S54H102	SL54H102	S8263	SL8263
SE374	SL374	S54H103	SL54H103	S8264	SL8264
SE375	SL375	S54H106	SL54H106	S8267	SL8267
SE377	SL377	S54H108	SL54H108	S8269	SL8269
SE380	SL380	S74H00	SL74H00	S8270	SL8270
SE381	SL381	S74H01	SL74H01	S8274	SL8274
SE384	SL384	S74H08	SL74H08	S8275	SL8275
SE387	SL387	S74H10	SL74H10	S8277	SL8277
SE391	SL391	S74H11	SL74H11	S8280	SL8280
SP3271	SL3271	S74H20	SL74H20	S8281	SL8281
SP3280	SL3280	S74H21	SL74H21	S8284	SL8284
SP3281	SL3281	S74H22	SL74H22	S8285	SL8285
		S74H30	SL74H30	S8288	SL8288
		S74H40	SL74H40	S8290	SL8290
		S74H52	SL74H52	S8291	SL8291
		S74H53	SL74H53	S8292	SL8292
		S74H54	SL74H54	S8293	SL8293
		S74H55	SL74H55		
		S74H60	SL74H60	INTERFACE	
		S74H61	SL74H61	S8H16	SL8H16
		S74H62	SL74H62	S8H20	SL8H20
		S74H71	SL74H71	S8H21	SL8H21
		S74H72	SL74H72	S8H22	SL8H22
		S74H73	SL74H73	S8H70	SL8H70
		S74H74	SL74H74	S8H80	SL8H80
		S74H76	SL74H76		
		S74H101	SL74H101	TTL	
		S74H102	SL74H102	S8806	SL8806
		S74H103	SL74H103	S8808	SL8808
		S74H106	SL74H106	S8815	SL8815
		S74H108	SL74H108	S8816	SL8816
				S8819	SL8819
		TTL - Interface		S8821	SL8821
		S8T04	SL8T04	S8822	SL8822
		S8T05	SL8T05	S8824	SL8824
		S8T06	SL8T06	S8825	SL8825
		S8T14	SL8T14	S8827	SL8827
		S8T15	SL8T15	S8828	SL8828
		S8T16	SL8T16	S8829	SL8829
		S8T18	SL8T18	S8840	SL8840
		S8T20	SL8T20	S8848	SL8848
		S8T24	SL8T24	S8855	SL8855
		S8T26	SL8T26	S8859	SL8859
		S8T31	SL8T31	S8870	SL8870
		S8T32	SL8T32	S8875	SL8875
		S8T33	SL8T33	S8879	SL8879
		S8T35	SL8T35	S8880	SL8880
		S8T36	SL8T36	S8881	SL8881
		S8T80	SL8T80	S8885	SL8885
		S8T90	SL8T90	S8889	SL8889
		S8T96	SL8T96		
				TTL	
		S8200	SL8200		
		S8201	SL8201		
		S8203	SL8203		
		S8221	SL8221		
		S8230	SL8230		
		S8231	SL8231		
		S8232	SL8232		
		S8235	SL8235		
		S8241	SL8241		
		S8242	SL8242		
		S8243	SL8243		
TTL					
S5401	SL5401				
S5402	SL5402				
S5409	SL5409				
S5447	SL5447				
S5448	SL5448				
S5453	SL5453				
S5454	SL5454				
S5460	SL5460				
S5470	SL5470				
S5472	SL5472				
S5480	SL5480				
S54100	SL54100				
S54152	SL54152				
S54182	SL54182				
S54198	SL54198				
S7401	SL7401				
S7402	SL7402				
S7409	SL7409				
S7447	SL7447				
S7448	SL7448				
S7453	SL7453				
S7454	SL7454				
S7460	SL7460				
S7470	SL7470				
S7472	SL7472				
S7480	SL7480				
S74100	SL74100				
S74152	SL74152				
S74182	SL74182				
S74198	SL74198				
TTL III					
S54H00	SL54H00				
S54H01	SL54H01				
S54H08	SL54H08				
S54H10	SL54H10				
S54H11	SL54H11				
S54H20	SL54H20				
S54H21	SL54H21				
S54H22	SL54H22				
S54H30	SL54H30				
S54H40	SL54H40				
S54H52	SL54H52				
S54H53	SL54H53				
S54H54	SL54H54				
S54H55	SL54H55				
S54H60	SL54H60				
S54H61	SL54H61				
S54H62	SL54H62				
S54H71	SL54H71				

Universal / Variable GAL Devices

FAMILY	PART	tpd ns	fmax MHz	icc mA	DEDICATED INPUTS	I/O MACRO- CELLS	PRODUCT TERMS/OUTPUT	PACKAGE
GAL16V8B	GAL16V8B-7L	7.5	100	115	8	8	8	20-Pin P-DIP, PLCC, & CerDIP
GAL16V8A	GAL16V8A-10L	10	62.5	115				
	GAL16V8A-15L	15	62.5	115				
	GAL16V8A-15Q	15	62.5	55				
	GAL16V8A-25L	25	41.7	90				
	GAL16V8A-25Q	25	41.7	55				
GAL18V10	GAL18V10-15L	15	62.5	115	8	10	8 - 10	24-Pin P-Dip, CerDIP, 28-Pin PLCC
	GAL18V10-20L	20	62.5	115				
GAL20V8A	GAL20V8A-10L	10	62.5	115	12	8	8	
	GAL20V8A-15L	15	62.5	115				
	GAL20V8A-15Q	15	62.5	55				
	GAL20V8A-25L	25	41.7	90				
	GAL20V8A-25Q	25	41.7	55				
GAL22V10	GAL22V10-15L	15	62.5	130	12	10	8 - 16	
	GAL22V10-20L	20	50	130				
	GAL22V10-25L	25	33.3	130				
GAL26CV12	GAL26CV12-15L	15	62.5	130	14	12	8 - 12	28-Pin P-Dip, CerDIP, 28-Pin PLCC
	GAL26CV12-20L	20	62.5	130				

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Asynchronous GAL Devices

FAMILY	PART	tpd ns	fmax MHz	icc mA	DEDICATED INPUTS	I/O MACRO- CELLS	PRODUCT TERMS/OUTPUT	CLOCKS	PACKAGE
GAL20RA10	GAL20RA10-15L	15	50	100	10	10	8	Individually Programmable	24-Pin P-DIP, CerDIP 28-Pin PLCC
	GAL20RA10-20L	20	41.7	100					
	GAL20RA10-30L	30	25	100					

FPLA GAL Devices

FAMILY	PART	tpd ns	fmax MHz	icc mA	MACROCELLS				PROD. TERMS	SUM TERMS	PACKAGE
					I/O	BURIED	INPUT	OUTPUT			
GAL6001	GAL6001-30	30	27	150	10	8	10	10	64	32	24-Pin PDip, CerDIP, 28-Pin PLCC
	GAL6001-35	35	22.9	150							

In-System-Programmable GAL Devices

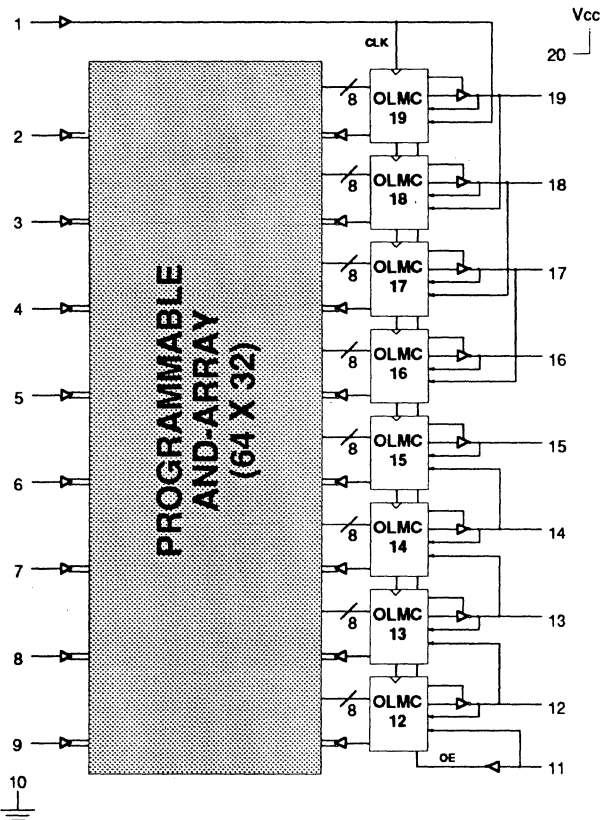
FAMILY	PART	tpd ns	fmax MHz	icc mA	DEDICATED INPUTS	I/O MACRO- CELLS	PRODUCT TERMS/OUTPUT	PACKAGE
ispGAL [®] 16Z8	ispGAL16Z8-20L	20	41.6	90	8	8	8	24-Pin P-Dip, CerDIP 28-Pin PLCC
	ispGAL16Z8-25L	25	33.3	90				

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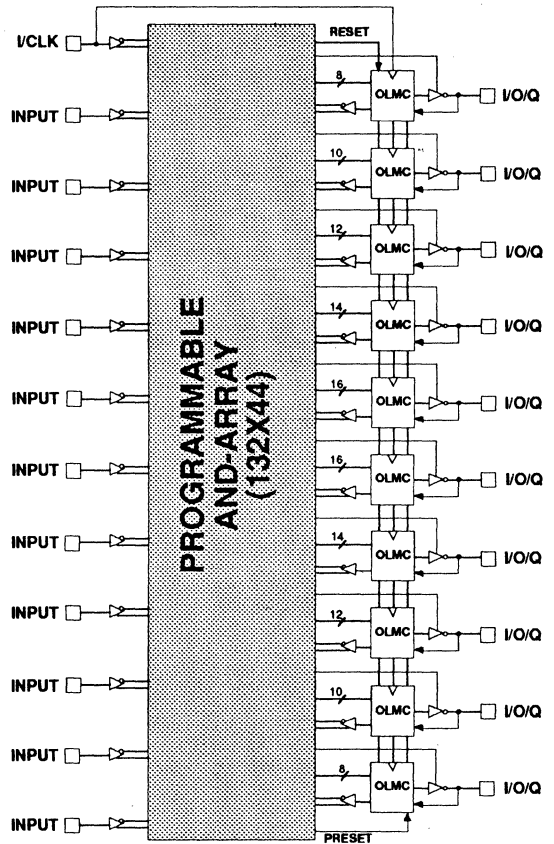
Effective Date: November 1990

Applications Hotline: 1-800-FASTGAL

GAL16V8 BLOCK DIAGRAM



GAL22V10 BLOCK DIAGRAM



GAL16V8 PIN DIAGRAM

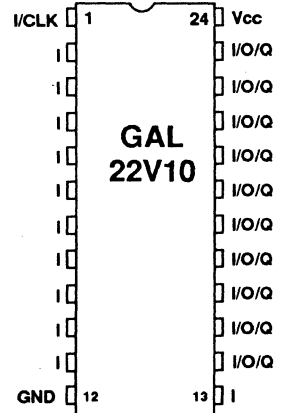
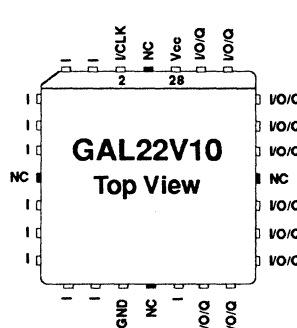
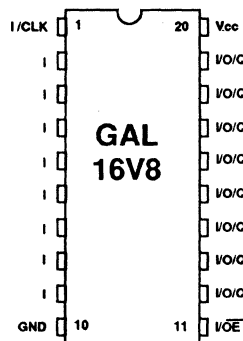
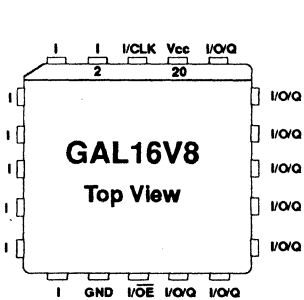
GAL22V10 PIN DIAGRAMS

Chip Carrier

Skinny DIP

Chip Carrier

Skinny DIP



Lattice Semiconductor

Lattice Semiconductor Corp., 5555 N.E. Moore Ct., Hillsboro, Oregon 97124
 Tel.: (503) 681-0118; FAX: (503) 681-3037
Applications & Literature Hotline: 1-800-FASTGAL
 Electronic Bulletin Board: (503) 693-0215; 1200/2400 Baud • N, 8, 1

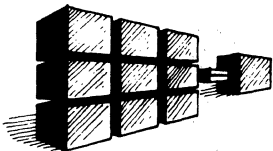
Extra•custom™ vs Semi•custom.

**EXTRA•CUSTOM IS LSI COMPUTER SYSTEM'S
ANALOG AND DIGITAL FULL CUSTOM SERVICE.
IT SAVES YOU MONEY THAT SEMI-CUSTOM WASTES.**

LSI Computer Systems

EXTRA-CUSTOM SAVES YOU MONEY WITH *MAXIMUM* SYSTEM INTEGRATION:

our engineers examine your total system to put more components on your chip. That means fewer components for you to mount on your board. (Analog and digital functions are integrated on the same chip.)



EXTRA-CUSTOM SAVES YOU MONEY WITH *MAXIMUM AREA* EFFICIENCY AND *MINIMUM* PIN COUNT:

utilizing CAE/CAD to speed and verify the design, our engineers optimize your circuit for MOS, and fully customize chip layout to reduce function area, interconnect, and pin count. The less silicon used, and the fewer pins, the lower the unit price for your chip. (Semi-custom provides little opportunity for such optimization.)



EXTRA-CUSTOM SAVES YOU MONEY WITH *THE RIGHT* MOS PROCESS TECHNOLOGY:

the process our engineers recommend for your chip will always be the utmost cost effective for your requirements. (With semi-custom you must use the process they have.)



EXTRA-CUSTOM *MAKES* MONEY FOR YOU WITH *MULTI-* SOURCED PRODUCTION:

our universal design rules let us use numerous fabricators, which ensures delivery of your chips on time. The more product you can ship on time, the more money you make. (With semi-custom, multi-sourcing is normally not available.)

100,000

EXTRA-CUSTOM *MAKES* MONEY FOR YOU BECAUSE:

our engineers concentrate on designing the chip and the test program that goes with it, while your engineers concentrate on developing new products. (With semi-custom, your engineers are all tied up designing the chip and test program.)

IF YOUR PRODUCTION QUANTITIES ARE 100K A YEAR OR MORE,

unit price of an LSI Computer Systems extra-custom chip will be much less than that of a semi-custom chip - significant savings are also achievable at lower production quantities.

LSI/CSI

LSI COMPUTER SYSTEMS INC.

THE REASON WE KNOW OUR EXTRA-CUSTOM SERVICE CAN SAVE MONEY

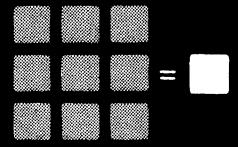
and make money for you, is that we've been offering it since 1969, producing reliable, high volume, cost effective MOS circuits for applications including:

- Phased locked loop touch control light dimmer/switches
- Programmable digital delay-timers
- Military computers, weapons test sets, and security systems
- Digital computer organs
- Auto correlators PBX systems
- Sound generators for toys and alarms
- Security system auto-dialers and wireless transmitters
- Electronic music for greeting cards and consumer novelties Pay TV decoders
- Frequency and event counters
- Synchro-to-digital converters
- Remote tone-activated isolation devices for telephone lines Camera electronics
- Programmable digital locks
- Police speed radar guns
- State of the art high frequency oscillator/dividers
- Street lighting controllers
- Brushless D.C. motor controllers
- Smoke detectors
- Appliance timers
- AC Motor controllers
- Infra-red controllers
- Programmable event controllers
- Electronic staplers
- Furnace controllers
- Industrial lighting controllers

**We also offer system design and
volume assembly of a pc-board
or a finished product.**



1235 Walt Whitman Road, Melville, New York 11747 USA • 516/271-0400 • FAX: 516/271-0405 • TWX: 510 226-7833



LS7339-LS7340: ON-OFF AC power switch with retriggerable TIMED-ON mode. TIMED-ON mode delivers full power for a time period determined by external R-C (minutes to several hours). TIMED-ON mode timer retriggers with each application of ON control. OFF control turns power off. Suitable for lamps and all AC appliances. 8 Pin Mini-DIP.

DISPLAY DRIVERS

For liquid crystal displays requiring up to 60V.

LS7100: BCD to 7 segment latch/decoder/driver.

LS7110: Binary addressable latched 8-channel demultiplexer/driver. Both are ion-implanted P Channel MOS circuits, compatible with CMOS and TTL systems. 16-pin DIPs.

CMOS DIVIDERS

For generating time bases from 50/60 Hz Input.

All feature input shaping network; resettable; division select input; 50/60 Hz; clock enable input; 8-pin mini-DIP.

RED 5/6: 10 pulses/sec.

RED 50/60: 1 pulse/sec.

RED 100/120: 1 pulse/2 seconds.

RED 300/360: 1 pulse/0.1 minute.

RED 500/600: 1 pulse/10 seconds.

RED 3000/3600: 1 pulse/minute.

For generating decade-related time bases.

RDD104: Addressable divider; divided by 10, 100, 1000, or 10,000. Input may be controlled by crystal or external frequency source. 8-pin mini-DIP.

TONE ACTIVATED, TELEPHONE LINE ISOLATION DEVICE

LS7501-LS7510: Frequency discriminator circuits which can disconnect or switch a telephone line upon detection of a specific frequency tone. 10 standard frequency circuit versions. Telephone line checking or automatic meter reading applications. 16 Pin DIP.

COUNTERS

LS7066: 24-bit multimode counter. Programmable by microprocessor, via three-state I/O bus, to operate in the following modes: binary, BCD, 24-hour clock, up, down, +n, quadrature, and single cycle. Modes can co-exist in different combinations. DC to 4 MHz in all modes. Includes 24-bit comparator for preset count

comparison; readable status register. Input/output TTL compatible. 20-pin plastic DIP.

LS7060: DC to 15 MHz 32-bit binary up counter with 32-bit latch and multiplexer; 8-bit three-state multiplexed outputs; input/output TTL compatible; bus compatible. 18-pin DIP.

LS7062: Identical to LS7060 except that it is a dual 16-bit counter, with two inputs.

LS7061: DC to 15 MHz 32-bit binary up counter with 40 bit latch and multiplexer; access to 8 LSB latches allow attachment of prescalers for counting to 3.84 GHz; 8-bit three-state multiplexed outputs; input/output TTL compatible; bus compatible. 24-pin DIP.

LS7063: Identical to LS7061 except that it is a dual 16-Bit counter, with two inputs.

LS7030: DC to 10 MHz eight decade up counter, with 8-decade latch and multiplexer, multiplexed BCD and 7 segment outputs; inputs CMOS and TTL compatible; outputs CMOS compatible; counter output latches; leading zero blanking. 40-pin DIP.

LS7031: DC to 10 MHz six decade up counter with 8-decade latch and multiplexer, access to LSD latches allows attachment of prescalers for counting to 1 GHz, multiplexed BCD outputs; leading zero blanking; inputs CMOS and TTL compatible; outputs CMOS compatible. 40-pin DIP.

LS7055: DC to 250 KHz six decade up/down counter with integral preset, presignal, and main signal store; automatic or manual preset/reset control; 3 comparators with output flags; multiplexed BCD, 7 segment outputs and blanking override; internal oscillator, high noise immunity; all inputs CMOS compatible. 40-pin DIP.

LS7056: Identical to LS7055, except that it has lamp test input instead of blanking override.

LS7080-LS7081: Quadrature to UP/DOWN Clock Converters. Quadrature clocks from optical and magnetic encoders are converted to UP CLOCK and DOWN CLOCK outputs (LS7080) or CLOCK and UP/DOWN outputs (LS7081). The outputs of LS7080 — LS7081 can be used to drive standard UP/DOWN counters for direction or position sensing of the encoder. 8 Pin Mini-DIP.

HIGH QUALITY MELODY CIRCUITS

LS3404 Series: Melody generators with 255 note capacity Mask-Programmable ROM. Excellent pitch resolution and exponential decay envelope imposed on each note account for the uniquely realistic quality of the chime-like musical sound produced by the LS3404 Series of circuits. Piezo transducers are directly driven. Standard speakers requires a single transistor interface. 31 musical fonts are available. Nominal charge to custom program your desired font. 8 Pin Mini-DIP or dice.

MEET THE HARDEST WORKING CHIPS IN THE BUSINESS

PROGRAMMABLE INTEGRATED CONTROLLER/SEQUENCER

Microprocessor designed for applications requiring simple decision-making, not computation.

LS7270: Performs logical sequencing, timing and controlling functions. Far more easily programmed than any other μ P; any program can be stored in any ROM, PROM, EPROM, or RAM. Low-cost reliable replacement for hard-wired controls and relay networks. 40-pin DIP.

DIGITAL LOCK CIRCUITS

Keyboard Programmable Keyless Locks

LS7222-LS7223: Stand alone lock logic with 38416, 4 digit codes: 3 different user programmable codes; momentary static lock control outputs; tamper detection output; high noise immunity. 20-pin DIP.

For automotive/marine anti-theft.

LS7220: 5,040 4-digit combinations: out-of-sequence detection logic; 25 μ A standby; "Save" mode for valet parking settable in "Unlock"; built-in convenience delay hard-wired programming. 14-pin DIP.

For area access and machine access.

LS7225-LS7226: 5,040 4-digit combinations; toggle output (set and reset with application of code); momentary output; tamper output; hard-wired programming. 14-pin DIP.

For serial address decoding or 2-pushbutton keyless locks.

LS7228-LS7229: Address decoder/digital lock; code programmable through 9 parallel pins; serial decoding input can be applied through dual pulse train or two pushbuttons; pulse output; duration between entries capacitor programmable; cascadable; hard-wired programming. 16-pin DIP.

BRUSHLESS DC MOTOR SPEED CONTROLLERS

LS7260-LS7262: 3 or 4-phase commutator chips; overcurrent sensing; brake, reverse, 20-pin DIP.

LS7263: Crystal controlled 3-phase motor speed controller; for fixed speed applications; accuracy 0.1%. 18-pin DIP.

LS7264: Crystal controlled 4-phase motor speed controller; for fixed speed applications; accuracy 0.1%. 16-pin DIP.

PROGRAMMABLE DIGITAL DELAY TIMER

For delaying the start or stopping of an operation.

LS7210: Can generate delays of ms to infinity, or add auto reset to μ P system; programmed by 5 binary weighted input bits plus on chip oscillator or external clock. Operable in 4 modes; delayed operate or release, dual delay, or one-shot. All inputs CMOS, MOS, and TTL compatible. 14-pin DIP.

TOUCH CONTROL LAMP DIMMER/AC MOTOR SPEED CONTROLS

Circuits digitally determine firing angle of a triac. Phase locked loop synchronization makes triac output "Pure AC", allowing triac to drive motor or transformer windings directly.

LS7231-LS7234: Momentary touch turns triac off, if on; if off, momentary touch turns triac to maximum or to firing angle stored in MEMORY (depending on circuit). Prolonged touch causes firing angle to vary. 8 pin mini-DIP.

LS7237: A touch causes firing angle to advance to next state in sequence. Three state input pin ("1", "0", or "open") selects one of 3 modes of firing angle sequence: MAX/OFF; LOW/MED/MAX/OFF; MIN/LOW/MED/MAX/OFF, Pin compatible with LS7231-LS7234. 8 pin mini-DIP.

LS7310-LS7315: Power Controllers provide ten POWER LEVEL controls and OFF control. LS7310-LS7313 also provide ON and MOMENTARY controls. Ideal for speed control of AC Motors (i.e. fans, blenders) and brightness control of incandescent lamps.

LS7310-LS7313: 18 Pin DIP

LS7314-LS7315: 16 Pin DIP

LS7331: Momentary touch turns triac on or off; prolonged touch causes firing angle to vary. Allows computer control of triac firing with outputs to computer when lamp is at full brightness, varying in brightness or when power loss has occurred. 14 Pin DIP

LS7338: Light switch with TIMED-ON and DELAYED-OFF modes. TIMED-ON mode delivers full power for a time period determined by external R-C (minutes to several hours). DELAYED-OFF mode starts at a reduced power level and DIMS-TO-OFF in 209 seconds. 8 Pin Mini-DIP.

Products and Services

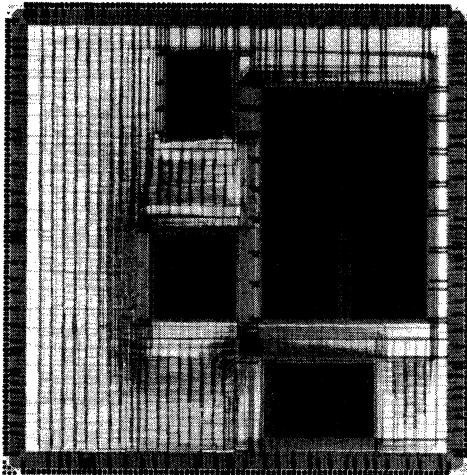
Introduction

ASICs

LSI Logic is the leading designer, developer and manufacturer of the most advanced application-specific integrated circuits (ASICs) in the industry. The company's broad ASIC line includes high performance HCMOS and BiCMOS array-based and cell-based ASICs which integrate random logic, microprocessors, memory and analog functions on chips with up to 200,000 equivalent gates. LSI Logic also manufactures and markets SPARC and MIPS microprocessors using Reduced Instruction Set Computing (RISC) technology and other selected standard products.

Military

Radiation-hardened versions of array-based ASICs are available from 10,000 to 50,000 usable gates with a total dose of 200 to 1,000 Krads (Si). LSI's mil/aero facility in Fremont, CA is fully self-contained, with assembly, burn-in, test and qualification in one domestic location.



LEA100K Embedded Array Device

MDE® Design Tools

LSI Logic's comprehensive and flexible ASIC design tools support both silicon-specific and system design environments. The MDE® (Modular Design Environment™), CDE® (Co-Designer® Environment) and third-party CAD Connection Program tools are fully integrated with the company's advanced manufacturing capabilities.

MDE tools offer Design Builder and Silicon Builder, which greatly increase ASIC designers' productivity while making sure that correct-by-construction circuits are designed. Design Builder tools synthesize higher level descriptions of circuits into netlists. These netlists are then synthesized using the Silicon Builder tools to produce efficient physical layout. This combination produces ASICs guaranteed to meet specifications, whether customers use in-house MDE software, or one of LSI Logics's Design Resource Centers.

The MDE toolset, comprised of over 25 modules, is used to design chips with up to 200,000 gates and systems in excess of two million gates. More than 1,000 library elements ranging from simple macrocells to complex megacells are available for both array and cell-based ASICs.

RISC Microprocessors

The LSI Logic MIPS and SPARC microprocessor product lines provide open-architecture RISC design solutions. A variety of peripheral chips and chip sets, including processors optimized for embedded control, and innovative chip-on-board module packaging technology, enhance the product line. LSI Logic's leading-edge microprocessor products simplify design and shorten the time-to-market for SPARC and MIPS-based products.

Products and Services

Introduction (Continued)

DSP Products

LSI Logic manufactures selected standard products, such as Digital Signal Processing (DSP) products. LSI Logic's DSP family currently includes 32-bit building block processors, special purpose memory devices, Function-Specific DSP, Crossbar Switch and Error Correcting Reed-Solomon Codec.

The term "Function-Specific DSP" covers a wide range of devices which are optimized to perform a particular algorithm, or function. Typically the system designer turns to function-specific devices when the performance required far exceeds that which can be delivered by a single chip DSP microprocessor. LSI Logic offers devices capable of processing video data at 20 or even 40 MHz in real time. Application areas where this kind of performance is required include image processing,

radar, sonar, C3I, visualization systems and any application where video data rates are required.

Worldwide Manufacturing

LSI Logic has eight state-of-the-art manufacturing sites in the US, Japan, United Kingdom, West Germany and Canada. Through these facilities, LSI Logic offers high-performance 1.0-micron drawn gate length (0.7-micron effective channel length) processes and more than 400 different advanced package types.

Right-First-Time™ Silicon

Prototype turnaround times average two weeks for gate arrays and six weeks for cell-based ASICs – the fastest in the industry. LSI Logic's proven track record of over 8,000 successful designs assures Right-First-Time ASIC solutions.

Array and Cell-Based ASICs

Product	Process Technology	Architecture	Usable Gates
LCA100K Compacted Array Plus™ Series	1.0-Micron Drawn Gate Length (0.7-Micron Effective Channel Length)	Channel-Free™ Array	3,000 to 100,000
LEA100K Embedded Array™ Series	1.0-Micron Drawn Gate Length (0.7-Micron Effective Channel Length)	Channel-Free Array with Embedded High-Density Cells	Up to 150,000 Equivalent Gates
LCA10000 Compacted Array™ Series	1.5-Micron Drawn Gate Length (0.9-Micron Effective Channel Length)	Channel-Free Array	10,000 to 50,000
LMA9000 Micro Array Series	1.5-Micron Drawn Gate Length (0.9-Micron Effective Channel Length)	Channel-Free Array	Up to 15,000
LDD10000 Direct Drive™ Array Series	1.5-Micron Drawn Gate Length (0.9-Micron Effective Channel Length)	Channel-Free Array	Up to 43,500 CMOS, 375 to 1,330 BiCMOS
LAD310 Analog/Digital Array Series	1.5-Micron Drawn Gate Length (0.9-Micron Effective Channel Length)	Channel-Free Array and Analog Tiles	600 to 46,000 CMOS Digital, 72 to 504 Analog Tiles
LCB007 Cell-Based ASICs	1.0-Micron Drawn Gate Length HCMOS (0.7-Micron Effective Channel Length)		Up to 200,000 Equivalent Gates
LCB15 Cell-Based ASICs	1.5-Micron Drawn Gate Length HCMOS (0.9-Micron Effective Channel Length)		Up to 100,000 Equivalent Gates

Military Radiation-Hardened Arrays

Product	Process Technology	Architecture	Usable Gates
RHASIC LRH10000 Compacted Array Series	1.0-Micron Channel Length Channel-Free HCMOS, 1000 KRADS	Channel-Free Array	10,000 to 50,000
RHASIC LRH9000 Channeled Array Series	1.1-Micron Channel Length Channel-Free HCMOS, 200 KRADS	Channeled Array	Up to 10,000

ASIC Libraries

Name	Description
Macrocells	More than 400 basic building blocks such as ORs, NANDs, latches, flip-flops, buffers and other gate-level structures.
Macrofunctions	More than 300 SSI and MSI elements including adders, counters, decoders, multiplexer, registers, etc.
Megacells	Large functional logic and memory building blocks including single- and multiport RAMs, ROMs, FIFOs and LIFOs, 4-bit 2901 slices, 32-bit RISC microprocessors, 1750 microprocessors, 32-bit multiplier-accumulators.
Spice I/O Models	Comprehensive, device-level descriptions of input and output macrocells for each array-based and cell-based ASIC family for use with HSPICE.

Products and Services

ASIC Design Services

Name	Description
Special Cell Development	Utilizing the industries largest collection of library elements, ranging from macrocells to mega-functions, customer specific designs can be developed.
Design Building Blocks	More than 100 large functional building blocks including popular AMD, Intel, and Motorola peripherals.
Fault Grading	State of the art fault grading services are available to provide reliable, accurate, convenient fault simulation based on exhaustive or statistical methods, accompanied by comprehensive, easy-to-analyze reports.
ATPG for SCAN Designs	Automatic Test Pattern Generation (ATPG) service provides the benefits of scan-based DFT without having to make the investment in time and money usually associated with learning the complexities of ATPG software.
Spice Models	SPICE I/O model licenses are available for most technologies, enabling circuit operation simulations to be made.
Layout	Proprietary, state-of-the-art layout design tools, optimized for array-based and cell-based ASIC products. Layout service is provided to determine die size fit or actual interconnection lengths for precise performance evaluation.
Application Support	Various levels of design and support services are available. LSI's extensive system level architectural experience and expertise can be tapped.
Production Services	Additional production services are available to support fast turnaround times through fabrication, assembly, test and delivery.

ASIC Design Tools

MDE Series	Description
Silicon Integrator™ Toolset	Single or multichip design tool system for arrays and cell-based ASICs with up to 200,000 equivalent gates per chip.
Design Builder	Design productivity tools including ChipSizer™, Logic Expression Synthesizer (LES), Logic Block Synthesizer (LBS) and Memory Compiler.
Silicon Builder	Produces optimized layouts of datapaths and random logic blocks.
Test Builder	Automatic test generation for synchronous ASIC designs.

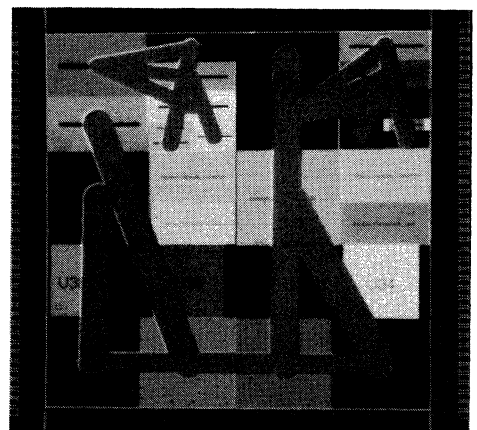
Third Party Interface

CDE/MG	Links Mentor Graphics' system-level tools with LSI Logic's silicon-accurate MDE tools.
Design Kits	Verilog®, Valid, IKOS, Viewlogic

Design Concept

LSI Logic design tools are focused on reducing the design cycle and "buying you time". This is vital in establishing a market lead in product introduction.

They also leverage the silicon technology providing highly optimized, fast circuits that lead to differentiated products.



FloorPlanner™ Software

Products and Services

Design Resource Centers

LSI Logic offers the industry's most extensive ASIC design support network and a full range of hardware and software design tools. At 39 LSI Logic Design Resource Centers worldwide and 18 authorized distributor Design Centers,

experienced application engineers offer training and design assistance giving customers the expertise, hardware platforms and software tools they need to integrate systems into silicon.

Manufacturing

Advanced wafer fabrication, assembly, testing and packaging technology make LSI Logic the leader in prototype and volume ASIC manufacturing. With worldwide production facilities extending from the US to the United Kingdom, Japan, West Germany and Canada, LSI Logic's manufacturing operations are geared to produce dense and fast chips, a wide variety of packages, small-to-large production runs and extensive test patterns. These manufacturing sites offer advanced ASIC processes including

1.0 and 1.5-micron drawn gate length (0.7-micron and 0.9-micron effective channel length) HCMOS and high-performance BiCMOS.

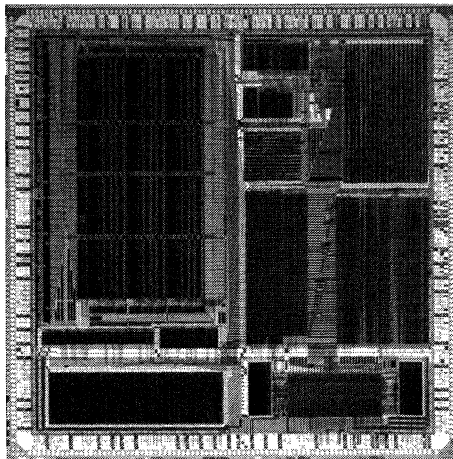
LSI Logic offers more than 400 different plastic and ceramic package types with up to 524 leads and accommodating die up to 1.5 cm sq. These include pin grid array, leaded and leadless chip carrier, chip on tape, plastic quad flat packs and dual-in-line packages.

Fast Prototypes

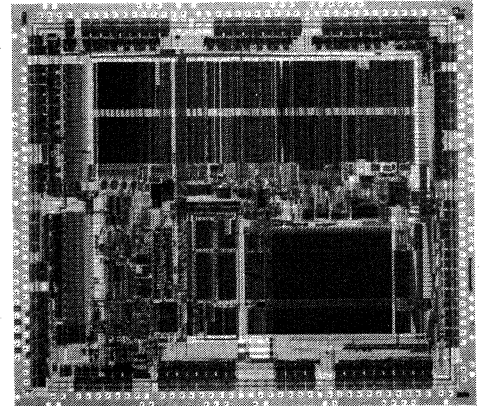
LSI Logic offers the fastest ASIC prototype services in the industry. Fully tested and working gate array prototypes are delivered in only two to three weeks – or an eight-day *Hot Lot* service is offered if a customer requires faster

turnaround. For cell-based ASICs, tested and working prototypes are delivered in six weeks – or *Hot Lots* in just four weeks.

LSI Logic



L64814 SPARC Microprocessor



LR3000 MIPS Microprocessor

SPARC Microprocessor Products

Components	Device Type	Product Code	Clock Rate (MHz)	Package	Available	Alternate Source
SPARC Integer Unit		L64801QC-	20	160 PQFP	Now	MB86901
		L64801NC-	20	179 PPGA	Now	
		L64801GC-	20	179 CPGA	Now	
		L64801QC-	25	160 PQFP	Now	
		L64801NC-	25	179 PPGA	Now	
		L64801GC-	25	179 CPGA	Now	
Advanced SPARC Integer Unit		L64811NC-	25	207 PPGA	Now	CY7C601
		L64811GC-	25	207 CPGA	Now	
		L64811NC-	33	207 PPGA	Now	
		L64811GC-	33	207 CPGA	Now	
		L64811GC-	40	207 CPGA	Now	
Floating-Point Unit		L64814NC-	25	143 PPGA	Now	W3171
		L64814GC-	25	143 CPGA	Now	
		L64814NC-	33	143 PPGA	Now	
		L64814GC-	33	143 CPGA	Now	
		L64814GC-	40	143 CPGA	Now	
MMU, Cache Controller, Tags (MCT)		L64815GC-	25	223 CPGA	Now	
			33	223 CPGA	Contact factory	
			40	223 CPGA	Contact factory	
Mbus DRAM Controller		L64850GC-	25	223 CPGA	Now	
			33	223 CPGA	Contact factory	
			40	223 CPGA	Contact factory	
Sbus DMA Controller		L64853QC-	25	120 PQFP	Now	
Mbus to STDIO Interface		L64851QC-	25	208 PQFP	Now	
			33	208 PQFP		
			40	208 PQFP		
Mbus to SBus Interface		L64852GC-	25	223 CPGA	Now	
			33	223 CPGA	Contact factory	
			40	223 CPGA	Contact factory	
SPARC Embedded Processor		L64901QC-	20	160 PQFP	Now	
		L64901NC-	20	144 PPGA	Now	
		L64901QC-	25	160 PQFP	Now	
		L64901NC-	25	144 PPGA	Now	
Integrated System Controller		L64951QC-	20	160 PQFP	Contact factory	
		L64951NC-	20	144 PPGA	Contact factory	
		L64951QC-	25	160 PQFP	Contact factory	
		L64951NC-	25	144 PPGA	Contact factory	
Evaluation/Development Board		EDB901-	20		Contact factory	
		EDB901-	25		Contact factory	

Development Systems Software	Product Code	Description	Available
	ST-N99-SSB10445	SPARCsim single user license; software on cartridge-tape media with one set of documentation.	Now
	ST-N99-RXT10445	RDBXtool single user license; software on cartridge-tape media with one set of documentation.	Now
	ST-N99-SPM10445	SPARCmon source code license; software on cartridge-tape media with one set of documentation.	Now

MIPS Microprocessor Products

Components	Device Type	Product Code	Description	Clock (MHz)	Package	Available
Central Processing Unit		LR2000GC-12	First Generation	12.5	144 CPGA	Now
		LR2000GC-16	RISC Processor with Memory Management	16.7	144 CPGA	Now
Floating-Point Accelerator		LR2010LC-12	High-Performance	12.5	84 CLDCC-J	Now
		LR2010LC-16	Coprocessor	16.7	84 CLDCC-J	Now
Write Buffer		LR2020JC-12	Cache-Main Memory	12.5	68 PLDCC-J	Now
		LR2020GC-12	Write Interface	12.5	68 CPGA	Now
		LR2020JC-16			16.768 PLDCC-J	Now
		LR2020GC-16			16.768 CPGA	Now
Central Processing Unit		LR3000LC-16	Second Generation	16.7	172 CLDCC	Now
		LR3000GC-16	RISC Processor with	16.7	144 CPGA	Now
		LR3000LC-20	Memory Management	20	172 CLDCC	Now
		LR3000GC-20		20	144 CPGA	Now
		LR3000LC-25		25	172 CLDCC	Now
		LR3000GC-25		25	144 CPGA	Now
		LR3000AKC-25		25	172 CLDCC (cavity-down)	Now
		LR3000AHC-25		25	175 CPGA (cavity-down)	Now
		LR3000AKC-33		33.3	172 CLDCC (cavity-down)	Now
		LR3000AHC-33		33.3	175 CPGA (cavity-down)	Now
		LR3000AKC-40		40	172 CLDCC (cavity-down)	Q1 '91
LR3000AHC-40		40	175 CPGA (cavity-down)	Q1 '91		
Floating-Point Accelerator		LR3010HC-16	High Performance	16.7	84 CPGA (cavity-down)	Now
		LR3010KC-16	Coprocessor	16.7	84 CLDCC (cavity-down)	Now
		LR3010HC-20		20	84 CPGA (cavity-down)	Now
		LR3010KC-20		20	84 CLDCC (cavity-down)	Now
		LR3010HC-25		25	84 CPGA (cavity-down)	Now
		LR3010KC-25		25	84 CLDCC (cavity-down)	Now
		LR3010AHC-25		25	84 CPGA (cavity-down)	Now
		LR3010AKC-25		25	84 CLDCC (cavity-down)	Now
		LR3010AHC-33		33.3	84 CPGA (cavity-down)	Now
		LR3010AKC-33		33.3	84 CLDCC (cavity-down)	Now
		LR3010AHC-40		40	84 CPGA (cavity-down)	Q1 '91
		LR3010AKC-40		40	84 CLDCC (cavity-down)	Q1 '91
		Write Buffer		LR3020JC-16	Cache-Main Memory	16.7	68 PLDCC-J	Now
LR3020GC-16	Write Interface			16.7	68 CPGA	Now
LR3020JC-20				20	68 PLDCC-J	Now
LR3020GC-20				20	68 CPGA	Now
LR3020JC-25				25	68 PLDCC-J	Now
LR3020GC-25				25	68 CPGA	Now
Read-Write Buffer		LR3220GC-25	Integrated Cache-	25	180 CPGA	Now
		LR3220QC-25	Main Memory Interface	25	184 PQFP	Now
		LR3220GC-33		33.3	180 CPGA	Now
		LR3220QC-33		33.3	184 PQFP	Now
MIPS Ngine™ Module		RPM3310-25	LR3000 and LR3010	25		Now
		RPM3330-33	Module with Caches and Read-Write Buffer	33.3		Now
Embedded Processor		LR33000HC-25	MIPS-Based	25	155 CPGA	Q4 '90
		LR33000QC-25	Embedded Processor	25	160 PQFP	Q2 '91
		LR33000HC-33		33.3	155 CPGA	Q1 '91
		LR33000HC-40		40	155 CPGA	Q2 '91

**MIPS
Microprocessor
Products**



Components (Continued)	Device Type	Product Code	Description	Clock (MHz)	Package	Available
	MIPSET	LR3201QC-16	RST/INT	16	64 PQFP	Now
		LR3201QC-20	Controller	20	64 PQFP	Now
		LR3201QC-25		25	64 PQFP	Now
		LR3202QC-16	L-Bus	16	208 PQFP	Now
		LR3202QC-20	Controller	20	208 PQFP	Now
		LR3202QC-25		25	208 PQFP	Now
		LR3203QC-16	DRAM	16	160 PQFP	Now
		LR3203QC-20	Controller	20	160 PQFP	Now
		LR3203QC-25		25	160 PQFP	Now
		LR3204QC-16	DRAM Data	16	64 PQFP	Now
		LR3204QC-20	Buffer	20	64 PQFP	Now
		LR3204QC-25		25	64 PQFP	Now
		LR32D04QC-16	Integrated	16	100 PQFP	Now
		LR32D04QC-20	DRAM Data	20	100 PQFP	Now
		LR32D04QC-25	Buffer	25	100 PQFP	Now
		LR3205QC-16	Block Transfer	16	208 PQFP	Now
		LR3205QC-20	Buffer	20	208 PQFP	Now
		LR3205QC-25		25	208 PQFP	Now
		LR3208QC-16	Video Frame	16	208 PQFP	Q1 '91
		LR3208QC-20	Controller	20	208 PQFP	Q1 '91
		LR3208QC-25		25	208 PQFP	Q1 '91
		LR3209QC-16	Video Shifter	16	Contact factory	Q1 '91
		LR3209QC-20		20	Contact factory	Q1 '91
		LR3209QC-25		25	Contact factory	Q1 '91

LSI Logic

Digital Signal Processing (DSP) Products

Fixed-Point Multipliers	Device Type	Part Number	Description	Speed (ns)		Packages	Available
				Commercial	Military*		
32-Bit MACs	L64032	32-Bit MAC with 64-Bit Mode	125	160	132 CPGA	Now	
			100	125	132 CLDCC	Now	
			80	100		Now	

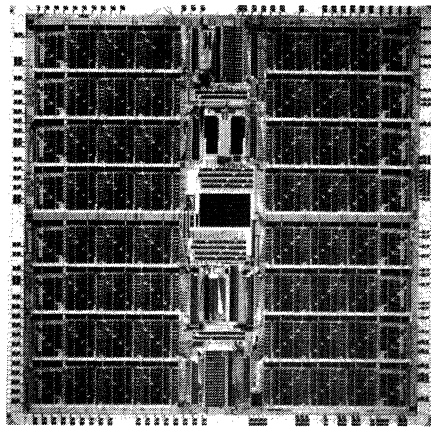
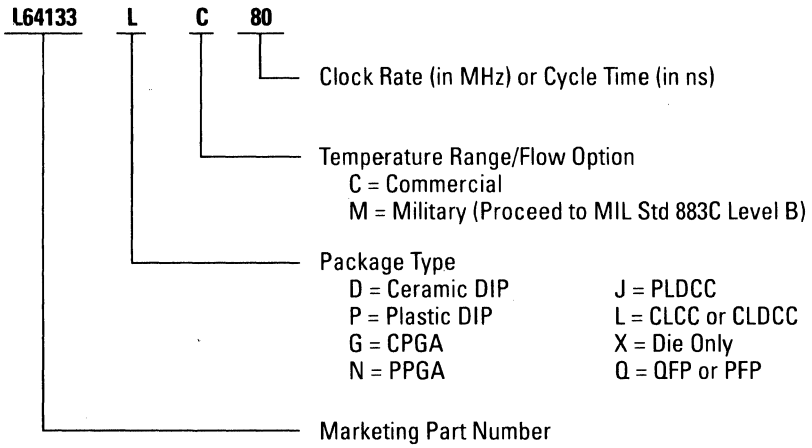
Floating-Point Processors	Device Type	Part Number	Description	Cycle Time (ns)		Packages	Available
				Commercial	Military*		
32-Bit Floating Point Processor	L64133	IEEE Multiplier and ALU	80	125	144 CPGA	Now	
			60	100		Now	
			50	80		Now	

Signal and Image Processing Devices	Device Type	Part Number	Description	Clock Rate (MHz)		Packages	Available	
				Commercial	Military*			
Variable-Length Video Shift Register (VSR)	L64210	1K x 4 x 8 Line Delay	15	12	68 PLCC	Now		
			20	16	68 CPGA	Now		
			L64211	512 x 8 x 8 Line Delay	15	12	120 CPGA	Now
					20	16	120 PPGA	Now
High Speed Variable-Length Video Shift Register (HVSR)	L64212	1K x 4 x 8 Line Delay	30	20	95 CPGA	Now		
			40	30		1Q90		
Rank-Value Filter (RVF)	L64220	12-Bit, 64-Tap Rank-Value Filter	15	12	155 CPGA	Now		
			20	16		Now		
Binary Filter and Template Matcher (BFIR)	L64230	1024-Tap Binary Data FIR Filter	15	12	155 CPGA	Now		
			20	16		Now		
8 x 8 Multi-Bit Filter (MFIR)	L64240	64-Tap, 8-Bit Data or 32-Tap, 16-Bit Data FIR Filter	15	12	155 CPGA	Now		
			20	16		Now		
3 x 3 Multi-Bit Filter (MFIR)	L64243	9-Tap, 8-Bit Data FIR Filter	20	20	68 CPGA	Now		
			30	30	68 PLCC	Now		
			40	40		Now		
Histogram/Hough Transform Processor (HHP)	L64250	4096 x 4096 Pixel Histogram and Hough Transform Processor	15	12	68 CPGA	Now		
			20	16	68 PLCC	Now		
Versatile FIR Filter Processor (VFIR)	L64260	Multi-Tap 16-Bit FIR Filter Processor	30	25	223 CPGA	Now		
			40	30		1Q90		
			L64261	Multi-Tap 16-Bit FIR Filter Processor	30	25	144 CPGA	Now
					40	30		1Q90
Crossbar Switch (XBAR)	L64270	64 to 64 Crossbar Switch with Pipeline and Flow-Through Modes	30	N/A	160 PQFP	Now		
			40	N/A	180 PPGA	1Q90		
Complex FFT Processor (FFTP)	L64280	Floating-Point Complex FFT Processor. Single and Multi-Processor Modes	30	25	144 CPGA	Now		
			40	30		2Q90		
FFT Video Shift Register (FFTSR)	L64281	FFT Video Shift Register Formats Data for L64280	30	30	132 CPGA	Now		
			40	40		2Q90		
Object Contour Tracer (TRACER)	L64290	Contour Tracer for Binary Images 128 x 128 with Internal RAM 1024 x 1024 with External RAM	15	12	68 CPGA	Now		
			20	16		2Q90		
R-S CODEC	L64710	8-Error Correcting Reed-Solomon Codec	40	30	68 CPGA	Now		
			30	25		2Q90		

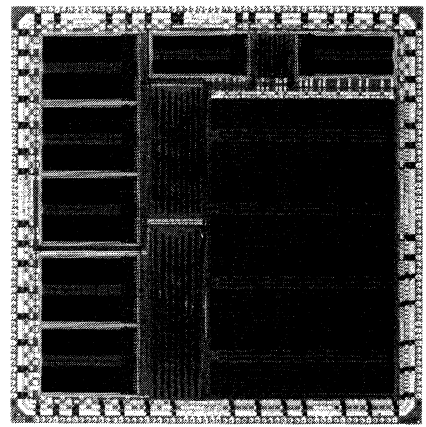
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Digital Signal Processing (DSP) Products

DSP Part Number



L64240 Chip



L64720 Chip

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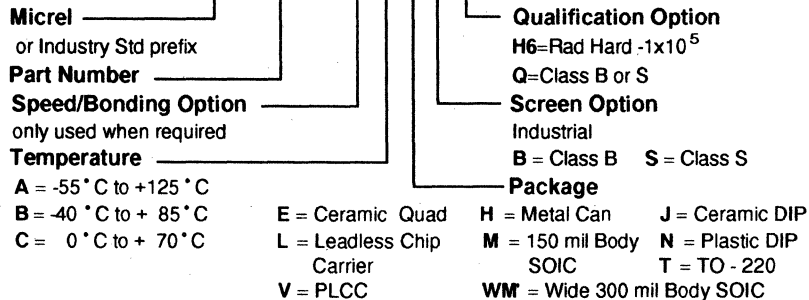
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- 5) Digital VLSI device testing services

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MIC1426CM/CN	LOW COST 1.2A DUAL HI-SP MOSFET DRIVER	MIC5010BM/BN	HIGH SIDE MOSFET PREDRIVER
MIC1427CM/CN	LOW COST 1.2A DUAL HI-SP MOSFET DRIVER	MIC5011BM/BN	HIGH SIDE MOSFET PREDRIVER
MIC1428CM/CN	LOW COST 1.2A DUAL HI-SP MOSFET DRIVER	MIC5012BM/BN	HIGH SIDE MOSFET PREDRIVER
MIC2533CN	1K STATIC S/R	MIC5013BN/BWM	HIGH SIDE MOSFET PREDRIVER
MIC2534CN	512 X 2 STATIC S/R	MIC50395CN	6 DECADE CTR/DECODER LED DRIVER
MIC2535CN	480 X 2 STATIC S/R	MIC50396CN	6 DECADE CTR/DECODER LED DRIVER
MIC2827CN	2K DYNAMIC S/R	MIC50397CN	6 DECADE CTR/DECODER LED DRIVER
MIC2855CN	128 X 4 SHIFT REGISTER	MIC50398CN	6 DECADE CTR/DECODER LED DRIVER
MIC2856CN	256 X 2 SHIFT REGISTER	MIC50399CN	6 DECADE CTR/DECODER LED DRIVER
MIC2856CN	512 X 1 SHIFT REGISTER	MIC5800CN	LATCHED DRIVER
MIC426AJ/CM/CN	1.5A DUAL HIGH SPEED MOSFET DRIVER	MIC5801BN	LATCHED DRIVER
MIC427AJ/CM/CN	1.5A DUAL HIGH SPEED MOSFET DRIVER	MIC5821BN	SERIAL INPUT LATCHED DRIVER
MIC428AJ/CM/CN	1.5A DUAL HIGH SPEED MOSFET DRIVER	MIC5822BN	SERIAL INPUT LATCHED DRIVER
MIC4350AJ	CMOS COUNTER/LATCH/DECODER/DRIVER	MIC5823BN	SERIAL INPUT LATCHED DRIVER
MIC4420AJ/CM/CN/CT	HI-SP, HI-CURRENT SINGLE MOSFET DRIVER	MIC5841BN	8 BIT SERIAL INPUT LATCHED DRIVER
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MIC4424AJ/CM/CWM	3A DUAL HIGH SPEED MOSFET DRIVER	MIC5843BN	8 BIT SERIAL INPUT LATCHED DRIVER
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MIC4469AJ/CM/CWM	POWER LOGIC QUAD DRIVER	MIC8031CL/CN	DICHROIC LCD DRIVER
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MIC5002CN	4 DIGIT 7-SEGMENT LED DRIVER	MM5451BN	LED DISPLAY DRIVER
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MIC5007CN	4 DIGIT LED DECODER/DRIVER	MPD8020-KP2	SEMICUSTOM SMART POWER DIGITAL KIT PART
MIC5009CN	COUNTER/TIME-BASE CKT		

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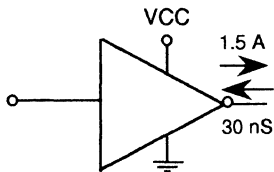
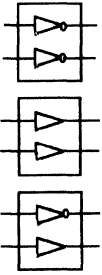
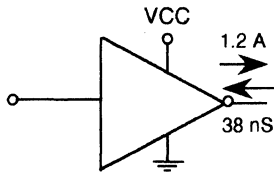
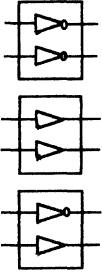
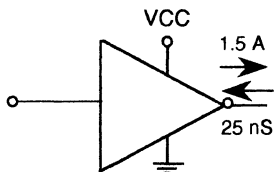
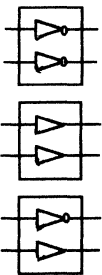
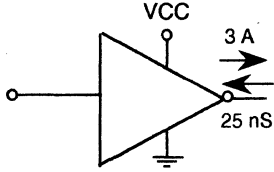
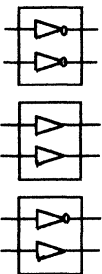
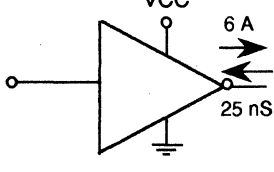
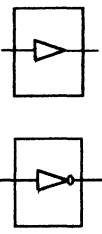
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MICREL MOSFET PREDRIVER SELECTION GUIDE

 <p>Drives a hex 0 - hex 3 size MOSFET; 400 pF to 3000 pF.</p>	<p>MIC426 Family (Original)</p> <ul style="list-style-type: none"> * 30 nS into 1000 pF * 4.5 V to 18 V supply * 1.5 A peak output * 6 Ω output impedance * Available in surface mount packages 	 <p>MIC426</p> <p>MIC427</p> <p>MIC428</p>
 <p>Drives a hex 0 - hex 3 size MOSFET; 400 pF to 3000 pF.</p>	<p>MIC1426 Family (Low Cost)</p> <ul style="list-style-type: none"> * Low cost predriver * 38 nS into 1000 pF * 4.75 V to 16 V supply * 1.2 A peak output * 8 Ω output impedance * Available in surface mount packages 	 <p>MIC1426</p> <p>MIC1427</p> <p>MIC1428</p>
 <p>Drives a hex 0 - hex 3 size MOSFET; 400 pF to 3000 pF.</p>	<p>MIC 4426 Family (Protected)</p> <ul style="list-style-type: none"> * Latch-up protected * 25 nS into 1000 pF * 1.5 A peak output * Withstands 5 V negative swing * 4.5 V to 18 V supply * 7 Ω output impedance * Available in surface mount packages 	 <p>MIC4426</p> <p>MIC4427</p> <p>MIC4428</p>
 <p>Drives a hex 4 - hex 5 size MOSFET; 6000 pF to 12000 pF.</p>	<p>MIC 4423 Family (High Current)</p> <ul style="list-style-type: none"> * Latch-up protected * 25 nS into 1800 pF * 3 A peak output * Withstands 5 V negative swing * 4.5 V to 18 V supply * 3.5Ω output impedance * Available in surface mount packages 	 <p>MIC4423</p> <p>MIC4424</p> <p>MIC4425</p>
 <p>Drives a hex 6 - hex 7 size MOSFET; 15000 pF to 16000 pF.</p>	<p>MIC4420/4429 (Singles)</p> <ul style="list-style-type: none"> * Latch-up protected * 25 nS into 10,000 pF * 6 A peak output * Withstands 5 V negative swing * 4.5 V to 18 V supply * 2.5 Ω output impedance * Available in surface mount and high temperature packages 	 <p>MIC4420</p> <p>MIC4429</p>

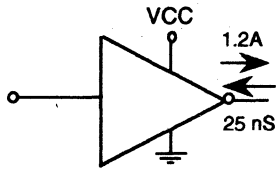
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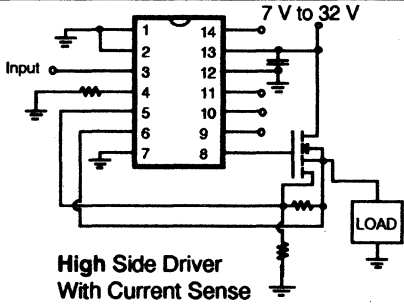
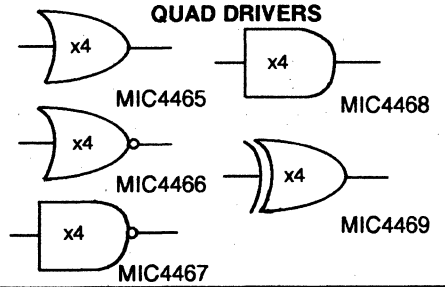
MICREL MOSFET PREDRIVER SELECTION GUIDE



Drives a hex 0 - hex 3 size MOSFET; 400 pF to 3000 pF

MIC4465 Family (Quads)

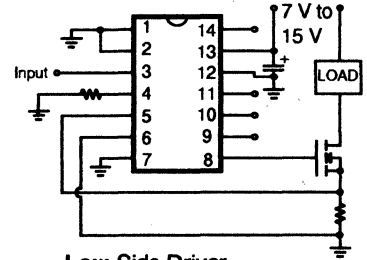
- * Latch-up protected
- * 25 nS into 470 pF
- * 1.2 A peak output
- * 4.5 V to 18 V supply
- * Available in surface mount packages
- * Five logic choices



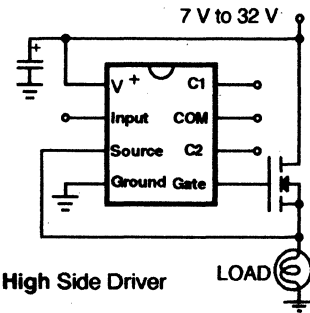
High Side Driver With Current Sense

MIC5010

- * Full featured predriver
- * Optional speed up caps
- * 7 V to 32 V supply
- * Internal charge pump
- * 60 μ S into 1 nF
- * Over current sensing
- * Fault flag output
- * Dynamic sensing threshold
- * Surface mount packages



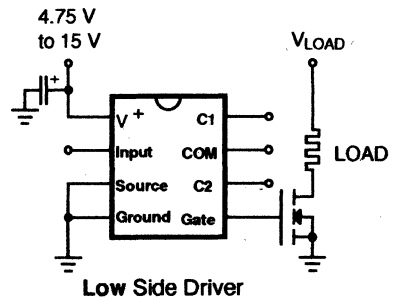
Low Side Driver With Current Sense



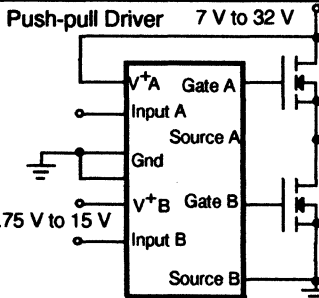
High Side Driver

MIC5011

- * Minimum parts count
- * Optional speed up caps
- * 4.75 V to 32 V supply
- * Internal charge pump
- * 60 μ S into 1 nF
- * Surface mount packages



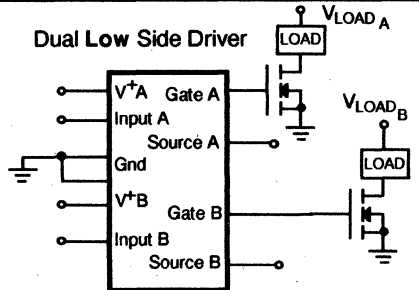
Low Side Driver



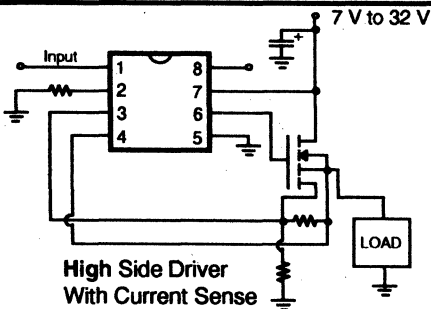
Push-pull Driver 7 V to 32 V

MIC5012

- * Dual predriver
- * Provides high and low side drive for H-bridge
- * 4.75 V to 32 V supply
- * Internal charge pump
- * 60 μ S into 1 nF
- * Surface mount packages



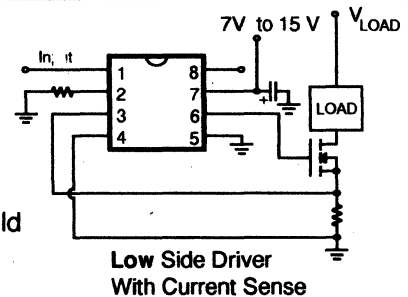
Dual Low Side Driver



High Side Driver With Current Sense

MIC5013

- * Over current sensing
- * 7 V to 32 V supply
- * Internal charge pump
- * 60 μ S into 1 nF
- * Fault flag output
- * Dynamic sensing threshold
- * Surface mount packages



Low Side Driver With Current Sense

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General Description

The MIC5010 family is a family of ICs designed to drive the gate of an N-channel power MOSFET above the supply rail in high side power switch applications. They are compatible with all sizes of standard and current sensing FETs, and can be used in both high and low side topologies. The MIC5010 is the full-featured member of this family, and includes both current sensing capability and pins available for two optional speed-up capacitors. The MIC5011 is the minimum parts count member, and is available in an 8-pin package. It has pins available for optional speed-up capacitors, but no current sense capability. The MIC5012 is a dual predriver, and can be used in half or full H-bridge topologies to provide both low and high side drive. The MIC5013 is also a minimum parts count version, and includes the current sense feature, but does not include the optional speed-up capacitors feature.

The current sense trip point is fully programmable via adjusting external resistor values, and a dynamic threshold allows high in-rush current loads to be started. A fault pin indicates when the FET has been turned off due to excessive current.

These versatile drivers are now available in hermetic and SOIC packages as well as the standard CERDIP and PDIP configurations. A version qualified to MIL-STD-883 class C as well as a nonqualified part with full military temperature range have also recently become available.

Military/Hermetic

PART NUMBER	TEMPERATURE RANGE	PACKAGE
MIC5010AJ	- 55 °C to + 125 °C	14 pin Ceramic DIP
MIC5010AJ/883	- 55 °C to + 125 °C	14 pin Ceramic DIP
MIC5010BJ	- 40 °C to + 85 °C	14 pin Ceramic DIP
MIC5011AJ	- 55 °C to + 125 °C	8 pin Ceramic DIP
MIC5011AJ/883	- 55 °C to + 125 °C	8 pin Ceramic DIP
MIC5011BJ	- 40 °C to + 85 °C	8 pin Ceramic DIP
MIC5012AJ	- 55 °C to + 125 °C	14 pin Ceramic DIP
MIC5012AJ/883	- 55 °C to + 125 °C	14 pin Ceramic DIP
MIC5012BJ	- 40 °C to + 85 °C	14 pin Ceramic DIP
MIC5013AJ	- 55 °C to + 125 °C	8 pin Ceramic DIP
MIC5013AJ/883	- 55 °C to + 125 °C	8 pin Ceramic DIP
MIC5013BJ	- 40 °C to + 85 °C	8 pin Ceramic DIP

Protected under one or more of the following Micrel patents:
patent #4,951,101; patent # 4,914,546

Features

- * New small outline SO (surface mount) packages
- * Internal charge pump to drive the gate of an N-channel FET
- * Internal zener clamp for gate protection
- * 7 V to 32 V operation: MIC5010/5013
- * 4.75 V to 32 V operation: MIC5011/5012
- * Less than 1 μ A standby current in the "off" state
- * 25 μ S typical turn-on time to 50% gate overdrive
- * Implements high or low side switches
- * Programmable current sensing with dynamic threshold for high inrush loads: MIC5010/5013
- * Fault output pin indicates current faults: MIC5010/5013
- * Available in a dual configuration: MIC5012
- * 883C qualified version available

Applications

- * Relay and solenoid drivers
- * Half or full H-bridge elements
- * Heater switching
- * Power bus switching
- * Switched mode power supply elements
- * Motion control
- * Incandescent or halogen lamp driver

Ordering Information: SOIC

PART NUMBER	TEMPERATURE RANGE	PACKAGE
MIC5010BM	- 40 °C to + 85 °C	14 pin Plastic SOIC
MIC5011BM	- 40 °C to + 85 °C	8 pin Plastic SOIC
MIC5012BWM	- 40 °C to + 85 °C	16 pin Plastic SOIC
MIC5013BM	- 40 °C to + 85 °C	8 pin Plastic SOIC

Standard PDIP

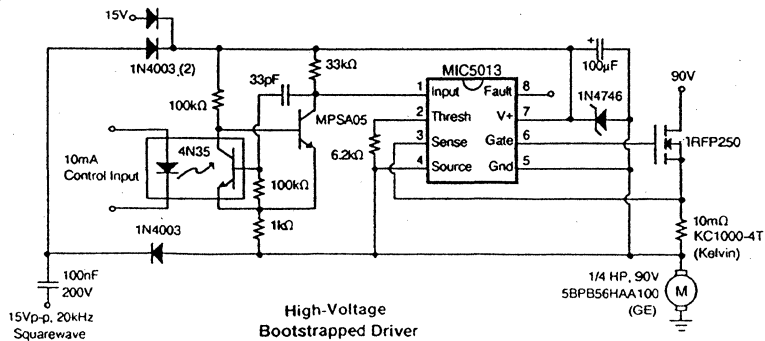
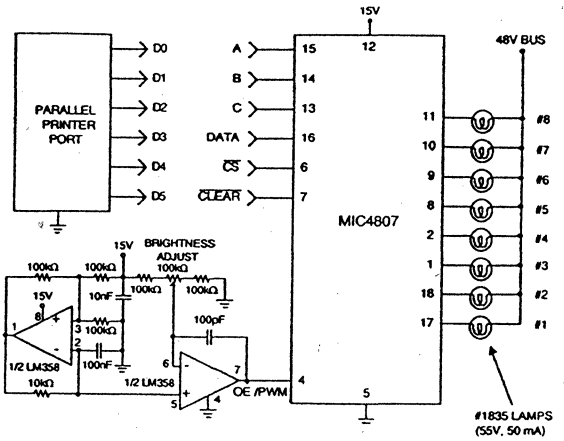
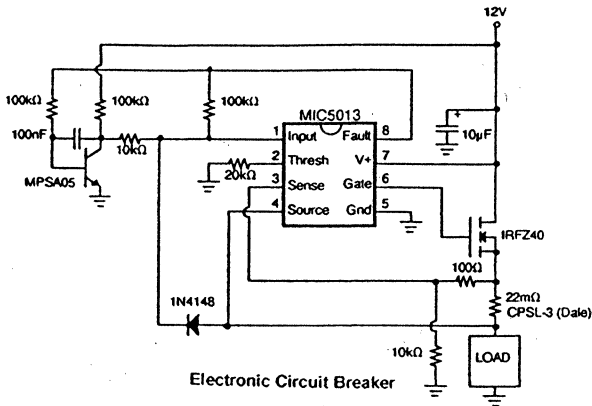
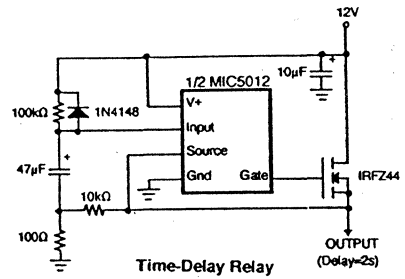
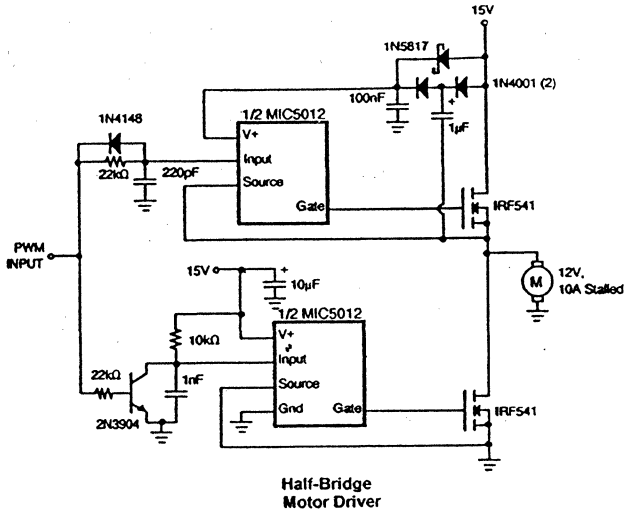
PART NUMBER	TEMPERATURE RANGE	PACKAGE
MIC5010BN	- 40 °C to + 85 °C	14 pin Plastic DIP
MIC5011BN	- 40 °C to + 85 °C	8 pin Plastic DIP
MIC5012BN	- 40 °C to + 85 °C	14 pin Plastic DIP
MIC5013BN	- 40 °C to + 85 °C	8 pin Plastic DIP

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Typical Product Applications



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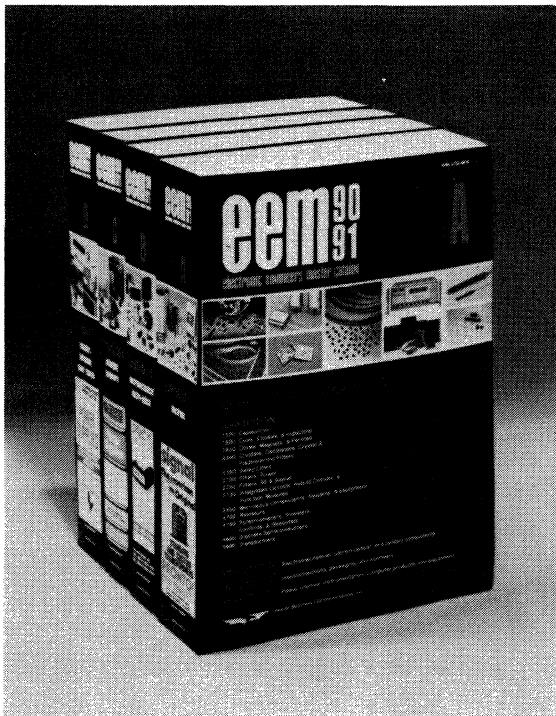
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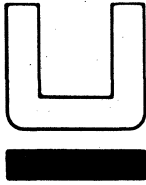
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Micro Networks, a division of Unitrode Corporation, is an established world leader in the design, development and manufacturing of high-performance data conversion products for military/aerospace and industrial applications. Our military data conversion products are manufactured in accordance with the requirements of MIL-STD-883, Method 5008 in our MIL-STD-1772 Qualified facility. This qualification also enables us to participate in DESC's Standardized Military Drawing (SMD) Program. Addition-

ally, we extend the high-performance and reliability of our military products to fulfill the demanding requirements found in the high-end industrial marketplace. The following selection guides represent our complete data converter product offerings with our new products highlighted by a check mark. We are introducing, for the first time, a product family of Flash A/D converters, ideal for both military and industrial applications.

- Analog to Digital Converters
- Sampling A/D Converters
- Multi-Channel A/D Converters and
- Amplifiers
- Digital to Analog Converters
- Track-Hold Amplifiers
- Data Acquisition Systems

Sampling A/D Converter Selection Guide

MIL-STD-1772 Qualified

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Resolution	Model Number	Description	Input Voltage Range		Minimum Sampling Rate	Minimum Input Bandwidth	SNR	Harmonics	DIP Pkg. (Pins)	Power (mW)	MIL-STD-883 Hi-Rel Option
			Unipolar	Bipolar							
✓ 16-Bits	MN6295	Low Distortion, 50kHz. Sampling A/D	0 to +10V	±5V	50kHz	25kHz	84dB	-88dB	32	1320	Yes
	MN6296		N.A.	±10V	50kHz	25kHz	84dB	-88dB	32	1320	Yes
	MN6290	Low Distortion, 20kHz. Sampling A/D	0 to -10V	±5V	20kHz	10kHz	84dB	-88dB	32	1150	Yes
	MN6291		N.A.	±10V	20kHz	10kHz	84dB	-88dB	32	1150	Yes
✓ 12-Bits	MN6249	Extremely High-Speed. Fully FFT Tested	N.A.	±2.5V, ±5V	2MHz	1MHz	68dB	-78dB	40 (triple)	3560	Yes
	MN6774	774 Equivalent with Internal Track-Hold	0 to -10V	±5V, ±10V	100kHz	50kHz	70dB	-80dB	28	690	Yes
	MN6231	674A Equivalent with Internal Track-Hold	0 to +10V	±5V	50kHz	25kHz	70dB	-80dB	28	885	Yes
	MN6232		N.A.	±10V	50kHz	25kHz	70dB	-80dB	28	885	Yes
	MN6227	574A Equivalent with Internal Track-Hold	0 to +10V	±5V	33kHz	16.5kHz	70dB	-80dB	28	885	Yes
MN6228	N.A.		±10V	33kHz	16.5kHz	70dB	-80dB	28	885	Yes	
✓ 8-Bits	MN6900	500MHz. Sampling A/D	N.A.	±270V	500MHz	1.26Hz	45dB	—	84	75	N.A.
	MN6901	250MHz. Sampling A/D	N.A.	±270V	250MHz	1.26Hz	45dB	—	84	5	N.A.
✓ Auto-ranging	MN5420	20-Bit Dynamic Range. Floating Point A/D Converter	N.A.	±5V	320kHz	160kHz	N.A.	-66dB	3" x 4" module	6700	N.A.

✓ = New Products

Multi-Channel A/D Converter and Data Acquisition System Selection Guide

MIL-STD-1772 Qualified

Resolution	Model Number	Description	Input Channels	Acquisition Time to ± 1/2 LSB (μsec)	Conversion Time (μsec)	Throughput (Channels/sec)	Maximum Linearity Error (%FSR)	Power (mW)	DIP Pkg. (Pins)	Specified Temp Range (°C)	MIL-STD-883 Hi-Rel Option
✓ 12-16-Bits	MN7208 MN7216	8 Diff/16 Channel Mux. Sequencer, Amp Front End for DAS	8 Diff. 16 (Expandable)	5	Depends on A/D	200,000	±0.002 (Typ)	240	40	0 to +70 -55 to +125	Yes
✓ 12-Bits	MN7150-8 MN7150-16	Complete 8 or 16-Channel DAS. Instru. Amp, T/H, A/D, 3-State Buffers, HDAS-8/16 Compatible	8 Diff. 16	9	9	55,000	±0.012	1785	62	0 to +70 -25 to +85 -55 to +125	Yes*
	MN7145 MN7146 MN7147	Complete 8-Channel, 12-Bit DAS, μP Interfaced	8	8	20	35,000	±0.012 ±0.024	710	28	0 to +70 -55 to +125	Yes
	MN7140	Complete 12-Bit DAS, Industry Standard, 40-Pin DIP for Military/Aerospace Applications	8 (Expandable)	8	40	20,000	±0.012	1250	40	0 to +70 -25 to +85 -55 to +125	Yes
	MN7130	16-Channel Multiplexer, Instru. Amp and T/H in DIP Package (Use with 12-Bit A/D to Configure a Low-Cost 2 Package DAS)	16 (Expandable)	65	Depends on A/D	N.A.	±0.002 (Typ)	900	32	0 to +70 -55 to +125	Yes
8-Bits	MN7120	Complete 8-Channel Mux, T/H, A/D 3-State Buffer	8	5	6	90,000	±0.2	680	32	0 to +70 -55 to +125	Yes

✓ = New Products

* = DESC Approved SMD Available

A/D Converter Selection Guide

MIL-STD-1772 Qualified

Resolution	Model Number	Description	Maximum Conversion Time (μsec) (1)	Internal Clock	Specified Temp Range (°C)	Maximum Linearity Error (% FSR)	Guaranteed No Missing Codes Over Temp	Power (mW)	DIP Pkg. (Pins)	MIL-STD-883 Hi-Rel Option
✓ 16-Bits	MN5295	High-Speed.	17	Yes	0 to +70	± 0.003	Yes (2)	945	32	Yes *
	MN5296	High Performance			-55 to +125	± 0.006	Yes (3)			
	MN5290	High Performance	40	Yes	0 to +70	± 0.003	Yes (2)	810	32	Yes *
	MN5291				-55 to +125	± 0.006	Yes (3)			
	MN5284 Series	Ultra Low Power. 15-Bit Performance TTL/CMOS. Fast	50	Yes	0 to +70	± 0.003	Yes (4)	255	32	No
MN5282	General Purpose. Fast. Low Cost	50	Yes	0 to +70	± 0.003	Yes (5)	1400	32	No	
MN5280	General Purpose. Low Cost	100	Yes	0 to -70	± 0.003	Yes (5)	1400	32	No	
✓ 12-Bits	MN5249	Subranging Technique. Extremely Fast. TTL Compatible. 3-State	0.4	(6)	0 to +70 -55 to +125	± 0.024	Yes	2500	40	Yes
	MN5245 MN5246	Subranging Technique. Extremely Fast. TTL Compatible. 3-State	0.85	(6)	0 to +70 -55 to +125	± 0.024	Yes	2560	40	Yes *
	MN5240	Fast. Internal Clock. No Missing Codes. ADC85 Pin-Compatible	5	Yes	0 to +70 -55 to +85	± 0.012	Yes	1400	32	Yes
	MN774	μP-Compatible. Very-Fast. Low Cost	8	Yes	0 to +70 -55 to +125	± 0.012	Yes	325	28	Yes
	ADC84	Fast. Popular. Low Cost. Internal Clock	8	Yes	0 to +70 -25 to +85	± 0.012	Yes	975	32	No
	ADC85	Fast. Internal Clock. Industry Standard for Industrial Applications	8	Yes	0 to +70 -25 to +85	± 0.012	Yes	975	32	No
	ADC87	ADC85 Pin-Compatible Guaranteed -55°C to +125°C Operation	8	Yes	-25 to +85 -55 to +125	± 0.012	Yes	1110	32	Yes
	MN5210 Series	Most Widely Used 12-Bit A/D for Military/Aerospace Applications. Fast	13	No	0 to +70 -55 to +125	± 0.012	Yes	695	24	Yes *
	MN674A	μP-Compatible. Fast. Low Cost	15	Yes	0 to +70 -55 to +125	± 0.012	Yes	325	28	Yes
	ADC80	Industry Standard Low Cost. Complete A/D	25	Yes	-25 to +85	± 0.012	Yes	593	32	No
	MN574A	μP-Compatible. Address Decoding. 3-State. Low Cost	25	Yes	0 to +70 -55 to +125	± 0.012	Yes	515	28	Yes
	MN5200 Series	Lower Cost Version of Industry Standard MN5210 Series	50	No	0 to +70 -55 to +125	± 0.012	Yes	695	24	Yes *
	MN5250 Series	Extremely Low Power. Widely Used in Satellite and Battery Applications	175	No	0 to +70 -55 to +125	± 0.012	Yes	56	24	Yes
✓ 8-Bits	MN5901	High-Speed. Flash Converter	0.01 100MHz	(6)	-55 to +125	± 0.2	Yes	1300	24	Yes
	MN5820	Flash Converter with Complete Support Circuitry	0.05 20MHz	(6)	0 to +70 -25 to +85 -55 to +125	± 0.4	Yes	858	24	Yes
	MN5902	20MHz CMOS Flash A/D	20	N.A.	0 to +70 -55 to +125	± 1	Yes	450	24	Yes,Q1.91
	MN5825	Succ. Approx. A/D High-Speed. Low Cost	1	Yes	0 to +70 -55 to +125	± 0.2	Yes	925	24	Yes
	MN5101 MN5100	Very-Fast. Widely Used in Avionics Applications	0.9 1.5	No	0 to +70 -55 to +125	± 0.2	Yes	1125	24	Yes
	MN5130 Series	Fast. Low Cost Popular. 18-Pin DIP	2.5	No	0 to +70 -55 to +125	± 0.2	Yes	680	18	Yes
	MN5140 Series	± 12V Supplies for Microprocessor and CMOS Applications	2.5	No	0 to +70 -55 to +125	± 0.2	Yes	680	18	Yes
	MN5150	Internal 3-State Output Buffer for Data Bus Applications	2.5	No	0 to +70 -55 to +125	± 0.2	Yes	680	24	Yes
	MN5120 Series	Most Popular 8-Bit A/D for Industrial and Military Applications	6	No	0 to +70 -55 to +125	± 0.2	Yes	680	18	Yes
	MN5065 MN5066	Ultra Low Power. Single 12V Supply. TTL/CMOS Compatible	100	No	0 to +70 -55 to +125	± 0.2	Yes	53	18	Yes
✓ 6-Bits	MN5900	Ultra-Fast Flash Converter	0.0033 300MHz	(6)	0 to +70	± 0.4	Yes	1500	40	No
	MN5903	Ultra-Fast Flash Converter. AD9000 Compatible	0.014 70MHz	(6)	0 to +70 -25 to +85 -55 to +125	78	Yes	650	16	Yes
	MN5904 MN5905	Ultra-Fast Flash Converter. Improved 5903 Cascadable	0.014 70MHz	(6)	0 to +70 -25 to +85 -55 to +125	78	Yes	650	16	Yes

✓ = New Products * = DESC Approved SMD Available

- Notes:
- For units with an external clock, the table shows the minimum conversion time that will result in specified accuracy. For units with internal clock, maximum conversion time is given.
 - No Missing Codes for 14 bits guaranteed over temperature.
 - No Missing Codes for 13 bits guaranteed over temperature.
 - No Missing Codes for 15 bits guaranteed over temperature.
 - No Missing Codes for 14 bits guaranteed at +25°C. No Missing Codes for 13 bits guaranteed 0°C to +70°C.
 - The conversion technique does not require a clock.

Micro Networks

D/A Converter Selection Guide

MIL-STD-1772 Qualified

Micro Networks

Resolution	Model Number	Description	Maximum Settling Time (μ sec) (1)	Internal Ref. and Output Op Amp	Specified Temp Range ($^{\circ}$ C)	Maximum Linearity Error (% FSR)	Monotonic Over Temp	Power (mW)	DIP Pkg. (Pins)	MIL-STD-883 Hi-Rel Option
16-Bits	MN3290-V MN3290-I	High Performance Guaranteed Over Extended Temperatures	8 1	Yes (2)	0 to +70 -55 to +125	\pm 0.003	(3)	525	24	Yes
	DAC71-V DAC71-I	Industry Standard for Industrial Applications	10 1	Yes (2)	0 to +70	\pm 0.003	(3)	850	24	No
12-Bits	MN565A	Industry Standard Monolithic D/A, Current Output, On-Chip Reference	0.25	Yes (2)	0 to +70 -55 to +125	\pm 0.012	Yes	225	24	Yes
	DAC80-V DAC80-I	Industry Standard, Low Cost	4 0.3 (Typ)	Yes (2)	0 to +70	\pm 0.012	Yes	345	24	No
	DAC85-V DAC85-I	Industry Standard, Binary Coding, Voltage/Current Output	4 0.3 (Typ)	Yes (2)	0 to +70 -25 to +85	\pm 0.012	Yes	345	24	No
	DAC87	Industry Standard, 12-Bit D/A for Military/Aerospace Applications	7	Yes	-25 to +85 -55 to +125	\pm 0.012	Yes	525	24	Yes
	DAC HK (4)	12-Bit D/A with Fast Input Register	4 (Typ)	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	975	24	Yes
	MN3850	For Military/Aerospace and Other High Reliability Applications	7	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	525	24	Yes
	MN3860 (5)	Fast Input Register, for Military/Aerospace Hi-Rel Applications	7	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	675	24	Yes
	MN3348	Low Cost, Low Power DAC349 Compatible	8	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	195	24	Yes
	DAC88 (5)	12-Bit D/A Converter with Fast Input Register, Hi-Rel and Industrial Applications	10	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	495	24	Yes
	MN3349	Low Cost, Low Power, Superior Second Source for the DAC349	10	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	195	24	Yes
	MN1900 (6)	Digitally Controlled, 2-Channel Waveform Synthesizer	100	Yes	0 to +70 -55 to +100	\pm 0.024	Yes	1700	40	Yes
	MN370 MN371	Industry Standard, Low Power D/A, Voltage Output	60 35	Yes	0 to +70 -55 to +125	\pm 0.012	Yes	90	18	Yes
10-Bits	MN3040 (5)	Fast Input Latch for Hi-Rel μ P Applications	10	Yes	0 to +70 -55 to +125	\pm 0.05	Yes	450	18	Yes
	MN3003 Series	Excellent for Servo Applications, Very Accurate Zero	30	Yes	0 to +70 -55 to +125	\pm 0.05	Yes	450	16	Yes
8-Bits	MN3008 MN3009	Fast Settling, 30 V/ μ sec Slew Rate	1	Yes	0 to +70 -55 to +125	\pm 0.2	Yes	495	16	Yes*
	MN3020 (5)	Fast Input Latch, Popular in Avionics Applications, Complete in 18-Pin DIP	3	Yes	0 to +70 -55 to +125	\pm 0.2	Yes	505	18	Yes*
	MN3014	Popular, Low Cost, General Purpose, Multirange	2.5	Yes	0 to +70 -55 to +125	\pm 0.2	Yes	420	16	Yes
	MN3000 Series	Excellent for Servo Applications, Very Accurate Zero, Small 14-Pin DIP	30	Yes	0 to +70 -55 to +125	\pm 0.2	Yes	510	14	Yes

✓ = New Products * = DESC Approved SMD Available

- Notes: 1. Specified for a full scale output step setting to \pm 1/2LSB.
 2. Current-output models do not have internal output op amps.
 3. Monotonicity for 14 bits guaranteed over temperature.
 4. Latch timing parameters: minimum setup time 50nsec, maximum hold time 0nsec, minimum latch enable pulse width 60nsec.

5. Latch timing parameters: minimum setup time 40nsec, maximum hold time 0nsec, minimum latch enable pulse width 60nsec.
 6. Latch timing parameters: minimum setup time 50nsec, maximum hold time 50nsec, minimum latch enable pulse width 30nsec.

Track-Hold Amplifier Selection Guide

MIL-STD-1772 Qualified

Applications	Model Number	Description	Maximum Linearity Error (%)	Acquisition Time	Gain and Voltage Range	Specified Temp Range (°C)	Aperture Jitter (psec)	Droop Rate (μV/μs)	Power (mW)	DIP Pkg. (Pins)	MIL-STD-883 Hi-Rel Option
13-16-Bits	MN375	Precision T/H Suitable for High Speed 12-14-Bit Applications	± 0.005	700nsec 10V Step to ± 0.005%	-1. ± 5V	0 to +70 -25 to +85	100	± 0.5	1325	24	Yes
	MN374	High Speed, High Resolution, 14-16-Bit Applications	± 0.003	3μsec 10V Step to ± 0.003%	-1. ± 10V	0 to +70 -55 to +125	400	± 0.1	390	14	Yes
	MN373	Precision T/H Compatible with MN5290, MN5291, MN5284 and other 16-Bit DIP A/D's	± 0.003	8.5μsec 10V Step to ± 0.003%	-1. ± 10V	0 to +70 -55 to +125	1000	± 0.5	300	14	Yes
12-Bits	MN376	Ultra High Speed ± 0.01% T/H, TTL Compatible	± 0.01	160nsec 10V Step to ± 0.01%	-1. ± 10V	0 to +70 -55 to +125	40	± 0.5	730	24	Yes
	MN0300A	Very High Speed ± 0.01% T/H, HTC-0300A Compatible	± 0.01	250nsec 10V Step to ± 0.01%	-1. ± 10V	0 to +70 -55 to +125	100	± 5	730	24	Yes
	MN375	Precision T/H Suitable for High Speed 12-14-Bit Applications	± 0.005	500nsec 10V Step to ± 0.01%	-1. ± 5V	0 to +70 -25 to +85	100	± 0.5	1325	24	Yes
	MN346	Fast, Low Cost, Internal Hold Capacitor, 14-Pin DIP	± 0.01	1μsec 10V Step to ± 0.01%	-1. ± 10V	0 to +70 -55 to +125	400	± 0.1	640	14	Yes
	MN347	Fast, Low Cost Internal Hold Capacitor, 14-Pin DIP	± 0.01	1μsec 10V Step to ± 0.05%	-1. ± 10V	0 to +70 -55 to +125	400	± 0.5	640	14	Yes
	MN7130	16-Channel Mux. Instru. Amp and T/H in a Single DIP (Use with A/D to make 2 Package DAS)	± 0.01	6.5μsec 20V Step to ± 0.01%	-1. ± 10V	0 to +70 -55 to +125	60 (1)	± 4	900	32	Yes
	MN343	Moderate Speed, Very Low Droop, Internal Hold Capacitor	± 0.01	75μsec 10V Step to ± 0.01%	-1. ± 10V	0 to +70 -55 to +125	2000	± 0.1	345	14	Yes
	MN344	Low Cost, Low Droop Internal Hold Capacitor	± 0.01	75μsec 10V Step to ± 0.05%	-1. ± 10V	0 to +70 -55 to +125	2000	± 0.4	345	14	Yes
10-Bits	MN4001	Very Fast T/H Amplifier	± 0.01	15ns 2V Step to ± 0.01%	± 1. ± 2	0 to +70 -55 to +125	1	60	500	16	Yes, Q1, 91
7-9 Bits	MN379	Ultra Fast, Designed to Drive Flash Converters, 500pF Cap Loading	± 0.1	35nsec 5V Step to ± 0.1%	+1. ± 2.5V	0 to +70 -55 to +125	1	± 500	1575	24	Yes

Micro Networks

Amplifier Selection Guide

MIL-STD-1772 Qualified

	Gain Ranges	Maximum Gain Error (%)	Offset Voltage (RTI, μV)	Offset Drift (μV/°C)	Small Signal BW (kHz)	Power (mW)	Specified Temp Range (°C)	DIP Pkg. (Pins)	MIL-STD-883 Hi-Rel Option
Instrumentation MN2200	1, 10, 100, 1000 Internal, 1 to 1000 with External Resistor	± 0.01 to ± 0.1 Depending on Range	± 100 (G=100)	± 0.6 (G=100)	750 (G=1)	240	-25 to +85 -55 to +125	18	Yes
Programmable-Gain MN2020	1, 2, 4, 8, 16, 32, 64, 128 Digitally Programmed	± 0.005 to ± 0.2 Depending on Range	± 100	± 5	5000 (G=1)	275	0 to +70 -55 to +125	18	Yes

	Open Loop Gain (dB)	Input Offset (mV)	Offset Drift (μV/°C)	Slew Rate (V/μsec)	Settling Time (to ± 1%, nsec)	Power (mW)	Specified Temp Range (°C)	DIP Pkg. (Pins)	MIL-STD-883 Hi-Rel Option
Operational MN542	75	± 2	± 5	± 175	60	450	0 to +70 -55 to +125	8	Yes

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PRECISELY THE ANSWER.

Mitsubishi CMOS Gate Arrays

INTRODUCTION

Mitsubishi offers three families of CMOS gate arrays: 1.0 μm , 1.3 μm , and 2.0 μm , with usable gates ranging from 200 to 35,000. The 1.0 and 1.3 μm devices are designed with low power, double-layer metal, single-poly, twin-well, silicon-gate CMOS processes.

All of the families feature Mitsubishi's patented gate isolation structure*. Gate isolation provides gate arrays with faster performance and higher gate density than conventional oxide isolation. Gate isolation results in an average of 15 percent faster performance and 20 percent higher gate density than conventional oxide isolation technology.

1.0 μm Gate Arrays

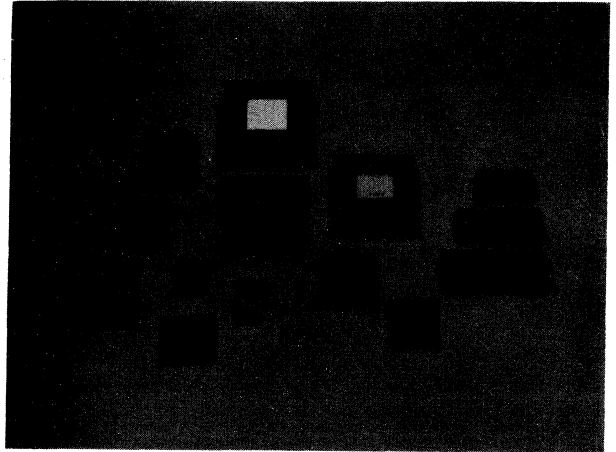
1 μm (M6005X) CMOS Gate Array Features

Feature	Parameter
Available Gates	10,000 to 70,000
Usable Gates (50% utilization)	5,000 to 35,000
Array Sizes	8
Architecture	Channel-less
Cell Architecture	Gate Isolation
Routing and Power Distribution	2 Layer Metal
Gate Length	1.0 μm Drawn
Gate Delay (2 input NAND, 2x drive, FO = 2, 2 mm metal)	450 psec
Gate Delay (2 input NAND, 4x drive, FO = 2, 2 mm metal)	370 psec
Toggle Rate	320 MHz
I/O Interface	TTL or CMOS Compatible
Power Consumption (2 NAND, FO = 2, 1x drive)	5 μW /gate/MHz
Output Buffer Drive (single)	1, 2, 4, 8, 12 mA
Output Slew Selection	0.5 to 1.0 volt/nsec
Library	500 Cells
Speed/Power Cell Option	1x, 2x, 3x, 4x Drive

Mitsubishi's gate arrays are available in through-hole and surface-mount packages including Adaptable Pin Grid Arrays (APGA) and Very-Fine-Pitch Quad Flat Packages (VQFP).

All gate arrays are 100 percent burned-in, and electrically (AC and DC) and functionally tested. Design kits for Mitsubishi gate arrays include the following CAE hardware and software: Dazix™, FutureNet®, Hewlett-Packard®, Intergraph®, IKOS®, Mentor Graphics®, OrCAD™, Synopsys®, Valid Logic™, Viewlogic™, Verilog®.

* U.S. Patent No. 4,562,453.



Typical Mitsubishi Gate Array Packages

M6005X Series — Mitsubishi's 1.0 μm gate arrays are designed with a channel-less architecture and allow efficient use of silicon. The 1.0 μm arrays have a propagation delay of 370 picoseconds for a 2-input NAND (FO = 2, 2 mm wire), a latch toggle rate of 320 MHz, and clock rates approaching 100 MHz. A typical input buffer delay is 1.0 ns and a typical output buffer delay is 2.0 ns.

In order to achieve low power dissipation and reduce operating temperature, the 1.0 μm gate arrays are designed with a minimized gate size resulting in a power dissipation of 5 μW /MHz/gate.

Features for 1.0 μm

Mitsubishi's 1.0 μm gate arrays include a speed/power option that allows design optimization to meet combined high speed, low power, and small die size requirements. The commonly used library cells are offered in a variety of sizes: 1, 2, 3, or 4 parallel transistors.

The optimization process is illustrated for the circuit path in Figure 1A. The optimum size of the second inverter is determined by the drive of the previous stage, as well as by the load. Since an increase in drive adds delay to the previous stage, this increase is added to the second stage delay in Figure 1B and 1C. The lowest attainable delay varies with buffer option,

depending on load. The large selection of Mitsubishi cell size options allows designers to achieve both needed speed and small die size.

In most gate arrays, 90 percent of the logic does not require fast performance. This means that small cells with low power are most efficient. Driving large loads at high speed, however, requires large cells with high power. The M6005X series features a speed/power option that allows the cell size to be set at x1, x2, x3 or x4 transistors, depending on the need for low power versus high speed. This feature allows the 1.0 micron gate arrays to take advantage of smaller cell size over the large area of the circuit where it is most appropriate and, at the same time, provide high speed where it is needed.

Figure 1A. Circuit Path

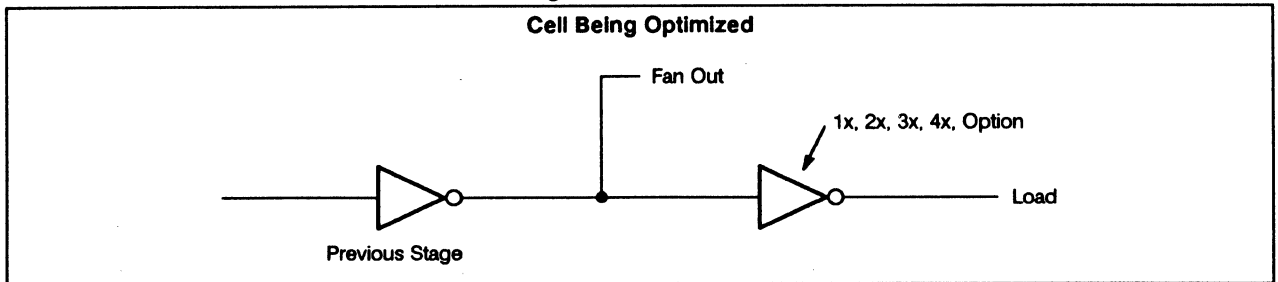


Figure 1B. Delay Characteristic Options

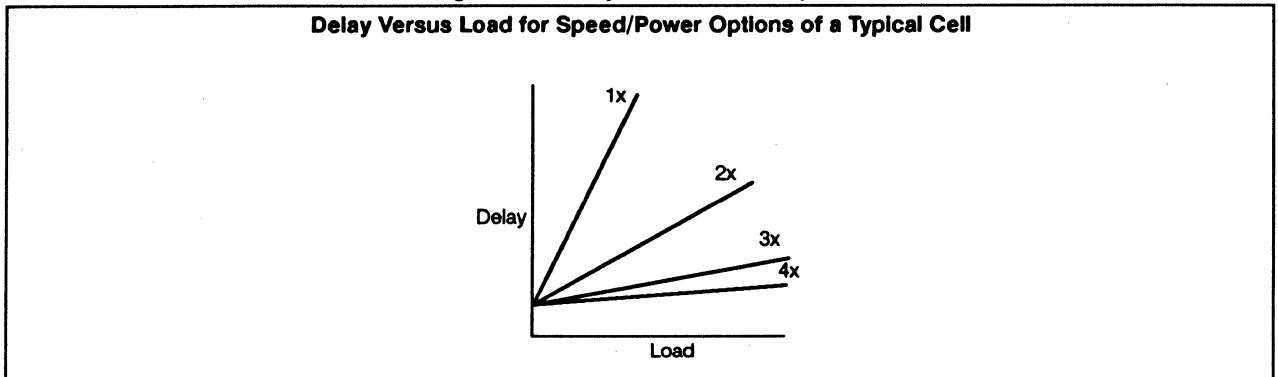
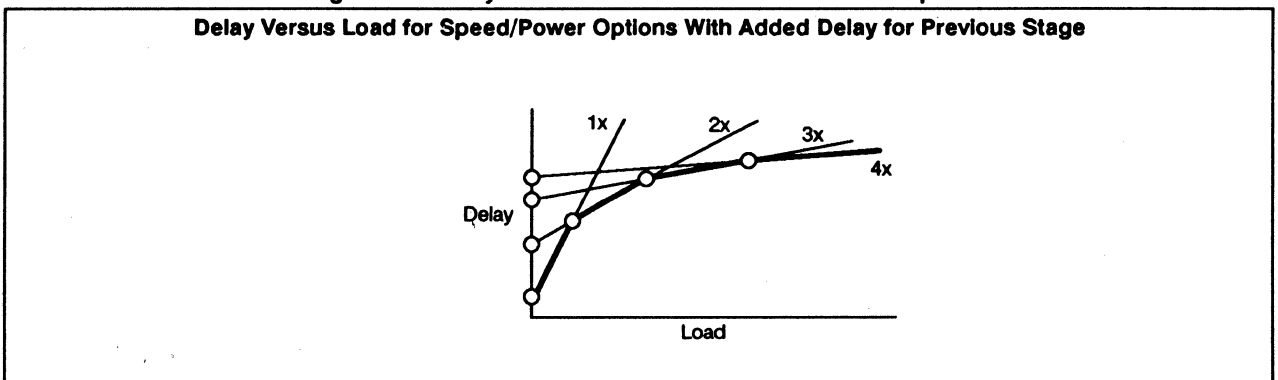


Figure 1C. Delay Variation of Circuit Path with Various Options



Mitsubishi Electronics

In addition to standard interface specifications, the M6005X series includes: optional pull-up or pull-down resistors for holding high or low states; a variable output drive, allowing buffer cells to be set for 1, 2, 4, 8 or 12 mA; and a selectable slew rate, ranging between 0.5 and 1.0 V/ns.

Figure 2 shows the improved gate utilization for 1.0 μm gate

arrays. In a three-input NAND gate, only four pitches are required using gate isolation, as opposed to eight that are required by conventional oxide isolation. The ability to use individual basic cells (pairs of n and p transistors) instead of two-input NAND gates increases gate utilization. This three-input NAND example illustrates a 50 percent improvement in density with gate isolation.

Figure 2. Gate Isolation and Oxide Isolation in a Three-Input NAND Gate

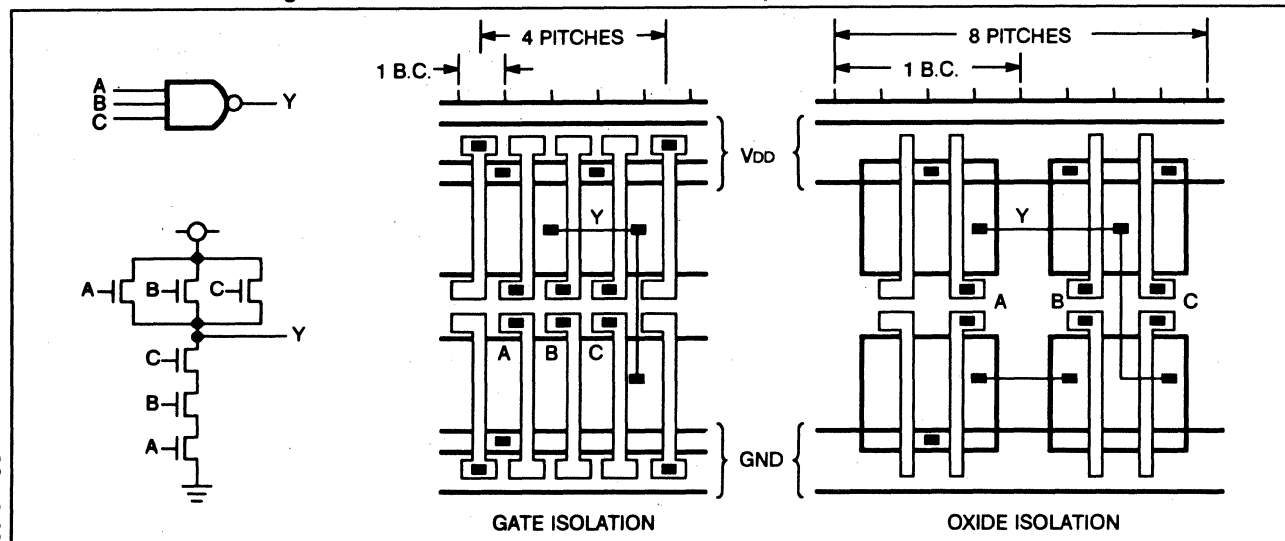


Table 1. Mitsubishi M6005X Series 1.0 μm CMOS Gate Arrays

Part Number			M60050	M60051	M60052	M60053	M60054	M60055	M60058	M60057
Number of Usable Gates			5,000	6,000	8,000	10,000	12,000	15,000	25,000	35,000
Maximum I/O Ports			112	120	128	150	188	178	216	234
Package Type	Lead Spacing	Pins								
Plastic Flat Package (QFP)	0.80 mm	80	•	•	•	•	•	•		
	0.65	100	•	•	•	•	•	•		
	0.80	128			•	•	•	•		
	0.65	160					•	•	•	
	0.50	208							•	•
Plastic Leaded Chip Carrier (PLCC)	50 mil	68	•	•	•	•	•	•		
	50	84	•	•	•	•	•	•		
Ceramic Pin-Grid-Array (PGA)	100 mil	281								•
Adaptable Pin-Grid-Array (APGA)	100 mil	***	***	***	***	***	***	***	***	

*****Adaptable Pin-Grid-Arrays (APGA)**

Gate arrays to be supplied in an APGA package are available in the configurations shown in the table below. After selecting a gate array master:

1. Determine the availability of a QFP with the required number of pins from the package matrix.
2. Find the APGA adapter available for the selected QFP.
3. Configurations not shown may be developed by Mitsubishi.

		ADAPTABLE PIN-GRID-ARRAY						
		Pins	84	100	124	144	160	208
Quad Flat Package	80	•						
	100	•	•					
	128				•			
	160					•	•	
	208							•

1.3 μ m Gate Arrays

M6004X, M6003X, and M6002X CMOS Gate Array Features

Feature	Parameter
Usable Gates	224 to 20,000
Array Sizes:	
M6002X	6
M6003X	6
M6004X	5
Architecture	
M6002X	Channeled
M6003X, M6004X	Variable Track Masterslice
Cell Architecture	Gate Isolation
Routing and Power Distribution	2 Layer Metal
Gate Length	1.3 μ m Drawn
Gate Delay (2 input NAND, FO = 2, 2 mm metal)	900 psec
Toggle Rate	175 MHz
I/O Interface	CMOS or TTL Compatible
Power Consumption	10 μ W/gate/MHz
Output Drive M6002X, M6003X	14 mA
Output Drive M6004X	4, 8, 12 mA (selectable)*
Library	Over 300 Cells

*M6004X has narrow bonding pad pitch to achieve 25% higher I/O pin count than M6002X/M6003X

M6004X Series — Mitsubishi's M6004X arrays are designed with variable track masterslice (VTM) architecture, providing variable-sized routing channel widths for efficient use of gates.

Figure 3 shows an example of variable width channels. Variable widths, achieved by the place and route software of VTM, increase an array's gate utilization by matching gate width re-

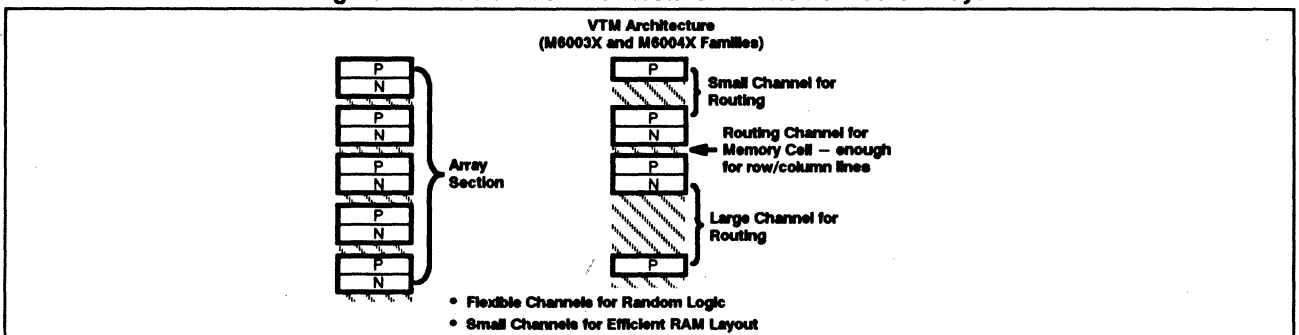
quirements. For large gate arrays, up to 50 percent of the silicon may be required for the interconnect of random logic, resulting in a 50 percent utilization rate. RAM and ROM implementation, conversely, uses close to 100 percent of the array transistors, requiring very little interconnect space.

Table 2. Mitsubishi M6004X Series 1.3 μ m CMOS Gate Arrays

Part Number			M60043	M60044	M60045	M60047	M60049
Number of Usable Gates			2,400	3,200	4,100	6,300	8,400
Maximum I/O Ports			112	132	144	180	184
Package Type	Lead Spacing	Pins					
Plastic Flat Package (QFP)	0.65 mm	100	.	.	.	.	.
	0.80	128	.	.	.	.	.
	0.65	160	.	.	.	.	.
	0.50	208	.	.	.	.	.
Adaptable Pin-Grid-Array (APGA)	100 mil	***	***	***	***	***	***

*** Refer to APGA Availability Chart p.5

Figure 3. Variable Track Architecture of Mitsubishi Gate Arrays



M6003X Series – With the same performance characteristics as the M6002X family, the M6003X 1.3 μm series offers large gate counts, ranging from 3200 usable gates with 88 I/Os to 20,000 usable gates with 256 I/Os. Series M6003X is also designed with VTM architecture.

M6002X Series – The family includes six sizes, ranging from 224 usable gates with 22 I/Os to 2400 usable gates with 72 I/Os.

Conventional channeled architecture is used to route interconnect lines over thick oxide, producing low capacitance in the M6002X series gate arrays.

Table 3. Mitsubishi M6002X and M6003X Series 1.3 μm CMOS Gate Arrays

Part Number (1)(2)			M60020	M60021	M60022	M60023	M60024	M60025	M60030	M60031	M60032	M60034	M60035	M60037	
Number of Usable Gates			224	507	800	1,104	1,773	2,400	3,200	4,100	6,300	8,400	11,000	20,000	
Maximum I/O Ports			22	32	42	48	62	72	88	110	132	180	196	256	
Package Type	Lead Spacing	Pins													
Plastic DIP	100 mil	16(3)	•												
		20(3)	•	•	•										
		28(4)	•	•	•	•									
Plastic Shrink DIP	70 mil	42		•	•	•	•	•	•			•			
		52			•	•	•	•	•			•			
		64								•	•	•			
Small Outline Package (SOP)	50 mil	24	•	•	•										
		36		•	•										
Plastic Flat Package (QFP)	1.00 mm	44			•	•	•	•	•	•	•	•	•		
		64				•	•	•	•	•	•	•	•		
		80								•	•	•	•		
		100								•	•	•	•	•	
		128									•	•	•	•	•
		160										•	•	•	•
Adaptable Pin-Grid-Array (APGA)	100 mil	***	***	***	***	***	***	***	***	***	***	***	***	***	
		***	***	***	***	***	***	***	***	***	***	***	***	***	
Plastic Leaded Chip Carrier (PLCC)	50 mil	44		•	•	•	•	•	•	•	•	•	•		
		52				•	•	•	•	•	•	•	•		
		68								•	•	•	•		
		84								•	•	•	•	•	
Ceramic Pin-Grid-Array (PGA)	100 mil	177											•	•	
		209												•	
		281												•	

Notes:

- (1) M6002X Series is conventional (channel) architecture.
- (2) M6003X Series is Variable Track Masterslice (VTM) architecture.
- (3) 300 mil body only available.
- (4) 600 mil body only available.

*****Adaptable Pin-Grid-Arrays (APGA)**

Gate arrays to be supplied in an APGA package are available in the configurations shown in the table below. After selecting a gate array master:

1. Determine the availability of a QFP with the required number of pins from the package matrix.
2. Find the APGA adapter available for the selected QFP.
3. Configurations not shown may be developed by Mitsubishi.

		ADAPTABLE PIN-GRID-ARRAY						
		Pins	84	100	124	144	160	208
Quad Flat Package	80	•						
	100	•	•					
	128				•			
	160					•	•	
	208							•

2.0 μ m Gate Arrays

M6001X Series — This family of conventional architecture arrays includes nine gate sizes ranging from 500 usable gates with 64 I/Os to 8,000 usable gates with 190 I/Os.

Table 4. Mitsubishi M6001X Series 2.0 μ m CMOS Gate Arrays

Part Number			M60011	M60012	M60013	M60014	M60015	M60016	M60017	M60018	M60019
Number of Usable Gates			500	810	1,100	1,680	2,666	3,608	4,814	6,233	8,096
Maximum I/O Ports			64	82	96	116	132	148	176	178	190
Package Type	Lead Spacing	Pins									
Plastic DIP	100 mil	16 ⁽¹⁾	•								
		18 ⁽¹⁾	•								
		20 ⁽¹⁾	•								
		24 ⁽²⁾	•	•	•	•	•	•	•	•	
		28 ⁽³⁾	•	•	•	•	•	•	•	•	
		40 ⁽³⁾	•	•	•	•	•	•	•	•	
Plastic Shrink DIP	70 mil	42	•	•	•	•	•	•	•		
		52	•	•	•	•	•	•	•		
		64	•	•	•	•	•	•	•	•	•
Ceramic Pin-Grid-Array (PGA)	100 mil	124						•	•	•	•
		209						•	•		•
Plastic Flat Package (QFP)	1.00 mm	44	•	•	•	•	•	•	•		
	1.00	64	•	•	•	•	•	•	•		
	0.80	80	•	•	•	•	•	•	•	•	•
	0.65	100		•	•	•	•	•	•	•	•
	0.80	128			•	•	•	•	•	•	•
	0.65	160					•	•	•	•	•
Adaptable Pin-Grid-Array (APGA)	100 mil		***	***	***	***	***	***	***	***	***
Plastic Leaded Chip Carrier (PLCC)	50 mil	44	•	•	•						
		52	•	•	•	•	•				
		68		•	•	•	•	•	•	•	
		84		•	•	•	•	•	•	•	•

Notes:

- (1) 300 mil body only available.
- (2) 600 and 300 mil body available.
- (3) 600 mil body only available.

*****Adaptable Pin-Grid-Arrays (APGA)**

Gate arrays to be supplied in an APGA package are available in the configurations shown in the table below. After selecting a gate array master:

1. Determine the availability of a QFP with the required number of pins from the package matrix.
2. Find the APGA adapter available for the selected QFP.
3. Configurations not shown may be developed by Mitsubishi.

		ADAPTABLE PIN-GRID-ARRAY					
		Pins	84	100	124	144	160
Quad Flat Package	80	•					
	100	•	•				
	128				•		
	160					•	•

SPECIFICATION TABLES

Tables 5 through 9 present the electrical specifications, typical DC and AC characteristics, and recommended operating conditions for Mitsubishi's 1.0, 1.3, and 2.0 μm gate arrays.

The worst case delays are calculated using the multiplication factors shown in Table 10. Typical performance characteristics for some commonly used library cells are shown in Table 11.

Table 5. Absolute Maximum Ratings for Mitsubishi CMOS Gate Arrays

Symbol	Parameter	Limits		Unit
		Min	Max	
V_{DD}	Supply Voltage	$V_{SS} - 0.3$	6.5	V
V_I	Input Voltage	$V_{SS} - 0.3$	$V_{DD} + 0.3$	V
V_O	Output Voltage	$V_{SS} - 0.3$	$V_{DD} + 0.3$	V
I_O	Output Current ⁽¹⁾		10	mA
I_O	Output Current ^(2, 3, 5)		16	mA
$I_O(T)$	Total Output Current (per power supply pin)		80	mA
T_{opr}	Operating Temperature	-20	75	$^{\circ}\text{C}$
T_{stg}	Storage Temperature	-55	150	$^{\circ}\text{C}$
	Electrostatic Discharge ⁽⁴⁾	-2000	2000	V
P_{DOUT}	Output Buffer Power Dissipation Limit*		360 ⁽⁶⁾	MHz \bullet pF*
			550 ⁽⁷⁾	
			890 ⁽⁸⁾	

Notes:

- (1) M6001X Series.
- (2) M6002X and M6003X Series.
- (3) M6005X Series.
- (4) Electrostatic discharge is measured from a 100 pF capacitor through a 1500 Ω resistor.
- (5) M6004X Series
- (6) Single Buffers rated at 12 mA.
- (7) Single Buffers rated at 8 mA.
- (8) Single Buffers rated at 4 mA.

*Calculated by multiplying output buffer by average output switching frequency.

Table 6. Recommended Operating Conditions for Mitsubishi Gate Arrays

Symbol	Parameter	Limits		Unit
		Min	Max	
V_{DD}	Supply Voltage	4.5	5.5	V
T_{opr}	Operating Temperature	-20	75	$^{\circ}\text{C}$
V_I	Input Voltage	0	V_{DD}	V
V_O	Output Voltage	0	V_{DD}	V
I_O	Output Current per Output ⁽¹⁾		6	mA
I_O	Output Current per Output ⁽²⁾		14	mA
I_O	Output Current per Output ⁽³⁾		12	mA
C_L	Output Load Capacitance		50	pF
$I_O(T)$	Total Output Sink Current (per V_{SS} pin)		80	mA
$I_O(T)$	Total Output Source Current (per V_{DD} pin)		40	mA
t_r, t_f	Input Rise Time, Fall Time	Normal Input	500	nS
		Schmitt Input	5	sec

Notes:

- (1) M6001X Series.
- (2) M6002X and M6003X Series.
- (3) For buffers rated at 12 mA.

Table 7. Typical DC Characteristic of Mitsubishi Gate Arrays

Symbol	Parameter	Test Conditions	Limits		Unit
			Min	Max	
V _{IL}	Input Voltage (TTL Interface)	V _{DD} = 4.5 V	0	0.8	V
V _{IH}		V _{DD} = 5.5 V	2.2	5.5	
V _{IL}	Input Voltage (CMOS Interface)	V _{DD} = 4.5 V	0	1.35	V
V _{IH}		V _{DD} = 5.5 V	3.85	5.5	
V _{T-}	Input Voltage Schmitt Trigger (TTL Interface)	V _{DD} = 5 V	0.7	1.65	V
V _{T+}			1.3	2.1	
V _H			0.3	1.2	
V _{T-}	Input Voltage Schmitt Trigger (CMOS Interface)	V _{DD} = 5 V	0.85	2.5	V
V _{T+}			2.3	3.7	
V _H			0.5	1.6	
V _{OL}	Output Voltage	V _{DD} = 5 V, I _o = 0 mA		0.05	V
V _{OH}			4.95		
I _{oL}	Output Current (1)	V _{OL} = 0.4 V, V _{DD} = 4.5 V	6		mA
I _{oH}		V _{OH} = 4.1 V, V _{DD} = 4.5 V	-2		
I _{oL}	Output Current (2)	V _{OL} = 0.4 V, V _{DD} = 4.5 V	14		mA
I _{oH}		V _{OH} = 4.1 V, V _{DD} = 4.5 V	-5		
I _{oL}	Output Current (5) (Selectable)	V _{OL} = 0.4 V, V _{DD} = 4.5 V	4 ⁽⁶⁾		mA
			8 ⁽⁷⁾		
			12 ⁽⁶⁾		
I _{oH}	V _{OH} = 4.1 V, V _{DD} = 4.5 V	-3			
I _{oL}	Output Current (3) (Selectable)	V _{OL} = 0.4 V, V _{DD} = 4.5 V	2 ⁽⁹⁾		mA
			4 ⁽⁶⁾		
			8 ⁽⁷⁾		
			12 ⁽⁶⁾		
I _{oH}	V _{OH} = 4.1 V, V _{DD} = 4.5 V	-6 ⁽¹⁰⁾			
		-2 ⁽¹¹⁾			
I _i	Input Leakage Current	V _i = V _{DD} , V _{SS}	-1	+1	μA
I _{oZ}	Output Leakage Current	V _o = V _{DD} , V _{SS}	-1	+1	μA
R _U	Pull-up Resistor (1)	V _{DD} = 5 V, V _i = 0 V	50	500	kΩ
R _D	Pull-down Resistor (1)	V _{DD} = 5 V, V _i = 5 V	50	500	kΩ
R _U	Pull-up Resistor (2, 5)	V _{DD} = 5 V, V _i = 0 V	23	230	kΩ
R _D	Pull-down Resistor (2, 5)	V _{DD} = 5 V, V _i = 5 V	16	160	kΩ
R _U	Pull-up Resistor (3)	V _{DD} = 5 V, V _i = 0 V	10	120	kΩ
R _D	Pull-down Resistor (3)	V _{DD} = 5 V, V _i = 5 V	10	120	kΩ

Notes:

- (1) M6001X Series.
- (2) M6002X and M6003X Series.
- (3) M6005X Series.
- (4) Electrostatic discharge is measured from a 100 pF capacitor through a 1500 Ω resistor.
- (5) M6004X Series
- (6) Buffers rated at 12 mA.
- (7) Buffers rated at 8 mA.
- (8) Buffers rated at 4 mA.
- (9) Buffers rated at 2 mA.
- (10) Buffers rated at 6 mA.
- (11) Buffers rated at 2 mA.

Table 8. Typical AC Characteristics of Mitsubishi Gate Arrays*

Parameter	Test Conditions	1.0 μm (M6005X)	1.3 μm (M6002X, M6003X)	1.3 μm (M6004X)	2.0 μm (M6001X)	Unit
2-Input NAND Gate Delay	FO = 2, 2 mm Metal	0.45	0.9	0.9	1.4	nsec
Input Buffer Delay	FO = 2, 2 mm Metal	0.6	1.2	1.2	1.4	nsec
Output Buffer Delay	Load: 20 pF	1.9 ⁽¹⁾	3.5	2.9	5.5	nsec
	Load: 50 pF	2.3 ⁽¹⁾	4.8	4.3	7.7	
	Load: 100 pF	3.9 ⁽¹⁾	7	6.5	11.9	
Power Dissipation/Output Buffer	Load: 20 pF	0.6	0.6	0.6	0.6	mW/MHz
	Load: 50 pF	1.3	1.3	1.3	1.3	
	Load: 100 pF	2.5	2.5	2.5	2.5	
Toggle Rate		320	175	175	100	MHz
Power Dissipation per Gate	FO = 2, 2 mm Metal	5	10	10	15	$\mu\text{W}/\text{MHz}$
Input Pin Capacitance	f = 1 MHz	8	8	8	8	pF
Output Pin Capacitance		8	8	8	8	
Bidirectional Pin Capacitance		8	8	8	8	

*V_{DD} = 5 V, T_{opr} = 25°C

Note:

(1) Output buffers for the M6005X have variable drive and slew rates. Choices of Sink Current are 1, 2, 4, 8, and 12 mA and of Source Current are 2 or 6 mA. The selectable slew rate is available on the 8, 12 mA drives. Delays shown are for the 12 mA buffer.

Table 9. Simultaneous Switching Outputs

To avoid noise caused by simultaneous switching outputs (SSO), Mitsubishi recommends limiting drive to a total of 48 mA for each power/ground pin pair. For the M6005X family this would be:

The total current between power/ground pin pairs is limited to 48 mA. The buffers should be surrounded as close as possible by the power/ground pins on either side of the simultaneously switching group of buffers.

Buffer	Number of SSOs Allowed Between Power/GND Pin Pairs
12 mA	4
8 mA	8
4 mA	16
2 mA	32
1 mA	48

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Table 10. Worst Case Timing for Mitsubishi Gate Arrays

The following factors are used to calculate worst case delays using the typical delay values:

Condition	K (min.)	K (max.)
Temperature -20 to + 75°C	0.82	1.20
Voltage 4.5 to 5.5 volts	0.90	1.10
Process Variation:		
M6005X	0.60	1.50
M6002X, M6003X, M6004X	0.60	1.40
M6001X	0.70	1.30
Family	K (min.)	K (max.)
M6001X	0.57	1.69
M6002X, M6003X, M6004X	0.48	1.82
M6005X	0.48	1.98

Table 11. Performance Characteristics of Mitsubishi Gate Array Library Cells

Cell	Function	M6001X 2.0 μ m			M6002X, M6003X 1.3 μ m			M6004X 1.3 μ m			M6005X 1.0 μ m			
		Loads	1	2	5	1	2	5	1	2	5	1	2	5
		Metal	1.0	1.5	2.0	1.0	1.5	2.0	1.0	1.5	2.0	0.5	1.0	1.5
VO1S	Inverter	R	0.78	1.18	2.22	0.48	0.68	1.20	0.48	0.68	1.20	0.26	0.38	0.62
		F	0.90	1.13	1.71	0.52	0.65	0.97	0.52	0.65	0.97	0.44	0.54	0.73
N02S	2 NAND	R	0.76	1.18	2.22	0.48	0.68	1.20	0.48	0.68	1.20	0.30	0.42	0.66
		F	1.20	1.50	2.28	0.71	0.89	1.34	0.71	0.89	1.34	0.47	0.61	0.71
R02S	2 NOR	R	1.37	2.12	4.07	0.87	1.25	2.22	0.87	1.25	2.22	0.39	0.60	1.04
		F	0.90	1.13	1.71	0.52	0.65	0.97	0.52	0.65	0.97	0.47	0.57	0.76
N03S	3 NAND	R	0.92	1.32	2.36	0.59	0.79	1.31	0.59	0.79	1.31	0.29	0.41	0.65
		F	1.60	1.94	2.85	1.02	1.25	1.83	.02	1.25	1.83	0.70	0.91	1.35
R03S	3 NOR	R	2.10	3.20	6.00	1.49	2.03	3.43	1.49	2.03	3.43	0.56	0.89	1.50
		F	0.45	1.18	1.76	0.59	0.72	1.04	0.59	0.72	1.040	.46	0.56	0.73
XORS	Exclusive OR	R	1.96	2.62	4.34	1.24	1.57	2.41	1.24	1.57	2.410	.73	0.94	1.33
		F	2.23	2.51	3.26	1.27	1.40	1.76	1.27	1.40	1.76	0.65	0.82	1.12
FDDS	D Latch	R	3.48	3.89	4.96	1.80	2.00	2.52	1.80	2.00	2.52	1.54	1.58	1.67
		F	3.33	3.61	4.32	1.75	1.88	2.20	11.75	1.88	2.20	.75	1.79	1.88
BI1N ⁽⁵⁾ T54N ⁽⁶⁾ T22N ⁽⁷⁾	TTL Input buffer	R	0.88	1.19	2.00	0.73	0.88	1.27	0.73	0.88	1.27	0.92	0.95	1.00
		F	3.07	4.46	8.38	1.72	1.85	2.21	1.72	1.85	2.21	0.91	0.95	1.01
BC1N ⁽⁵⁾ C54N ⁽⁶⁾ C22N ⁽⁷⁾	CMOS Input Buffer	R	1.23	1.81	3.30	0.78	0.93	1.32	0.78	0.93	1.32	1.11	1.15	1.22
		F	1.05	1.43	2.40	0.89	1.04	1.43	0.89	1.04	1.43	0.74	0.77	0.84
		Load (pF)	20	50	100	20	50	100	20 ⁽⁴⁾	50 ⁽⁴⁾	100 ⁽⁴⁾	20 ⁽⁴⁾	50 ⁽⁴⁾	100 ⁽⁴⁾
BO1N ⁽⁵⁾ O55N ^(6, 7)	Output Buffer	R	5.40	8.10	12.6	3.70	5.20	7.70	2.80	4.30	6.80	2.07	2.85	4.15
		F	5.60	7.70	11.2	4.12	5.32	7.32	3.10	4.30	6.30	1.75	2.71	4.31
BZ1N ⁽⁵⁾ Z77N ⁽⁶⁾ Z55N ⁽⁷⁾	3-State Buffer	R	6.60	9.30	13.8	5.45	6.95	9.45	4.55	6.05	8.55	3.39	4.17	5.47
		F	7.40	9.50	13.0	5.01	6.21	8.21	3.45	4.69	6.69	3.20	4.16	5.76

Notes:

- (1) All delays are for typical conditions ($V_{DD} = 5$ V, $T_A = 25^\circ$ C, and typical process conditions).
- (2) Cell delays are rising output on first line and falling output on second line.
- (3) Metal interconnect length is in mm.
- (4) Performance for 12 mA buffer.
- (5) M6001X, M6002X, M6003X.
- (6) M6004X.
- (7) M6005X.

QUALITY AND RELIABILITY

All Mitsubishi gate arrays, except prototypes, undergo static burn-in at 125 degrees Centigrade and 7.0 volts. Burn-in duration varies between 12 and 40 hours, according to the product line maturity, in order to achieve a minimum failure rate for the array. All products, including prototypes, are 100 percent functionally and AC and DC tested.

Mitsubishi uses proprietary I/O protection techniques to enhance electrostatic discharge (ESD) and latch-up immunity. This results in the gate arrays being able to withstand dis-

charges of over +2000 volts from a 100 pF capacitor when tested with 1500 ohms of series resistance, or ± 300 volts from a 200 pF capacitor with zero resistance. Current surges of 200 mA on any pin can be tolerated without latch-up. Test circuit and conditions for ESD and latch-up are shown in Figures 4 and 5.

Each Mitsubishi part is internally qualified by being subjected to an accelerated life test, monitoring infant mortality and long-term failures.

Figure 4. Test Circuit and Conditions for ESD in Mitsubishi Gate Arrays

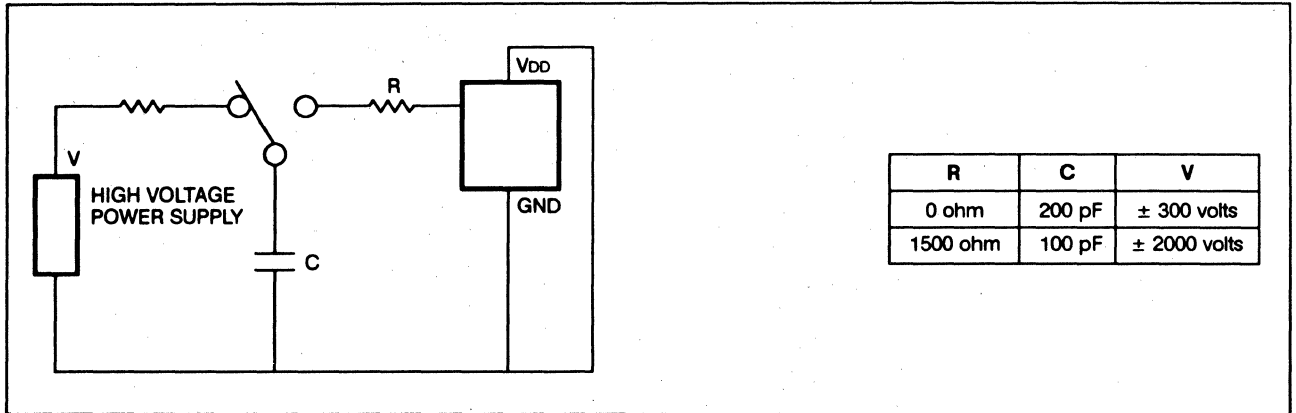


Figure 5. Test Circuits and Conditions for Latch-Up in Mitsubishi Gate Arrays

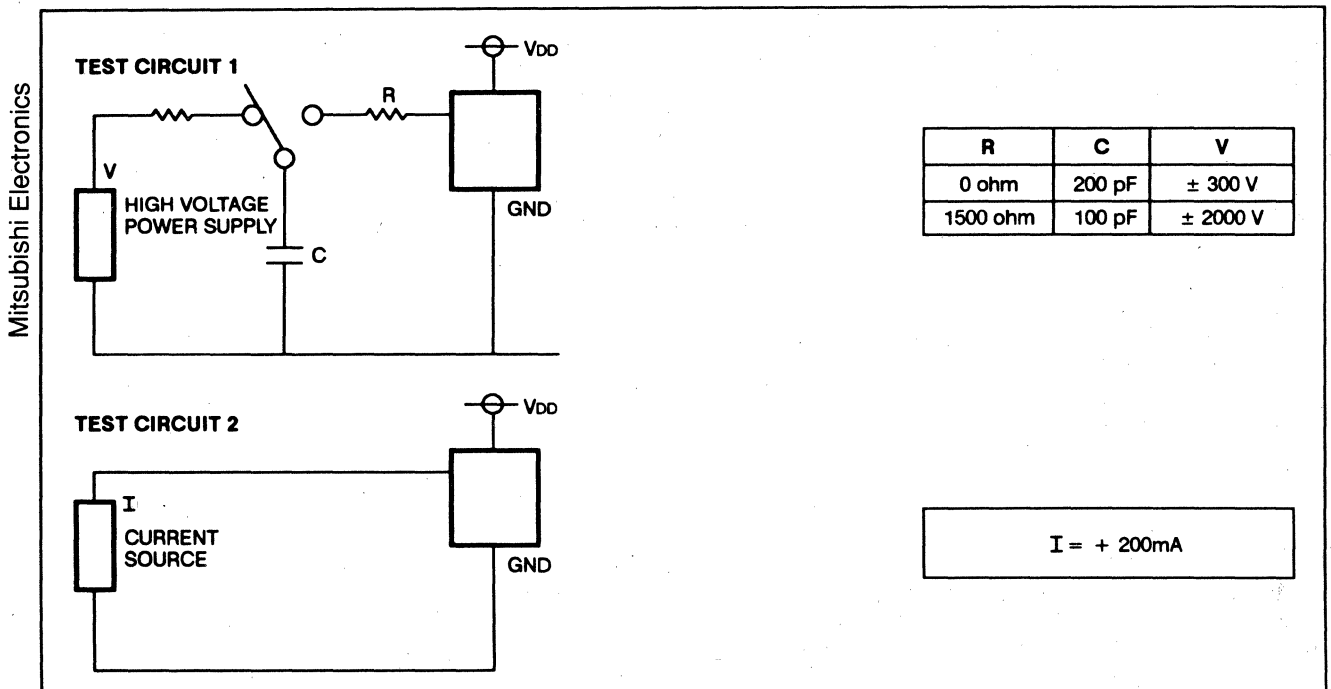


Table 12. Internal Qualification Tests for Mitsubishi Gate Arrays

Test Items	Test Conditions	Failure Identification
Dynamic Life Test	TA = 125°C, Vcc = 7.0 V, t = 1000 H	DC and functional stability of electrical margin
High Temperature Bias	TA = 125°C, Vcc = 7.0 V, t = 1000 H, I/O; open	
Dynamic Life Test	TA = -40°C, Vcc = 7.0 V, t = 1000 H	
Humidity	85°C, 85%, Vcc = 5.5 V output; open, t = 1000 H	
	130°C, 85%, Vcc = 5.5 V output; open, t = 500 H	
	140°C, 85%, storage, t = 240 H	
	Soldering Heat* 260°C, 10 sec x 4 = 40 sec + 85°C, 85% Bias, t = 1000 H	
High Temperature Storage	150°C, t = 1000 H	
Temperature Cycling	-65°C/150°C, 30 min/cycle, 200 cycle	
Soldering Heat	260°C, 10 sec x 4 = 40 sec*		DC and functional stability of electrical margin
Thermal Shock	-55°C/125°C, 10 min/cycle, 15 cycle	Visual
Temperature Cycling	-65°C/150°C, 30 min/cycle, 100 cycle	
Solderability	230°C, 10 sec	Visual
Mechanical Shock	1500 G, 0.5 msec, X1, Y1, Z1	DC and functional
Vibration	20 G, 20-2 KHz, X, Y, Z	Visual

*Leads are immersed up to the base of the outline, 4 directions.

PACKAGING AND THERMAL CHARACTERISTICS

Mitsubishi develops and manufactures its own ASIC packages. Table 13 summarizes the types of surface-mount and through-hole packages offered for Mitsubishi's gate arrays.

Table 13. Summary of Packages Available for Mitsubishi Gate Arrays

		Number of Pins																									
		16	18	20	24	28	36	40	42	44	52	64	68	80	84	100	124	128	144	160	177	208	209	256	281	304	
Through-Hole Devices	Plastic Standard DIP	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Plastic Shrink DIP								.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Ceramic Pin-Grid-Array (PGA)																.				.		.		.		.
	Adaptable Plastic Pin-Grid-Array (APGA)														
Surface Mount Devices	Plastic Small Outline Package (SOP)			.		.																					
	Plastic Quad Flat Package (QFP)									.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Plastic Leaded Chip-Carrier (PLCC)									.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

*Available second half of 1990

Package Thermal Resistance – Table 14 shows the thermal resistances for Mitsubishi's gate array packages when mounted on standard printed circuit boards. Chip temperature (T_j) can be determined from the total power consumption (P_t), the thermal resistance (θ_{ja}) of the package used, and the ambient temperature (T_A), by using the formula:

$$T_j = T_A + \theta_{ja} (^\circ\text{C}/\text{W}) \times P_t (w)$$

The chip temperature (T_j) must not exceed 100 °C. In order to keep the chip temperature below this limit, the power consumption or ambient temperature should be decreased.

Table 14. Thermal Resistances of Mitsubishi Gate Arrays with Standard Board Mounting

Package Type	Number of Pins	Thermal Resistance (θ_{ja})		
		Natural Air Flow	With 1 m/s Air Flow	With 2 m/s Air Flow
Plastic DIP	16	129	75	70
	18	129	75	(70)
	20	72	(50)	(46)
	24 (300 mil)	86	63	55
	24 (600 mil)	(94)	(65)	(62)
	28	44	36	(32)
	40	63	49	(45)
Plastic Shrink DIP	42	63	50	(46)
	52	59	47	(43)
	64	56	45	(42)
Plastic SOP	24	(96)	(76)	(70)
	36	(87)	(69)	(64)
Plastic QFP/APGA*	44	92	74	(68)
	64	87	72	(67)
	80	72	64	(59)
	100	72	(64)	(59)
	128	57	44	40
	160	57	(44)	(40)
PLCC	208	47	37	33
	44	70	50	44
	52	70	50	44
	68	68	55	50
	84	62	48	(44)

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*For APGA thermal resistance, use data for the QFP package.

(): Calculated Value

Standard board: Material composition – Glass epoxy single-surface board
 Dimensions – 70 mm x 70 mm, thickness 1.6 mm
 Copper foil thickness – 18 μm

GATE ARRAY DESIGN

Mitsubishi Design Kits – Working with major design hardware and software suppliers, Mitsubishi has developed design kits for schematic entry, design rule check and circuit simulation. Software is also available for converting completed designs to a standard format so they can be submitted to Mitsubishi for circuit layout. Mitsubishi's gate array design kits contain the following, as appropriate to the design:

- Symbol Library – Graphic symbols for the Mitsubishi ASIC library used in producing schematics on a workstation or personal computer (PC).
- Simulation Library – Simulation models and time delay data for the ASIC library cells.
- Design Rule Check – Program for checking a workstation or PC schematic for design errors such as fan-out violations, floating nodes, shorted outputs, and illegal or duplicate names.
- Net List Converter – Program for converting a workstation or PC net list to the format used by Mitsubishi to produce circuit layout.
- Test Vector Conversion – Program for converting the simulation vectors to the format used by Mitsubishi production tester programs.
- Compare – Program for comparing simulation output with the expected output values on a workstation or PC, and listing the bits that do not match.
- Back Annotation – Software for converting wire length data from the circuit layout to delay information for the simulator in order to assure accurate simulation based on the final circuit layout.

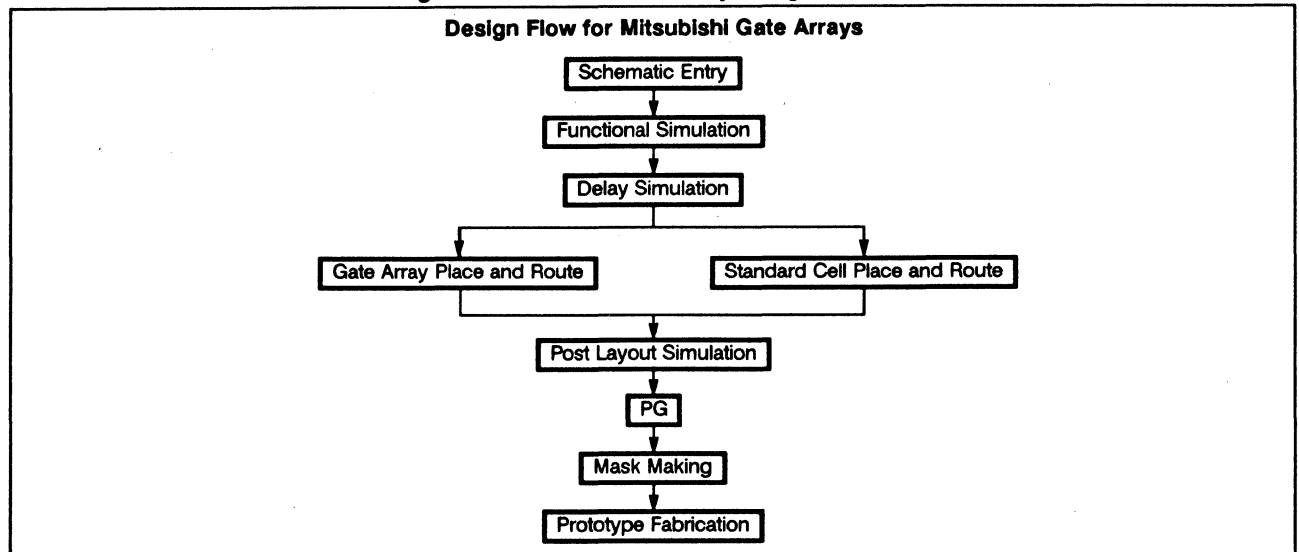
Hardware and Software CAE Support — The CAE hardware and software supported by Mitsubishi for design of its gate arrays is summarized in Table 15. Figure 8 shows the overall de-

sign process for Mitsubishi gate arrays, while Table 16 summarizes Mitsubishi's customer design interface.

Table 15. Mitsubishi Workstation and Simulator Support for Gate Array Design

Workstation	Schematic Entry	DRC	Functional Simulation	Delay Simulation
Mentor®	X	X	X	X
Dazix™	X	X	X*	X
Valid™	X	X	X	X
Viewlogic™	X	X	X	X
HP 9000®	X		X*	X
Integraph®	X	X	X	X
OrCAD®	X			
FutureNet®	X			
* Support of M6005X not available				
Simulator			Functional Simulation	Delay Simulation
IKOS®			X	X
Verilog®			X	X
Logic Synthesis	Design Entry	Technology Mapping	Design Optimization	
Synopsys®	X	X	X	

Figure 8. Mitsubishi Gate Array Design Process



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Table 16. Mitsubishi Customer Design Interface

	Schematic & Test Vectors	Schematic Entry	Functional Simulation	Net List & Test Vectors	Timing Simulation	Verification	Routing	Post Layout Simulation	Test Program Generation
Turnkey	C	M/C	M/C	M/C	M/C	M	M	M	M
Net List	C	C	M/C	M/C	M/C	M	M	M	M
Functional Simulation	C	C	C	C	M/C	M	M	M	M
Timing Simulation	C	C	C	C	C	M/C	M	M/C	M

C = Customer Functions on Customers EWS
M = Mitsubishi
M/C = Joint Effort

Mitsubishi Design Network — Mitsubishi operates design centers in Sunnyvale, California; Boston, Massachusetts; and Raleigh, North Carolina and Ottawa, Canada. The centers provide design assistance and access to Mitsubishi supported CAE hardware and software.

The four design centers are linked by satellite to Mitsubishi Electric Corporation's automated gate array production facilities in Kita-Itami and Kumamoto, Japan.

CELL LIBRARIES

Mitsubishi has a gate array cell library of over 500 cells, including macro cells with fixed cell configuration and more complex macro functions. A sample of macro functions is presented in

Table 17. Macro functions are designed using macro cells, and layout is done as part of the gate array schematic. A sample of commonly used Mitsubishi macro cells is shown in Table 18.

RAM is implemented with a compiler and can be configured for the required memory size. Word lengths are from 1 to 8 bits. Sizes are in 16 word increments from 16 to 1024 words. Larger sizes are implemented with multiple cells. Dual port RAM is available in the same size cells. The gate count for single RAM cells is less than two gates per bit. Access times vary with cell size, from 8 to 15 nsec.

ROM cells are also compiled to the required size. Sizes are 32 to 2048 words in increments of 32, with word lengths from 1 to 8 bits. Gate counts are about 0.8 gate per bit. Access times for ROM cells are similar to RAM cells at 8 to 15 nsec.

Table 17. A Sample of the Macro Functions in Mitsubishi's Gate Array Cell Library

Cell Name	LS TTL Equiv	Description	Basic Cells (1)
T04200SA	LS42	BCD: Decimal Decoder	66
T04800SA	LS48	BCD: 7 Segment Decoder/Driver	146
T07500WA	LS75	4-Bit Through Latch	64
T08300WB	LS83	4-Bit Full Adder	137
T08301WA	LS83	4-Bit Full Adder	137
T08500WB	LS85	4-Bit Magnitude Comparator	194
T09000WA	LS90	Decade Counter	157
T09100SA	LS91	8-Bit Shift Register	171
T09101SA	LS91	8-Bit Shift Register	190
T09200WA	LS92	Divide-by-12 Counter	132
T09300SA	LS93	4-Bit Binary Counter	103
T09500WA	LS95	4-Bit Parallel Register	135
T09600WA	LS96	5-Bit Shift Register	157
T13700SA	LS137	3:8 Decoder/Demux with Latch	95
T13800SA	LS138	3:8 Decoder/Demux	60
T13800WA	LS138	3:8 Decoder/Demux	130
T13900SA	LS139	2:4 Decoder/Demux	54
T13901SA	LS139	2:4 Decoder/Demux	26
T14700WB	LS147	10-Dec: 4-BCD Priority Encoder	115
T14800WB	LS148	8:3 Priority Encoder	163
T15100WA	LS151	8:1 Data Selector/Mux	77
T15300WA	LS153	4:1 Data Selector/Mux	82
T15301SB	LS153	4:1 Data Selector/Mux	35
T15500SA	LS155	2-Bit Binary: 4-Dec Demux with Strobe	56
T15700SA	LS157	2:1 Data Selector/Mux	40
T15700WA	LS157	2:1 Data Selector/Mux	49
T15800WA	LS158	2:1 Data Selector/Mux	53
T16000WA	LS160	Synchronous Presettable Decade Counter with Reset	225
T16100WB	LS161	Synchronous Presettable 4-Bit Counter with Reset	212
T16200WA	LS162	Fully Synchronous Presettable Decade Counter	194
T16300WA	LS163	Synchronous 4-Bit Binary Counter	199
T16400SA	LS164	8-Bit Serial-In/Parallel-Out Shift Register	211
T16500WA	LS165	8-Bit Parallel-In/Serial-Out Shift Register	268
T16600WA	LS166	8-Bit Shift Register	247
T17300WA	LS173	4-Bit D-Type Register with 3-State Output	172
T17400SA	LS174	Hex D Flip-Flop with Reset	151
T17500SA	LS175	Quad D Flip-Flop with Reset	100

Cell Name	LS TTL Equiv	Description	Basic Cells (1)
T18100SB	LS181	ALU/Function Generator	341
T18200SB	LS182	Look-Ahead Carry Generator	95
T19000WA	LS190	Synchronous Presettable Up-Down Decade Counter	288
T19100WA	LS191	Synchronous Presettable Up-Down 4-Bit Counter	278
T19200WA	LS192	Synchronous Presettable Up-Down Decade Counter	230
T19300WA	LS193	Synchronous Presettable Up-Down 4-Bit Counter	229
T19400WB	LS194	4-bit Bidirectional Universal Shift Register	208
T19500WA	LS195	Parallel Access Shift Register with Reset	178
T19600WA	LS196	Presettable Decade Counter/Latch	222
T19700SA	LS197	Presettable 4-Bit Binary Counter/Latch	192
T24800WA	LS248	BCD: 7-Segment Decoder/Driver	157
T25100WA	LS251	8:1 Data Selector/Mux with 3-State Output	100
T25700WA	LS257	2:1 Data Selector/Mux with 3-State Output	84
T25800WA	LS258	Quad 2:1 Data Selector/Mux with 3-State Output	71
T27300WA	LS273	Octal Positive Edge-Triggered D Flip-Flop with Reset	202
T28000WB	LS280	9-Bit Odd/Even Parity Generator/Checker	159
T28001WA	LS280	9-Bit Even Parity Generator/Checker	72
T28002WA	LS280	9-Bit Odd Parity Generator/Checker	72
T29500WA	LS295	4-Bit Shift Register with 3-State Output	162
T29800WA	LS298	Quad 2-Input Mux with Storage	122
T35200WA	LS352	Dual 4:1 Data Selector/Mux with Strobe	74
T35300WA	LS353	Dual 4:1 Data Selector/Mux with 3-State Output	94
T36700WA	LS367	Hex Bus Driver with 3-State Output	72
T36800WA	LS368	Hex Bus Driver with 3-State Output (Inverter)	84
T37300WA	LS373	Octal Positive Edge D Flip-Flop with 3-State Output	193
T37400WA	LS374	Octal Positive Edge D Flip-Flop with 3-State Output	287
T37700WA	LS377	Octal Positive Edge D Flip-Flop with Enable	244
T39000WA	LS390	Dual Decade Counter	135
T39300SA	LS393	Dual 4-Bit Binary Counter	214
T39500WA	LS395	4-Bit Cascadable Shift Register	179
T49000WA	LS490	Dual 4-Bit Decade Counter	165
T59500WA	LS595	8-Bit Shift Register/Latch with 3-State Output	451
T66800WA	LS668	Synchronous Presettable Up-Down Counter	285
T66900WB	LS669	Synchronous 4-Bit Up-Down Counter	261
T67001WB	LS670	4 x 4 Register Files with 3-State Output	505
T68401WA	LS684	8-Bit Magnitude Comparator	224
T68801WA	LS688	8-Bit Magnitude Comparator with Enable	130

Note:

(1) A basic cell is the pair of corresponding p and n transistors from which the array is constructed. Three basic cells are equivalent to a 2-input NAND gate.

Table 18. A Sample of the Macro Cells in Mitsubishi's Gate Array Cell Library

Cell Name	Drive	Description	Basic Cells (1)	Availability		
				2.0 μ m	1.3 μ m	1.0 μ m
INVERTERS						
V01S		Inverter	2	X	X	X
V01W	X2	Inverter	3	X	X	X
V01T	X3	Inverter	4	X	X	X
V01Q	X4	Inverter	5	X	X	X
DRIVERS						
K02W	X2	Driver, 3-State, High Enable	9	X	X	X
K02Q	X4	Driver, 3-State, High Enable	11	X	X	X
K1NS		Driver, Clock Line	3	X	X	X
K1NW	X2	Driver, Clock Line	4	X	X	X
K1NQ	X4	Driver, Clock Line	6	X	X	X
K12W	X2	Driver, 3-State, L Enable	9	X	X	X
K12Q	X4	Driver, 3-State, Low Enable	11	X	X	X
K2GW	X2	Driver, Clock Line, Gated	5	X	X	P
KH1S		Driver, 3-State, Active High	7	X	X	P
KH4S		Driver, 3-State, Active High, 4 Bit	19	X	X	P
KH1W	X2	Driver, 3-State, H Enable	9	X	X	X
KH4W	X2	Driver, 3-State, H Enable, 4 Bit	25	X	X	X
KH8W	X2	Driver, 3-State, H Enable, 8 Bit	53	X	X	X
KL1S		Driver, 3-State, Active Low	7	X	X	P
KL4S		Driver, 3-State, Active Low, 4 Bit	19	X	X	P
KL1W	X2	Driver, 3-State, L Enable	9	X	X	X
KL4W	X2	Driver, 3-State, L Enable, 4 Bit	25	X	X	X
KL8W	X2	Driver, 3-State, L Enable, 8 Bit	53	X	X	X
AND GATES						
AN2S		AND Gate, 2 Input	4	X	X	X
AN2W	X2	AND Gate, 2 Input	5	X	X	X
AN3S		AND Gate, 3 Input	5	X	X	X
AN3W	X2	AND Gate, 3 Input	6	X	X	X
AN4S		AND Gate, 4 Input	6	X	X	X
AN4W	X2	AND Gate, 4 Input	7	X	X	X
NAND GATES						
NO2S		NAND Gate, 2 Input	3	X	X	X
NO22	X2	NAND Gate, 2 Input	5	X	X	X
NO23	X3	NAND Gate, 2 Input	7	X	X	X
NO24	X4	NAND Gate, 2 Input	9	X	X	X
NO2W	X2	NAND Gate, 2 Input	6	X	X	X
NO3S		NAND Gate, 3 Input	4	X	X	X
NO32	X2	NAND Gate, 3 Input	7	X	X	X
NO33	X3	NAND Gate, 3 Input	10	X	X	X
NO34	X4	NAND Gate, 3 Input	13	X	X	X
NO3W	X2	NAND Gate, 3 Input	7	X	X	X
NO4S		NAND Gate, 4 Input	5	X	X	X
NO42	X2	NAND Gate, 4 Input	9	X	X	X
NO43	X3	NAND Gate, 4 Input	13	X	X	X
NO44	X4	NAND Gate, 4 Input	18	X	X	X
NO4W	X2	NAND Gate, 4 Input	8	X	X	X
NO5S		NAND Gate, 5 Input	6	X	X	X
NO52	X2	NAND Gate, 5 Input	13	X	X	X
NO6W	X2	NAND Gate, 6 Input	12	X	X	X
NO8W	X2	NAND Gate, 8 Input	14	X	X	X
NO9W	X2	NAND, 9 Input	16	X	X	X
N12W	X2	NAND, 12 Input	19	X	X	X
N16W	X2	NAND, 16 Input	25	X	X	X
OR GATES						
OR2S		OR Gate, 2 Input	4	X	X	X
OR2W	X2	OR Gate, 2 Input	5	X	X	X
OR3S		OR Gate, 3 Input	5	X	X	X
OR3W	X2	OR Gate, 3 Input	6	X	X	X
OR4S		OR Gate, 4 Input	6	X	X	X
OR4W	X2	OR Gate, 4 Input	7	X	X	X
NOR GATES						
RO2S		NOR Gate, 2 Input	3	X	X	X
RO22	X2	NOR Gate, 2 Input	5	X	X	X
RO23	X3	NOR Gate, 2 Input	7	X	X	X
RO24	X4	NOR Gate, 2 Input	9	X	X	X
RO2W	X2	NOR Gate, 2 Input	6	X	X	X
RO3S		NOR Gate, 3 Input	4	X	X	X
RO32	X2	NOR Gate, 3 Input	7	X	X	X
RO33	X3	NOR Gate, 3 Input	10	X	X	X
RO34	X4	NOR Gate, 3 Input	13	X	X	X
RO3W	X2	NOR Gate, 3 Input	7	X	X	X
RO4S		NOR Gate, 4 Input	5	X	X	X
RO42	X2	NOR Gate, 4 Input	9	X	X	X
RO43	X3	NOR Gate, 4 Input	13	X	X	X
RO44	X4	NOR Gate, 4 Input	18	X	X	X
RO4W	X2	NOR Gate, 4 Input	8	X	X	X
RO6W	X2	NOR Gate, 6 Input	12	X	X	X
RO8W	X2	NOR Gate, 8 Input	14	X	X	X
RO9W	X2	NOR Gate, 9 Input	16	X	X	X
R12W	X2	NOR Gate, 12 Input	19	X	X	X
R16W	X2	NOR Gate, 16 Input	25	X	X	X

Cell Name	Drive	Description	Basic Cells (1)	Availability		
				2.0 μ m	1.3 μ m	1.0 μ m
EXCLUSIVE OR/NOR						
XORS		Exclusive OR	6	X	X	X
XORW	X2	Exclusive OR	8	X	X	X
XNOS		Exclusive NOR	6	X	X	X
XNOW	X2	Exclusive NOR	8	X	X	X
XOR2	X2	Exclusive OR	11	X	X	X
XNO2	X2	Exclusive NOR	11	X	X	X
COMBINATIONAL GATES						
A01S		2 Input OR into 2 Input AND into 2 Input NOR	5	X	X	X
A012	X2	2 Input OR into 2 Input AND into 2 Input NOR	10	X	X	X
A23S		2 Input AND into 2 Input NOR	4	X	X	X
A232	X2	2 Input AND into 2 Input NOR	7	X	X	X
A24S		2 Input AND into 3 Input NOR	5	X	X	X
A242	X2	2 Input AND into 3 Input NOR	9	X	X	X
A34S		3 Input AND into 2 Input NOR	5	X	X	X
A342	X2	3 Input AND into 2 Input NOR	9	X	X	X
O01S		2 Input AND into 2 Input OR into 2 Input NAND	5	X	X	X
O012	X2	2 Input AND into 2 Input OR into 2 Input NAND	10	X	X	X
O23S		2 Input OR into 2 Input NAND	4	X	X	X
O232	X2	2 Input OR into 2 Input NAND	7	X	X	X
O24S		2 Input OR into 3 Input NAND	5	X	X	X
O242	X2	2 Input OR into 3 Input NAND	9	X	X	X
O34S		3 Input OR into 2 Input NAND	5	X	X	X
O342	X2	3 Input OR into 2 Input NAND	9	X	X	X
MULTIPLEXERS						
LM1W	X2	2 Wide 2 Input AND into 2 Input OR	7	X	X	X
LM2W	X2	2 AND 3 Input AND into 2 Input OR	8	X	X	X
T24S		2 Wide 2 Input AND into 2 Input NOR	5	X	X	X
T242	X2	2 Wide 2 Input AND into 2 Input NOR	9	X	X	X
T26S		3 Wide 2 Input AND into 3 Input NOR	7	X	X	X
T262	X2	3 Wide 2 Input AND into 3 Input NOR	13	X	X	X
T28W	X2	4 Wide 2 Input AND into 4 Input NOR	13	X	X	X
T2GW	X2	8 Wide 2 Input AND into 8 Input NOR	25	X	X	X
T38W	X2	2 Wide 3 Input AND into 2 Input NOR	10	X	X	X
T39W	X2	3 Wide 3 Input AND into 3 Input NOR	14	X	X	P
T3CW	X2	4 Wide 3 Input AND into 4 Input NOR	17	X	X	X
T48W	X2	2 Wide 4 Input AND into 2 Input NOR	12	X	X	X
T4CW	X2	3 Wide 4 Input AND into 3 Input NOR	18	X	X	X
T4GW	X2	4 Wide 4 Input AND into 4 Input NOR	22	X	X	X
U24S		2 Wide 2 Input OR into 2 Input NAND	5	X	X	X
U242	X2	2 Wide 2 Input OR into 2 Input NAND	9	X	X	X
U26S		3 Wide 2 Input OR into 3 Input NAND	7	X	X	X
U262	X2	3 Wide 2 Input OR into 3 Input NAND	13	X	X	X
U28W	X2	4 Wide 2 Input OR into 4 Input NAND	13	X	X	X
U2CW	X2	6 Wide 2 Input OR into 6 Input NAND	21	X	X	X
U2GW	X2	8 Wide 2 Input OR into 8 Input NAND	25	X	X	X
U36W	X2	2 Wide 3 Input OR into 2 Input NAND	10	X	X	X
U39W	X2	3 Wide 3 Input OR into 3 Input NAND	14	X	X	P
U3CW	X2	4 Wide 3 Input OR into 4 Input NAND	17	X	X	X
U48W	X2	2 Wide 4 Input OR into 2 Input NAND	12	X	X	X
ADDERS						
AD2S		Adder, Full, 2 Bit	35	X	X	X
SFAW	X2	Adder, Full, 1 Bit	19	X	X	X
SHAW	X2	Adder, Half, 1 Bit	10	X	X	X
SFAS		Adder, Half, 1 Bit	9	X	X	P
SFAS		Adder, Full, 1 Bit	18	X	X	P
SA2S		Adder, Full, 2 Bit	49	X	X	P
SA3S		Adder, Full, 2 Bit	41	X	X	P
SELECTORS						
D12S		Selector, Dual 1 to 2	9	X	X	X
D122	X2	Selector, Dual 1 to 2	16	X	X	X
D21S		Selector, Dual 2 to 1	9	X	X	X
D21W	X2	Selector, Dual 2 to 1	11	X	X	X
S12S		Selector, 1 to 2	5	X	X	X
S122	X2	Selector, 1 to 2	8	X	X	X
S21S		Selector, 2 to 1	5	X	X	X
S212	X2	Selector, 2 to 1	11	X	X	X
S21B		Selector, 2 to 1	6	X	X	X
S21W	X2	Selector, 2 to 1	6	X	X	X
S24S		Selector, 2 to 1, 4 Bit	35	X	X	X
S24W	X2	Selector, 2 to 1, 4 Bit	52	X	X	X
S34W	X2	Selector, 3 to 1, 4 Bit	40	X	X	X
S41S		Selector, 4 to 1	12	X	X	X
S44W	X2	Selector, 4 to 1, 4 Bit	52	X	X	X
DECODERS						
D2GW		Decoder, 2 to 4 With Output Enable	24	X	X	X
D2GS		Decoder, 2 to 4 With Output Enable	24	X	X	X
D3GS		Decoder, 3 to 8	51	X	X	P

Table 18. A Sample of the Macro Cells in Mitsubishi's Gate Array Cell Library (continued)

Cell Name	Drive	Description	Basic Cells (1)	Availability		
				2.0 μ m	1.3 μ m	1.0 μ m
DECODERS (continued)						
D4GS		Decoder, 4 to 16	97	X	X	P
LATCHES						
FDAS		D Latch, NAND Type	12	X	X	X
FDAW	X2	D Latch, NAND Type	13	X	X	X
FLAS		RS Latch, NAND Type	8	X	X	X
FLA2	X2	RS Latch, NAND Type	13	X	X	X
FLOS		RS Latch, NOR Type	8	X	X	X
FLO2	X2	RS Latch, NOR Type	15	X	X	X
HLAS		Half Latch, NAND Type	11	X	X	X
HLAW	X2	Half Latch, NAND Type	12	X	X	X
HLBS		Half Latch	10	X	X	X
HLBW	X2	Half Latch	11	X	X	X
HLOS		Half Latch, NOR Type	12	X	X	X
HLOW	X2	Half Latch, NOR Type	13	X	X	X
LF1S		D Latch, Hazard Free	12	X	X	X
LF1W	X2	D Latch, Hazard Free	14	X	X	X
LF4S		D Latch, 4 Bit	52	X	X	X
LF4W	X2	D Latch, 4 Bit	57	X	X	X
LFAS		D Latch, 4 Bit	39	X	X	X
LFAW	X2	D Latch, 4 Bit	45	X	X	X
LFBS		D Latch, 4 Bit	42	X	X	X
LFBW	X2	D Latch, 4 Bit	47	X	X	X
FLIP-FLOPS						
FD1S		D Flip-Flop, + Negative Edge Trigger	19	X	X	X
FD1W	X2	D Flip-Flop, + Negative Edge Trigger	21	X	X	X
FD2S		D Flip-Flop With Set, + Negative Edge Trigger	21	X	X	X
FD2W	X2	D Flip-Flop With Set, + Negative Edge Trigger	23	X	X	X
FD3S		D Flip-Flop With Reset, + Negative Edge Trigger	21	X	X	X
FD3W	X2	D Flip-Flop With Reset, + Negative Edge Trigger	23	X	X	X
FD4S		D Flip-Flop With Set and Reset, + Negative Edge Trigger	23	X	X	X
FD4W	X2	D Flip-Flop With Set and Reset, + Negative Edge Trigger	25	X	X	X
FD7S		D Flip-Flop With Reset, + Edge Trigger	23	X	X	X
FD7W	X2	D Flip-Flop With Reset, + Edge Trigger	24	X	X	X
FD8W	X2	D Flip-Flop With Set and Reset, + Edge Trigger	26	X	X	X
FD8S		D Flip-Flop	15	X	X	X
FD8W	X2	D Flip-Flop	17	X	X	X
FDCS		D Flip-Flop With Set	19	X	X	X
FDCW	X2	D Flip-Flop With Set	21	X	X	X
FDDS		D Flip-Flop With Reset	19	X	X	X
FDDW	X2	D Flip-Flop With Reset	21	X	X	X
FDES		D Flip-Flop With Set and Reset	21	X	X	X
FDEW	X2	D Flip-Flop With Set and Reset	23	X	X	X
FDFS		D Flip-Flop and Latch	22	X	X	X
FDFW	X2	D Flip-Flop and Latch	24	X	X	X
FDQS		D Flip-Flop, 4 Bit, With Reset	85	X	X	X
FDQW	X2	D Flip-Flop, 4 Bit, With Reset	89	X	X	X
FDRS		D Flip-Flop, 4 Bit	60	X	X	X
FDRW	X2	D Flip-Flop, 4 Bit	67	X	X	X
FDSS		D Flip-Flop, 4 Bit, With Reset	75	X	X	X
FDSW	X2	D Flip-Flop, 4 Bit, With Reset	79	X	X	X
FJBS		JK Flip-Flop	22	X	X	X
FJBW	X2	JK Flip-Flop	23	X	X	X
FJES		JK Flip-Flop With Set and Reset, + Edge Trigger	29	X	X	X
FJEW	X2	JK Flip-Flop With Set and Reset, + Edge Trigger	30	X	X	X
FJ3W	X2	JK Flip-Flop With Reset, Master-Slave	28	X	X	P
FJ4W	X2	JK Flip-Flop With Set and Reset, Master-Slave	30	X	X	P
FJAS		JK Flip-Flop With Set and Reset, Positive Edge Triggered	32	X	X	P
FJ7W	X2	JK Flip-Flop, With Reset, Positive Edge Triggered	29	X	X	P
COUNTERS						
CA1S		Counter, 1 Bit With Reset + Edge Trigger	23	X	X	X
CA1W	X2	Counter, 1 Bit With Reset + Edge Trigger	24	X	X	X
CA2S		Counter, 1 Bit	20	X	X	X
CA2W	X2	Counter, 1 Bit	22	X	X	X
FC1S		Counter, 4 Bit + Binary Asynchronous Up	66	X	X	X
FC1W	X2	Counter, 4 Bit + Binary Asynchronous Up	70	X	X	X
FT7S		Counter, 1 Bit With Direct Reset	27	X	X	X
FT7W	X2	Counter, 1 Bit With Direct Reset	28	X	X	X

Cell Name	Drive	Description	Basic Cells (1)	Availability		
				2.0 μ m	1.3 μ m	1.0 μ m
PULSE GENERATORS						
PGN1		Edge Sensitive Pulse Generator	23	X	X	P
PGN2		Edge Sensitive Pulse Generator	34	X	X	P
PGN3		Edge Sensitive Pulse Generator	45	X	X	P
PGN4		Edge Sensitive Pulse Generator	56	X	X	P
PGN5		Edge Sensitive Pulse Generator	67	X	X	P
PGN6		Edge Sensitive Pulse Generator	78	X	X	P
PGR1		Edge Sensitive Pulse Generator	23	X	X	P
PGR2		Edge Sensitive Pulse Generator	34	X	X	P
PGR3		Edge Sensitive Pulse Generator	45	X	X	P
PGR4		Edge Sensitive Pulse Generator	56	X	X	P
PGR5		Edge Sensitive Pulse Generator	67	X	X	P
PGR6		Edge Sensitive Pulse Generator	78	X	X	P
SHIFT REGISTERS						
FR1S		Shift Registers, 4 Bit, Serial-In Parallel-Out	41	X	X	X
FR2S		Shift Register, 4 Bit, Serial-In Parallel-Out, With Synchronous Load	97	X	X	P
FR3S		Shift Register, 4 Bit, Serial-In Parallel-Out, With Synchronous Load	82	X	X	P
I/O BUFFERS						
C22N		Buffer, Input, CMOS	0			X
C52N		Buffer, Input/Output, CMOS Input	0			X
C54N		Buffer, Input/Output, CMOS Input	0			X
C75N		Buffer, Input/Output, CMOS Input	19			X
C77N		Buffer, Input/Output, CMOS Input	19			X
C88N		Buffer, Input, CMOS, With Pull-Up	0			X
CBEN		Buffer, Input, CMOS, With Pull-Down	0			X
O52N		Buffer, Output	0			X
O54N		Buffer, Output	0			X
O75N		Buffer, Output	0			X
O77N		Buffer, Output	0			X
T22N		Buffer, Input, TTL	0			X
T52N		Buffer, Input/Output, TTL Input	0			X
T54N		Buffer, Input/Output, TTL Input	0			X
T75N		Buffer, Input/Output, TTL Input	19			X
T77N		Buffer, Input/Output, TTL Input	19			X
T88N		Buffer, Input, TTL With Pull-Up	0			X
TBEN		Buffer, Input, TTL With Pull-Down	0			X
Z24N		Buffer, Output, L Level Out Open Drain	0			X
Z25N		Buffer, Output, L Level Out Open Drain	0			X
Z26N		Buffer, Output, L Level Out Open Drain	0			X
Z27N		Buffer, Output, L Level Out Open Drain	0			X
Z34N		Buffer, Output, H Level Out Open Drain	0			X
Z48N		Buffer, Output, H Level Out Open Drain	0			X
Z52N		Buffer, Output, 3-State	0			X
Z54N		Buffer, Output, 3-State	0			X
Z75N		Buffer, Output, 3-State	19			X
Z77N		Buffer, Output, 3-State	19			X
BOSN		Buffer, Oscillator	4	X	X	
BI1N		Buffer, Input, TTL	0	X	X	
BK1N		Buffer, Input, Clock Line, TTL	5	X	X	
BC1N		Buffer, Input, CMOS	0	X	X	
BS1N		Buffer, Input, TTL, Schmitt Trigger	14	X	X	
BCSN		Buffer, Input, CMOS, Schmitt Trigger	12	X	X	
BPUN		Buffer, Input, TTL With Resistor Pull-Up	0	X	X	
BPDN		Buffer, Input, TTL With Resistor Pull-Down	0	X	X	
BO1N		Buffer, Output	0	X	X	
BZ1N		Buffer, Output, 3-State	12	X	X	
BPON		Buffer, Output, Source-Only	0	X	X	
BNON		Buffer, Output, Sink-Only	0	X	X	
BR1N		Buffer, Input/Output, 3-State, TTL Input	12	X	X	
BQ1N		Buffer, Input/Output, 3-State, CMOS Input	12	X	X	
BSDT		Buffer, Input, TTL Schmitt In, Pull-Down	14	X	X	
BSUT		Buffer, Input, TTL Schmitt In, Pull-Up	14	X	X	
BUCN		Buffer, Input, CMOS Input, Pull-Up	0	X	X	
BDCN		Buffer, Input, CMOS Input, Pull-Down	0	X	X	
BSUC		Buffer, Input, CMOS Schmitt In, Pull-Up	12	X	X	
BSDC		Buffer, Input, CMOS Schmitt In, Pull-Down	12	X	X	
BSRN		Buffer, Input/Output, 3-State, TTL Schmitt In	26	X	X	
BSON		Buffer, Input/Output, 3-State, CMOS Schmitt In	24	X	X	
VDD AND GND						
ZHHH		VDD	1	X	X	X
ZLLL		GND	1	X	X	X

Note:

(1) A basic cell is the pair of corresponding p and n transistors from which the array is constructed. Three basic cells are equivalent to a 2-Input NAND gate.

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VMEbus Interface Chips

- CA91C014 ACC
- CA91C015 DARF

AVICS chip set implements full VMEbus interface specification, integrating all functions required to interface a master or slave card to the VMEbus.

VMEbus to T1 Link Communication Cards

- VMET1-100
- VMET1-105
- VMET1-115

VMET1 family brings T1, Fractional T1 and Switched 384 to VMEbus systems. Connecting directly to North American digital T1 networks allows access to all DSØ based T1 network services. Data can be routed to and from T1, VMEbus and TDMbus. CSU and DSX-1 options configure VMET1 boards for customer premises or central office.

Futurebus+ Interface Chips

- CA91C896 Arbiter
- CA91C897 Interface Unit
- CA91C880 MC88000 Interface

CA91C896 and CA91C897 implement the IEEE P896.1-1990 Futurebus+ arbiter and interface functionality that permit Futurebus+ cards to take control of the bus to transfer data or generate arbitration messages. Available as VHDL models for design and simulation.

The CA91C880 features both arbiter and interface functions, optimized for Motorola 88000 RISC.

ESM Programmable Window Filter

- CA29C632A ESM Window Addressable Memory

High speed associative processor compares up to 32-bit input words against 32 programmable sets of upper and lower limits. Applications include electronic warfare signal processing, fuzzy memory and pattern recognition.

Audio Processing Products

- CA16C001 Digital Audio Companding Processor
- CDS-001D Audio Compression Development System
- CA16C440 BBC AESIC AES/EBU Interface Transceiver
- AES-001D Evaluation Board
- CA16M801 High Capacity Voice Module

CA16C001 features single pass compression/ expansion on 16-bit audio data sampled at rates up to 50 KHz. *No loss* Unity™ mode compresses up to 2:1. Hicom™ modes give psycho-acoustically lossless compression up to 4:1, with selectable compression rates up to 30:1. Professional audio data compression applications can be developed using the CDS-001D in a PC XT/AT platform.

CA16C440 BBC AESIC transceiver implements complete AES/EBU interface standard. Variable sample rate selection from 32 to 54 KHz, error detection and channel status info. AES-001D evaluation board accesses all CA16C440 signals via pin headers and all control bits via DIP switches.

The CA16M801 HCV module increases voice channel bandwidth utilization with 4:1 and 8:1 voice compression.

CMOS Microprocessor and Peripheral Circuits

- CA80C85B 8-bit Microprocessor
- CA53C80 SCSI Controller
- CA82C37A DMA Controller
- CA82C50A Comms Controller
- CA82C52 Serial Controller
- CA82C54 Prog Interval Timer
- CA82C55A Peripheral Interface
- CA82C59A Interrupt Controller
- CA82C84A Clock Generator/Driver
- CA82C88 Bus Controller
- CA85C30 SCC Serial Comms Controller

8000 series peripherals are fully pin and function compatible with industry standard counterparts. PDIP and PLCC packaging and industrial temp operation: (-40 to +85°C).

Data Security Products

- CA34C168 Data Encryption Processor (DEP)
- RBG 1210 Random Bit Generator
- EDS-001D Encryption Development System
- NM 810 RNG
- NM 820 SSC
- NM 830 iSECOM

The CA34C168 DEP and RBG 1210 implement fully functional Public Key security systems to protect sensitive data in the commercial sector. The DEP incorporates key management, message authentication, user verification and data encryption. Compliant with ANSI X9.17 standard defining public key passing in a DES environment. Approximately 1 million times more secure than DES.

The CA34C168 public key data security technology is available in several board level products for applications development and OEM systems integration.

FM Receiver Circuits

- CA404/CA406 FM Rcvr chip set
- CA404/CA407 FM Rcvr chip set
- CA408/CA411 FM Rcvr for data
- CA412 Cellular Radio Rcvr
- CA422 Single Chip FM Rcvr

Bipolar RF communication circuits for low power voice and data applications such as pagers, cellular phones and other portable transceivers.

DC-DC Converters and RF Support Circuits

- CA144 Prog Triple Op Amp
- CA416 Mini-PROM
- CA424 DC-DC Converter
- CA426 DC-DC Converter
- CA2842 Delta Codec for telecom
- CA2855 Control Unit
- CA2862 Power Supply Monitor

Bipolar circuits are available in different pinouts, functionality and packages according to application requirements. Call our technical support for assistance.



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NEWBRIDGE MICROSYSTEMS

BIPOLAR LINEAR INTEGRATED CIRCUITS

Operational Amplifiers

	Main Feature	Circuits /Unit	Operating Voltage	Supply Current	Output Current	Unity Gain Frequency	Package
--	--------------	----------------	-------------------	----------------	----------------	----------------------	---------

Single Supply

NJM2904 *	General Purpose	2	3 to 32V	0.7mA	20mA	0.8MHz	D, L, M, E8, S9
NJM3404A *	Low Distortion	2	to 36V	2.0mA	20mA	1.2MHz	D, L, M, E8, S9
NJM3415 *	High Output Current	2	to 15V	5.5mA	110mA	1.3MHz	D, L, M, E8, S9
NJM324 *	General Purpose	4	3 to 32V	0.7mA	20mA	0.4MHz	D, M, E14
NJM3403A *	Low Distortion	4	to 36V	3.0mA	20mA	1.2MHz	D, M14

Dual Supply

NJM0P-07 *	Precision	1	±3 to ±22V	2.7mA	40mA	0.5MHz	D, M8
NJM318 *	High Speed	1	to ±20V	5.0mA	20mA	15MHz	D, T, M, E8
NJM4250 *	Low Supply Current	1	±1 to ±18V	Variable	Variable	Variable	D, M, E8
NJM5534 *	Low Noise	1	to ±22V	4.0mA	50mA	10MHz	D, M8
NJM4558 *	General Purpose	2	to ±18V	3.5mA	12mA	2MHz	D, L, T, M, E8, S9
NJM022B *	Low Supply Current	2	±2 to ±18V	250µA	10mA	—	D, L, M, E8
NJM4560 *	Low Noise	2	to ±18V	3.5mA	25mA	10MHz	D, L, T, M, E8, S9
NJM2041 *	Low Noise	2	to ±22V	6.0mA	25mA	7MHz	D, L, M, E8, S9
NJM062 *	J-FET Input	2	to ±18V	400µA	12mA	1MHz	D, L, M, E8, S9
NJM072B *	J-FET Input	2	to ±18V	3.0mA	25mA	3MHz	D, L, M, E8, S9
NJM353 *	J-FET Input	2	to ±18V	3.6mA	16mA	4MHz	D, T, M8
NJM2082 *	J-FET Input	2	to ±18V	4.0mA	40mA	5MHz	D, L, M8, S9
NJM2068 *	Low Noise	2	to ±18V	5.0mA	50mA	5.5MHz	D, L, M, E8, S9
NJM5532 *	Low Noise	2	to ±22V	9.0mA	50mA	10MHz	D, M8, S9
NJM4556 *	High Output Current	2	to ±18V	9.0mA	70mA	8MHz	D, L, M, E8, S9
NJM2058 *	General Purpose	4	to ±18V	3.5mA	12mA	2MHz	D, M14
NJM2060 *	Low Noise	4	to ±18V	3.5mA	25mA	10MHz	D, M14
NJM064 *	J-FET Input	4	to ±18V	800µA	12mA	1MHz	D, M14
NJM074 *	J-FET Input	4	to ±18V	6.0mA	25mA	3MHz	D, M14

Series Voltage Regulators

	Output Voltage	Maximum Input Voltage	Output Current	Tolerance	Package
NJM78LXXA*	2, 5, 6, 8, 9, 12, 15, 18, 20, 24V	30V for V ₀ = 2 to 9V	100mA	4%	L, U
NJM78MXXA	5, 6, 8, 9, 12, 15, 18, 20, 24V	35V for V ₀ = 12 to 15V	500mA	4%	F
NJM78XXA	5, 6, 8, 9, 12, 15, 18, 20, 24V	40V for V ₀ = 18 to 24V	1A	4%	F
NJM317	1.25 to 37V (Variable)	V _{in} -V ₀ = 40V	1.5A	4%	F
NJM79LXXA*	-3, -5, -6, -8, -9, -12, -15, -18, -24V	-30V for V ₀ = -3 to -9V	100mA	4%	L, U
NJM79MXXA	-5, -6, -8, -9, -12, -15, -18, -24V	-35V for V ₀ = -9 to -15V	500mA	4%	F
NJM79XXA	-5, -6, -8, -9, -12, -15, -18, -24V	-40V for V ₀ = -18 to -24V	1A	4%	F
NJM2351	(±7, ±10 and 5V)/Unit	±22V	200mA	4%	D16

Switching Regulators

	Main Feature	Operating Voltage	Supply Current	Reference Voltage	Tolerance	Package
NJM2048 *	Two Tracking Output	6.5 to 20V	2mA	5.0V	5%	D, M16
NJM2352 *	Low Power Consumption	2.4 to 30V	280µA	1.3V	5%	D, M8
NJM2355	High Voltage and Two Output	6.5 to 50V	5.8mA	5.0V	4%	D18
NJM2360 *	High Switching Current (1.5A)	2.5 to 40V	2.4mA	1.25V	5%	D, M8

Audio and Video ICs

	Description	Application Examples	Package
NJM386 *	Low Voltage Power Amplifier	AM/FM Radios, Portable Tape Player	D, L, M, E, S9
NJM2067 *	Dual Pre-amplifier	Head Phone Stereos	D, M14
NJM2073 *	Dual Power Amplifier	AM/FM Radios, Portable Tape Player	D, M8, S9
NJM592 *	Differential Video Amplifier	VCR, Audio Equipment	D, M14
NJM2219	RF Modulator	VCR	D16
NJM2228 *	Frequency Doubler/Tripler	VCR	D, M8, S9
NJM2234 *	3-input 1-output Video Switch	VCR, Audio Equipment	D, M8, S9
NJM2244 *	Video Switch with 75Ω Driver	VCR, Audio Equipment	D, M8, S9

* SMT packages are available (M-packages are Japanese standard size packages, and E-packages are U.S. standard).



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C-MOS LINEAR / DIGITAL INTEGRATED CIRCUITS

Operational Amplifiers

	Main Feature	Circuits /Unit	Operating Voltage	Supply Current	Input Current	Band Width	Package
NJU7001 *	Low Supply Current	1	1 to 18V	15µA	1pA	0.1MHz	D, M8
NJU7002 *	Low Supply Current	2	1 to 18V	30µA	1pA	0.1MHz	D, M8
NJU7004 *	Low Supply Current	4	1 to 18V	60µA	1pA	0.1MHz	D, M14

Quartz Crystal Oscillators

	Operating Voltage	Operating Current	Stand-by Current	Fanout Ability	Frequency	Package
NJU6323 *	3 to 6V	10mA	100µA	10LSTTL	to 50MHz	E8, Chip
NJU6331 *	4 to 6V	15mA	100µA	5TTL	20 to 75MHz	E8, Chip
NJU6332 *	4 to 6V	15mA	100µA	10LSTTL	20 to 75MHz	E8, Chip
MJU6341 *	4 to 6V	25mA	100µA	5TTL	to 120MHz	E8, Chip

Analog Switches

	Feature and Description	Circuits /Unit	Analog Signal Range	Break Down Voltage	On-state Resistance	Package
NJU201A *	Low On-state Resistance	4	±15V	44V	50Ω	D, M16
NJU211 *	General Purpose	4	±15V	40V	115Ω	D, M16
NJU7301 *	General Purpose	4	±15V	44V	115Ω	D, M16
NJU7304 *	8-channel Multiplexer	1	0 to 10V	20V	—	D16

LCD Controller/Drivers

	Description	Maximum Shift Clock	Package
NJU6408 *	Dot Matrix LCD Controller Driver	—	F80
NJU6407 *	Dot Matrix LCD 40-out Segment Driver	6MHz	F56
NJU6417 *	Dot Matrix LCD 64-out Segment Driver	6MHz	F80
NJU6405 *	Dot Matrix LCD Serial-in 86-out Row Driver	6MHz	F100
NJU6404 *	Dot Matrix LCD 4-bit Bus 80-out Column Driver	6MHz	F100

OPTO DEVICES

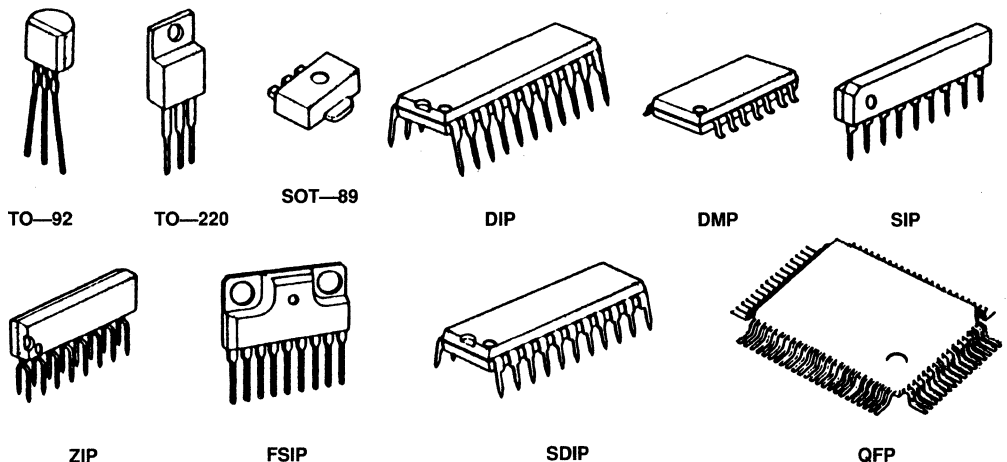
Photo Couplers

	Couplers /Unit	Isolation Voltage	Emitter		Detector		Package
			Forward Current	Reverse Voltage	C-E Voltage	Collector Current	
NJL5151 **	1	4000V	to 70mA	6V	35V	50mA	D, M4
NJL5152 **	2	4000V	to 50mA	6V	35V	50mA	D, M8
NJL5153 **	3	4000V	to 50mA	6V	35V	50mA	D, M12

Package Outlines

Package Table

TYPE	SYMBOL
TO-92	—
TO220	—
SOT-89	U
TO-220F	F
DIP	D
DMP	M
EMP	E
SIP	S
ZIP	S
FSIP	S
HDIP	K
SDIP/SIP	L
QFP	F



* SMT packages are available (M-packages are Japanese standard size packages, and E-packages are U.S. standard). ** Packages are (not standard).



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UNILAB 8620

ANALYZER-EMULATOR

Emulators



UniLab the universal system for rapid development of embedded processor systems.

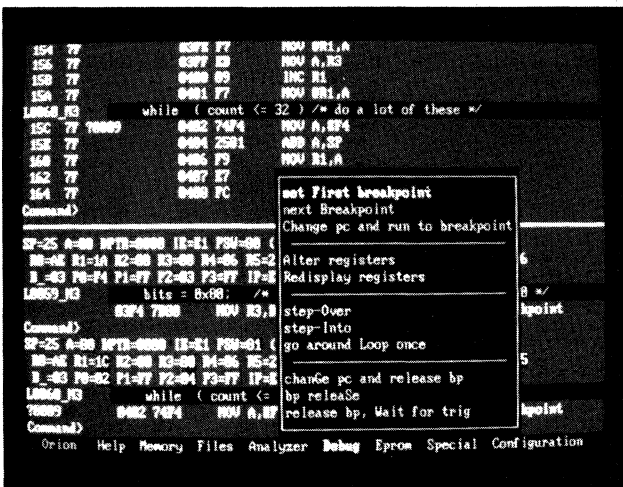
SOFTWARE DEVELOPMENT TOOLS

- High Level Language/Symbolic debug support for a wide variety of development software packages.
- Source Tracking automatically displays the corresponding sections of your source file in its original format while you work.
- UniLab's trademark ability to debug by symptom with the analyzer—not just breakpointing and single stepping.
- Easy to learn and use PopUp menu interface.
- Program Performance Analysis computes both address and execution time histograms by gathering information while the target system runs at full speed.

INTEGRATED HARDWARE COMPONENTS

- A 48-channel bus state analyzer for real-time trace without stopping the processor.
- 32K to 128K emulation ROM.
- A generous 2730 cycle trace buffer with powerful triggering and selective filtering.
- Integrated EPROM programmer (handles 2716 thru 27512) and stimulus generator built right into the unit to help you quickly complete your project.
- High speed parallel interface zips data between your PC/AT and the 8620 fast—64K bytes from hard disk to emulator in 5 seconds.

Orion Instruments



UniLab split screen display includes analyzer trace and breakpoints with high level language source lines. Also shown is PopUp menu interface with debug selections.

More Emulation For Less Cost

The UniLab 8620 combines a bus-state analyzer with an emulator to provide more capability and faster debugging than traditional in-circuit emulators. Whether you're working on single-chip controllers or high speed 8- and 16-bit microprocessors, the UniLab 8620 handles them all at a low, low price.

Over 170 different processors are supported by the same universal system, all with the same software environment. Support for additional processors requires only the purchase of an inexpensive Processor Personality Pak (PPAK).

UniLab 8620 Supports Over 170 Processors including:

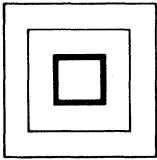
INTEL	HITACHI	MOTOROLA	ROCKWELL	ZILOG
8031	6301	6800	6500	Z180
8032	6303R	6801	6501Q	Z80
8051	6303X	6802	6502	Z8
8085	6303Y	6803	6510	SUPER 8
8086	6305	68HC05C4/C8	6511Q	Z8000
8088	6309	6805	6541Q	
8096	6309E	6809		NEC
80188	64180	6809E	NSC	V20
80C196		68HC11	NSC800	V30
80186	OKI	68000	87P50	V40
80286	80C51VS	68008		V50
	85C154			78310

Details of UniLab 8620 support for these and other processors is available.

Please call ORION for more information.



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MEMORY MODULES

PART NUMBER	ORGANIZATION	DIMENSIONS	PKG.
64 K DRAM BASED MODULES SPEEDS — 120, 150, 200 nS.			
PEP4064EC4	64K × 4	2.2 × 0.42 × 0.180	22 PIN SIP
PEP4064EC5	64K × 5	2.9 × 0.42 × 0.180	24 PIN SIP
PEP4064EL8*	64K × 8	3.0 × 0.60 × 0.180	30 PIN SIP
PEP4064EL9*	64K × 9	3.0 × 0.60 × 0.180	30 PIN SIP
256 K DRAM BASED MODULES — 60, 70, 80, 100, 120, 150 nS.			
PEP4256EC4	256K × 4	2.2 × 0.42 × 0.180	22 PIN SIP
PEP4256EC5	256K × 5	2.9 × 0.42 × 0.180	24 PIN SIP
†PEP4256EL8*	256K × 8	3.0 × 0.60 × 0.180	30 PIN SIP
†PEP4256EL9*	256K × 9	3.0 × 0.60 × 0.180	30 PIN SIP
PEP4256EL8-LP	256K × 8	3.0 × 0.45 × 0.320	30 PIN SIP
PEP4256EL9-LP	256K × 9	3.0 × 0.45 × 0.320	30 PIN SIP
1M BIT DRAM BASED MODULES — 80, 100, 120 nS.			
PEP1MX4	1M × 4	2.8 × 0.42 × 0.180	24 PIN SIP
PEP1MX5	1M × 5	3.5 × 0.42 × 0.180	26 PIN SIP
PEP4MX1	4M × 1	2.8 × 0.42 × 0.180	26 PIN SIP
PEP1MX4Z	1M × 4	1.5 × 0.350 × 0.440	26 PIN ZIP
PEP4MX1Z	4M × 1	1.5 × 0.350 × 0.440	23 PIN ZIP
PEP1MX8*	1M × 8	3.2 × 0.775 × 0.190	30 PIN SIP
PEP1MX9*	1M × 9	3.2 × 0.775 × 0.190	30 PIN SIP
PEP1MX8-LP	1M × 8	3.5 × 0.435 × 0.320	30 PIN SIP
PEP1MX9-LP	1M × 9	3.5 × 0.435 × 0.320	30 PIN SIP
PEP1MX16	1M × 16	3.3 × 1.50 × 0.320	64 PIN DIP
PEP2MX8	2M × 8	3.3 × 1.50 × 0.320	64 PIN DIP
4M BIT DRAM BASED MODULES			
PEP4MX8*	4M × 8	3.5 × 0.975 × 0.180	30 PIN SIP
PEP4MX9*	4M × 9	3.5 × 0.975 × 0.180	30 PIN SIP
PEP4MX9	4M × 9	3.50 × 0.950 × 0.190	30 PIN SIMM
PEP25636	256K × 36 ⁽¹⁾	4.25 × 1.0 × 0.190	72 PIN SIMM
PEP51236	512K × 36 ⁽²⁾	4.25 × 1.0 × 0.325	72 PIN SIMM
PEP1MX36	1M × 36 ⁽³⁾	4.25 × 1.25 × 0.190	72 PIN SIMM
PEP2MX36	2M × 36	4.25 × 1.25 × 0.325	72 PIN SIMM
NTX 4M	4M × 8 ⁽⁴⁾	3.55 × 0.810 × 0.190	64 PIN SIMM
NTX 4000	1M × 8 ⁽⁴⁾	3.55 × 0.810 × 0.190	64 PIN SIMM
AST 1000	256K × 36 ⁽⁵⁾	3.55 × 0.810 × 0.190	64 PIN SIMM
AST 4000	1M × 36 ⁽⁵⁾	3.55 × 0.810 × 0.190	64 PIN SIMM
STATIC RAM MODULES — 30, 45, 55, 70, 100, 120 nS.			
S128KX8	128K × 8 80, 100, 120	1.80 × 0.680	32 PIN DIP (0.600)
S256KX8	256K × 8 80, 100	1.70 × 0.620	32 PIN DIP (0.600)
S512KX8	512K × 8 80, 100	1.70 × 0.620	32 PIN DIP (0.600)
1PE0176	256K × 8 55 70	2.60 × 0.620	54 PIN DIP (0.600)
LI6432	64K × 32 20-55 NS	3.00 × 0.620	60 PIN DIP (0.600)
LI25632	256K × 32 20-55 NS	3.00 × 0.620	60 PIN DIP (0.600)
S256EC4	256K × 4 20-55	3.00 × 0.450	30 PIN SIP

NOTES:

(1) IBM PS/2 PART #6450603

(2) IBM PS/2 PART #6450604/6450608

(3) IBM PS/2 PART #29F2933

(4) UPGRADES FOR APPLE MAC IIFX AND LASERWRITER NTX

(5) AST RESEARCH PART #500718-002 AND 4M UPGRADE

*Also available in SIMM package. † Also available in 3 chip solution.

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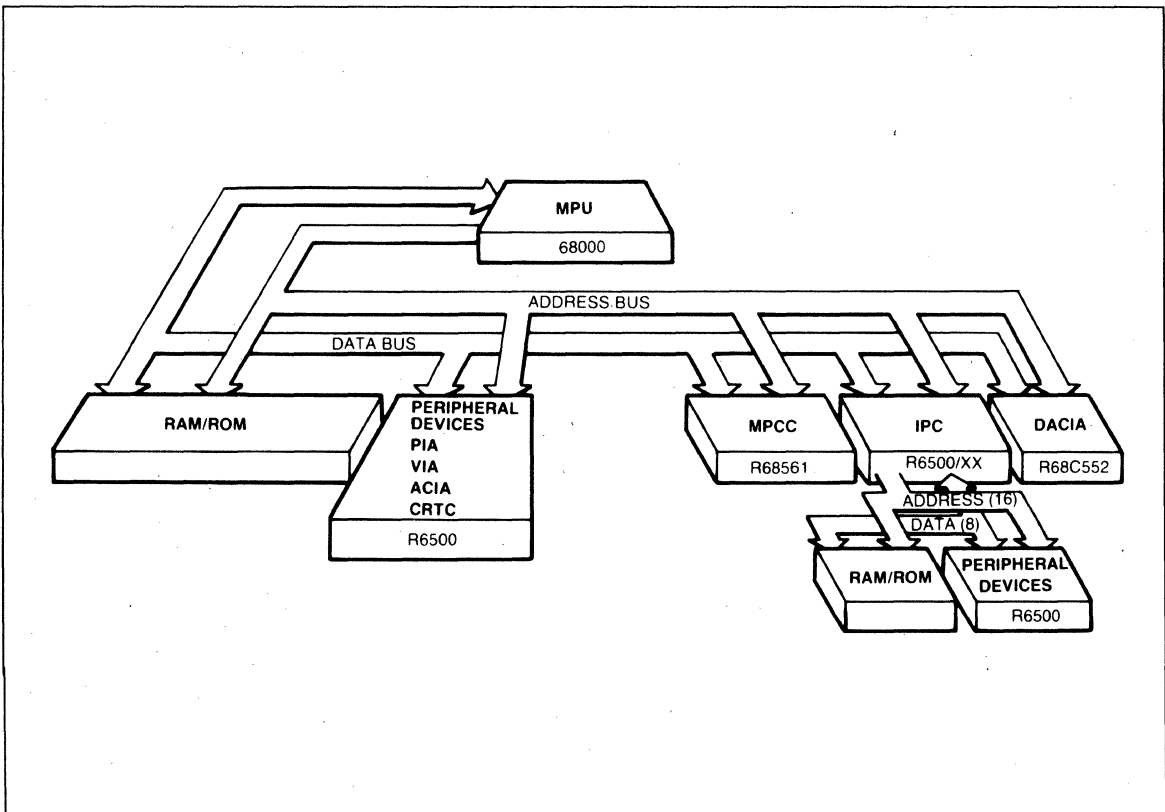
Rockwell International designs and manufactures a family of VLSI products to serve your system requirements. As shown in the diagram below, compatible controller products are available for a wide range of 16-bit and 8-bit applications. Peripheral devices operate on either the 68000 or the 6500 microprocessor bus structure. Many of the peripheral devices are now being used on additional bus structures such as 8085, 80286 and Z80, just to name a few.

These products are produced in high volume at a modern state-of-the-art facility located in

Newport Beach, California and are packaged in a newly constructed, fully automated manufacturing facility in Mexicali, Mexico. The class 10,000 clean room environment produces devices to the most stringent industry standards. Rockwell has the organization, systems and support to manufacture products to existing and future quality levels.

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Serving System Requirements



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CMOS and NMOS 8-Bit Microcomputers Highest Industry Performers

The R6500 single-chip CMOS and NMOS microcomputers provide high-speed and low-power CMOS while being completely software compatible with the 8-bit multi-chip family. They let you move easily from a multi-chip to a single-chip solution when the application warrants. They also function as intelligent peripheral controllers. The R65C10, a CMOS version of the R6500/1,

combines the low power of CMOS with advanced pipelining architecture to provide an efficient high-speed single-chip system solution.

We also offer a set of extremely versatile FORTH language devices. The R65F11 and R65F12 contain both the high level language and operating system that can put your product on the market in the shortest possible time.

Feature/Models	R6500/1	R6500/11	R6500/12	R6500/13	R6500/15	R65C10
• INSTRUCTION SPEED	1000ns	1000ns	1000ns	1000ns	1000ns	1000ns
• ROM (x8)	2K	3K	3K	256	4K	2K
• RAM (x8)	64	192	192	192	192	64
• I/O LINES	32	32	56	32	32	32
• SERIAL COMM.	—	USART	USART	USART	USART	—
• 16-BIT COUNTERS	ONE	TWO	TWO	TWO	TWO	ONE
• EXPANSION BUS	—	16K	16K	65K	16K	—
• INTERRUPTS						
— EXTERNAL	5	6	6	6	6	5
— INTERNAL	1	4	4	4	4	1
• OPERATING POWER (mW)	750	800	800	800	800	40
• STANDBY (mW)	35*	12*	12*	12*	12*	12
• PACKAGE	40 DIP	40 DIP	QUIP	QUIP	40 DIP	40 DIP
	44 PLCC	44 PLCC	68 PLCC	68 PLCC	44 PLCC	44 PLCC
* STANDBY RAM						

Rockwell Microcomputers

Feature/Models	R6501Q	R6511Q	R6518
• INSTRUCTION SPEED	1000ns	1000ns	1000ns
• RAM (x8)	192	192	192
• I/O LINES	32	32	16
• SERIAL COMM.	USART	USART	USART
• 16-BIT COUNTERS	TWO	TWO	TWO
• EXTERNAL MEMORY	64K	64K	16K
• INTERRUPTS			
— EXTERNAL	6	6	6
— INTERNAL	4	4	4
• OPERATING POWER (mW)	800	800	800
• STANDBY RAM (mW)	12	12	12
• PACKAGE	64 QUIP	64 QUIP	40 DIP
	68 PLCC	68 PLCC	44 PLCC

Rom-less Microcomputers

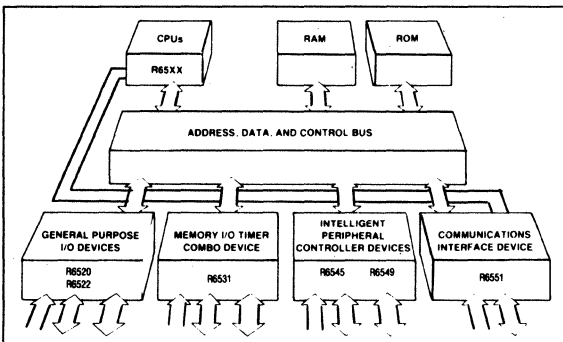




NMOS 8-bit Microprocessors and Peripherals Largest Selling 8-Bit Family

The NMOS R6500 microprocessor family has a wide range of CPUs and peripheral controllers plus versatile memory-I/O timer combinations. It is software compatible with the CMOS microprocessor and peripheral family, as well as, with the family of single-chip microcomputers. Fast instruction execution (1 μ s and 2 μ s) is available in 1 and 2 MHz versions, respectively.

The entire 8-bit R6500 family is upward compatible with 16-bit bus systems, software compatible with the Rockwell 8-bit microcomputers, and are the building blocks for a wide range of system applications.



NMOS R65XX Microprocessor Family

NMOS

8-Bit Processor

R6502: 8-Bit Microprocessor Unit (MPU) provides high performance (down to 1 μ s instruction time) using memory efficient byte-level instructions.

8-Bit Peripherals—6500/6800 bus compatible

R6520: Peripheral Interface Adapter (PIA) interfaces two 8-bit bidirectional parallel data ports with four control lines and an interrupt request output on each port.

R6522: Versatile Interface Adapter (VIA) interfaces two 8-bit bidirectional parallel data ports, two 16-bit timers, and an 8-bit serial port.

R6531: ROM-RAM-I/O Counter (RRIOC) combines 1K bytes read-only memory, 64 bytes random access memory, a 16-bit counter/latch, and an 8-bit serial channel.

R6545: CRT Controller (CRTC) controls a CRT raster scan video display at a character clock frequency of 2.5 MHz or 3.7 MHz using 19 registers to program display parameters such as number of rows, number of lines, sync positions and widths, row/column or straight binary addressing selection, and interface/non-interlaced scan selection.

R6549: Color Video Display Generator (CVDG) is a color graphics CRT display driver for any application requiring 256 x 210 pixels resolution and a 4096-color palette. Also, special features attractive to videotex and teletext (NAPLPS) applications.

R6551: Asynchronous Communications Adapter (ACIA) with on-board baud generator interfaces an asynchronous channel with 5-8 data bits; 1 or 2 stop bits; and odd, even or no parity; at 1 of 15 selectable rates (to 38,000 baud), or 1/16 external clock rate.

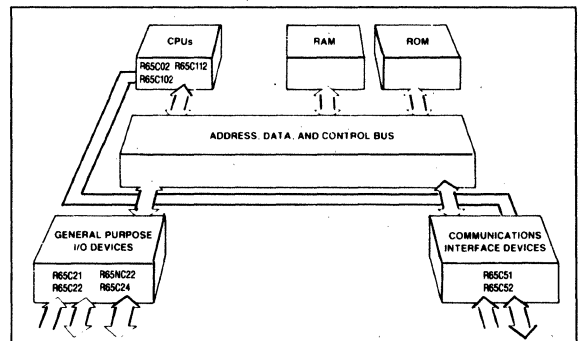
R68560/61: Multi Protocol Communications Controller (MPCC) interfaces to a single high speed serial data channel (up to 4 Mbps), supports popular synchronous or asynchronous formats, and performs protocol handling and checking. Eight and 16 bit host interfaces available.

CMOS 8-bit Microprocessors & Peripherals Fastest Executing — Low Power

There is no CMOS microprocessor family easier to implement than the R65CXX. It is a fast instruction-executing 8-bit family of devices. It's software compatible with a family of single-chip microcomputers and has three powerful CPUs and peripherals for parallel and serial I/O.

In the 8-bit range, nothing gives faster instruction execution (500 μ s) with most parts available in 1, 2, 3 and 4 MHz versions.

Because of its inherent characteristics, advanced Rockwell CMOS provides low power consumption, high noise immunity and high speed operation. It's 2 MHz CPU dissipates only 40 mW (compared to 800 mW in NMOS) and requires only 10 μ A standby current. Instruction memory requirements are 20% less due to added bit manipulation features.



CMOS R65CSS Microprocessor Family

8-Bit Processor and Peripherals

CMOS

8-Bit Processors - 6500/6800 bus compatible

R65C02/R65C102/R65C112: 8-Bit Microprocessor Units (MPUs) provide high performance (down to 55 ns instruction time) using memory efficient bit and byte-level instructions.

8-Bit Peripherals - 6500/6800 bus compatible

R65C21: Peripheral Interface Adapter (PIA) interfaces two 8-bit bidirectional parallel data ports with four control lines and an interrupt request output on each port.

R65C22: Versatile Interface Adapter (VIA) interfaces two 8-bit bidirectional parallel data ports plus two 16-bit timers and an 8-bit serial port.

R65C24: Peripheral Interface Adapter/Timer (PIAT) interfaces two 8-bit bidirectional parallel data ports and a 16-bit Counter/Timer.

R65C51: Asynchronous Communications Interface Adapter (ACIA) with on-board baud generators interfaces an asynchronous channel with 5-8 data bits; 1 or 2 stop bits; and odd, even or no parity; at 1 of 15 selectable rates (to 38,000 baud) or 1/16 external clock rate.

R65C52: Dual Asynchronous Communications Interface Adapter (DACIA) is a dual channel version of the R65C51 ACIA above.

R68C552: DACIA is a 68000 bus compatible version of the R65C52 DACIA above.





PMOS INTELLIGENT DISPLAY CONTROLLERS

The Rockwell Intelligent Display Controller family of products is designed to interface a host processor to various types of Vacuum Fluorescent Displays (VFD). In addition to providing the display drive signals, these products perform character decoding, grid timing, and display refresh functions. Included in the family are a series of single chip display controllers, a series of anode decoder/drivers, and a grid controller driver.

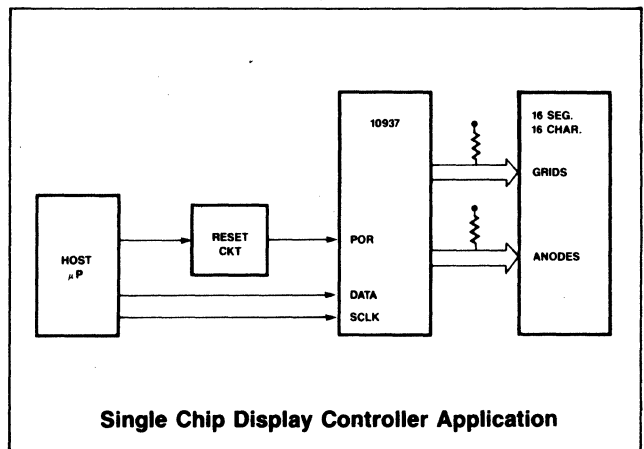
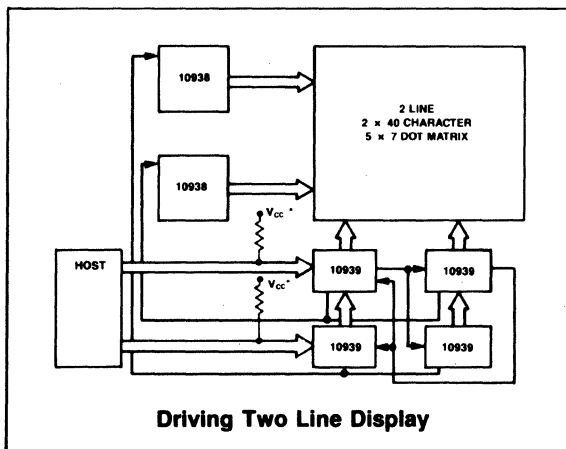
Typical applications for the intelligent display controller family include: automotive instrument clusters, interactive terminals, typewriters, telecommunications products, industrial automation applications, hand-held

computers, and instrumentation systems.

By providing a simple interface, both with the host computer and the associated display, the intelligent controller family provides significant advantages over other approaches. The benefits of Rockwell's intelligent display controller approach are: reduction of operation time required of the host computer, less display overhead electronics, simplified system design, less board real estate for the display control function, reduced power and cooling, lower overall installed cost and lower maintenance costs.

Features	Grid Drivers 10939	Anode Drivers				Comparison of Single Chip Display Controller Features		
		10938	10941	10942	10943	10937	10951	10957
PLA Size Font		128 5 x 7 Dot Matrix Alphanumeric	128 16 Segment Alphanumeric and Bargraph	128 Top Half 5 x 12 Dot Matrix Alphanumeric	128 Bottom Half 5 x 12 Dot Matrix Alphanumeric	64 16 Segment Alphanumeric Decimal Point Comma	64 7 Segment Numeric Decimal Point Comma 16 Segment Bargraph	64 16 Segment Alphanumeric Decimal Point Comma
Grid Drivers Type Number Current Limit (mA)						Open-Drain 16 20	Open-Drain 16 20	Open-Drain 16 20
Anode Drivers Type Number Current Limit(mA)	Push-Pull 20 10	Push-Pull 35 2	Push-Pull 18 2	Push-Pull 23 2	Push-Pull 23 2	Open-Drain 18 10	Open-Drain 18 10	Open-Drain 18 10
Host Interface Control Options	Serial or Parallel Digit Time Duty Cycle Character Count Buffer Pointer Blank Mode Inverse Mode Start Refresh	Via 10939	Via 10939	Via 10939	Via 10939	Serial Duty Cycle Character Count Buffer Pointer Test Mode	Serial Duty Cycle Character Count Buffer Pointer Test Mode	Serial Duty Cycle Buffer Pointer Test Mode
Power Supply Limits VDD(V) VFF(V)	-20 ± +20 to -50	-20 ± +20 to -50	-20 ± +20 to -50	-20 ± +20 to -50	-20 ± +20 to -50	-15 ± +15 to -50	-15 ± +15 to -50	-15 ± +15 to -50
Package Other	40 Pin Dip Cursor Driver Cascadable	40 Pin Dip	24 Pin Dip Decimal Point Driver Comma Driver	28 Pin Dip	28 Pin Dip	40 Pin Dip 2 Decimal and Tail Commands	40 Pin Dip 2 Decimal and Tail Command	40 Pin Dip 4 Decimal and Tail Commands

Rockwell Semiconductor





World Leader in Fax Modem Technology Single Device MONOFAX[®] Modems

The Rockwell R96MFX, R96EFX, R96DFX, and R144EFX MONOFAX modems are synchronous half-duplex modems. Each modem is available in a single VLSI device package.

The modems can operate over the public switched telephone network (PSTN) through line terminations provided by a data access arrangement (DAA).

The modems satisfy the telecommunications requirements specified in CCITT recommendations V.29, V.27 ter, V.21 Channel 2, and T.4, and the binary signaling requirements of T.30. The R144EFX also meets V.33 and V.17 requirements.

The modems can operate at a speed of 9600, 7200, 4800, 2400, or 300 bps depending upon the selected configuration. In addition, the R144EFX modem can operate at 14400 or 12000 bps.

The modems are designed for use in Group 3 facsimile machines. The R96MFX, R96EFX, and R144EFX also support Group 2.

The R96EFX, R96DFX, and R144EFX support V.27 ter short train.

The R96EFX, R96DFX, and R144EFX can also perform HDLC framing according to T.30 at all speeds.

The voice mode supported by the R96EFX, R96DFX, and R144EFX allows the host computer to efficiently transmit and receive audio signals and messages.

The modem is available in either a 64-pin quad in-line package (QUIP) or a 68-pin plastic leaded chip carrier (PLCC) package.

MONOFAX is a registered trademark of Rockwell International.

FEATURES

- Group 3 facsimile transmission/reception
 - CCITT V.33, V.17 (R144EFX only)
 - CCITT V.29, V.27 ter, T.30, V.21 Channel 2, T.4
 - T.3 Group 2 facsimile (except R96DFX)
 - HDLC framing at all speeds (except R96MFX)
- V.27 ter short train (except R96MFX)
- Voice mode (except R96MFX)
- DTMF reception (R96DFX and R144EFX)
- Half-duplex (2-Wire)
- Programmable dual tone generation
- Programmable tone detection
- Programmable turn-on and turn-off thresholds
- Programmable transmit output level
- Programmable interface memory interrupt
- Diagnostic capability allows telephone line quality monitoring
- Automatic adaptive equalization
- Compromise cable (selectable) equalization
- DTE interface: two alternate ports
 - Selectable microprocessor bus (6500 or 8085)
 - CCITT V.24 (RS-232-C compatible) interface
- TTL and CMOS compatible
- Low power CMOS
 - Single voltage: + 5 Vdc ± 5%
 - Operating power: 370 mW (typical)
- Single VLSI package
 - 64-pin QUIP
 - 68-pin PLCC

Rockwell Semiconductor

Model	Data Speed (bps)	PSTN/Leased Line	2/Wire/4-Wire Half/Full-Duplex	Sync/Async	Compliance
R144EFX	14400, 12000, 9600, 7200, 4800, 2400, 300	P/L	2WHD	Sync	CCITT V.33, V.17, V.29, V.27 ter, T.30, V.21 Channel 2, T.3, T.4 V.27 ter short train HDLC Framing at all speeds DTMF Reception
R96DFX	9600, 7200, 4800, 2400, 300	P/L	2WHD	Sync	CCITT V.29, V.27 ter, T.30, V.21 Channel 2, T.4 V.27 ter short train HDLC Framing at all speeds DTMF Reception
R96EFX	9600, 7200, 4800, 2400, 300	P/L	2WHD	Sync	CCITT V.29, V.27 ter, T.30, V.21 Channel 2, T.3, T.4 V.27 ter short train HDLC Framing at all speeds
R96MFX	9600, 7200, 4800, 2400, 300	P/L	2WHD	Sync	CCITT V.29, V.27 ter, T.30, V.21 Channel 2, T.3, T.4





World's First 2400 bps Data/Fax Modems with Send and Receive Group 3 Facsimile

RC224ATF/1 Data/Fax Modem with "AT" and Class 1 Commands

The Rockwell RC224ATF/1 is a combination V.22 bis data and Group 3 facsimile (fax) CMOS modem in a single 68-pin PLCC.

Optimized for battery-powered portable designs, the RC224ATF/1 modem provides maximum integration and functionality through a low power, small footprint, minimum supporting component design resulting in a highly compact, low cost, universal data/fax application solution.

Fax modes, controlled by a built-in Class 1 command interface, provide Group 3 transmit and receive functions.

Data modes, controlled by an industry standard 2400 "AT" command set, can transmit and receive up to 2400 bps.

The modem has a selectable parallel or serial DTE interface. In parallel mode, a 16C450-compatible interface allows direct connection to a PC-compatible bus without an external UART. In serial mode, a CCITT V.24 logic-compatible interface with TTL levels is supplied along with indicator outputs.

The RC224ATF/2 2-device set performs the same functions as the RC224ATF/1 and has a memory expansion bus.

FEATURES

- Low power CMOS
 - Single voltage: + 5 Vdc \pm 5%
 - Operating power: 235 mW (typical)
 - Sleep power: 30 mW (typical)
- Data modes
 - CCITT V.22 bis (2400 bps), V.22 (1200 bps)
 - Bell 212A (1200 bps) and 103 (300 bps)
 - EIA TR30.2.2/88 "AT" commands
- Group 3 fax modes
 - V.29 (9600/7200 bps) transmit
 - V.27 ter (4800/2400 bps) transmit and receive
 - V.21 Channel 2 (300 bps) transmit and receive
 - EIA-578 Service Class 1 commands
- Communications software compatible
- Integrated call progress and dialing
- No external microcomputer or memory required
- Parallel or serial asynchronous DTE interface
- Direct connect to telco transformer
- A/A1 relay control
- NVRAM interface allows storage of two user configurations and four 36-digit dial strings
- Automatic adaptive/ fixed compromise equalization
- Automatic sleep mode and wake-up
- Full-duplex data mode test capabilities

RC9624DP Single Device Data/Fax Modem Data Pump

The Rockwell RC9624DP is a low power, integrated data/fax modem data pump in a single 68-pin PLCC.

The modem operates over the public switched telephone network (PSTN), as well as on point-to-point leased lines.

The RC9624DP modem supports data modes meeting the requirements specified in CCITT recommendations V.22 bis, V.22, and V.21, as well as Bell 212A and Bell 103.

The modem supports fax modes meeting the requirements specified in V.29, V.27 ter, and V.21 channel 2 synchronous.

Internal HDLC support eliminates the need for an external serial input/output (SIO) device or comparable functions in the host controller in products incorporating error correction and T.30 protocols.

The RC9623DP modem, which includes V.23 in addition to all the capabilities of the RC9624DP modem, is also available.

FEATURES

- Low power CMOS
 - Single voltage: + 5 Vdc \pm 5%
 - Operating power: 400 mW (typical)
 - Sleep power: 5 mW (typical)
- Data modes
 - CCITT V.22 bis, V.22, V.21
 - Bell 212A and 103
 - 2-wire full-duplex (FDX) operation
- Group 3 fax modes
 - V.29, V.27 ter, V.21 Channel 2
 - 2-wire half-duplex (HDX) operation
- Receive dynamic range: -9 dBm to -43 dBm
- Maximum transmit level: 0 dBm \pm 1 dB (programmable)
- Multi-mode data/fax detection support
- V.22 bis fallback/fall-forward - 2400/1200 bps
- Serial data: synchronous and asynchronous
- Parallel data: HDLC, synchronous, and asynchronous
- Programmable ring detect
- Programmable dialer
- Adjustable speaker output to monitor received signal
- Diagnostics
- Host bus interface memory for configuration, control, and parallel data; 8086 microprocessor bus compatible
- 5-pin serial data interface; TTL compatible
- Automatic adaptive equalizer
- Selectable fixed compromise equalizers
- Answer and originate handshake in data modes





World's First QUAD Modem Device Set with International Standard V.42 and V.42 bis

The Rockwell RC2324AC is a modem device set which operates over dial-up or leased lines at communication speeds up to 2400 bps, and with data compression delivers effective throughput up to 9600 bps. Based on the Rockwell RC2324DP/1 2400 bps modem data pump, this modem is compatible with CCITT V.22 bis, V.22, V.21, and V.23 recommendations, and Bell 103 and 212A interfaces.

Supporting global connectivity via multi-mode operation, plus V.42 error correcting and V.42 bis data compression protocols, the RC2324AC delivers maximum performance and compatibility. The RC2324AC also implements an error-control protocol compatible with MNP® classes 2, 3, 4, and 5, and operates in non-error-correcting mode as well.

A full-featured Hayes-compatible "AT" command set is implemented, which ensures operation with popular communications software packages. AT command extensions simplify the use of V.42, V.42 bis, and MNP capabilities. The modem provides auto-dial, auto-redial and auto-answer capabilities, and can operate in both synchronous and asynchronous modes. Configuration information is stored in non-volatile memory.

The two-device RC2324AC consists of a microcontroller unit (MCU) and a modem data pump (MDP). The OEM adds ROM, RAM, and NVRAM (1024 bits) devices, and discrete filtering components, to complete the modem.

To aid in rapid product development, two complete modem evaluation boards are available—a parallel interface version and a serial interface version. The parallel version is a PC half card and is PC/XT™ and PC/AT™ compatible.

The RC2324AC can operate in US/Canada or Japan using call progress and tone detect parameters selected by a hardware pin. For European operation, the RC2324AC-E is available.

XT and AT are trademarks of International Business Machines Corporation.

MNP is a trademark of Microcom, Inc.

FEATURES

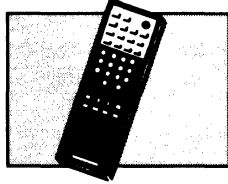
- CCITT V.22 bis, V.22, V.21, and V.23 operating modes with automode detection
- Bell 212A and 103 operating modes
- V.42 compliant error correction (LAPM and MNP)
- V.42 bis and MNP 5 data compression
- Automatic V.42/MNP4, V.42 bis/MNP5 negotiation
- Asynchronous mode
 - Programmable S register control
 - Automatic format sensing
 - Automatic speed sensing between 75-9600 bps
- Synchronous mode
- Extensive communication software compatibility
- Enhanced "AT" command set
- Extended MNP commands
 - Originate MNP (conditionally or unconditionally)
 - Answer MNP (conditionally or unconditionally)
 - Auto fallback
 - Programmable inactivity timer
 - Block or stream mode data transfer
- Speed buffering/flow control
 - DTE to modem flow control
 - Modem to modem flow control
 - RTS/CTS and XON/XOFF flow control
- Inactivity timer
- Direct mode option (passthrough data path)
- Line quality monitor and retrain capability
- Built-in DTE interfaces
 - Parallel 16C450 UART interface
 - Serial CCITT V.24 (EIA-232-D)
- Programmable speaker volume control
- Diagnostics
 - Remote digital loop and remote digital loop self test
 - Analog loop and analog loop self test
 - Digital loop test
 - Power-on self test
- Dialing and answering features
 - Auto dial/answer
 - Tone or pulse dialing
 - Answer/originate using asynchronous command set
 - Blind dialing and adaptive dialing
- Phone number directory up to 114 digits
 - NVRAM space for four telephone numbers
 - 36-digit directory field length maximum
- Two CMOS VLSI devices in 68-pin PLCC



SRAMICS

Series BU2403L/BU2404L

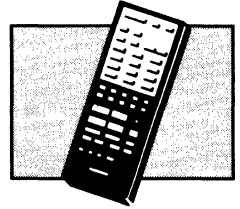
- 8-bit parallel output
- 4-bit parallel input
- Carrier output
- Delay timer
- Watchdog timer



Typical Application:
 Basic 32 key remote control

Series BU2430L/BU2431L

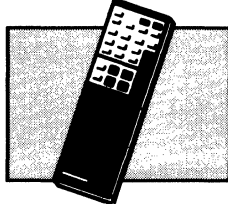
- 8-bit parallel output
- 4-bit parallel input
- 2-bit parallel I/O port
- Carrier output
- Watchdog timer



Typical Application:
 Basic 48 key remote control

Series BU2428L/BU2429L

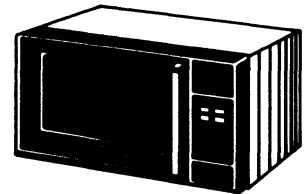
- 6-bit parallel output
- 4-bit parallel input
- Carrier output
- Delay timer
- Watchdog timer



Typical Application:
 Basic 24 key remote control

Series BU2421/BU2425

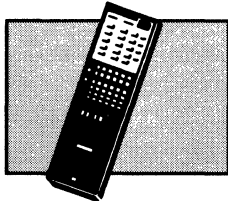
- 4-bit parallel input
- 4-bit parallel I/O port
- Buzzer output
- Timer counter
- LED controller/driver (3x8)
- Watchdog timer
- A/D converter (8-bit x 2-channel)/comparator (2-channel)



Typical Application:
 Microwave oven or other kitchen appliance with display; NiCad battery charger

Series BU2418L/BU2419L/BU2422L

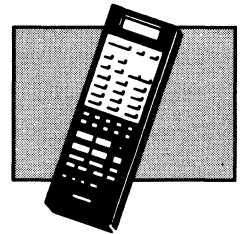
- 8-bit parallel output
- 4-bit parallel input
- 4-bit parallel I/O port
- Carrier output
- Watchdog timer



Typical Application:
 Basic 64 key remote control

Series BU2424L

- 8-bit parallel output
- 4-bit parallel input
- 2-bit parallel I/O port
- Carrier output
- LCD controller/driver (4x20)
- Watchdog timer
- Datatable ROM (64x48)
- LCD pattern ROM (48x20x4)



Typical Application:
 LCD Remote Control 48 keys

Series	ROM 8-bit	RAM 4-bit	Ports I O I/O	Instruction Set	Stack	EXE Time (μs)	V _{DD} (V)	I _{DD} (mA)	Package	Support System
BU2403L BU2404L	640	16	4 8 -	40	2	12.5	3.0	0.3	MF18 DIP18	RDSBU2 EV2403C
BU2428L BU2429L	640	16	- - -	40	2	12.5	3.0	0.3	MF16 DIP16	RDSBU2 EV2403C
BU2418L BU2419L BU2422L	1024	32	4 8 4	43	3	12.5	3.0	0.3	MF22 DIP22 SDIP22	RDSBU2 EV2418
BU2430L BU2431L	1024	32	- - -	43	3	12.5	3.0	0.3	MF20 DIP20	RDSBU2 EV2418
BU2421 BU2425	1024	64	4 1 4	38	3	1.5	5.0	0.5	SDIP32 QFP32	RDSBU2 EV2421
BU2424L*	2048	64	4 1 4	38	3	12.5	3.0	0.3	QFP44	RDSBU2 EV2424

* Under development

RAMICS-4

RAMICS-4 μPs rival the functionality of many 8-bit microcontrollers by generating in a 4-bit format the design's required functions with minimum silicon redundancy. The series offers an unusual degree of architectural flexibility, plus rapid concept-to-production turnaround.

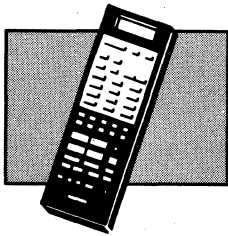
The architecture is built around a CPU core and a series of RAM-mapped I/O blocks. The user may develop the hardware around a chosen CPU in core. This helps to optimize the hardware in a very short time.

Instruction execution times range from 6 to 1.5 μsec. Most instructions are executable in one cycle.

A 100 instruction set allows for efficient, yet powerful, software control. Both external and internal interrupts are supported.

The base chip offers a group of features that meet many needs, including ROM ranging in size from 2K to 8K 8-bit bytes and RAM from 128 to 512 4-bit nibbles. The functional I/O library block includes serial and parallel I/Os, LCD controller/drivers and LED drivers, timers, timer/counters, high-current carrier generator output ports, watchdog timers, A/D, D/A converters in a variety of configurations, pulse-width modulators and TV on-screen display blocks.

Series BU24407L/BU24808L

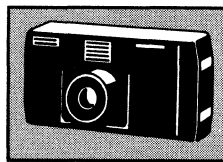


- Parallel I/O ports: two 4-bit, one 2-bit
- Timer/counter
- Carrier generator
- Two 4-bit STOP control inputs
- Dual clock

Typical Application:
 48-Key LCD Remote Control

Rohm

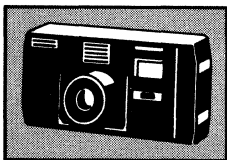
Series BU24410L/BU24809L



- Four 4-bit parallel I/O ports
- LCD controller/driver (4x36)
- Carrier generator
- 8-bit serial I/O
- Dual clock
- Two 4-bit STOP control inputs
- Clock timer
- Watchdog timer

Typical Application:
 Camera

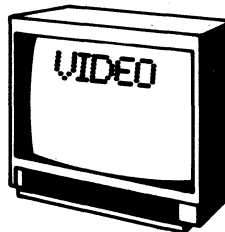
Series BU24805L



- Five 4-bit parallel I/O ports
- 4-bit parallel input
- LCD controller/driver (3x8)
- Two 4-bit LED parallel outputs
- 8-bit serial I/O port
- Two 4-bit STOP control inputs
- 8-bit 8-channel A/D converter
- Carrier generator
- Two 8-bit 2-channel timer/counters
- Dual clock
- Clock timer
- Watchdog timer

Typical Application:
 Camera

Series BU24807



- Two 4-bit parallel I/O ports
- OSD controller/driver (HSYNC, VSYNC, OUT, R,G,B, CLK0, CLK1)
- 8-bit serial I/O port
- 4-bit STOP control input
- 8-bit 8-channel A/D converter
- Seven 6-bit PWM D/A converters
- 14-bit PWM D/A converter
- Two 8-bit 2-channel timer/counters
- Dual clock
- Clock timer
- Watchdog timer

Typical Application:
 Television

Series	ROM 8-bit	RAM 4-bit	Ports I O I/O	Instruction Set	INT Stack I O	EXE Time (μs)	V _{DD} (V)	I _{DD} (mA)	Package	Support System
BU24407L	4096	128	8 — 10	100	8 2 2	6.0	3.0	1.0	QFP64	RAMICS-4/ICE
BU24808L	8192									
BU24410L	4096	256	8 — 12	100	8 2 2	6.0	3.0	2.0	SQFP80	RAMICS-4/ICE
BU24809L	8192									
BU24805L	8192	256	8 — 12	100	8 4 0	6.0	3.0	2.0	SQFP80	RAMICS-4/ICE
BU24807	8192	512	— — —	100	8 3 5	6.0	3.0	2.0	SQFP56	RAMICS-4/ICE

Dual Operational Amplifiers *Internally Compensated; Commercial Temperature Range (-20°C to +75°C)*

BA4558

- High-speed, low noise, wide bandwidth
- Low power consumption (50 mW typ.)
- Short-circuit protected output
- Internal phase compensation

BA4560

- Offers increased performance over BA4558
- High output current capacity
- Excellent slew rate of 4V/μS
- 10 MHz gain-bandwidth product

BA15532

- Low noise
- High output current capacity
- High slew rate
- Pin-compatible with Signetics NE5532

BA15218

- Low noise
- Internal phase compensation
- Low distortion
- Operate on either single or dual power supply

BA10358

- Wide supply voltage range: 3 - 30V
- Can operate on single power supply
- Low current consumption
- Level compatible with any type of logic device

Device	V _{IO} mV MAX	I _{IO} nA MAX	I _B nA MAX	SVR mV/V MAX	I _O mA MAX
BA4558*	6.0	200	500	150	6.0
BA4560*	±6.0	±200	±500	150	—
BA15532*	4.0	300	1500	100	8.0
BA15218*	5.0	200	500	—	8.0
BA10358*	4.0	300	1500	—	1.2

*Surface Mount Packages Available

Quad Operational Amplifiers *Internally Compensated; Extended Temperature Range (-40°C to +85°C)*

BA14741A

- Can operate on single or dual power supply
- Internal phase compensation
- Broad supply voltage range (±2 to ±18 V)

BA10324

- Wide supply voltage range: 3 to 32 V
- Can operate on single or dual power supply
- Low current consumption

Device	V _{IO} mV TYP	I _{IO} nA TYP	I _B nA TYP	AV V/mV TYP	CMR dB TYP	SVR dB TYP	V _{ICM} V/m TYP	VN Vrms TYP	SR V/μS TYP	SEP dB TYP	I _O mA TYP
BA14741A*	1.0	10	60	100	100	100	±13.5	2.0	1.0	100	3.0
BA10324*	2.0	5.0	45	—	80	100	—	—	—	120	0.8

*Surface Mount Packages Available

Quad Comparator

Commercial Temperature Range (-20°C to +75°C)

BA10339

- Wide supply voltage range: 2 to 36 V
- Can operate on single or dual power supply
- Open collector outputs allow wired OR output connections

Dual Comparator

Commercial Temperature Range (-20°C to +75°C)

BA10393

- Wide supply voltage range: 2 to 30 V
- Can operate on single or dual power supply
- Open collector outputs allow wired OR output connections

Device	V _{IO} mV MAX	I _{IO} nA MAX	I _B nA MAX	V _{ICM} V MAX	V _{OSAT} mV MAX	I _O mA MAX
BA10339*	±5.0	±50	250	V _{CC} -1.5	400	1.0
BA10393*	±5.0	±50	250	V _{CC} -1.5	400	1.0

*Surface Mount Packages Available

New CMOS SRAMs: 1Mbit, 2Mbit, 4Mbit

The BPS41288P, BPS81288P, & BPS16288P, are 32-pin DIP modules that allow fast, easy upgrades from 1Mbit, 2Mbit, and 4Mbit packages without consuming additional space.

The SRAMs incorporate CMOS memory ICs, plus chip select logic and on-board capacitors. TSOP packaging of the ICs contributes to lower

profile height, reduced cost, better process control, and the highest quality product available.

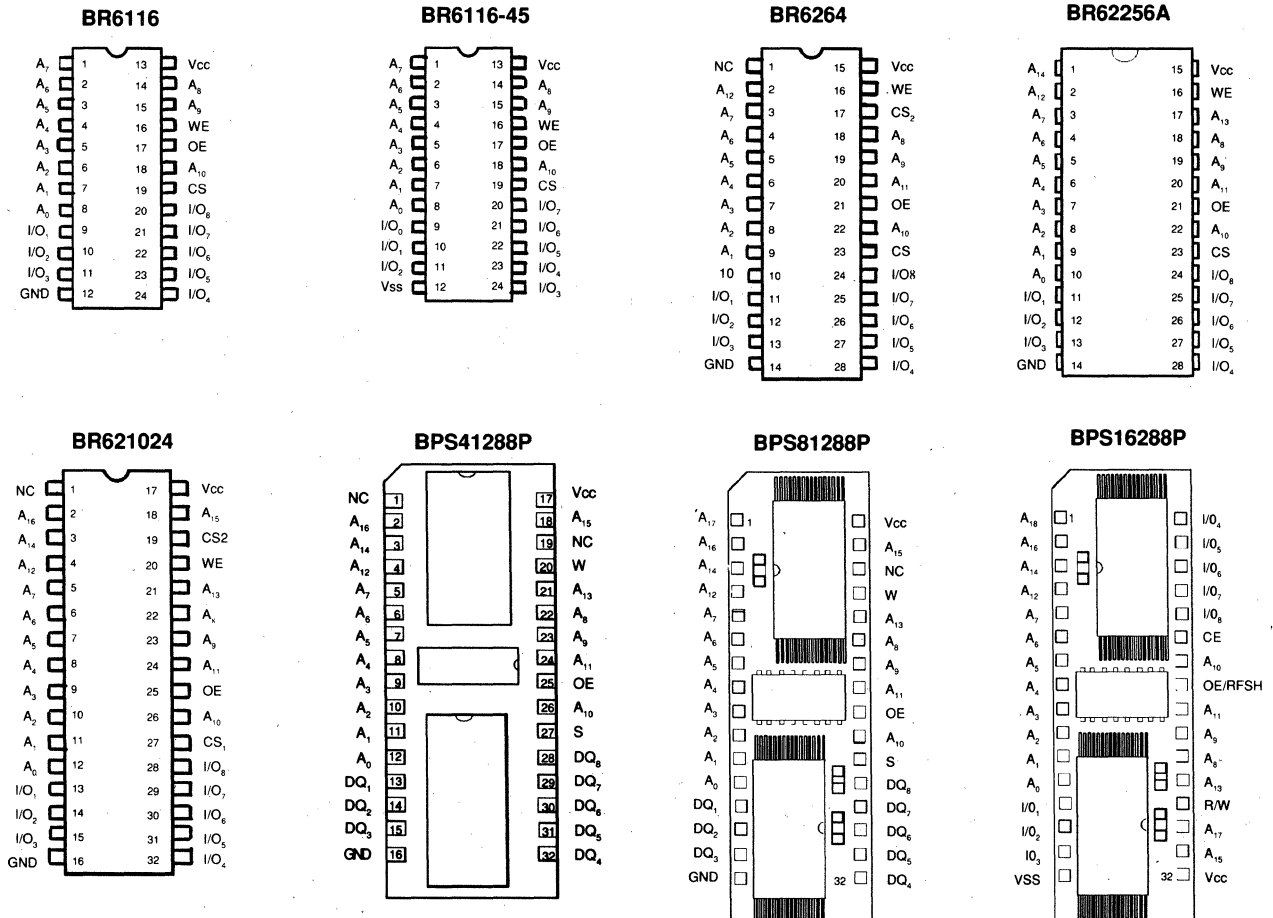
Module access time is 100 nSec, with maximum chip select times of 150 nSec for the BPS41288P, BPS81288P and 120 nSec for the BPS16288P. Operation is fully static: no clock or refresh is required. All inputs and outputs are TTL compatible.

Part Number	Access Organization	Access Time (nS)	Icc 2mA Max	Isb 1mA Max	Package			Pins
					DIP	SO	TAB	
BR6116*	2Kx8	90, 120	100	0.05	(0.6)	(0.3)	—	24
BR6116-45	2Kx8	45	70	0.002	(0.6)(0.3)	—	—	24
BR6264*	8Kx8	100, 120	90	0.1	(0.6)	(0.3)	—	28
BR62256A*	32Kx8	100,120,150	15	0.1	(0.6)	(0.3)	(.035)	28/28
BR621024*	128Kx8	70,85,100	70	0.1	(0.6)	—	—	32
BPS41288P**	128Kx8	100,120,150	75	0.4	(.675)	—	—	32
BPS81288P**	256Kx8	100,120,150	80	0.4	(.695)	—	—	32
BPS16288P**	512x8	85,100,120	36	0.4	(.59)	—	—	32

*Low power monolithic version available.

**Low power version module available

Rohm



NV RAMs

Features

- Single 5-V power supply. All the inputs and outputs are TTL compatible
- Three-state outputs
- Store and recall are controlled by a narrow signal width: > 300ns
- 10,000 erase/write cycles for E²PROM
- Ten-year data retention
- Erroneous storage preventing function Approx. 3.5V max.
- Autorecall function at power on

Applications

- Constants setting
- Data memory
- Rewritable programs and firm ware
- System configuration setting
- System parameters and part No. setting
- System status monitor
- Others

Specifications

Model No.	Memory Size (bit)	Composition	Operating Voltage (V)	Current consumption (mA)		Static RAM operation (ns)				Store Operation (ns)		Array Recall Operation (ns)		Package
				Operating (max.)	Standby (max.)	Read Cycle Time (min.)	Access Time (max.)	Write Cycle Time (min.)	Write Pulse Width (min.)	Store Time (max.)	Store Pulse Width (min.)	Recall Cycle Time (min.)	Recall Pulse Width (min.)	
S-2210R	256	64x4	5±10%	40	0.03	300	300	300	150	10x10 ⁶	200	1,400	300	18 DIP
S-2210I	256	64x4	5±10%	50	0.04	300	300	300	150	12x10 ⁶	200	1,500	300	18 DIP
S-2212R	1K	256x4	5±10%	50	0.03	300	300	300	150	10x10 ⁶	200	1,400	300	18 DIP
S-2212I	1K	256x4	5±10%	60	0.04	300	300	300	150	12x10 ⁶	200	1,500	300	18 DIP
S-2430I/IF	64	8x8	5±10%	16	0.04	1000	750	1000	—	12x10 ⁶	200	2,500	500	8 DIP, 8 SOP
S-2444R	256	16x16	5±10%	20	0.03	1000	750	1000	—	10x10 ⁶	200	2,500	500	8 DIP
S-2444I	256	16x16	5±10%	50	0.04	1000	750	1000	—	12x10 ⁶	200	2,500	500	8 DIP
S-2445I/IF	256	16x16	5±10%	12	0.04	1000	750	1000	—	12x10 ⁶	200	2,500	500	8 DIP, 8 SOP

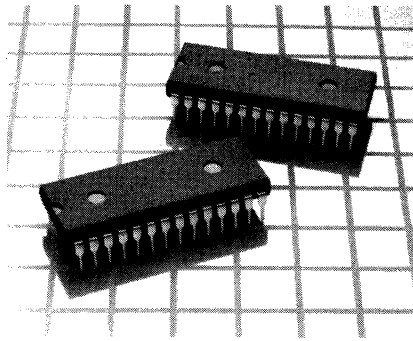
S-2444R, S-2444I, S-2445I/IF, S-2430I, S-2430I/IF are bit-serial type models. S-2445I/IF, S-2430I/IF can be directly connected to serial port.

EEPROMs

Features

- Low current consumption
- 5-V single power supply
- Write operation with built-in timer

- Data retention: 10 years
- Memory protection (S-2918, S-2961)



Specifications

Model No.	Memory size (bit)	Composition	Operating voltage range (V)		Read current consumption (mA) Max.	Standby consumption (μA) Max.	Clock frequency (kHz) Max.	Write (ms) Max.	Package
			Read Min.	Write Min.					
S-2940I/IF	128 bit	16x8 serial	2.7	3.8	5.0	1.0	150	10	8 DIP, 8 SOP
S-2961I/IF	384 bit	39x8+9x8 serial	2.7	3.8	5.0	1.0	150	10	8 DIP, 8 SOP
S-2980I/IF	768 bit	bit sequential	2.4	4.5	2.0	2.0	250	10	8 DIP, 8 SOP
S-2911R/I	1024 bit	64x16, 128x8 serial	4.5	4.5	3.0	100	250	10	8 DIP
S-2914R/RF	1024 bit	64x16, 128x8 serial	4.5	4.5	3.0	100	250	10	8 DIP, 8 SOP
S-2917R/I	1024 bit	64x16, 128x8 serial	4.5	4.2	4.0	100	500	10	8 DIP, 8 SOP
S-2918R/I	1024 bit	32x8+96x8 serial	4.5	4.2	4.0	100	500	10	8 DIP, 8 SOP
S-2921R/RF	2048 bit	128x16, 256x8 serial	4.5	4.5	3.0	100	250	10	8 DIP, 8 SOP
S-2924R/RF	2048 bit	128x16, 256x8 serial	4.5	4.5	3.0	100	250	10	8 DIP, 8 SOP

Model No.	Memory size (bit)	Composition	Operating voltage range (V)		Read current consumption (mA) Max.	Standby consumption (μA) Max.	Address access time (ns) Max.	Write (ms) Max.	Package
			Read Min.	Write Min.					
S-2840A(R)	16K bit	2Kx8 parallel	4.5	4.5	25	100	200	10	24 DIP
S-2816I	16K bit	2Kx8 parallel	4.5	4.5	25	100	200	10	24 DIP
S-2817I	16K bit	2Kx8 parallel	4.5	4.5	25	100	200	10	28 DIP
*S-2864R/I	64K bit	2Kx8 parallel	4.5	4.5	30	100	200	10	28 DIP

*Under development

STATIC RAMs

Features

- Low Power Consumption
- Operating: 60mA max
- Standby: (CMOS)
- S-2517R: 50μA max
- S-2517RL: 2μA max
- 5-Volt single power supply (±10%)

- 85ns high speed access time
- 2.0V data retention
- Compatible with 16K EPROM or mask ROM
- 24-pin DIP

Specifications

Model No.	Composition	Operating voltage range (V)	Data retention voltage (V) min.	Current Consumption		Access time (ns) max.	Cycle time (ns) min.	Operating temperature range	Package
				Operating	Standby				
S-2517R/RL	2Kx8	-0.3 to 7.0	2.0	60mA	50μA (2517R) 2μA (2517RL)	85	85	0-70°C	24 DIP

Ordering Information

Product name	Standby current consumption	Temperature	Package
S-2517R	50μA max.	0°C to 70°C	DIP
S-2517RL	2μA max.	0°C to 70°C	DIP

FUSE (OTP) ROM

Features

- Wide operating voltage range 1.1V to 5.5V

Applications

- ID ROM
- Cordless telephone
- Security equipment

The S-2100R/RF is a 64-bit serial fuse ROM developed by using the CMOS process. It has low standby current (0.3μA max. V_{DD}=1.5V) and has a wide operating voltage range. Data can be read by the clock pulses

from address 1 to address 64 serially. All the addresses are initialized with H, so writing into L can be done only once.

Specifications

Model	Memory size (bit)	Composition	Operating voltage range (V)			Current consumption (μA)		Clock frequency (kHz) Max.	Write time (ms) Min.	Package
			Read Min.	Write V _{DD} Min.	Write V _{pp} Typ.	Operating Max.	Standby Max.			
S-2100R/RF	64	bit sequential	1.10	4.5	21	20	0.3	140	8	8 DIP, 8 SOP

4-BIT MICROCOMPUTER

Applications

- VTR, TV, Cassette deck
- Office equipment, Copy equipment, Medical equipment
- Pager, Security equipment

Package

- 80-pin QFP (0.65mm pitch)

The S-1400BF is a 4-bit 1-chip microcomputer mainly composed of a 4-bit CPU core, program memory (ROM), data memory (RAM) and an I/O port. It also integrates LCD driver, 8-bit timer/event counter, 15-bit time base

timer, key-in input function, 8-bit serial input/output and 4-value level detect circuit on one chip. It runs on batteries with low power consumption, so it is particularly suitable for use in compact portable equipment.

Specifications/Functions

Model No.	ROM memory size	RAM memory size	Operating voltage range (V)			I/O line	Serial I/O	Timer 1	Timer 2	4-valued level detect circuit	LCD driver	Key-in input
			32.768kHz	200kHz	1MHz							
S-1400BF	4Kx16	512x4	1.6 to 3.5	2.0 to 3.5	2.2 to 3.5	28	8-bit serial	15-bit time base timer	8-bit programmable	$(V_{CC}-V_{IC}) \times \frac{n}{4}$ $n = 1, 2, 3$	32-segment x 4-common x 1/3 bias	8 x 4

VOLTAGE DETECTORS (S-805 SERIES)

The S-805 Series is a fixed type voltage detector developed by using the CMOS process. The detection voltage is fixed internally. It is made up of a standard voltage source comparator, hysteresis circuit, and output driver. TO-92 plastic package and plastic minimold package are available.

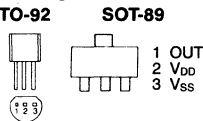
Features

- Low current consumption
- Low voltage drive
- Built-in stable detection standard voltage supply
- Good hysteresis characteristics
- Excellent detection voltage temperature characteristics

Applications

- Battery checker
- Level selector
- Store-signal detector for non-volatile RAM
- Window comparator
- Recharger monitor
- Power failure detector

Pin Arrangement



Operation Timing Chart

Note: S-805 Series is an Active "L" type device. Operation Timing Chart is shown below in S-807 Series.

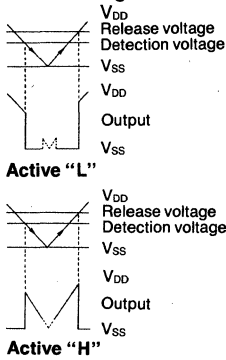
Specifications

Model No.	Detection Voltage (V)	Output State	Hysteresis Width (V)	Current Consumption (μ A) Typ.	Output Current		Operating Voltage (V)	
					Nch Typ.	V_{DD} (V)		
S-8051ANB	0.995 - 1.105	Nch open drain		1.4 ($V_{DD} = 1.5$ V)	Nch Typ.	V_{DD} (V)	0.9 - 5.0	
S-8051ANR	1.095 - 1.205						1.0 - 5.0	
S-8051HN	1.795 - 2.005						1.5 - 10	
S-8052ANB	1.995 - 2.205							
S-8052ALB	1.995 - 2.205							
S-8052ALR	2.195 - 2.405	CMOS	(Typical detection voltage) \times 0.05	2.2 ($V_{DD} = 4.5$ V)	Pch Min.	V_{DD} (V)	1.6 - 10	
S-8052ALO	2.395 - 2.605							
S-8052ALY	2.595 - 2.805							
S-8053ALB	2.795 - 3.105							
S-8053HLB	2.895 - 3.105							
S-8053ALR	3.095 - 3.405							
S-8054ALB	3.995 - 4.305							
S-8054ALR	4.295 - 4.605							
S-8054ALO	4.595 - 4.905							
S-8054ALY	4.895 - 5.205							
S-8053AHN	3.395 - 3.705	Nch open drain		2.2 ($V_{DD} = 4.5$ V)	Pch Min.	V_{DD} (V)	1.6 - 10	
S-8054HN	3.80 - 4.20							
S-8052HNM	2.295 - 2.505							
S-8052ANY	2.595 - 2.805							
S-8053HNB	2.895 - 3.105							
S-8054HNM	4.50 - 4.70							
S-8052ALB	2.195 - 2.405							1.5 - 10
S-8052ALO	2.395 - 2.605							
S-8052ALY	2.595 - 2.805	1.6 - 10						
S-8053ALB	2.795 - 3.105							

BOTTOM VIEW

VOLTAGE DETECTORS (S-807 SERIES)

Operation Timing Chart



Additional models/detection voltages are available - contact Seiko Instruments for details.

Specifications

Model No.	Detection Voltage (V)	Output State	Hysteresis Width (V)	Current Consumption (μ A) Typ.	Output Current ($V_{DS} = 0.5$ V)				Operating Voltage (V)	
					Nch	Typ	Pch	Min.		
S-80721AN	2.049 - 2.151	Nch open drain		1.3 ($V_{DD} = 4.5$ V)	0.50	1.2	—	—	1.0 - 15.0	
S-80727AN	2.635 - 2.765									
S-80732AN	3.123 - 3.277									
S-80734AN	3.318 - 3.482									
S-80740AN	3.904 - 4.096									
S-80725AL	2.44 - 2.56	CMOS (active "L")	(Typical detection voltage) \times 0.05	1.3 ($V_{DD} = 4.5$ V)	0.50	1.2	0.36	4.80		
S-80730AL	2.928 - 3.072									
S-80733AL	3.220 - 3.380									
S-80741AL	4.001 - 4.199									
S-80744HL	4.295 - 4.605									
S-80740AH	3.904 - 4.096				CMOS (active "H")	1.0 ($V_{DD} = 6.0$ V)	0.50	1.2	0.46	6.0
S-80740AH	3.904 - 4.096				1.0 ($V_{DD} = 6.0$ V)	0.03	1.2	9.60	6.0	
S-80740AH	3.904 - 4.096				1.0 ($V_{DD} = 6.0$ V)	0.15	2.4			

Seiko Instruments

VOLTAGE REGULATORS

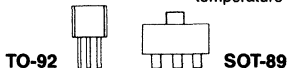
The S-802 and S-812 Series are CMOS voltage regulators. Both Series are the fixed type which the output voltage is internally fixed. The S-802 Series is a negative voltage regulator and the S-812 is a positive voltage regulator. SOT-89 package available for surface mount.

Features

- Low current consumption
- Low input/output voltage difference
- Low temperature coefficient of output voltage (± 0.38 mV/ $^{\circ}$ C for the S-81230AG typ.)
- Wide operating voltage range
- Good input stability (0.1%/V typ.)

Applications

- Automobile voltage regulator
- High stability standard voltage
- Constant voltage power supply for battery-powered equipment, communications equipment, video equipment, and other equipments which require voltage temperature control



Specifications

Model No.	Output Voltage (V)	Output Current (mA) Typ.	Load Stability (mV) Typ.	Input/Output Voltage Difference (mV) Typ.	Current Consumption (μ A) Typ.	Input Voltage (V) Max.	Absolute Maximum Rating (V)
S-80230AG	-3 \pm 5%	30 ($V_N = -5$ V)	60 ($I_{OUT} = 1$ to 20 mA)	60 ($I_{OUT} = 1$ mA)	2.5	-10	-12
S-80250AG	-5 \pm 5%	50 ($V_N = -7$ V)	40 ($I_{OUT} = 1$ to 40 mA)	30 ($I_{OUT} = 1$ mA)	3.0	-10	-12
S-81211AG	1.1 \pm 5%	3 ($V_N = 1.5$ V)	100 ($I_{OUT} = 40$ to 500 μ A)	250	2.2	10	12
S-81225AG	2.5 \pm 5%	25 ($V_N = 4.5$ V)	80 ($I_{OUT} = 1$ to 10 mA)	100	2.5	10	12
S-81230AG	3 \pm 5%	30 ($V_N = 5$ V)	60 ($I_{OUT} = 1$ to 20 mA)	60 ($I_{OUT} = 1$ mA)	2.5	10	12
S-81250AG	5 \pm 5%	50 ($V_N = 7$ V)	40 ($I_{OUT} = 1$ to 40 mA)	30 ($I_{OUT} = 1$ mA)	3.0	10	12
S-81250HG	5 \pm 5%	50 ($V_N = 7$ V)	40 ($I_{OUT} = 1$ to 40 mA)	30 ($I_{OUT} = 1$ mA)	3.0	12	18
S-81350AG	5 \pm 5%	40 ($V_N = 5.2$ V)	80 ($I_{OUT} = 1$ to 60 mA)	200 ($I_{OUT} = 40$ mA)	25	8	10

VOLTAGE REGULATOR WITH DC-DC CONVERTER

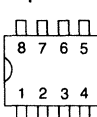
S-8430AF is a high-precision DC-DC converter consisting of a CR oscillating circuit, a switching regulator, a series regulator and a Shottky-diode. The S-8430AF serves as a series regulator when the input voltage is higher than the output voltage. On the other hand, it serves as a step up switching regulator and as a series regulator when the input voltage is lower than the output voltage. Therefore, the output level is kept constant. The output voltage can be changed from 3V to 5V, and vice versa by an external signal. The S-8430AF is provided with a standby function that stops an internal CR oscillating circuit by other external signal.

Features

- Low current consumption
Operating: 11 μ A typ.
Standby: 0.2 μ A max.
- High-precision output voltage
3.0V \pm 5%, 5.0V \pm 4%
- Low voltage operation
0.9V min.
- Selectable output voltage
(switchable from 3V to 5V, and vice versa)
- Standby function

Pin Arrangement

8-pin SOP



- 1. VIN
- 2. ON/OFF
- 3. SEL1
- 4. SEL2
- 5. VOUT
- 6. VSW
- 7. CONT
- 8. VSS

OTHER PRODUCTS

- Telephone Dialer IC's
- Hall IC's
- Temperature Sensors
- Timers
- POC SAG Decoder IC
- Precision Electrically Adjustable Capacitor (PEAC)

FUNCTIONAL DESCRIPTION

The LH5492 is a 4K x 9 bit dual-port memory with internal addressing to implement a First-In-First-Out Algorithm. One port is dedicated to write operations, and the other is dedicated to read operations. Two edge sampled enable inputs are provided for each port. These read and write controls are designed to interface to continuously clocked synchronous systems, but the independent read and write clocks may be operated completely asynchronously relative to each other. Data flow is initiated on the rising edge of the appropriate clock signal, and gated only by the corresponding enable control inputs.

A broad range of status flags monitor the extent to which data has been written into the FIFO. These include Empty, Half, Almost Empty/Full (within 8 of Empty or Full), and Full status flags. These flags may be tied directly enabling the inputs to prevent overrun of FIFO boundaries. Alternately, enabling read/write operations may be controlled entirely by external system logic, while the flags serve as system interrupts. This approach is particularly useful when the relation between read and write clocks is asynchronous.

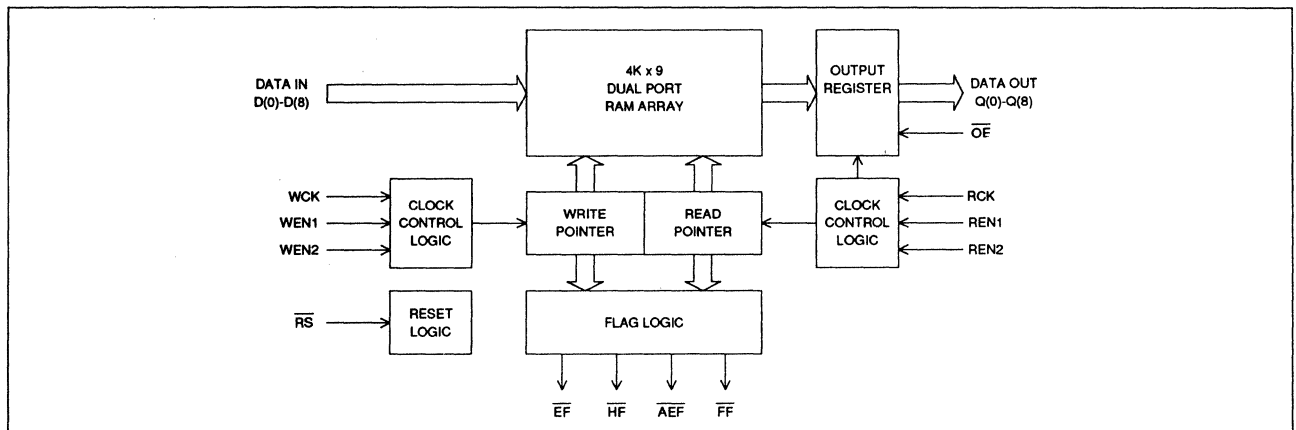
A level sensitive Output Enable input provides high impedance output capability for interface to shared system buses. This Output Enable function along with the multiple Read and Write Enable inputs allows for simplified implementation of Bidirectional FIFO interfaces, as well as interfaces between system buses of different word widths.

AC ELECTRICAL CHARACTERISTICS

V_{CC} = 5V ± 10%, T_A = 0°C to 70°C

Symbol	Description	-25		-35		-50		unit	note
		min	max	min	max	min	max		
f _c	Cycle Frequency	—	40	—	28.5	—	20	Mhz	
t _{wc}	Write Clock Cycle Time	25	—	35	—	50	—	ns	
t _{wh}	Write Clock High Time	10	—	14	—	20	—	ns	
t _{wl}	Write Clock Low Time	10	—	14	—	20	—	ns	
t _{rc}	Read Clock Cycle Time	25	—	35	—	50	—	ns	
t _{rh}	Read Clock High Time	10	—	14	—	20	—	ns	
t _{rl}	Read Clock Low Time	10	—	14	—	20	—	ns	
t _{ds}	Data Setup Time to rising Clock	10	—	10	—	15	—	ns	
t _{dh}	Data Hold Time from rising Clock	0	—	0	—	2	—	ns	
t _{es}	Enable Setup Time to rising Clock	10	—	10	—	15	—	ns	
t _{eh}	Enable Hold Time from rising Clock	0	—	0	—	2	—	ns	
t _a	Data Output Access Time	—	20	—	25	—	35	ns	
t _{oh}	Output Hold Time	5	—	5	—	5	—	ns	
t _{ol}	OE to Data Outputs Low-Z	5	—	5	—	5	—	ns	
t _{oz}	OE to Data Outputs High-Z	—	15	—	20	—	25	ns	8
t _{ef}	Clock to Empty Flag Valid	—	20	—	25	—	35	ns	
t _{ff}	Clock to Full Flag Valid	—	20	—	25	—	35	ns	
t _{hf}	Clock to Half Flag Valid	—	35	—	40	—	45	ns	
t _{aef}	Clock to AEF Flag Valid	—	35	—	40	—	45	ns	
t _{rs}	Reset Pulse Width	25	—	35	—	50	—	ns	
t _{rss}	Reset Setup Time	10	—	15	—	25	—	ns	.9
t _{rf}	Reset low to Flag Valid	—	30	—	35	—	40	ns	
t _{rql}	Reset to Data Outputs low	—	20	—	25	—	30	ns	
t _{f_{rl}}	First Read Latency	18	—	20	—	20	—	ns	10
t _{f_{wl}}	First Write Latency	18	—	20	—	20	—	ns	11

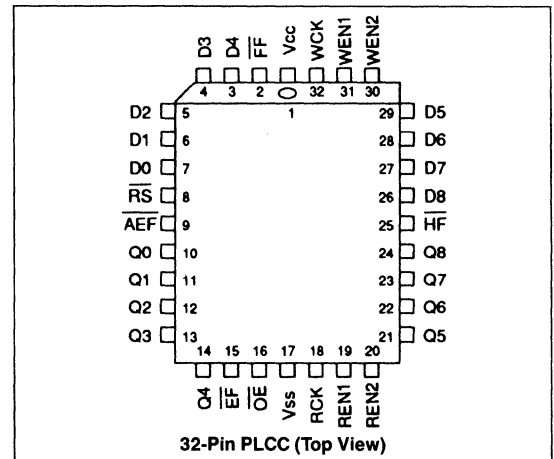
BLOCK DIAGRAM



FEATURES

- Fast Cycle Times—25/35/50ns Frequency—40/28.5/20MHz
- Rising Edge Triggered Clock Inputs
- Multiple Read & Write Enable Inputs Sampled on Rising Edge
- Full CMOS Dual Port Memory Array
- Fully Asynchronous Read & Write Operations
- Empty, Half, Almost Empty/Full, Full Flags
- Output Enable for 3 State Output Capability
- Adaptable to Bidirectional Bus Interfaces
- Interface between Buses of different Word Widths
- Reset Reread Capability
- TTL & CMOS Compatible I/O
- 32 Pin PLCC Package

PINOUT DIAGRAMS



ABSOLUTE MAXIMUM RATINGS

- Supply Voltage to V_{SS} Potential: -0.5V to 7V
- Signal Pin Voltage to V_{SS} Potential: -0.5V to V_{CC} + 0.5V
- DC Output Current: ±40 mA
- Storage Temperature Range: -65°C to 150°C
- Power Dissipation (Package Limit): 1.0W

FUNCTIONAL DESCRIPTION

The LH5420 contains two FIFO buffers which operate in parallel but opposite directions for bidirectional data buffering. The two FIFO buffers are each organized as 256 words by 36 bits. The LH5420 is ideal for either wide unidirectional or bidirectional data applications, since components count and board area is reduced.

Each port has its own port-synchronous clock, but the two ports may operate asynchronously relative to each other. Data flow is initiated on a port by the rising edge of the appropriate clock and gated by the corresponding edge sampled enable and read/write control signals. Clock duty cycles can vary from 40% to 60% without sacrificing performance.

FIFO status flags monitor the extent to which the FIFO buffers have been filled. These include Empty, Almost Empty, Half Full, Almost Full, and Full flags for each FIFO. The Almost Empty and Almost Full flags are programmable over the entire FIFO depth, but are conveniently initialized to 8 locations from the respective boundaries at reset.

A synchronous request acknowledge handshake is provided on each port for FIFO data accesses. This request-acknowledge handshake resolves FIFO full and empty boundary conditions, when the two ports are operated asynchronously relative to each other.

Two mailbox registers provide a separate path for passing control or status words between ports. Each mailbox has a flag which is synchronized to the reading port's clock. This mailbox function can facilitate the synchronization of data transfers between asynchronous systems.

Data Bypass mode allows Port-A to directly transfer data to or from Port-B at reset. In this mode the device acts as a registered transceiver under Port-A control. For instance, a master processor on Port-A can use the Data Bypass feature to pass initialization or configuration information directly to or from a peripheral device on Port-B during a system start-up.

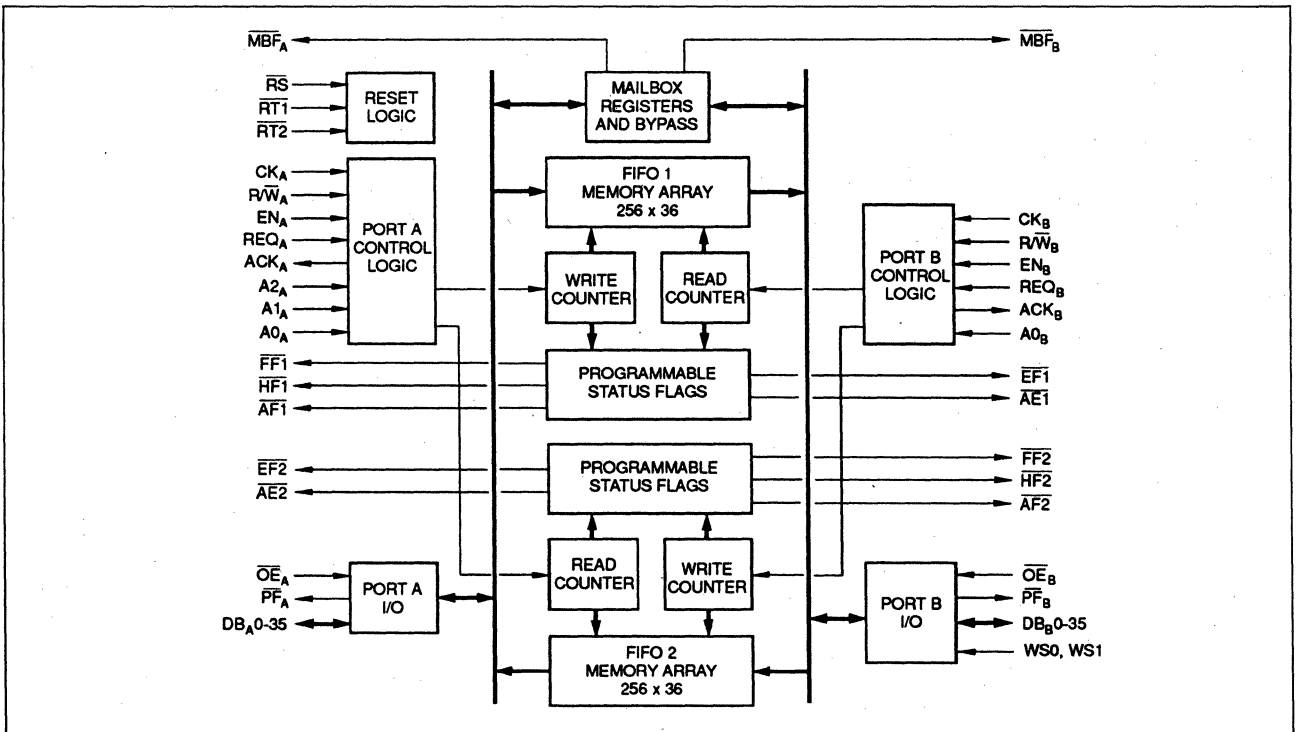
A word width select option is provided on Port B for 9, 18, or 36-bit data accesses. This allows word width matching between Port A and Port B with no additional logic; and ensures maximum utilization of bus bandwidths. A Byte Parity Check Flag on each port ensures data integrity. These flags initialize for odd data parity at reset, but may be reprogrammed for even or odd parity.

FEATURES

- Fast Cycle Times—25/30/35 ns
- Two 256 × 36-bit FIFO Buffers
- Wide 36-bit Word Width
- Selectable 9/18/36-bit Word Width on Port-B
- Fully Asynchronous Port-to-Port Communications
- High Speed, Port-Synchronous Clocking Mechanism
 - Edge Triggered Clock
 - R/W, Enable & Address Pins Sampled on the Rising Clock Edge
 - Synchronous Request Acknowledge Handshake (Optional)
- Device powers up into known state at reset, no programming is required
- Asynchronous Output Enables
- Dedicated FIFO Status Flags for Empty, Half-Full, & Full Flags
- Programmable Status Flags for Almost Empty & Almost Full
- Mailbox Registers with Synchronized Flags
- Data Bypass Function
- Data Retransmit Function
- Byte Parity Check
- TTL & CMOS Compatible I/O
- Area Efficient QFP, or PGA Packages

Sharp Electronics

BLOCK DIAGRAM—256 × 36 × 2 BIDIRECTIONAL FIFO



SHARP ELECTRONICS CORPORATION

Microelectronics Division, Sharp Plaza, Mahwah, New Jersey 07430 • 201/529-8757 FAX 201/512-2020 Telex 426903 (SHARPAM PARA)

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5V ± 10%, T_A = 0°C to 70°C)

SYMBOL	DESCRIPTION	-25		-30		-35		UNITS
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{CC}	Clock Cycle Frequency	—	40	—	33	—	28.5	MHz
t _{CC}	Clock Cycle Time	25	—	30	—	35	—	ns
t _{CH}	Clock High Time	10	—	12	—	14	—	ns
t _{CL}	Clock Low Time	10	—	12	—	14	—	ns
t _{DS}	Data Setup Time	10	—	10	—	15	—	ns
t _{DH}	Data Hold Time	0	—	0	—	0	—	ns
t _{ES}	Enable Setup Time	10	—	10	—	15	—	ns
t _{EH}	Enable Hold Time	0	—	0	—	0	—	ns
t _{AS}	Address Setup Time	15	—	15	—	20	—	ns
t _{AH}	Address Hold Time	0	—	0	—	0	—	ns
t _A	Data Output Access Time	—	15	—	20	—	25	ns
t _{ACK}	Acknowledge Access Time	—	15	—	20	—	25	ns
t _{OH}	Output Hold Time	5	—	5	—	5	—	ns
t _{OLZ}	\overline{OE} to Data Outputs Low-Z	5	—	5	—	5	—	ns
t _{OHZ}	\overline{OE} to Data Outputs High-Z	—	15	—	20	—	25	ns

SYMBOL	DESCRIPTION	-25		-30		-35		UNITS
		MIN	MAX	MIN	MAX	MIN	MAX	
t _{EF}	Clock to Empty Flag Valid	—	20	—	25	—	30	ns
t _{FF}	Clock to Full Flag Valid	—	20	—	25	—	30	ns
t _{HF}	Clock to Half Flag Valid	—	20	—	25	—	30	ns
t _{AE}	Clock to AE Flag Valid	—	20	—	25	—	30	ns
t _{AF}	Clock to AF Flag Valid	—	20	—	25	—	30	ns
t _{MF}	Clock to MF Flag Valid	—	15	—	20	—	25	ns
t _{PF}	Data to Parity Flag Valid	—	15	—	20	—	25	ns
t _{RS}	Reset Pulse Width	25	—	30	—	35	—	ns
t _{RSS}	Reset Setup Time	20	—	20	—	25	—	ns
t _{RSH}	Reset Hold Time	20	—	20	—	25	—	ns
t _{RF}	Reset low to Flag Valid	—	30	—	35	—	35	ns
t _{RFL}	First Read Latency	25	—	30	—	35	—	ns
t _{RWL}	First Write Latency	25	—	30	—	35	—	ns
t _{BS}	Bypass Data Setup	15	—	15	—	20	—	ns
t _{BH}	Bypass Data Hold	5	—	5	—	5	—	ns
t _{BA}	Bypass Data Access	—	20	—	25	—	30	ns

ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING
Supply Voltage to V _{SS} Potential	-0.5V to 7V
Signal Pin Voltage to V _{SS} Potential	-0.5V to V _{CC} + 0.5V
DC Output Current	± 40 mA
Storage Temperature Range	-65°C to 150°C
Power Dissipation (Package Limit)	2 Watts (Quad Flat Pack)

OPERATING RANGE

SYMBOL	PARAMETER	MIN	MAX	UNIT
T _A	Temperature, Ambient	0	70	°C
V _{CC}	Supply Voltage	4.5	5.5	V
V _{SS}	Supply Voltage	0	0	V
V _{IL}	Logic "0" Input Voltage	-0.5	0.8	V
V _{IH}	Logic "1" Input Voltage	2.1	V _{CC} + 0.5	V

DC ELECTRICAL CHARACTERISTICS (OVER OPERATING RANGE)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
I _{LI}	Input Leakage Current	V _{CC} = 5.5V, V _{IN} = 0V To V _{CC}	-10	10	μA
I _{LO}	I/O Leakage Current	$\overline{OE} \geq V_{IH}$, 0V ≤ V _{OUT} ≤ V _{CC}	-10	10	μA
V _{OH}	Output High Voltage	I _{OH} = -2.0mA	2.4		V
V _{OL}	Output Low Voltage	I _{OL} = 8.0mA		0.4	V
I _{CC}	Average Supply Current	Measured at f _C = max		180	mA
I _{CC2}	Average Standby Current	All Inputs = V _{IH}		30	mA
I _{CC3}	Power Down Current	All Inputs = V _{CC} - 0.2V		1	mA

AC TEST CONDITIONS

PARAMETER	RATING
Input Pulse Levels	V _{SS} to 3V
Input Rise and Fall Times (10% to 90%)	5ns
Output Reference Levels	1.5V
Input Timing Reference Levels	1.5V
Output Load, Timing Tests	see Figure 1

CAPACITANCE

PARAMETER	RATING
C _{IN} (Input Capacitance)	7pF
C _O (Output Capacitance)	7pF

SHARP ELECTRONICS CORPORATION

Microelectronics Division, Sharp Plaza, Mahwah, New Jersey 07430 • 201/529-8757 FAX 201/512-2020 Telex 426903 (SHARPAM PARA)

Cellular Radio Chip Set

COMPONENTS

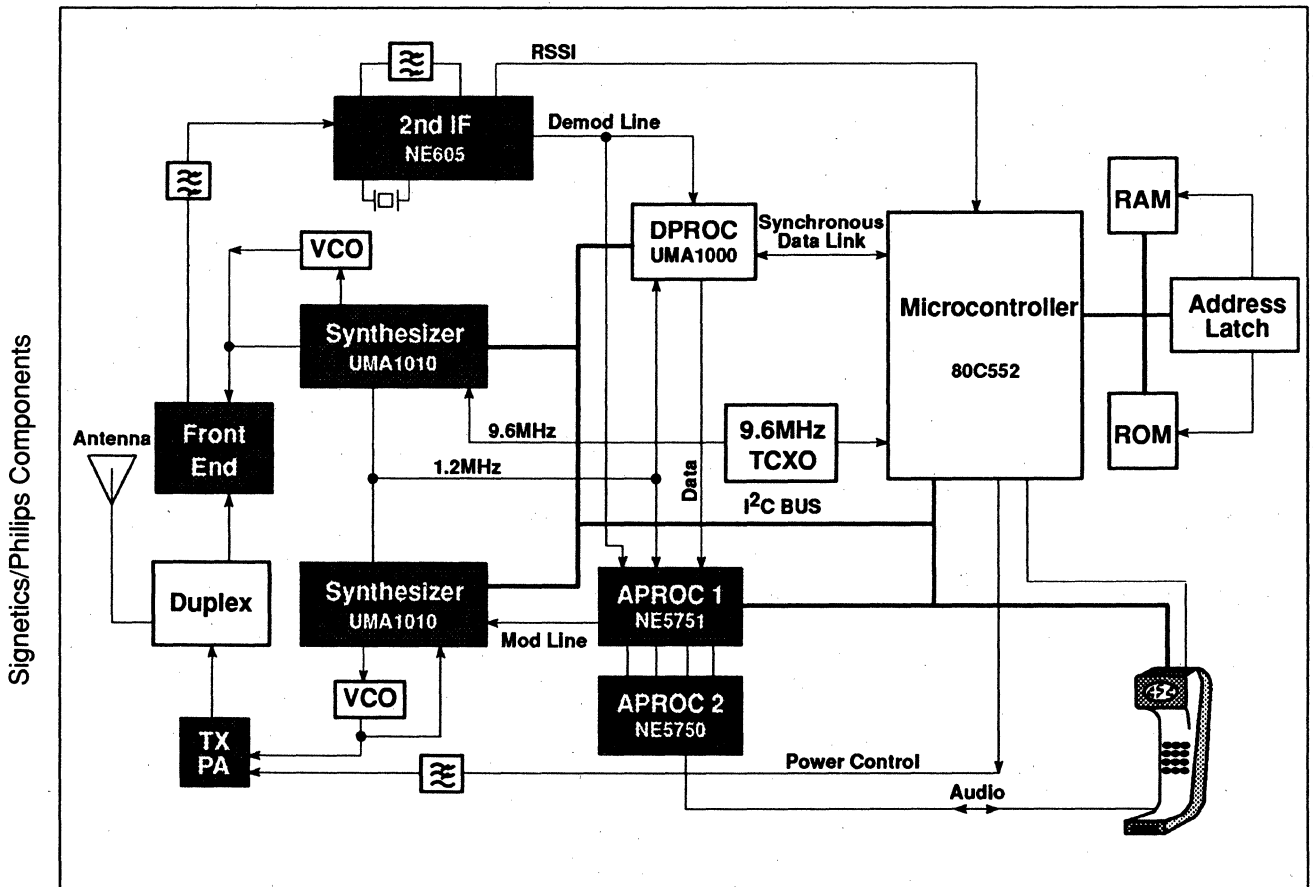
- NE605 – Low Power Single Chip FM System
- NE5750 – Audio Processor - Companding and Amplifier
- NE5751 – Audio Processor - Filter and Control Section
- UMA1000 – Data Processor for Cellular Radio

- UMA1010 – Low-Power Universal Synthesizer for Radio Communication
- S80C552 – Single Chip 8-Bit Microcontroller with A/D, Capture/Compare Timer, with High-Speed Outputs, PWM

FEATURES

- 6 key ICs for maximum integration
- Integrated filters, amplifiers, and companders to reduce off-chip components
- Designed for minimum current consumption, i.e., maximum use of standby modes, low current IC design
- I²C serial control bus

SCHEMATIC



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PHILIPS

NE8392A – Coaxial Transceiver Interface for Ethernet/Thin Ethernet

DESCRIPTION

The NE8392A Coaxial Transceiver Interface (CTI) is a coaxial line driver/receiver for Ethernet (10base5) and Thin Ethernet (10base2) local area networks. The CTI is connected between the coaxial cable and the Data Terminal Equipment (DTE) and consists of a receiver, transmitter, collision detector, heartbeat generator and jabber timer (see Block Diagram). The transmitter output connects directly to a doubly terminated 50Ω cable, while the receiver output, collision detector output and transmitter input are connected to the DTE through isolation transformers. Isolation between the CTI and the DTE is an IEEE 802.3 requirement that can be met on signal lines by using a set of pulse transformers normally available in a standard 16-pin DIP. Power isolation for the CTI is achieved using DC-to-DC conversion through a power transformer (see Figure 1, Connection Diagram).

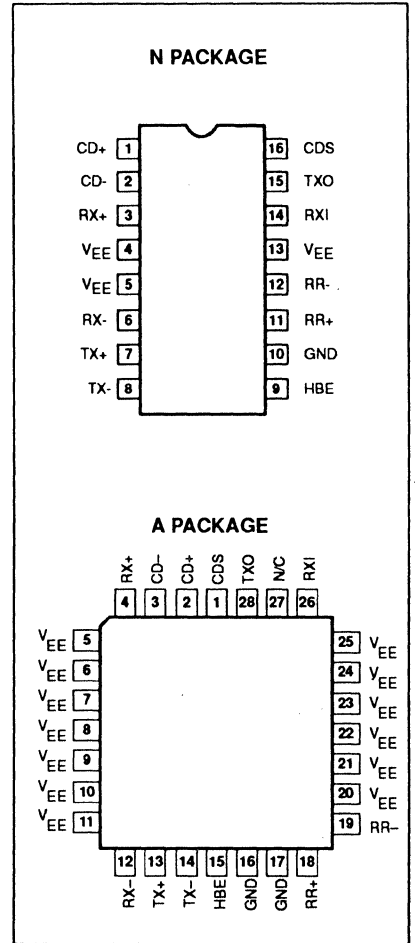
During transmission the jabber timer is initiated to disable the CTI transmitter in the event of a longer than legal length data packet. Collision detection circuitry monitors the signals on the coaxial cable to determine the presence of colliding packets and signals the DTE in the event of a collision. At the end of every transmission the heartbeat generator creates a pseudo collision for a short time to ensure that the collision circuitry is functioning correctly. The heartbeat function can be disabled for repeater applications.

The CTI is normally part of a three chip set that implements a complete Ethernet/ Thin Ethernet network interface for a DTE (see Figure 2, Interface Diagram). The other chips are a Serial Network Interface (SNI) and a Network Interface Controller (NIC). The SNI provides Manchester Encoding and Decoding while the NIC handles the media access protocol and buffer management tasks.

FEATURES

- **Compatible with Ethernet II, IEEE 802.3 10base5 and 10base2, and ISO 8802/3 interface specifications**
- **Integrates all transceiver electronics except signal and power isolation**
- **Only one external resistor required for setting coaxial signaling current**
- **Jabber timer function integrated on chip**
- **Heartbeat generator can be externally disabled for operation as IEEE 802.3 compatible repeaters**
- **On-chip precision voltage reference for receive mode collision detection**
- **Squelch circuitry on all signal inputs rejects noise**
- **Full ESD protection**
- **Standard 16-pin DIP with special lead frame minimizes the operating die temperature**
- **Power-on reset prevents glitches on coaxial cable during power up.**

PIN CONFIGURATION



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PHILIPS

NE502A – Ethernet Encoder/Decoder

DESCRIPTION

The NE502A is an Ethernet™ encoder/decoder designed to meet all the requirements of the IEEE 802.3 and Ethernet/Thin Ethernet specification and fabricated with high-speed ECL and Schottky TTL technology.

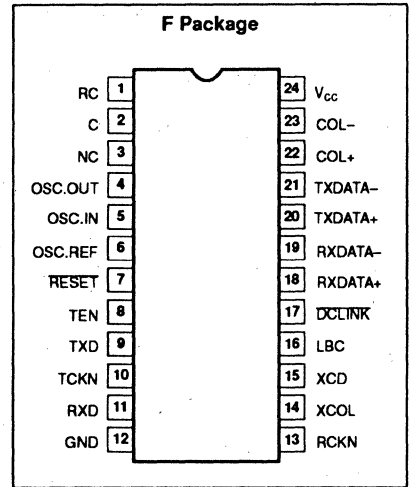
The encoder converts serial binary data into complementary Manchester code. The decoder converts Manchester code into binary data and synchronous clock signals. The decoding method is a digital phase locked loop with dual bandwidth which allows both fast lock-on and low jitter. Typical acquisition is eight bits or better. A key feature of the decoder design is its capability to recover distorted input signals. The NE502A is packaged in a standard 24-pin ceramic DIP.

The NE502A is normally part of a 3-chip set that implements a complete Ethernet/Thin Ethernet interface for a DTE. The other chips are an Ethernet Data Link Controller (EDLC) such as the NE86950 and a coaxial transceiver interface (CTI) such as the NE8392A.

FEATURES

- Full Ethernet II, IEEE 802.3 10base5 and 10base2 compatibility
- Manchester encode and decode
- Level conversion: transceiver level to/from TTL level
- Carrier detection
- Large distortion recovery: $\pm 20\text{ns}$
- Dual bandwidth phase locked loop: allows fast acquisition
- Loopback "CONFIDENCE" test feature
- Built-in clock generator
- Small external parts count:
- High-speed ECL and Schottky TTL technology
- Single power supply: +5V
- Low power dissipation: 750mW typ.
- 24-pin standard dual in-line ceramic package

PIN CONFIGURATION



*Ethernet™ is a Trade Mark of Xerox Corp., USA

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PHILIPS

NE86950B – Ethernet Controller

DESCRIPTION

The NE86950 is a highly integrated, local area network controller that supports both IEEE 802.3 CSMA/CD 10Mb/s Ethernet and 1Mb/s StarLAN™ protocols. Configurable for 8- or 16-bit wide bus interfaces, it links a host system bus to the local area network (LAN) transceiver or drivers in cost sensitive network applications such as personal computers, terminals, workstations, and other resource-sharing controllers with the minimum amount of controlling software and host system interaction. Its design enables the controller to be connected directly on the main system bus without contention with the host CPU for the bus. Also, there is no need for a dedicated local CPU to handle data transfers.

FEATURES

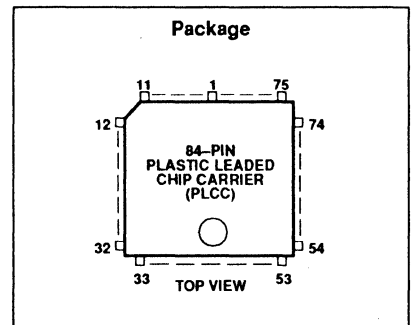
- IEEE802.3 CSMA/CD Ethernet/Thin Ethernet and StarLAN compatibility
- Configurable for 8-bit or 16-bit data path widths

- Unique buffer management architecture arbitrates all dedicated SRAM or DRAM memory data accesses and automatically allocates buffer memory area for incoming data frames
- Allows simultaneous transfer of data frames to/from host system and transmission/reception of data frames to/from LAN media
- Allows automatic retransmission of data packets during collisions, thus saving bus bandwidth
- Keeps track of all buffer memory area pointers internally in hardware to reduce software overhead
- Supports data transfers at up to 3.3 Mbytes or Mwords per second to the host system
- Addresses 8, 16, 32, or 64 Kbytes of dedicated SRAM or DRAM buffer memory. Dedicated buffer memory architecture allows data packet

reception without using bus bandwidth

- Supports DMA transfers
- Available in 84-pin plastic J-bend PLCC or 80-pin plastic quad flat pack
- Dual metal, CMOS technology
- 25mA typical I_{CC} current

PIN CONFIGURATION



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PHILIPS

SCN68562/SCN26562 – Dual Universal Serial Communications Controller (DUSCC)

FEATURES

General Features

- SCN26562 is fully compatible with Intel
- SCN68562 is fully compatible with Motorola
- Dual full-duplex synchronous/asynchronous receiver and transmitter
- Multiprotocol operation
 - BOP: HDLC/ADCCP, SDLC, SDLC loop, X.25 or X.75 link level, etc.
 - COP: BISYNC, DDCMP
 - ASYNC: 5 - 8 bits plus optional parity
- Four character receiver and transmitter FIFOs
- 0 to 4MHz data rate
- Programmable bit rate for each receiver and transmitter selectable from:
 - 16 fixed rates: 50 to 38.4k baud
 - One user-defined rate derived from programmable counter/timer
 - External 1X or 16X clock
 - Digital phase-locked loop
- Programmable data transfer mode: polled, interrupt, DMA, wait
- DMA interface
 - Compatible with Signetics' SCB68430 Direct Memory Access Interface (DMAI) and other DMA controllers
 - Half- or full-duplex operation
 - Single or dual address data transfers
 - Automatic frame termination on counter/timer terminal count or DMA DONE

- Interrupt capabilities
 - Daisy chain option
 - Vector output (fixed or modified by status)
 - Programmable internal priorities
 - Maskable interrupt conditions
- Multifunction programmable 16-bit counter/timer
 - Bit rate generator
 - Event counter
 - Count received or transmitted characters
 - Delay generator
 - Automatic bit length measurement
- Modem controls
 - RTS, CTS, DCD, and up to four general purpose I/O pins per channel
 - CTS and DCD programmable autoenables for Tx and Rx
 - Programmable interrupt on change of CTS or DCD

Asynchronous Mode Features

- Character length: 5 to 8 bits
- Odd or even parity, no parity, or force parity
- Up to two stop bits programmable in 1/16-bit increments
- 1X or 16X Rx and Tx clock factors
- Parity, overrun, and framing error detection
- False start bit detection
- Start bit search 1/2 bit time after framing error detection
- Break generation with handshake for counting break characters
- Detection of start and end of received break

Character-Oriented Protocol Features

- Character length: 5 to 8 bits
- Odd or even parity, no parity, or force parity
- LRC or CRC generation and checking
- Optional opening PAD transmission
- SYN detection and optional stripping
- SYN or MARK linefill on underrun
- Parity, FCS, overrun, and underrun error detection
- BISYNC Features
 - EBCDIC or ASCII header, test and control messages
 - SYN, DLE stripping
 - EOM (End Of Message) detection and transmission
 - Auto transparency mode switching
 - Auto hunt after receipt of EOM sequence (with closing PAD check after EOT or NAK)

Bit-Oriented Protocol Features

- Character length: 5 to 8 bits
- Detection and transmission of residual character: 0 - 7 bits
- Automatic switch to programmed character length for 1 field
- Zero Insertion and deletion
- Optional opening PAD transmission
- ABORT, ABORT-FLAGS, or FCS-FLAGS line fill on underrun
- Extended address and control fields
- CRC generation and checking
- SDLC loop mode capability

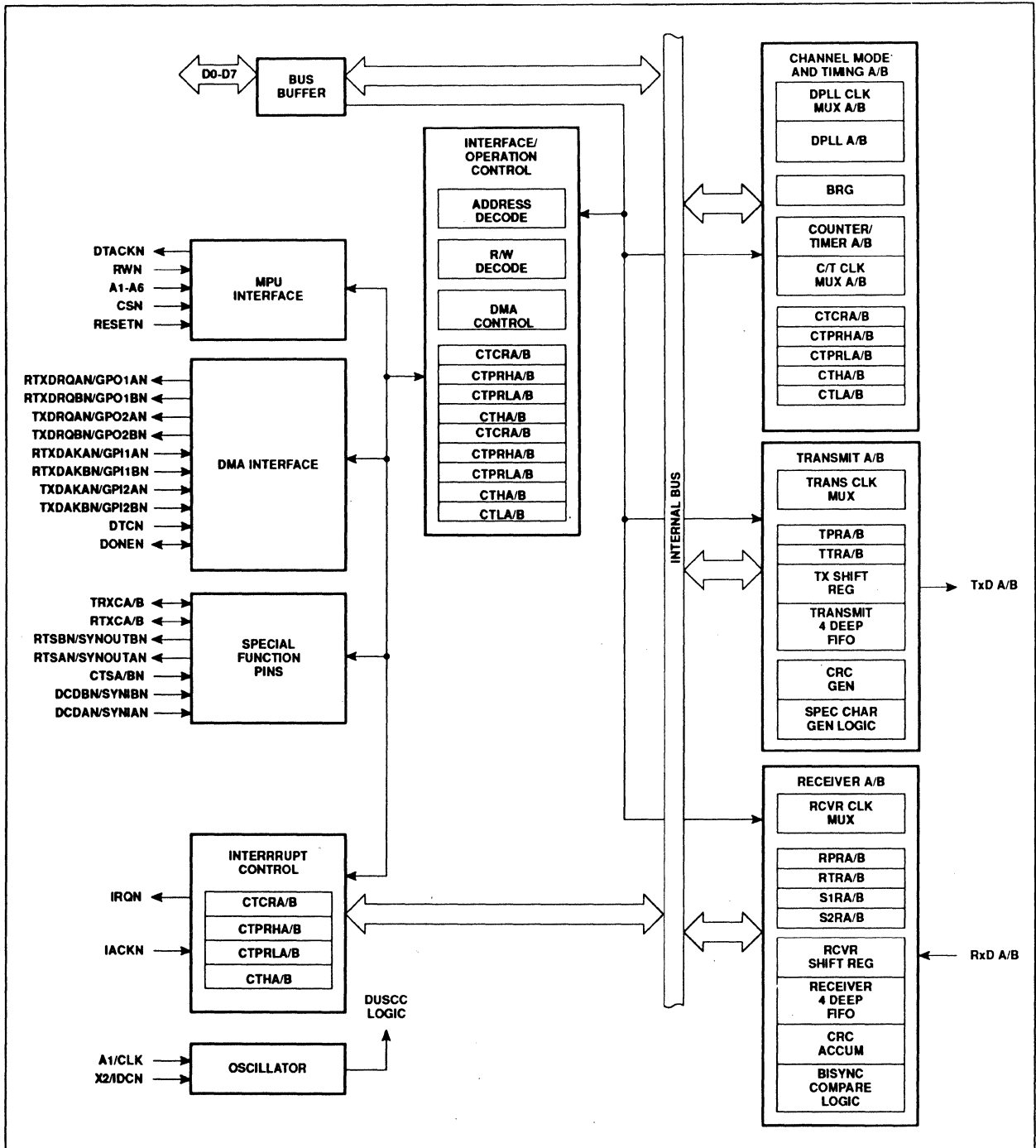
Signetics

Philips Components



PHILIPS

SCN68562/SCN26562 - BLOCK DIAGRAM



Signetics/Philips Components

Signetics

Philips Components



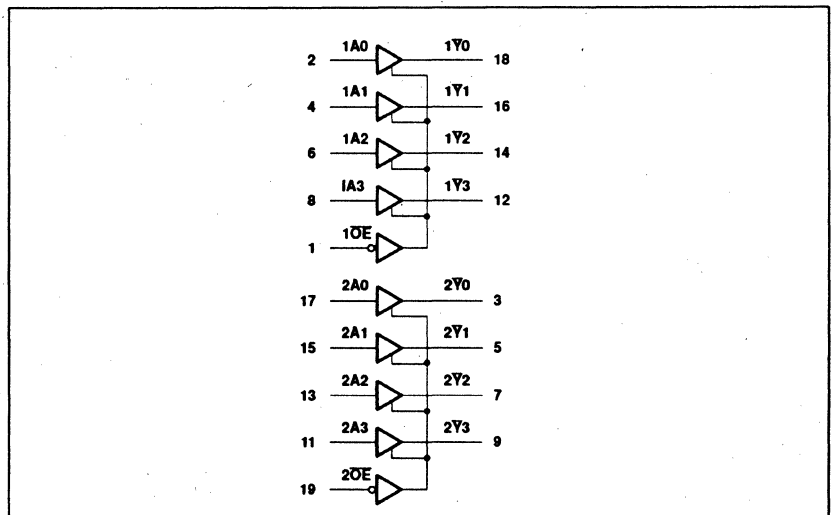
PHILIPS

74ABT 244 – Octal Buffer/Line Driver (3-State)

FEATURES

- Octal bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 4.6ns worst case propagation delay
- 50 μ A worst case I_{CCZ}

LOGIC DIAGRAM

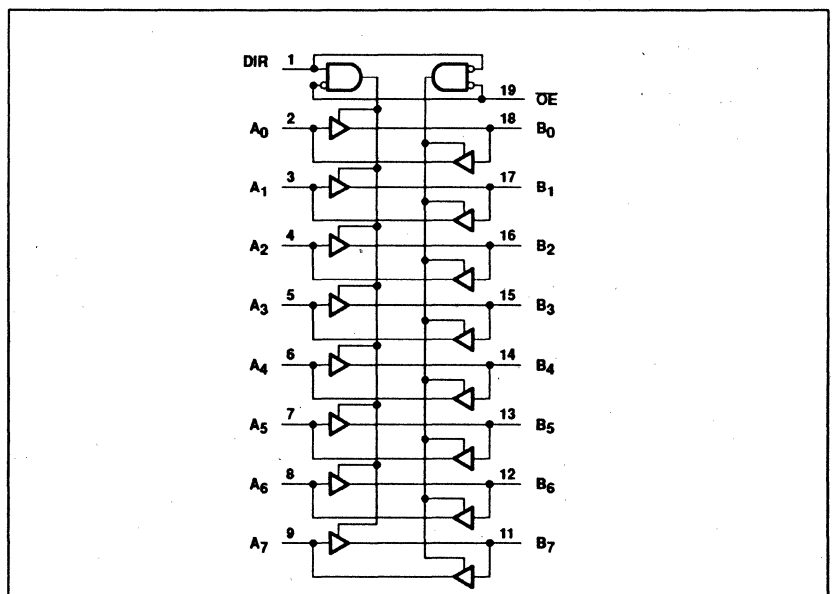


74ABT245 – Octal Transceiver with Directional Pin (3-State)

FEATURES

- Octal bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 4.6ns worst case propagation delay
- 50 μ A worst case I_{CCZ}

LOGIC DIAGRAM



Signetics

Philips Components



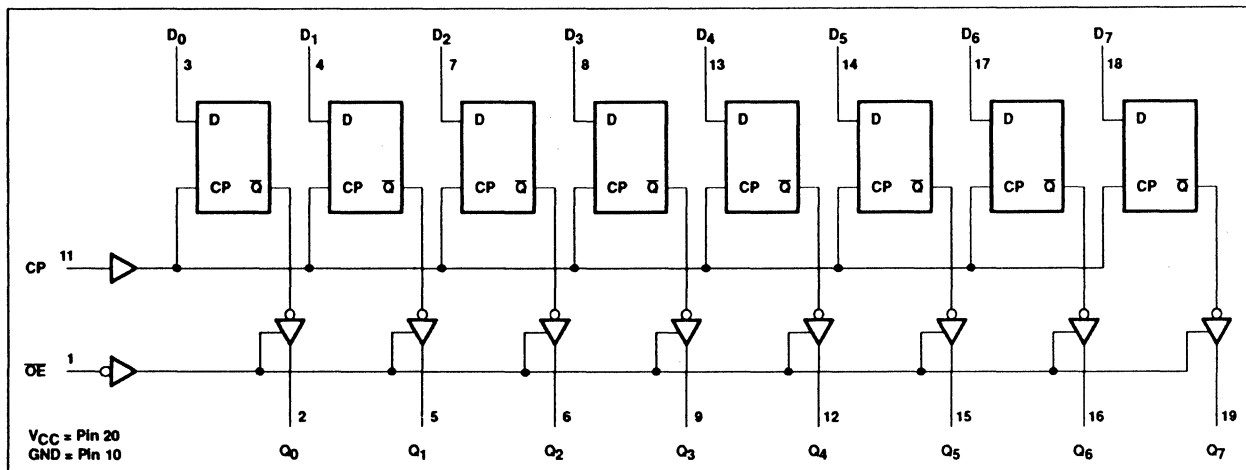
PHILIPS

74ABT374 – Octal D-Type Flip-Flop; Positive-Edge Trigger (3-State)

FEATURES

- 8-bit positive edge triggered register
- 3-State output buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 150MHz worst case f_{MAX}
- 50 μ A worst case I_{CCZ}

LOGIC DIAGRAM

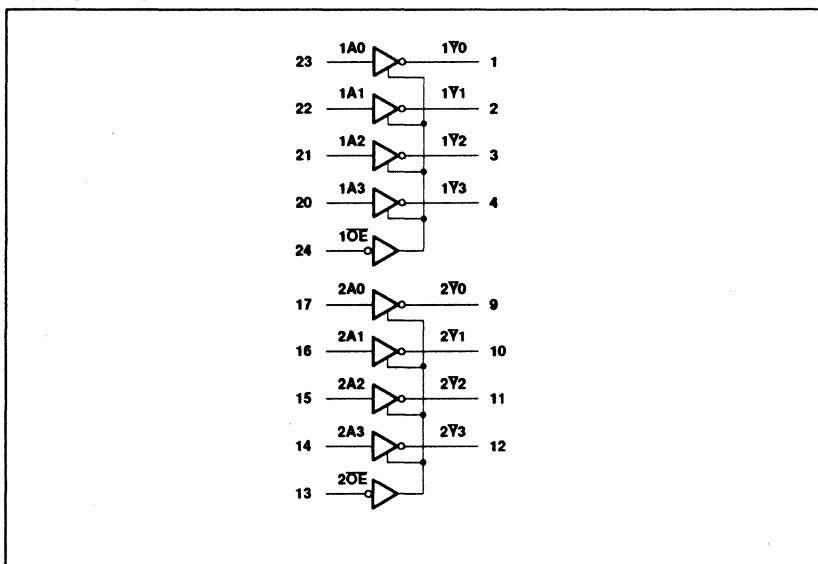


74AC/ACT11240 – Octal Buffer/Line Driver; 3-State; INV

FEATURES

- Octal bus interface
- 3-State buffers
- Output capability: ± 24 mA
- CMOS (AC) and TTL (ACT) voltage level inputs
- 50 Ω incident wave switching
- Center-pin V_{CC} and ground configuration to minimize high-speed switching noise
- I_{CC} category: MSI

LOGIC DIAGRAM



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Philips Components



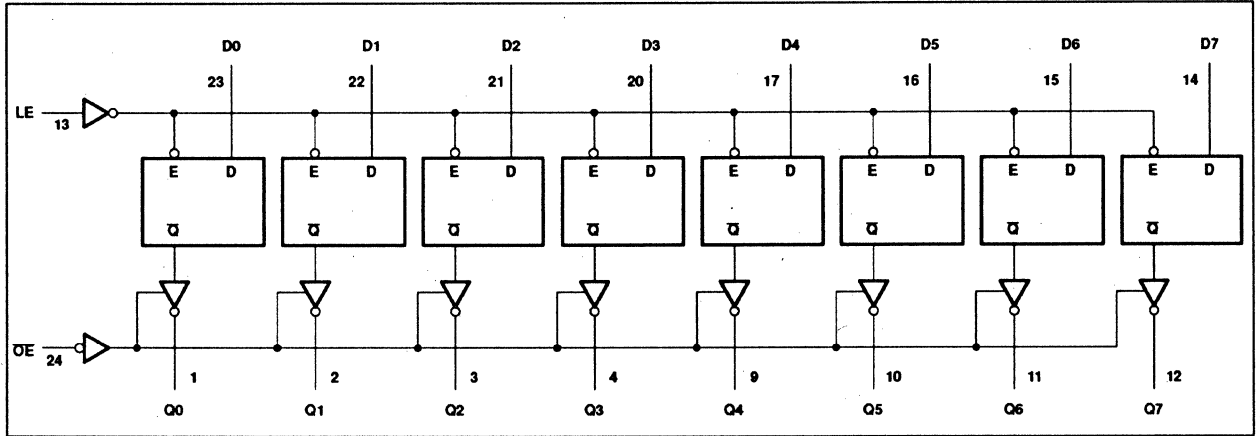
PHILIPS

74AC/ACT11373 – Octal D-Type Transparent Latch; 3-State

FEATURES

- 8-bit transparent latch
- 3-State output buffers
- Common 3-State Output Enable
- Independent register and 3-State buffer operation
- Output capability: $\pm 24\text{mA}$
- CMOS (AC) and TTL (ACT) voltage level inputs
- 50Ω incident wave switching
- Center-pin V_{CC} and ground configuration to minimize high-speed switching noise
- I_{CC} category: MSI

LOGIC DIAGRAM

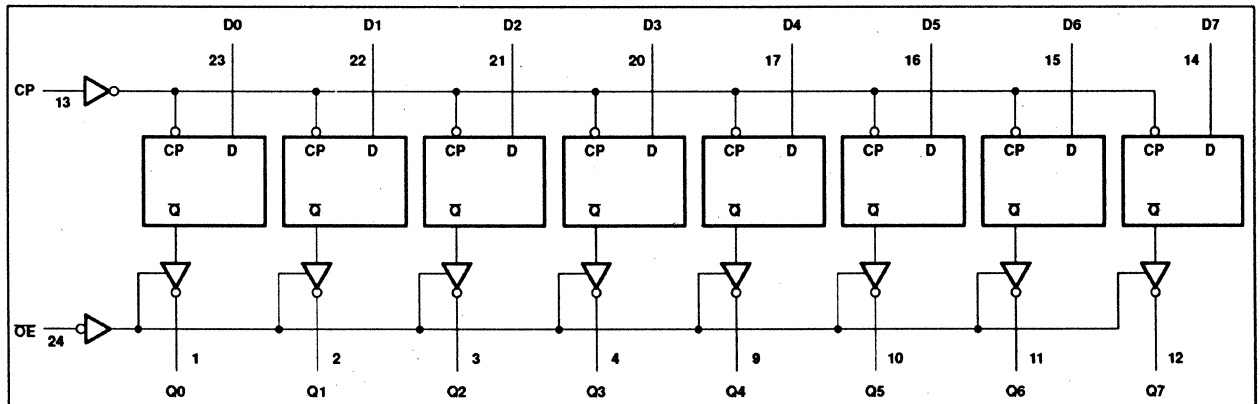


74AC/ACT11374 – Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State

FEATURES

- 3-State output buffers
- Common 3-State Output Enable
- Independent register and 3-State buffer operation
- Output capability: $\pm 24\text{mA}$
- CMOS (AC) and TTL (ACT) voltage level inputs
- 50Ω incident wave switching
- Center-pin V_{CC} and ground configuration to minimize high-speed switching noise
- I_{CC} category: MSI

LOGIC DIAGRAM



Signetics/Philips Components

Signetics

Philips Components



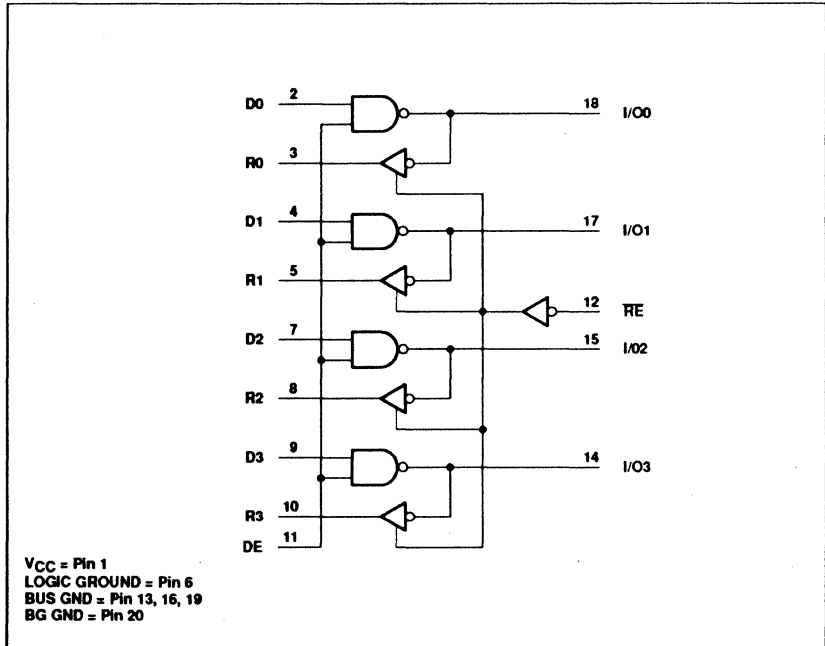
PHILIPS

74F3893 – Quad Futurebus Backplane Transceiver (3-State + Open Collector)

FEATURES

- Drives heavily loaded backplanes with equivalent load impedances down to 10 ohms
- Futurebus drivers sink 100mA
- Reduced voltage swing (1 volt) produces less noise and reduces power consumption
- High speed operation enhances performance of backplane buses and facilitates incident wave switching
- Compatible with IEEE 896 and IEEE 1194.1 Futurebus Standards
- Built-in precision band-gap (BG) reference provides accurate receiver threshold and improved noise immunity
- Glitch-free power up/power down operation on all outputs
- Pin and function compatible with NSC DS3893

LOGIC DIAGRAM



Signetics/Philips Components

Signetics

Philips Components



PHILIPS

74F8960/8961 – Futurebus Transceiver

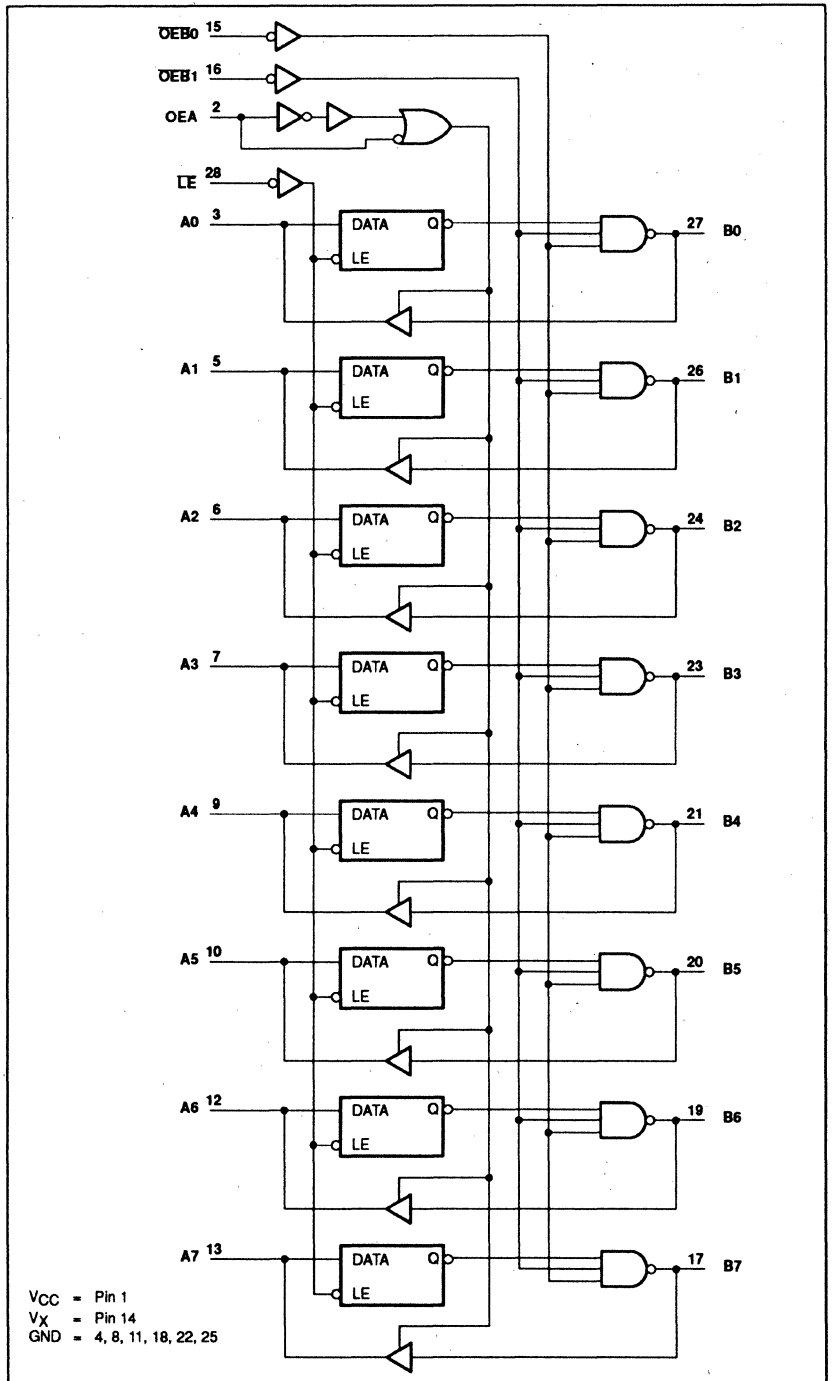
FEATURES

- Octal latched transceiver
- Drives heavily loaded backplanes with equivalent load impedances down to 10 ohms
- High drive (100mA) open collector drivers on B-port
- Reduced voltage swing (1 volt) produces less noise and reduces power consumption
- High speed operation enhances performance of backplane buses and facilitates incident wave switching
- Compatible with IEEE 896 Futurebus Standard
- Built-in precision band-gap reference provides accurate receiver thresholds and improved noise immunity
- Controlled output ramp and multiple GND pins minimize ground bounce
- Glitch-free power up/power down operation on all outputs

74F776 Only

- Multiple package options
- Industrial temperature range available (-40°C to +80°C)

LOGIC DIAGRAM



Signetics/Philips Components

Signetics

Philips Components



PHILIPS

74F711/711-1, 74F712/712-1 – Multiplexers

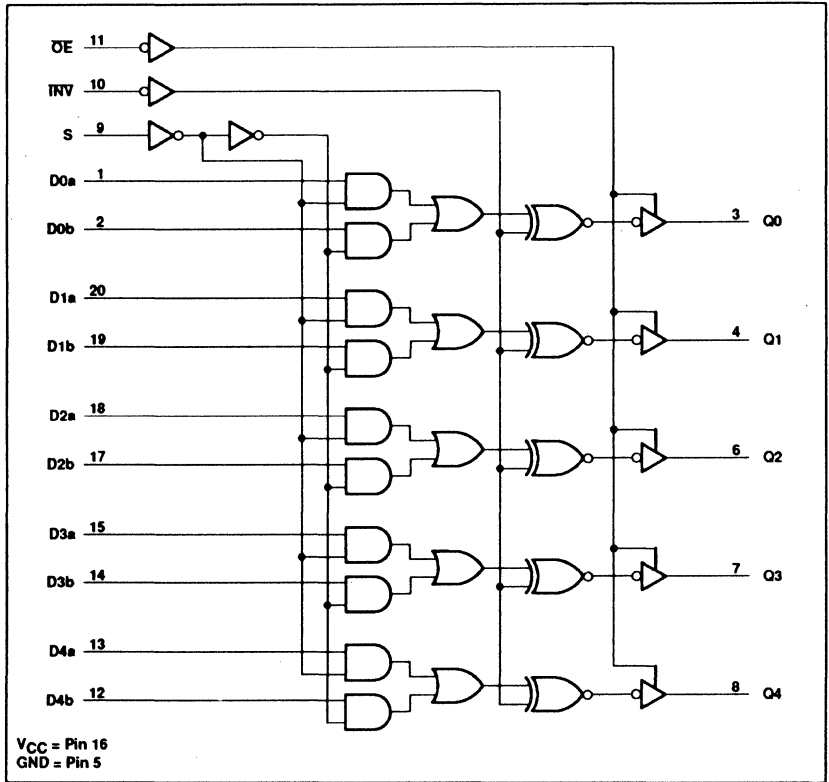
FEATURES for 74F711/711-1

- Consists of five 2-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20 μ A in High and Low states)
- Designed for address multiplexing of dynamic RAM and other applications
- Output inverting/non-inverting option
- 74F711-1 offers 30 Ω output impedance characteristics
- Outputs sink 48mA ('F711 only)

FEATURES for 74F712/712-1

- Consists of five 3-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20 μ A in High and Low states)
- Designed for address multiplexing of dynamic RAM and other applications
- 74F712-1 offers 30 Ω output impedance characteristics
- Outputs sink 64mA ('F712 only)

LOGIC DIAGRAM



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74F723/723-1, 74F725/725-1 – Multiplexers

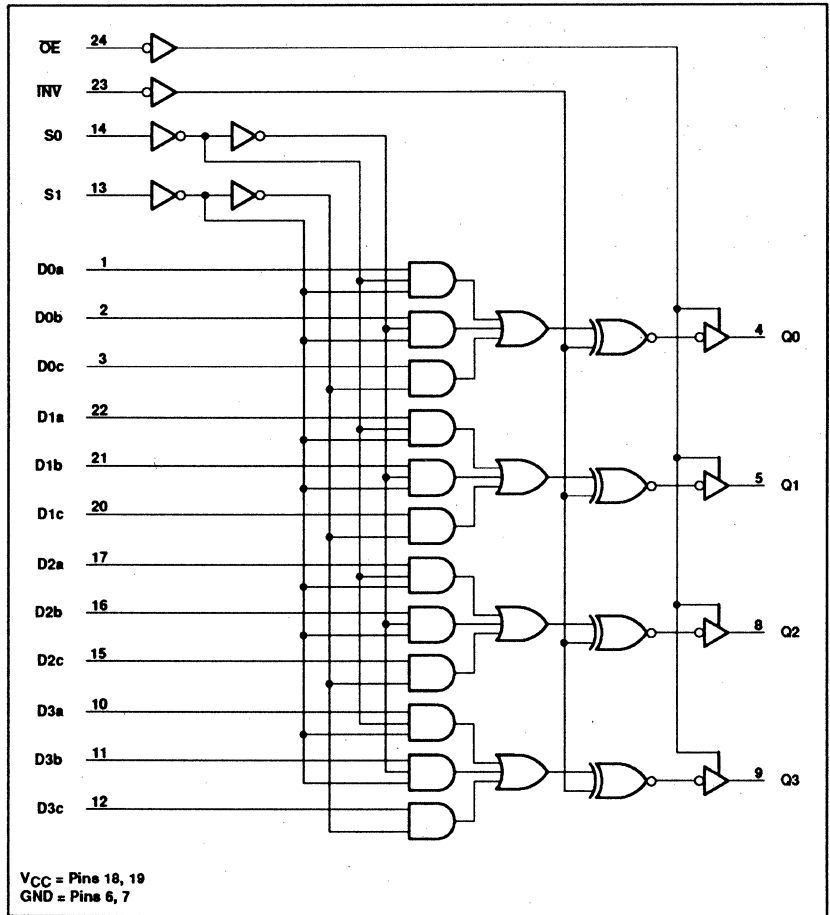
FEATURES for 74F723/723-1

- Consists of four 3-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20µA in High and Low states)
- Inverting or non-inverting data path capability by an invertint (INV) input
- Designed for address multiplexing of dynamic RAM and other applications
- Multiple side pins for V_{CC} and GND to reduce lead inductance (Improves speed and noise immunity)
- 3-State outputs sink 48mA ('F723 only)
- 74F723-1 offers 30Ω output impedance characteristics

FEATURES for 74F725/725-1

- Consists of four 4-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20µA in High and Low states)
- Equivalent to two 'F253s without 3-State
- Outputs sink 48mA ('F725 only)
- 74F725-1 offers 30Ω output impedance characteristics

LOGIC DIAGRAM



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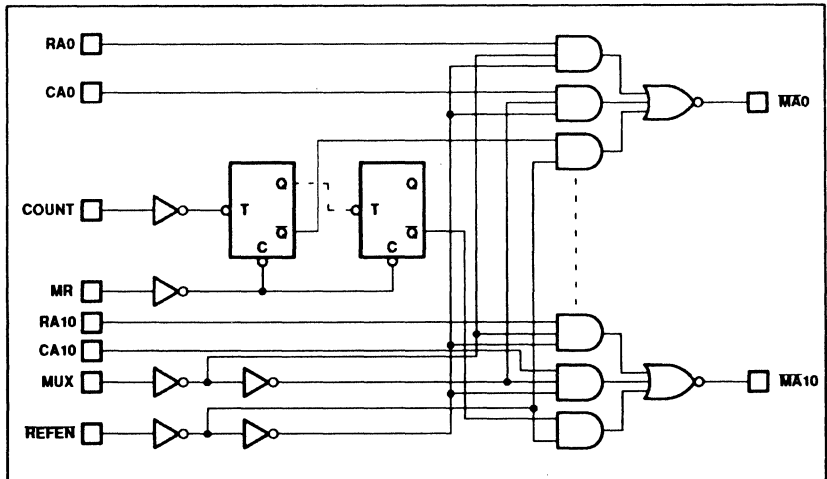
PHILIPS

74F1762 – Memory Address Multiplexer

FEATURES

- Provides refresh and multiplexed row and column addresses for DRAMs
- Addressing up to 4MBit DRAMs
- Compatible with 74F171 DIVC and other DRAM controllers
- High-performance outputs
- High-speed address multiplexing
- On-chip 11-bit refresh counter

LOGIC DIAGRAM

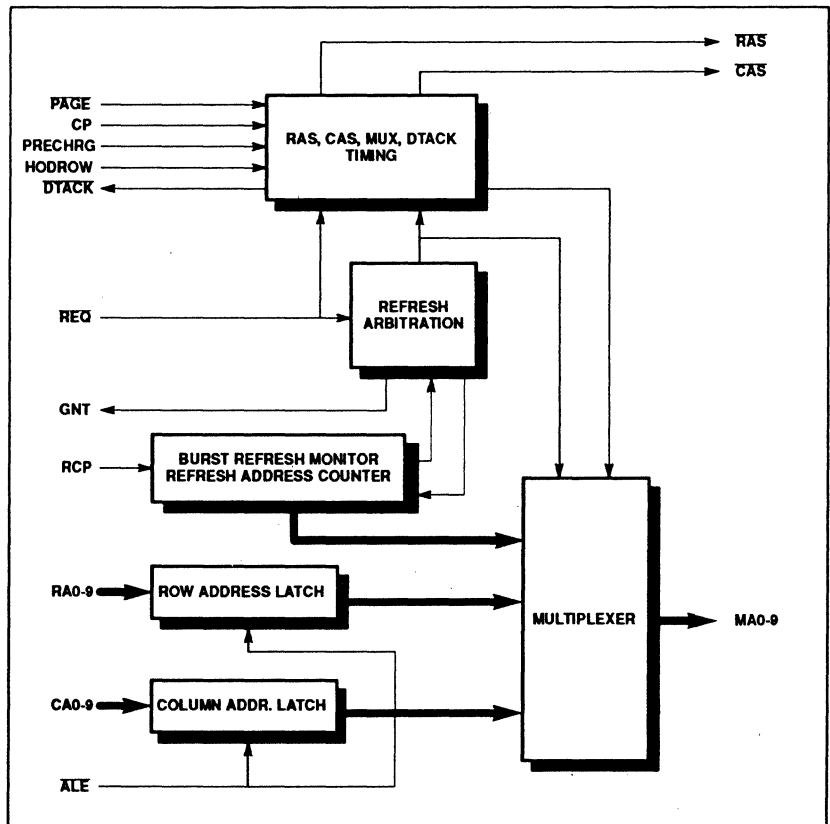


74F1763 – Intelligent DRAM Controller (IDC)

FEATURES

- DRAM signal timing generator
- Automatic refresh circuitry
- Selectable row address hold and RAS precharge times
- Facilitates page mode accesses
- Controls 1Mbit DRAMs
- Intelligent burst-mode refresh after page-mode access cycles

BLOCK DIAGRAM



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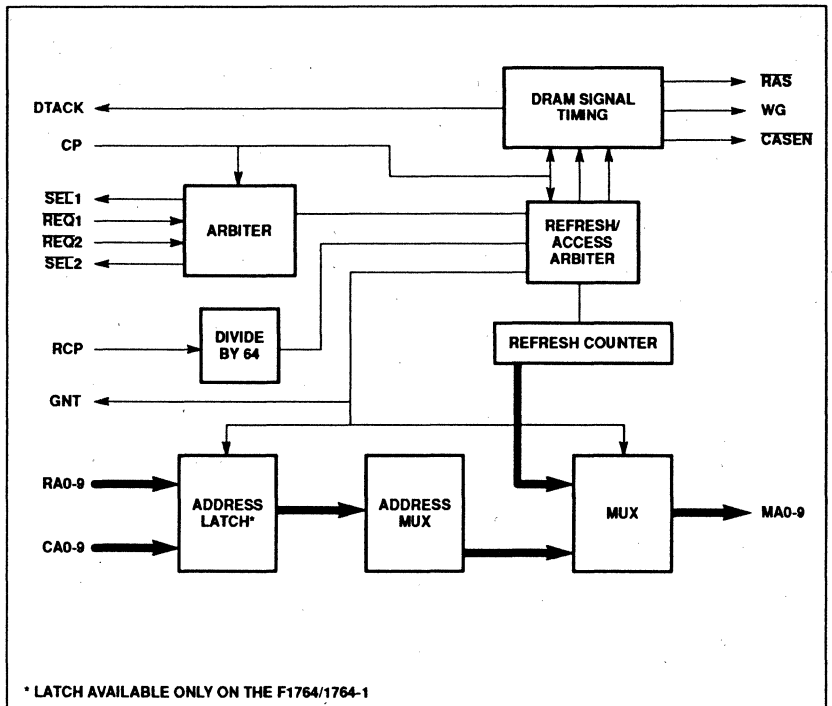
PHILIPS

74F1764/1765 74F1764-1/1765-1 – 1Megabit DRAM Dual-Ported Controller

FEATURES

- Allows two microprocessors to access the same bank of dynamic RAM
- Performs arbitration, signal timing, address multiplexing and refresh
- 10 address output pins allow direct control of up to 1Mbit dynamic RAMs
- External address multiplexing enables control of 4Mbit (or reater) dynamic RAMs
- Separate refresh clock allows adjustable refresh timing
- 74F1764/F1764-1 have on-chip 20-bit address input latch
- Allows control of dynamic RAMs with row access times down to 40ns
- 74F1764/F1765 output drivers designed for incident wave switching
- 74F1764-1/F1765-1 output drivers designed for first reflected wave switching

BLOCK DIAGRAM



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PHILIPS

74F5074 – Flip-Flop/Clock Driver

FEATURES

- Metastable Immune Characteristics
- Propagation delay skew and output to output skew guaranteed less than 1.5ns
- High source current ($I_{OH} = 15\text{mA}$) ideal for clock driver applications
- Pinout compatible with 74F74
- See 74F50728 for Synchronizing Cascaded D-Type Flip-Flop
- See 74F50729 for Synchronizing Dual D-Type Flip-Flop with Edge-Triggered Set and Reset
- See 74F50109 for Synchronizing Dual J-K Positive Edge-Triggered Flip-Flops

74F50109 – Flip-Flop/Clock Driver

FEATURES

- Metastable immune characteristics
- Propagation delay skew and output to output skew guaranteed less than 1.5ns
- High source current ($I_{OH} = 15\text{mA}$) ideal for clock driver applications
- Pinout compatible with 74F109
- See 74F5074 for Synchronizing Dual D-Type Flip-Flop
- See 74F50728 for Synchronizing Cascaded D-Type Flip-Flop
- See 74F50729 for Synchronizing Dual D-Type Flip-Flop with Edge-Triggered Set and Reset

74F50728 – Flip-Flop

FEATURES

- Metastable immune characteristics
- Propagation delay skew and output to output skew less than 1.5ns
- See 74F5074 for Synchronizing Dual D-Type Flip-Flop
- See 74F50109 for Synchronizing Dual J-K Positive Edge-Triggered Flip-Flops
- See 74F50729 for Synchronizing Dual D-Type Flip-Flop with Edge-Triggered Set and Reset
- Industrial temperature range available (-40°C to $+85^{\circ}\text{C}$)

74F50729 – Flip-Flop/Clock Driver

FEATURES

- Metastable immune characteristics
- Propagation delay skew and output to output skew less than 1.5ns
- High source current ($I_{OH} = 15\text{mA}$) ideal for clock driver applications
- See 74F5074 for Synchronizing Dual D-Type Flip-Flop
- See 74F50109 for Synchronizing Dual J-K Positive Edge-Triggered Flip-Flops
- See 74F50728 for Synchronizing Cascaded Dual D-Type Flip-Flop

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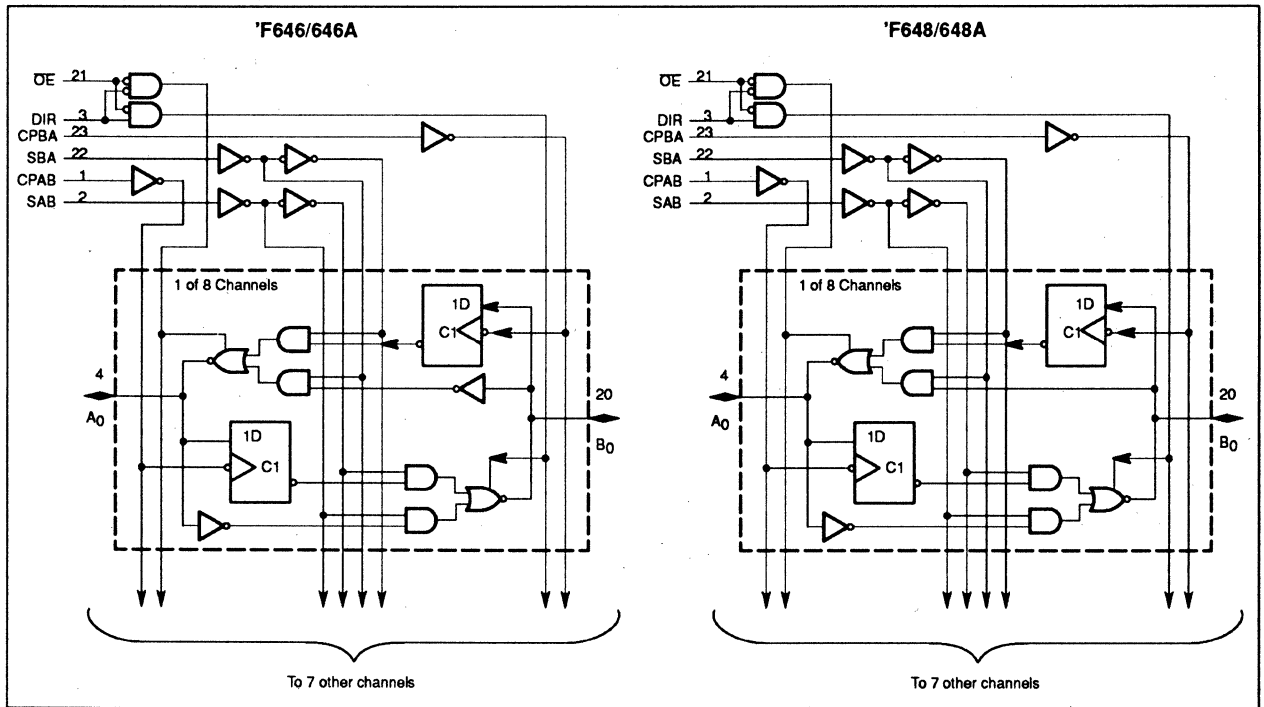
PHILIPS

74F646/646A, 74F648/648A – Transceivers/Registers

FEATURES

- Combines 54F245 and 54F374 type functions in one chip
- High impedance base inputs for reduced loading (70µA in High and Low states)
- Independent registers for A and B buses
- Multiplexed real-time and stored data
- Choice of non-inverting and inverting data paths
- Controlled ramp outputs for 'F646A/'F648A
- 3-state outputs
- 300 mil wide 24-pin Slim Dip package

LOGIC DIAGRAM



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Philips Components



PHILIPS

74F651/651A, 74F652/652A – Transceivers/Registers

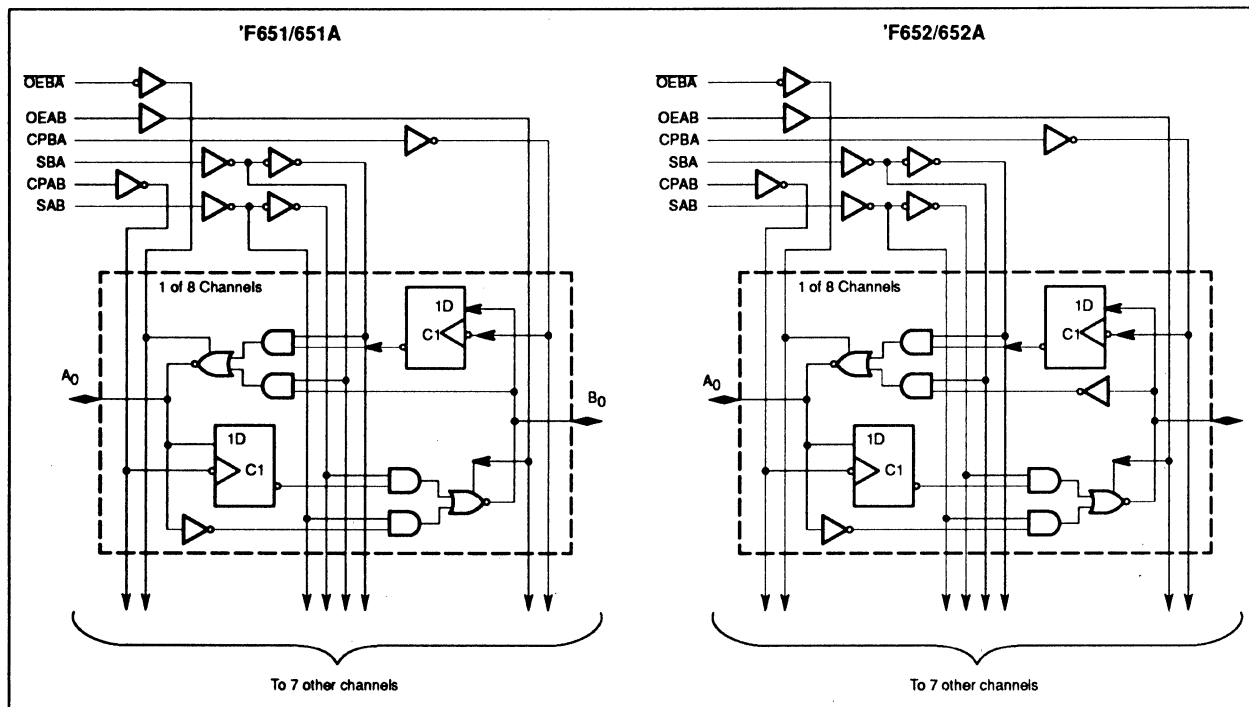
FEATURES

- Combines 54F245 and 54F374 type functions in one chip
- High impedance base inputs for reduced loading ($70\mu\text{A}$ In High and Low states)

- Independent registers for A and B buses
- Multiplexed real-time and stored data

- Choice of non-inverting and inverting data paths
- 3-state outputs

LOGIC DIAGRAM



74HC/HCT555 – Programmable Delay Timer with Oscillator

FEATURES

- Positive and negative edge triggered
- Retriggerable or non-retriggerable
- Programmable delay minimum: 100ns maximum: depends on input frequency and division ratio
- Divide by range of 2 to 2^{24}
- Direct reset terminates output pulse

- Very low power consumption in triggered start mode
- 3 oscillator operation modes: RC oscillator, Crystal oscillator, External oscillator
- Device is unaffected by variations in temperature and V_{CC} , when using an external oscillator

- Automatic power-on reset
- Schmitt trigger action on both trigger inputs
- Direct drive for power transistor
- Output capability: 20mA
- I_{CC} category: MSI

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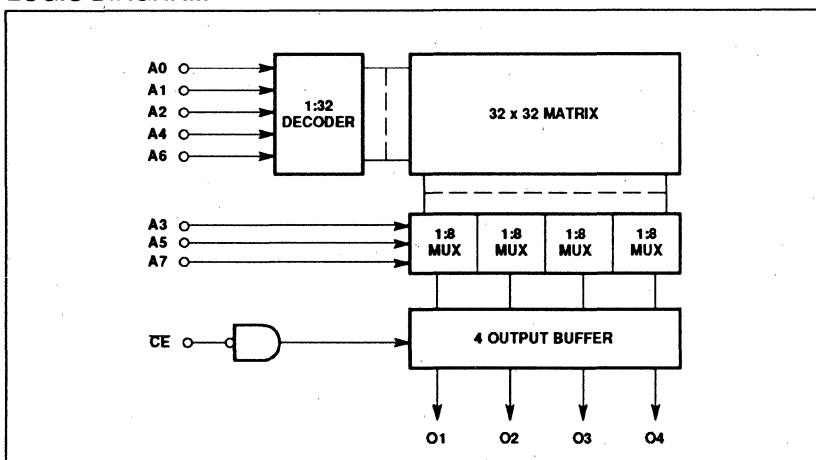
PHILIPS

10149A – 1K-Bit ECL Bipolar PROM

FEATURES

- Address access time: 10ns max
- Power dissipation: 0.66mW/bit typ
- High-impedance inputs (50K Ω pulldown)
- One Chip Enable input
- Open Emitter outputs (50 Ω drive)
- On-chip address decoding
- No separate fusing pins
- Fully compatible with ECL 10K series

LOGIC DIAGRAM

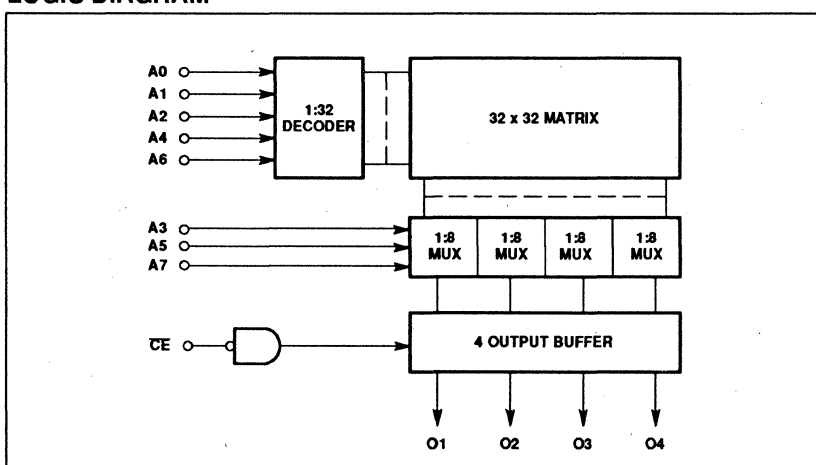


100149A – 1K-Bit ECL Bipolar PROM

FEATURES

- Address access time: 10ns max
- Power dissipation: 0.66mW/bit typ
- High-impedance inputs (50K Ω pulldown)
- One Chip Enable input
- Open Emitter outputs (50 Ω drive)
- On-chip address decoding
- No separate fusing pins
- Fully compatible with ECL 100K series

LOGIC DIAGRAM



100124/100124A – Hex TTL-to-ECL Translator

FEATURES

- Typical propagation delay: 1.70ns

- Typical ECL supply current ($-I_{EE}$): 96mA for the 100124 and 71mA for the 100124A

- Typical TTL supply current (I_{TTL}): 44mA for the 100124 and 10mA for the 100124A

100125 – Hex ECL-to-TTL Translator

FEATURES

- Typical propagation delay: 2.2ns

- Typical ECL supply current ($-I_{EE}$): 65mA

- Typical TTL supply current (I_{TTL}): 75mA

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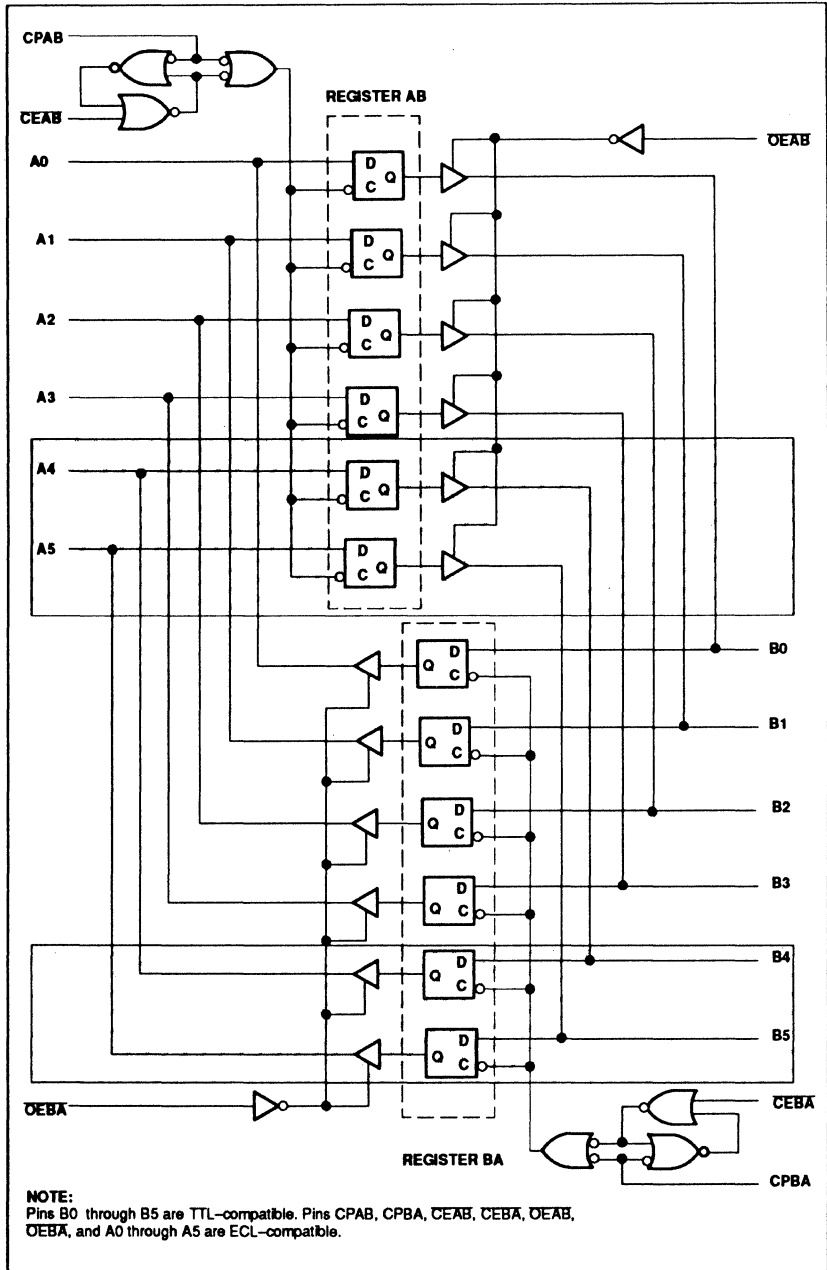
100982 – Hex ECL-TTL Translating Transceiver with Registers 100984 – Quad ECL-TTL Translating Transceiver with Registers

FEATURES

- Typical propagation delay from clock to output: 3.5ns
- Typical ECL supply current (-IECL): 110mA
- Typical TTL supply current (ITTL): 25mA
- Low logic level of ECL output doubles as a high impedance state
- ECL output drives 25Ω loads
- 4,000 Volt ESD protection for all pins
- Controlled edge rates for quieter bus operation

NOTE: Shaded area included only in 100982

LOGIC DIAGRAM



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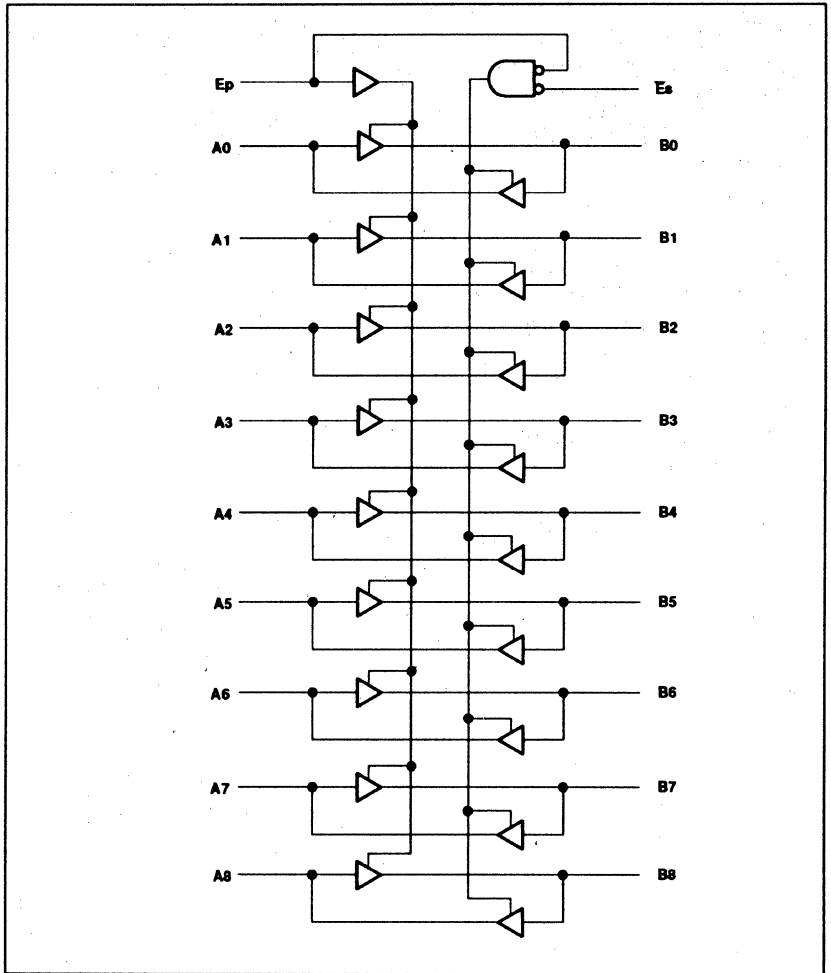
PHILIPS

100990 – 9-Bit Transceiver

FEATURES

- Typical propagation delay from input to output: 1.3ns
- Typical supply current ($-I_{EE}$): 240mA
- 3-state outputs eliminate bus impedance discontinuities and wire-OR problems
- 9-bit data width provides optimum handling of parity bit
- Drives 25 Ω loads
- 4,000 Volt ESD protection for all pins
- Controlled edge rates for quieter bus operation

LOGIC DIAGRAM



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PHILIPS

PHD16N8-5 – Programmable High-Speed Decoder Logic (16 × 16 × 8)

DESCRIPTION

The PHD16N8-5 is an ultra fast Programmable High-speed Decoder featuring a 5ns maximum propagation delay. The architecture has been optimized using Philips Components-Signetics state-of-the-art bipolar oxide isolation process coupled with titanium-tungsten fuses to achieve superior speed in any design.

The PHD16N8-5 is a single level logic element comprised of 10 fixed inputs, 8 AND gates, and 8 outputs of which 6 are bidirectional. This gives the device the ability to have as many as 16 inputs. Individual 3-State control of all outputs is also provided.

The device is field-programmable, enabling the user to quickly generate custom patterns using standard programming

equipment. Proprietary designs can be protected by programming the security fuse.

The AMAZE software package from Philips Components-Signetics supports easy design entry for the PHD16N8-5 as well as other PLD devices.

FEATURES

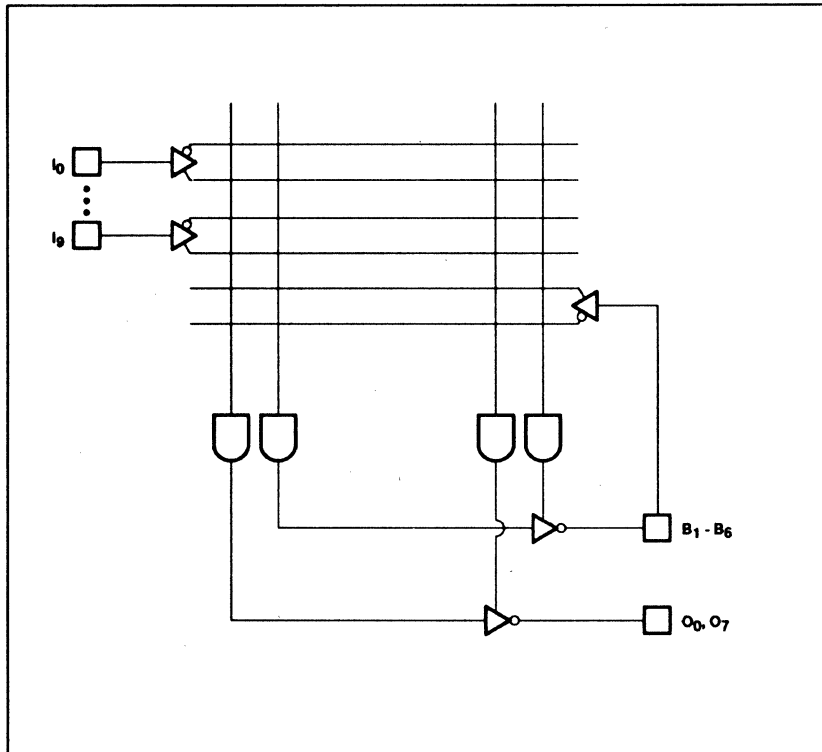
- Ideal for high speed system decoding
- Super high speed at 5ns t_{PD}
- 10 dedicated inputs
- 8 outputs
 - 6 bidirectional I/O
 - 2 dedicated outputs
- Security fuse to prevent duplication of proprietary designs.

- Individual 3-State control of all outputs
- Field-programmable on industry standard programmers
- Available in 20-pin Plastic DIP and 20-Pin PLCC

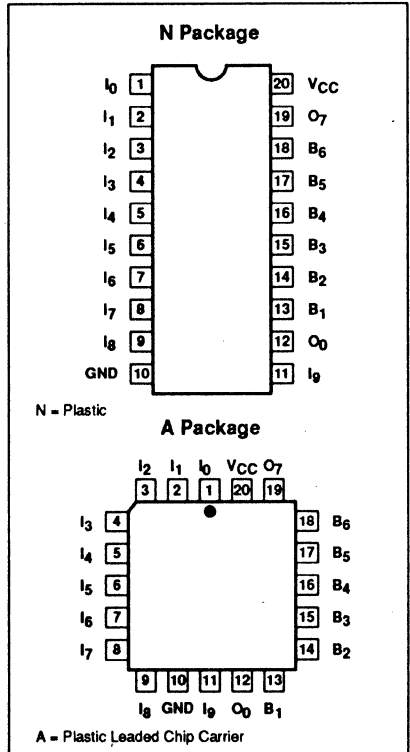
APPLICATIONS

- High speed memory decoders
- High speed code detectors
- Random logic
- Peripheral selectors
- Machine state decoders
- Footprint compatible to 16L8
- Fuse/Footprint compatible to TIBPAD

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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PHILIPS

PHD48N22-7 – Programmable High-Speed Decoder Logic (48 × 73 × 22)

DESCRIPTION

The PHD48N22-7 is an ultra fast Programmable High-speed Decoder featuring a 7.5ns maximum propagation delay. The architecture has been optimized using Philips Components-Signetics state-of-the-art bipolar oxide isolation process coupled with titanium-tungsten fuses to achieve superior speed in any design.

The PHD48N22-7 is a two level logic element comprised of 36 fixed inputs, 73 AND gates, 10 outputs, and 12 bi-directional I/Os. This gives the device the ability to have as many as 48 inputs. Individual 3-State control of all outputs is also provided.

The device is field-programmable, enabling the user to quickly generate custom

patterns using standard programming equipment. Proprietary designs can be protected by programming the security fuse.

The AMAZE software package from Philips Components-Signetics supports easy design entry for the PHD48N22-7 as well as other PLD devices.

FEATURES

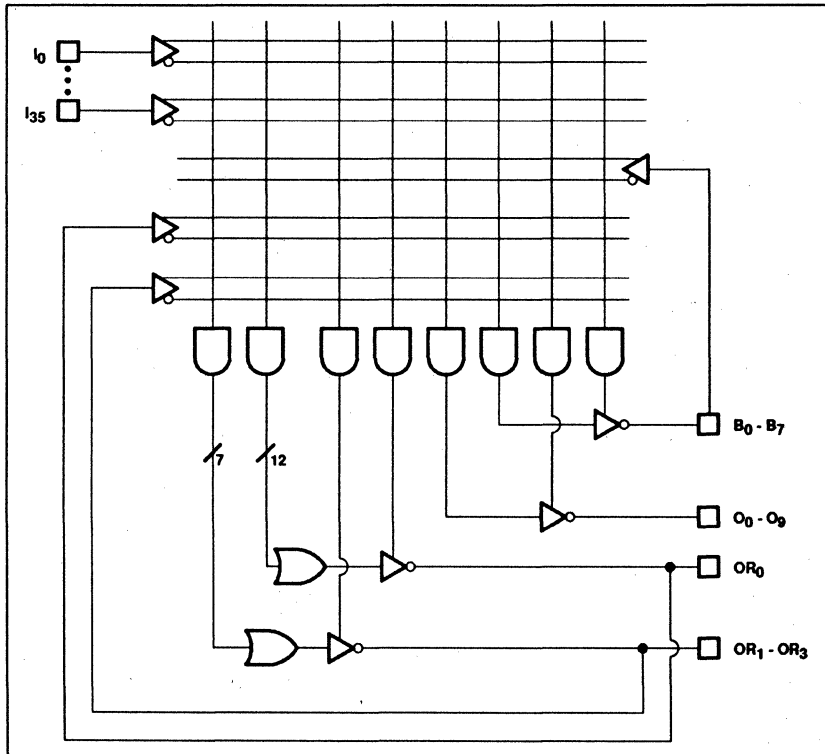
- Ideal for high speed system decoding
- Super high speed at 7.5ns t_{PD}
- 36 dedicated inputs
- 22 outputs
 - 12 bidirectional I/O
 - 10 dedicated outputs

- Security fuse to prevent duplication of proprietary designs.
- Individual 3-State control of all outputs
- Field-programmable on industry standard programmers
- Available in 68-Pin Plastic Leaded Chip Carrier (PLCC)

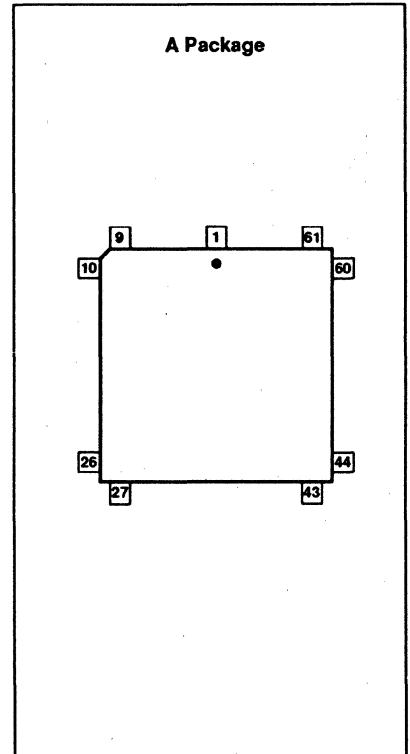
APPLICATIONS

- High speed memory decoders
- High speed code detectors
- Random logic
- Peripheral selectors
- Machine state decoders

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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PHILIPS

80C31/80C51/87C51 – CMOS Single-Chip, 8-Bit Microcontroller

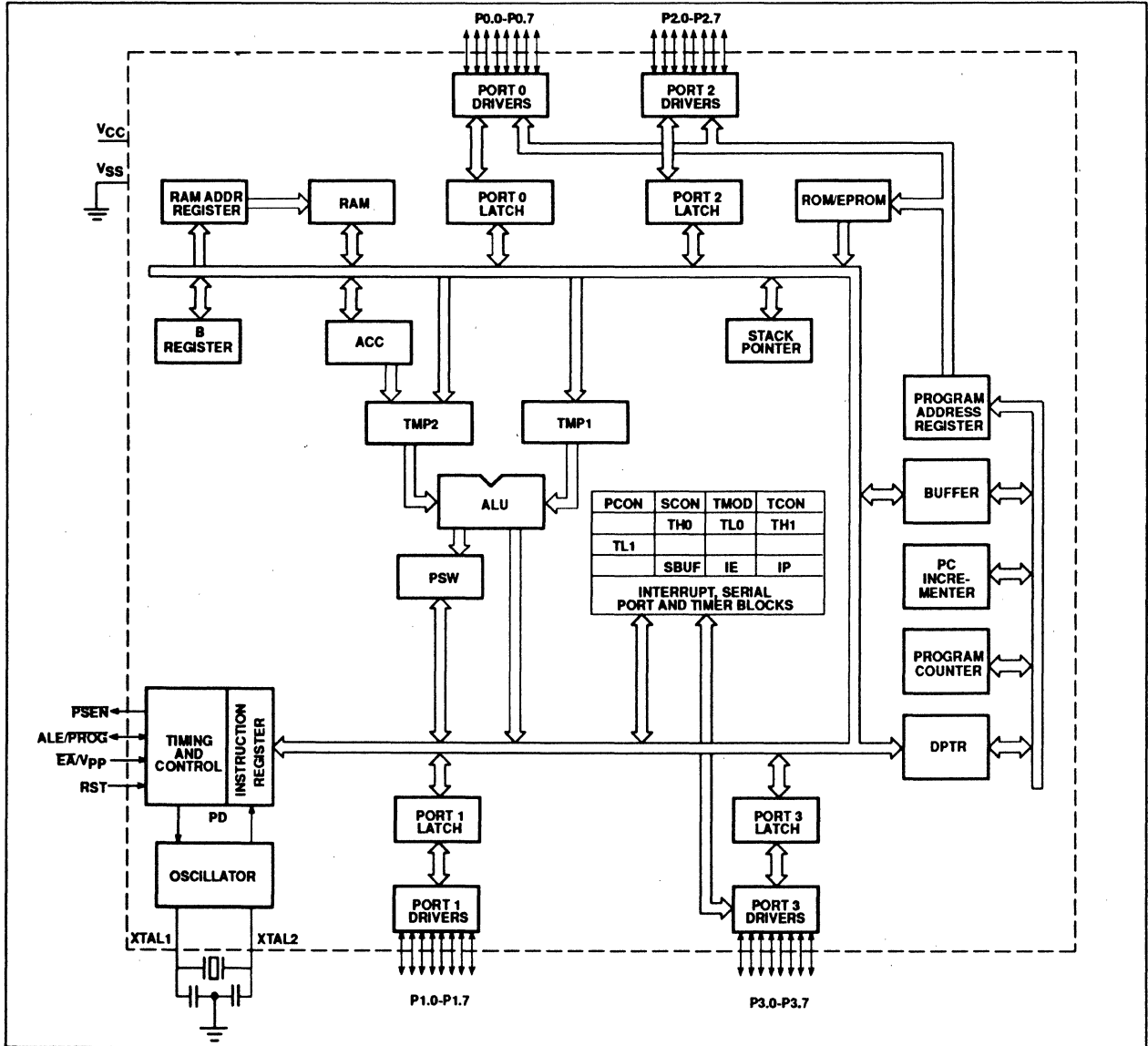
FEATURES

- 8031/8051 compatible
 - 4k x 8 ROM (80C51)
 - 4k x 8 EPROM (87C51)
 - ROMless (80C31)
 - 128 x 8 RAM
 - Two 16-bit counter/timers

- Full duplex serial channel
- Boolean processor
- Memory addressing capability
 - 64k ROM and 64k RAM
- Power control modes:
 - Idle mode
 - Power-down mode

- CMOS and TTL compatible
- Five speed ranges at $V_{CC} = 5V$
 - 12MHz, 16MHz, 20MHz, 24MHz, 30MHz
- Five package styles
- Extended temperature ranges
- OTP package available

BLOCK DIAGRAM



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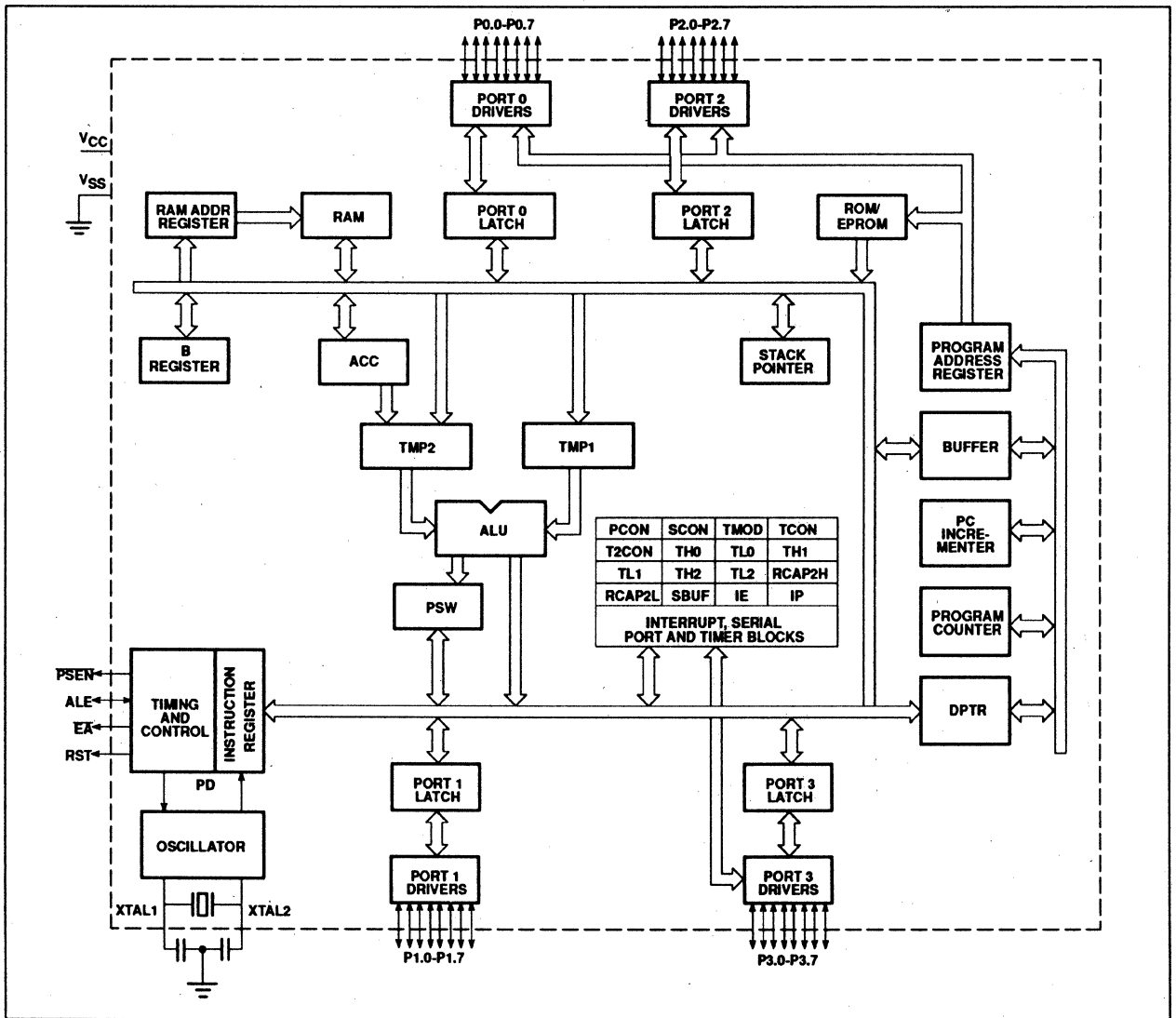
80C32/80C52/87C52 — CMOS Single-Chip 8-Bit Microcontroller

FEATURES

- 80C51 based architecture
- 8032/8052 compatible
 - 8k × 8 ROM (80C52)
 - 8k × 8 EPROM (87C52)
 - ROMless (80C32)
 - 256 × 8 RAM
 - Three 16-bit counter/timers
- Full duplex serial channel
- Boolean processor
- Memory addressing capability
 - 64k ROM and 64k RAM
- Power control modes:
 - Idle mode
 - Power-down mode
- CMOS and TTL compatible
- Two speed ranges:
 - 3.5 to 16MHz
 - 3.5 to 20MHz
- Five package styles
- Extended temperature ranges
- OTP package available

BLOCK DIAGRAM

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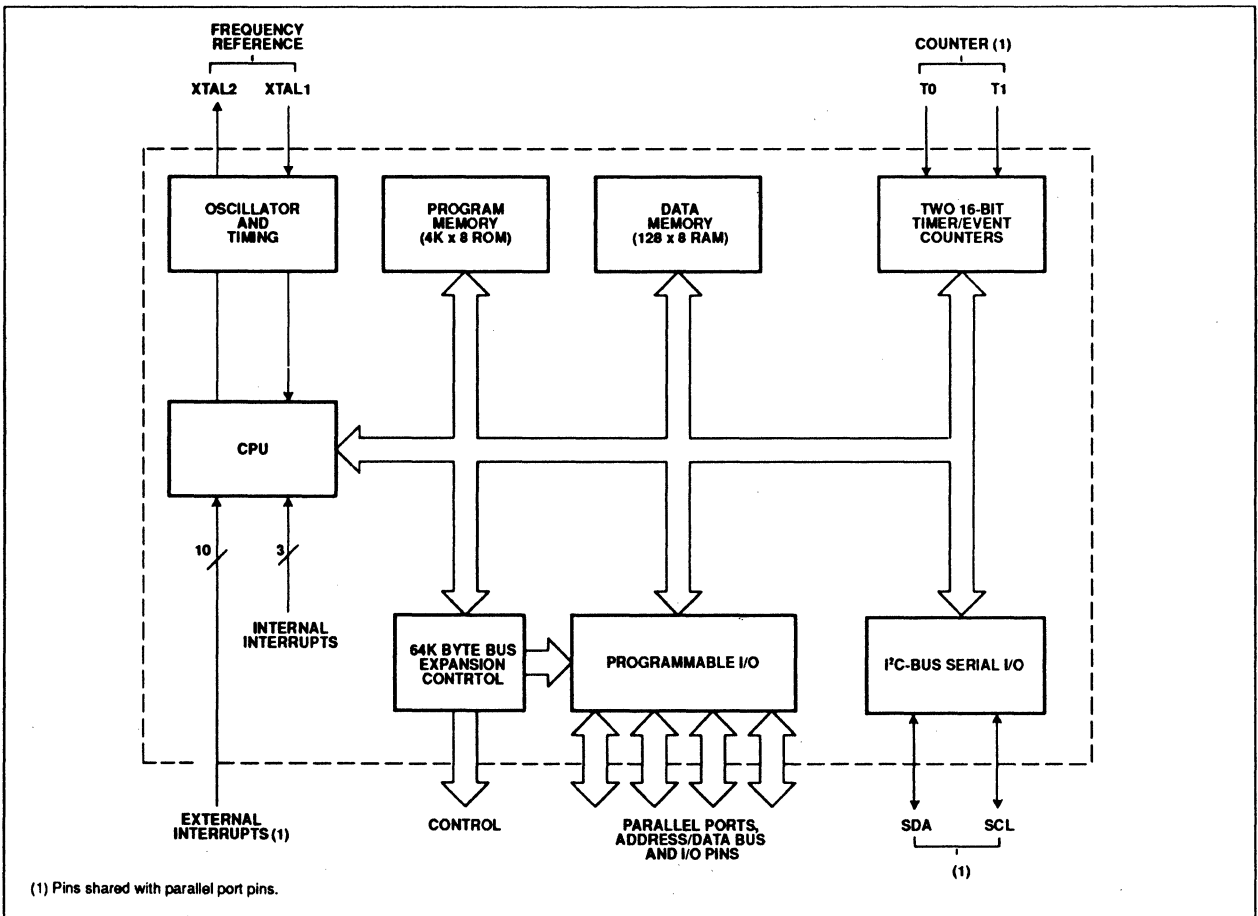
PHILIPS

80CL410/83CL410 — Low Voltage/Low Power Single-Chip 8-Bit Microcontroller

FEATURES

- Supply voltage from 1.5 to 5.5V
- Operating frequency from 32kHz to 20MHz
- 80C51 based architecture
- 4k × 8 ROM (64k external)
- 128 × 8 RAM (64k external)
- Four 8-bit I/O ports
 - Two 16-bit timer/counters
- A thirteen-source, two-level, nested priority interrupt structure
- Ten external interrupts
- Fully static 80C51 CPU
- I²C Serial Interface
- Two power control modes
 - Idle mode
 - Power-down mode — can be terminated by reset or external interrupt
- Wake-up via external interrupts at port 1
- On-chip oscillator (quartz crystal, ceramic resonator, RC, LC)
- Very low power consumption
- Operating temperature range: -40 to +85°C

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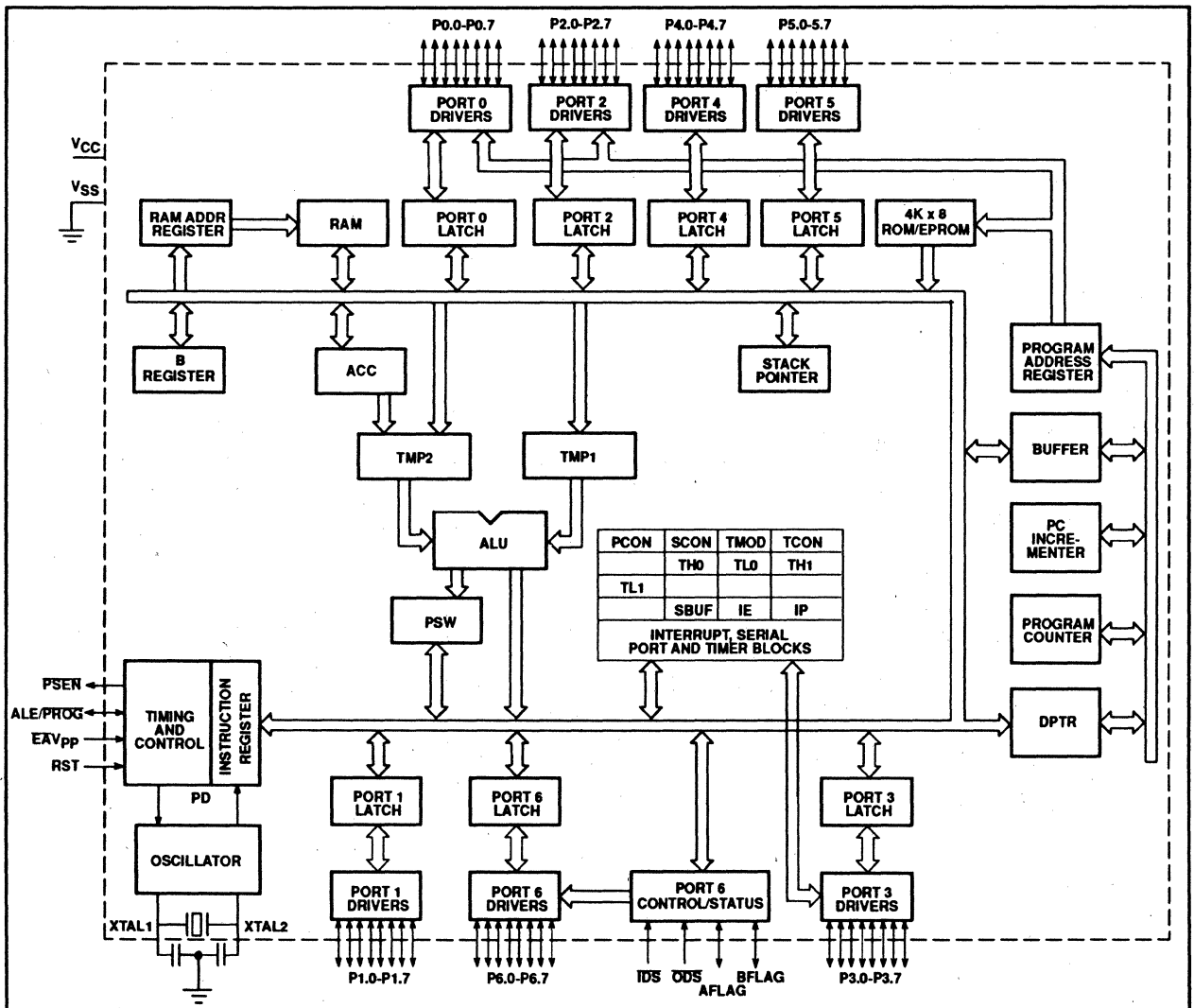
80/83/87C451 – CMOS Single-Chip, 8-Bit Microcontroller

FEATURES

- 80C51 based architecture
- 68-pin PLCC and 64-pin DIP packages:
 - Seven 8-bit I/O ports (PLCC version)
 - Six 8-bit ports and one 4-bit port (DIP version)
- Port 6 features:
 - 8 data pins
- 4 control pins
- Direct MPU bus interface
- Parallel printer interface
- On the microcontroller:
 - 4k X 8 ROM (83C451)
 - 4k X 8 EPROM (87C451)
 - ROMless version (80C451)
 - 128 X 8 RAM
 - Two 16-bit counter/timers
- Two external interrupts
- External memory addressing capability
 - 64k ROM and 64k RAM
- Low power consumption:
 - Normal operation: less than 24mA at 5V, 12MHz
 - Idle mode
 - Power-down mode

BLOCK DIAGRAM

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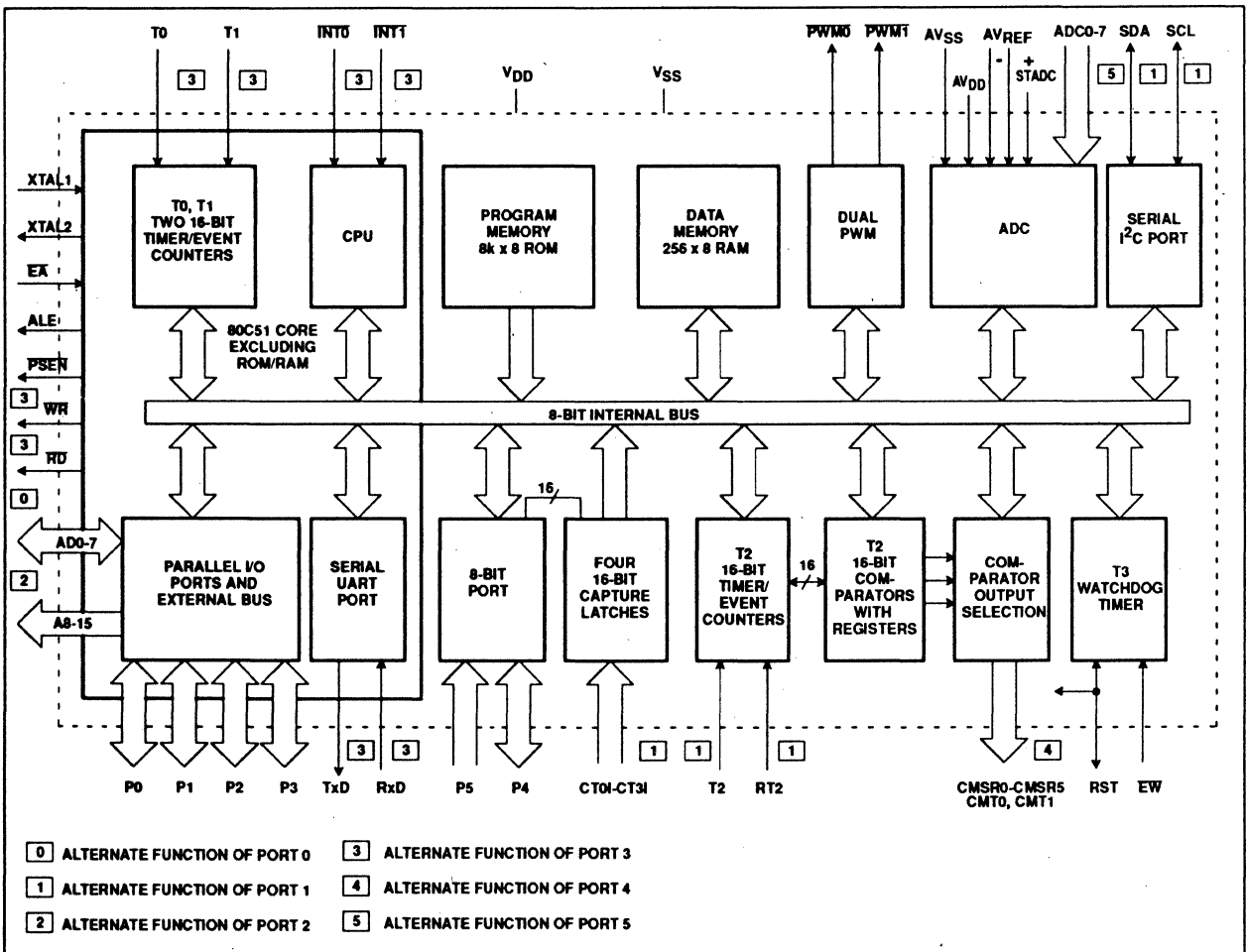
PHILIPS

80C552/83C552/87C552 — Single-Chip 8-Bit Microcontroller with 10-Bit A/D, Capture/Compare Timer, High-Speed Outputs, PWM

FEATURES

- 80C51 central processing unit
- 8k x 8 ROM expandable externally to 64k bytes
- An additional 16-bit timer/counter coupled to four capture registers and three compare registers
- Two standard 16-bit timer/counters
- 256 x 8 RAM, expandable externally to 64k bytes
- Capable of producing eight synchronized, timed outputs
- A 10-bit ADC with eight multiplexed analog inputs
- Two 8-bit resolution, pulse width modulation outputs
- Five 8-bit I/O ports plus one 8-bit input port shared with analog inputs
- I²C-bus serial I/O port with byte oriented master and slave functions
- Full-duplex UART compatible with the standard 80C51
- On-chip watchdog timer
- Two speed ranges:
 - 12MHz
 - 16MHz
- Extended temperature ranges
- OTP package available

BLOCK DIAGRAM



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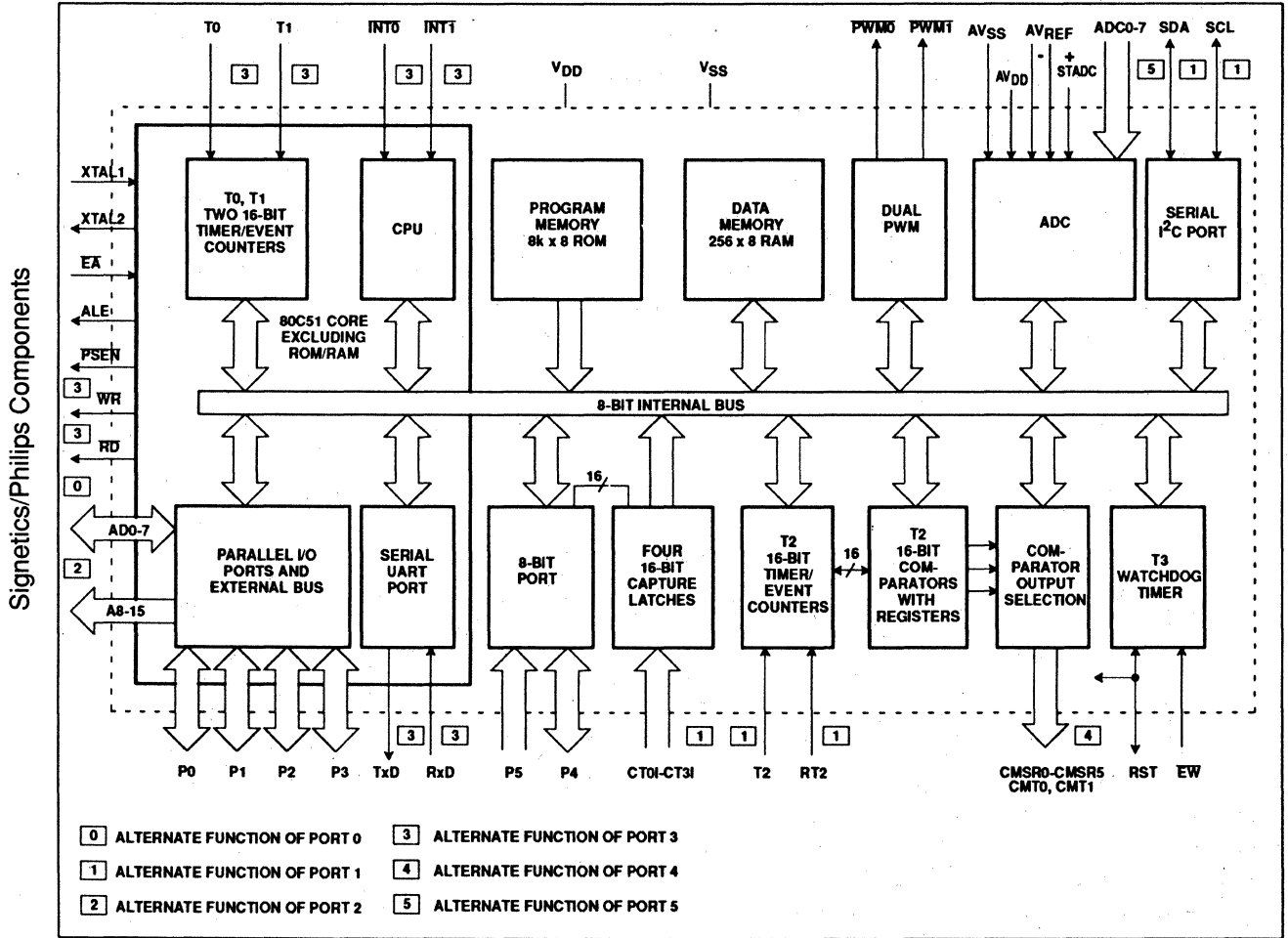
PHILIPS

80C562/83C562 — Single-Chip 8-Bit Microcontroller with 8-Bit A/D, Capture/Compare Timer, High-Speed Outputs, PWM

FEATURES

- 80C51 instruction set
- 8k × 8 ROM expandable externally to 64k bytes
- 256 × 8 RAM, expandable externally to 64k bytes
- Two standard 16-bit timer/counters
- An additional 16-bit timer/counter coupled to four capture registers and three compare registers
- Capable of producing eight synchronized, timed outputs
- A 8-bit ADC with eight multiplexed analog inputs
- Two 8-bit resolution, pulse width modulated outputs
- Five 8-bit I/O ports plus one 8-bit input port shared with analog inputs
- Full-duplex UART compatible with the standard 80C51
- On-chip watchdog timer
- Three temperature ranges
 - 0 to +70°C
 - -40 to +85°C
 - -40 to +125°C

BLOCK DIAGRAM



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Philips Components



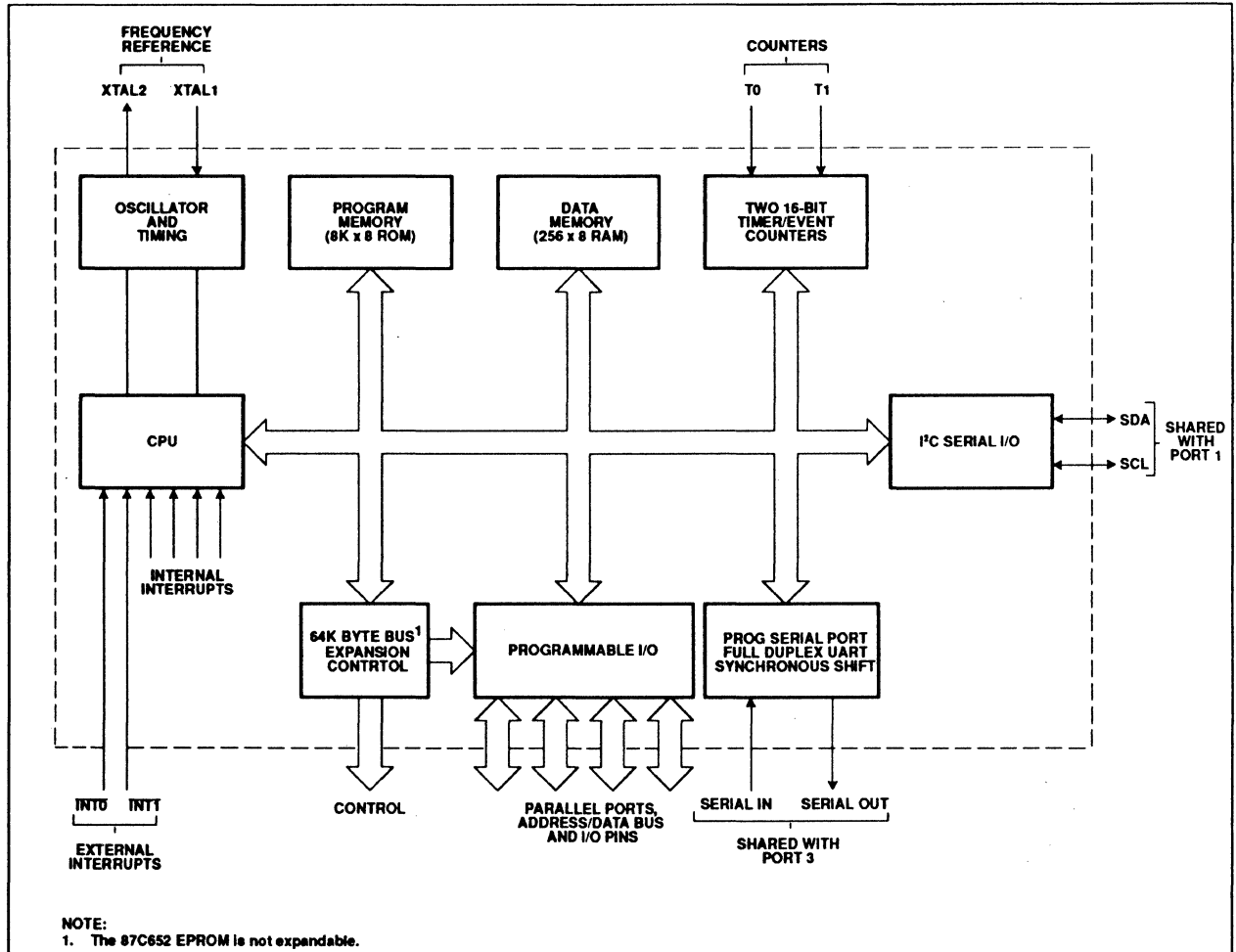
PHILIPS

80C652/83C652/87C652 – CMOS Single-Chip, 8-Bit Microcontroller

FEATURES

- 80C51 central processing unit
- 8k X 8 ROM expandable externally to 64k bytes (87C652 EPROM is not expandable)
- 256 X 8 RAM, expandable externally to 64k bytes
- Two standard 16-bit timer/counters
- Four 8-bit I/O ports
- I²C-bus serial I/O port with byte oriented master and slave functions
- Full-duplex UART facilities
- Power control modes
 - Idle mode
 - Power-down mode
- Five package styles
- Extended temperature ranges
- OTP package available

BLOCK DIAGRAM



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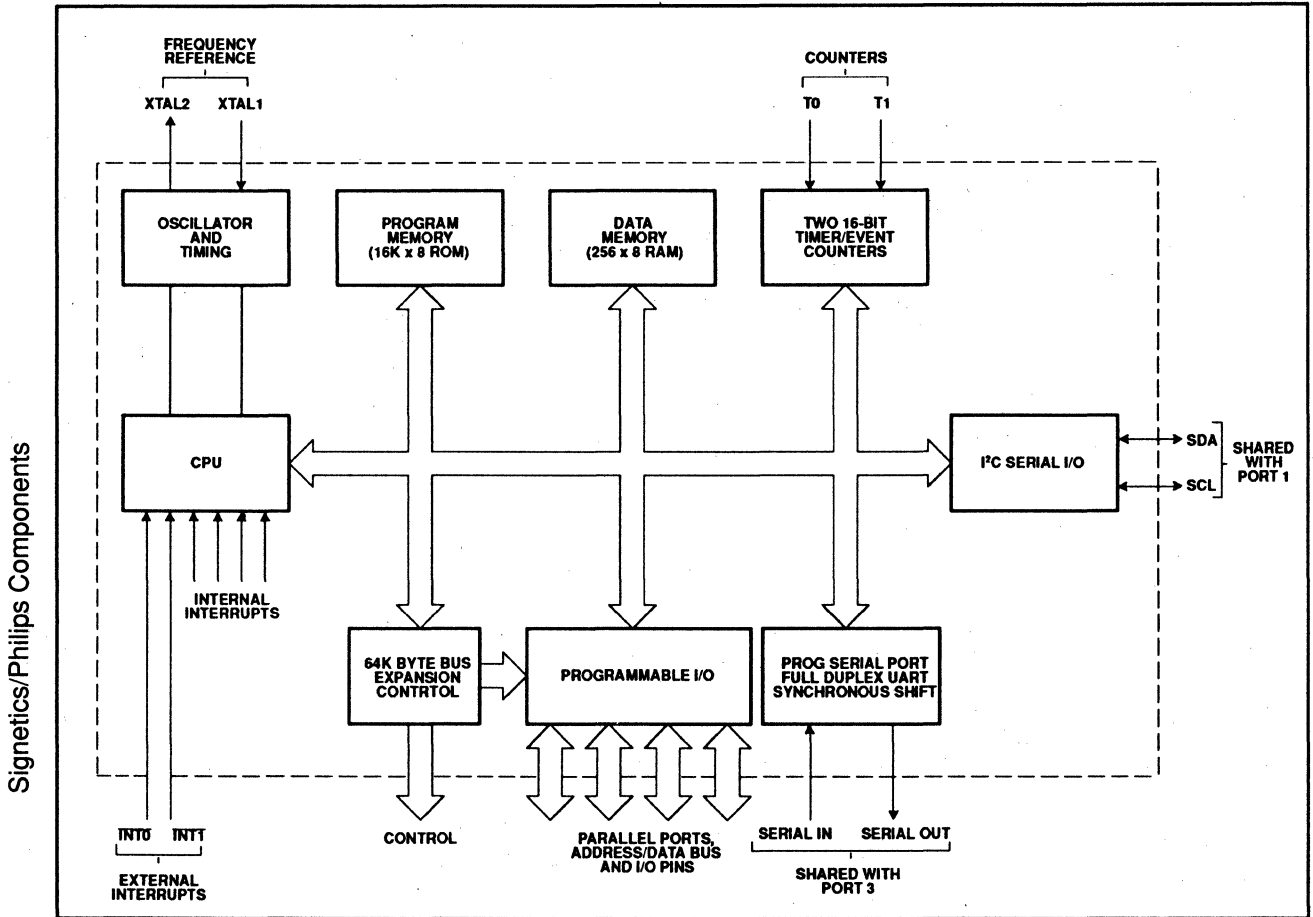
PHILIPS

83C654/87C654 – CMOS Single-Chip, 8-Bit Microcontroller

FEATURES

- 80C51 central processing unit
- 16k X 8 ROM expandable externally to 64k bytes
- 256 X 8 RAM, expandable externally to 64k bytes
- Two standard 16-bit timer/counters
- Four 8-bit I/O ports
- I²C-bus serial I/O port with byte oriented master and slave functions
- Full-duplex UART facilities
- Power control modes
 - Idle mode
 - Power-down mode
- Five package styles
- Extended temperature ranges
- OTP package available

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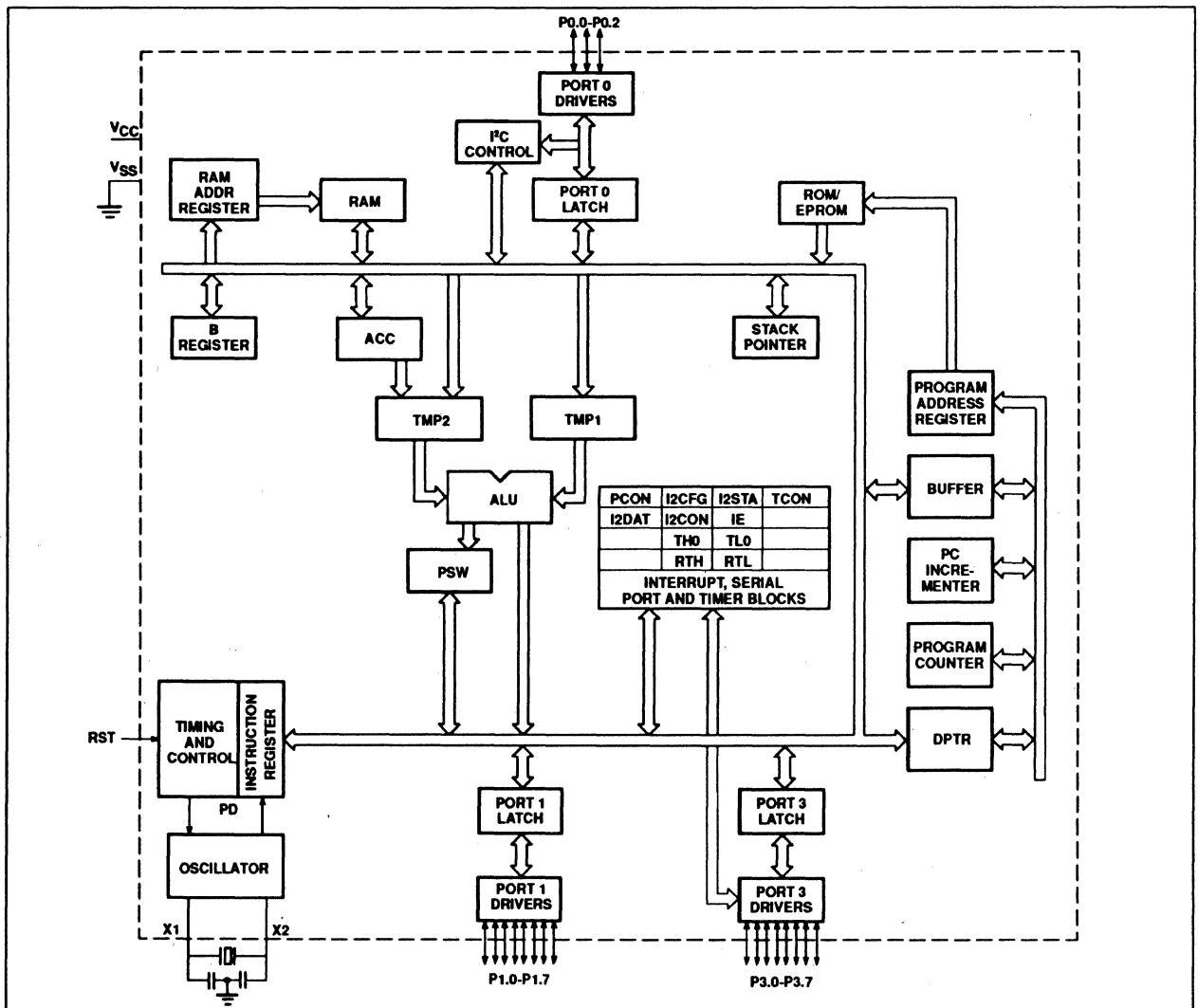
PHILIPS

83C751/87C751 – CMOS Single-Chip 8-Bit Microcontroller

FEATURES

- 80C51 based architecture
- Inter-Integrated Circuit (I²C) serial bus interface
- Small package sizes
 - 24-pin DIP (300 mil "skinny DIP")
 - 28-pin PLCC
- 87C751 available in erasable quartz lid or one-time programmable plastic packages
- Wide oscillator frequency range
- Low power consumption:
 - Normal operation: less than 11mA @ 5V, 12MHz
 - Idle mode
 - Power-down mode
- 2k × 8 ROM (83C751)
2k × 8 EPROM (87C751)
- 64 × 8 RAM
- 16-bit auto reloadable counter/timer
- Fixed-rate timer
- Boolean processor
- CMOS and TTL compatible
- Well suited for logic replacement, consumer and industrial applications

BLOCK DIAGRAM



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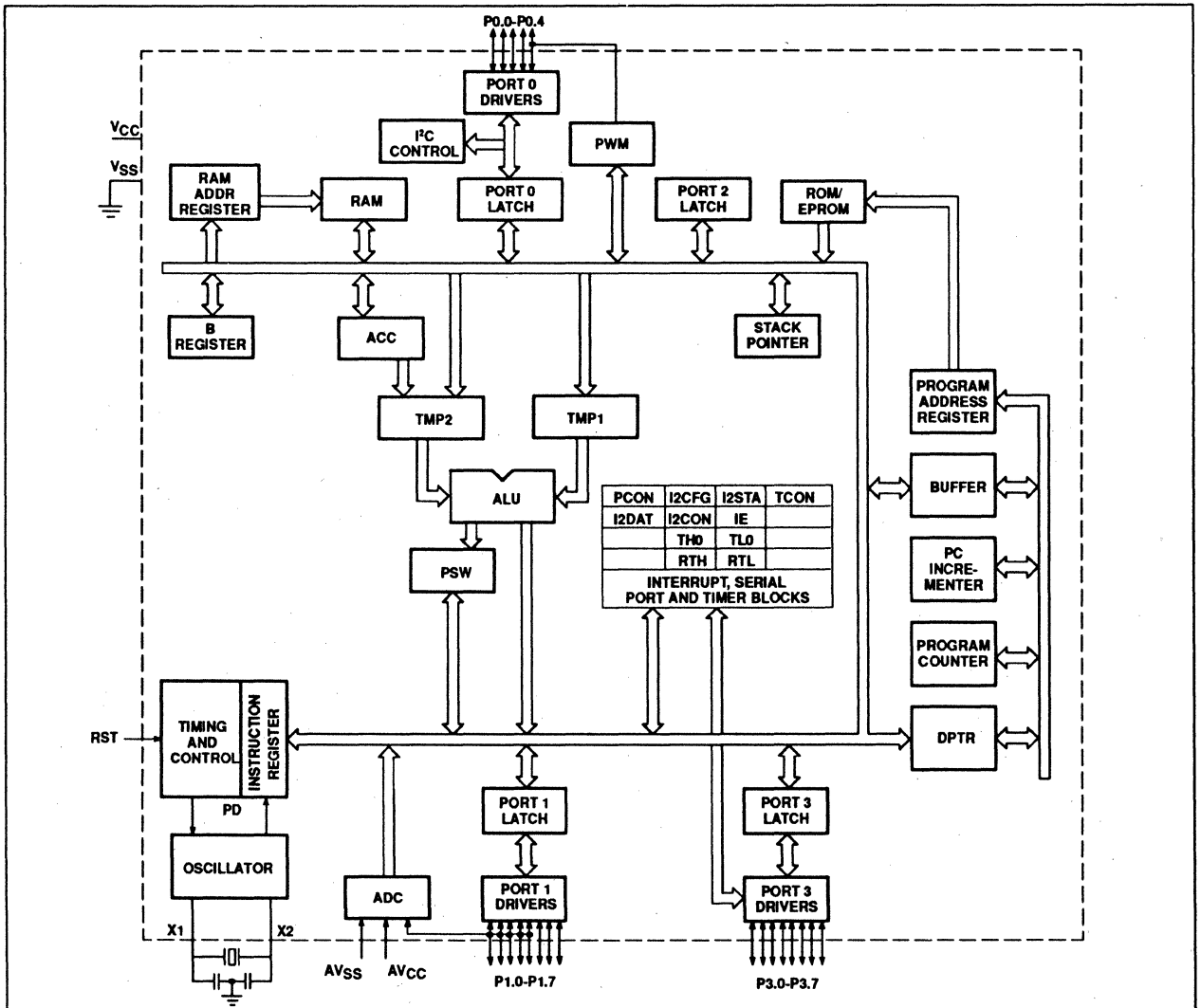
PHILIPS

83C752/87C752 – CMOS Single-Chip 8-Bit Microcontroller with A/D, PWM

FEATURES

- Available in erasable quartz lid or One-Time Programmable plastic packages
- 80C51 based architecture
- Inter-Integrated Circuit (I²C) serial bus interface
- Small package sizes
 - 28-pin DIP
 - 28-pin PLCC
- Wide oscillator frequency range
- Low power consumption:
 - Normal operation: less than 11mA @ 5V, 12MHz
 - Idle mode
 - Power-down mode
- 2k x 8 ROM (83C752) EPROM (87C752)
- 64 x 8 RAM
- 16-bit auto reloadable counter/timer
- 5-channel 8-bit A/D converter
- 8-bit PWM output/timer
- Fixed-rate timer
- Boolean processor
- CMOS and TTL compatible
- Well suited for logic replacement, consumer and industrial applications

BLOCK DIAGRAM



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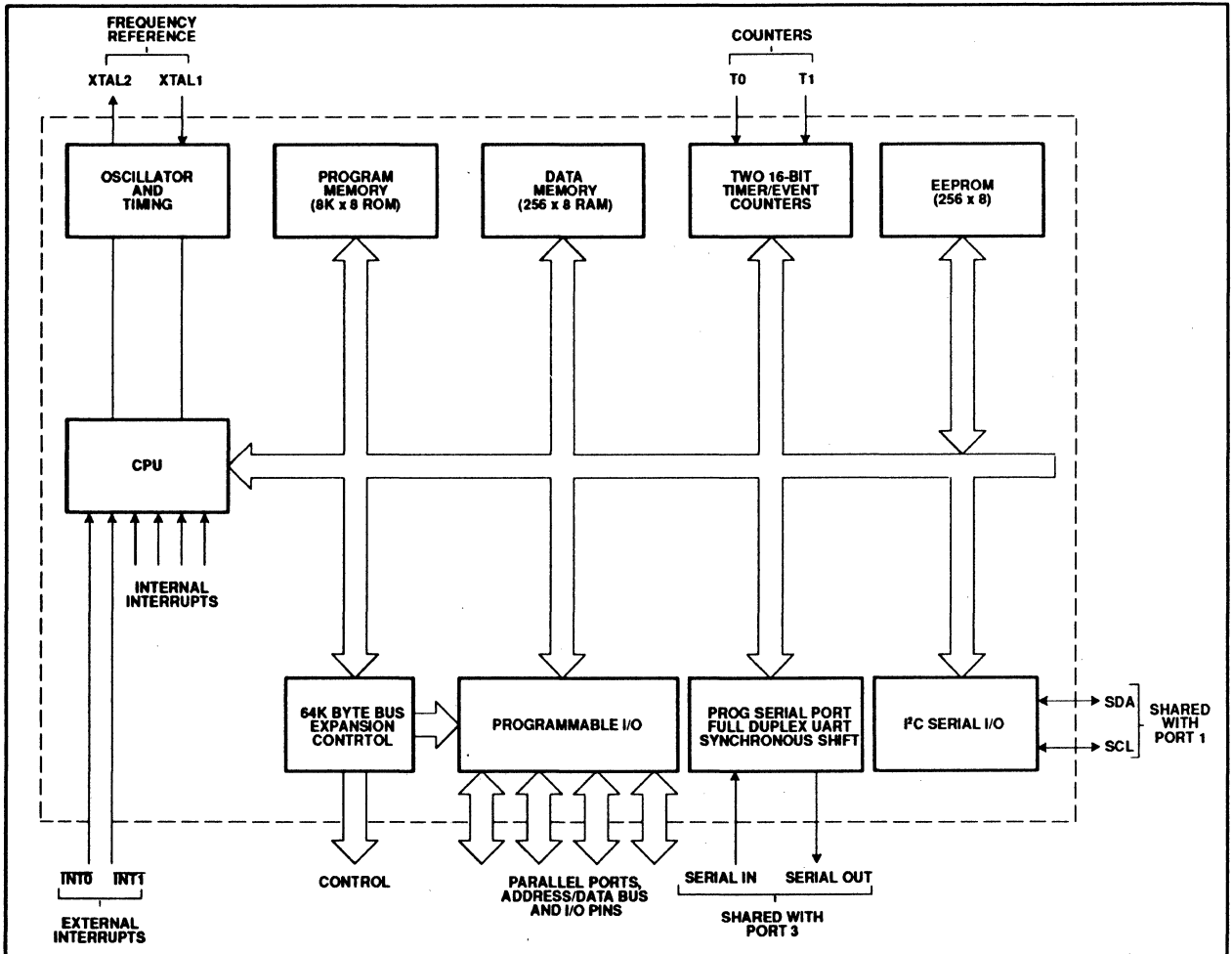
PHILIPS

80C/83C851 – CMOS Single-Chip, 8-Bit Microcontroller w/ On-Chip EEPROM

FEATURES

- 80C51 based architecture
 - 4k x 8 ROM
 - 128 x 8 RAM
 - Two 16-bit counter/timers
 - Full duplex serial channel
 - Boolean processor
- Non-volatile 256 x 8-bit EEPROM (electrically erasable programmable read only memory)
- On-chip voltage multiplier for erase/write
- 10,000 erase/write cycles per byte
- 10 years non-volatile data retention
- Infinite number of read cycles
- User selectable security mode
- Block erase capability
- Mask-programmable ROM code protection
- Memory addressing capability
 - 64k ROM and 64k RAM
- Power control modes:
 - Idle mode
 - Power-down mode
- CMOS and TTL compatible
- 1.2 to 12MHz
- Two temperature ranges
- Three package styles

BLOCK DIAGRAM



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PCD3346 – Single Chip 8-Bit Microcontroller

FEATURES

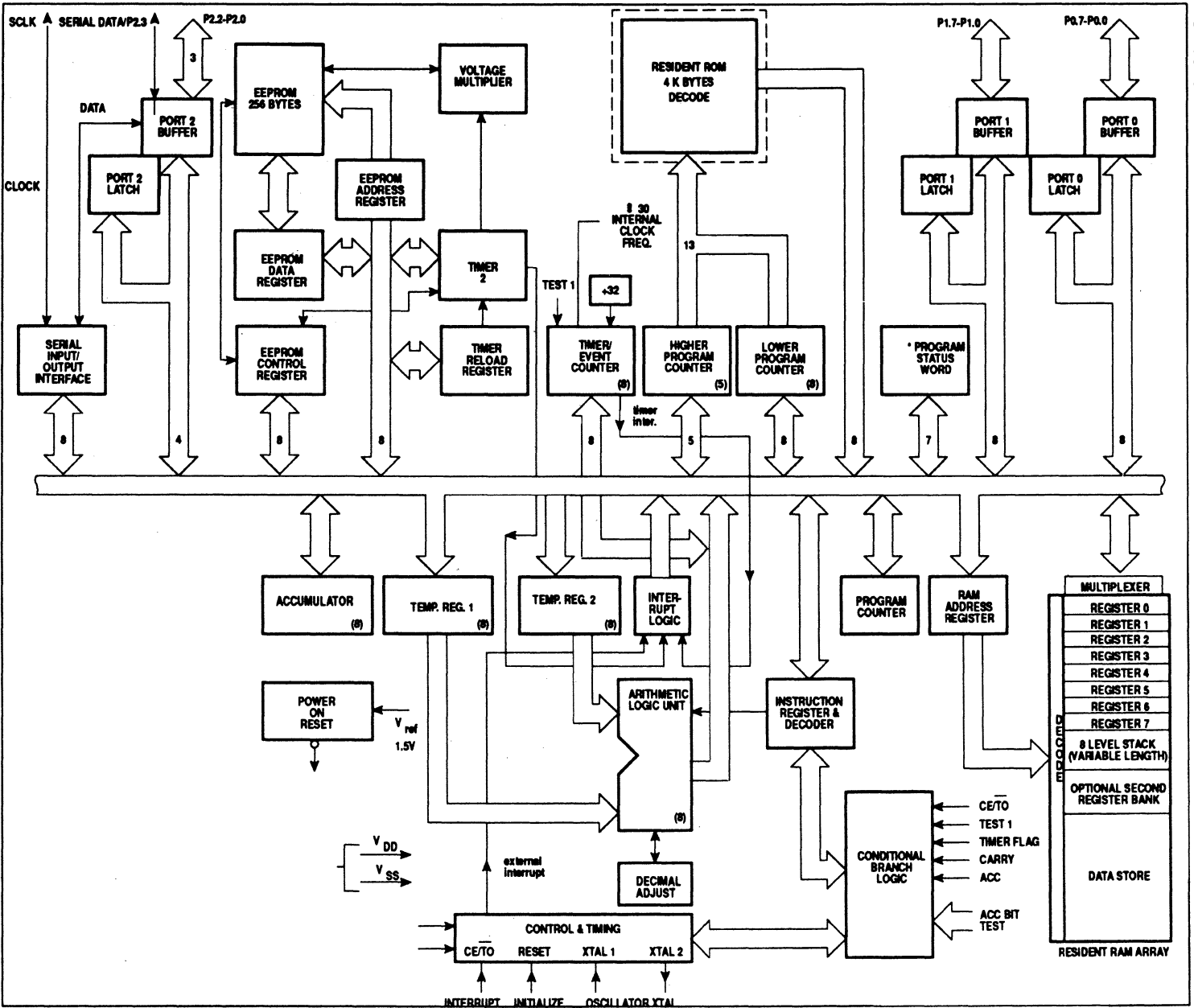
- 8-bit CPU, ROM, EEPROM, RAM, I/O in a single 28-lead DIL or SO package
- 4K ROM bytes
- 128 RAM bytes
- 256 bytes EEPROM
- 20 quasi-bidirectional I/O port lines
- 2 x 8-bit programmable timers
- Two test inputs: one of which is also the external interrupt input (CE/TO)
- Single-level vectored interrupts: external, timer/event counter, serial I/O data via an existing port line and clock via a dedicated line)
- Clock frequency 450kHz to 10MHz
- Over 80 instructions (based on MAB8048) all of 1 or 2 cycles
- Single supply voltage from 2.5V to 6.0V
- STOP and IDLE mode
- On-chip oscillator with output drive capability for peripherals (e.g. PCD3312 DTMF generator)
- Individual mask configuration of all port lines for: pull-up, push-pull or open drain
- Power-on-reset circuit and low supply voltage detection
- Individual mask selection of reset state for all ports
- Operating temperature range: -25 to +70°C

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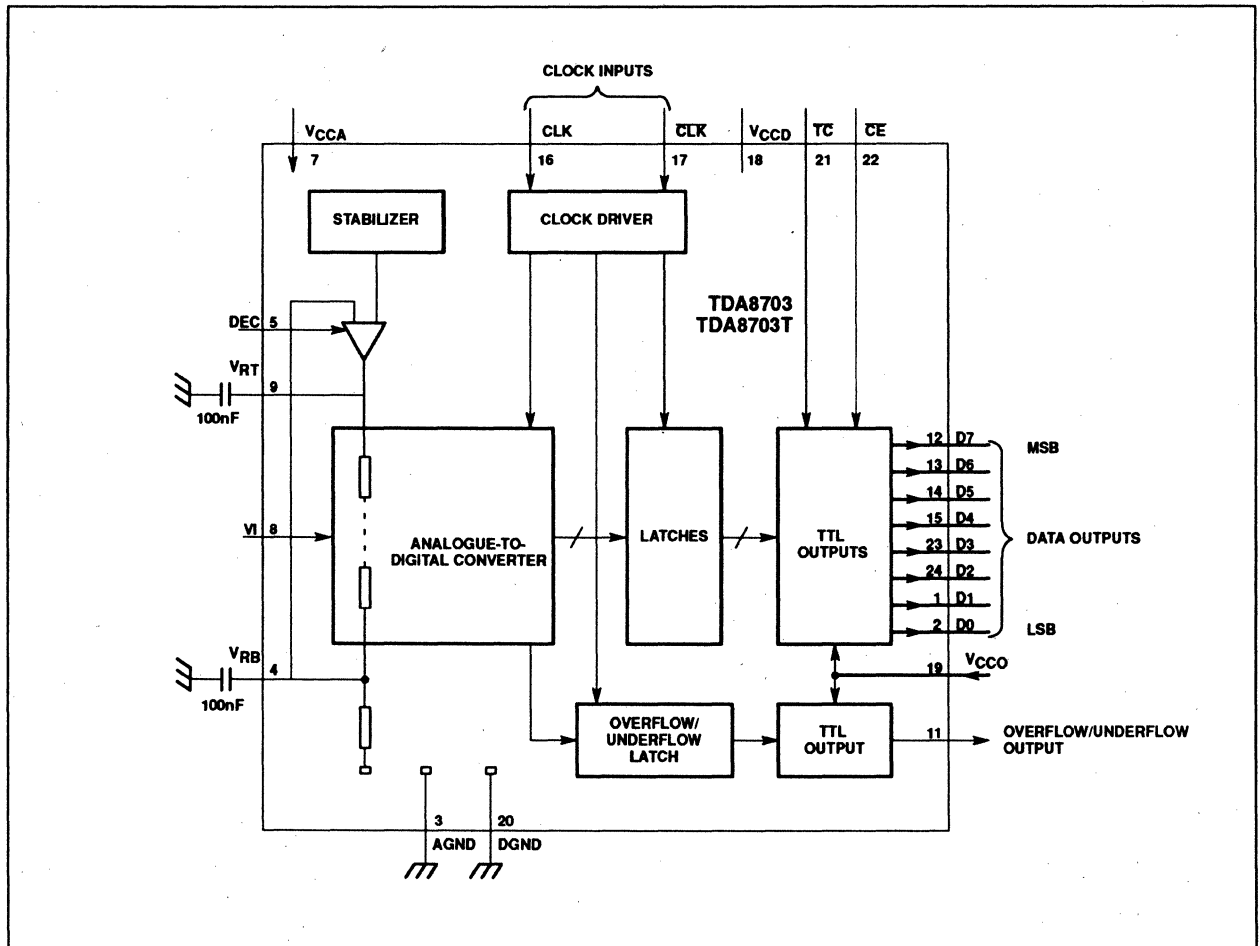
TDA8703/TDA8703T – 8-Bit High-Speed Analog-to-Digital Converter

FEATURES

- 8-bit resolution
- Sampling rate up to 40MHz
- High signal-to-noise ratio over a large analog input frequency range (7.1 effective bits at 4.43MHz full-scale input)
- Binary or two's complement 3-state TTL outputs
- Overflow/underflow 3-state TTL output
- TTL compatible digital inputs
- Low-level AC clock input signal allowed
- Internal reference voltage generator
- Power dissipation only 290mW (typical)
- Low analog input capacitance, no buffer amplifier required
- No sample and hold circuit required

BLOCK DIAGRAM

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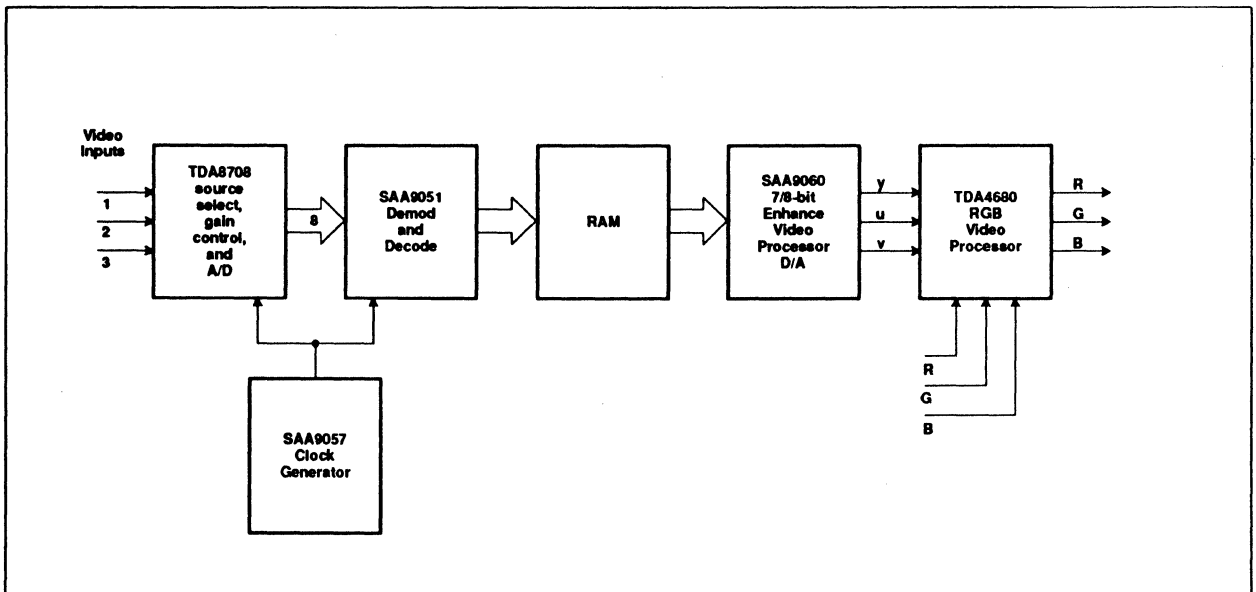
PHILIPS

Video Digital Signal Processing Chip Set

FEATURES

- All operations based upon a sampling frequency of 13.5MHz providing: full adaptability to all transmission standards capability for memory-based features
- Separate chrominance and luminance input (Y/C)
- CVBS Input for standard application
- CVBS throughput capability for SECAM application
- Luminance signal processing for all TV standards (PAL, NTSC, SECAM, B/W)
- Horizontal and vertical sync detection for all standards
- Chrominance signal processing for all quadrature amplitude modulated color-carrier signals
- Requires only one crystal
- I²C bus controlled
- User-programmable aperture correction (horizontal peaking)
- Compatible with memory-based features (line-locked clock)
- Cross-color reduction by chrominance comb-filtering (NTSC)
- Wide range hue control

BLOCK DIAGRAM



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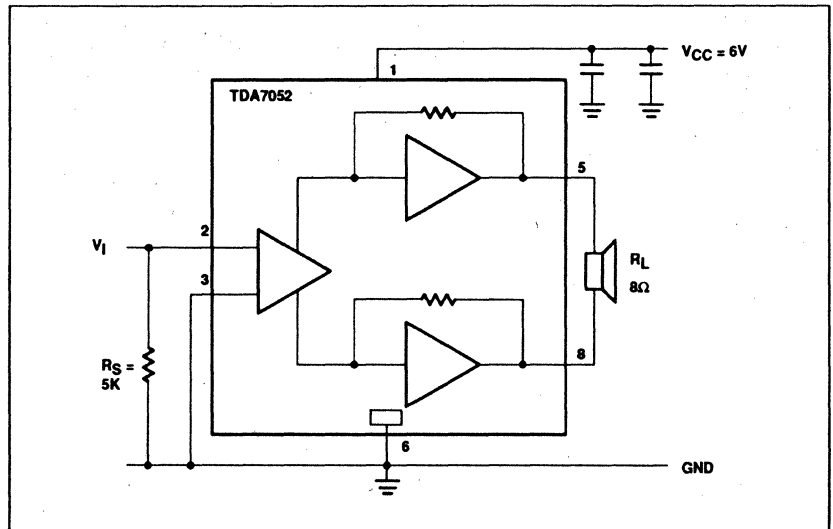
PHILIPS

TDA7052 – 1 Watt Low Voltage Audio Power Amplifier

FEATURES

- No external components
- No switch-on or switch-off clicks
- Good overall stability
- Low power consumption
- No external heatsink required
- Short-circuit proof

LOGIC DIAGRAM



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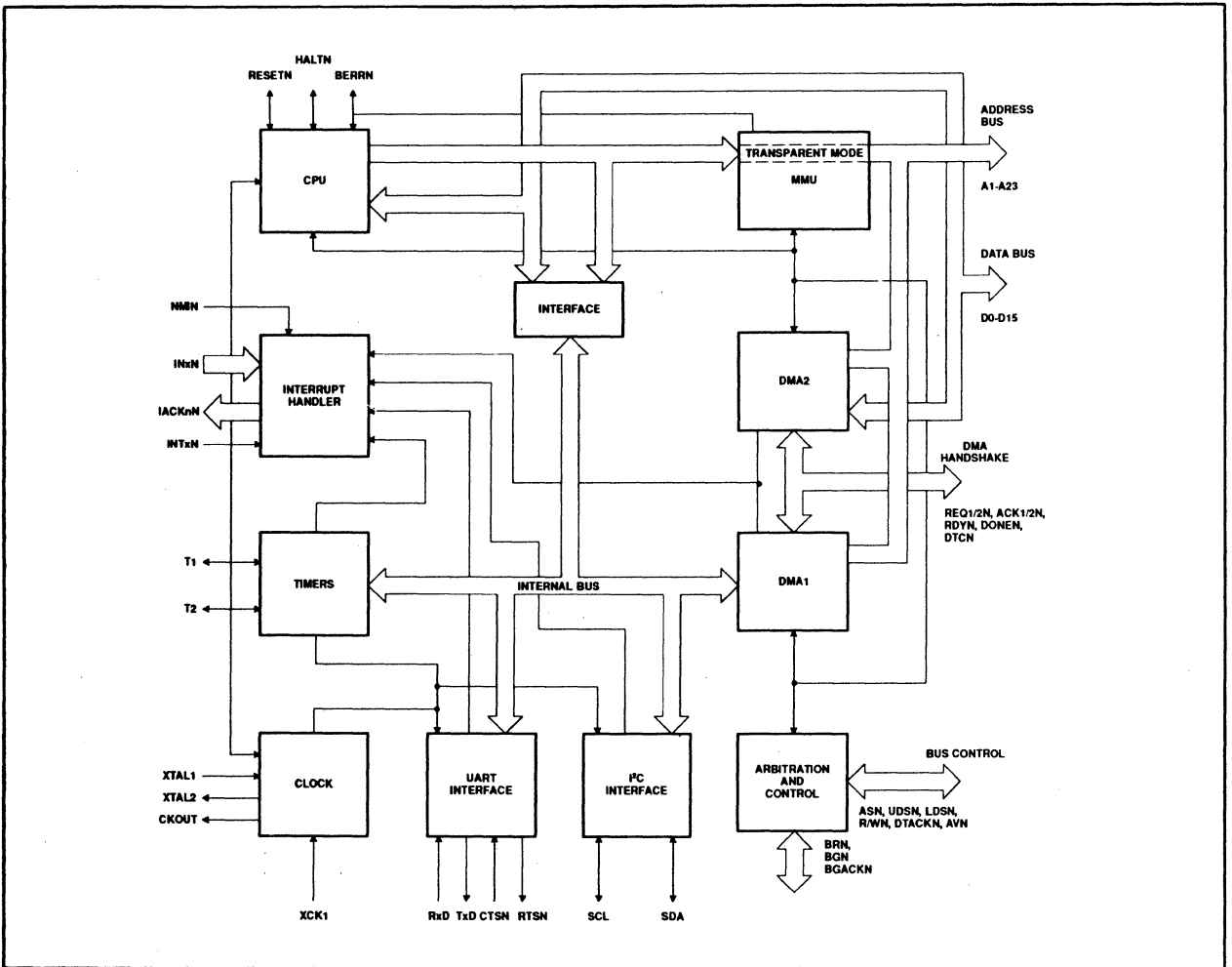
PHILIPS

SCC68070 – 16-Bit Integrated Microprocessor

FEATURES

- CMOS technology
- 32-bit internal structure
- Enhanced bus error handling
- 4 decoded Interrupt Inputs
- 2 programmable Interrupt Inputs
- Decoded Interrupt acknowledge
- Built-in clock generator – maximum 30MHz crystal
- On-chip MMU; supporting virtual memory
- 2-channel DMA controller
- I²C serial bus interface
- 16-bit timer/counter
- Two 16-bit match/count/capture registers
- Fully 68000 object code compatible
- Bus interface similar to 68000
- 56 powerful instruction types
- 5 basic data types
- 16Mbyte addressing range
- 14 addressing modes
- Memory mapped I/O
- Vectored and auto-vectored interrupts
- 7 internal interrupt levels
- Maximum internal clock frequency: 15MHz
- 84-pin PLCC package

BLOCK DIAGRAM



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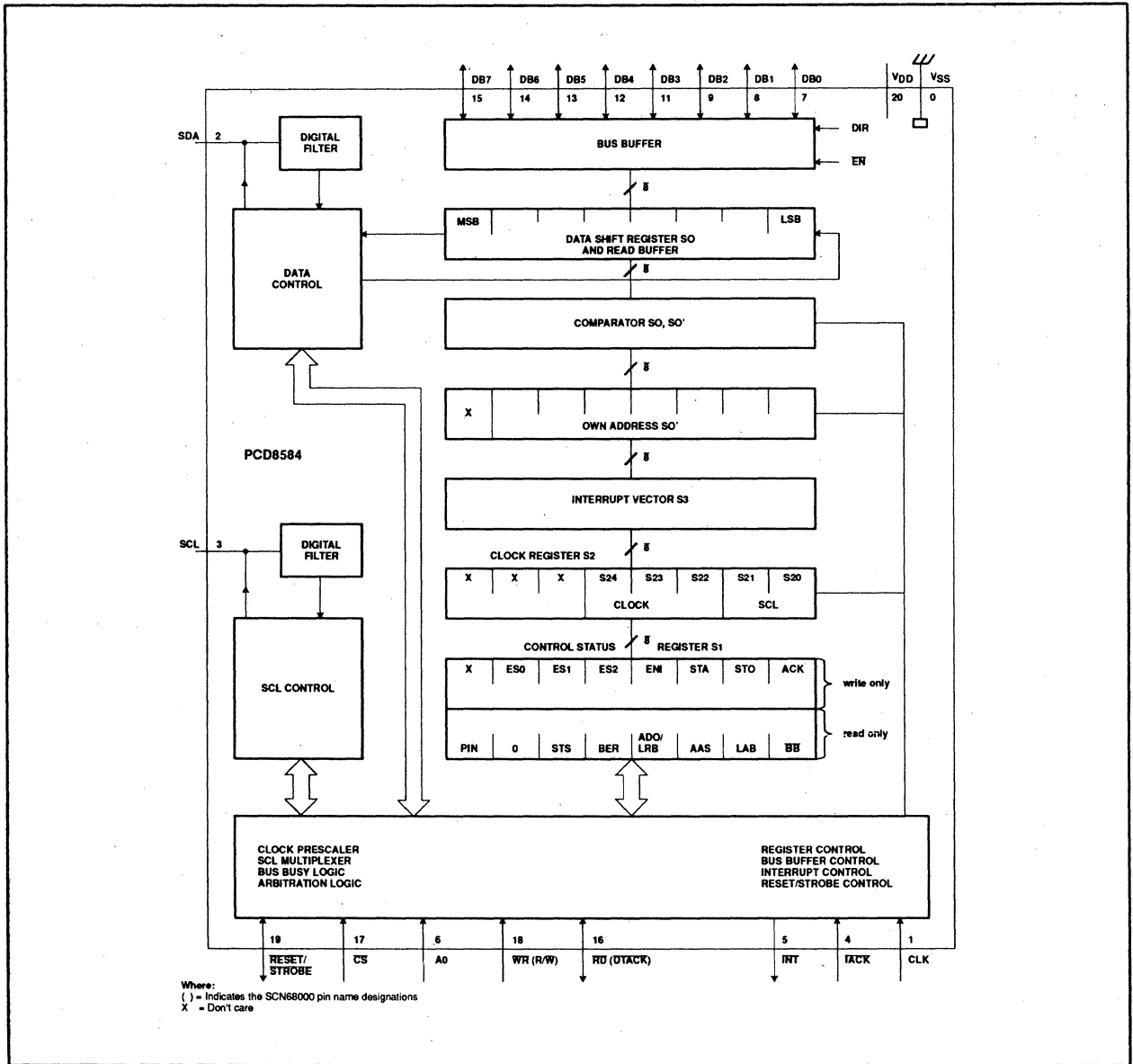
PHILIPS

PCD8584 – I²C-Bus Controller

FEATURES

- Parallel-bus/I²C-bus protocol converter
- Compatible with most parallel-bus processors including MAB8049, MAB8051, SCN68000 and Z80
- Automatic selection of bus interface
- Programmable interrupt vector
- Multi-master capability
- I²C-bus monitor mode
- Long-distance mode
- Operating supply voltage 4.5 to 5.5V
- Operating temperature range -20 to 70°C

PCD8584 – BLOCK DIAGRAM



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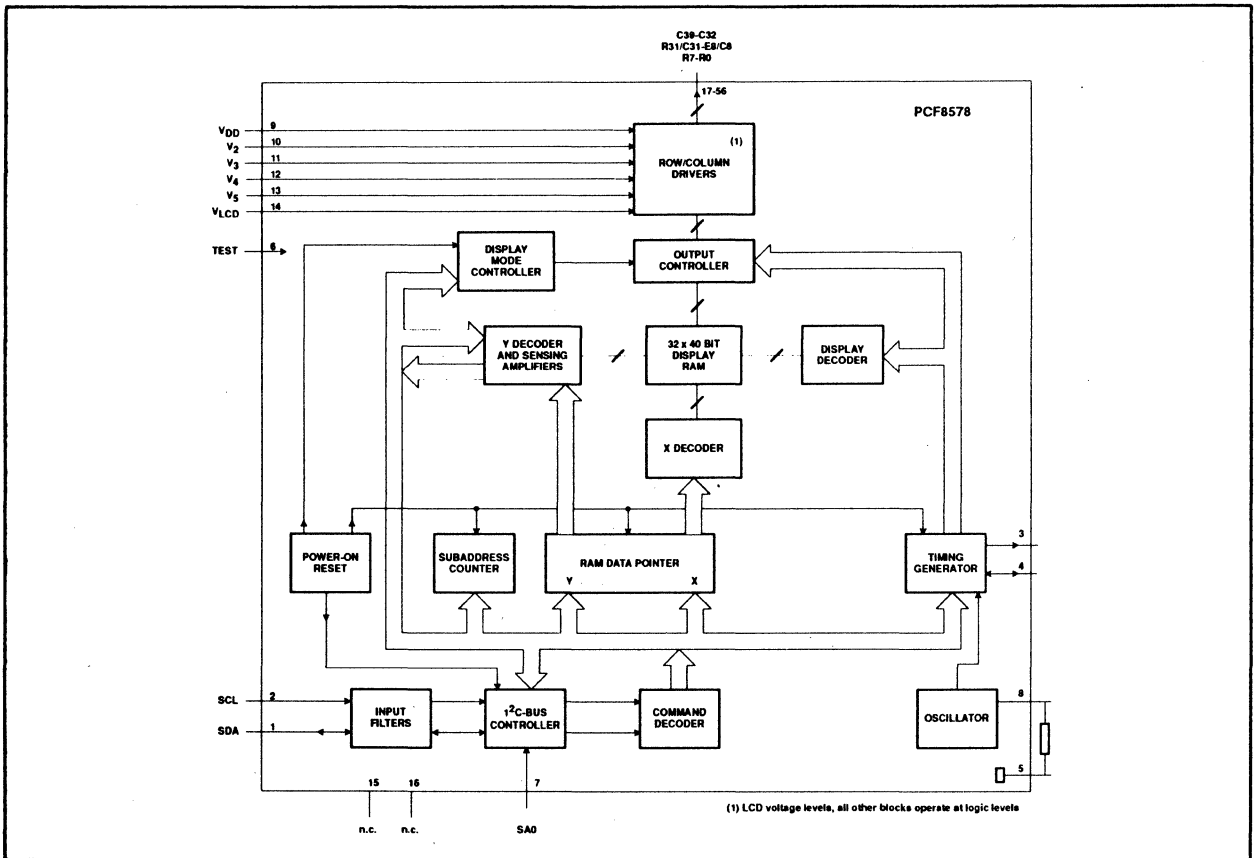
PHILIPS

PCF8578 – LCD Row/Column Driver for Dot Matrix Graphic Displays

FEATURES

- Single chip LCD controller/driver
- Stand-alone or may be used with up to 32 PCF8579s (40,960 dots possible)
- 40 driver outputs, configurable as 32/8, 24/16, 16/24 or 8/32 rows/columns
- Selectable multiplex rates; 1:8, 1:16, 1:24 or 1:32
- Externally selectable bias configuration, 5 or 6 levels
- 1280-bit RAM for display data storage and scratch pad
- Display memory bank switching
- Auto-incremented data loading across hardware subaddress boundaries (with PCF8579)
- Provides display synchronization for PCF8579
- On-chip oscillator, requires only 1 external resistor
- Power-on reset blanks display
- Logic voltage supply range 2.5V to 6.0V
- Maximum LCD supply voltage 9V
- Low power consumption
- I²C-bus interface
- TTL/CMOS compatible
- Compatible with most microcontrollers
- Optimized pinning for single plane wiring in multiple device applications (with PCF8579)
- Space saving 56-lead plastic mini-pack
- Compatible with chip-on-glass technology

BLOCK DIAGRAM



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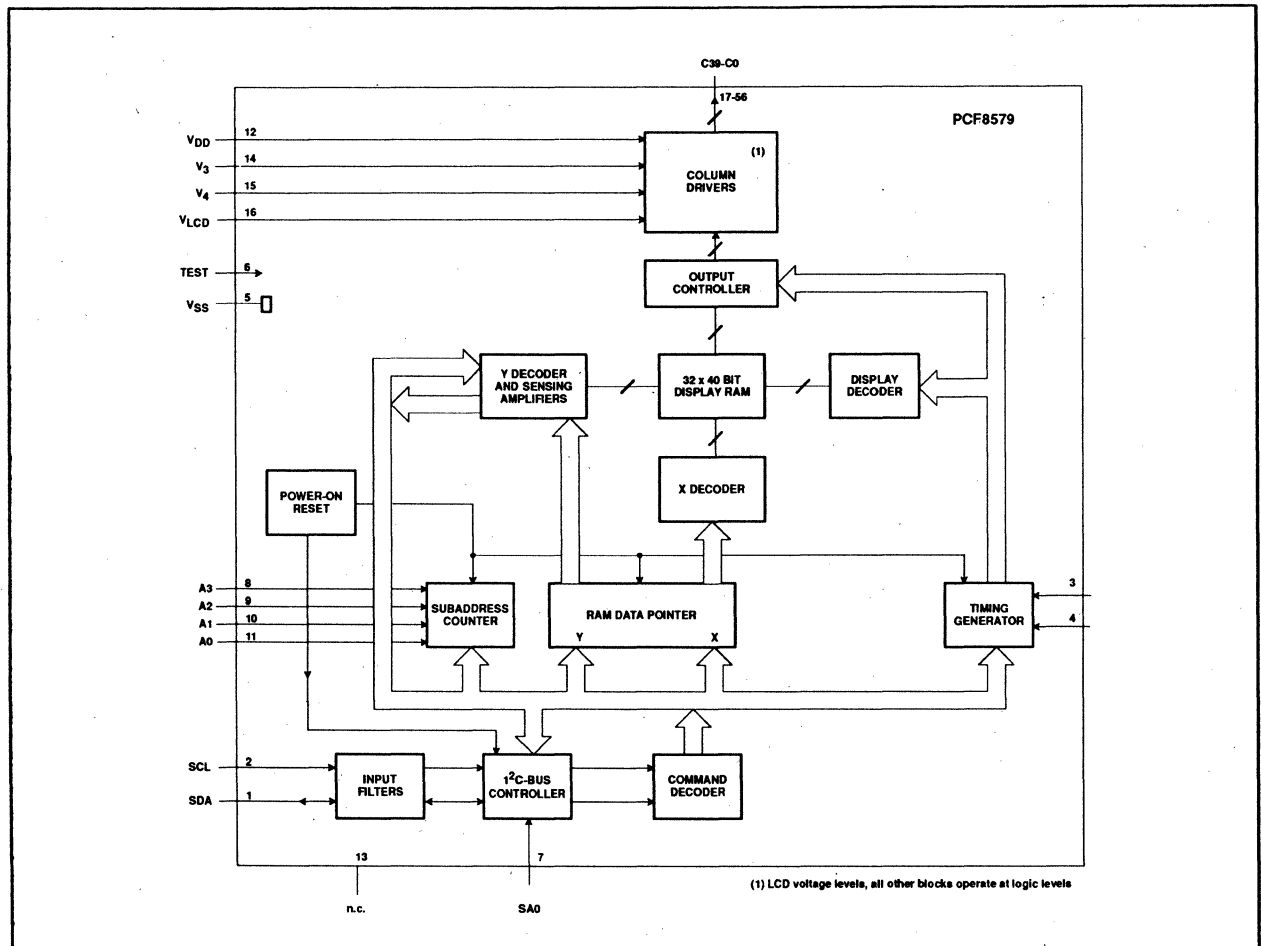
PHILIPS

PCF8579 – LCD Row/Column Driver for Dot Matrix Graphic Displays

FEATURES

- LCD column driver
- Used in conjunction with the PCF8578, this device forms part of a chip set capable of driving up to 40,960 dots
- 40 column outputs
- Selectable multiplex rates; 1:8, 1:16, 1:24 or 1:32
- Externally selectable bias configuration, 5 or 6 levels
- Easily cascadable for large applications (up to 32 devices)
- 1280-bit RAM for display data storage
- Display memory bank switching
- Auto-incremented data loading across hardware subaddress boundaries
- Power-on reset blanks display
- Logic voltage supply range 2.5V to 6.0V
- Maximum LCD supply voltage 9V
- Low power consumption
- I²C-bus interface
- TTL/CMOS compatible
- Compatible with most microcontrollers
- Optimized pinning for single plane wiring in multiple device applications
- Space saving 56-lead plastic mini-pack
- Compatible with chip-on-glass technology

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PLUS16R8D/-7 SERIES – Pal[®]-Type Devices 16L8, 16R8, 16R6, 16R4

DESCRIPTION

The Signetics PLUS16XX family consists of ultra high-speed 7.5ns and 10ns versions of Series 20 PAL devices.

The PLUS16XX family is 100% functional and pin-compatible with the 16L8, 16R8, 16R6, and 16R4 Series devices.

The sum of products (AND-OR) architecture is comprised of 64 programmable AND gates and 8 fixed OR gates. Multiple bidirectional pins provide variable input/output pin ratios. Individual 3-State control of all outputs and registers with feedback (R8, R6, R4) is also provided. Proprietary designs can be protected by programming the security fuse.

The PLUS16R8, R6, and R4 have D-type flip-flops which are loaded on the Low-to-High transition of the clock input.

In order to facilitate state machine design and testing, a power-up reset function has

been incorporated into these devices to reset all internal registers to active-Low after a specific period of time.

The Signetics State-of-the-Art oxide isolation Bipolar fabrication process is employed to achieve high-performance operation.

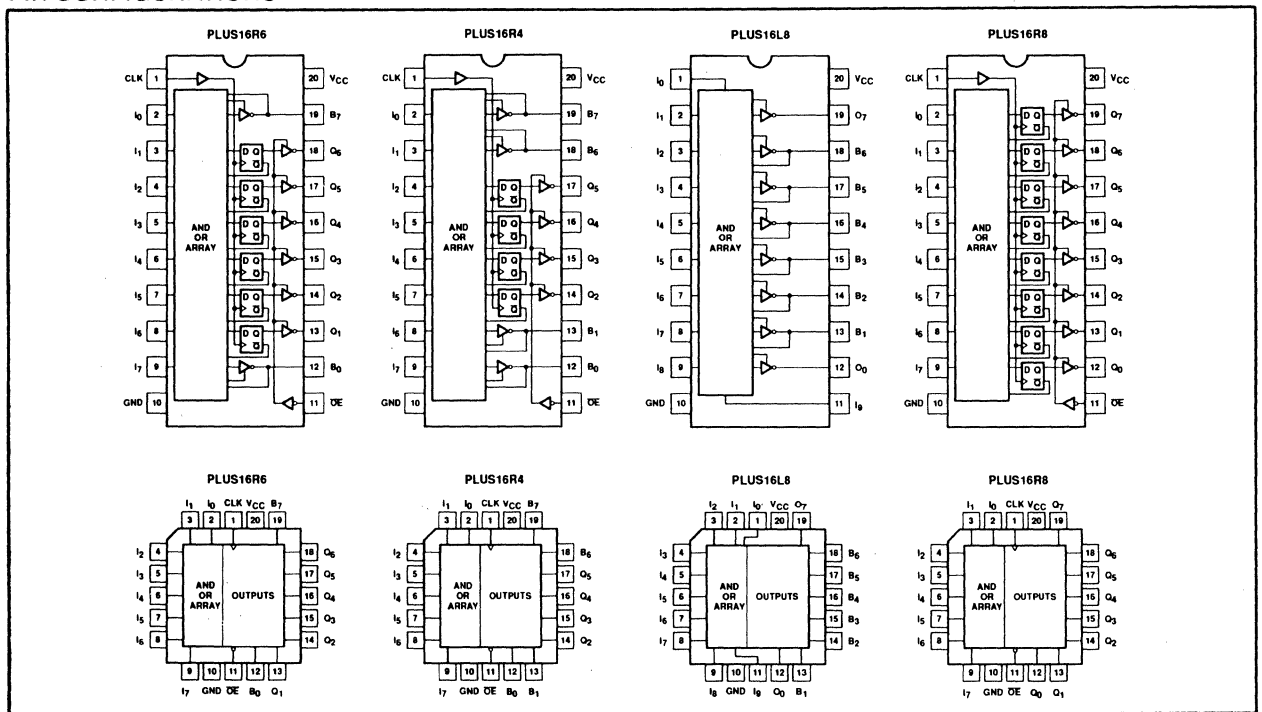
The PLUS16XX family of devices are field programmable, enabling the user to quickly generate custom patterns using standard programming equipment. See the programmer chart for qualified programmers.

The AMAZE software package from Signetics supports easy design entry for the PLUS16XX series as well as other PLD devices from Signetics. The PLUS16XX series are also supported by other standard CAD tools for PAL-type devices.

FEATURES

- Ultra high-speed
 - $t_{PD} = 7.5ns$ and $f_{MAX} = 74MHz$ for the PLUS16R8-7 Series
 - $t_{PD} = 10ns$ and $f_{MAX} = 60 MHz$ for the PLUS16R8D Series
- 100% functionally and pin-for-pin compatible with industry standard 20-pin PAL ICs
- Power-up reset function to enhance state machine design and testability
- Design support provided via AMAZE and other CAD tools for Series 20 PAL devices
- Field-programmable on industry standard programmers
- Security fuse
- Individual 3-State control of all outputs

PIN CONFIGURATIONS



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PLUS20R8D/-7 SERIES – Pal®-Type Devices 20L8, 20R8, 20R6, 20R4

DESCRIPTION

The Signetics PLUS20XX family consists of ultra high-speed 7.5ns and 10ns versions of Series 24 PAL devices.

The PLUS20XX family is 100% functional and pin-compatible with the 20L8, 20R8, 20R6, and 20R4 Series devices.

The sum of products (AND-OR) architecture is comprised of 64 AND gates and 8 fixed OR gates. Multiple bidirectional pins provide variable input/output pin ratios. Individual 3-State control of all outputs and registers with feedback (R8, R6, R4) is also provided. Proprietary designs can be protected by programming the security fuse.

The PLUS20R8, R6, and R4 have D-type flip-flops which are loaded on the Low-to-High transition of the clock input.

In order to facilitate state machine design and testing, a power-up reset function has

been incorporated into these devices to reset all internal registers to active-Low after a specific period of time.

The Signetics State-of-the-Art oxide isolation Bipolar fabrication process is employed to achieve high-performance operation.

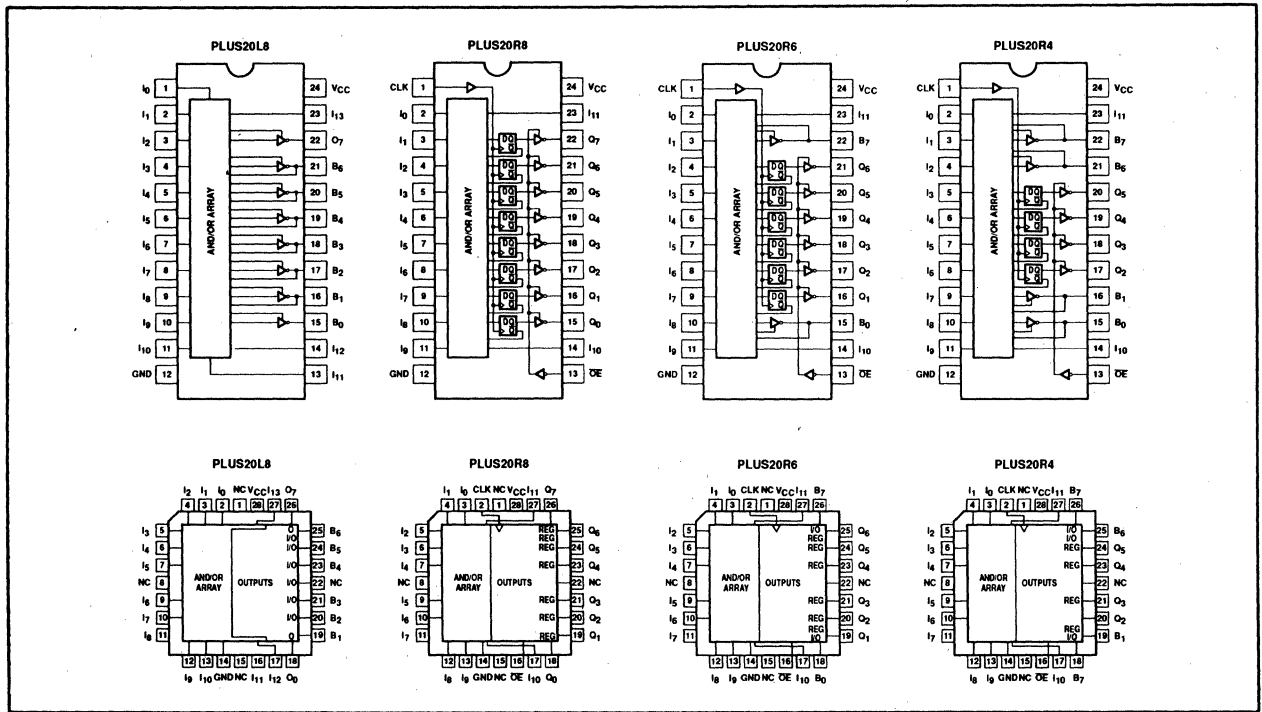
The PLUS20XX family of devices are field programmable, enabling the user to quickly generate custom patterns using standard programming equipment. See the programmer chart for qualified programmers.

The AMAZE software package from Signetics supports easy design entry for the PLUS20XX series as well as other PLD devices from Signetics. The PLUS20XX series are also supported by other standard CAD tools for PAL-type devices.

FEATURES

- Ultra high-speed
 - $t_{PD} = 7.5ns$ and $f_{MAX} = 74MHz$ for the PLUS20R8-7 Series
 - $t_{PD} = 10ns$ and $f_{MAX} = 60MHz$ for the PLUS20R8D Series
- 100% functionally and pin-for-pin compatible with industry standard 24-pin PAL ICs
- Power-up reset function to enhance state machine design and testability
- Design support provided via AMAZE and other CAD tools for Series 24 PAL devices
- Field-programmable on industry standard programmers
- Security fuse
- Individual 3-State control of all outputs

PIN CONFIGURATIONS



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PHILIPS

PLC18V8Z35/ PLC18V8ZI

Zero Standby Power Universal PAL[®]-type Devices

Signetics Programmable Logic

DESCRIPTION

The PLC18V8Z is a universal PAL-type device featuring high performance and virtually zero-standby power for power sensitive applications. It is a reliable and user-configurable substitute for discrete TTL/CMOS logic. While compatible with TTL and HCT logic, the PLC18V8Z can also replace HC logic over the V_{CC} range of 4.5 to 5.5V.

The PLC18V8Z is a two-level logic element comprised of 10 inputs, 74 AND gates (product terms) and 8 output Macro cells.

FEATURES

- 20-pin Universal Programmable Array Logic
- Virtually Zero-Standby-power
- Functional replacement for Series 20 PAL devices
 - $I_{OL} = 24mA$
- High-performance CMOS EPROM cell technology
 - Erasable
 - Reconfigurable
 - 100% testable
- 35ns Maximum propagation delay, 40ns Industrial
- Up to 18 Inputs and 8 input/output macro cells
- Programmable output polarity
- Power-up reset on all registers
- Register Preload capability
- Synchronous Preset/Asynchronous Reset
- Design support provided using AMAZE software development package and other CAD tools for PLDs

Each output features an "Output Macro Cell" which can be individually configured as a dedicated input, a combinatorial output, or a registered output with internal feedback. As a result, the PLC18V8Z is capable of emulating all common 20-pin PAL devices to reduce documentation, inventory, and manufacturing costs.

A power-up reset function and a Register Preload function have been incorporated in the PLC18V8Z architecture to facilitate state machine design and testing.

With a standby current of less than 100 μ A and active power consumption of 1.5mW/MHz, the PLC18V8Z is ideally suited for power sensitive applications in battery operated/backed portable instruments and computers.

The PLC18V8Z is also processed to industrial requirements for operation over an extended temperature range of -40°C to +85°C and supply voltage of 4.5V to 5.5V.

Ordering information can be found in the Ordering Information table.

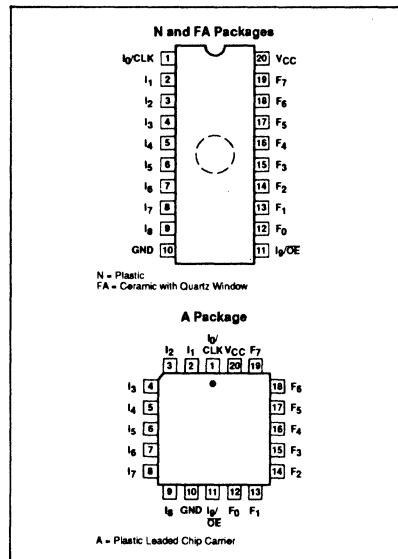
- Available in 300mil-wide DIP with quartz window, plastic DIP (OTP) or PLCC (OTP)

APPLICATIONS

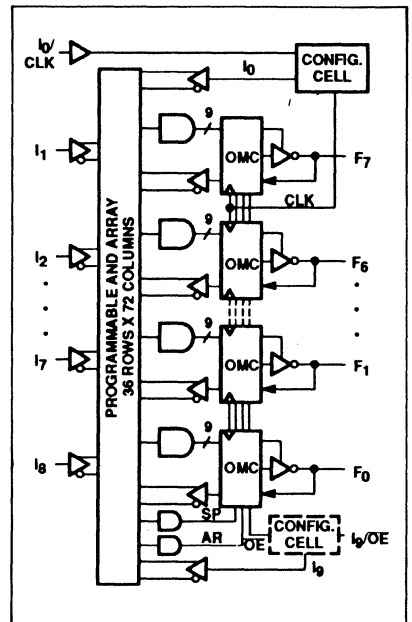
- Battery powered instruments

- Laptop and pocket computers
- Industrial control
- Medical Instruments
- Portable communications equipment

PIN CONFIGURATIONS



FUNCTIONAL DIAGRAM



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PLHS502

Programmable Macro Logic

Signetics Programmable Logic

DESCRIPTION

The Signetics PML family of PLDs provides the capability to create fast and cost effective solutions for a number of microprocessor interface and control applications. PML incorporates the unique feature of a programmable NAND structure as the basis of its architecture.

The PLHS502 is a high-density Bipolar Programmable Macro Logic Device. The folded NAND array combined with embedded I/O flip-flops allows for both timing control, wide decoders, multiplexers, and system input and output bus latches to be combined onto one device.

FEATURES

- Programmable Macro Logic
- Full connectivity
- Delay per internal NAND function = 6.5ns
- Maximum operating frequency = 40MHz (Internal flip-flop)
- SNAP development system eases design
 - Supports third-party schematic entry formats
 - Macro library
 - Versatile netlist format for design portability
 - Logic, timing, and fault simulation
- TTL compatible
- Power dissipation = 1.6W
- Security fuse allows protection of proprietary designs
- Testable in unprogrammed state

ARCHITECTURE

The core of the PLHS502 is a programmable fuse array of 64 NAND gates and 16 buried flip-flops. The output of each gate and flip-flop folds back upon itself and all other NAND gates and flip-flops. In this manner, full connectivity of all logic functions is achieved in the PLHS502. Any logic function can be created within the core of the device without wasting valuable I/O pins. Furthermore, a speed advantage is acquired by implementing multi-level logic within a fast internal core without incurring any delays from the I/O buffers.

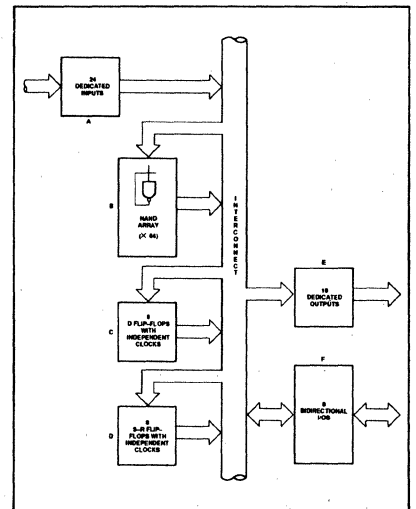
STRUCTURE

- NAND gate based architecture
 - 64 foldback NAND terms
- 80 additional logic terms
- 128 Inputs per logic term
- 20 dedicated inputs
- 4 programmable input/clock inputs
- 8 independent clocks
 - 4 from input/clock pins
 - 4 from NAND array
- 8 bidirectional I/Os
- 16 dedicated outputs
 - 8 active-High outputs
 - 4 outputs with programmable polarity
 - 4 3-State outputs with programmable polarity
- 16 buried flip-flops
 - 8 D type
 - 8 S-R type

DESIGN SECURITY

The PLHS502 has a programmable security fuse that controls the access to the data programmed in the device. By using this programmable feature, proprietary designs implemented in the device cannot be copied or retrieved.

PLHS502 FUNCTIONAL BLOCK DIAGRAM



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FEATURES

- Full connectivity
- Scan test
- Power down mode
- Power on reset
- 100% testable

STRUCTURE

- 258 inputs per NAND gate
- 112 possible foldback NAND gates:
 - 96 internal NAND
 - 16 from the I/O macros
- 114 additional logic terms
- 53 possible inputs
 - 29 dedicated inputs
 - 24 bidirectional I/Os
- 24 bidirectional pins
- 52 flip-flops
- 24 possible outputs (8 with programmable polarity)
- 21 independent clocks
- 20 Buried JK-type flip-flops with fold-back (JKFFs):
 - 10 JKFFs with one shared preset signal and one shared clocked signal originating from the clock array.
 - 10 JKFFs with 10 independent clock signals originating from the clock array and 10 independent clear signals
- Bypassable Input D-type flip-flop (DFFs)/Combinatorial Inputs:
 - 16 DFFs/combinatorial inputs
 - DFFs clocked in two groups of eight
 - DFFs not bypassed in unprogrammed state

- High-Speed and Standard versions
 - Logic, timing, and fault simulation
- SNAP development system
 - Supports third-party schematic entry formats
 - Macro library
 - Versatile netlist format for design portability
- Inputs/bypassable D-type flip-flop outputs/foldback NAND gates:
 - 16 output DFFs/combinatorial inputs/outputs
 - DFFs clocked in two groups of eight
 - DFFs not bypassed in unprogrammed state
 - The DFF can be used as an internal DFF or an internal foldback NAND gate.
- Combinatorial inputs:
 - 9 dedicated inputs to the NAND array
 - 3 inputs optional to NAND array and/or clock array
 - 1 input optional to NAND array and/or clock array, and/or clock of Input D Flip-Flops (Group B)
- Separate clock array:
 - Separate clock array for JKFFs clock inputs
 - 4 inputs to clock array originate from NAND array
 - 4 inputs directly from input pins
 - 10 inputs from Q outputs of JKFFs with clear
- Dedicated clocks:
 - One dedicated clock for input DFFs (Group A)
 - Two dedicated clocks for output DFFs
- Scan test feature:
 - Scan chain is implemented through the 20 buried JKFFs and 16 DFFs
 - Pins SCI, SCM, and CKE1 are used to operate the scan test
- Power down mode
 - Dedicated pin (PD) freezes the circuit when brought to logic "1". The circuit remains in the same state prior to the logic "0" to logic "1" transition of the "PD" pin.
 - When in the power down mode, the SCI pin acts as the 3-State pin for the 24 outputs.
- Power on reset:
 - All flip-flops (16 input DFFs, 20 buried JKFFs, and 16 output DFFs) are reset to logic "0" after power on.

PROPAGATION DELAYS

- Delay per internal NAND gate
 - = 12ns (typ)
 - = 15ns (typ)
- Maximum operating frequency (internal flip-flops)
 - = 50MHz (High-Speed)
 - = 33MHz (Standard)

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PLUS405-37/ -45

Application Specific Products
• Series 28

Field-Programmable Logic Sequencers (16 × 64 × 8)

Signetics Programmable Logic
Product Specification

DESCRIPTION

The PLUS405 devices are bipolar, programmable state machines of the Mealy type. Both the AND and the OR array are user-programmable. All 64 AND gates are connected to the 16 external dedicated inputs ($I_0 - I_{15}$) and to the feedback paths of the 8 on-chip State Registers ($Q_{P0} - Q_{P7}$). Two complement arrays support complex IF-THEN-ELSE state transitions with a single product term (input variables C_0, C_1).

All state transition terms can include True, False and Don't Care states of the controlling state variables. All AND gates are merged into the programmable OR array to issue the next-state and

next-output commands to their respective registers. Because the OR array is programmable, any one or all of the 64 transition terms can be connected to any or all of the State and Output Registers.

All state ($Q_{P0} - Q_{P7}$) and output ($Q_{F0} - Q_{F7}$) registers are edge-triggered, clocked J-K flip-flops, with Asynchronous Preset and Reset options. The PLUS405 architecture provides the added flexibility of the J-K toggle function which is indeterminate on S-R flip-flops. Each register may be individually programmed such that a specific Preset-Reset pattern is initialized when the initialization pin is raised to a logic level "1". This feature allows the state ma-

chine to be asynchronously initialized to known internal state and output conditions prior to proceeding through a sequence of state transitions. Upon power-up, all registers are unconditionally preset to "1". If desired, the initialization input pin (INIT) can be converted to an Output Enable (OE) function as an additional user-programmable feature.

Availability of two user-programmable clocks allows the user to design two independently clocked state machine functions consisting of four state and four output bits each.

Order codes are listed in the Ordering Information Table.

Signetics/Philips Components

FEATURES

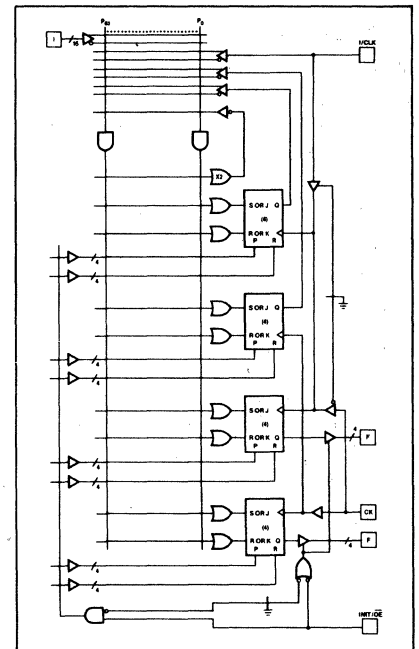
- 50 and 58.8MHz clock rates
- $f_{MAX} = 37$ and 45MHz ($1/(t_{IS1} + t_{CKO1})$)
- Functional superset of PLS105/105A
- Field-programmable (Ti-W fusible link)
- 16 input variables
- 8 output functions
- 64 transition terms
- 8-bit State Register
- 8-bit Output Register
- 2 transition Complement Array terms
- Multiple clocks*
- Programmable Asynchronous Initialization or Output Enable
- Power-on preset of all registers to "1"

- "On-chip" diagnostic test mode features for access to state and output registers
- 950mW power dissipation (typ.)
- TTL compatible
- J-K or S-R flip-flop functions
- Automatic "Hold" states
- 3-State outputs

APPLICATIONS

- Interface protocols
- Sequence detectors
- Peripheral controllers
- Timing generators
- Sequential circuits
- Elevator controllers
- Security locking systems
- Counters
- Shift registers

FUNCTIONAL DIAGRAM



* Refer to AC Specifications for clock and operating frequencies when using multiple clocks.

January 23, 1989

Signetics

Philips Components



PHILIPS

PLC415-16

CMOS Programmable Logic Sequencer (17 × 68 × 8)

DESCRIPTION

The PLC415-16 PLD is a CMOS Programmable Logic Sequencer of the Mealy type. The PLC415-16 is a pin-for-pin compatible, functional superset of the PLS105 and PLUS405 Bipolar Programmable Logic Sequencer devices.

The PLC415 is ideally suited for high density, power sensitive controller functions. The Power Down feature provides true CMOS standby power levels of less than 100µA. The EPROM-based process technology supports operating frequencies of 16 to 20MHz. The PLC415-16 has been designed to accept both CMOS and

TTL input levels to facilitate logic integration in almost any system environment.

The PLC415 architecture has been tailored for state machine functions. Both arrays are programmable, thus providing full interconnectability. Any one or all of the 64 AND transition terms can be connected to any (or all) of the 8 buried state and 8 output registers.

Two clock sources enable the design of 2 state machines on one chip. The J-K flip-flops provide the added flexibility of the toggle function which is indeterminate on S-R flip-flops. The

programmable Initialization feature supports asynchronous initialization of the state machine to any user defined pattern. Separate INIT functions and Output Enable functions are controllable either from the array or from an external pin.

The unique Complement Array feature supports complex ELSE transition statements with a single product term. The PLC415-16 has 2 Complement Arrays which allows the user to design two independent complement functions. This is particularly useful if two state machines have been implemented on one chip.

FEATURES

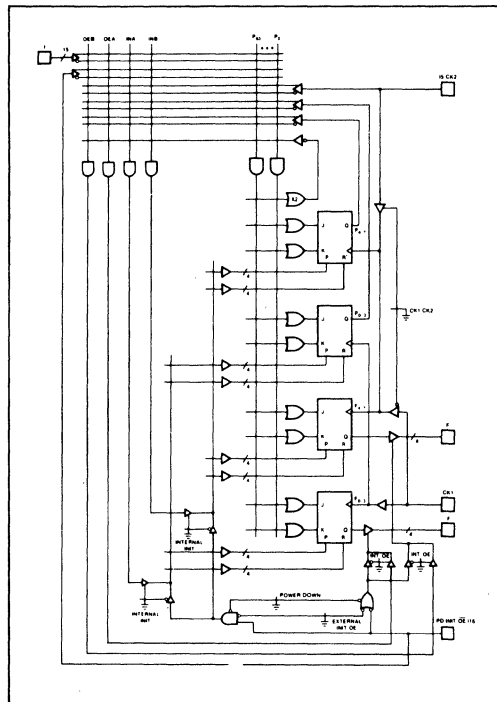
- Pin-for-Pin compatible, functional superset of PLS105/A and PLUS405 Logic Sequencers
- Zero standby power of less than 100µA (worst case)
 - Power dissipation at $f_{MAX} = 80mA$ (worst case)
- CMOS and TTL compatible
- Programmable asynchronous Initialization and OE functions
 - Controllable from AND Array or external source
- 17 Input variables
- 8 output functions
- 68 Product Terms
 - 64 transition terms
 - 4 control terms
- 8-bit State Register
- 8-bit Output Register
- 2 Transition Complement Arrays
- Multiple clocks
- Diagnostic test modes features for access to state and output registers
- Power-on preset of all registers to "1"
- J-K flip-flops
 - Automatic Hold states
- Security Fuse
- 3-State outputs

APPLICATIONS

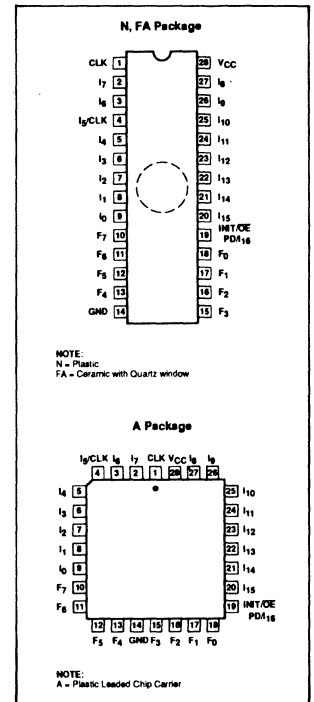
- Interface protocols
- Sequence detectors
- Peripheral controllers
- Timing generators

- Sequential circuits
- Elevator controllers
- Security locking systems
- Counters
- Shift Registers

FUNCTIONAL DIAGRAM



PIN CONFIGURATIONS



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PLC42VA12

CMOS Programmable Logic Sequencer (42 × 105 × 12)

DESCRIPTION

The new PLC42VA12 CMOS PLD from Signetics exhibits a unique combination of the two architectural concepts that revolutionized the PLD marketplace.

The Signetics unique Output Macro Cell (OMC) embodies all the advantages and none of the disadvantages associated with the "V" type Output Macro Cell devices. This new design, combined with

added functionality of two programmable arrays, represents a significant advancement in the configurability and efficiency of multi-function PLDs.

The most significant improvement in the Output Macro Cell structure is the implementation of the register bypass function. Any of the 10 J-K/D registers can be individually bypassed, thus creating a combinatorial I/O path from the AND array to the output pin. Unlike other "V" type devices,

the register in the PLC42VA12 Macro Cell remains fully functional as a buried register. Both the combinatorial I/O and buried register have separate input paths (from the AND array). In most V-type architectures, the register is lost as a resource when the cell is configured as a combinatorial I/O. This feature provides the capability to operate the buried register independently from the combinatorial I/O.

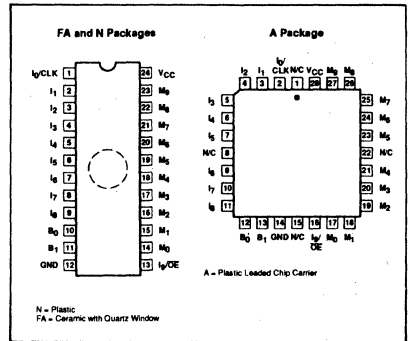
FEATURES

- High-speed EPROM-based CMOS Multi-Function PLD
 - Super set of 22V10, 32VX10 and 20RA10 PAL® ICs
- Two fully programmable arrays eliminate "P-term Depletion"
 - Up to 64 P-terms per OR function
- Improved Output Macro Cell Structure
 - Individually programmable as:
 - * Registered Output
 - * Registered Input
 - * Combinatorial I/O with Buried Register
 - Bypassed Registers are 100% functional with separate input and feedback paths
 - Individual Output Enable control functions
 - * From pin or AND array
- Eleven clock sources
- Register Preload and Diagnostic Test Mode Features
- Security fuse

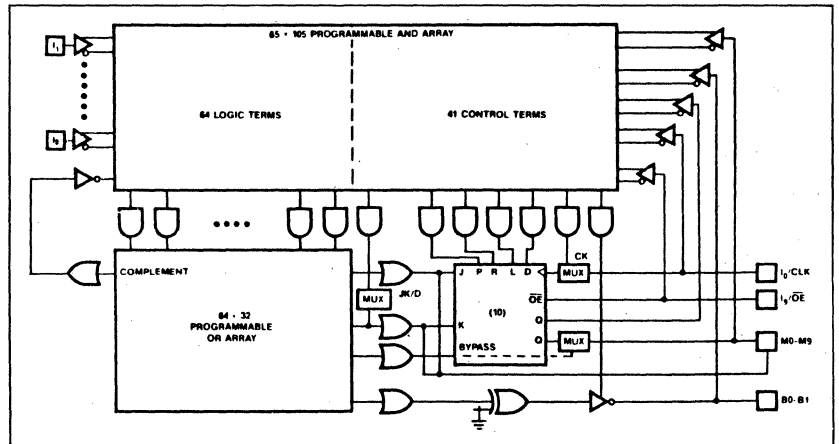
APPLICATIONS

- Mealy or Moore State Machines
 - Synchronous
 - Asynchronous
- Multiple, independent State Machines
- 10-bit ripple cascade
- Sequence recognition
- Bus Protocol generation
- Industrial control
- A/D Scanning

PIN CONFIGURATIONS



BLOCK DIAGRAM



PAL is a registered trademark of Monolithic Memories, Inc., a wholly owned subsidiary of Advanced Micro Devices, Inc.

Signetics

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LINEAR INTEGRATED CIRCUITS

POWER SUPPLY CIRCUITS		SWITCHING REGULATOR OUTPUT STAGE
<p>SWITCHING REGULATOR CONTROL I.C.'s</p> <p>Voltage Mode PWM's SG1524/2524/3524 SG1524B/2524B/3524B SG1525A/2525A/3525A SG1526/2526/3526 SG1526B/2526B/3526B SG1527A/2527A/3527A SG1529/2529/3529 SG1840/2840/3840</p> <p>Current Mode PWM's SG1528/2528/3528 SG1530/2530/3530 SG1825/2825/3825 SG1842/2842/3842 SG1843/2843/3843 SG1844/2844/3844 SG1845/2845/3845 SG1846/2846/3846 SG1847/2847/3847</p>	<p>Dual Tracking Fixed SG1501A/2501A/3501A/4501 SG1568/1468</p> <p>Positive Fixed Voltage SG109/209/309 SG140/340-5 SG140A/340A-5 SG140/340-6 SG140/340-8 SG140/340-12 SG140A/340A-12 SG140/340-15 SG140A/340A-15 SG140/340-18 SG140/340-20 SG7805/7805C/7805A/7805AC SG7806/7806C/7806A/7806AC SG7808/7808C/7808A/7808AC SG7812/7812C/7812A/7812AC SG7815/7815C/7815A/7815AC SG7818/7818C/7818A/7818AC SG7820/7820C/7820A/7820AC SG7824/7824C/7824A/7824AC</p>	<p>SM600/601/602 SM610/611/612 SM625/626/627 SM635/636/637 SM645/646/647 SM655/656/657 SM660/661/662 SM670/671/672</p>
<p>POWER SUPPLY SUPPORT FUNCTIONS</p> <p>Protection Circuits SG1542/2542/3542 SG1543/2543/3543 SG1544/2544/3544 SG1548/2548/3548 SG1549/2549/3549 SG3523A/3423A SG3523/3423</p> <p>Magnetic Amplifier Controllers SG1557/2557/3557 SG1559/2559/3559 SG1560/2560/3560</p> <p>Off Line Start-Up Controller SG1540/2540/3540</p> <p>VOLTAGE REGULATORS</p> <p>Positive Adjustable SG105/205/305/305A SG117/217/317 SG117A/217A/317A SG117HV/217HV/317HV SG117AHV/217AHV/317AHV SG138/238/338 SG138A/238A/338A SG150/250/350 SG150A/250A/350A SG723/723C SG1532/2532/3532</p> <p>Negative Adjustable SG104/204/304 SG137/237/337 SG137A/237A/337A</p> <p>Dual Tracking Adjustable SG1502/2502/3502</p>	<p>Negative Fixed Voltage SG120/320-5 SG120A/320A-5 SG120/320-5.2 SG120/320-8 SG120/320-12 SG120A/320A-12 SG120/320-15 SG120A/320A-15 SG120/320-18 SG120/320-20 SG7905/7905C/7905A/7905AC SG7905.2/7905.2C SG7905.2A/7905.2AC SG7908/7908C/7908A/7908AC SG7912/7912C/7912A/7912AC SG7915/7915C/7915A/7915AC SG7918/7918C/7918A/7918AC SG7920/7920C/7920A/7920AC</p> <p>Low Dropout Regulators SG29055/29055A SG29085/29085A SG29125/29125A</p> <p>Voltage Reference Circuits SG103-1.8 SG103-2.0 SG103-2.2 SG103-2.4 SG103-2.7 SG103-3.0 SG103-3.3 SG103-3.6 SG103-3.9 SG103-4.3 SG103-4.7 SG103-5.1 SG103-5.6 SG1503/2503/3503</p>	<p>MOTION CONTROL CIRCUITS</p> <p>DC MOTOR PWM's SG1731/2731/3731</p> <p>STEPPER MOTOR DRIVER SG3718</p> <p>MOTOR DRIVERS</p> <p>High Current Motor Drivers SG1173/2173/3173 SG1635/3635, SG1635A/3635A SG1650/3650 SG3645 SG3663 SG3172</p> <p>Medium Current Motor Drivers SG2001/2011/2021 SG2002/2012/2022 SG2003/2013/2023 SG2004/2014/2024 SG2005/2015/2025 SG2064/2065 SG2066/2067 SG2068/2069 SG2070/2071 SG2074/2075 SG2076/2077 SG2801/2811/2821 SG2802/2812/2822 SG2803/2813/2823 SG2804/2814/2824 SG2805/2815 SG3272</p> <p>Dual Hammer Drivers SG3700</p>

Silicon General

PRODUCT SELECTION GUIDE

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 11861 WESTERN AVE.
 GARDEN GROVE, CA. 92641
 TELE: (714) 898-8121 / FAX: 714-893-2570

POWER DRIVERS AND INTERFACE CIRCUITS		AUTOMOTIVE CIRCUITS
<p>POWER MOSFET DRIVERS</p> <p>SG1626/2626/3626 SG1644/2644/3644</p> <p>HIGH CURRENT DRIVERS</p> <p>Output Drivers SG1627/2627/3627</p> <p>Switch Drivers SG1629/2629/3629</p> <p>Quad Power Drivers SG3645</p> <p>Dual Hammer Drivers SG3700</p> <p>Half Bridge Driver SG1635/3635, SG1635A/3635A SG1650/3650</p> <p>Dual Solenoid Driver SG3663</p> <p>Quad PIN Diode Driver SG5792 SG5793</p> <p>Line Drivers / Receivers SG1488 SG1489/1489A</p> <p>Darlington Array Drivers SG2001/2011/2021 SG2002/2012/2022 SG2003/2013/2023 SG2004/2014/2024 SG2005/2015/2025 SG2801/2811/2821 SG2802/2812/2822 SG2803/2813/2823 SG2804/2814/2824 SG2805/2815</p> <p>Quad Darlington Array Drivers SG2064/2065 SG2066/2067 SG2068/2069 SG2070/2071 SG2074/2075 SG2076/2077</p> <p>Dual Peripheral Drivers SG55450B/75450B SG55451B/75451B SG55452B/75452B SG55453B/75453B SG55454B/75454B SG55460/75460 SG55461/75461 SG55462/75462</p>	<p>SG55463/75463 SG55464/75464 SG55470/75470 SG55471/75471 SG55472/75472 SG55473/75473 SG55474/75474</p> <p>Quad Peripheral Drivers SG508</p>	<p>LOW DROPOUT DUAL VOLTAGE REGULATORS</p> <p>SG29055/29055A SG29085/29085A SG29125/29125A</p>
	OPERATIONAL AMPLIFIERS AND COMPARATORS	OTHER LINEAR CIRCUITS
	GENERAL PURPOSE	<p>DISK DRIVE</p> <p>SG541</p> <p>READ/WRITE AMPLIFIER</p> <p>SG510A4/SG510AR4</p> <p>VOLTAGE COMPARATORS</p> <p>SG111/211/311 SG2111</p> <p>WIDE BAND VIDEO AMPLIFIERS</p> <p>SG040 SG1401/2401/3401</p> <p>MULTIPLIERS</p> <p>SG1402/2402/3402 SG1595/1495</p> <p>MODULATOR / DEMODULATOR</p> <p>SG1596/1496</p> <p>VOLTAGE REFERENCE CIRCUITS</p> <p>SG103-1.8 SG103-2.0 SG103-2.2 SG103-2.4 SG103-2.7 SG103-3.0 SG103-3.3 SG103-3.6 SG103-3.9 SG103-4.3 SG103-4.7 SG103-5.1 SG103-5.6 SG1503/2503/3503</p> <p>TRANSISTOR ARRAYS</p> <p>SG3049 SG3183 SG3821/3046/3086</p>
	CORE MEMORY CIRCUITS	
	SENSE AMPLIFIERS	
	<p>SG5524 SG5534 SG55234/55234A SG55236/55236A</p>	
	MEMORY DRIVERS	
	<p>SG55325/75325 SG55326/75326 SG55327/75327</p>	
	DIODE ARRAYS	
	<p>SG5768/5768A SG5770/5770A SG5772/5772A SG5774/5774A SG25768 SG6496 SG6100/6101</p>	
	BRIDGE CIRCUITS	
	<p>SG3212</p>	

Silicon General

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Our Market Focus

“MSICs™” – Mixed-Signal Integrated Circuits that combine complex analog and digital functions on the same chip – are the wave of the future. And though it’s a new wave for much of the industry, it’s a wave Silicon Systems has been riding for almost two decades.

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The Storage Products Market

Whether you choose our standard or custom ICs – you can rely on Silicon Systems’ devices to enhance the performance of your new disk drive products while reducing board space, power dissipation, and cost. Our standard product ICs include the industry’s most highly integrated and comprehensive families of read/write, pulse detection, data separation, head positioning, motor speed control, and controller devices. And if your design requires a custom solution, we can also support you with a full range of custom/semicustom capabilities.

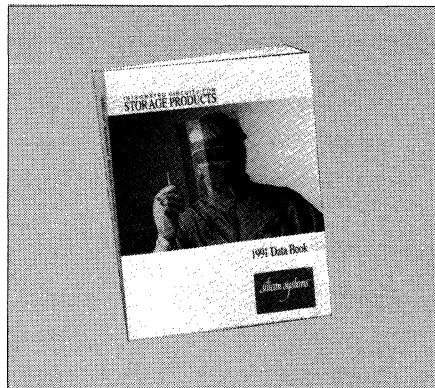
The Communication Market

Silicon Systems’ K-Series family of highly-integrated single-chip modems includes the lowest-power 5-volt products available. These K-Series modems cover all the primary operating modes – both U.S. and international – from Bell 212A/103 through V.21, V.22, V.22bis, V.23, and V.42bis migrating toward V.32. Silicon Systems also backs up its modem ICs with a comprehensive line of UARTs, DTMF receivers and transceivers, as well as DS-1 and DS-3 interface chips, and related communication ICs.

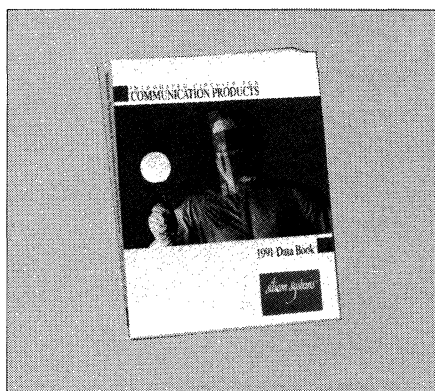
The Custom/Semicustom Market

With 20 years of successful IC design experience, Silicon Systems is uniquely able to take a look at your specific IC application problem, and move quickly to the right mixed-signal solution. Key issues such as power, cost and performance are balanced to deliver you the right solution for a competitive advantage. But our capabilities don’t stop with design. We follow through and process your design in one of our multi-process CMOS/Bipolar wafer fabs, with comprehensive test, QA, and assembly facilities to assure prompt delivery to your production requirements. The end result is a highly-optimized, quick-turnaround, custom or semicustom development.

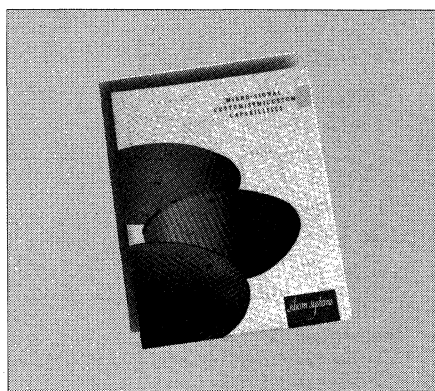
For a copy of the literature, contact Silicon Systems or your local representative.



A full-line catalog of Storage IC products



A full-line catalog of Communication IC products



A brochure describing Custom/Semicustom capabilities



Storage Products Selector Guide

Silicon Systems Device Number	Head Type	No. of Channels	Max Input Noise (nV/√Hz)	Max Input Capacitance (pF)	Read Gain (typ)	Write Current Range (mA)	Power Supplies (V)	Read/Write Data Ports
HDD READ/WRITE AMPLIFIERS								
SSI 32R104C	Ferrite	4	2.4	23	35	15 to 45	+6, -4	Differential, Bi-directional
SSI 32R104CLN	Ferrite	4	1.7	23	35	15 to 45	+6, -4	Differential, Bi-directional
SSI 32R115	Ferrite	2, 4, 5	1.8	20	40	30 to 50	+5, -5	Differential, Bi-directional
SSI 32R117	Ferrite	2, 4, 6	2.1	23	100	10 to 50	+5, +12	Differential / TTL
SSI 32R117A	Ferrite	2, 4, 6	1.7	20	100	10 to 50	+5, +12	Differential / TTL
SSI 32R188	Ferrite	4	2.4	18	43	35 to 70	+6, -5	Differential, Bi-directional
SSI 32R501	Ferrite	4, 6, 8	1.5	23	100	10 to 50	+5, +12	Differential / TTL
SSI 32R510A	Ferrite	2, 4, 6	1.5	20	100	10 to 40	+5, +12	Differential / TTL
SSI 32R511	Ferrite	4, 6, 8	1.5	20	100	10 to 40	+5, +12	Differential / TTL
SSI 32R5111	Ferrite/MIG	4, 6, 8	1.5	20	150	10 to 40	+5, +12	Differential / TTL
SSI 32R512	Thin Film	8, 9	0.85	35	150	10 to 40	+5, +12	Differential / TTL
SSI 32R5121	Thin Film	14	0.85	35	250	10 to 40	+5, +12	Differential / TTL
SSI 32R514	Ferrite	2, 4, 6	1.5	20	150	10 to 40	+5, +12	Differential / TTL
SSI 32R515	Ferrite	9, 10	1.5	20	100	10 to 50	+5, +12	Differential / TTL
SSI 32R516	Ferrite/MIG	4, 6, 8	1.3	18	120	20 to 60	+5, +12	Differential / TTL
SSI 32R5161	Ferrite/MIG	10	1.3	18	150	20 to 60	+5, +12	Differential / TTL
SSI 32R520	Thin Film	4	0.9	65	123	30 to 75	+5, -5	Differential / Differential
SSI 32R521	Thin Film	6	0.9	65	100	20 to 70	+5, +12	Differential / TTL
SSI 32R5211	Thin Film	6	0.9	65	150	20 to 70	+5, +12	Differential / TTL
SSI 32R522	Thin Film	4, 6	1.0	32	100	6 to 35	+5, +12	Differential / TTL
SSI 32R524R	Thin Film	7.5	0.8	60	100	20 to 60	+5, +12	Differential / Differential
SSI 32R525	Thin Film	4	0.8	35	150	25 to 40	+5, -5	Differential / Differential
SSI 32R526R	Thin Film	4	0.6	65	100	17 to 50	+5, -5	Differential / Differential
SSI 32R527	Thin Film	8, 9	0.85	35	120	10 to 40	+5, +12	Differential / Differential
SSI 32R528	Thin Film	8, 9	0.85	35	150	10 to 40	+5, +12	Differential / Differential
SSI 32R2010	Thin Film	10	0.8	25	150	17 to 50	+5, +12	Differential / Differential
SSI 32R529	Thin Film	8	0.8	35	100	17 to 50	+5, -5	Differential / Differential
SSI 32R1200	Ferrite	2, 4	1.2	17	200	15 to 45	+5	Differential / TTL
SSI 32R4610	Thin Film	2, 4	0.85	35	200	10 to 35	+5	Differential / TTL
Silicon Systems Device Number	Circuit Function		Features					
HDD PULSE DETECTION								
SSI 32P540	Read Data Processor	Time Domain Filter						
SSI 32P541	Read Data Processor	AGC, Amplitude & Time Pulse Qualification, RLL Compatible						
SSI 32P541A	Read Data Processor	32P541 pin compatible w/ Enhanced Write to Read Recovery and Voltage Fault Detection						
SSI 32P541B	Read Data Processor	32P541 pin compatible, 32P541A w/ Increased Data Rate to 24 Mbit/s						
SSI 32P542	Read Data Processor	32P544-type Pulse Detector w/ Data Channel, Clock Channel for Access						
SSI 32P544	Pulse Detector	32P541-type Pulse Detector w/ Embedded Servo Electronics						
SSI 32P546	Pulse Detector	32P541-type Pulse Detector w/ Pulse Slimming Compatibility						
SSI 32P547	Pulse Detector	32P544-type Pulse Detector w/ Filter Multiplexer, Pulse Slimming Support						
SSI 32P549	Read Data Processor	32P541 pin compatible, Low Power, +5V only, Enhanced Write to Read Recovery						
HDD READ CHANNEL COMBINATION DEVICES								
SSI 32P548	Pulse Detector / Data Synchronizer	32P544-type w/ 2, 7 Synchronizer, Low Power, +5V only, <700 mW						
SSI 32P4620	Pulse Detector / Data Synchronizer	32P541-type + 32D537-type Data Separator w/ Pulse Slimming & Constant Density Recording Support						

Silicon Systems Inc.

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 Far East Headquarters, Singapore Ph. (65) 744-7700 • FAX (65) 747-7609

Storage Products Selector Guide

Silicon Systems Inc.

Silicon Systems Device Number	Circuit Function	Features
HDD ACTIVE FILTERS		
SSI 32F8011	Programmable Active	7-Pole Bessel Active Filter, Programmable Cutoff Freq., Programmable Pulse Slimming Channel Filter 7-Pole Equiripple Active Filter, Programmable Cutoff Freq., Programmable Pulse Slimming
SSI 32F8020	Programmable Channel Filter	
HDD DATA RECOVERY		
SSI 32D5321	Data Separator	Data Synchronizer / 2, 7 RLL ENDEC
SSI 32D534A	Data Separator	Data Synchronizer / MFM ENDEC / Write Precompensation
SSI 32D535	Data Separator	Data Synchronizer / 2, 7 RLL ENDEC / Write Precompensation
SSI 32D5351	Data Separator	Data Synchronizer / 2, 7 RLL ENDEC / Write Precompensation 8 to 18 Mbit/s
SSI 32D5362A	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Write Precompensation 10 to 20 Mbit/s
SSI 32D5371/2	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Write Precompensation 12 to 24 Mbit/s
SSI 32D5373/4	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Write Precompensation 15 to 32 Mbit/s
SSI 32D4660/1/2	Time Base Generator	Up to 100 MHz Reference Frequency; PLC for Constant Density Recording
HDD HEAD POSITIONING		
SSI 32H101A	Preamplifier -Ferrite	AV = 93, BW = 10 MHz, e _n = 7.0 nV/√Hz
SSI 32H116	Preamplifier -Thin Film	AV = 250, BW = 20 MHz, e _n = 0.94 nV/√Hz
SSI 32H523R	Servo Read/Write	Single-channel Thin Film Read/Write Device
SSI 32H566	Servo Read/Write	Single-channel Ferrite Read/Write Device
SSI 32H567	Servo Demodulator	Di-bit Quadrature Servo Pattern; PLL Synchronization
SSI 32H568	Servo Controller	Track & Seek Mode Operation; Microprocessor Interface
SSI 32H569	Servo Motor Driver	Head Parking, Spindle Motor Braking
SSI 32H4631	Combo Servo & MSC	Embedded & Hybrid Servo, Hall Sensor-less MSC, +5V only
SSI 32H6110	Preamplifier -Thin Film	AV = 250 or 300, BW = 20 MHz, e _n = 0.85 nV/√Hz
SSI 32H6210	Servo Demodulator	Di-bit Quadrature Servo Pattern; PLL Synchronization AGC Adjustment
SSI 32H6220	Servo Controller	Track & Seek Mode Operation; Microprocessor Interface
SSI 32H6230	Servo Motor Driver	Head Parking, Spindle Motor Braking, Voltage Clamp
SSI 32H6240	Servo Motor Driver	Predriver for Bipolar H-bridge
HDD SPINDLE MOTOR CONTROL		
SSI 32M590	2-Phase MSC	±0.035% Speed Accuracy; Unipolar Operation
SSI 32M591	3-Phase MSC	±0.05% Speed Accuracy; Unipolar Operation
SSI 32M593	3-Phase MSC	±0.037% Speed Accuracy; Bipolar Operation, 5 1/4" Drives
SSI 32M594	3-Phase MSC	±0.037% Speed Accuracy; Bipolar Operation, 3 1/2" & 5 1/4" Drives
SSI 32M595	3-Phase Sensor-less MSC	Hall Sensor-less; 5V only Motor Speed Control
HDD CONTROLLER/INTERFACE		
SSI 32B451	SCSI Controller	Async transfer to 1.5 Mbit/s; Internal Drivers; AIC 500L Compatible
SSI 32C452	Storage Controller	20 Mbit/s; CMOS; Programmable; AIC 010 Compatible
SSI 32C453	Buffer Controller	Non-mux Addressing to 16K; CMOS; AIC 300 Compatible
SSI 32B545	Support Logic	Includes ST506 Bus Drivers/Receivers
SSI 32C260	PC AT/XT Combo Controller	15 Mbit Combo Buffer Manager/Disk Controller/AT/XT; SH-260 Compatible
SSI 32C4650	PC AT/XT Combo Controller	24 Mbit Disk Controller/ AT/XT
SSI 32C261	PC AT/XT Combo Controller	Manager/ 2,7 ENDEC/ AT-XT Interface
SSI 32C9000	High Performance PC AT/XT Combo Controller	32 Mbit; High Performance AT Controller
FLOPPY DISK DRIVES		
SSI 34D441	Data Separator	High Performance Analog Data Separator, NEC 765 Compatible
SSI 34P570	Read Data Path	2 Channel Read/Write, w/ Read Data Path
SSI 34R575	Read/Write	2, 4 Channel Read/Write Circuit
SSI 34B580	Support Logic	Port Expander, Includes SA400 Interface Drivers/Receivers
TAPE DRIVER CIRCUITS		
SSI 35P550	Read Data Path	4 Channel Read/Write w/ Read Data Path

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Communication Products Selector Guide

				Power Supply (V)	Available Packages
K-SERIES SINGLE CHIP MODEM FAMILY					
SSI 73K212	x			300, 1200 bit/s, Bell 212A/103 compatible	12 28, 22 DIP, 28 PLCC
SSI 73K212L	x			Low power 73K212, 40 mW, +5V single supply	5 28, 22 DIP, 28 PLCC
SSI 73K221		x		600, 1200 bit/s, CCITT V.22/V.21 compatible	12 28, 22 DIP, 28 PLCC
SSI 73K221L		x		Low power 73K221, 40 mW, +5V single supply	5 28, 22 DIP, 28 PLCC
SSI 73K222	x	x		300,600,1200 bit/s Bell 212/103,CCITT V.22/V.21	12 28, 22 DIP, 28 PLCC
SSI 73K222L	x	x		Low power 73K222, 40 mW, +5V single supply	5 28, 22 DIP, 28 PLCC
SSI 73K222U	x	x		73K222 with integral 16C450 UART	5 40 DIP
SSI 73K302L	x			0-1200 bit/s	
SSI 73K321L				0-1200 bit/s, V.23, V.21 modes	5 28, 22 DIP, 28 PLCC
SSI 73K322L		x		73K221 w/ V.23 mode (European applications)	5 28, 22 DIP, 28 PLCC
SSI 73K324L		x	x	300, 1200, 2400 bit/s, V.22bis, V.22, V.21 w/ V.23 mode (European applications)	
SSI 73K224L	x	x	x	Low power 73K224, 100 mW, +5V single supply	5 28, 44 PLCC
MODEM PROTOCOL					
SSI 73D2180	x	x		1200 bit/s low power "AT" device set for integral apps.	5 40 DIP, 44 PLCC
SSI 73D2240	x	x	x	2400 bit/s low power "AT" modem device set	5 28, 40 DIP, 32, 44 PLCC
SSI 73D2404	x	x	x	2400 bit/s "AT" modem device set	±5 28, 40 DIP, 28, 44 PLCC
SSI 73D2407	x	x	x	"AT" modem with MNP 4 + 5	±5 DIP + PLCC
SSI 73D2417	x	x	x	"AT" modem with FAX, MNP 4 + 5	±5 DIP + PLCC
SSI 73D2420	x	x	x	"AT" modem with V.42 MNP 4 + 5	±5 Numerous
BUS INTERFACE PRODUCTS					
SSI 73M450				16C450 pin compatible UART	5 40 DIP, 44 PLCC
SSI 73M450F				Fast version of SSI 73M450 UART	5 40 DIP, 44 PLCC
SSI 73M1450				28-pin version of SSI 73M450	5 28 DIP, 28 PLCC
SSI 73M2450				Adds µPRST function to SSI 73M1450	5 28 DIP, 28 PLCC
SSI 73M550				16C550 pin compatible UART	5 40 DIP, 44 PLCC
SSI 73M1550				28-pin version of SSI 73M550	5 28 DIP, 28 PLCC
SSI 73M2550				Adds µPRST function to SSI 73M1550	5 28 DIP, 28 PLCC
SPECIAL MODEM PRODUCTS					
SSI 73M214	2400 bit/s Modem Filter			V.22bis/V.22/V.21, Bell 212/103 modes	±5V 28 DIP, 28 PLCC
SSI 73M223	1200 bit/s Modem			Compact HDX V.23 modem	5V 16 DIP
SSI 73M3522	1200 bit/s Modem Filter			High performance filter for V.22/212A modes	±5V 16 DIP
PHONE SIGNALLING PRODUCTS					
SSI 75T201	Integrated DTMF Receiver			Binary of 2-of-8 output	12V 22 DIP
SSI 75T202	Int. DTMF Receiver			Low power, binary output	5V 18 DIP
SSI 75T203	Int. DTMF Receiver			Early detect, binary output	5V 18 DIP
SSI 75T204	Int. DTMF Receiver			Low power, binary output	5V 14 DIP, 16 SO
SSI 75T2089	Int. DTMF Transceiver			Generator & receiver, µP interface	5V 22 DIP
SSI 75T2090	Int. DTMF Transceiver			Like 75T2089 w/ call progress detect	5V 22 DIP
SSI 75T2091	Int. DTMF Transceiver			Like 75T2090 w/ early detect	5V 28 DIP, 28 PLCC
SSI 75T957	Int. DTMF Receiver			Early detect, dial tone reject	5V 22 DIP, 24 SO
SSI 75T980	Imprecise Call Progress Detector			Energy detect in 305-640 Hz band, Teltone	5V 8 DIP
SSI 75T981	Precise Call Progress Detector			Det. 350, 400, 440, 480 Hz, Teltone 2nd source	5V 22 DIP
SSI 75T982	Precise Call Progress Detector			Det. 350, 440, 480, 620 Hz, Teltone 2nd source	5V 22 DIP
TELEPHONY / DIGITAL TELECOM					
SSI 78P233	DS-1 Line Interface			T1 clock data recovery, transmit equalization	5V 24 DIP, SDIP, SO
SSI 78P234	2048 kbit/s PCM Interface			Receive clock & data recovery, transmit drivers	5V 20 DIP, SO
SSI 78A093A/B	12x8x1 Crosspoint Switch			Low ON resistance, two versions	5-12V 40 DIP, 44 PLCC
SSI 78A207	Integrated MF Receiver			Detects central office toll signals	5V 20 DIP
SSI 78A400	4-Wire Loopback			2713 Hz detector, failsafe timeouts	±5V 16 DIP, 18 SO
SSI 78A420	4-Wire Loopback			As above w/ gain/loss block	±5V 22 DIP

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Silicon Systems Inc.

Mixed-Signal IC Custom and Semicustom Solutions

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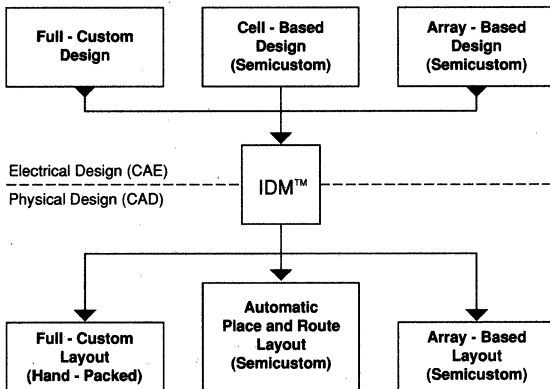
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Our automatic place-and-route component software uses macro cell assemblers to route full-custom circuitry. The result is standard cell design that requires minimal layout effort, costs less to develop and, most importantly, gives you a higher first article success rate.

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Custom vs. Semicustom

Choosing the Optimum Route.

	Full - Custom	Semicustom	
	Composite Design	Cell-Based Design	Array - Based Design
Design Parameters			
Cost (Non-Recurring Expense)	1.0	.40 - .70	.20 - .40
Time (Schedule)	1.0	.40 - .60	.20 - .40
Production Parameters			
Piece Price (Production Cost)	1.0	1.5 - 2.0	2.0 - 2.5
Die Size (Silicon Area)	1.0	1.3 - 1.6	1.6 - 2.0

NOTE: All comparisons are normalized to a composite-level design.

Silicon Systems Inc.

Choose optimum CMOS or Bipolar process for designing and fabricating circuits.

CMOS MIXED-SIGNAL PROCESS CHART								
PROCESS	TYPE	APPL. VOLTAGE	BV _{DSS}	DRAWN GATE LENGTH	Interconnect Pitches			FEATURES
					POLY 1	METAL 1	METAL 2	
CH	Silicon Gate, single metal dual poly, P Well	12V	18V	3.6μ	5.8μ	6.4μ	N/A	<ul style="list-style-type: none"> • DDD S/D Structure • Poly-Poly Capacitors • Low-Voltage Coefficient, High Ohm Poly Resistors • Epi Substrate Option • Buried Well-Ring
CG	Silicon Gate, Dual Metal, Dual Poly, P Well	5V	7V	1.5μ	3.0μ	4.5μ	6.0μ	<ul style="list-style-type: none"> • DDD S/D Structure • Poly-Poly Capacitors • Shrinkable to 1.2μ

BIPOLAR MIXED-SIGNAL PROCESS CHART							
PROCESS	TYPE	BV _{ceo}	NPN FT	EMITTER SIZE	M1 PITCH	M2 PITCH	FEATURES
BK	Junction-Isolated	12V	2GHz	2.5μ	9.0μ	14.0μ	<ul style="list-style-type: none"> • Polysilicon Emitters • A1 Schottky Diodes • Nitride Capacitors • Ion Implanted Resistors • Up/Down Junction Isolation • Collector/Base Plugs
N	Oxide-Isolated	6V	8GHz	2.0μ	4.5μ	8.0μ	<ul style="list-style-type: none"> • High Performance NPNs • P+Si Schottky Diodes • Nitride Capacitors • Ion Implanted Resistors • Sidewall Oxide Isolated • Collector/Base Plugs

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STK10C48 / STK11C48

CMOS/SNOS nvSRAM

High Performance

2K x 8 Nonvolatile Static RAM

FEATURES

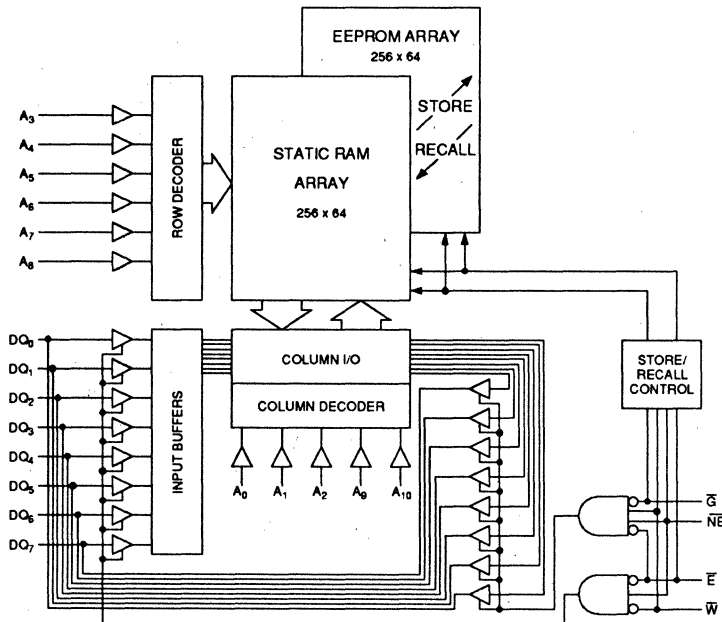
- Nonvolatile Data Integrity
- 25, 30, 35, 45 and 55ns Address Access
- 25, 30, 35, 45 and 55ns Chip Enable Access
- 12, 15, 20 and 25ns Output Enable Access
- Unlimited Read and Write to SRAM
- Unlimited Recall cycles from EEPROM
- 10⁵ Store cycles to EEPROM
- Commercial and Military Temperature Ranges
- Hardware Store Protection
- Automatic Recall on Power Up
- Hardware or Software Store/Recall
- Automatic Store Timing
- Single 5V ±10% Operation
- 10 year data retention in EEPROM
- Available in multiple standard packages

DESCRIPTION

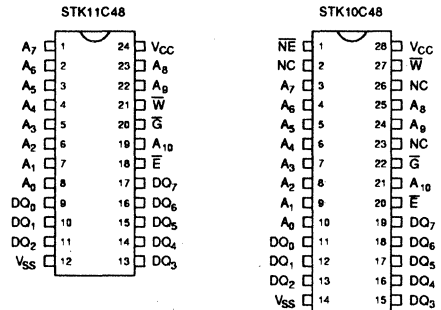
The Simtek STK10C48 / STK11C48 are fast static RAMs with a nonvolatile EEPROM cell incorporated in each static memory cell. They combine the high performance and ease of use of a fast SRAM with the data integrity of an EEPROM. Data may easily be transferred from the SRAM to the EEPROM (STORE), and from the EEPROM back to the SRAM (RECALL) using the \overline{NE} pin on the STK10C48. On the STK11C48, six address read sequences cause the non-volatile cycles to be run. A RECALL also takes place upon power-up.

The STK10C48 features the industry standard pinout for non-volatile RAMs, while the STK11C48 is pin compatible with industry standard SRAMs. The STK10C48 is available in a 28-pin 300 mil ceramic or plastic DIP, and the STK11C48 is available in a 24-pin DIP package. Simtek is currently establishing a MIL-STD-883 compliant program.

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS



PIN NAMES

A ₀ - A ₁₀	Address Inputs
W	Write Enable
DQ ₀ - DQ ₇	Data In/Out
E	Chip Enable
G	Output Enable
NE	Nonvolatile Enable
V _{CC}	Power (+5V)
V _{SS}	Ground

October 1990

Simtek Corporation

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Colorado Springs, Colorado 80920 USA

(719) 531-9444 FAX (719) 531-9481



STK10C68 / STK11C68

CMOS/SNOS nvSRAM

High Performance

8K x 8 Nonvolatile Static RAM

FEATURES

- Nonvolatile Data Integrity
- 25, 30, 35, 45 and 55ns Address Access
- 25, 30, 35, 45 and 55ns Chip Enable Access
- 12, 15, 20 and 25ns Output Enable Access
- Unlimited Read and Write to SRAM
- Unlimited Recall cycles from EEPROM
- 10^5 Store cycles to EEPROM
- Commercial and Military Temperature Ranges
- Hardware Store Protection
- Automatic Recall on Power Up
- Hardware or Software Store/Recall
- Automatic Store Timing
- Single 5V $\pm 10\%$ Operation
- 10 year data retention in EEPROM
- Available in multiple standard packages

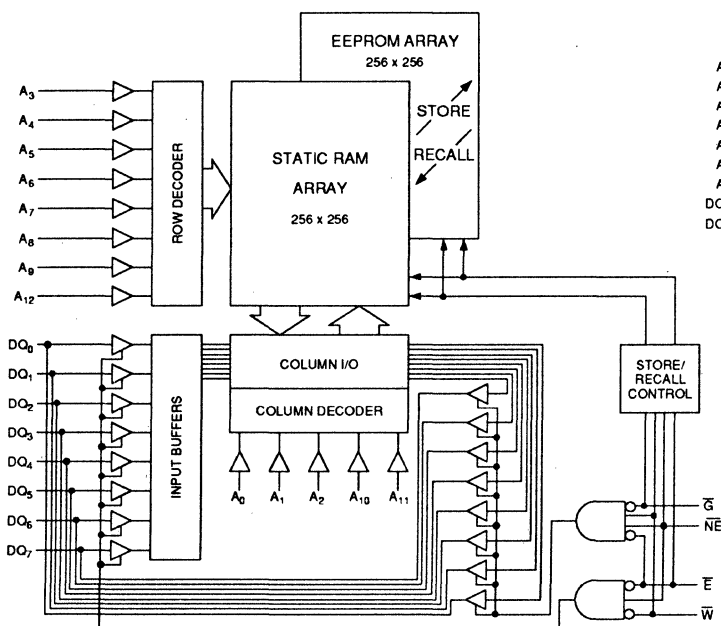
DESCRIPTION

The Simtek STK10C68 / STK11C68 are fast static RAMs with a nonvolatile EEPROM cell incorporated in each static memory cell. They combine the high performance and ease of use of a fast SRAM with the data integrity of an EEPROM.

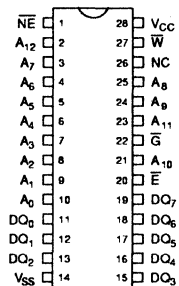
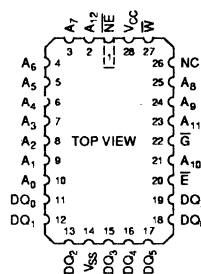
Data may easily be transferred from the SRAM to the EEPROM (STORE), and from the EEPROM back to the SRAM (RECALL) using the \overline{NE} pin on the STK10C68. On the STK11C68, six address read sequences cause the non-volatile cycles to be run. A RECALL also takes place upon power-up.

The STK10C68 features the industry standard pinout for non-volatile RAMs, while the STK11C68 is pin compatible with industry standard SRAMs. The parts are available in 28-pin 300 mil ceramic and plastic DIP, a 28-pin 400 mil SOJ and 28-pin LCC. Simtek is currently establishing a MIL-STD-883 compliant program.

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS



PIN NAMES

$A_0 - A_{12}$	Address Inputs
W	Write Enable
$DQ_0 - DQ_7$	Data In/Out
\overline{E}	Chip Enable
\overline{G}	Output Enable
\overline{NE}	Nonvolatile Enable
V_{CC}	Power (+5V)
V_{SS}	Ground

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STK28C64

CMOS/SNOS EEPROM

High Performance

8K x 8 Electrically Erasable PROM

FEATURES

- 55, 70, 90 and 120ns Access Times
- Self-Timed Page Write
- Single 5V $\pm 10\%$ Supply
- Commercial and Military Temperature Ranges
- 55, 70, 90 and 120ns Byte Load Times
- 160 μ s/byte Effective Write Time
- 80mA Active Current
- 200 μ A Standby Current
- Hardware and Software Data Protection
- DATA Polling
- Toggle Bit
- 10 Year Retention at 10⁵ Write Cycles
- 10ms Chip Erase and Chip Program
- Margin Mode
- Industry Standard Pinout and Operation

DESCRIPTION

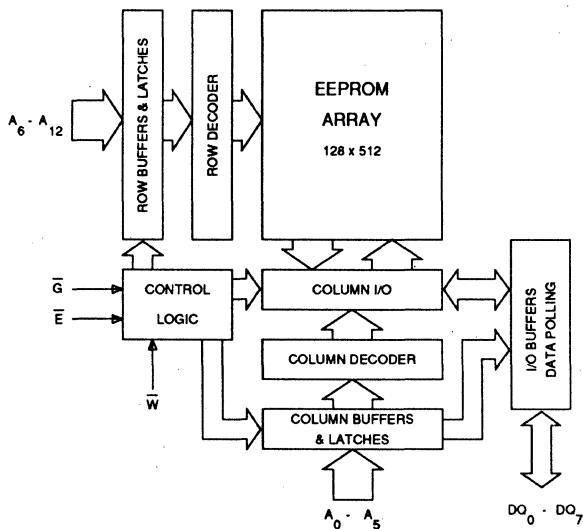
The STK28C64 is a high performance EEPROM fabricated with Simtek's proprietary CMOS/SNOS technology. This full-featured device follows the JEDEC-approved pinout and 5V-only operation standard for 8K x 8 EEPROMs. Simtek is currently establishing a MIL-STD-883 compliant program.

The STK28C64 features single and multi-byte page write cycles. Internal latches allow a byte load cycle time as fast as the read cycle time. Writing of latched data into the non-volatile cells is self-timed, resulting in an effective write time of 160 μ s/byte. Other features include software data protection, DATA polling and toggle bit early end-of-write detection, as well as software chip erase/program and hardware chip erase modes.

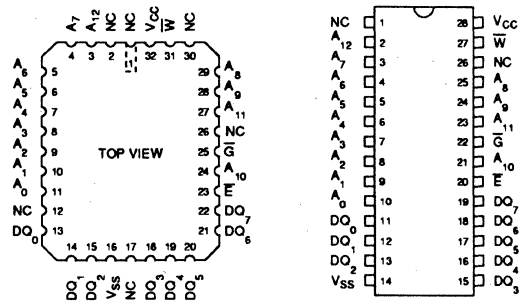
All devices are margin mode tested to a standard of 10 years data retention after 10⁵ write cycles. Margin mode testing may be performed by the user at any time.

Simtek

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS



PIN NAMES

A ₀ - A ₁₂	Address Inputs
DQ ₀ - DQ ₇	Data In/Out
\bar{E}	Chip Enable
\bar{G}	Output Enable
\bar{W}	Write Enable
V _{CC}	Power (+5V)
V _{SS}	Ground



STK28C256

CMOS/SNOS EEPROM

High Performance

32K x 8 Electrically Erasable PROM

FEATURES

- 70, 90, 120 and 150ns Access Times
- Self-Timed Page Write
- Single 5V $\pm 10\%$ Supply
- Commercial and Military Temperature Ranges
- 70, 90, 120 and 150ns Byte Load Times
- 160 μ s/byte Effective Write Time
- 80mA Active Current
- 200 μ A Standby Current
- Hardware and Software Data Protection
- DATA Polling
- Toggle Bit
- 10 Year Retention at 10⁵ Write Cycles
- 10ms Chip Erase and Chip Program
- Margin Mode
- Industry Standard Pinout and Operation

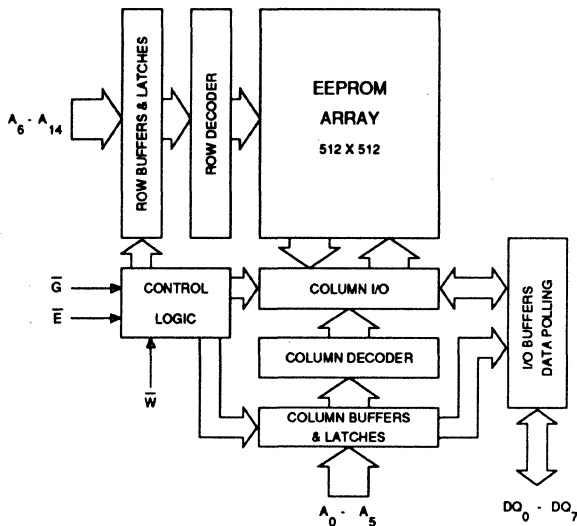
DESCRIPTION

The STK28C256 is a high performance EEPROM fabricated with Simtek's proprietary CMOS/SNOS technology. This full-featured device follows the JEDEC-approved pinout and 5V-only operation standard for 32K x 8 EEPROMs. Simtek is currently establishing a MIL-STD-883 compliant program.

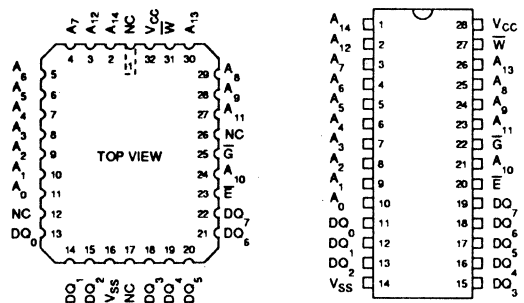
The STK28C256 features single and multi-byte page write cycles. Internal latches allow a byte load cycle time as fast as the read cycle time. Writing of latched data into the non-volatile cells is self-timed, resulting in an effective write time of 160 μ s/byte. Other features include software data protection, DATA polling and toggle bit early end-of-write detection, as well as software chip erase/program and hardware chip erase modes.

All devices are margin mode tested to a standard of 10 years data retention after 10⁵ write cycles. Margin mode testing may be performed by the user at any time.

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS



PIN NAMES

A ₀ - A ₁₄	Address Inputs
DQ ₀ - DQ ₇	Data In/Out
\bar{E}	Chip Enable
\bar{G}	Output Enable
\bar{W}	Write Enable
V _{CC}	Power (+5V)
V _{SS}	Ground

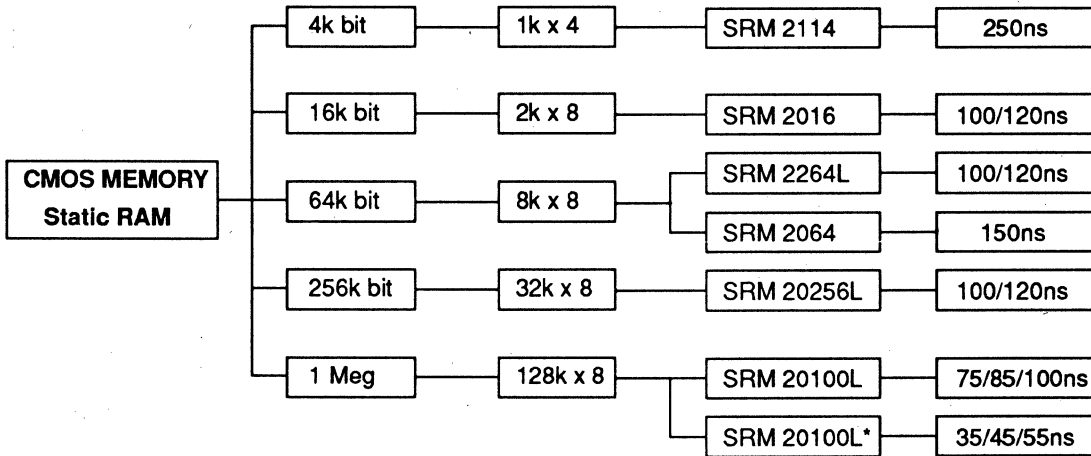
October 1990

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* Under development

Static Rams

S-MOS Systems

Our static RAMs are fabricated using advanced CMOS technology. S-MOS offers 1k x 4, 2k x 8, 8k x 8, 32k x 8 and 128k x 8 static RAMs with industry standard pinouts. In addition to our standard dual inline packages, we also offer space-saving, small outline packages, and thin small outline packages. Selected versions are also offered for industrial temperature ranges.

Organization	Part #	Access Time (ns Max)	Average Operating Current (mA Typ)	Standby Supply Current (μ A Typ)	Package
1024 x 4	SRM2114	250	14	0.1	18 ¹
2048 x 8	SRM2016	100/120	30/25	1	24 ^{1,2,3}
8192 x 8	SRM2064	120/150	30/25	1	28 ^{1,2}
8192 x 8	SRM2264L	100/120	47/45	0.5	28 ^{1,2}
32768 x 8	SRM20256L	100/120	40/37	2	28 ^{1,2,4}
131,072 x 8	SRM20100L	70/85/100	45	2	32 ^{1,2,4,5}

- (1) Plastic DIP
- (2) Small Outline
- (3) 300 mil Skinny DIP
- (4) TSOP (EIAJ standard) under development
- (5) RTSOP (EIAJ standard) under development

S-MOS Systems, Inc. 2460 North First Street San Jose, CA 95131 (408) 922-0200

S-MOS
S Y S T E M S

A Seiko Epson Affiliate

SONY

CXK58258AP/AJ -15/20/25

32,768-word × 8-bit High Speed CMOS Static RAM*Preliminary***Description**

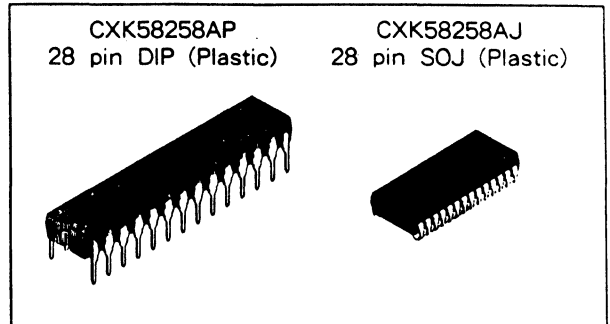
The CXK58258AP/AJ is a high speed CMOS static RAM which consists of 32,768-word × 8-bit. It operates at 15/20/25ns access time from 5V single power supply.

Features

- High speed, low power consumption :

	Access time (Max.)	Power consumption (Typ., Cycle = Min.)
CXK58258AP/AJ-15	15ns	500mW
CXK58258AP/AJ-20	20ns	425mW
CXK58258AP/AJ-25	25ns	375mW

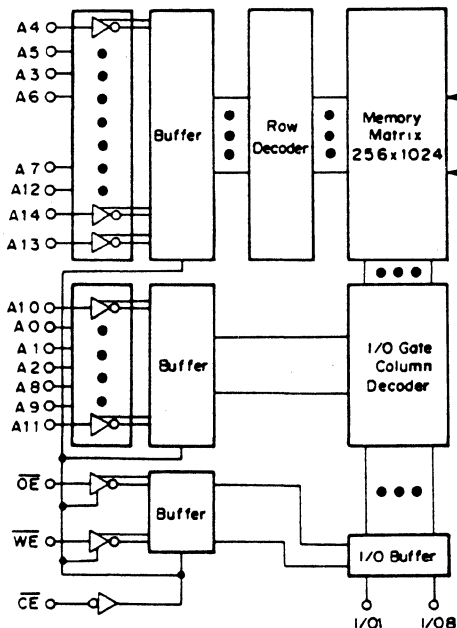
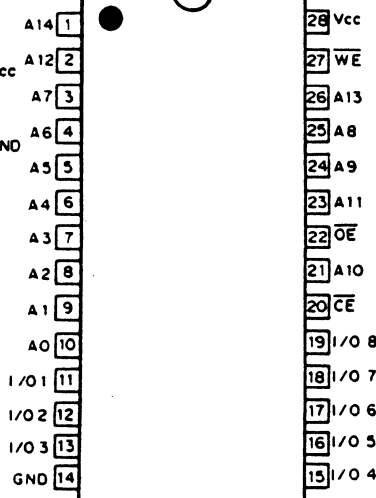
- Single + 5V power supply :
 - 15 5V ± 5%
 - 20/25 5V ± 10%
- Fully static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible all inputs and outputs.
- Common data input and output : three state output
- Available in 28 pin 300mil DIP, 300mil SOJ package.

**Function**

32,768-word × 8-bit static RAM

Structure

Silicon gate CMOS IC

Block Diagram**Pin Configuration (Top view)****Pin Description**

Symbol	Description
A0 to A14	Address input
I/O1 to I/O8	Data input/output
CE	Chip enable input
WE	Write enable input
OE	Output enable input
Vcc	+ 5V power supply
GND	Ground

SONY

CXK58258BP/BJ

-20L/25L/35L
-20LL/25LL/35LL

32,768-word × 8-bit High Speed CMOS Static RAM

Preliminary

Description

The CXK58258BP/BJ is a high speed CMOS static RAM which consists of 32,768-word × 8-bit. It operates at 20/25/35ns access time from 5V single power supply.

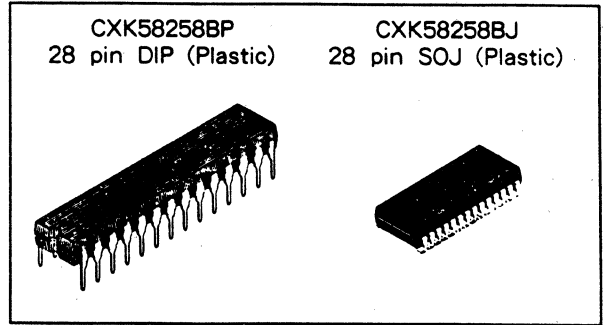
This device is suitable for use in high speed and low power applications in which battery back up for nonvolatility is required.

Features

- Fast access time (Access time)
CXK58258BP/BJ-20L, 20LL 20ns (Max.)
CXK58258BP/BJ-25L, 25LL 25ns (Max.)
CXK58258BP/BJ-35L, 35LL 35ns (Max.)
- Low power operation

	Standby (Max.)	Operation (Typ., Min. Cycle)
CXK58258BP/BJ-20LL	5 μW	425mW
CXK58258BP/BJ-25LL	5 μW	375mW
CXK58258BP/BJ-35LL	5 μW	325mW
CXK58258BP/BJ-20L	10 μW	425mW
CXK58258BP/BJ-25L	10 μW	375mW
CXK58258BP/BJ-35L	10 μW	325mW

- Single + 5V power supply : 5V ± 10%
- Fully static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible all inputs and outputs.
- Common data input and output : three state output
- Available in 28 pin 300mil DIP, 300mil SOJ package.



Function

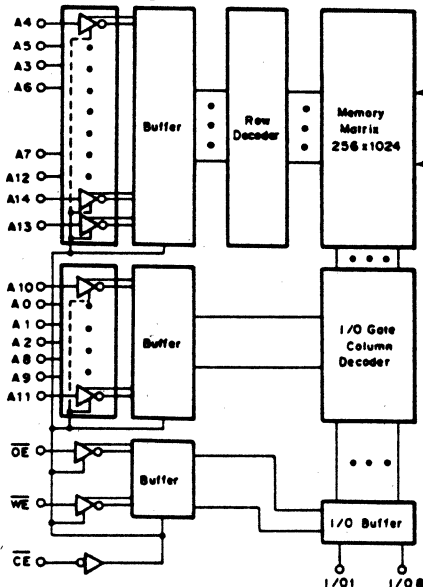
32,768-word × 8-bit static RAM

Structure

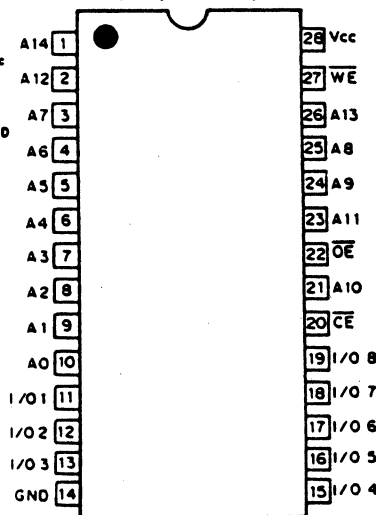
Silicon gate CMOS IC

Sony

Block Diagram



Pin Configuration (Top view)



Pin Description

Symbol	Description
A0 to A14	Address input
I/O 1 to I/O 8	Data input/output
CE	Chip enable input
WE	Write enable input
OE	Output enable input
Vcc	+ 5V power supply
GND	Ground

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PE90268 - ST

SONY

CXK581000P/M

-10L/12L/15L
-10LL/12LL/15LL

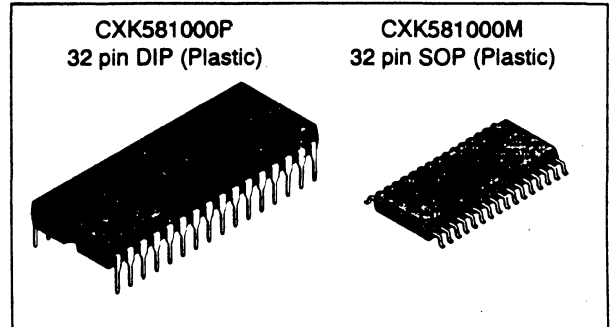
131072-word × 8-bit High Speed CMOS Static RAM

Description

CXK581000P/M is a general purpose high speed CMOS static RAM organized as 131,072 words by 8 bits. Operating on a single 5V supply, this asynchronous IC is suitable for high speed and low power consumption applications where battery back up for nonvolatility is required.

Features

- Fast access time : (Access time)
CXK581000P/M-10L/10LL 100ns (Max.)
CXK581000P/M-12L/12LL 120ns (Max.)
CXK581000P/M-15L/15LL 150ns (Max.)
- Low power consumption operation :
Standby /DC operation
CXK581000P/M-10L, 12L, 15L ; 10 μ W (Typ.) /35mW (Typ.)
10LL, 12LL, 15LL ; 3.5 μ W (Typ.) /35mW (Typ.)
- Single +5V supply : +5V \pm 10%
- Fully static memory ... No clock or timing strobe required.
- Equal access and cycle time.
- Common data input and output:three state output.
- Directly TTL compatible : All inputs and outputs.
- Low voltage data retention : 2.0V (Min.)
- CXK581000P 600mil 32 pin DIP package
CXK581000M 525mil 32 pin SOP package



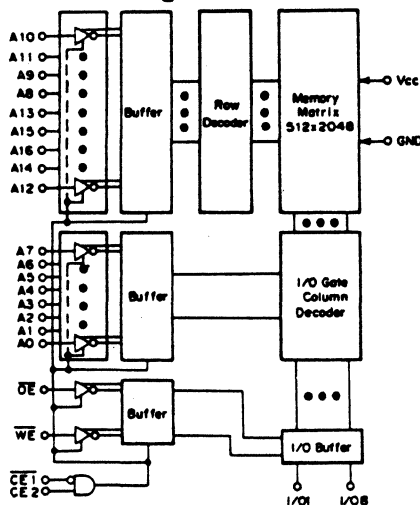
Functions

131,072 word × 8 bit static RAM

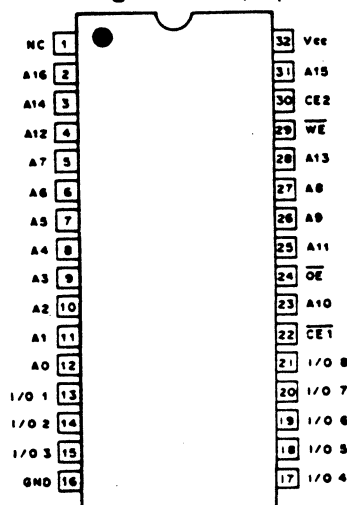
Structure

Silicon gate CMOS IC

Block Diagram



Pin Configuration (Top View)



Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input output
$\overline{CE}1, \overline{CE}2$	Chip enable 1, 2 input
\overline{WE}	Write enable input
\overline{OE}	Output enable input
Vcc	Power supply
GND	Ground
NC	No connection

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E89Y03 -

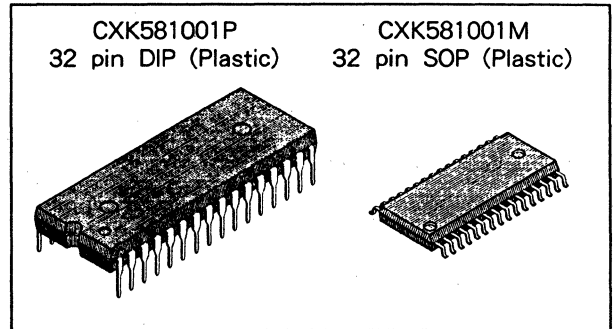
131,072-word × 8-bit High Speed CMOS Static RAM

Description

CXK581001P/M is a 1,048,576 bits high speed CMOS static RAMs organized as 131,072 words by 8-bit and operates from a single 5V supply. This IC is suitable for use in high speed and low power applications in which battery back up for nonvolatility is required.

Features

- Fast access time : (Access time)
 CXK581001P/M-70L 70ns (Max.)
 CXK581001P/M-85L 85ns (Max.)
- Single + 5V supply : +5V ± 10%
- Fully static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Common data input and output : three state output.
- Directly TTL compatible : All inputs and outputs.
- Low voltage data retention : 2.0V (Min.)
- CXK581001P 600-mil 32 pin DIP package
- CXK581001M 525-mil 32 pin SOP package
- Low power operation : CXK581001P/M-70L, 85L
 Standby / Operation
 10μW (Typ.) / 237.5mW (Typ., Cycle = Min.)



Function

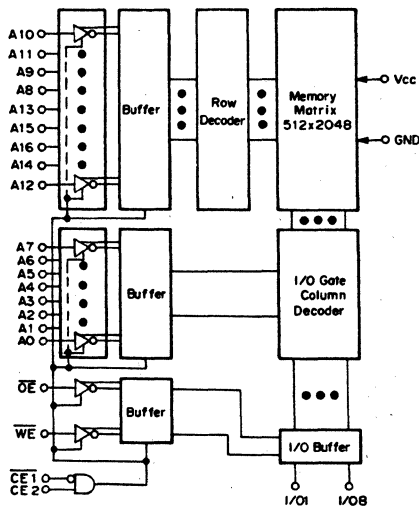
131,072-word × 8-bit static RAM

Structure

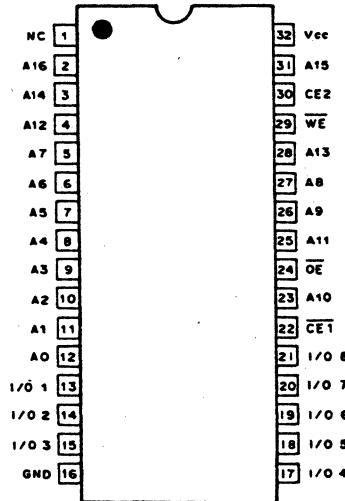
Silicon gate CMOS IC

Sony

Block Diagram



Pin Configuration (Top view)



Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input output
CE1, CE2	Chip enable 1, 2 input
WE	Write enable input
OE	Output enable input
Vcc	+5V Power supply
GND	Ground
NC	No connection

SONY

CXK581100TM/YM -10L/12L/15L -10LL/12LL/15LL

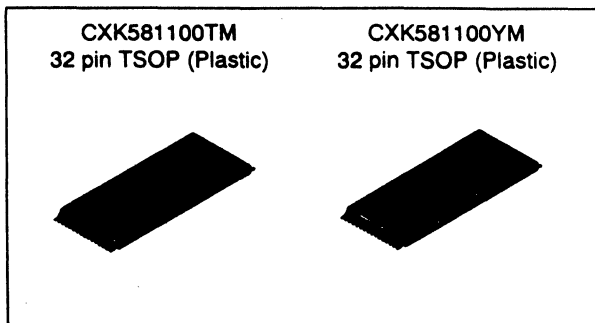
131072-word × 8-bit High Speed CMOS Static RAM

Description

CXK581100TM/YM is a 1M bits, 131072 words by 8 bits, CMOS static RAM. It is suitable for portable and battery back-up systems which require extremely small package and low stand-by current.

Features

- Thin Small-outline Packages of EIAJ standard :
 CXK581100TM :
 8mm × 20mm 32 pin TSOP
 CXK581100YM :
 8mm × 20mm 32 pin TSOP (Mirror image pinout)
- Low stand-by current :
 L-Version :
 100 μA (Max.) @Vcc=5.5V, Ta=0 to 70 °C
 LL-Version :
 20 μA (Max.) @Vcc=5.5V, Ta=0 to 70 °C
- Low voltage data retention : 2.0V (Min.)
- Fast access time : (Access time)
 CXK581100TM/YM-10L, -10LL 100ns (Max.)
 CXK581100TM/YM-12L, -12LL 120ns (Max.)
 CXK581100TM/YM-15L, -15LL 150ns (Max.)
- Single +5V Supply : +5V ± 10%



Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input/output
CE1, CE2	Chip enable 1, 2 input
WE	Write enable input
OE	Output enable input
Vcc	+5V power supply
GND	Ground
NC	No connection

Sony

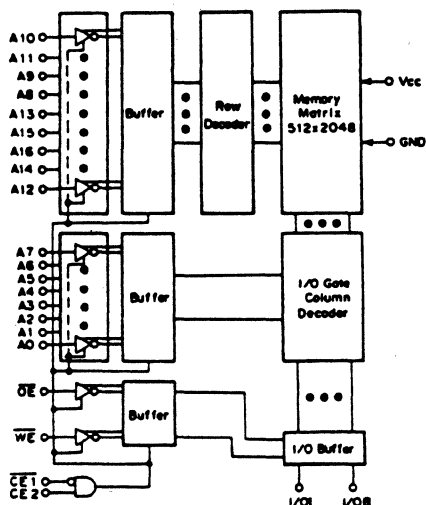
Function

131072-word × 8-bit static RAM

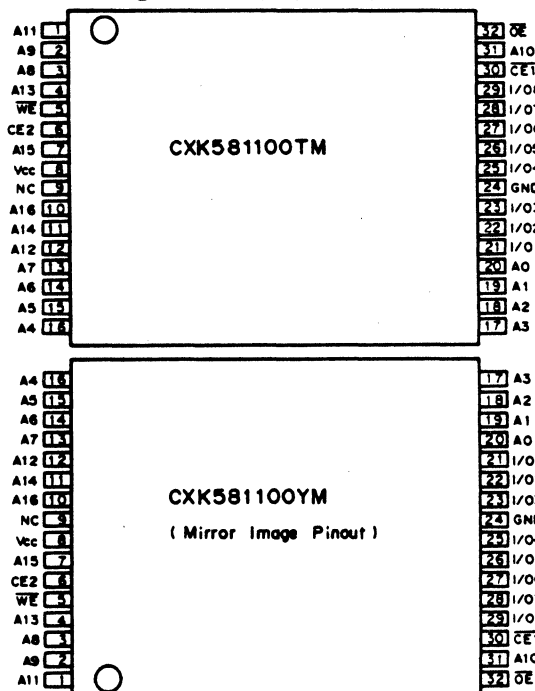
Structure

Silicon gate CMOS IC

Block Diagram



Pin Configuration (Top View)



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E90609 - ST

131072-word × 8-bit High Speed CMOS Static RAM

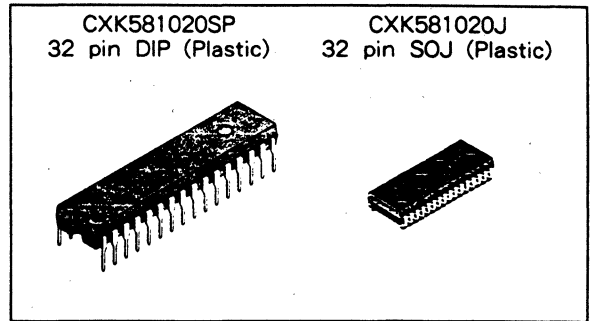
Description

CXK581020SP/J are 131,072-word × 8-bit high speed CMOS static RAMs suitable for use in high speed and low power applications.

Organized as 131,072 words by 8 bits, it operates from a single 5V supply.

Features

- Fast access time : (Access time)
 CXK581020SP/J-35 35ns (Max.)
 CXK581020SP/J-45 45ns (Max.)
 CXK581020SP/J-55 55ns (Max.)
- Low power operation : (Standby) (Operation)
 CXK581020SP/J-35, 45, 55
 50 μW(Typ.) 150mW(Typ.)
- Single +5V supply : +5V ± 10%
- Fully static memory ... No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible : All inputs and outputs.
- Available in 32 pin 400-mil DIP and 400-mil SOJ



Function

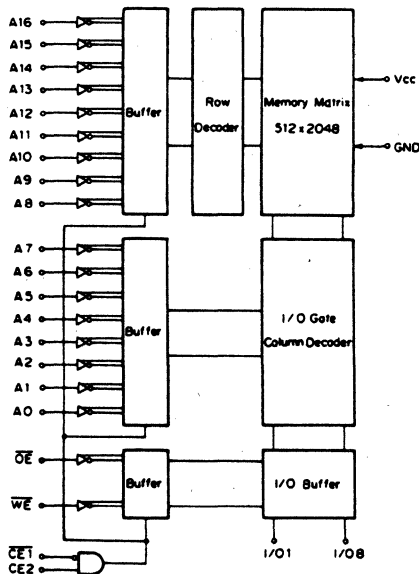
131,072-word × 8-bit static RAM

Structure

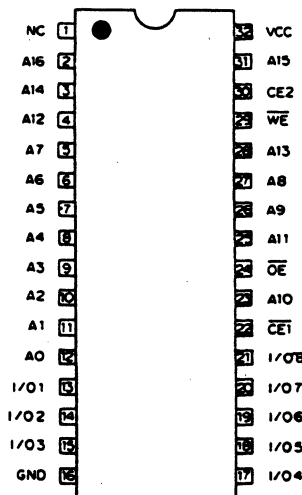
Silicon gate CMOS IC

Sony

Block Diagram



Pin Configuration (Top View)



Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input output
CE1, CE2	Chip enable 1, 2 input
WE	Write enable input
OE	Output enable input
Vcc	+ 5V Power supply
GND	Ground
NC	No connection

32768-word × 9-bit High Speed CMOS Static RAM

Preliminary

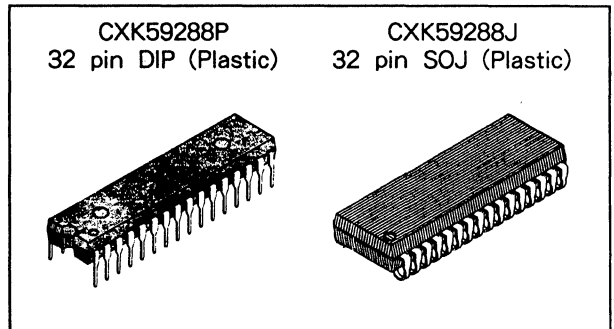
Description

The CXK59288P/J is a high speed CMOS static RAM which consists of 32768-word × 9-bit. It operates at 15ns/20ns/25ns access time from 5V single power supply.

Features

- High speed, low power consumption :

	Access time (Max.)	Power consumption (Typ., Cycle=Min.)
CXK59288P/J-15	15ns	500mW
CXK59288P/J-20	20ns	425mW
CXK59288P/J-25	25ns	375mW
- Single +5V power supply :
 - 15 5V ± 5%
 - 20/25 5V ± 10%
- Fully static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible all inputs and outputs.
- Available in 32 pin 300mil DIP, 300mil SOJ package.



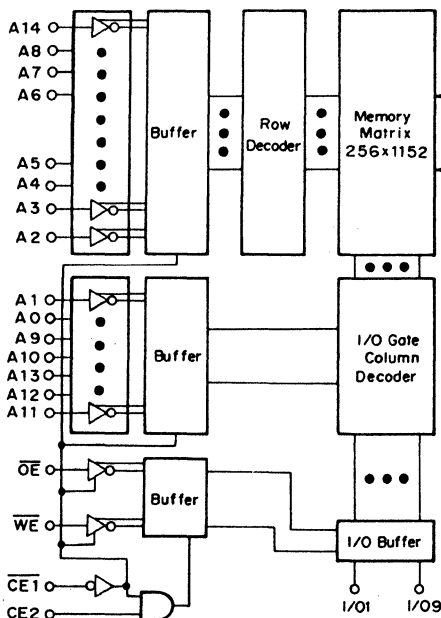
Function

32768-word × 9-bit static RAM

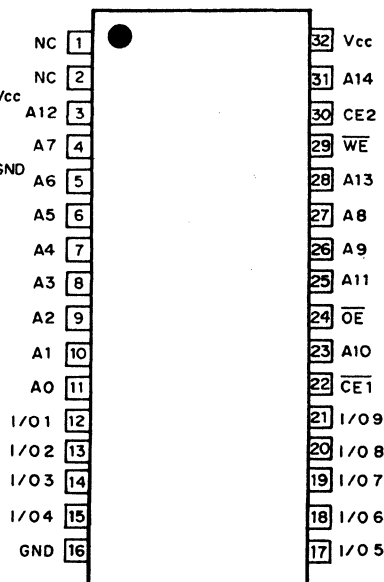
Structure

Silicon gate CMOS IC

Block Diagram



Pin Configuration (Top view)



Pin Description

Symbol	Description
A0 to A14	Address input
I/O1 to I/O9	Data input/output
CE1, CE2	Chip enable 1, 2 input
WE	Write enable input
OE	Output enable input
Vcc	+5V power supply
GND	Ground
NC	Non connection

High-Speed Latched Cache-SRAM

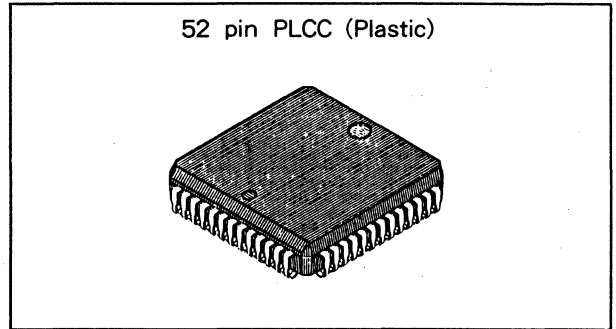
Description

The CXK7701J is a 131,072-bit high speed latched Cache-SRAM suitable for use in high speed cache configurations and low power applications.

Organized as 8192 word × 16-bit or 4096 word × 16-bit × 2 WAY selected by mode control pin, it operates from a single 5V supply.

Features

- Best fit for Cache configurations
Intel 82385 Cache Controller (for 80386-33 MHz, 25MHz, 20MHz)
- Fast access time : (Access time)
CXK7701J-30 30ns (Max.)
CXK7701J-35 35ns (Max.)
CXK7701J-45 45ns (Max.)
- Fast output Enable
CXK7701J-30 10ns (Max.)
CXK7701J-35 13ns (Max.)
CXK7701J-45 16ns (Max.)
- Available in 52 pin PLCC
- Internal 12-bit address latch (A0 – A11)
- Directly TTL compatible : All inputs and outputs

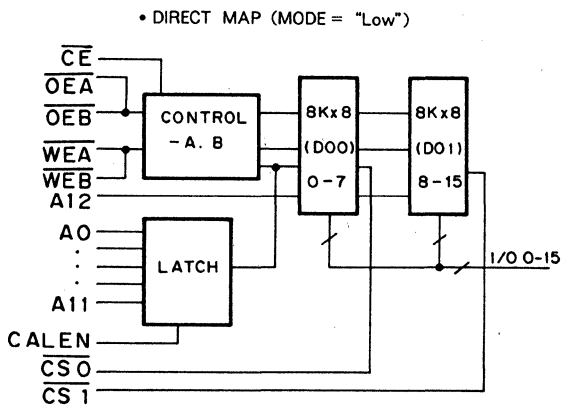
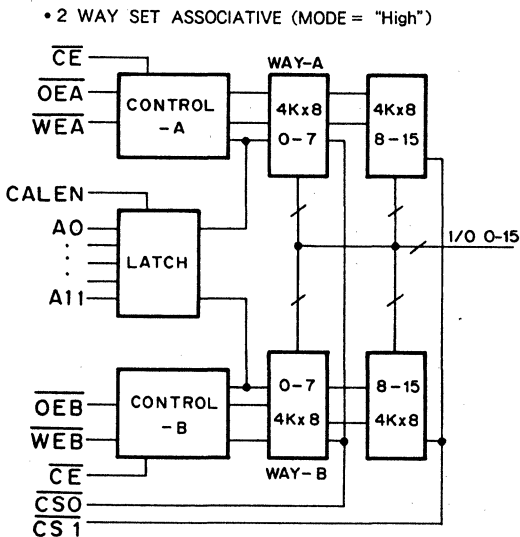


Structure

Silicon gate CMOS IC

Sony

Block Diagram



Spread Spectrum At Your Finger Tips.



HIGHEST PERFORMANCE VITERBI DECODER

At 20 Mbps with 4-bit soft decision the STEL-2020 is the highest performance K=6 and K=7 Viterbi decoder in the industry.

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At 30 Mcps and up to 32 taps per coder the STEL-1032 Triple PN Coder has the flexibility to generate a wide variety of codes for many spread spectrum applications.

HIGHEST PERFORMANCE DIGITAL FILTER

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LOWEST PRICE VITERBI DECODER

At less than \$100 (qty. 1000) the STEL-5269 K=7 Viterbi decoder has the most attractive price in the industry, with industry standard polynomials and a 256 Kbps data rate.

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The STEL-1023 generates the C/A (Clear/Acquisition) coding and timing for GPS receivers in a single chip.

HIGHEST SPEED ACCUMULATOR

With a 70 Msamples/sec. accumulation rate the STEL-2410 is the industry's highest speed signal accumulator for spread spectrum applications.

HIGHEST PERFORMANCE BIT SYNCHRONIZER/ DEMODULATOR

The STEL-2110A is a digital bit synchronizer and PSK demodulator, providing high performance in spread spectrum BPSK and QPSK applications.

FASTEST BURST DATA ACQUISITION

The STEL-2210 Block Phase Estimator allows burst signals to be acquired rapidly and demodulated coherently when used in conjunction with the STEL-2110A.

HIGHEST PERFORMANCE QUADRATURE NCO

The STEL-1177 Quadrature NCO has a 60 MHz clock frequency and incorporates linear PM and FM capabilities as well as providing quadrature 12-bit outputs for -75 dBc purity.

SIGNAL QUALITY ESTIMATOR

The STEL-2330 Signal Quality Estimator provides front-end processing to allow the E_b/N_0 of signals to be calculated at up to 15 Msamples/sec.

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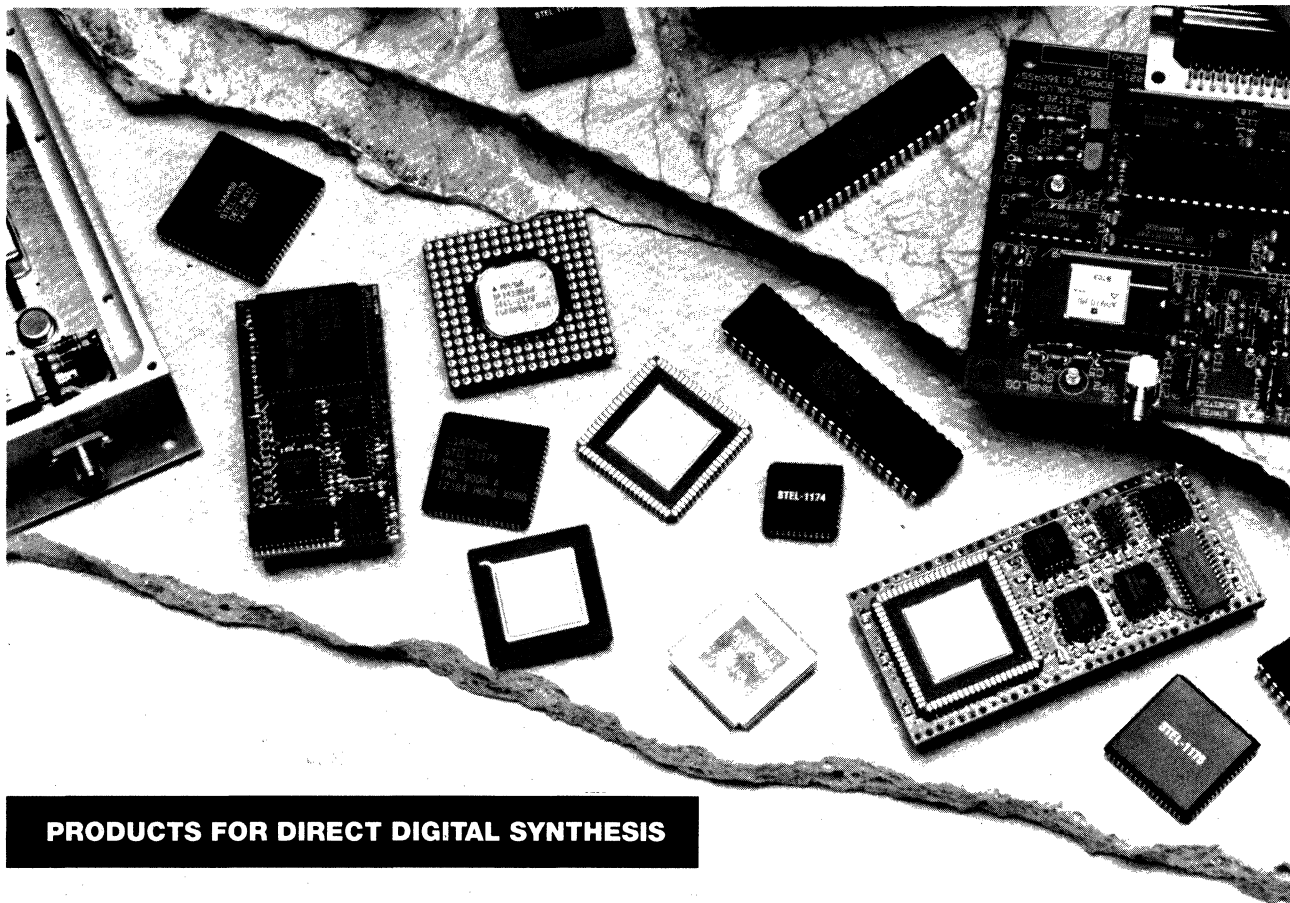
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- STEL-1176** 80 MHz, BCD/Decimal, high speed CMOS
- STEL-1177** 60 MHz, 32bit, full PM, FM, & Quadrature
- STEL-2172** 300 MHz, ECL, 28-bit
- STEL-2173** 1 GHz, GaAs, 32-bit, BPSK, QPSK

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- STEL-1272** based on 1172B, 0-20 MHz
- STEL-1273** based on 1173, 0-20 MHz
- STEL-1275** based on 1175, 0-25 MHz
- STEL-1375A** miniature assembly based on 1175
- STEL-1376** miniature assembly based on 1176
- STEL-1377** miniature assembly based on 1177
- STEL-1277** based on 1177, 0-25 MHz
- STEL-2272** based on 2172, 0-130 MHz
- STEL-2273** based on 2173, 0-400 MHz

CHASSIS-LEVEL DDS

- STEL-9272** based on 2172
- STEL-9273** based on 2173





SYNERGY
SEMICONDUCTOR

COMPANY OVERVIEW

Synergy Semiconductor has emerged as the leader in the high-performance ECL market by designing and manufacturing the industry's fastest memory and logic products. Synergy utilizes a combination of a unique proprietary process and design innovations to provide the very best in *ULTRA-FAST USABLE SPEEDSM*. Synergy's initial products are a family of industry standard ECL RAMs and Logic. The first product introduced in January 1989, was a 1K x 4 Static RAM providing the industry's fastest access and write time of 3 nanoseconds. The proprietary ASSETTM (All Spacer Separated Element Transistor) Technology allows Synergy to build devices which achieve an f_T of 15 GHz and unloaded gate delays of 80 picoseconds at 200uA, while utilizing very conservative 1.5 micron lithography. It is a fully self-aligned technology making it alignment tolerant, which is extremely important to allow the technology to be truly scalable to much more aggressive geometries. ASSET is readily scalable to sub-micron lithography levels allowing Synergy to continue to demonstrate significant performance improvements as the technology advances.

Synergy currently offers a complete series of ultra-fast 1K, 4K and 16K RAMs as well as *SUPER-300KTM* and ECLinPS ECL Logic families, each of which have set new speed standards for the industry. The series of ECL RAMs features equally fast read and write times, not offered by the competition. In addition to the high-speed read and write capabilities, without the disadvantage of higher power, the products are designed for immunity to alpha-particles, therefore reducing the "soft error" rates often suffered by memory cells.

Synergy will continue to develop additional complementary product families to progressively fill the ever increasing demands of high-end systems for the ultimate in high-performance.

Synergy is headquartered in Santa Clara, California. The company's operations are housed in a 45,000 square foot facility which incorporates all aspects of its business from research and development, to design, wafer fabrication, test, shipping and administration. This facility incorporates a modern wafer fabrication clean room with the equipment operating in a sub-Class 10 environment. The fabrication area incorporates state-of-the-art high resolution steppers, dry-etchers, films deposition systems, etc. The company's test area utilizes advanced test equipment capable of holding extremely tight, picosecond level testing accuracies.

ASSET is a trademark of Synergy Semiconductor Corporation
SUPER-300K is a trademark of Synergy Semiconductor Corporation
ULTRA-FAST USABLE SPEED is a servicemark of Synergy Semiconductor Corporation

3450 Central Expressway
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Synergy Semiconductor



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ULTRA FAST ECL LOGIC

- Ultra-fast gate speeds for performance oriented ECL systems
- **SUPER-300K** functions offer almost twice the speed and half the power of F100K functions from National and Signetics
- **SUPER-300K** devices are pin compatible with National and Signetics
- **SUPER-300K** devices packaged in **CERDIP, CERPAC**K and also in **PLCC, CLCC**
- Superior ESD protection of 2000V
- Typical edge rates of 500ps
- Extended supply voltage option:
 - $V_{EE} = -4.5V$ (100K)
 - $V_{EE} = -5.2V$ (101K)

PART NUMBER	DESCRIPTION	MAX SPEED			I_{EE} MIN mA
		DIP	FLAT	PLCC	
100K/101K					
SY100/101S301	Triple 5-input OR/NOR Gate	900ps	750ps	700ps	-25
SY100/101S302	Quint 2-Input OR/NOR Gate	800ps	750ps	700ps	-45
SY100/101S304	Quint AND/NAND Gate	1250ps	1150ps	1050ps	-60
SY100/101S307	Quint Exclusive OR/NOR Gate	1200ps	1100ps	1000ps	-58
SY100/101S313	Quad Driver	950ps	850ps	850ps	-70
SY100/101S314	Quint Differential Line Receiver	1200ps	1100ps	1000ps	-60
SY100/101S317	Triple 2-Wide OA/OAI Gate	1750ps	1600ps	1500ps	-48
SY100/101S318	5-Wide 5,4,4,4,2 OA/OAI Gate	1300ps	1100ps	1000ps	-55
SY100/101S322	9-Bit Buffer	900ps	800ps	700ps	-63
SY100/101S324	Hex TTL-to-ECL Translator	1.5ns	1.4ns	1.3ns	-55
SY100/101S325	Hex ECL-to-TTL Translator	2.8ns	2.7ns	2.6ns	-37
SY100/101S331	Triple D Flip-Flop	600MHz	700MHz	700MHz	-90
SY100/101S336	4-Stage Counter/Shift Register	500MHz	500MHz	500MHz	-170
SY100/101S341	8-Bit Shift Register	500MHz	500MHz	500MHz	-145
SY100/101S350	Hex D Latch	1050ps	1000ps	900ps	-98
SY100/101S351	Hex D Flip-Flop	600MHz	700MHz	700MHz	-98
SY100/101S355	Quad Multiplexer/Latch	1300ps	1200ps	1100ps	-80
SY100/101S356	Mask-Merge/Latch	1400ps	1200ps	1100ps	-141
SY100/101S360	Dual Parity Checker/Generator	2400ps	2300ps	2200ps	-60
SY100/101S363	Dual 8-Input Multiplexer	1100ps	1000ps	900ps	-92
SY100/101S364	16-Input Multiplexer	1500ps	1400ps	1300ps	-63
SY100/101S365	Universal Priority Encoder	2300ps	2200ps	2100ps	-120
SY100/101S366	9-Bit Comparator	2200ps	2100ps	2000ps	-150
SY100/101S370	Universal Demultiplexer/Decoder	1400ps	1300ps	1200ps	-92
SY100/101S371	Triple 4-Input Multiplexer with Enable	1200ps	1100ps	1000ps	-68

Synergy Semiconductor

SUPER-300K is a trademark of Synergy Semiconductor Corporation

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- Ultra-Fast Access Times
- Ultra-Fast Write Times
- Eliminates write recovery glitch found on competitors' ECL RAMs
- Designed for alpha particle immunity
- Built with ASSETTM I Technology
- Meets 100K, 101K and 10K interface standards and supply voltages
 - 100K -4.5V
 - 101K -5.2V
 - 10K -5.2V
- 1500V ESD protection
- Industry standard architecture and pinouts

PART NUMBER	DESCRIPTION	DATASHEET LIMITS (ns)		MIN (mA) I _{EE}
		T _{AA}	T _{ww}	
100K				
SY100422-3	256 x 4 ECL RAM	3	3	-270
SY100422-5/7	256 x 4 ECL RAM	5 / 7	3.5 / 5	-200
SY100474-3	1K x 4 ECL RAM	3	3	-300
SY100474-5/7	1K x 4 ECL RAM	5 / 7	5 / 8	-250/-220
SY100480-6	16K x 1 ECL RAM	6	6	-220
SY100480-8/10	16K x 1 ECL RAM	8 / 10	10	-260/-220
SY100484-5	4K x 4 ECL RAM	5	5	-300
SY100484-8/10	4K x 4 ECL RAM	8 / 10	10	-330/-260
SY100494-5	16K x 4 ECL RAM	5	5	-395
101K				
SY101422-3	256 x 4 ECL RAM	3	3	-270
SY101422-5/7	256 x 4 ECL RAM	5 / 7	3.5 / 5	-200
SY101474-3	1K x 4 ECL RAM	3	3	-300
SY101474-5/7	1K x 4 ECL RAM	5 / 7	5 / 8	-250/-220
SY101480-6	16K x 1 ECL RAM	6	6	-220
SY101480-8/10	16K x 1 ECL RAM	8 / 10	10	-260/-220
SY101484-5	4K x 4 ECL RAM	5	5	-300
SY101484-8/10	4K x 4 ECL RAM	8 / 10	10	-330/-260
SY101494-5	16K x 4 ECL RAM	5	5	-395
10K				
SY10422-3	256 x 4 ECL RAM	3	3	-270
SY10422-5/7	256 x 4 ECL RAM	5 / 7	3.5 / 5	-200
SY10474-3	1K x 4 ECL RAM	3	3	-300
SY10474-5/7	1K x 4 ECL RAM	5 / 7	5 / 8	-250/-220
SY10480-6	16K x 1 ECL RAM	6	6	-220
SY10480-8/10	16K x 1 ECL RAM	8 / 10	10	-260/-220
SY10484-5	4K x 4 ECL RAM	5	5	-300
SY10484-8/10	4K x 4 ECL RAM	8 / 10	10	-330/-260
SY10494-5	16K x 4 ECL RAM	5	5	-395

Synergy Semiconductor

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- Ultra-fast gate speeds for performance oriented ECL systems
- 100% compatible with Motorola
- Packed in efficient high performance 28-lead PLCC and CLCC
- Superior ESD protection of 2000V
- Typical edge rates of 500 ps
- Industry standard 10KH and 100K I/O levels
- Extended supply voltage option with 100K I/O
 $V_{EE} = -4.5V$ (100K)
 $V_{EE} = -5.2V$ (101K)

Synergy Semiconductor

PART NUMBER	DESCRIPTION	MAX SPEED	10KH I _{EE} MAX mA	100K/101K I _{EE} MAX mA
10KH/100K/101K				
SY10/100/101E016	8-Bit Synchronous Binary Up Counter	700MHz	181	208
SY10/100/101E101	Quad 4-Input OR/NOR Gate	500ps	36	42
SY10/100/101E104	Quint 2-Input AND/NAND Gate	600ps	50	58
SY10/100/101E107	Quint 2-Input XOR/NOR Gate	600ps	50	58
SY10/100/101E111	1:9 Differential Clock Driver	630ps	60	69
SY10/100/101E112	Quad Driver with Enable	600ps	56	65
SY10/100/101E116	5-Bit Differential Line Receiver	500ps	35	40
SY10/100/101E122	9-Bit Buffer	500ps	56	63
SY10/100/101E131	4-Bit D Flip-Flop	800MHz	70	81
SY10/100/101E141	8-Bit Shift Register	700MHz	168	193
SY10/100/101E142	9-Bit Shift Register	700MHz	145	165
SY10/100/101E143	9-Bit Hold Register	700MHz	145	165
SY10/100/101E150	6-Bit Latch	800ps	60	69
SY10/100/101E151	6-Bit D Register	800MHz	85	98
SY10/100/101E154	5-Bit 2:1 Mux-Latch	825ps	91	105
SY10/100/101E155	6-Bit 2:1 Mux-Latch	825ps	102	117
SY10/100/101E156	3-Bit 4:1 Mux Latch	950ps	90	103
SY10/100/101E158	5-Bit 2:2 Multiplexer	600ps	40	46
SY10/100/101E160	12-Bit Parity Generator/Checker	900ps	69	79
SY10/100/101E163	Dual 8-Input Multiplexer	850ps	88	100
SY10/100/101E166	9-Bit Magnitude Comparator	1400ps	120	120
SY10/100/101E167	6-Bit 2:1 Mux-Register	800MHz	113	130
SY10/100/101E171	3-Bit 4:1 Multiplexer	725ps	67	77
SY10/100/100E193	8-Bit Error Detection/Correction (EDAC)	1400ps	120	120
SY10/100/101E241	8-Bit Scannable Register	700MHz	168	193
SY10/100/101E256	3-Bit 4:1 Mux-Latch	950ps	83	96
SY10/100/101E336	3-Bit Registered Bus XVCR	1000ps	122	141
SY10/100/101E337	3-Bit Scannable Reg. Bus XCVR	1000ps	161	185
SY10/100/101E451	6-Bit D Reg. , Diff. Data & CLK Inputs	800MHz	101	116

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CMOS 4-BIT MICROCONTROLLER — TLCS-42 SERIES

Type	Function	ROM (bit)	RAM (bit)	I/O (bit)	Min. Instruction Execution Time (μs)	Supply Voltage (V)	Package
TMP42C40P	STANDARD	512 X 8	32 x 4	11	1.0 (2.5)	4.5~5.5 (4.0~6.0)	16-PIN DIP
TMP42C60P		1024 X 8					28-PIN SDIP
TMP42C50N		512 X 8		28-PIN SOP			
TMP42C70N		1024 X 8		23			28-PIN SOP
TMP42C70M				15			20-PIN DIP
TMP42C66P				Pulse (Remote-controlled) Output Circuit AC Zero-crossing Detection Circuit			23	20-PIN DIP
TMP42C00Y	EVALUATOR CHIP	EXTERNAL (1024 X 8)				64-PIN PGA	

NMOS

TMP4240P	STANDARD 1024 X 8	512 x 8	32 x 4	11	2.5	4.5-5.5	16-PIN DIP
TMP4260P		1024 x 8		23			28-PIN SDIP
TMP4250N		512 x 8					
TMP4270N							

4-BIT MICROCONTROLLER — TLCS-470 CMOS SERIES

TMP47C800N TMP47C800F	STANDARD (LED DRIVER)	8192 X 8	512 X 4	36	1.3 (244)	4.5-6.0	42-PIN SDIP 44-PIN PQFP				
TMP47P800N TMP47P800F		OTP 8192 X 8					80-PIN PQFP				
TMP47P800E		EPROM 8192 X 8						42-PIN CERDIP WITH WINDOW			
TMP47C620F	LCD DRIVER HIGH SPEED TIMER/COUNTER	6144 X 8	384 X 4	56	1.9	4.5-6.0	80-PIN PQFP				
TMP47C820F		8192 X 8	512 X 4								
TMP47P820F		OTP 8192 X 8									
TMP47CE820F		ON-CHIP EPROM 84 X 8-BIT						8192 X 8			
TMP47C434N TMP47C434F	DISPLAY ON SCREEN CIRCUIT D/A CONVERSION (PW/M) OUTPUT 3-BIT A/D CONVERSION INPUT REMOTE CONTROL PRE-PROCESSING LED DRIVER	4096 X 8	256 X 4	28	1.9	4.5-6.0	42-PIN SDIP 44-PIN PQFP				
TMP47C634N TMP47C634F		6144 X 8	384 X 4				54-PIN SDIP				
TMP47C635N											
TMP47C850N	DTMF RECEIVER, BEEP OUTPUT LED DRIVER	8192 X 8	512 X 4	52	2.2 (244)	4.5-5.5	64-PIN SDIP				
TMP47C858F	DTMF GENERATOR, LCD DRIVER			36		2.7-6.0	100-PIN PQFP				
TMP47C660N TMP47C660F	8-BIT A/D CONVERTER REMOTE CONTROL PRE-PROCESSING LED DRIVER	6144 X 8	384 X 4	55	1.3 (244)	4.5-6.0	64-PIN SDIP 64-PIN PQFP				
TMP47C860N TMP47C860F		8192 X 8	512 X 4								
TMP47P860N TMP47P860F		OTP 8192 X 8									
TMP47P860E		EPROM 8192 X 8									
TMP47C662N		VFT DRIVER PULSE GENERATOR	6144 X 8					384 X 4	55		64-PIN SDIC WITH WINDOW
TMP47C862N			8192 X 8					512 X 4			64-PIN SDIP
TMP47C670N TMP47C670F	VFT DRIVER D/A CONVERSION (PWM) OUTPUT 4-BIT A/D CONVERSION INPUT REMOTE CONTROL PRE-PROCESSING	6144 X 8	384 X 4	53	1.3 (244)	4.5-6.0	64-PIN SDIP 64-PIN PQFP				
TMP47C870N TMP47C870F		8192 X 8	512 X 4								
TMP47P870N TMP47P870F		OTP 8192 X 8									
TMP47P870E		EPROM 8192 X 8									
TMP47C1260N		LED DRIVER 8-BIT A/D CONVERTER REMOTE CONTROL PRE-PROCESSING	12288 x 8					768 x 4	56	1.3 (244)	4.5-6.0	64-PIN SDIP
TMP47C1660N		16384 x 8									
TMP47C1270N	VFT DRIVER D/A CONVERSION (PWM) OUTPUT 4-BIT A/D CONVERSION INPUT REMOTE CONTROL PRE-PROCESSING	12288 x 8	53								
TMP47C1670N		16384 x 8									

4-BIT MICROCONTROLLER — TLCS-470A CMOS SERIES

TMP47C1260N	LED DRIVER 8-BIT A/D CONVERTER REMOTE CONTROL PRE-PROCESSING	12288 x 8	768 x 4	56	1.3 (244)	4.5-6.0	64-PIN SDIP	
TMP47C1660N		16384 x 8						
TMP47C1270N		VFT DRIVER D/A CONVERSION (PWM) OUTPUT 4-BIT A/D CONVERSION INPUT REMOTE CONTROL PRE-PROCESSING		12288 x 8				53
TMP47C1670N				16384 x 8				

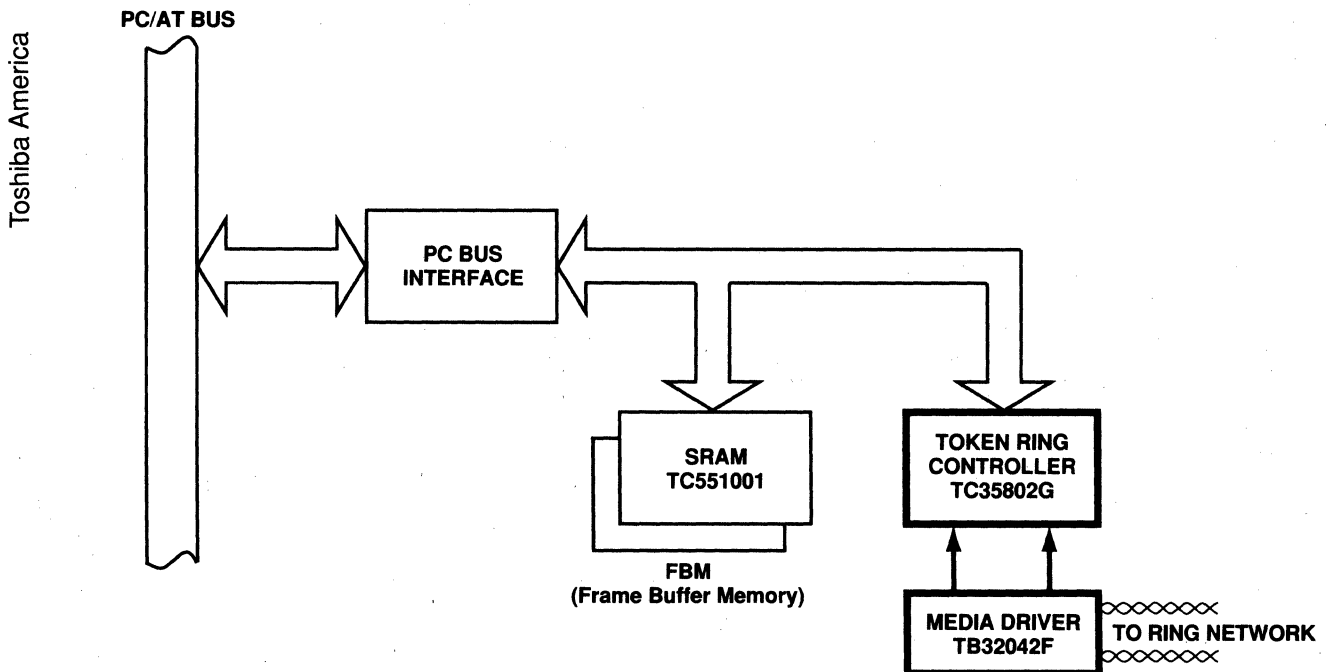
Toshiba America

16/4 MBPS TOKEN RING CONTROLLER, MEDIA DRIVER/RECEIVER

TC35802, TB32042F

- 1.2 μ CMOS Integrated Token Ring Controller (TC35802G) and Bi-CMOS Media Driver/Receiver (TB32042F)
- Compatible with IEEE 802.5 specifications
- MAC level function support
- Software switchable 16 or 4 Mbps data rates
- Intelligent DMA utilizing linked list data structures
- Automatic execution of token passing protocol
- On-chip FIFO queues for high tolerance to bus latency and high packet performance
- On-chip logic to support source routing bridge
- Direct interface between the TC35802G Token Ring Controller and the TB32042F Media Driver/Receiver
- Built-in self-diagnostic functions
- 16-bit bus interface allows for easy integration with iAPX86, 186, 286 microprocessors
- Built-in phantom drive control, loop-back, watchdog timer and error detection in the TB32042F
- 144-pin flat package (TC35802G), 60-pin flat package (TB32042F)

TYPICAL PC ADAPTER APPLICATION



Toshiba's TC35802G TRC (Token Ring Controller) is an IEEE 802.5 based LAN controller which utilizes the token ring protocol. The TC35802G has been designed to easily interface to the iAPX series of microprocessors. The TRC's built-in DMA controller and advanced linked list buffer management scheme allows a system to be configured for maximum performance in node processor applications. For systems without a dedicated node processor, the system designer can choose the best cost perform-

ance ratio by choosing between shared memory interfaces and bus master applications. All MAC level functions are supported. The Logical Link Control, Configuration Report Server, Ring Error Monitor and Ring Parameter Server are implemented in software. The TB32042F MDR (Media Driver/Receiver) allows for easy connection between the ring network and TRC. The MDR has built-in phantom drive control, loop-back, watchdog timer, wire-error detection and is switchable between 4 Mbps and 16 Mbps speeds.

TMP68301/3 – 68HC000 BASED INTEGRATED MICROPROCESSORS

TMP68301/3 FEATURES

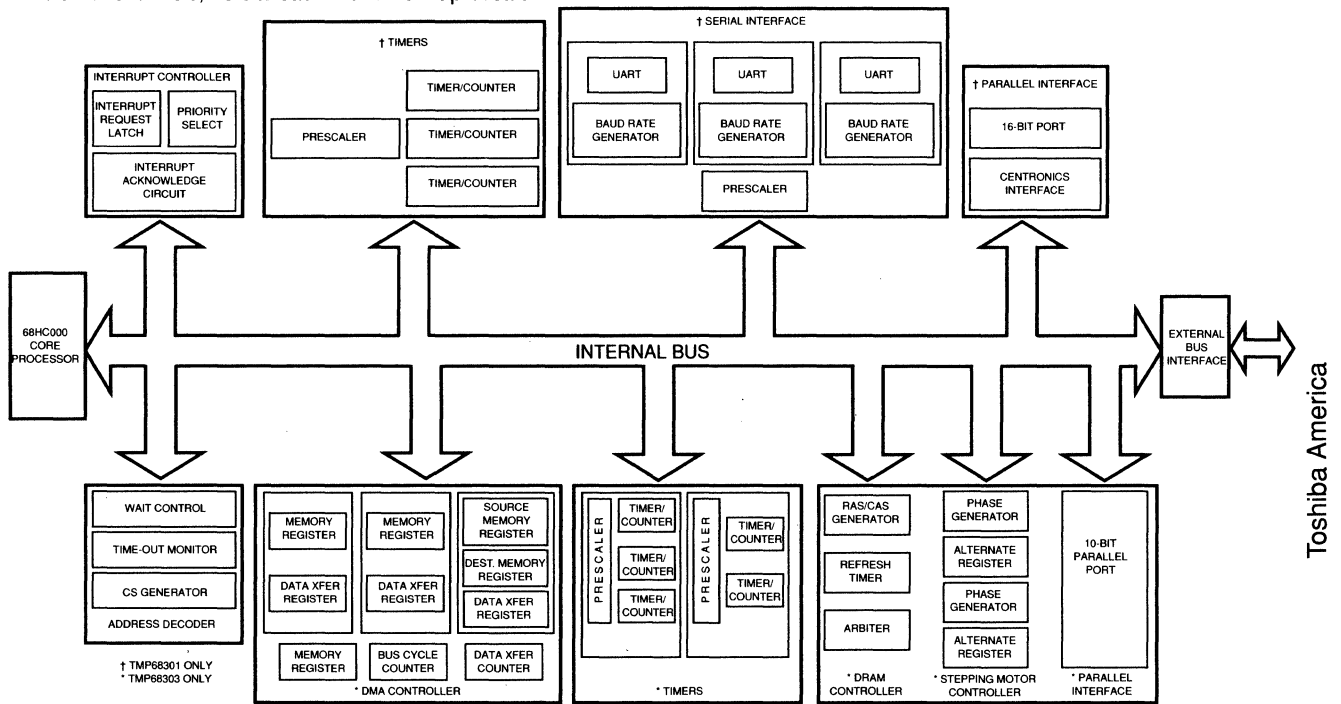
- 12.5, 16.67 MHz 68HC000 based integrated microprocessor
- Sophisticated address decoder — relocatable chip-select generation for internal peripherals and external chip-selects
- Built-in interrupt controller — 3 external plus internal channels with auto-vector interrupt generation
- Automatic DTACK generation with 0 to 7 wait-states and programmable BERR generation
- 100-pin plastic flat package

TMP68301 UNIQUE FEATURES

- 3 Asynchronous serial ports with baud rate generators with optional modem control
- 16-bit parallel interface with optional Centronics interface port
- 3 timer channels, 16 bits each with an 8-bit prescaler

TMP68303 UNIQUE FEATURES

- 3 independent DMA channels capable of 8 Mbyte/sec transfer rate
- DRAM controller with programmable refresh and memory wait-states
- 2 Asynchronous serial ports with independent baud rate generators
- General purpose 10-bit parallel interface
- 2 channel stepping motor controller
- 4 timer channels — Two 16-bit with 8-bit prescaler and two 8-bit with 9-bit prescaler
- 16-bit watchdog timer with system reset output



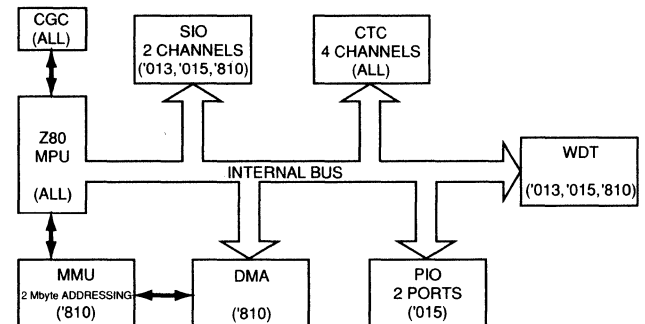
Toshiba America

TLCS-Z80 APPLICATION SPECIFIC STANDARD PRODUCTS (ASSPs)

TLCS-Z80 FEATURES

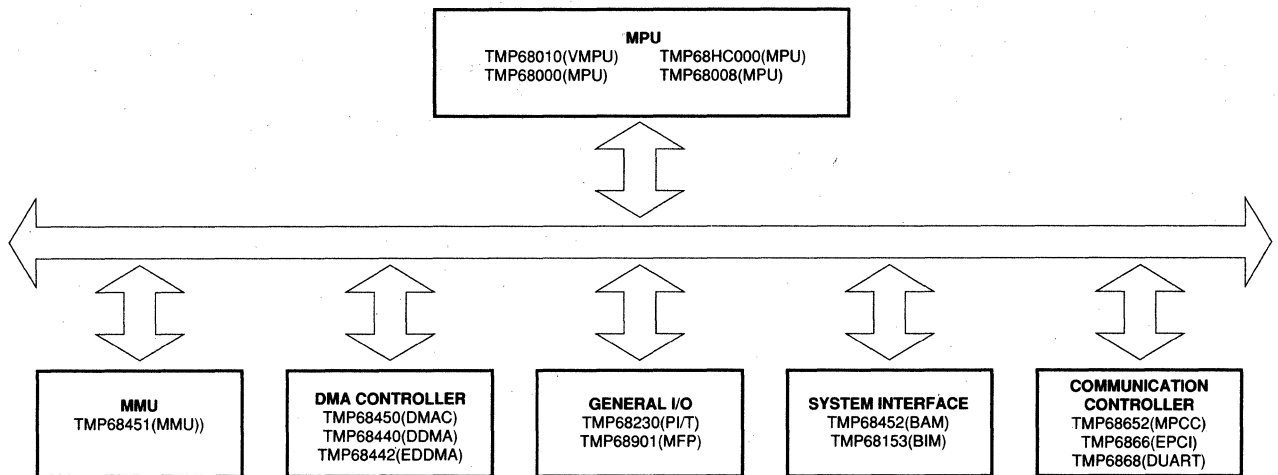
- Z80 based Application Specific Standard Product (ASSP)
- Industry Standard CGC, CTC, DMA, SIO, PIO AND MMU
- Watchdog timer, RAM and additional I/O
- Industry standard development tools can be used for debug and test
- Available in 6, 8 and 10 MHz versions

DEVICE	FEATURES	PACKAGE
TMPZ84C011AF	Z80 MPU + Z80 CGC + Z80 CTC + FIVE 8-BIT I/O PORTS	100-PIN PQFP
TMPZ84C013AF	Z80 MPU + Z80 CGC + Z80 CTC + Z80 SIO + WATCHDOG TIMER	84-PIN PLCC
TMPZ84C015AF	Z80 MPU + Z80 CGC + Z80 CTC + Z80 PIO + Z80 SIO + WATCHDOG TIMER	100-PIN PQFP
TMPZ84C810AF	Z80 MPU + Z80 CGC + Z80 CTC + Z80 SIO + DMA + I/O + MMU (1MB PROGRAM & DATA) + WATCHDOG TIMER	100-PIN PQFP
TMPZ84C112AN TMPZ84C112AF	Z80 MPU + 256 BYTES RAM + TWO 8-BIT & ONE 5-BIT I/O PORTS	64-PIN SDIP 64-PIN PQFP



16-BIT MICROPROCESSORS TLCS-68000 SERIES

System Configuration



Clock Rates and Package Type of the TLCS-68000 Family

DEVICE NO.	DEVICE NAME	PROCESS	SPEEDS (MHZ)	DIP	CERAMIC PGA	
				PLASTIC	WITH STANDOFFS	WITHOUT STANDOFFS
TMP68000	MPU	N	8, 10, 12.5	64	68	68
TMP68008	MPU	N	8, 10	48	—	—
TMP68010	VMPU	N	8, 10, 12.5	64	68	68
TMP68230	PI/T	N	8, 10	48	—	—
TMP68450	DMAC	N	8, 10	—	68	68
TMP68451	MMU	N	8, 10	—	68	—
TMP68HC000	MPU	C	10, 12.5, 16	64	68	—
TMP68681	DUART	N	1 Mbps	40	—	—
TMP68901	MFP	N	4	48	—	—
TMP68153	BIM	B	16	40	—	—
TMP68440	DDMA	N	8, 10	64	68	68
TMP68442	EDDMA	N	8, 10	—	—	68
TMP68452	BAM	B	50ns (ARBITRATION TIME)	28	—	—
TMP68661	EPCI	N	1 Mbps	28	—	—

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8-BIT MICROCONTROLLERS TMP68HC05/11 SERIES

Product List

PRODUCT NUMBER	ROM (bytes)	EEPROM (bytes)	RAM (bytes)	I/O PORT (bits)	MINIMUM INSTRUCTION EXECUTION TIME (μS)	CLOCK FREQUENCY FOSC (MHz)	SUPPLY VOLTAGE (V)	OPERATING TEMPERATURE (°C)	PACKAGE TYPE
TMP68HC05C4	4160	—	176	31	0.95	D.C. ~ 4.2	3.0 ~ 5.5	0 ~ +70	40-pin DIP *44-pin QFP 44-pin PLCC
TMP68HC05B6	5952	256	176	32	0.95	D.C. ~ 4.2	3.0 ~ 5.5	0 ~ +70	52-pin PLCC 64-pin SDIP
TMP68HC11A8	8K	512	256	38	0.95	D.C. ~ 8.4	4.5 ~ 5.5	-40. ~ +85	64-pin SDIP *64-pin QFP 52-pin PLCC 48-pin DIP
TMP68HC11A1	—	512							
TMP68HC11A0	—	—							
TMP68HC11E9	12K	512							
TMP68HC11E1	—	512	512	38	0.95	D.C. ~ 8.4	4.5 ~ 5.5	-40. ~ +85	64-pin SDIP *64-pin QFP 52-pin PLCC
TMP68HC11E0	—	—							
TMP68HC711J6	16K (EPROM)	—	512	54	0.47	D.C. ~ 16.8	4.5 ~ 5.5	-40 ~ +85	64-pin SDIP 68-pin PLCC

* : Planned Product

PACKAGE DIP: Plastic Dual-in-line (Pin pitch : 2.54mm)
 PLCC: Plastic Leaded Chip Carrier
 SDIP: Shrink DIP (Pin pitch : 1.78mm)
 QFP: Plastic Quad Flat Package

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Powerful Microprocessor Peripherals

- Total CMOS solution for low power consumption and heat dissipation
- Many devices compatible with accepted industry standards
- Many devices available in both DIP and surface mount packages

COMPONENTS

TYPE NUMBER	PACKAGE		DESCRIPTION	COMPATIBLE PART	PRODUCTION AVAILABILITY
TC8250AP	16-PIN DIP	RTC	REAL TIME CLOCK/CALENDAR	TOSHIBA ORIGINAL	NOW
TC8521P	18-PIN DIP				
TC8505AP	40-PIN DIP	CRTC	CRT DISPLAY CONTROLLER	MOTO/HITACHI 6845 (NMOS) PINOUT	NOW
TC8505AF	44-PIN MFP				
T7518	144-PIN QFP	HDC	HARD DISK CONTROLLER	TOSHIBA ORIGINAL	NOW
TC85041F	100-PIN QFP	BIA	BUS INTERFACE ADAPTER PC/AT	TOSHIBA ORIGINAL	NOW
TC8540F					
TC8541F					
TC8563AF	60-PIN QFP	VFO	VFO FOR HDC	TOSHIBA ORIGINAL	NOW
TC8564AF					
TC8565AP	40-PIN DIP	FDC	FLOPPY DISK CONTROLLER	NEC μ PD765	NOW
TC8565AF	44-PIN MFP			INTEL 8272A	
TC8566AF	100-PIN MFP			FDC WITH VCO	
TC8568AM	28-PIN SOIC	VFO	VFO FOR FLOPPY DISK	TOSHIBA ORIGINAL	NOW
TC8569AF	80-PIN MFP	FDC	FLOPPY DISK CONTROLLER (PERPENDICULAR RECORDING)		NOW
TC85069F					NOW
TC8576AF	44-PIN MFP	CPC	CENTRONICS I/O + RS232C	TOSHIBA ORIGINAL	NOW
TC8577AP	40-PIN DIP		CENTRONICS OUTPUT + RS232C		
TC8578AP	40-PIN DIP		CENTRONICS INPUT + RS232C		
T7779	100-PIN FP	LCK/CRTC	LCD/CRTC CONTROLLER 640X 400 DOT MATRIX	MOTO/HITACHI 6845 (SOFTWARE)	NOW
T7889A	100-PIN FP	LCD	ROW/COLUMN DRIVER/CONTROLLER		NOW
T7934	80-PIN FP	LCD	LCD CONTROLLER/DRIVER/(40 DIGIT X 16 LINES)		NOW
T6963C	67-PIN MFP	LCD	LCD CONTROLLER (80 DIGIT X 16 LINES)	TOSHIBA ORIGINAL	NOW
TC8506M	28-PIN SOP	LUT	LOOK UP TABLE RAM W/DAC	TOSHIBA ORIGINAL	NOW
TC8507P	40-PIN DIP				
TC8554F	100-PIN QFP	ODC	ERROR CORRECTION FOR OPTICAL DISK	TOSHIBA ORIGINAL	NOW
TC8570AP	44-PIN QFP	UART	UNIVERSAL ASYNCHRONOUS R/T	TOSHIBA ORIGINAL	NOW
TC8570AF					

Toshiba America

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Toshiba offers the most comprehensive CMOS LOGIC line available — from our standard 4000 series up to our new Advanced High Speed 74AC series. The Advanced High Speed series has typical prop delay times of 3.5ns and maximum clock frequencies of 150 megahertz. That's 33% faster than the original 74HC series. With high noise

margin, high speed and low power consumption, these devices create opportunities for designers of high speed portable instruments, telecommunicators or any digital system. Now Toshiba offers a line of BiCMOS Logic. Available currently is a full line of Bus Interface Devices as well as several gate functions.

TOSHIBA HIGH SPEED (HC), ADVANCED HIGH SPEED (AC) CMOS AND BiCMOS (BC) FUNCTION SELECTION GUIDE

Toshiba America

FUNCTION		HIGH SPEED (P/N TC74HC)	ADVANCED HIGH SPEED (P/N TC74AC)	BiCMOS (P/NTD74BC)
GATE	NAND	00A, T00A, 03A, 10A, 20A, 30A, 132A, 133A	00, T00, 10, T20, T10	00
	NCR	02A, T02A, 27A, 4002A, 407A, 4078A	02, T02	
	AND	08A, T08A, 09A, 11A, 21A	08, T08, 11	08
	OR	32A, T32A, 4072A, 4075A, 4078A	32, T32	32
	INVERTER	04A, U04A, T04A, 05A, 07A	04, T04, 05	
	SCHMIDT TRIGGER	14A, 132A	14, T14	
MULTIFUNCTION	51A, 86A, T86A, 266A, 386A, 7266A	86, T86		
BUFFER		4049A, 4050A, T7007A		
	3-STATE	125A, 126A, 240A, T240A, 241A, T241A, 244A, T244A, 365A, 366A, 367A, 368A, 540A, T540A, 541A, T541A, 7240A, 7241A, 7244A	125, 126, 240, T240, 241, T241, 244, T244, 367, 368, 540, T540, 541, T541	230, 231, 240, 241, 244, 365, 366, 367, 368, 540, 541
	BIDIRECTIONAL	242A, 243A, 245A, T245A, 620A, 623A, 640A, T640A, 634A, T634A, 7640A, 7643A, 7645A	245, T245, 620, 623, 640, T640, 643	242, 243, 620, 623, 640, 643, 645
FLIP FLOP	J-K TYPE	73A, 76A, 107A, 109A, 112A, 113A	109, T109, 112, T112	
	D TYPE		74A, T74A, 174A, T174A, 175A, 273A, T273A, 377A	74, T74, 174, T174, 175, 273, T273, 377, T377, 823, T823, 825, T825
		3-STATE	374A, T374A, 534A, T534A, 564A, T564A, 574A, T574A, 646A, T646A, 648A, T648A, 651A, T651A, 652A, T652A	374, T374, 534, T534, 564, T564, 574, T574, 646, T646, 648, T648, 821, T821	374, 533, 563, 573
LATCH		75A, 77A, 259A, 279A, 375A	843, T843	
	3-STATE	373A, T373A, 533A, T533A, 563A, T563A, 573A, T573A	373, T373, 533, T533, 563, T563, 573, T573, 841, T841	373, 533, 563, 573
MULTIVIBRATOR		123A, 221A, 423A, 4538A		
DECODER		42A, 131A, 137A, T137A, 138A, T138A, 139A, T139A, 154A, 155A, 237A, 238A, 4028A, 4514A, 4515A	138, T138, 139, T139	
	7-SEGMENT	4511A, 453A		
ENCODER		147A, 148A		
REGISTER		164A, T164A, 165A, 166A, 173A, 194A, 195A, 299A, 323A, 595A, 597A, 670A, 4094A, 40105A	164, T164, 166, 299, 323, T323, 670	
COUNTER	BINARY	161A, 163A, 191A, 193A, 393A, 590A, 592A, 593A, 691A, 693A, 697A, 699A, 4520A	161, T161, 163, T163, 169, 191, 393	
	DECADE	160A, 162A, 190A, 192A, 390A, 690A, 692A, 696A, 698A, 4518A	160, 162, 390	
	DIVIDER	4017A, 4020A, 4022A, 4024A, 4040A, 4060A, 40102A, 40103A, 7292A, 7294A		
MULTIPLEXER	ANALOG	4016A, 4051A, 4052A, 4053A, 4066A, 4316A, 4351A, 4352A, 4353A		
	DIGITAL	151A, 153A, 157A, T157A, 158A, T158A, 251A, 253A, 257A, T257A, 258A, T258A, 298A, 352A, 353A, 354A, 356A	151, T151, 153, T153, 157, T157, 158, T158, 251, T251, 253, T253, 257, T257, 258, T258	
OTHER	COMPARATOR	85A, 688A, T688A	520, T520, 521, T521	
	ADDER	283A	283, T283	
	ALU	181A, 182A		
	PARITY TREE	280A	280, T280	

TOSHIBA STANDARD CMOS FUNTION SELECTION GUIDE

FUNCTION		TYPE NUMBER	
GATE BUFFERS	NAND	TC4011BP/BF, TC4011UBP, TC4012BP/BF, TC4023BP/BF, TC4068BP/BF, TC7400BP	
	NOR	TC4000BP, TC4001BP/BF, TC4001UBP, TC4002BP/BF, TC4025BF/BP, TC4078BP/BF	
	AND	TC4068BP/BF, TC4073BP/BF, TC4081BP/BF, TC4082BP	
	OR	TC4071BP/BF, TC4072BP/BF, TC4075BP/BF, TC4078BP/BF	
	INVERTER	TC4007UBP/UBF, TC4009UBP/BF, TC4049BP/BF, TC4069UBP/UBF, TC7404UBP	
	BUFFERS		TC4009UBP, TC4010BP, TC4049BP/BF, TC4050BP/BF
		3-STATE	TC4502BP, TC5012BP/BF, TC5024BP, TC5025BP
		OPEN DRAIN	TC40107BP, TC5029BP, TC5064BP, TC5065BP, TC5066BP, TC5067BP
	MULTIFUNCTION	TC4019BP/BF, TC4030BP/BF, TC4077BP/BF, TC4085BP, TC4086BP, TC4501BP, TC4519BP, TC4530BP, TC4572BP/BF	
	SCHMITT TRIGGER	TC4093BP/BF, TC4583BP, TC4584BP/BF	
LEVEL SHIFTER	TC4009UBP, TC4010BP, TC4049BP/BF, TC4050BP/BF, TC5020BP		
FLIP FLOP		TC4013BP/BF, TC4027BP/BF, TC40174BP/BF, TC40175BP/BF, TC7476BP	
LATCHES		TC4042BP/BF, TC4043BP, TC4044BP/BF, TC4099BP/BF, TC4508BP	
MULTIVIBRATORS		TC4047BP, TC4528BP/BF, TC4538BP/BF	
DECODERS		TC4028BP/BF, TC4514BP, TC4515BP, TC4555BP, TC4556BP/BF	
DISPLAY	LED	TC4511BP/BF, TC502BP, TC5022BP	
DRIVER	LCD	TC4054BP/BF, TC4055BP, TC4056BP/BF, TC4543BP/BF	
	DIGITRON	TC5068BP, TC5069BP	
ENCODER		TC4532BP	
REGISTERS	SHIFT	TC4006BP, TC4014BP, TC4015BP/BF, TC4021BP, TC4034BP, TC4035BP TC4094BP/BF, TC40104BP, TC40194BP, TC5050P	
	STORAGE	TC4076BP	
COUNTERS	BINARY	TC4029BP/BF, TC40161BP, TC40163BP, TC40193BP, TC4516BP/BF, TC4520BP/BF, TC5018BP, TC5027BP	
	DECADE	TC40209BP/BF, TC40160BP, TC40162BP, TC40192BP, TC4510BP/BF, TC4518BP/BF, TC5026BP	
	DIVIDER	TC4020BP/BF, TC4024BP/BF, TC4040PB/BF, TC4521BP, TC5036P, TC5048P	
	DIVIDE-BY-"N"	TC4018BP, TC40102BP, TC40103BP, TC4522BP, TC4526BP/BF	
	N-DIGIT DECADE	TC5001P, TC5032P, TC5037P, TC5051P, TC5052P, TC5053P, TC5054P, TC5070P	
	OTHER	TC4017BP/BF, TC4022BP	
TIMERS		TC5043P, TC5071P, TC5072P	
MULTI- PLEXERS	ANALOG	TC4051BPBF, TC4052BP/BF, TC4053BP/BF	
	DIGITAL	TC4512BP/BF, TC4539BP/BF, TC5023BP	
ARITHMETIC CIRCUITS	ADDER	TC4008BP, TC4032BP, TC4038BP, TC4560BP	
	COMPARATOR	TC4063BP/BF, TC4585BP	
	PARITYTREE	TC4531BP	
	RATE MULTIPLIER	TC4527BP	
	9's COMPLEMENTER	TC4561BP	
MEMORIES (RAM)		TC4036BP, TC4039BP	
A/D CONVERTERS		TC5090AP, TC5091AP, TC5092AP, TC5093AP	
ANALOG SWITCH		TC4016BP/BF, TC4066BP/BF	
OTHER		TC40117BP	

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Toshiba EPROM. Balancing Technology and Performance.

Preliminary

**524,288 WORD x 8-BIT CMOS UV ERASABLE AND ELECTRICALLY
PROGRAMMABLE READ ONLY MEMORY
SILICON STACKED GATE MOS**

**TC574000D-12
TC574000D-120
TC574000D-150**

The TC574000D is a 524,288 word x 8-bit CMOS ultraviolet light erasable and electrically programmable read only memory. For read operation, the TC574000D's access time is 120ns, and the TC574000D operates from a single 5-volt power supply and has low power standby mode which reduces the power dissipation without increasing access time.

The standby mode is achieved by applying a TTL-high level signal to the CE input.

Advanced CMOS technology reduces the maximum active current to 60mA / 8.3MHz and standby current to 100µA. For program operation, the programming is achieved by using the high speed programming mode. TC574000D is fabricated with the CMOS technology and the N-channel silicon double layer gate MOS technology.

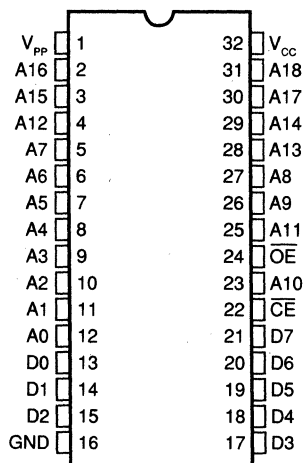
- Peripheral circuit : CMOS
Memory cell : N-MOS
- Access time

	-12	-120	-150
VCC	5V ± 5%	5V ± 10%	
Temp	0°C~70°C		
t _{ACC}	120ns		150ns

- Low power dissipation
Active : 60mA/8.3MHz
Standby : 100µA(Ta=70°C)
- High speed programming operation
- Single 5V power supply
- Full static operation
- Input and output TTL compatible
- JEDEC standard 32 pin
- Standard 32 pin DIP cerdip package

Toshiba America

PIN CONNECTION (TOP VIEW)



TC574000D

PIN NAMES

A0~A18	ADDRESS INPUTS
D0~D7	OUTPUTS (INPUTS)
\overline{CE}	CHIP ENABLE INPUT
\overline{OE}	OUTPUT ENABLE INPUT
V _{CC}	V _{CC} SUPPLY VOLTAGE
V _{PP}	PROGRAM SUPPLY VOLTAGE
GND	GROUND

The TC571000AD/TC571001AD is a 131,072 word x 8-bit CMOS ultraviolet light erasable and electrically programmable read only memory.

The TC571000AD has a JEDEC standard pin configuration and the TC571001AD is compatible with a 28-pin 1 Mbit Mask ROM. Both products are packed in 32-pin standard cerdip packages.

The TC571000AD/TC571001AD is fabricated with the CMOS technology. Advanced circuit techniques provide both high speed and low power features with a maximum operating current of 30mA/8.3MHz and access time of 120ns/150ns.

The programming times of the TC571000AD/TC571001AD except overhead times of EPROM programmer is only 14 seconds by using the high speed programming algorithm.

- Peripheral circuit : CMOS
Memory cell : N-MOS
- Access time

	-12	-150
V_{CC}	$5V \pm 5\%$	$5V \pm 10\%$
t_{ACC}	120ns	150ns

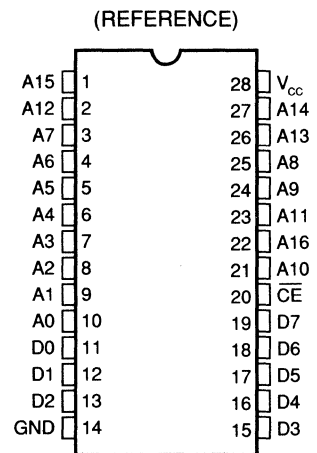
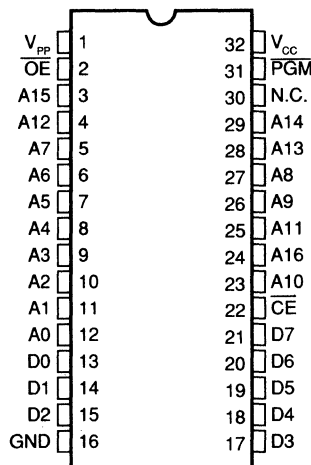
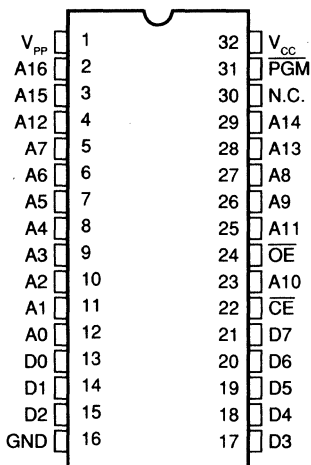
- Low power dissipation
Active : 30mA/8.3MHz
Standby : 100 μ A
- Wide operating temperature range : 0~70°C
- Single 5V power supply
- Full static operation
- High speed programming operation : t_{pw} 0.1ms
- Input and output TTL compatible
- JEDEC standard 32-pin : TC571000AD
- 1M MROM compatible : TC571001AD
- Standard 32-pin DIP cerdip package

PIN NAMES

A0~A16	ADDRESS INPUTS
D0~D7	OUTPUTS (INPUTS)
\overline{CE}	CHIP ENABLE INPUT
\overline{OE}	OUTPUT ENABLE INPUT
PGM	PROGRAM CONTROL INPUT
V_{CC}	V_{CC} SUPPLY VOLTAGE
V_{PP}	PROGRAM SUPPLY VOLTAGE
GND	GROUND
N.C.	NO CONNECTION

Toshiba America

PIN CONNECTION (TOP VIEW)



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Toshiba Mask ROM. Economy at the Leading Edge.

Preliminary

**4M BIT (512K WORD x 8-BIT) CMOS MASK ROM
SILICON GATE CMOS**

TC534000AP/AF

The TC534000AP/AF is a 4,194,304 bits read only memory organized as 524,288 words by 8-bits.

The TC534000AP/AF is fabricated using Toshiba's advanced CMOS technology which provides the high speed and low power features with access time of 150ns, an operation current of 40mA at 6.7MHz and a standby current of 20µA.

The TC534000AP/AF has one programmable chip enable input $\overline{CE}/\overline{CE}$ for device selection.

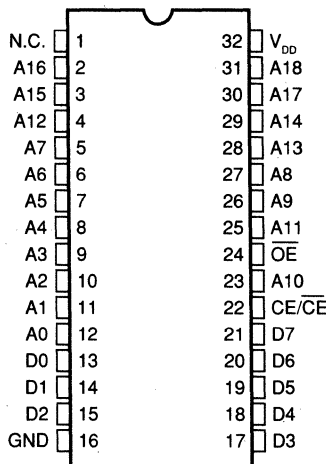
The TC534000AP/AF is packaged in a standard 600mil 32-pin DIP or 525mil 32-pin SOP.

- Single 5V Power Supply
- Access Time : 150ns (Max.) $V_{DD}=5V\pm 10\%$
- Power Dissipation
Operating Current : 40mA (Max.)
Standby Current : 20µA (Max.)
- All Inputs and Outputs : TTL Compatible
- Three State Outputs
- Fully Static Operation
- Programmable Chip Enable
- Package Plastic DIP : TC534000AP
Plastic FP : TC534000AF

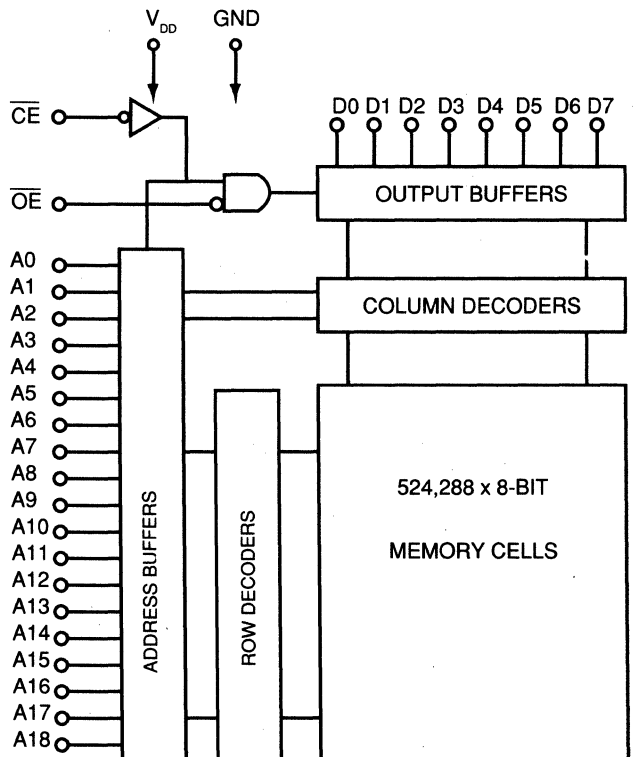
PIN NAMES

A0~A18	ADDRESS INPUTS
D0~D7	DATA OUTPUTS
\overline{OE}	OUTPUT ENABLE INPUT
$\overline{CE}/\overline{CE}$	CHIP ENABLE INPUT
V_{DD}	POWER SUPPLY
GND	GROUND
N.C.	NO CONNECTION

PIN CONNECTION (TOP VIEW)



BLOCK DIAGRAM



Toshiba America

The TC534200P/F is a 4,194,304 bits read only memory organized as 262,144 words x 16-bits when BYTE is logical high, and is organized as 524,288 words by 8-bits when BYTE is logical low.

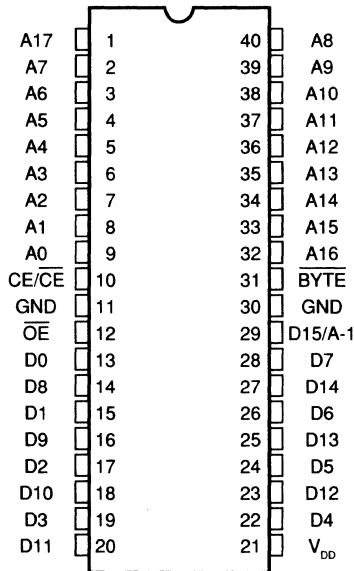
The TC534200P/F is most suitable for program memory of 16-bit microprocessors, data memory, and character generator applications.

The TC534200P/F has a programmable chip enable input CE/CE for device selection.

The TC534200P/F is packaged in a standard 600mil 40-pin DIP, or 525mil 40-pin SOP.

- Single 5V Power Supply
- Access Time : 150ns (Max.)
- Power Dissipation
 - Operating Current : 50mA (Max.)
 - Standby Current : 20µA (Max.)
- Fully Static Operation
- All Inputs and Outputs : TTL Compatible
- Three State Outputs
- Programmable Chip Enable
- 40-pin 600mil width Plastic DIP
- 40-pin 525mil width Plastic SOP

PIN CONNECTION (TOP VIEW)



PIN NAMES

A0~A17	ADDRESS INPUTS
D0~D14	DATA OUTPUTS
CE/CE	CHIP ENABLE INPUT
OE	OUTPUT ENABLE INPUT
D15/A-1	DATA OUTPUT/ADDRESS INPUT
BYTE	WORD, BYTE SELECTION INPUT
V _{DD}	POWER SUPPLY
GND	GROUND

Toshiba America

The TC5316200P/F is a 16,777,216 bits read only memory organized as 1,048,576 words x 16-bits when BYTE is logical high, and is organized as 2,097,152 words x 8-bits when BYTE is logical low.

The TC5316200P/F is most suitable for the program memory, data memory, and character generator.

The TC5316200P/F has a programmable chip enable input CE/CE for device selection.

The TC5316200P/F is packaged in a standard 600mil 40-pin DIP, or 600mil 44-pin SOP.

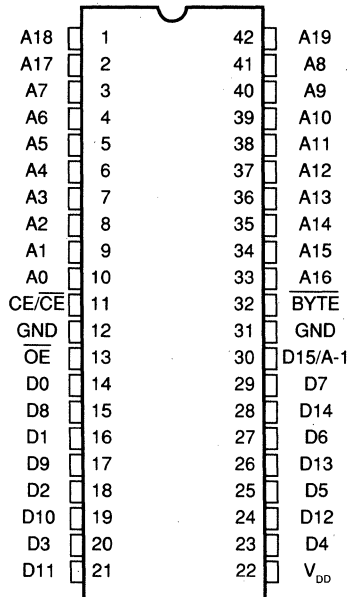
- Single 5V Power Supply
- Access Time : 200ns (Max.)
- Power Dissipation
 - Operating Current : 50mA (Max.)
 - Standby Current : 100µA (Max.)
- Fully Static Operation
- All Inputs and Outputs : TTL Compatible
- Three State Outputs
- Programmable Chip Enable
- 42-pin 600mil width Plastic DIP
- 44-pin 600mil width Plastic SOP

PIN NAMES

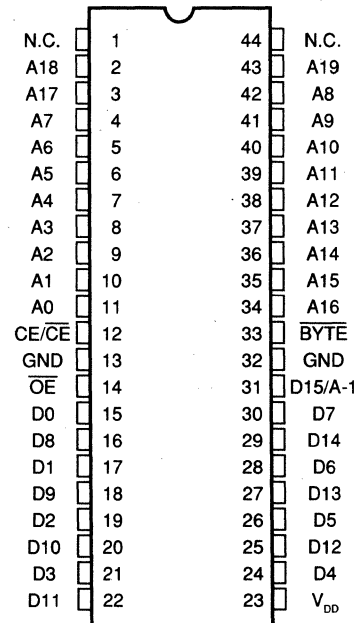
A0~A19	ADDRESS INPUTS
D0~D14	DATA OUTPUTS
CE/CE	CHIP ENABLE INPUT
OE	OUTPUT ENABLE INPUT
D15/A-1	DATA OUTPUT/ADDRESS INPUT
BYTE	WORD, BYTE SELECTION INPUT
V _{DD}	POWER SUPPLY
GND	GROUND
N.C.	NO CONNECTION

Toshiba America

PIN CONNECTION (TOP VIEW)



TC5316200P



TC5316200F

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Toshiba. World Leader in High Speed SRAMs.

Preliminary

16,384 WORD x 4-BIT BiCMOS STATIC RAM
8,192 WORD x 8-BIT BiCMOS STATIC RAM
Silicon Gate BiCMOS

TC55B417P/J
TC55B88P/J

The TC55B417P/J and TC55B88P/J are 65,536-bit high speed static random access memories organized as 16,384 words x 4-bits and 8,192 words x 8-bits, respectively. Both use BiCMOS technology, and are operated from a single 5-volt supply. Toshiba's advanced BiCMOS circuitry provides high speed characteristics. The TC55B417P/J has low stand-by power using Chip Enable (CE), while the TC55B88P/J has low stand-by power using Chip Enables (CE1/CE2). Both have fast memory access using Output Enable (OE). These devices are suitable for use as cache memory where high speed is required. All inputs and outputs are directly TTL compatible. The TC55B417P/J is offered in 24-pin DIP and SOJ. The TC55B88P/J is offered in 28-pin DIP and SOJ. All packages are 300 mil width for high density surface assembly and are JEDEC standard.

• Output buffer control: \overline{OE}

• Package:

24-pin plastic 300 mil DIP : TC55B417P
 24-pin plastic 300 mil SOJ : TC55B417J
 28-pin plastic 300 mil DIP : TC55B88P
 28-pin plastic 300 mil SOJ : TC55B88J

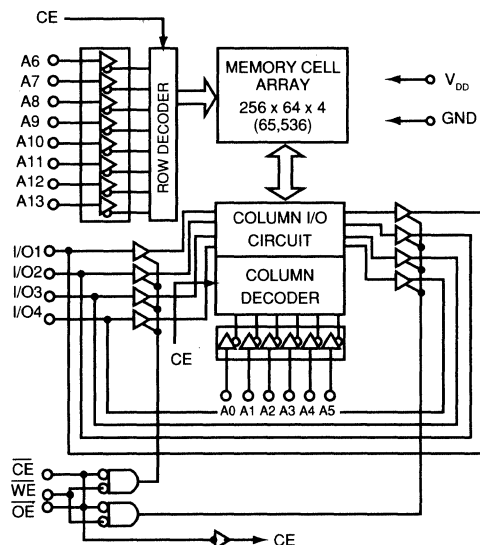
- Fast access time:

TC55B417	TC55B88	P/J-10ns (max)
		P/J-12ns (max)
- Low power dissipation

Operation:		
TC55B417		120mA (max)
TC55B88		155mA (max)
Standby:		
TC55B417	TC55B88	10mA (max)
- 5V single power supply:

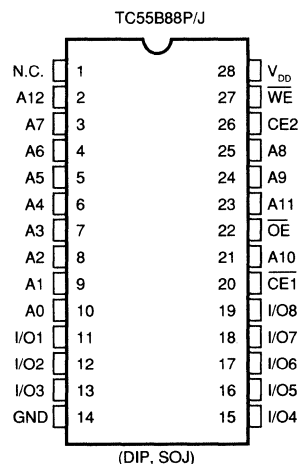
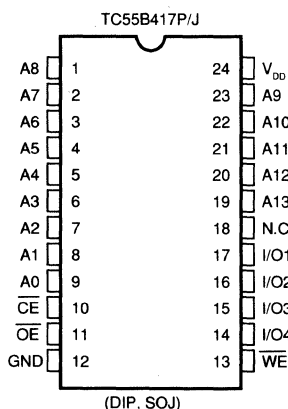
-10: 5V ± 5%	-12: 5V ± 10%
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- Fully static operation
- All Inputs and Outputs: TTL compatible

BLOCK DIAGRAM (TC55B417)



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PIN CONNECTION (TOP VIEW)



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Broad Line Supplier of SRAMs.

TOSHIBA PART NO.	ORG.	PROCESS	SAMPLES	PROD.	SPEED SORTS AVAILABLE															PACKAGE OPTIONS	COMMENTS
					10	12	15	20	25	35	45	55	70	80	90	100	120	150			
STANDARD STATIC RAM																					
TC5565APL	8KX8	CMOS	YES	YES													X	X	X	P28	4T Cell Low Power
TC5565AFL	8KX8	CMOS	YES	YES													X	X	X	F28	4T Cell Low Power
TC5563APL	8KX8	CMOS	YES	YES													X	X	X	P28	300 mil DIP/4T Cell
TC55257BPI	32KX8	CMOS	YES	YES													X			P28	Industrial Temp Range
TC55257BFI	32KX8	CMOS	YES	YES													X			P28	Industrial Temp Range
TC55257APL/BPL	32KX8	CMOS	YES	YES										(85)			X			P28	4T Cell Low Power
TC55257AFL/BFL	32KX8	CMOS	YES	YES										(85)			X			F28	4T Cell Low Power
TC55257BSPL	32KX8	CMOS	YES	YES													X			P28	300 mil DIP
TC51832PL	32KX8	CMOS	YES	YES										(85)			X			P28	Pseudo Static
TC51832SPL	32KX8	CMOS	YES	YES										(85)			X			P28	300 mil DIP
TC51832FL	32KX8	CMOS	YES	YES										(85)			X			F28	Flat Pack
TC518128APL	128KX8	CMOS	YES	YES	Low Volt Option Available										X	X		P32	Pseudo Static, CE1, CE2		
TC518128ASPL	128KX8	CMOS	YES	YES													X	X		P32	300 Mil DIP
TC518128AFL	128KX8	CMOS	YES	YES	Low Volt Option Available										X	X		F32	Flat Pack		
TC518129APL	128KX8	CMOS	YES	YES	Low Volt Option Available										X	X		P32	Pseudo Static, CE, CS		
TC518129ASPL	128KX8	CMOS	YES	YES													X	X		P32	300 Mil DIP
TC518129AFL	128KX8	CMOS	YES	YES	Low Volt Option Available										X	X		F32	Flat Pack		
TC518129AFWL	128KX8	CMOS	YES	YES	Low Volt Option Available										X	X		F32	525 mil Flat Pack		
TC551001PL	128KX8	CMOS	YES	YES													X	(85)	X	P32	Full Static
TC551001FL	128KX8	CMOS	YES	YES													X	(85)	X	F32	Flat Pack
HIGH SPEED STATIC RAM																					
TC5561P	64KX1	CMOS	YES	YES													X	X		P22	4T Cell Low Stand-By Power
TC5561J	64KX1	CMOS	YES	YES													X	X		J24	4T Cell Low Stand-By Power
TC5562P	64KX1	CMOS	YES	YES													X	X		P22	4T Cell Low Power
TC5562J	64KX1	CMOS	YES	YES													X	X		J24	4T Cell Low Power
TC55416P-H	16KX4	CMOS	YES	YES				X	X	X	X									P22	1.0μ
TC55417P-H	16KX4	CMOS	YES	YES				X	X	X	X									P24	1.0μ with OE
TC55417J-H	16KX4	CMOS	YES	YES				X	X	X	X									J24	1.0μ With OE
TC55B417P	16KX4	BICMOS	3Q90	3Q90	X	X														P24	
TC55B417J	16KX4	BICMOS	4Q90	4Q90	X	X														J24	
TC5588P	8KX8	CMOS	YES	YES				X	X	X	X									P28	
TC5588J	8KX8	CMOS	YES	YES				X	X	X	X									J28	
TC55B88P	8KX8	BICMOS	3Q90	4Q90	X	X														P28	
TC55B88J	8KX8	BICMOS	3Q90	4Q90	X	X														J28	
TC5589P	8KX9	CMOS	YES	YES				X	X	X	X									P28	
TC5589J	8KX9	CMOS	YES	YES				X	X	X	X									J28	
TC55187T	8KX18	CMOS	YES	YES						X	X	(30)								T52	Cache Data RAM
TC55188T	8KX18	CMOS	YES	YES						X	X	(30)								T52	Cache Data RAM
TC55464P	64KX4	CMOS	YES	YES			(17)	X	X	X										P24	
TC55464J	64KX4	CMOS	YES	YES			(17)	X	X	X										J24	
TC55465P	64KX4	CMOS	YES	YES			(17)	X	X	X										P28	with OE
TC55465J	64KX4	CMOS	YES	YES			(17)	X	X	X										J28	with OE
TC55328P	32KX8	CMOS	YES	YES			(17)	X	X	X										P28	
TC55328J	32KX8	CMOS	YES	YES			(17)	X	X	X										J28	
TC55329P	32KX9	CMOS	YES	YES			(17)	X	X	X										P32	
TC55329J	32KX9	CMOS	YES	YES			(17)	X	X	X										J32	
TC55B328P	32KX8	BICMOS	2Q91	2Q91	X	X	X													P28	
TC55B328J	32KX8	BICMOS	2Q91	2Q91	X	X	X													J28	
TC55B329P	32KX9	BICMOS	2Q91	2Q91	X	X	X													P32	
TC55B329J	32KX9	BICMOS	2Q91	2Q91	X	X	X													J32	
TC55B464P	64KX4	BICMOS	2Q91	2Q91	X	X	X													P24	
TC55B464J	64KX4	BICMOS	2Q91	2Q91	X	X	X													J24	
TC55B465P	64KX4	BICMOS	2Q91	2Q91	X	X	X													P28	with OE
TC55B465J	64KX4	BICMOS	2Q91	2Q91	X	X	X													J28	with OE

P = PLASTIC F = FLAT PACK T = PLCC J = SOJ Z = ZIP (17)⁹ = +/- 5%V_{cc}

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

Toshiba. 1 Meg E/R Static RAM.

Preliminary

131,072 WORD x 8-BIT STATIC RAM

**TC551001APL-70/APL-85/APL-10
TC551001AFL-70/AFL-85/AFL-10
TC551001AFTL-70/AFTL-85/AFTL-10**

The TC551001APL/AFL/AFTL is a 1,048,576-bit static random access memory organized as 131,072 words by 8-bits using CMOS technology, and operates from a single 5V power supply. Advanced circuit techniques provide both high speed and low power features with an operating current of 5mA/MHz (Typ.) and minimum cycle time of 70/85/100ns. When $\overline{CE1}$ is a logical high, or $CE2$ is a logical low, the device is placed in low power standby mode in which standby current is 2 μ A typically. The TC551001APL/AFL/AFTL has three control inputs. Chip enable inputs ($\overline{CE1}$, $CE2$) allow for device selection and data retention control, and an output enable input (\overline{OE}) provides fast memory access. Thus the TC551001APL/AFL/AFTL is suitable for use in various micro-processor application systems where high speed, low power, and battery back up are required.

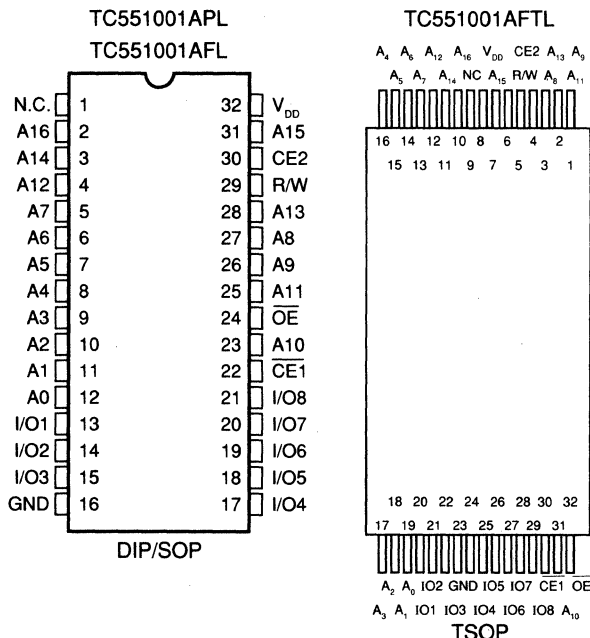
The TC551001APL is offered in a dual-in-line standard 32-pin 600 mil plastic package. The TC551001AFL is offered in a 32-pin 525 mil small-outline plastic flat package. The TC551001AFTL is offered in a 32-pin 8mm x 20mm Type I plastic TSOP package.

- Low power dissipation
Operation: 70mA at min. cycle time
Standby Current: 100 μ A (Max.)
50 μ A (Max.) for Low/Low power version
- 5V Single Power Supply
- Power Down Feature: $\overline{CE1}$, $CE2$
- Data Retention Supply Voltage: 2.0~5.5V
- Access Time

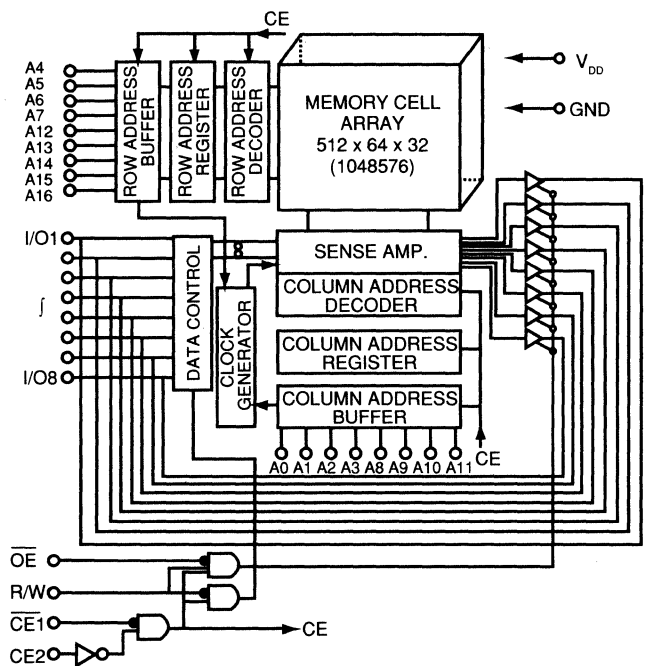
	TC551001 APL/AFL/AFTL-70	TC551001 APL/AFL/AFTL-85	TC551001 APL/AFL/AFTL-10
Access Time(max.)	70ns	85ns	100ns
$\overline{CE1}$	70ns	85ns	100ns
$CE2$	70ns	85ns	50ns

- Directly TTL Compatible: All Inputs and Outputs
- Plastic DIP, Plastic Flat Package, Plastic TSOP

PIN CONNECTION (TOP VIEW)



BLOCK DIAGRAM



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Toshiba.

Offering the first 16-bit Wide DRAM in the Industry.

Preliminary

**65,536 WORD x 16-BIT DYNAMIC RAM
SILICON GATE CMOS**

**TC511664J/Z-80
TC511664J/Z-10**

The TC511664J/Z is the new generation dynamic RAM organized 65,536 words x 16-bits. The TC511664J/Z utilizes TOSHIBA's CMOS Silicon gate process technology as well as advanced circuit techniques to provide wide operating margins, both internally and to the system user. Multiplexed address inputs permit the TC511664J/Z to be packaged in a standard 40-pin plastic SOJ and 40-pin

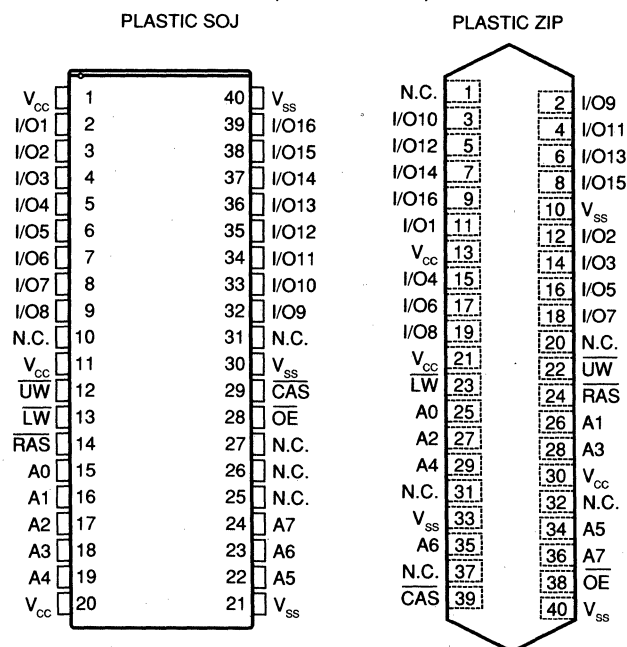
plastic ZIP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of $5V \pm 10\%$ tolerance and direct interfacing capability with high performance logic families such as Schottky TTL.

		TC511664J/Z-80/-10	
t_{RAC}	RAS ACCESS TIME	80ns	100ns
t_{AA}	COLUMN ADDRESS ACCESS TIME	45ns	55ns
t_{CAC}	CAS ACCESS TIME	35ns	40ns
t_{RC}	CYCLE TIME	135ns	170ns
t_{PC}	FAST PAGE MODE CYCLE TIME	55ns	65ns

- 65,536 word by 16 bit organization
- Fast access time and cycle time
- Single power supply of $5V \pm 10\%$ with a built-in V_{BB} generator
- Low Power
633mW MAX. Operating (TC511664J/Z - 80)
495mW MAX. Operating (TC511664J/Z - 10)
5.5mW MAX. Standby
- Outputs unlatched at cycle end allows two-dimensional chip selection
- Read-Modify-Write, \overline{CAS} before \overline{RAS} refresh, \overline{RAS} -only refresh, Hidden refresh, Byte-Write and Fast Page Mode capability
- All inputs and outputs TTL compatible
- 256 refresh cycles/4ms
- Package Plastic SOJ : TC511664J
Plastic ZIP : TC511664Z

Toshiba America

PIN CONNECTION (TOP VIEW)



PIN NAMES

SYMBOL	NAME
A0-A7	ADDRESS INPUTS
\overline{RAS}	ROW ADDRESS STROBE
\overline{CAS}	COLUMN ADDRESS STROBE
\overline{UW}	READ/UPPER BYTE WRITE INPUT
\overline{LW}	READ/LOWER BYTE WRITE INPUT
\overline{OE}	OUTPUT ENABLE
I/O01-I/O16	DATA INPUT/OUTPUT
V_{CC}	POWER (+5V)
V_{SS}	GROUND
N.C.	NO CONNECTION

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Toshiba. World Leader in 4Mb DRAMs.

Preliminary

1,048,576 WORD x 4-BIT DYNAMIC RAM

SILICON GATE CMOS

TC514400AP/AJ/ASJ/AZ-70
TC514400AP/AJ/ASJ/AZ-80
TC514400AP/AJ/ASJ/AZ-10

The TC514400AP/AJ/ASJ/AZ is the new generation dynamic RAM organized 1,048,576 words x 4-bits. The TC514400AP/AJ/ASJ/AZ utilizes TOSHIBA's CMOS Silicon gate process technology as well as advanced circuit techniques to provide wide operating margins, both internally and to the system user. Multiplexed address inputs permit the TC514400AP/AJ/ASJ/AZ to be packaged in a standard 20-pin plastic DIP, 26/20-pin plastic SOJ (300/350mil) and 20-pin plastic ZIP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of $5V \pm 10\%$ tolerance and direct interfacing capability with high performance logic families such as Schottky TTL.

- 1,048,576 word x 4-bit organization
- Fast access time and cycle time

		TC514400AP/AJ/ASJ/AZ-70/-80/-10		
t _{RAC}	RAS Access Time	70ns	80ns	100ns
t _{AA}	Column Address Access Time	35ns	40ns	50ns
t _{CAC}	CAS Access Time	20ns	20ns	25ns
t _{RC}	Cycle Time	130ns	150ns	180ns
t _{FC}	Fast Page Mode Cycle Time	45ns	50ns	60ns

- Single power supply of $5V \pm 10\%$ with a built-in V_{BB} generator
- Low Power

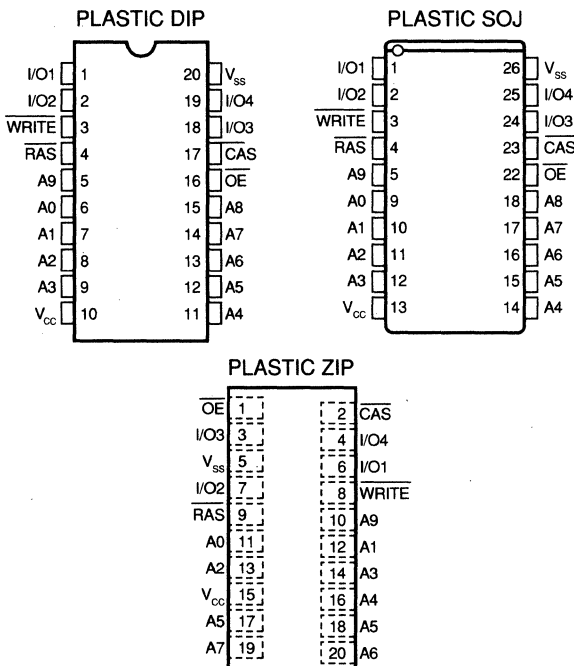
550mW MAX. Operating
(TC514400AP/AJ/ASJ/AZ—70)
468mW MAX. Operating
(TC514400AP/AJ/ASJ/AZ—80)
413mW MAX. Operating
(TC514400AP/AJ/ASJ/AZ—10)
5.5mW MAX. Standby

- Outputs unlatched at cycle end allows two-dimensional chip selection
- Read-Modify-Write, CAS before RAS refresh, RAS-only refresh, Hidden refresh, Fast Page Mode and Test Mode capability
- All inputs and outputs TTL compatible
- 1024 refresh cycles/16ms
- Package TC514400AP : DIP20-P-300C
TC514400AF : SOJ26-P-350
TC514400ASJ : SOJ26-P-300A
TC514400AZ : ZIP20-P-400A

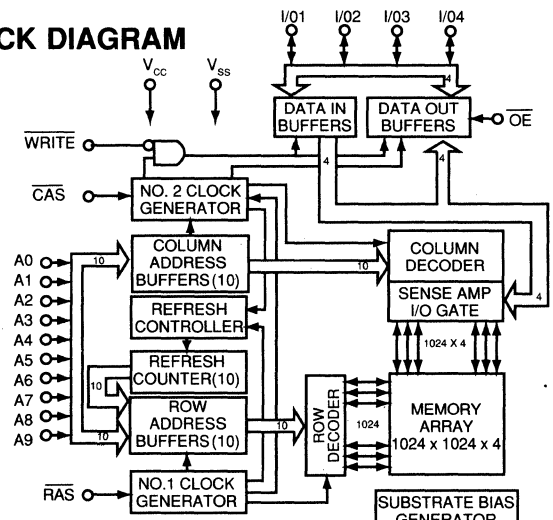
PIN NAMES

A0~A9	ADDRESS INPUTS	\overline{OE}	OUTPUT ENABLE
RAS	ROW ADDRESS STROBE	I/O1~I/O4	DATA INPUT/OUTPUT
CAS	COLUMN ADDRESS STROBE	V_{CC}	POWER (+5V)
WRITE	READ/WRITE INPUT	V_{SS}	GROUND

PIN CONNECTION (TOP VIEW)



BLOCK DIAGRAM



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Toshiba. Provider of Video RAMs for All Graphics Applications.

Preliminary

**262,144 WORDS x 4-BITS MULTIPOINT DRAM
SILICON GATE CMOS**

**TC524256AJ/AZ-10
TC524256AJ/AZ-12**

The TC524256AJ/AZ is a CMOS multipoint memory equipped with a 262,144 words by 4-bits dynamic random access memory (RAM) port and a 512 words by 4-bits static serial access memory (SAM) port. The TC524256AJ/AZ supports three types of operations: random access to and from the RAM port, high speed serial access to and from the SAM port, and bidirectional transfer of data between any selected row in the RAM port and the SAM port. The RAM port and the SAM port can be accessed independently except when data is being transferred between them internally. The TC524256AJ/AZ is fabricated using Toshiba's CMOS silicon gate process as well as advanced circuit designs to provide low power dissipation and wide operating margins.

- Single power supply of $5V \pm 10\%$ with a built-in V_{BB} generator
- All inputs and outputs : TTL Compatible
- Organization
 - RAM Port : 262,144 words x 4-bits
 - SAM Port : 512 words x 4-bits
- RAM Port
 - Fast Page Mode, Read - Modify - Write
 - CAS before RAS Refresh, Hidden Refresh
 - RAS only Refresh, Write per Bit
 - 512 refresh cycles/8ms
- SAM Port
 - High Speed Serial Read/Write Capability
 - 512 Tap Locations
 - Fully Static Register
- RAM - SAM Bidirectional Transfer
 - Read/Write/Pseudo Write Transfer
 - Real Time Read Transfer
- Package
 - TC524256AJ : 400mil 28-Pin Standard SOJ
 - TC524256AZ : 400mil 28-Pin Standard ZIP

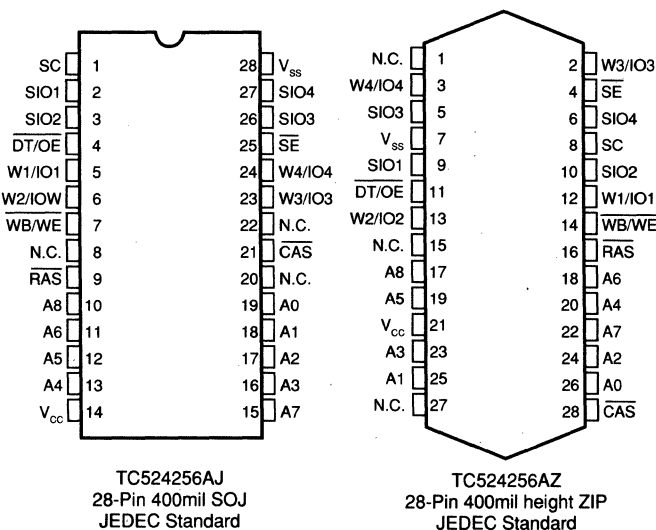
Toshiba America

	ITEM	TC524256AJ/AZ	
		-10	-12
t_{RAC}	\overline{RAS} ACCESS TIME (MAX.)	100ns	120ns
t_{CAC}	\overline{CAS} ACCESS TIME (MAX.)	30ns	35ns
t_{AA}	COLUMN ADDRESS ACCESS TIME (MAX.)	55ns	65ns
t_{RC}	CYCLE TIME (MIN.)	180ns	210ns
t_{PC}	PAGE MODE CYCLE TIME (MIN.)	60ns	70ns
t_{SCA}	SERIAL ACCESS TIME (MAX.)	25ns	35ns
t_{SCC}	SERIAL CYCLE TIME (MIN.)	30ns	40ns
I_{CC1}	RAM OPERATING CURRENT (RAM : STANDBY)	110mA	100mA
I_{CC2A}	SAM OPERATING CURRENT (RAM : STANDBY)	50mA	45mA
I_{CC2}	STANDBY CURRENT	10mA	10mA

PIN NAMES

A0~A8	ADDRESS INPUTS
\overline{RAS}	ROW ADDRESS STROBE
\overline{CAS}	COLUMN ADDRESS STROBE
$\overline{DT}/\overline{OE}$	DATA TRANSFER/OUTPUT ENABLE
$\overline{WB}/\overline{WE}$	WRITE PER BIT/WRITE ENABLE
W1/I01~W4/I04	WRITE MASK/DATA IN, OUT
SC	SERIAL CLOCK
\overline{SE}	SERIAL ENABLE
SIO1~SIO4	SERIAL INPUT/OUTPUT
V_{CC}/V_{SS}	POWER (5V)/GROUND
N.C.	NO CONNECTION

PIN CONNECTION (TOP VIEW)



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Toshiba. World Technology Leader in ASICs.

Toshiba America can meet your volume requirements for gate arrays and standard cells, whether 1,000 or 100,000 or more devices per month. You get working silicon in as little as 7 days from our U.S. fab and packaging facility.

TC150G CMOS Gate Array

The TC150G series of triple-layer metal, 1.0 micron gate arrays has a 0.4ns gate delay and up to 120K usable gates—one of the highest in the industry.

- Triple-layer metal interconnect technology improves gate utilization substantially, up to 70% from the previous 40% for two-layer metal
- Use for designs where you require the high density and you are not pad limited
- Compatible with the TC110G, TC120G and TC140G gate arrays
- **Process:** 1.0 micron drawn HC²MOS Si-gate triple-layer metal
- **Raw gates:** 2K to 172K*
- **Usable gates:** up to 120K
- **Gate delay:** 0.4ns (2-input NAND gate, fanout - 2, tpd.) equivalent to 100K ECL
- **Maximum toggle frequency:** 200 MHz, ultra-high speed
- **I/O pads:** up to 360
- **Output drive:** up to 24mA
- **Advanced packaging techniques:** I/O cells are TAB compatible
- **More flexible utilization of I/O:** so even a high current driver only takes one bonding position
- **Programmable I/O cells:** with slew rate control
- **Functional blocks of megacells and megafunctions**
 - Multiplier, barrelshifter, ALU, CLA
 - LSI/VLSI CPU peripheral
 - 2900 family
- **Building-block memory (32 to 16K bit)**
 - RAMs
 - ROMs

* Gate utilization is dependent on design architecture

TC11L CMOS Gate Array: 1.5 μ m

TC14L CMOS Gate Array: 1.0 μ m

These two gate array families provide a unique solution for designs which have a high ratio of pin count to gates.

Toshiba's optimized assembly technology allows the use of smaller die sizes in traditional plastic and ceramic flat packs—thus providing a silicon efficient solution for pad limited designs.

Applications include any low gate count, high pin count design (for example, peripheral interfaces and 32- and 64- bit bus applications).

TC11L, 1.5 μ m CMOS

- 300, 500 and 700 usable gates
- 0.6ns typical gate delay
- 44 pads
- Through hole and surface mount packaging
 - 16 to 42 pin DIP
 - 24, 28 SOP
 - 44 PLCC
 - μ 44 QFP
- Compatible with the TC110G "parent family"
 - Process technology
 - Internal gate delays
 - Tested, verified cell libraries

TC14L, 1.0 μ m CMOS

- 1K, 2K, 4K, 5K, 6K, 7K, 8K, 10K usable gates
- Double-layer metal
- 0.4ns typical gate delay
- From 100 to 208 pads
- Through hole and surface mount packaging
 - 84 PLCC
 - 120, 144, 160, 176, 184, 208 QFP
 - 80, 100 RFP
- Compatible with the TC140G "parent family"
 - Process technology
 - Internal gate delays
 - Tested, verified libraries

TC25SC CMOS Standard Cell

The TC25SC series of 0.8 micron drawn CMOS standard cells has a 0.33ns typical gate delay and more than 100K usable gates.

- **Process:** 0.8 micron drawn HC²MOS Si-gate double layer metal
- **Gate complexity:** 700 to 103K
- **Maximum toggle frequency:** 240 MHz, ultra-high speed
- **Gate delay:** CMOS 0.33ns (internal gate, typical) (2-input NAND gate, fanout - 2, tpd.)
- **I/O pads:** up to 360
- **Library**
 - Complete, full featured library from primitive cells thru megafunctions
- **Compatible blocks**
 - Synchronous/asynchronous SRAMs
 - Synchronous ROMs
 - FIFOs
 - Multipliers
- **Macrofunctions**
 - A large selection of 7400 series TTL macrofunctions
 - Many 4000 series CMOS macrofunctions
 - Soft macros provide maximum design utilization
- **Megacells**
 - 16 x 16 and 8 x 8 multipliers
 - ALUs
 - Arithmetic units (fast adder, subtractor and CLA)
 - Microprocessor support cells
 - Barrel shifters

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UMC Memory Products

If you are looking for a CMOS solution to your memory needs, UMC has a complement of SRAMs and ROMs which support a wide variety of applications with high performance, tightly controlled quality and reliability, dedicated customer service and very reasonable pricing.

STANDARD CMOS SRAM

Built to address the demands of today's advanced applications these products make available a wide range of speed, low power and operating temperatures. Highly accessible to markets around the globe, UMC maintains memory product inventories in our strategically located warehouses for quick delivery. UMC specializes in high performance SRAM's at very competitive prices.

STANDARD CMOS SRAM

Density	P/N	Speed(ns)	Icc1 mA(max.)	I _{sb} 1 mA(max.)	Package	Remarks
2Kx8	UM6116-3	90	100	0.1	24 pin DIP, SKINNY, SOP	
2Kx8	UM6116-2	120	100	0.05	24 pin DIP, SKINNY, SOP	
2Kx8	UM6116-3L/2L	90, 120	50	0.001	24 pin DIP, SKINNY, SOP	
8Kx8	UM6264A-L	100	45	0.1	28 pin DIP, SKINNY, SOP	
8Kx8	UM6264A-LL	100	45	0.05	28 pin DIP, SKINNY, SOP	
32Kx8	UM62256A	100	70	2	28 pin DIP, SOP	
32Kx8	UM62256A-L	100	70	0.1	28 pin DIP, SOP	
32Kx8	UM62256A-LL	100	70	0.05	28 pin DIP, SOP	
128Kx8	UM621024-L	70, 85, 100	70	0.1	32 pin, DIP, SOP	

HIGH SPEED CMOS SRAM

2Kx8	UM6116-35	35	90	5	24 pin DIP, SKINNY	
2Kx8	UM6116-45	45	90	5	24 pin DIP, SKINNY	
4Kx4	UM6168-35	35	90	5	20 pin DIP	
4Kx4	UM6168-45	45	90	5	20 pin DIP	
8Kx8	UM6164K-25	25	200	2	28 pin SKINNY	
8Kx8	UM6164K-30	30	200	2	28 pin SKINNY	
8Kx8	UM6164K-25L	25	200	0.1	28 pin SKINNY	
8Kx8	UM6164K-30L	30	200	0.1	28 pin SKINNY	
32Kx8	UM61256-25L	25	200	0.1	28 pin DIP SKINNY	

CMOS MASK ROM

8Kx8	UM23C64-A	150	30	30	28 pin DIP, SOP	Auto power down
8Kx8	UM23C64-B	150	30	30	28 pin DIP, SOP	
16Kx8	UM23C128-A	150	30	30	28 pin DIP, SOP	Auto power down
16Kx8	UM23C128-B	150	30	30	28 pin DIP, SOP	
32Kx8	UM23C256	150	30	30	28 pin DIP, SOP	
64Kx8	UM23C512	150	30	30	28 pin DIP, SOP	
128Kx8	UM23C1024	200	35	30	28 pin DIP, SOP	
128Kx8	UM23C1025-A/-B	120	40	50	32 pin DIP	EPROM printout
128Kx8	UM23C1000	120	40	50	28 pin DIP	
256Kx8	UM23C2001	120	40	30	32 pin DIP	
256Kx16/512Kx8	UM23C4000	250	40	30	32 pin DIP/64 QFP	x16/x8 bits optional
512Kx8	UM23C4001	200	50	30	32 pin DIP	
1Mx8	UM23C8001	200	40	30	32 pin DIP, SOP	

SPECIALTY MEMORIES

FIFO 4,096x9	UM4503-12	120	40	0.5	28 pin DIP/32 PLCC	
FIFO 4,096x9	UM4503-80	80	40	0.5	28 pin DIP/32 PLCC	
FIFO 4,096x9	UM4503-65	65	40	0.5	28 pin DIP/32 PLCC	
FIFO 4,096x9	UM4503-50	50	40	0.5	28 pin DIP/32 PLCC	
FIFO 4,096x9	UM4503-35	35	40	0.5	28 pin DIP/32 PLCC	



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Computer IC Selection Guide

MICROPROCESSOR

Part No.	Description	Remarks
UM6502/07/12	8-bit Microprocessor	1, 2, 3, 4 MHz Versions
UM6502E	8-bit Microprocessor	1, 2, 3, 4 MHz Versions
UM74HCT612	Memory Mapper	—
UM82C086	PC/XT Integration Chip	10 MHz Version
UM82C206	Integrated Peripheral Controller	16, 20 MHz Versions
UM82C210 Series	386SX/286 AT Chip Set	16, 20 MHz Versions
UM82C211	System Controller	16, 20 MHz Versions
UM82C212	Memory Controller	16, 20 MHz Versions
UM82C215	Data/Address Buffer	16, 20 MHz Versions
UM82C230 Series	286 PC/AT Chip Set	12 MHz Version
UM82C231	System/Memory Controller	12 MHz Version
UM82C232	Data Buffer	12 MHz Version
UM82C380 Series	Page Mode	20, 25 MHz Versions
UM82C380 Series	INTEL Cache Mode	20, 25 MHz Versions
UM82C380 Series	AUSTEK Cache Mode	20, 25 MHz Versions
UM82C381	System Controller	20, 25 MHz Versions
UM82C382	Address Buffer	20, 25 MHz Versions
UM82C383	Data Buffer	20, 25 MHz Versions
UM82C384	Memory Controller	20, 25 MHz Versions
UM82C388	INTEL Cache Interface	20, 25 MHz Versions
UM82C389	AUSTEK Cache Interface	20, 25 MHz Versions
UM82C55A	CMOS Programmable Peripheral Interface	—
UM82C336	386SX Single Chip	16, 20 MHz Versions
UM82C481	486/386 System Controller	33, 40, 50 MHz Versions
UM82C482	486/386 Memory/Cache Controller	33, 40, 50 MHz Versions
UM82152	Cache Controller	—
UM8237AE/-4/-5	Programmable DMA Controller (DMAC)	—
UM8253/-5	Programmable Interval Timer	—
UM8259A-2	Programmable Interrupt Controller	—

DISPLAY

UM487	HCGA Controller	—
UM6845/A/B	CRT Controller	1, 1.5, 2 MHz Versions
UM6845R/RA/RB	CRT Controller	1, 2, 3 MHz Versions
UM6845E/EA/EB	CRT Controller	1, 2, 3 MHz Versions
UM70C171	Color Palette with Triple 6-bit DAC	35, 50, 65 MHz Version

STORAGE

UM8272A/A-4	Floppy Disk Controller	4, 8 MHz Versions
UM83C001	Hard Disk Controller	For PC/XT H.D.C.
UM83C004	Hard Disk Controller Interface	For PC/XT MFM/RLH H.D.C.
UM83C021	Hard Disk Controller	For PC/AT H.D.C.
UM83C022	At HDC Interface	For PC/AT H.D.C.
UM8326/B	Floppy Disk Data Separator (FDDS)	4, 8 MHz Versions
UM8388	Single-Chip Floppy Disk Controller	Special Design For IBM PC
UM8397	Single-Chip Floppy Disk Controller	Design For IBM PC XT
UM8398	Single-Chip Floppy Disk Controller	Special Design For IBM PC

I/O AND PERIPHERALS

UM2661	Enhanced Programmable Communications Interface (EPCI)	Three Baud Rates
UM6522/A	Versatile Interface Adapter (VIA)	1, 2 MHz Versions
UM6532/A	RAM, I/O, Timer Array	1, 2 MHz Versions
UM6551	Asynchronous Communication Interface Adapter (ACIA)	1, 2 MHz Versions
UM82C11-C	Printer Adapter Interface (PAI)	—
UM82C450	Asynchronous Communication Element (ACE)	—
UM82C451	Parallel/Asynchronous Communication Element	—
UM82C452	Single Chip Multi-I/O	—
UM82C550	Asynchronous Communication Element with 16 bit FIFO	—
UM82C8167	Real Time Clock (RTC)	—
UM82450	Asynchronous Communication Element (ACE)	—
UM82450A	Asynchronous Communication Element (ACE)	—
UM8250B	Asynchronous Communication Element (ACE)	—
UM82C862	Super AT I/O	—



UNITED MICROELECTRONICS CORPORATION

OFFSHORE BRANCHES:

UNICORN MICROELECTRONICS CORPORATION
3350 SCOTT BLVD., BUILDINGS 48 & 49, SANTA CLARA, CA 95054, U.S.A.
TEL: 408-727-9589, 727-9239 FAX: 408-492-1720, 970-0548 TLX: 172730 NMC SNTA

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UMC K.K.
3F, 20-29, 2-CHOME TAKANAWA, MINATO-KU, TOKYO, JAPAN
TEL: 03-280-3661 FAX: 03-280-3663

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RM. 1003, TOWER B, HUNGHOM COMMERCIAL CENTER,
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TEL: 852-765-7122 FAX: 852-765-7483

SALES OFFICE:
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TEL: 02-715-2455, 717-1739 FAX: 02-716-6291, 716-8304 TLX: 28560 UMC TPE

UMC I/O Family

UMC offers a wide variety of Asynchronous Communication Element (ACE) devices, with applications ranging from single serial port to parallel port and Multi-I/O configurations.

Detailed technical data sheets fully describing the listed I/O devices are available from your local UMC distributor or by directly contacting the UMC sales office.

UMC fully integrates the design, processing, testing and reliability control of its products. This assures our customers of tightly controlled reliability, fast delivery and very competitive pricing. For convincing proof on how you can "WIN WITH UMC" contact your area UMC representative at the locations addressed below.

UMC I/O Family

Item	Parallel Port	Serial Port	Package	Features
UM8250A		1	DIP 40, PLCC 44	
UM8250B		1	DIP 40, PLCC 44, QFP 48	
UM82C50A		1	DIP 40, PLCC 44, QFP 48	
UM82450		1	DIP 40, PLCC 44, QFP 48	
UM82C450		1	DIP 40, PLCC 44, QFP 48	
UM82C451	1	1	PLCC 68	
UM82C452	1	2	PLCC 68	Compatible with VTI 16C452
UM82C452A	1	2	PLCC 68	Compatible with SIS 82C452
UM82C550		1	DIP 40, PLCC 44	with 16 Byte FIFO

UMC



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Modems-UM92240/41 - Chip Set, UM9610-Single Chip, UM9600-Module

Computer communications soars to new heights when UMC Modem Products are employed. For speed, compatibility, accuracy and convenience, the UMC solution is a hard combination to beat. What's more, these high performance products come with UMC's dependable and efficient after-sales service.

High Speed Performance

Equipped to provide full-range modem protocol, the UM92240/92241 operates from 300 bps up to 2400 bps for the V.22 bis data Modem Solution, while the UM9600/9610 addresses all the protocols used by G3 and G2 fax machines.

Catering to the Hayes AT Command Solution, the UM92240/92241 offers the S/W command set, which is fully compatible with the Hayes Smart Modem.

Single Clock Source

A Single System Clock Source simplifies the system. All of UMC's Modem chipsets use a single clock source at board level implementation.

Board Compatibility

The On-chip/On-board Hybrid feature rounds out the versatility of these products. To enhance system design, the hybrid circuit has been embedded into the UM92241 front end and UM9600 board.

FEATURES

	UM92240/92241	UM9600/9610
Compatibility	V.22bis/V.22/V.21 Bell 212A/103	V.29/V.27ter/V.21ch 2 T.30/T.4/T.3
Transmission Speed	2400bps/1200bps/0 ~ 300bps	9600/7200/4800/2400bps
Package	UM92240 : 28DIP/PLCC UM92241 : 28DIP/PLCC	Dual-In-Line PCB 100 pin QFP
Power Consumption (Typical)	300mw	800mw (PCB) 400mw (100 pin QFP)
Clock source	11.0592 MHz	20.16 MHz
Input Level	-10 ~ -43 dBm	0 ~ -47 dBm
Generated Tone (except carrier frequency)	DTMF/Guard Tone/Answer Tone	DTMF/T.30 Tonal Signaling/Melody/Specified Tone
Diagnostics	Analog/Digital Loopback Remote Digital Loopback	Eye Quality Monitor
Equalization	Adaptive/Compromise	Adaptive/Compromise
Operating Temperature	0 ~ 70°C	0 ~ 70°C

UMC



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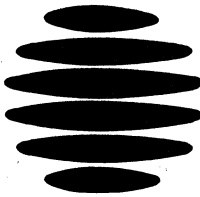
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UNIVERSAL SEMICONDUCTOR INC.

Integrated Semiconductor Manufacturer Offering Single-Chip Solutions for Analog/Digital and Smart Power Applications

Application Specific Solutions

High Voltage Drive & Control Systems

Our **USH5000** Smart Power technology allows virtually unlimited interconnection of circuits operating at up to 500 volts. In addition to high voltage drive circuitry, 5-15 volt analog and digital CMOS and bipolar control circuitry can be integrated on the same monolithic IC. Dielectric isolation processing provides enhanced operating conditions and improved reliability.

Applications include automatic test equipment, flat panel displays, electrostatic printers, smart motor control, ultrasound imaging, and telephone loop equipment.

Analog/Digital ASIC

Our **USI6000** family of CMOS arrays achieves single-chip integration of analog-digital subsystems. Implement systems which require A/D, D/A, and precision analog signal processing and interface functions.

Cell library, kit parts, spice models, and CAD tools are customer accessible.

CMOS Gate Arrays

Our **ISO-CMOS** series offers an economical solution for digital applications up to 2400 gates. 2, 3, and 5 MICRON technology achieves high speed and low power with operating range up to 25 volts. ISO-RAD processing provides radiation tolerance of 1 megarad.

Standard Product Solutions

Smart Power Products

- Analog Switches
- Push-Pull Drivers
- ATE Pin Drivers
- OPTO-Isolators

Data Acquisition Products

- Flash ADCs
- Video DACs
- Triple DACs
- Quad DACs

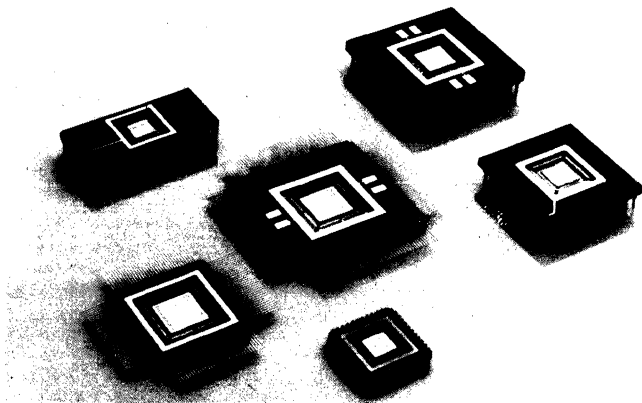
Microprocessor Interface Products

- Address Decoders
- Communications Adapters
- Interrupt Controllers

Lateral D-MOS FETs N-Channel Enhancement Mode

- Transistors (SD210/211 Series.)
- Quad Analog Switch Arrays (SD5000 Series)
- Quad Analog Switch Driver Arrays (SD5100 Series)

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RAD-SPEC PRODUCTS

UTD-R / UTE-R GATE ARRAYS

Gate array family	Density, usable gates	Packaging	Work-station support	JTAG compatible	MIL-STD-883C, Mthd 5004	Dose rate upset, rads(Si)/s	Dose rate survival, rads(Si)/s	Neutron fluence, n/cm ²	SEU, ** errors/cell-day	RAD-SPEC level
UTD-R	3400	PGA/FP	M/D	No	Level B/S	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UTD-R	6000	PGA/FP	M/D	No	Level B/S	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UTD-R	7800	PGA/FP	M/D	No	Level B/S	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UTD-R	11000	PGA/FP	M/D	No	Level B/S	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UTE-R	20000	PGA/FP	M/D	Yes	Level B/S	>1E9	>1E12	>1E14	<1E-8	M,D,R,H
UTE-R	50000	PGA/FP	M/D	Yes	Level B/S	>1E9	>1E12	>1E14	<1E-8	M,D,R,H

M=Mentor D=Daisy

MIL-STD-1553 BUS INTERFACE

UTMC part number	Packaging	Built-In-Test (BIT)	MIL-STD-883, Mthd 5004	SMD number	Dose rate upset, rads(Si)/s	Dose rate survival, rads(Si)/s	Neutron fluence, n/cm ²	SEU, ** errors/cell-day	RAD-SPEC level
UT1553B BCRT	84 PGA/FP/LCC	Yes	Class B/Level S	5962-88645	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UT1553B BCRTM	84 PGA/FP/LCC	Yes	Class B/Level S	5962-89577	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UT1553 BCRTMP	144 PGA/132 FP	Yes	Class B/Level S	5962-89501	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UT63M100 Transceiver (bipolar)	24-36 DIP/36 FP/36 SOP	No	Class B/Level S	5962-88644	NA	NA	NA	NA	M,D

MEMORIES

SRAMs	Address access time, ns	Packaging	MIL-STD-883, Mthd 5004	SMD number	Dose rate upset, rads(Si)/s	Dose rate survival, rads(Si)/s	Neutron fluence, n/cm ²	SEU, ** errors/bit-day	RAD-SPEC level
UT67164	55, 70, 85	28 DIP/FP	Level B/S	None	>1E9	>1E12	>1E14	<1E-10	M,D,R,H
UT7164	55, 70, 85	28 DIP/FP	Level B/S	None	>1E9	>1E12	>1E14	<1E-8	M,D,R,H

PROCESSORS

Processor	Mode	Speed	Packaging	MIL-STD-883, Mthd 5004	SMD number	Dose rate upset, rads(Si)/s	Dose rate survival, rads(Si)/s	Neutron fluence, n/cm ²	SEU, ** errors/cell-day	RAD-SPEC level
UT1750AR	RISC or 1750A	12 MHz	144 PGA/132 FP	Class B/Level S	5962-89578	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UT1750AR	RISC or 1750A	16 MHz	144 PGA/132 FP	Class B/Level S	5962-89578	>1E9	>2E11*	>1E14	<3.4E-8	M,D,R,H
UT69532	DSP	75 MFLOP	281 PGA/256 FP	Level B/S	5962-89579	>1E9	>1E12	>1E14	<1E-8	M,D,R,H

Latchup will not occur over the specified radiation level for UTMC radiation-hardened devices.

Both dose rate upset and dose rate survival are measured with a short pulse.

* Limit of test equipment

**Design dependent

For more information call 1-800-MIL-UTMC.

RAD-SPEC is a service mark of United Technologies Microelectronics Center, Inc.

FEATURES -- UT67164 SEU-Hard SRAM

- 55ns maximum address access time, single-event upset less than 1.0×10^{-10} errors/bit-day (-55°C to $+125^{\circ}\text{C}$)
- Asynchronous operation for compatibility with industry-standard 8K x 8 SRAM
- TTL-compatible input and output levels
- Three-state bidirectional data bus
- Low operating and standby current
- Full military operating temperature range, -55°C to $+125^{\circ}\text{C}$, screened to specific test methods listed in Table I MIL-STD-883 Method 5004 for Class S or Class B
- Radiation-hardened process and design; total dose irradiation testing to MIL-STD-883 Method 1019
 - Total-dose: 1.0×10^6 rads (Si)
 - Dose rate upset: 1.0×10^9 rads (Si)/sec
 - Dose rate survival: 1.0×10^{12} rads (Si)/sec
 - Single-event upset: $<1.0 \times 10^{-10}$ errors/bit-day
- Industry standard (JEDEC) 64K SRAM pinout
- Packaging options:
 - 28-pin 100-mil center DIP (.600 x 1.2)
 - 28-pin 50-mil center flatpack (.700 x .75)
- Latchup immune
- 5 volt operation
- Post-radiation AC/DC performance characteristics guaranteed by MIL-STD-883 Method 1019 testing at 1.0×10^6 rads(Si)

UTMC

FEATURES -- UT7164 SEU-Tolerant SRAM

- 55ns maximum address access time, single-event upset less than 1.0×10^{-8} errors/bit-day (-55°C to $+125^{\circ}\text{C}$)
- Asynchronous operation for compatibility with industry-standard 8K x 8 SRAM
- TTL-compatible input and output levels
- Three-state bidirectional data bus
- Low operating and standby current
- Full military operating temperature range, -55°C to $+125^{\circ}\text{C}$, screened to specific test methods listed in Table I MIL-STD-883 Method 5004 for Class S or Class B
- Radiation-hardened process and design; total dose irradiation testing to MIL-STD-883 Method 1019
 - Total-dose: 1.0×10^6 rads (Si)
 - Dose rate upset: 1.0×10^9 rads (Si)/sec
 - Dose rate survival: 1.0×10^{12} rads (Si)/sec
 - Single-event upset: $<1.0 \times 10^{-8}$ errors/bit-day
- Industry standard (JEDEC) 64K SRAM pinout
- Packaging options:
 - 28-pin 100-mil center DIP (.600 x 1.2)
 - 28-pin 50-mil center flatpack (.700 x .75)
- Latchup immune
- 5 volt operation
- Post-radiation AC/DC performance characteristics guaranteed by MIL-STD-883 Method 1019 testing at 1.0×10^6 rads(Si)

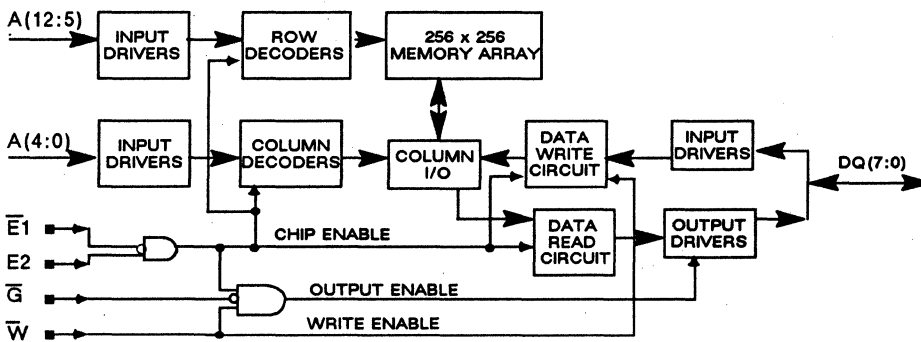


Figure 1. SRAM Block Diagram

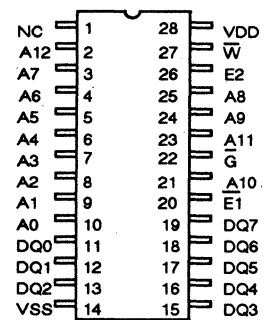
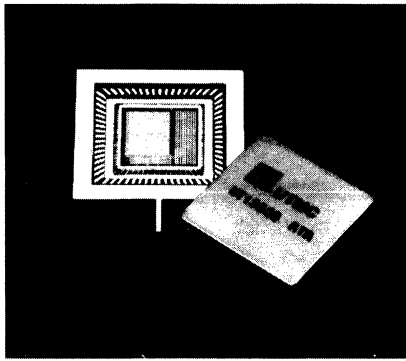


Figure 2. SRAM Pinout

For more information call 1-800-MIL-UTMC.

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SPEC



UTMC UT1553B Remote Terminal with RAM (RTR) in high-density PGA

RTR is first 1553B Remote Terminal with on-chip 1Kx16 SRAM

The UT1553B RTR from United Technologies Microelectronics Center (UTMC) combines a 1553 Remote Terminal with a 1K x 16 static RAM on a single chip. The device executes all dual-redundant 1553B operational mode codes and functions. Programmable memory mapping allows efficient use of internal memory. The device is available to SMD #5962-89576, and in 68-pin PGA and 68-lead LCC packages. For more information, contact UTMC at 1-800-MIL-UTMC or 1575 Garden of the Gods Rd., Colorado Springs, CO 80907.

Remote Terminal Multi-Protocol supports MIL-STD-1553 A and B

The UT1553 RTMP Remote Terminal Multi-Protocol from United Technologies Microelectronics Center (UTMC) supports both MIL-STD-1553 A and B standards, including differences in status word response time and bit definitions. The RTMP performs all dual-redundant Remote Terminal functions, and provides handshake control for quad-redundant systems and a direct memory access interface. Packaged in 84-lead LCCs and 84-pin PGAs, the RTMP is available to SMD #5962-88645. For more information, call UTMC at 1-800-MIL-UTMC.

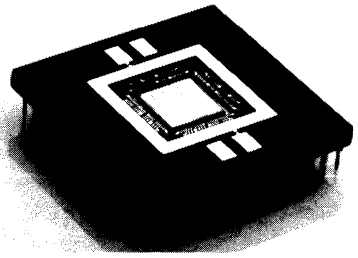
UTMC's 1553 BCRT family now rad-hard and available to SMDs

United Technologies Microelectronics Center (UTMC) announces Standard Military Drawings (SMDs) for its entire Bus Controller/Remote Terminal family. Devices may be purchased by referencing the SMD number, including package type and lead finish, saving time and expense.

The monolithic devices support MIL-STD-1553B dual-redundant Bus Controller (BC) and Remote Terminal (RT) functions, and advanced specialized memory management.

The UT1553B BCRT is available to SMD #5962-88628. The UT1553B BCRTM, a BCRT with Monitor, is available to SMD #5962-89577. Both are packaged in 84-pin PGAs, 84-lead flatpacks, and 84-pad LCCs.

The UT1553 BCRTMP is a BCRT with Multi-Protocol sup-



UTMC UT1553 BCRTMP supports MIL-STD-1553 A and B

porting MIL-STD-1553 A and B; McDonnell Douglas A3818, A5690, and A5232; and Grumman SP-G-151A. Available to SMD #5962-89501, it is packaged in 144-pin PGAs and 132-lead flatpacks.

The BCRTs are available to MIL-M-38510 radiation hardness levels M, D, R, and H through UTMC's RAD-SPECSM program. RAD-SPEC guarantees specifications after irradiation, and off-the-shelf pricing and delivery. For details, contact UTMC at 1-800-MIL-UTMC.

PLUG IN A BETTER 63100



UTMC's new monolithic 1553 transceivers are off-the-shelf, direct SMD replacements for outdated hybrids. You'll find our UT63M100 series to be higher in reliability, lower in power and cost. For retrofits, choose our standard 24- and 36-pin ceramic packages. For new programs, save board space with our small outline, surface-mount packages. To find out how to plug-in to a better 1553 source, call UTMC today.

1575 Garden of the Gods Rd.
Colorado Springs, CO 80907

1-800-MIL-UTMC



UNITED TECHNOLOGIES MICROELECTRONICS CENTER

DEDICATED TO MILITARY AND AEROSPACE

UTMC

UTMC's products are a high-density, high-reliability solution to military and aerospace applications. We continue to support our customers with our commitment to DESC's JAN Class B and Class (S)pace programs, our radiation-hardening capabilities, module-generated silicon compilation, workstation tool kits, and expanded macro libraries.

Gate Arrays

Product Description

Our 1.5-micron UTD and UTD-R families and our 1.2-micron UTE-R family are CMOS silicon-gate dual-layer metal technology providing desirable features such as low-power consumption, high-noise immunity, and Schottky-like speeds. Our gate arrays use a patented continuous-column architecture which minimizes the number of unusable transistors common in conventional block structures. This highly efficient approach results in a 100% automatic layout with utilizations up to 95%.

UTD & UTD-R Gate Array Family

Part Number	Transistor Pairs	Equivalent Usable Gates	I/O Pads	Total Pads
UT116D/DR	7,774	3,400	96	116
UT160D/DR	13,920	6,000	136	160
UT180D/DR	17,952	7,800	156	180
UT212D/DR	25,350	11,000	188	212

UTE-R Gate Array Family

Part Numbers	Equivalent (1) Usable Gates	I/O Circuits		Total Pads
		(2)	(3)	
UT20ER	20,000	176	40	218
UT50ER	50,000	256	80	342

Notes:

- Usable gates will vary, depending on design.
- I/O signals, including 5 JTAG I/Os. Available I/O count is dependent upon package selected.
- VDD/VDDQ -- VSS/VSSQ power pads reserved.

JAN Class B and Level S

UTMC demonstrates its commitment to meeting military specifications through its MIL-STD-976, JAN

Class B line certification, and its MIL-M-38510/605 - 608 JAN Class B product qualifications. UTMC is the first DESC-qualified JAN CMOS gate array manufacture. To solidify this commitment, UTMC is pursuing Class S qualification for its 1.2-micron gate array family.

Expanded Toolkits

UTMC offers cell libraries and design tools on Mentor and Valid workstations. The toolkits, along with the workstations' CAE tools, provide a front-end interface to UTMC. The toolkits allow customers to complete design capture, verification, and accurate pre- and post-layout timing simulations before submitting the design to UTMC for completion.

Macros

UTMC is the only manufacturer to offer 1553-compatible macros, including the Remote Terminal Interface (RTI) and the Remote Terminal Multi-Protocol (RTMP). Our macros also include the UT1750AR RISC.

Module-Generated/Silicon Compilation

UTMC and Seattle Silicon Corporation (SSC) have signed a joint agreement to deliver high-density, radiation-hardened ASICs. Under the agreement, SSC provides design methodology and customer support and UTMC fabricates and tests the rad-hard ASIC designs. Using SSC's ChipCraftertm design tools and UTMC's process, ASICs composed of up to 425,000 transistors are possible.

Radiation-Hardening Capabilities

Our products comply with the harsh and rugged environmental requirements of high-reliability military and aerospace systems where high radiation tolerance is required. Built using UTMC's proprietary radiation-hardened process, these devices meet the needs of strategic and tactical radiation-hardened applications as identified in UTMC's RAD-SPECsm program. RAD-SPEC guarantees the hardness assurance levels M, D, R, H specified in MIL-M-38510.

For more information call 1-800-MIL-UTMC.

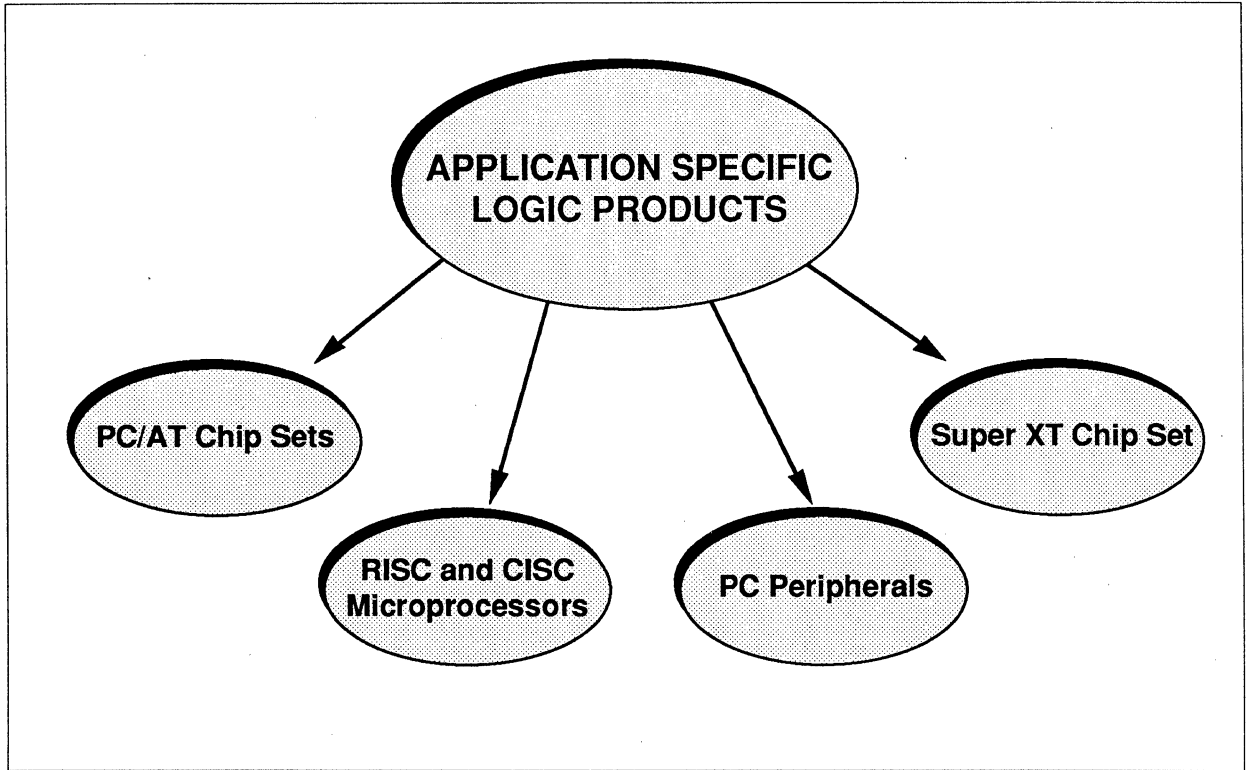
RAD-SPEC is a service mark to United Technologies Microelectronics Center
ChipCrafter is a trademark of Seattle Silicon Corporation





Quick Reference Guide

LOGIC PRODUCTS



VLSI Technology

VLSI Technology, Inc., is headquartered in San Jose, California. It is a leading designer and manufacturer of application specific logic products and application specific integrated circuits (ASICs). The Company's products are targeted for use in computers, communications equipment and government products.

VLSI's Logic Products Division is headquartered in Tempe, Arizona. It is responsible for unique catalog products that are developed with the Company's innovative design technology including communications, microprocessors, and PC and peripheral support products.

VLSI Technology, Inc., has engineering and manufacturing operations in San Jose, California; Tempe, Arizona; and San Antonio, Texas. It also maintains sales offices and technology design centers around the world.

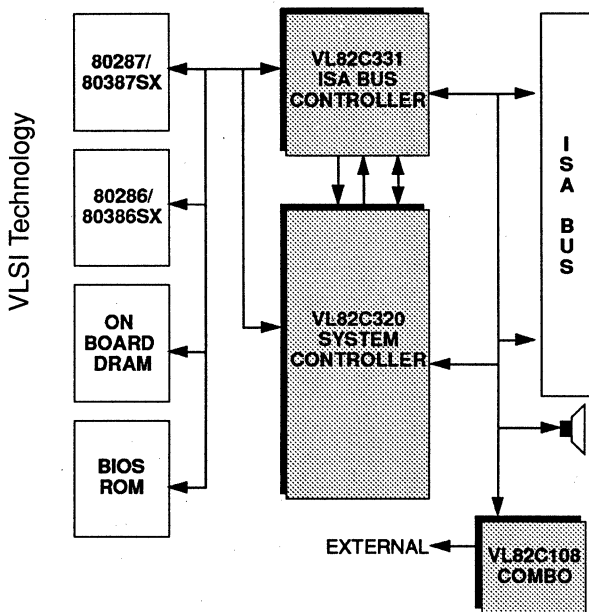
PC/AT is a registered trademark of IBM Corporation.
Multibus is a registered trademark of Intel Corporation.
LIM EMS 4.0 is a registered trademark of Lotus Development Corporation.

**PC/AT®-COMPATIBLE
DEVICE SOLUTIONS**

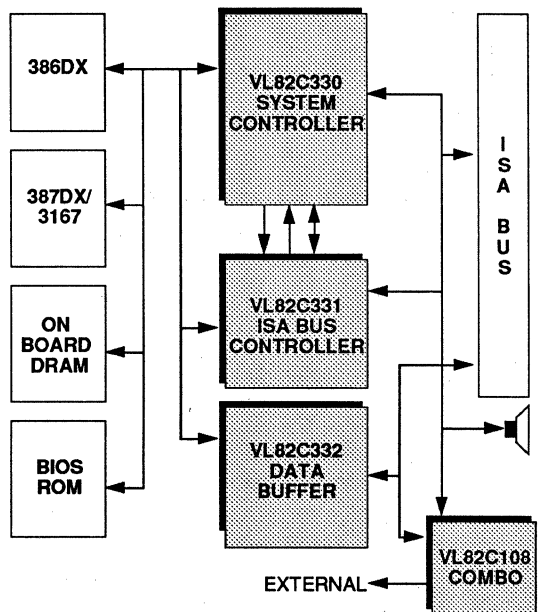
TOPCAT™ CHIP SETS

Device	Description	Packaging
<u>VL82C286-SET</u>	<u>TOPCAT 286/386SX CHIP SET</u>	
VL82C320-FC	System Controller/Data Buffer	160-lead PQFP
VL82C331-FC	ISA Bus Controller	160-lead PQFP
<u>VL82C386-SET</u>	<u>TOPCAT 386DX CHIP SET</u>	
VL82C330-FC	System Controller	128-lead PQFP
VL82C331-FC	ISA Bus Controller	160-lead PQFP
VL82C332-FC	Data Buffer	128-lead PQFP

VL82C286-SET CHIP SET SYSTEM DIAGRAM



VL82C386-SET CHIP SET SYSTEM DIAGRAM



FEATURES (VL82C286-SET):

- Two-chip set implements complete 80286 or 80386SX PC/AT motherboard using only five ICs
- 12 to 25 MHz, 512 KB to 32 MB Systems with 256K, 1M, and/or 4M DRAM
- Full LIM 4.0 hardware EMS
- Power down control for laptop, portable, and hand-held applications
- Built-in real-time clock and scratchpad RAM

FEATURES (VL82C386-SET):

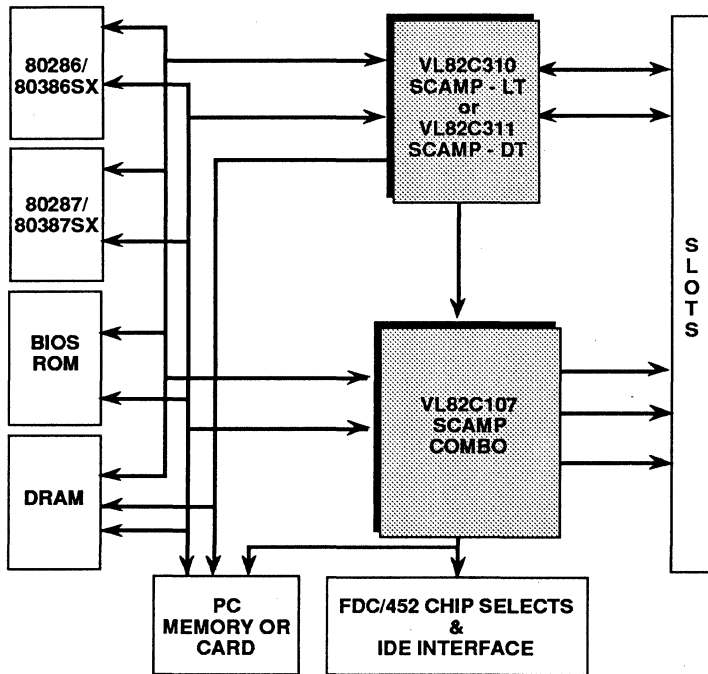
- Three-chip set implements complete 80386DX PC/AT motherboard using only ten ICs
- 12 to 33 MHz, 512 KB to 64 MB systems with 256K, 1M, and/or 4M DRAM
- Full LIM 4.0 hardware EMS
- Power down control for laptop, portable, and handheld applications
- Built-in real-time clock and scratchpad RAM

**PC/AT-COMPATIBLE
DEVICE SOLUTIONS**

SCAMP CHIPS

Device	Description	Packaging
<u>LAPTOP</u>		
<u>SCAMP-LT CONTROLLER CHIP</u>		
VL82C310-FC	Single-chip AT Mid-range Performance Laptop	160-lead PQJFP
<u>DESKTOP</u>		
<u>SCAMP-DT CONTROLLER CHIP</u>		
VL82C311-FC	Single-chip AT Mid-range Performance Desktop	160-lead PQJFP

VL82C310/VL82C311 SCAMP AND VL82C107 SCAMP COMBO FAMILY



VLSI Technology

FEATURES (VL82C311 DESKTOP):

- Provides system control, memory control, integrated peripheral controllers, and data buffer control for use in 80286- or 80386SX-based systems from 10 to 20 MHz
- Memory control of one to four banks of DRAM using 256K and/or 1M components allowing up to 8 Mbytes on the system board
- Two-way page-mode block interleaving or normal system board memory operation
- Supports 8- or 16-bit wide BIOS ROMs

FEATURES (VL82C310 LAPTOP):

VL82C311 features plus:

- 4M DRAM support
- Built-in "sleep" mode features, including use of slow refresh DRAMs in power critical operations
- Special power saving page-mode operation
- Advanced ROM remapping capabilities
- PC Memory Card Support
- Pin-compatible with VL82C311

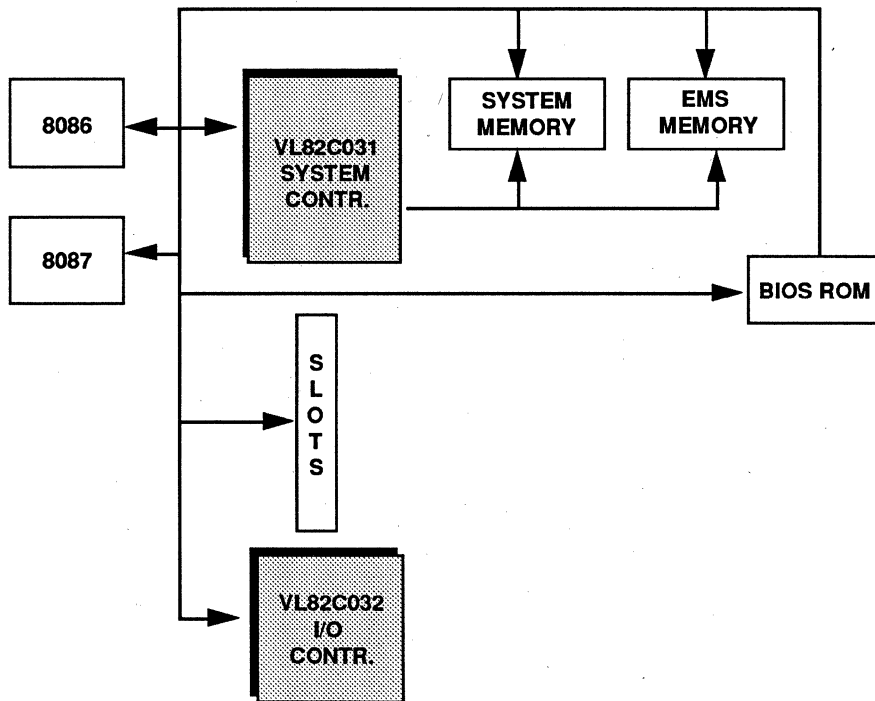


TWO-CHIP SUPER XT CHIP SET SOLUTION

TWO-CHIP SUPER XT CHIP SET

Device	Description	Packaging
TWO-CHIP SUPER XT CHIP SET		
VL82C031-FC	System Controller	100-lead PQJFP
VL82C032-FC	I/O Controller	100-lead PQJFP

TWO-CHIP SUPER XT CHIP SET SYSTEM BLOCK DIAGRAM



VLSI Technology

FEATURES

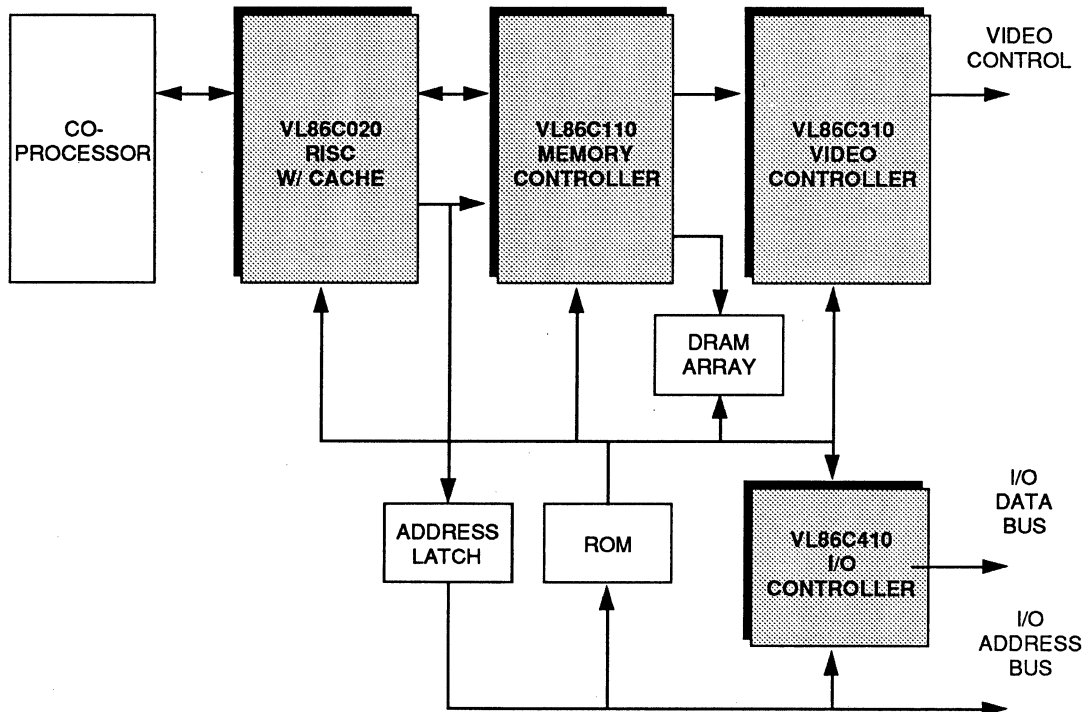
- 10 MHz 8086 Super XT using 18 total ICs
- Hardware EMS
- Laptop power down control
- Keyboard controller
- Real-time clock
- Dual UARTs
- Parallel printer port

MICROPROCESSOR DEVICE SOLUTIONS

MICROPROCESSORS

Device	Description	Packaging
<u>32-BIT RISC MICROPROCESSOR SYSTEM</u>		
VL86C010	32-Bit RISC Microprocessor	84-lead PLCC
VL86C020	32-Bit RISC Microprocessor w/Cache	160-lead PQFP
VL86C110	RISC Memory Controller	68-lead PLCC
VL86C310	RISC Video Controller	68-lead PLCC
VL86C410	RISC I/O Controller	68-lead PLCC
<u>COPROCESSOR</u>		
VL82C389	Message-Passing Coprocessor for Multibus® II Systems	149-lead Ceramic PGA

VL86C020 RISC WITH CACHE SYSTEM BLOCK DIAGRAM



VLSI Technology



**PERIPHERAL
DEVICE SOLUTIONS**

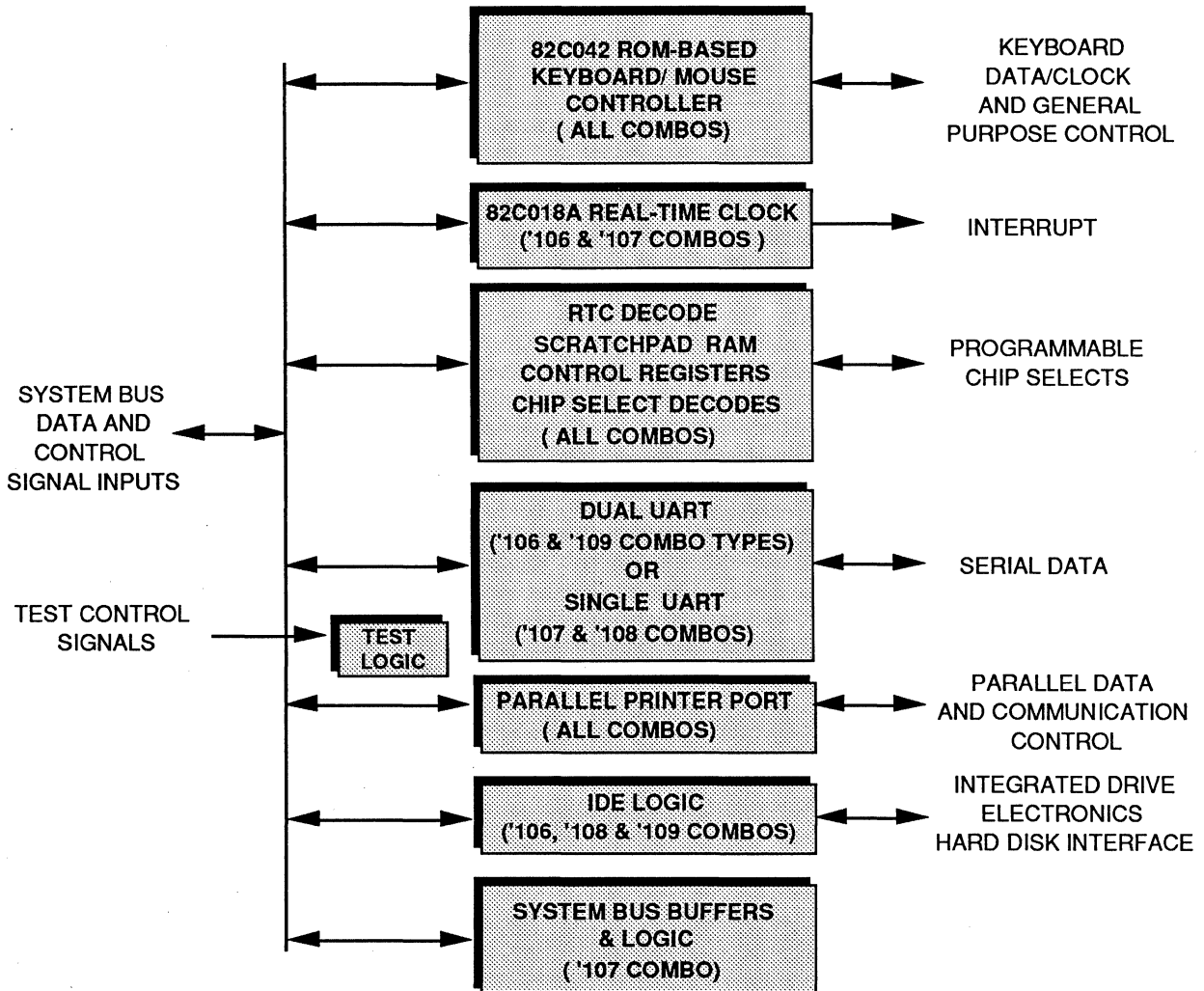
PERIPHERAL CHIPS

Device	Description	Packaging
<u>COMBO I/O</u>		
VL82C106	PC/AT-Compatible Combo I/O Chip	128-lead PQFP
VL82C107	SCAMP Combo I/O Chip	128-lead PQFP
VL82C108	TOPCAT Combo I/O Chip	100-lead PQFP
VL82C109	Enhanced TOPCAT Combo I/O Chip	160-lead PQFP
<u>GRAPHIC CONTROLLERS</u>		
VL68C45R/S	CRT Controller	40-lead Plastic DIP 44-lead PLCC
VL16160	Raster Operation Graphics ALU	28-lead Plastic DIP 28-lead PLCC
VL82C164	Quad Raster Operation Graphics ALU	100-lead PQFP
<u>DISK CONTROLLERS</u>		
VL1772-02	Floppy Disk Controller	28-lead Plastic DIP 28-lead PLCC
<u>OTHER</u>		
VL65C22V	Parallel Interface/Timer	40-lead Plastic DIP 44-lead PLCC
VL4502	256K Dynamic RAM Controller	40-lead Plastic DIP
<u>UARTS</u>		
VL16C450	Single UART	40-lead Plastic DIP 44-lead PLCC
VL16C451B	Enhanced UART with Parallel Port	68-lead PLCC
VL16C452B	Enhanced Dual UART with Parallel Port	68-lead PLCC
<u>ENHANCED UARTS</u>		
VL16C550	Enhanced UART with FIFO	40-lead Plastic DIP 44-lead PLCC
VL16C551	Enhanced UART with FIFO and Parallel Port	68-lead PLCC
VL16C552	Enhanced Dual UART with FIFO and Parallel Port	68-lead PLCC
VL16C554	Quad UART with FIFO	84-lead PLCC
<u>COMMUNICATIONS CONTROLLER</u>		
VL85C30	Enhanced Serial Communication Controller	40-lead Plastic DIP 44-lead PLCC

VLSI Technology

**PERIPHERAL
DEVICE SOLUTIONS**

COMBO FAMILY I/O BLOCK DIAGRAM



VLSI Technology

OVERVIEW

Increased product performance and decreased time-to-market are the key issues that continue to drive today's marketplace.

As a recognized pioneer and leader in application-specific integrated circuit (ASIC) design, VLSI Technology provides today's system engineers with a complete and comprehensive set of products and services that allow complex ASICs to be developed, tested, and manufactured with maximum efficiency.

In a tightly unified ASIC design and manufacturing environment, VLSI provides a full spectrum of ASIC solutions backed through our vast network of worldwide technology centers, highly efficient and easy-to-use ASIC design software, unmatched gate array and standard cell libraries, and the manufacturing strength required for quick turn-around and high-volume production.

SOLUTIONS IN SILICON

Whether gate array, cell-based, or custom/foundry implementations, VLSI brings you a complete portfolio of ASIC products to meet almost any high-integration design requirement.

VLSI's gate arrays are based on our proprietary Continuous Gate™ Technology. Implemented in double-metal, 1-micron and 1.5 micron CMOS processes, this advanced technology yields high-density, high-performance ASIC architectures. You can choose from a wide variety of bases in our VGT Series gate array families that offer from 1,000 to 74,000 usable gates. Additionally, our VSC Series of cell-based products provide you with a broad selection of products featuring densities to 180,000 usable gates, and speeds to 280 ps.

Our foundry services fully complement our ASIC capabilities. You are assured of high-quality and reliable product yields, state-of-the-art processing technology, expert design and product engineering support, rapid prototype and expedited deliveries, and a flexible approach to customer service.

DESIGN TOOLS

VLSI Technology, an early leader in IC design software, has developed a very powerful set of IC design software tools that are provided in seven different configurations so you can get exactly those tools you need to implement your design with the utmost speed and productivity.

Called the Express ASIC Design System™, the tools offer a design environment streamlined to minimize your design time with the goal of providing first-time silicon success. The Express packages range in power from a logic-only design environment to a full-scale ASIC CAD system and are available on a number of hardware platforms.

The foundation of all the Express design system tools are the VLSI Portable Library™ tools which contain elements that can be compiled either to gate arrays or standard cells. The Portable Library gives you the freedom to choose a silicon implementation technology at the end of logic design, when you are better able to decide which technology would be best for you.

TECHNOLOGY CENTERS

Just as VLSI's design tools are among the most powerful and advanced in the industry, VLSI's worldwide network of Technology Centers offer the most sophisticated user-oriented services available anywhere. Each center is staffed by experienced ASIC designers and equipped with powerful on-site computing capabilities to help assure the speed of your ASIC development.

When you come to a VLSI Technology Center, you can expect an honest assessment of your needs by experienced professionals whose ultimate aim is to ensure that your design works successfully in silicon. Whether you want to enter schematics and turn over the rest of the design to us, or you want to do everything yourself and only use a few of our special services, we will respond to your needs. Virtually every service that you might need is available through VLSI. These include such advanced techniques as: system partitioning, custom cell design, fault simulation, logic/timing simulation, test vector generation, physical design, chip composition and special testing services.

VLSI Technology

PRODUCT PORTFOLIO

	Gate Array	Cell Based	Foundry
Product	<ul style="list-style-type: none"> • Sea of Gates • 74K Gates • 350 ps Gate Delay 	<ul style="list-style-type: none"> • Highest Density • >180K Gates • 280 ps Gate Delay 	<ul style="list-style-type: none"> • 1.0 μ, 1.5 μ, 2 μ CMOS • Wafer, Die, Pkgd Parts
Library Support	1.0 μ and 1.5 μ Portable Libraries: <ul style="list-style-type: none"> • Compilers • Megacells 		<ul style="list-style-type: none"> • I/O Pads • Custom Cells
Design Tool Support	VLSI's ASIC Design Platform 3rd Party: <ul style="list-style-type: none"> • Mentor Graphics • Valid • Ikos • Viewlogic • H.P. • Daisy • Verilog • Zycad • Aida • Others 		<ul style="list-style-type: none"> • VLSI Custom Tools • Calma (Valid) • Mentor Graphics • Cadence

CELL-BASED PRODUCTS

STANDARD CELL LIBRARY

FEATURES

- Fast design turn-around with VLSI Technology's advanced design tools and methodology
- Highly testable: automatic test vector and test program generation using scan methodology and Built-In Self-Test (BIST) techniques
- Third-party CAE workstation support for schematic capture and simulation
- Over 2000 V protection against Electrostatic Discharge (ESD)

- High performance with balanced drive.

DESCRIPTION

The VSC Series standard cell families are fabricated in an advanced, dual-metal, planarized, fully implanted CMOS process. With densities up to 180,000 usable gates, and performance features to 0.35 ns (typ) gate delay, the VSC Series families are fully supported by VLSI's advanced design tools. Datapath, multiplier, and memory compilers

automatically generate physical design layout. VLSI's efficient placement and routing software provides automatic conversion of schematics into silicon. The VLSI standard cell library corresponds functionally to the gate array (VGT) macros and permits easy conversion of CMOS gate array designs into standard cells. With the upward compatibility of the VLSI Portable Library, design migration within the same family can be easily achieved.

PRODUCT CHARACTERISTICS

	VSC120	VSC350	VSC370
Technology (Drawn)	1.5-micron CMOS	1.0-micron CMOS	1.0-micron CMOS
Gate Delay	730 ps (typ)	280 ps (typ)	280 ps (typ)
Toggle Rate	180 MHz	250 MHz	250 MHz
Gate Power @ Freq.	6.5 μ W/gate/MHz	6.5 μ W/gate/MHz	3.6 μ W/gate/MHz
Output Drive	2, 4, 8, 12, 16 mA	2, 4, 8, 12, 16 mA	2, 4, 8, 12, 16 mA
I/O Signal Pins	> 340 I/O	> 380 I/O	> 380 I/O
Cell Library:			
Simple	225 macros 165 MSI	299 macros 165 MSI	299 macros 165 MSI
Complex	Megacells: 82CXX Peripherals, 68C45 CRT Controller, Z80 CPU plus Peripherals, 85C30, 16C450 Video Display Controller (for VSC120)		

VLSI Technology

DATAPATH COMPILER

FEATURES

- Compiles to an optimized layout for cell-based designs or to a portable netlist that can be implemented in a gate array or standard cells
- High-level schematic entry
- Flexible busing architecture
 - unlimited number of buses
 - arbitrary inter-bit-slice wiring
- Automatic placement of library elements
- Flexible clocking scheme
- Automatic power bus sizing and refresh
- Accurate simulation models
- 1.0-, 1.5- and 2.0-micron CMOS technologies available

OVERVIEW

The Datapath Compiler™ gives the designer the ability to rapidly design multi-bit architectures. A system designer can take advantage of a circuit designer's skill and the resulting silicon efficiency through the compiler interface. A datapath is specified using higher level icons. The Compiler then builds an optimized layout for cell-based designs or a netlist for gate arrays using the circuit designer descriptions that have been built into the Compiler.

In contrast to the previous generation of compilers, which implemented a single, fixed function, the Datapath Compiler allows the user to define unique complex functions, which are automatically implemented by the compiler. The datapath design is entered by drawing a high-level, free-

form schematic to describe the interconnection of library elements. The schematic also contains such parameters as number of bits and number of words in register files. The Datapath Compiler will then create the user's choice of either an optimized layout or a gate-level netlist.

The optimized layout is generated automatically, including automatic placement to optimize wiring. Wiring within the datapath is unrestricted, freeing the designer from burdensome interconnect constraints and allowing the implementation of datapaths of arbitrary complexity.

The compiled gate-level netlist generated from the Datapath Compiler can be implemented in a gate array or standard cell.



GATE ARRAY PRODUCTS

GATE ARRAY BASES

FEATURES

- High reliability - over 2000 V ESD protection for 1.5-micron, 4000 V for 1.0-micron
- High design productivity with VLSI's advanced compilers and logic synthesis tools
- Continuous Gate architecture offers maximum layout efficiency
- Low power consumption
- Wide range of package styles and lead counts to fit demanding system environments

DESCRIPTION

VLSI Technology's VGT Series of high-performance and high-density gate arrays utilize the Company's proprietary Continuous Gate architecture to achieve high transistor densities, and a unique global routing scheme to offer high speed and a high-integration design approach.

VLSI's VGT Series gate arrays are fully compatible with the VLSI Portable Library and are supported by VLSI's leading-edge ASIC design tools.

Gate array designs may be developed on popular workstations supported by VLSI Technology, including Daisy, Valid, and Mentor Graphics. Designers using such workstations are provided with a macro library containing the symbols, simulation models, and software for design verification, timing conditions, and netlist generation.

(Note: Three-layer metal version of VGT300 available 2Q91.)

PRODUCT CHARACTERISTICS

	VGT200	VGT350
Technology (Drawn)	1.5-micron CMOS	1.0-micron CMOS
Available Gates	3,200 to 180,000	21,200 to 172,500
I/O Count	48 to 348	80 to 388
Gate Delay	560 ps (typ)	260 ps (typ)
Toggle Rate	250 MHz	250 MHz
Gate Power @ Freq.	15 μ W/gate/MHz	6.5 μ W/gate/MHz
Output Drive	2, 4, 8, 12 or 16 mA	2, 4, 8, or 16 mA
Temp. Range:		
	Commercial	0°C to +70°C
	Industrial	-40°C to +85°C
Military	-55°C to +125°C	-55°C to +125°C

VLSI Technology

Device Number	Available Gates	Estimated Usable Gates	Maximum I/O Pads
VGT300010	6,700	2,900	80
VGT300022	15,500	6,600	120
VGT300030	21,200	9,100	140
VGT300046	32,400	13,900	172
VGT300077	54,200	23,300	220
VGT300110	77,200	33,200	260
VGT300163	144,700	49,300	316
VGT300198	139,200	59,800	348
VGT300246	172,500	74,200	388
VGT200003	3,200	960	48
VGT200006	6,728	2,018	68
VGT200010	10,952	3,285	88
VGT200017	17,672	5,302	112
VGT200024	24,200	7,260	128
VGT200029	28,800	8,640	140
VGT200033	33,800	10,140	152
VGT200042	42,632	12,790	172
VGT200056	56,448	16,934	196
VGT200073	73,728	22,118	224
VGT200109	109,512	32,854	272
VGT200145	145,800	43,740	312
VGT200180	180,000	54,000	348

DESCRIPTION

VLSI's V8 ASIC Design Platform™ is a fully-integrated semicustom design system that unifies the design tools and advanced design libraries for both commercial and military applications. The ASIC Design Platform is available to you in several "Express" configurations, with each configuration designed to meet your specific ASIC design requirements. VLSI's Express packages range in capabilities from the basics of schematic capture and simulation, to the

complex environment of full silicon layout. Floorplanning tools extend the front-end design environment for you by providing control of the layout stage of the design, and offering the ability to extract the most performance from your ASIC design.

In addition to the Express systems, VLSI continues its leadership role in the development of advanced ASIC design tools by introducing the ASIC Synthesizer™ tool. The ever-growing complexities of ASICs requires more

efficient methods of design, and the ASIC Synthesizer incorporates critical parts of the Express systems to provide you with unequalled design productivity.

Where simple logic synthesizers create netlists, the ASIC Synthesizer creates completely routed ASICs.

VLSI's Express system is supported on Apollo®, VAX®, MicroVAX™, Sun-3™, Sun-4™, HP9000 model 350/360/370 and DEC Stations.

TOOLS SUMMARY**LOGIC ASSISTANT™**

A unified design environment providing a common interface to all Logic Express™ applications.

DESIGN ASSISTANT™

Estimates chip size and helps determine optimal partitioning.

SCHEMATIC EDITOR

Provides hierarchical entry and editing of schematics.

DATAPATH COMPILER

Provides high-level schematic entry and compilation for various datapaths for gate arrays or cell-based designs.

LOGIC SYNTHESIZER™

Creates and optimizes control logic and creates netlists for gate arrays or cell-based designs.

ICON EDITOR

Creates custom symbols (icons) for the logical representation of cells in the schematic editor.

LAYOUT EDITOR

Provides hierarchical physical chip layout.

STICKS EDITOR

Provides symbolic cell layout.

SCREENER

Checks gate arrays and standard cells for adherence to design rules.

NETCOMPARE

Compares netlists produced from the other VLSI tools to verify that the schematics and layouts match.

SPICE

Provides nonlinear DC, nonlinear transient, and linear AC analysis.

COMPOSITION EDITOR

Edits the interconnection of routed, arbitrary sized rectangular logic blocks.

CHIP COMPILER

Speeds cell-based design with automated floorplanning, placement, and routing.

TIMING VERIFIER

Performs static timing checks prior to simulation.

LIBRARIES

Design Express™ includes VLSI's unique Portable Library. Also included are the compiler libraries for ALUs, PLAs, RAMs, ROMs, and datapaths.

SIMULATION

Custom Express™ provides two advanced simulators for ASIC design. VLSISim™ is a comprehensive simulator that provides for detailed simulation of design components at the transistor-level, gate-level, or with behavioral-level models. VLSI's QSim is a complete multi-ASIC simulator that can support simulation of even the largest designs at the gate level or with behavioral models.

DESIGN AND ELECTRICAL RULE CHECKER

Verifies the correctness of the design's layout and circuit configuration.

CIF/CAL TRANSLATOR

Translates from Calma to Caltech Intermediate format and vice versa.

TEST ASSISTANT™

Automatic insertion of isolation and BIST circuitry and test program compilation.

BISTRAM™

Built-In Self-Test for compiled RAM.

LFSR COMPILER

Linear Feedback Shift Register compiler for other BIST circuits.

VLSI PROFAULT™

Probabilistic fault simulator.

VCC ATVG

Automatic test vector generation for VLSI's optimized cell layout.

LOGIC SYNTHESIS ATVG

Automatic test vector generation of VLSI's Logic Synthesis product.

VLSIWAVE™

Graphical and procedural stimulus mechanism for vector input to VLSI's QSim and VLSISim simulation tools.

FLOORPLANNING

VLSI's Gate Assistant™ and Chip Assistant™ floorplanners provide for chip floorplan evaluation throughout the design cycle for better control of critical timing requirements

ASIC SYNTHESIZER

The ASIC Synthesizer is a powerful design capture and synthesis tool that can tremendously improve productivity by translating high-level Verilog or VHDL languages into optimized and efficient ASICs.

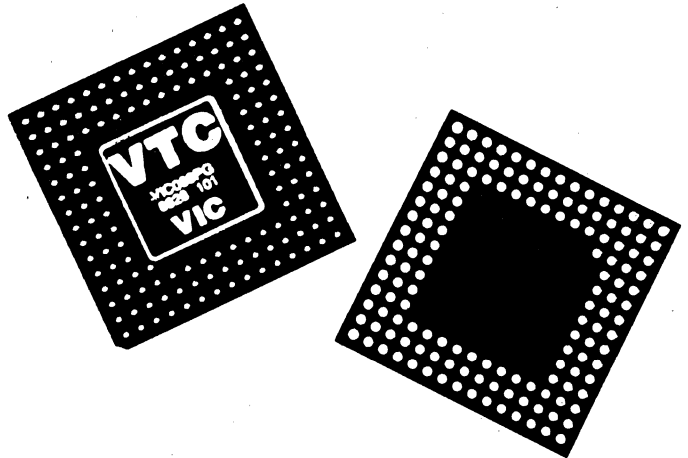


VTC Incorporated

VIC068 VMEbus Interface Controller

FEATURES

- **Complete VMEbus Interface Controller and Arbiter**
 - 58 Internal Registers Provide Configuration Control and Status of VME and Local Operations
 - Drives Arbitration, Interrupt, Address Modifier Utility, Strobe, Address Lines A07-A01 and Data Lines D07-D00 Directly, and Provides Signals for Control Logic to Drive Remaining Address and Data Lines
 - Direct Connection to 68xxx Family and Mappable to Non-68xxx Processors
- **Complete Master/Slave Capability**
 - Supports Read, Write, Write Posting, and Block Transfers
 - Accommodates VMEbus Timing Requirements with Internal Digital Delay Line (7.8 ns granularity)
 - Programmable Metastability Delay
 - Programmable Delays for DSACK to DTACK
 - Provides Timers for Local Bus and VMEbus Transactions
- **Interleaved Block Transfers over VMEbus**
 - Acts as DMA Master on Local Bus
 - Programmable Burst Count, Transfer Length, and Interleaved Period Interval
 - Also Supports Local Module-based DMA
- **Arbitration Support**
 - Supports Single Level, Priority and Round Robin Arbitration
 - Supports Fair Request Option as Requester
- **Interrupt Support**
 - Complete Support for the VME Interrupts: Interrupter and Interrupt Handler
 - Seven Local Interrupt Lines
 - 8-level Interrupt Priority Encode
 - Total of 29 Interrupts Mapped through the VIC068
- **Miscellaneous Features**
 - Refresh Option for Local DRAM
 - Option to Drive DTACK High upon Release
 - Four Broadcast Location Monitors
 - Four Module-specific Location Monitors
 - Eight Interprocessor Communications Registers
 - TAS/CAS/CAS2 Instruction Support for 68020
 - Available in 144-pin Plastic or Ceramic PGA Package; Commercial or Military



VTC's VIC068 Interface Controller chip is available in a 144-pin pin grid array (PGA) package.

DESCRIPTION

The VME Interface Controller (VIC068) is a single chip designed to minimize the cost and board area requirements and to maximize performance of the VMEbus interface of a VMEbus master/slave module. This can be implemented on either a 8-bit, 16-bit, or 32-bit system. The VIC068 was designed using VTC's high-performance standard cells on an advanced one-micron CMOS process. The VIC068 provides all VMEbus system controller functions plus many other features which simplify the development of a VMEbus interface. The VIC068 utilizes output buffers based on VTC's patented and military-approved ACL product family. These CMOS high-drive buffers provide direct connection to the address and data lines. In addition to these signals, the VIC068 connects directly to the arbitration, interrupt, address modifier, utility and strobe lines. Signals are provided which control data direction and latch functions needed for a 32-bit implementation.

The VIC068 was developed through the joint efforts of both VTC and a consortium of board vendors, under the auspices of the VMEbus International Trade Association (VITA). The VIC068 thus offers an implementation that provides inputs from a wide array of users, thus maximizing the number of applications. This also provides compatibility between boards using the VIC068 yet designed by different manufacturers.

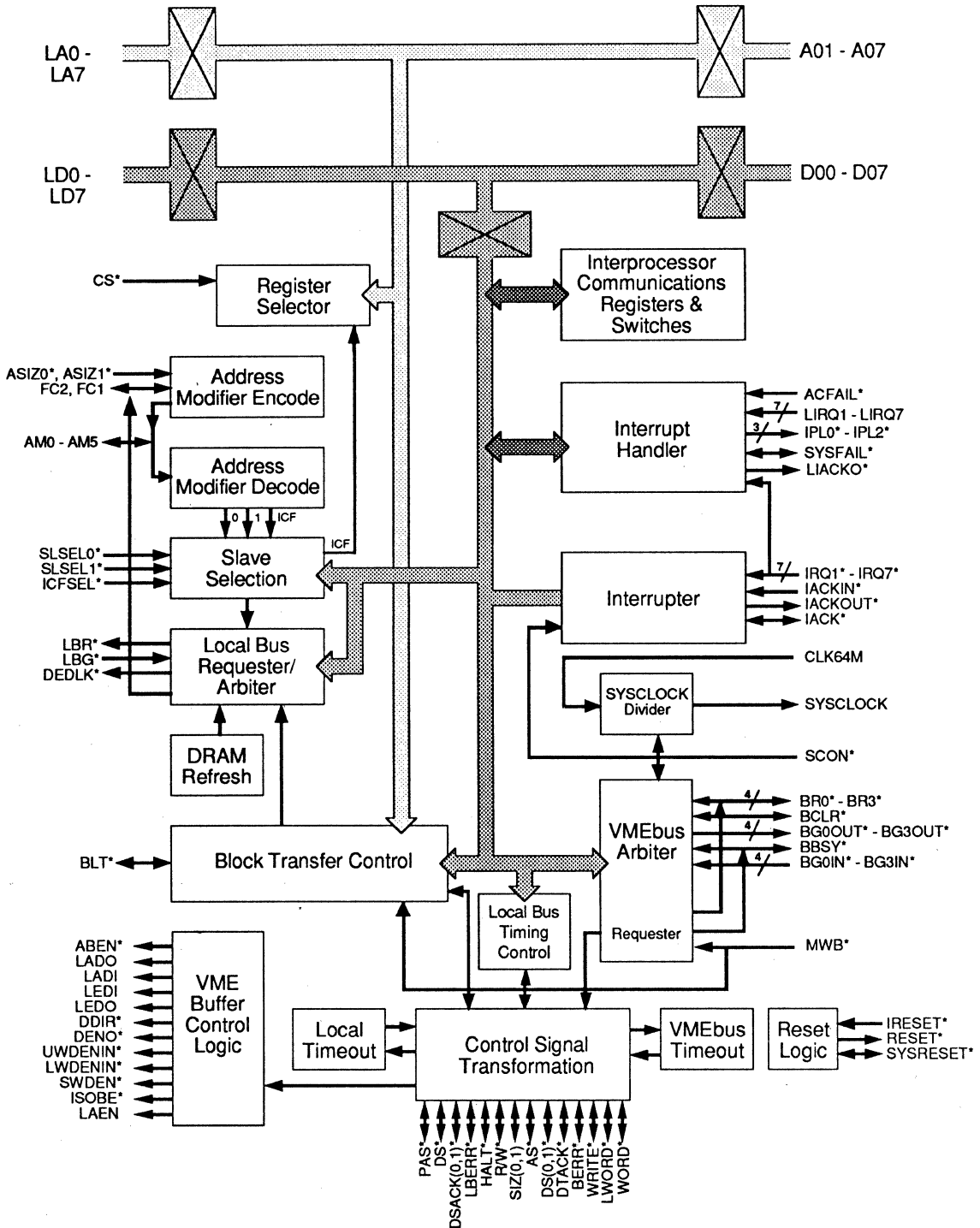
VTC Incorporated



VTC Incorporated

VIC068 VMEbus Interface Controller

FUNCTIONAL BLOCK DIAGRAM



VTC Incorporated



VTC Incorporated

VIC068 VMEbus Interface Controller

VIC068 REGISTERS AVAILABLE FOR PROGRAMMING

Address	Register Name	Global Reset
\$03	VMEbus Interrupter Interrupt Control Register	1 1 1 1 1 0 0 0
\$07 - \$1F	VMEbus Interrupter Control Registers 1 thru 7	1 1 1 1 1 0 0 0
\$23	DMA Status Interrupt Control Register	1 1 1 1 1 0 0 0
\$27 - \$3F	Local Interrupt Control Registers 1 thru 7	1 0 0 0 X 0 0 0
\$43	ICGS Interrupt Control Register	1 1 1 1 1 0 0 0
\$47	ICMS Interrupt Control Register	1 1 1 1 1 0 0 0
\$4B	Error Group Interrupt Control Register	1 1 1 1 1 0 0 0
\$4F	ICGS Interrupt Vector Base Register	0 0 0 0 1 1 1 1
\$53	ICMS Interrupt Vector Base Register	0 0 0 0 1 1 1 1
\$57	Local Interrupt Vector Base Register	0 0 0 0 1 1 1 1
\$5B	Error Group Interrupt Vector Base Register	0 0 0 0 1 1 1 1
\$5F	Interprocessor Communications Switch Register	0 0 0 0 0 0 0 0
\$63 - \$73	Interprocessor Communications Registers 0 thru 4	0 0 0 0 0 0 0 0
\$77	Interprocessor Communications Register 5	1 1 1 1 0 0 0 1
\$7B	Interprocessor Communications Register 6	X 1 1 1 1 1 1 X X
\$7F	Interprocessor Communications Register 7	0 0 X 0 0 0 0 0
\$83	VMEbus Interrupt Request and Status Register	0 0 0 0 0 0 0 0
\$87 - \$9F	VMEbus Interrupt Vector Registers 1 thru 7	0 0 0 0 1 1 1 1
\$A3	Transfer Timeout Register	0 1 1 0 1 0 0 0
\$A7	Local Bus Timing Register	0 0 0 0 0 0 0 0
\$AB	Block Transfer Definition Register	0 0 0 0 0 0 0 0
\$AF	VMEbus Interface Configuration Register 1	0 0 0 0 0 0 0 0
\$B3	Arbiter and Requester Configuration Register	0 1 1 0 0 0 0 0
\$B7	Address Modifier Source Register	0 0 0 0 0 0 0 0
\$BB	Bus Error Status Register	X 0 0 0 0 0 0 0
\$BF	DMA Status Register	0 0 0 0 0 0 0 0
\$C3	Slave Select 0 Control Register 0	0 0 0 0 0 0 0 0
\$C7	Slave Select 0 Control Register 1	0 0 0 0 0 0 0 0
\$CB	Slave Select 1 Control Register 0	0 0 0 0 0 0 0 0
\$CF	Slave Select 1 Control Register 1	0 0 0 0 0 0 0 0
\$D3	Release Control Register	0 0 0 0 0 0 0 0
\$D7	Block Transfer Control Register	0 0 0 0 0 0 0 0
\$DB	Block Transfer Length Register 0	0 0 0 0 0 0 0 0
\$DF	Block Transfer Length Register 1	0 0 0 0 0 0 0 0
\$E3	System Reset Register	1 1 1 1 1 1 1 1
\$EB - \$FF	Undefined Locations	1 1 1 1 1 1 1 1

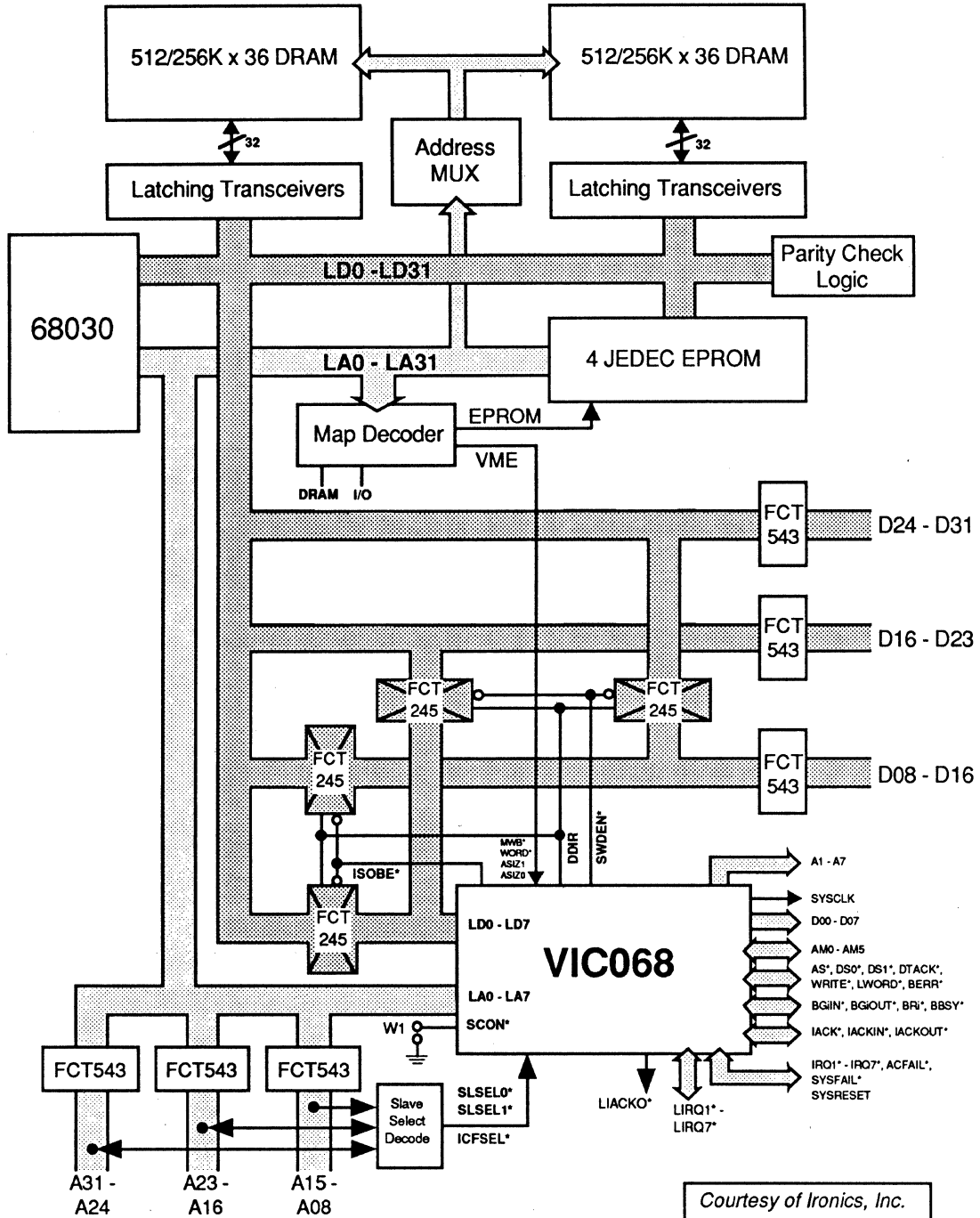
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VIC068 VMEbus Interface Controller

SAMPLE BOARD IMPLEMENTATION



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Courtesy of Ironics, Inc.

Note: VTC's Advanced CMOS Logic parts V74FCT245 and V74FCT543 are also ideal for this application.



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Advanced CMOS Logic

Our FCT Doesn't Bounce So High.

The results are in. VTC's new, improved Advanced CMOS Logic (ACL) product line — from our state-of-the-art 6" CMOS wafer-fab — has passed full internal qualification.

And our ground bounce is significantly less than that reported for competitive FCT products. Which means reduced noise and better performance for your system.

VTC's ACL product line includes both FCT and ACT. Because it's manufactured in our world-class CMOS wafer fab, it means higher quality and reliability, with lower costs for you.

FCT and ACT are ideal for bus-type applications, with up to 64mA drive.

We offer both FCT and ACT in two versions: commercial grade, and with MIL-STD-883C Class B compliancy. Packages include CERDIP, LCC, PDIP, and SOIC. And products are available through distributors worldwide.

So call today. We won't send you a lot of noise . . . just our ACL ground-bounce specs and a short-form product catalog.

VTC Incorporated, 2401 East 86th Street,
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Telex 857113.

(In Minnesota, call 612/851-5200)

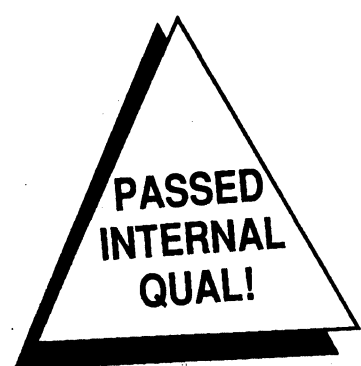
VTC's ACL Products: FCT and ACT

240	533	640	821A	826A	843A	861A
244	534	645	822A	827A	844A	862A
245	543	646	823A	841A	845A	863A
373	544	648	824A	842A	846A	864A
374	573	651	825A			
	574	652				

Plus 21 additional ACT parts

241	465	466	467	468	540	541
563	564	575	576	577	580	620
623	643	874	876	878	879	880

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Linear Signal Processing

The linear signal processing (LSP) product line is part of the system solution for such applications as scientific and medical instrumentation, data acquisition, process control, and general signal processing on either side of the A/D and D/A conversion blocks.

VTC's unique processes couple high speed with close device matching along with laser trimming capabilities. LSP products include operational amplifiers, buffers, comparators, transconductance amplifiers, sample-hold and D-to-A converters.

As in all products offered by VTC, the emphasis is on performance and reliability. The devices are designed to fit applications where high performance, high slew rate, low offset, wide gain bandwidth and high output current capability is required.

OPERATIONAL AMPLIFIERS (All Parameters @ 25°C, V supplies = ±5V)							
DEVICE	SLEW RATE	GAIN BANDWIDTH PRODUCT		OFFSET		OUTPUT CURRENT	BIAS CURRENT
				Voltage	Current		
VA701J	6V/μs	30MHz	ACL≥1	400μV	150nA	50mA	200nA
VA701K	6V/μs	30MHz	ACL≥1	100μV	100nA	50mA	100nA
VA701L	6V/μs	30MHz	ACL≥1	25μV	50nA	50mA	40nA
VA705J	30V/μs	25MHz	ACL≥1	10mV	100nA	40mA	1100nA
VA705K	30V/μs	25MHz	ACL≥1	5mV	50nA	50mA	900nA
VA705L	30V/μs	25MHz	ACL≥1	2mV	25nA	50mA	900nA
VA706J	38V/μs	25MHz	ACL≥1	20mV	120nA	40mA	1100nA
VA706K	38V/μs	25MHz	ACL≥1	10mV	120nA	50mA	1100nA
VA707J	80V/μs	300MHz	ACL≥12	12mV	120nA	40mA	1100nA
VA707K	80V/μs	300MHz	ACL≥12	6mV	120nA	50mA	1100nA
VA708J	60V/μs	100MHz	ACL≥3	12mV	120nA	40mA	1100nA
VA708K	60V/μs	100MHz	ACL≥3	6mV	120nA	50mA	1100nA
VA711J	25V/μs	90MHz	ACL≥5	400μV	150nA	50mA	200nA
VA711K	25V/μs	90MHz	ACL≥5	100μV	100nA	50mA	100nA
VA711L	25V/μs	90MHz	ACL≥5	25μV	50nA	50mA	40nA
VA721J	100V/μs	450MHz	ACL≥25	400μV	150nA	50mA	200nA
VA721K	100V/μs	450MHz	ACL≥25	100μV	100nA	50mA	100nA
VA721L	100V/μs	450MHz	ACL≥25	25μV	50nA	50mA	40nA
VA2705J	30V/μs	25MHz	ACL≥1	12mV	50nA	40mA	1100nA
VA2705K	30V/μs	25MHz	ACL≥1	6mV	100nA	50mA	900nA
VA2706J	38V/μs	25MHz	ACL≥1	20mV	120nA	40mA	1100nA
VA2707J	80V/μs	300MHz	ACL≥12	12mV	120nA	40mA	1100nA
VA2707K	80V/μs	300MHz	ACL≥12	6mV	120nA	50mA	1100nA
VA2708J	60V/μs	100MHz	ACL≥3	12mV	120nA	40mA	1100nA
VA2708K	60V/μs	100MHz	ACL≥3	6mV	120nA	50mA	1100nA
VA4701J	6V/μs	80MHz	ACL≥1	500μV	150nA	50mA	200nA
VA4705J	30V/μs	25MHz	ACL≥1	12mV	100nA	50mA	1100nA
VA4705K	30V/μs	25MHz	ACL≥1	6mV	50nA	50mA	900nA
VA4706J	38V/μs	25MHz	ACL≥1	20mV	120nA	50mA	1100nA
VA4707J	80V/μs	300MHz	ACL≥12	12mV	120nA	40mA	1100nA
VA4707K	80V/μs	300MHz	ACL≥12	6mV	120nA	50mA	1100nA
VA4708J	60V/μs	100MHz	ACL≥3	12mV	120nA	40mA	1100nA
VA4708K	60V/μs	100MHz	ACL≥3	6mV	120nA	50mA	1100nA
VA4711J	25V/μs	90MHz	ACL≥5	500μV	150nA	50mA	200nA
VA4721J	100V/μs	450MHz	ACL≥25	400μV	150nA	50mA	200nA
VA4741J	2.7V/μs	5MHz	ACL≥1	5mV	200nA	13mA	400nA
VA4742J	2.7V/μs	5MHz	ACL≥1	5mV	200nA	13mA	400nA

OPERATIONAL TRANSCONDUCTANCE AMPLIFIERS (OTA)						
DEVICE	SLEW RATE	BANDWIDTH	OFFSET		OUTPUT CURRENT	BIAS CURRENT
			Voltage	Current		
VA703J	50V/μs	75MHz	5mV	0.6μA	—	5μA
VA713J	50V/μs	75MHz	5mV	0.6μA	20mA	5μA
VA2703J	50V/μs	75MHz	5mV	0.6μA	—	5μA
VA2713J	50V/μs	75MHz	5mV	0.6μA	20mA	5μA

LINEAR AMPLIFIERS, SPECIAL PURPOSE	
DEVICE	COMMENTS
VA730J	50MHz Sampling Frequency, Sample & Hold Amplifier

DATA CONVERTERS	
DEVICE	COMMENTS
VC108J	8-Bit DAC, 400MHz
VC512J	12-Bit DAC, 125ns Settling Time

COMPARATORS					
DEVICE	OFFSET		PROP DELAY	ENABLE	
	Voltage	Current		PW	Set-up/Hold
VC7690J	5mV	5μA	1.9ns	—	—
VC7695J	5mV	5μA	1.9ns	2.0ns	1.0ns
VC7696J	3mV	5μA	6.0ns	2.0ns	2.0ns
VC7697J	5mV	5μA	2.5ns	2.0ns	1.0ns
VC7698J	3mV	5μA	8.0ns	2.0ns	2.0ns

VIDEO AMPLIFIERS										
DEVICE	GAIN			BANDWIDTH			INPUT NOISE	PROP DELAY		
	G1	G2	G3	G1	G2	G3		G1	G2	G3
VA592J	400	100	—	80MHz	100MHz	—	4μVrms	7.5ns	6.0ns	—
VA733J	400	100	10	95MHz	110MHz	140MHz	4μVrms	7.5ns	6.0ns	3.6ns

BUFFER AMPLIFIERS				
DEVICE	SLEW RATE	BANDWIDTH	OUTPUT OFFSET VOLTAGE	OUTPUT CURRENT
VA003J	600V/μs	300MHz	15mV	±100mA
VA033J	1500V/μs	300MHz	15mV	±100mA

LINE DRIVERS	
DEVICE	COMMENTS
VS610	MIL-STD-1397 TYPE B,C NTDS Driver/Receiver
VS620	SMPT E RP-125 Digital Video, ECL
VS621	SMPT E RP-125 Digital Video, TTL

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Standard Products for Mass Storage

VTC's mass storage products provide solutions for flexible disk systems, rigid disk systems, optical disk systems and tape systems. They have been designed to provide the ultimate in performance and include preamplifiers, read/write preamplifiers for ferrite and thin-film heads, read channels, custom data separators and ASICs for special needs.

VTC's 20 years of experience manufacturing ICs for the tape and disk drive market has resulted in design expertise and semiconductor processes that lead the industry. Both its 3-micron LHD and 2-micron CBP processes are production-proven, high-yielding state-of-the-art processes that form the basis of the mass storage product line.

Low-Noise, High-Performance Preamplifiers

The VM201 servo preamplifier is the industry's lowest noise ($1 \text{ nV}/\sqrt{\text{Hz}}$) servo preamp for ferrite heads. This is complemented with the VM104, VM117 and VM217 read/write preamps for ferrite heads.

The VM216 servo preamp is the industry's lowest noise ($1 \text{ nV}/\sqrt{\text{Hz}}$) preamp for non-center-tapped thin-film heads. The VM214 read/write preamp has been used extensively for nearly a decade. The VM218 is a read/write preamplifier for center-tapped thin-film heads. It has very low noise and is stable over all operating conditions.

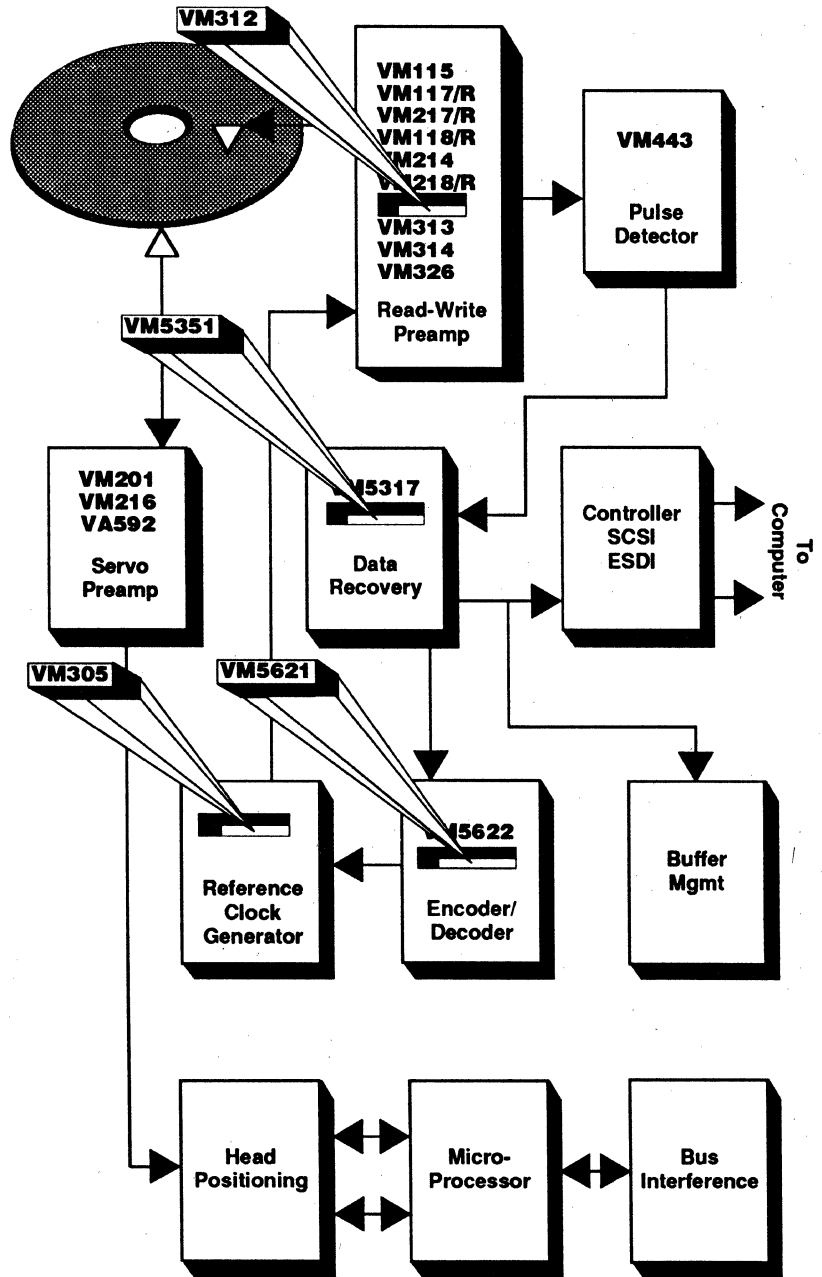
The VM314 is the highest performance read/write preamp for thin-film heads available today. Designed on VTC's 6 GHz, 2-micron CBP process, the VM314 offers $0.6 \text{ nV}/\sqrt{\text{Hz}}$ input noise and 8 ns rise/fall time with 0.5 ns symmetry. The VM314 is specifically designed for high capacity advanced disk drives using thin-film heads.

VTC has an aggressive development program in place to continue the introduction of advanced standard disk drive circuits using high-performance processes and design expertise.

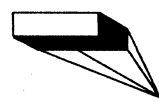
Packages Include TAB-PAC™

All VTC's mass storage products are available in industry-standard packages as well as small outline TAB-PAC. The TAB-PAC provides a low-cost, thermally efficient, compact packaging solution for applications requiring high component packing density.

The VTC Channel



VTC Incorporated



48MB/sec. Transfer Rate Channel Set

TAB-PAC is a trademark of VTC Incorporated



VTC Incorporated

Standard Products for Mass Storage

DISK DRIVE READ/WRITE PREAMPLIFIERS

DEVICE	DAMPING RESISTOR OPTION	CHANNELS	POWER SUPPLY	INPUT NOISE	VOLTAGE GAIN (TYP)	PIN COUNT	PACKAGE
Ferrite Heads							
VM115		5	+5V,-5V	2.5nV/√Hz	40	24	F
VM117		2, 4, 6	+5V,+12V	1.6nV/√Hz	100	18,22,24,28	P,D,F,PO
VM117R	Yes	2, 4, 6	+5V,+12V	1.6nV/√Hz	100	18,22,24,28	P,D,F,PO
VM217		6, 8	+5V,+12V	1.6nV/√Hz	100	28,40,44	P,PL,TB
VM217R	Yes	6, 8	+5V,+12V	1.6nV/√Hz	100	28,40,44	P,PL,TB
Center-Tapped Thin-Film Heads							
VM118		2, 4, 6	+5V,+12V	1.6nV/√Hz	100	18,22,24,28	P,PO
VM118R	Yes	2, 4, 6	+5V,+12V	1.6nV/√Hz	100	18,22,24,28	P,PO
VM218		6, 8	+5V,+12V	1.6nV/√Hz	100	28,40,44	P,PL,TB
VM218R	Yes	6, 8	+5V,+12V	1.6nV/√Hz	100	28,40,44	P,PL,TB
Thin-Film Heads							
VM312		2,4,6,8,9,10	+5V,+12V	0.8nV/√Hz	150	20,24,28,32,34	PO
VM313		2,4,6,8,9,10	+5V,+12V	0.8nV/√Hz	150	20,24,28,32,34,44	PO,PL
VM214		4	+5V,-5V	1.1nV/√Hz	125	24	F
VM314		4	+5V,-5V	0.6nV/√Hz	100	24	F
VM326		2,4,6,8,9,10	+5V,-5V	0.8nV/√Hz	150	20,24,28,32,34,44	PO,PL

DISK DRIVE SERVO PREAMPLIFIERS

DEVICE	DESCRIPTION	POWER SUPPLY	INPUT NOISE	PACKAGE
VM201	Servo Preamp, Ferrite Head, Low Noise	-8.3V, or +10V	1nV/√Hz	D,PO
VM216	Servo Preamp, Thin-film Head	-8.3V, or +12V	1nV/√Hz	D,PO
VM592	Servo Preamp, Ferrite Head, Thin Film	±5.0V, or +12V	1nV/√Hz	P,PO

DISK DRIVE DATA RECOVERY

DEVICE	DESCRIPTION	POWER SUPPLY	CHARACTERISTICS	PACKAGE
VM305	Write/Servo Phase-Locked Oscillator	-5.2V or +5V	Data Rates from 10-48 Mbit/s	PO
VM443	Read Channel, Enhanced	+5V,+12V	RLL Compatible, BW = 30MHz	P, PL
VM5317/VM5327	Data Separator	+5V,+12V	Data Rates up to 22 Mbit/s, ECL	PL
VM5351/VM5352	Data Separator	+5V, +12V	Data Rates up to 48 Mbit/s, ECL	PL
VM5621/VM5622	(2,7) Encoder/Decoder	+5V	Differential ECL Drivers	PL
VM5622	(2,7) Encoder/Decoder	+5V,-5V	Differential ECL Drivers	PL

VTC Incorporated



PROGRAMMABLE PERIPHERALS

CMOS USER-CONFIGURABLE PERIPHERAL WITH MEMORY

Part No.	Description	Speed (ns)		DESC SMD	Package Selection			
		Commercial	Military		C	J	L	X
PSD301	Microcontroller Peripheral; 256K Bits EPROM, 16K Bits SRAM, PAD, Address/Data Latches, I/O Ports. Configurable: $\times 8$ or $\times 16$, Mux'd/Non-Mux'd Address/Data Buses, Programmable Processor Interface, Software Design Support.	120-200	150-200		.	.	.	.
MAP168	DSP Peripheral; 128K Bits EPROM, 32K Bits SRAM, Programmable Address Decoder (PAD). Configurable: $\times 8$ or $\times 16$, Software Design Support.	45-55	55		.	.	.	.

CMOS USER-CONFIGURABLE 16-BIT PERIPHERAL

Part No.	Description	Speed (ns)		DESC SMD	Package Selection
		Commercial	Military		X
PAC1000	High-Speed Single-Chip Data Flow/Event Control Engine; 16-Bit ALU and Register File, Microprogram Sequencer; Embedded CMOS EPROM Program Store (1K \times 64), On-Chip Interrupt and Status Test Logic (incl. Multi-Way Branch), Configurable I/O Structure - Peripheral or Stand-Alone Modes, Single Cycle Instruction Execution, Parallel Operation, Fixed Instruction Set - Assembly and High-Level Languages, Software Design Support - Assembler, Simulator.	12-16 MHz	12 MHz		.

CMOS USER-CONFIGURABLE MICROSEQUENCER/STATE MACHINE

Part No.	Description	Speed (ns)		DESC SMD	Package Selection			
		Commercial	Military		J	L	S	T
SAM448	448-Word CMOS EPROM Microcode Memory, 8 Inputs, 15 Control Outputs, Branch Control. EPLD Design Support Software - Assembler, Simulator.	20-30 MHz	20 MHz	

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NON-VOLATILE MEMORY

CMOS PROM

Part No.	Organization	Description	Speed (ns)		DESC SMD	Package Selection												
			Commercial	Military		C	D	F	H	J	K	L	P	S	T	Z		
WS57C191B	2K \times 8	16K CMOS PROM	35-45	45-55	.	.	.										.
WS57C291B	2K \times 8	16K CMOS PROM	35-45	45-55	.												.	.
WS57C45	2K \times 8	16K CMOS Registered PROM	25-35	35-45	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WS57C43B	4K \times 8	32K CMOS PROM	35-70	45-70	.	.											.	.
WS57C49B	8K \times 8	64K CMOS PROM	35-70	45-70	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WS57C51B	16K \times 8	128K CMOS PROM	40-70	45-70	.	.											.	
WS57C51C	16K \times 8	128K CMOS PROM	35-55	40-55	.	.							.				.
WS57C71C	32K \times 8	256K CMOS PROM	45-70	55-90	.	.											.	

HIGH-SPEED CMOS EPROM

Part No.	Organization	Description	Speed (ns)		DESC SMD	Package Selection				
			Commercial	Military		C	D	J	L	T
WS57C64F	8K \times 8	High-Speed 64K CMOS EPROM	55-70	70	.	.	.	.	.
WS57C128F	16K \times 8	High-Speed 128K CMOS EPROM	55-70	70	.	.	.	.	.
WS57C256F	32K \times 8	High-Speed 256K CMOS EPROM	45-70	55-70	.	.	.	.	.	.
WS57C257	16K \times 16	High-Speed 256K CMOS EPROM	55-70	70	.	.	.	.	.	.

PRODUCT SELECTOR GUIDE

NON-VOLATILE MEMORY (continued)

HIGH-SPEED MILITARY CMOS EPROM

Part No.	Organization	Description	Speed (ns)		DESC SMD	Package Selection	
			Commercial	Military		C	D
WS27C64F	8K × 8	64K Military CMOS EPROM	N/A	90	•	•	•
WS27C128F	16K × 8	128K Military CMOS EPROM	N/A	90	•	•	•
WS27C256F	32K × 8	256K Military CMOS EPROM	N/A	90	•	•	•

CMOS EPROM

Part No.	Organization	Description	Speed (ns)		DESC SMD	Package Selection				
			Commercial	Military		C	D	J	L	T
WS27C64L	8K × 8	64K CMOS EPROM	N/A	120-200	•	•				
WS27C128L	16K × 8	128K CMOS EPROM	N/A	120-200	•	•				
WS27C256L	32K × 8	256K CMOS EPROM	90-150	120-200	•	•	•	•	•	•
WS27C512L	64K × 8	512K CMOS EPROM	100-150	120-250	•	•	•	•	•	•
WS27C010L	128K × 8	1 MBit CMOS EPROM	100-150	120-200	•	•	•	•	•	•
WS27C210L	64K × 16	1 MBit CMOS EPROM	120-200	150-200		•	•	•	•	•

CMOS BIT SLICE AND LOGIC

Part No.	Organization	Description	Speed (ns)		DESC SMD	Package Selection								
			Commercial	Military		B	D	G	J	K	L	P	S	
WS5901	4-Bit Slice	CMOS Bit Slice Processor	32, 43 MHz	32, 43 MHz		•								•
WS59016	16-Bit Slice	CMOS Bit Slice Processor	15, 32 MHz	12.5, 27 MHz		•			•	•	•			
WS59032	32-Bit Slice	CMOS Bit Slice Processor	26.4, 33 MHz	23.6, 29 MHz					•					
WS5910A/B		CMOS Microprogram Controller	20, 30 MHz	20, 30 MHz	•	•								•
WS59510	16 × 16	CMOS Multiplier-Accumulator	30-50 ns	40-50 ns	•				•	•				•
WS59520	4 × 8-Bit	CMOS Pipeline Register	T _{pd} = 22 ns	T _{pd} = 24 ns	•								•	•
WS59521	4 × 8-Bit	CMOS Pipeline Register	T _{pd} = 22 ns	T _{pd} = 24 ns									•	•
WS59820	2 × 8 × 8-Bit	CMOS Bi-Directional Register	T _{pd} = 23 ns	T _{pd} = 25 ns					•	•				

WSI PACKAGE DESCRIPTIONS

Package Code	Description	Window	Surface Mount	Plastic/OTP
B/R	Sidebrazed Ceramic DIP	N/Y	N	N
C/Z	Ceramic Leadless Chip Carrier (CLLCC)	Y/N	Y	N
D/Y	0.600" CERDIP	Y/N	N	N
F/H	Ceramic Flatpack	Y/N	Y	N
J	Plastic Leaded Chip Carrier (PLDCC)	N	Y	Y
L/N	Ceramic Leaded Chip Carrier (CLDCC)	Y/N	Y	N
P	0.600"/0.900" Plastic DIP	N	N	Y
S	0.300" Thin Plastic DIP	N	N	Y
T/K	0.300" Thin CERDIP	Y/N	N	N
X/G	Ceramic Pin Grid Array (CPGA)	Y/N	N	N



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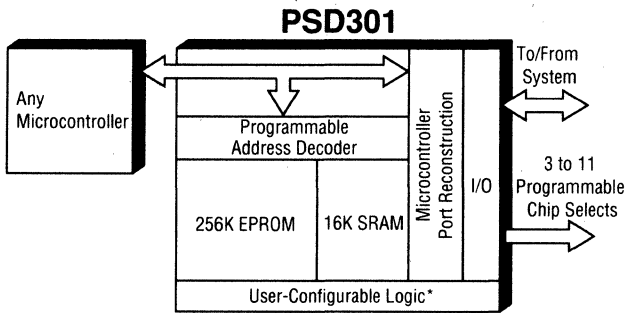
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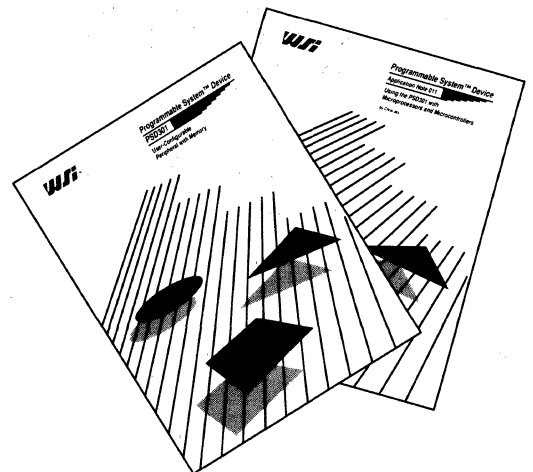
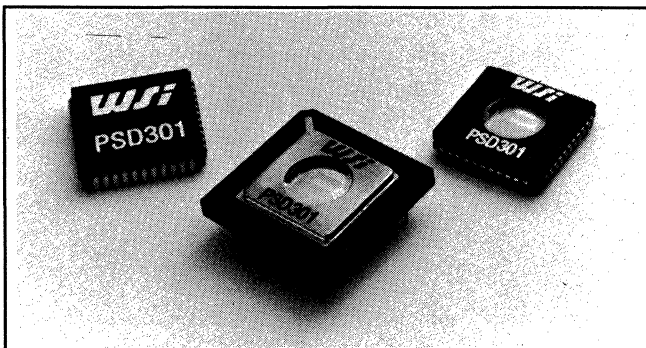
PSD301 USER-CONFIGURABLE PERIPHERAL WITH MEMORY SAVES BOARD SPACE



- Integrates 256K EPROM, 16K SRAM, configurable logic, latches and I/O in one small 44-pin PGA, ceramic or plastic surface mount "J-lead" package.
- Interfaces to any microcontroller or microprocessor with no "glue" logic.
- X8 or X16 operation
- 120/150/200 ns access time
- 1 Meg addressing range

Use with any of these Microcontrollers or Microprocessors: 80C31, 68HC11, 68008, 68010, 68020, 80186, 80196, 80286, 6809, Z80, Z180, 80C451, HPC36400, SC80C451

- * Shortens Time to Market
- * Reduces Board Size
- * Improves System Reliability
- * Simplifies System Design



Telephone or Fax for free copies of the PSD301 Data Sheet and 52-page Applications Booklet



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Direct Office: Excelsiorlaan 53
1930 Zaventem, Belgium
Tel: 32 2 725 0546
Fax: 32 2 725 1146

PSD-GOLD



Waterscale

PSD-GOLD

WSI's PSD-GOLD System Development Tools contain all the hardware and software needed to configure and program the PSD-301 and MAP168 user-configurable peripherals with memory. Operating on the user's IBM-PC compatible AT or XT, the PSD-GOLD includes WISPER Software which is the top level easy-to-use menu. The MAPLE Software enables the user to select all options and parameters required for device configuration. The MAPPRO Software controls the actual programming of the device on WSI's MagicPro™ programmer. Complete user's manual documentation is included as well as a socket adaptor for programming samples of the PSD301 or MAP168 which are shipped with each system.

PSD-SILVER

WSI's PSD-SILVER is a sub-set of the above and includes all software and documentation found in the PSD-GOLD. Absent from the lower cost PSD-SILVER system is the hardware portion of the PSD-GOLD which includes the MagicPro™ programmer, socket adaptor and sample parts.



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Tel: 32 2 725 0546
Fax: 32 2 725 1146

Nonvolatile Static RAM

FEATURES

- Single 5V Supply
- Fully TTL Compatible
- Infinite E²PROM Array Recall, RAM Read and Write Cycles
- Access Time of 300 ns Max.
- Nonvolatile Store Inhibit: $V_{CC} = 3V$ Typical
- High Reliability
 - Store Cycles: 10,000
 - Data Retention: 100 Years

DESCRIPTION

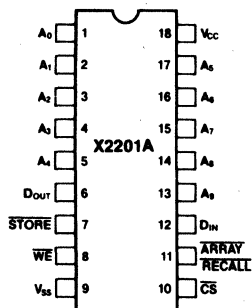
The Xicor X2201A is a 1024 x 1 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The X2201A is fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V nonvolatile memories.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and from E²PROM to RAM (recall). The store operation is completed in 10 ms or less and the recall is typically completed in 1 μ s.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM. The E²PROM array is designed for a minimum 10,000 store cycles and inherent data retention is specified to be greater than 100 years. Refer to RR-520 and RR-515 for details on Xicor nonvolatile memory endurance and data retention characteristics.

Xicor

PIN CONFIGURATION

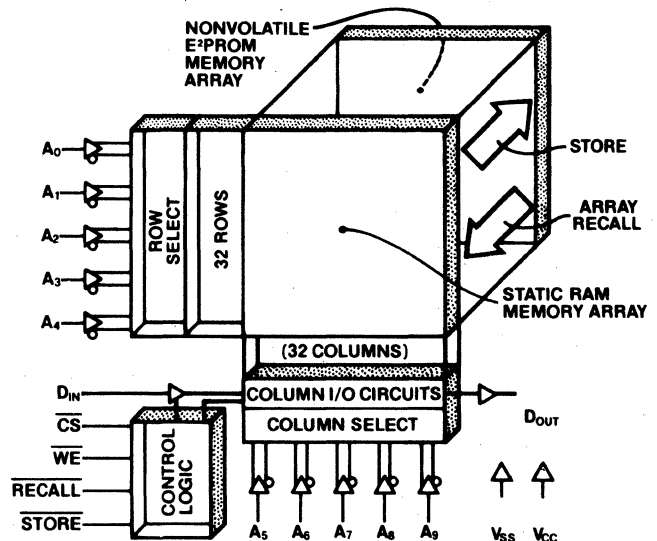


0056-1

PIN NAMES

A ₀ -A ₉	Address Inputs
D _{IN}	Data Input
D _{OUT}	Data Out
WE	Write Enable
CS	Chip Select
ARRAY RECALL	Array Recall
STORE	Store
V _{CC}	+5V
V _{SS}	Ground

FUNCTIONAL DIAGRAM



0056-2

256 Bit

Commercial
Industrial

X2210
X2210I

64 x 4 Bit

Nonvolatile Static RAM

FEATURES

- Single 5V Supply
- Fully TTL Compatible
- Infinite E²PROM Array Recall, RAM Read and Write Cycles
- Access Time of 300 ns Max.
- Nonvolatile Store Inhibit: $V_{CC} = 3V$ Typical
- High Reliability
 - Store Cycles: 100,000
 - Data Retention: 100 Years
- JEDEC Standard 18-Pin Package

DESCRIPTION

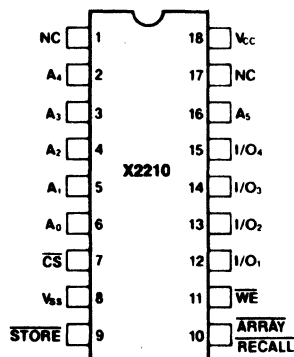
The Xicor X2210 is a 64 x 4 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The X2210 is fabricated with the same reliable N-channel floating gate MOS technology used

in all Xicor 5V nonvolatile memories. The X2210 features the JEDEC approved pinout for 4-bit-wide memories, compatible with industry standard RAMs.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and from E²PROM to RAM (recall). The store operation is completed in 10 ms or less and the recall is typically completed in 1 μ s.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM. The E²PROM array is designed for a minimum 100,000 store cycles and inherent data retention is specified to be greater than 100 years. Refer to RR-520 and RR-515 for details on Xicor nonvolatile memory endurance and data retention characteristics.

PIN CONFIGURATION

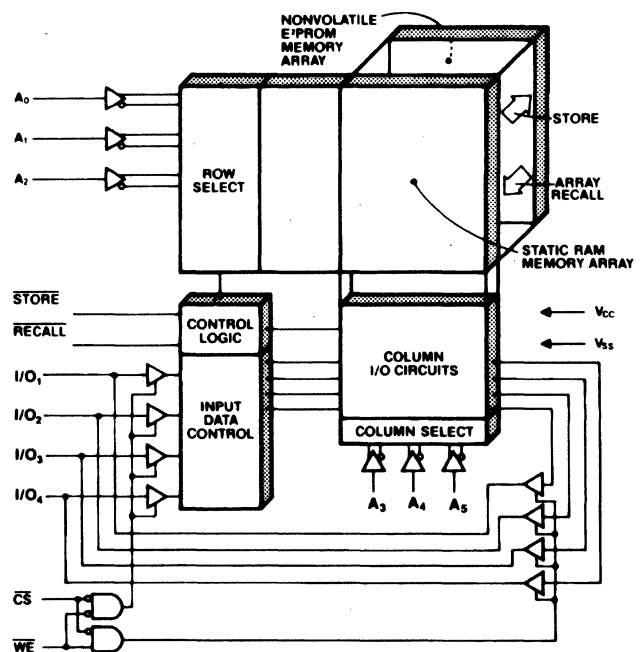


0045-1

PIN NAMES

A ₀ -A ₅	Address Inputs
I/O ₁ -I/O ₄	Data Inputs/Outputs
WE	Write Enable
CS	Chip Select
ARRAY RECALL	Array Recall
STORE	Store
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0045-2

Nonvolatile Static RAM

FEATURES

- Single 5V Supply
- Fully TTL Compatible
- JEDEC Standard 18-Pin Package
- Infinite E²PROM Array Recall, RAM Read and Write Cycles
- Access Time of 250 ns Max.
- Nonvolatile Store Inhibit: V_{CC} = 3V Typical
- 100 Year Data Retention

DESCRIPTION

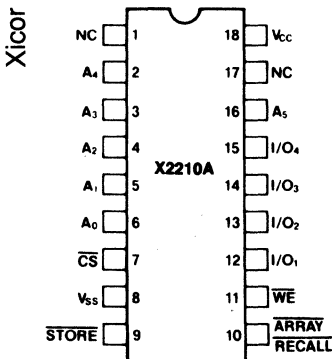
The Xicor X2210A is a 64 x 4 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The X2210A is fabricated with the same reliable N-channel floating gate MOS technology used

in all Xicor 5V nonvolatile memories. The X2210A features the JEDEC approved pinout for 4-bit-wide memories, compatible with industry standard RAMs.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and from E²PROM to RAM (recall). The store operation is completed in 10 ms or less and the recall is typically completed in 1 μs.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM. The E²PROM array is designed for a minimum 10,000 store cycles. Data retention is specified to be greater than 100 years.

PIN CONFIGURATION

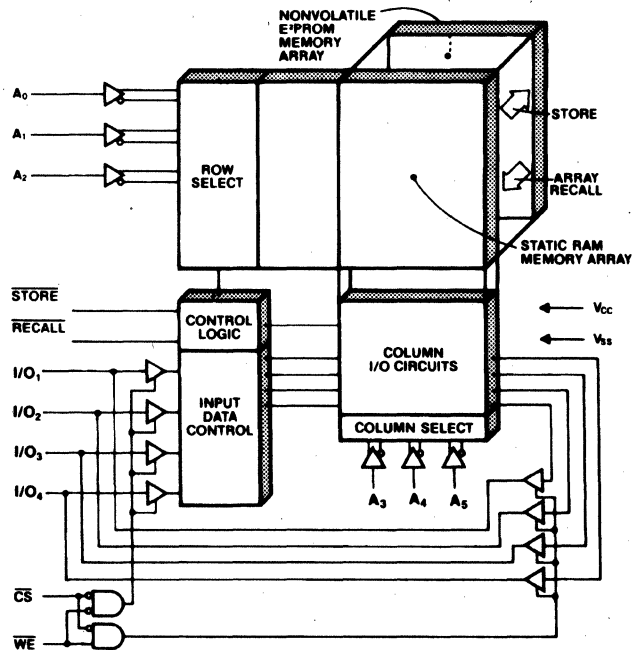


0128-1

PIN NAMES

A ₀ -A ₅	Address Inputs
I/O ₁ -I/O ₄	Data Inputs/Outputs
WE	Write Enable
CS	Chip Select
ARRAY RECALL	Array Recall
STORE	Store
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0128-2

1K

Commercial
Industrial

X2212
X2212I

256 x 4 Bit

Nonvolatile Static RAM

FEATURES

- Single 5V Supply
- Fully TTL Compatible
- Infinite E²PROM Array Recall, RAM Read and Write Cycles
- Access Time of 300 ns Max.
- Nonvolatile Store Inhibit: V_{CC} = 3V Typical
- High Reliability
 - Store Cycles: 100,000
 - Data Retention: 100 Years
- JEDEC Standard 18-Pin Package

DESCRIPTION

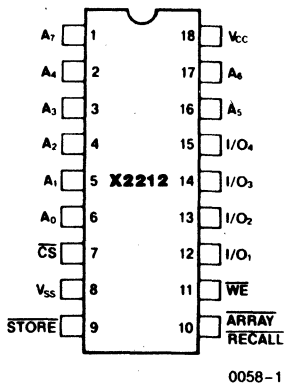
The Xicor X2212 is a 256 x 4 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The X2212 is fabricated with the same reliable N-channel floating gate MOS technology used

in all Xicor 5V nonvolatile memories. The X2212 features the JEDEC approved pinout for 4-bit-wide memories, compatible with industry standard RAMs.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and from E²PROM to RAM (recall). The store operation is completed in 10 ms or less and the recall is typically completed in 1 μs.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM. The E²PROM array is designed for a minimum 100,000 store cycles and inherent data retention is specified to be greater than 100 years. Refer to RR-520 and RR-515 for details on Xicor nonvolatile memory endurance and data retention characteristics.

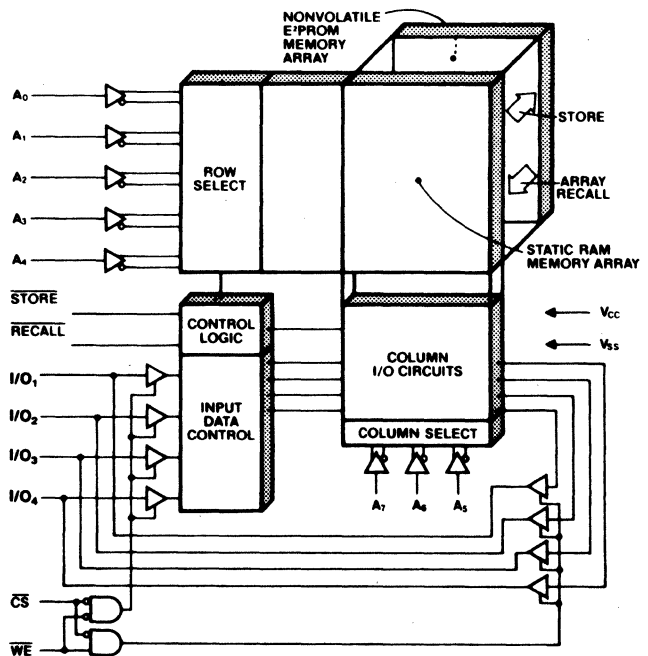
PIN CONFIGURATION



PIN NAMES

A ₀ -A ₇	Address Inputs
I/O ₁ -I/O ₄	Data Inputs/Outputs
WE	Write Enable
CS	Chip Select
ARRAY RECALL	Array Recall
STORE	Store
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



Xicor

Nonvolatile Static RAM

FEATURES

- Single 5V Supply
- Fully TTL Compatible
- JEDEC Standard 18-Pin Package
- Infinite E²PROM Array Recall, RAM Read and Write Cycles
- Access Time of 250 ns Max.
- Nonvolatile Store Inhibit: $V_{CC} = 3V$ Typical
- 100 Year Data Retention

DESCRIPTION

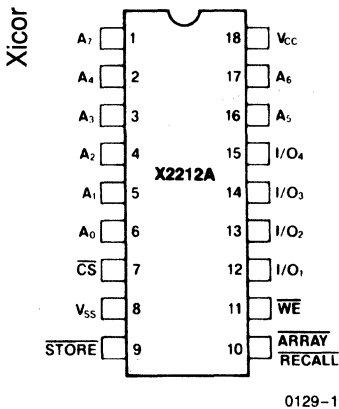
The Xicor X2212A is a 256 x 4 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The X2212A is fabricated with the same reliable N-channel floating gate MOS technology used

in all Xicor 5V nonvolatile memories. The X2212A features the JEDEC approved pinout for 4-bit-wide memories, compatible with industry standard RAMs.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and from E²PROM to RAM (recall). The store operation is completed in 10 ms or less and the recall is typically completed in 1 μ s.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM. The E²PROM array is designed for a minimum 10,000 store cycles. Data retention is specified to be greater than 100 years.

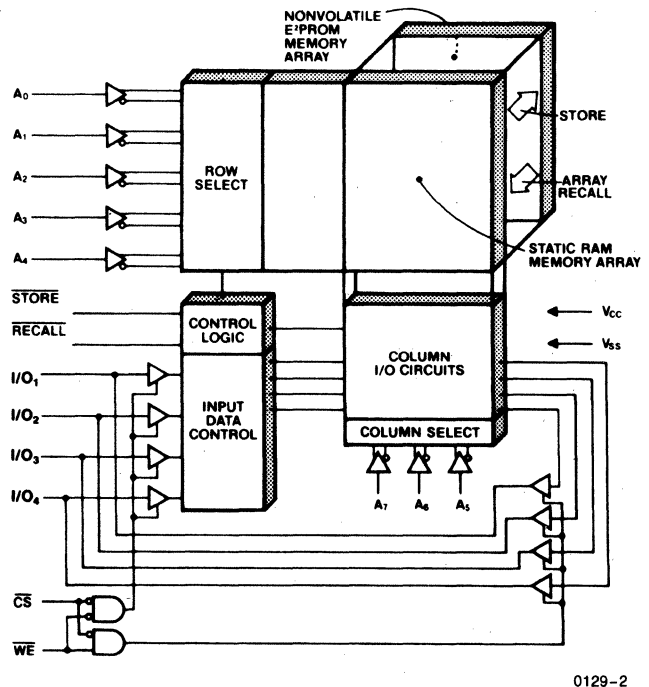
PIN CONFIGURATION



PIN NAMES

A ₀ -A ₇	Address Inputs
I/O ₁ -I/O ₄	Data Inputs/Outputs
WE	Write Enable
CS	Chip Select
ARRAY RECALL	Array Recall
STORE	Store
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



256 Bit Commercial X22C10 64 x 4 Bit
Industrial X22C10I

Nonvolatile Static RAM

FEATURES

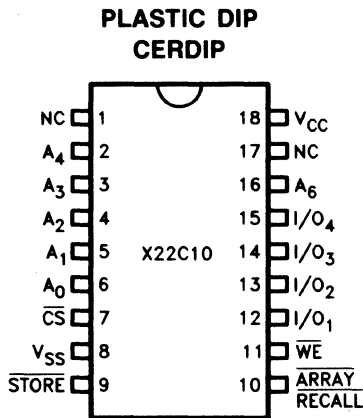
- **100% Compatible with X2210**
—With Timing Enhancements
- **Infinite Array Recall, RAM Read and Write Cycles**
- **High Reliability**
—Store Cycles: 1,000,000
—Data Retention: 100 Years
- **High Performance CMOS**
—120 ns RAM Access Time
—Low Power Consumption
 Active: 40 mA Max.
 Standby: 100 μ A Max.
- **Nonvolatile Store Inhibit: $V_{CC} = 3.5V$ Typ**
- **Fully TTL and CMOS Compatible**
- **JEDEC Standard 18-Pin 300-mil DIP**

DESCRIPTION

The X22C10 is a 64 x 4 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The NOVRAM design allows data to be easily transferred from RAM to E²PROM (STORE) and from E²PROM to RAM (RECALL). The STORE operation is completed within 10 ms or less and the RECALL is typically completed within 1 μ s.

Xicor NOVRAMs are designed for unlimited write operations to the RAM, either RECALLs from E²PROM or writes from the host. The X22C10 will reliably endure 1,000,000 STORE cycles. Inherent data retention is greater than 100 years. Refer to RR-515, RR-504 and RR-520 for details of data retention and endurance characteristics for Xicor nonvolatile memories.

PIN CONFIGURATION



PIN NAMES

A_0-A_5	Address Inputs
$I/O_1-I/O_4$	Data Inputs/Outputs
\overline{WE}	Write Enable
\overline{CS}	Chip Select
\overline{RECALL}	Array Recall
\overline{STORE}	Store
V_{CC}	+5V
V_{SS}	Ground
NC	No Connect

0123-1

256 Bit Commercial X22C11 64 x 4 Bit
Industrial X22C11I

Nonvolatile Static RAM

FEATURES

- **Autostore™**
—Automatically Stores Data Upon Detection of Power Loss
- **Store-Lock™**
—Software Enabled Store Lockout
- **100% Compatible with X2210 and X22C10**
—With Timing Enhancements
- **Infinite Array Recall, RAM Read and Write Cycles**
- **High Reliability**
—Store Cycles: 1,000,000
—Data Retention: 100 Years
- **High Performance CMOS**
—120 ns RAM Access Time
—Low Power Consumption
 Active: 40 mA Max.
 Standby: 100 μ A Max.
- **Nonvolatile Store Inhibit: $V_{CC} = 3.5V$ Typ**
- **Fully TTL and CMOS Compatible**
- **JEDEC Standard 18-Pin 300-mil DIP**

DESCRIPTION

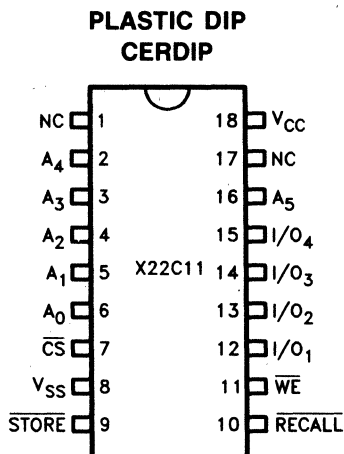
The X22C11 is a 64 x 4 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile E²PROM. The NOVRAM design allows data to be easily transferred from RAM to E²PROM (STORE) and from E²PROM to RAM (RECALL). The STORE operation is completed within 10 ms or less and the RECALL is typically completed within 1 μ s.

In addition, the X22C11 features Autostore and Store-Lock. Autostore is a user selectable option that will automatically perform a Store operation when power is removed from the X22C11. Store-Lock will lockout all inadvertent store conditions.

Xicor NOVRAMs are designed for unlimited write operations to the RAM; either RECALLs from E²PROM or writes from the host. The X22C11 will reliably endure 1,000,000 STORE cycles. Inherent data retention is greater than 100 years. Refer to RR-515, RR-504 and RR-520 for details of data retention and endurance characteristics for Xicor nonvolatile memories.

Xicor

PIN CONFIGURATION



PIN NAMES

A ₀ -A ₅	Address Inputs
I/O ₁ -I/O ₄	Data Inputs/Outputs
\overline{WE}	Write Enable
\overline{CS}	Chip Select
RECALL	Array Recall
STORE	Store
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

0124-1

1K Commercial Industrial X2001 X2001I 128 x 8 Bit

Nonvolatile Static RAM

FEATURES

- Nonvolatile Data Integrity
- Automatic Store Timing
- Store and Array Recall Combined on One Line (\overline{NE})
- Enhanced Store Protection
- Infinite E²PROM Array Recall, and RAM Read and Write Cycles
- Single 5V Supply
- High Reliability
 - Store Cycles: 100,000
 - Data Retention: 100 Years
- Fast Access Time: 200 ns Max.
- Automatic Recall on Power-Up
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

The Xicor X2001 is a byte-wide NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile electrically erasable PROM (E²PROM). The X2001

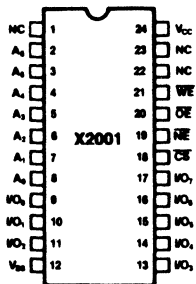
is fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V programmable nonvolatile memories. The X2001 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs, EPROMs and E²PROMs.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and E²PROM to RAM (recall). With \overline{NE} LOW, these functions are performed in the same manner as RAM read and write operations. The store operation is completed in 10 ms or less and the recall operation is completed in 5 μ s or less.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM, and a minimum 100,000 store operations to the E²PROM. Inherent data retention is specified to be greater than 100 years. Refer to RR-520, RR-504 and RR-515 for details on Xicor nonvolatile memory endurance and data retention characteristics.

Xicor

PIN CONFIGURATION

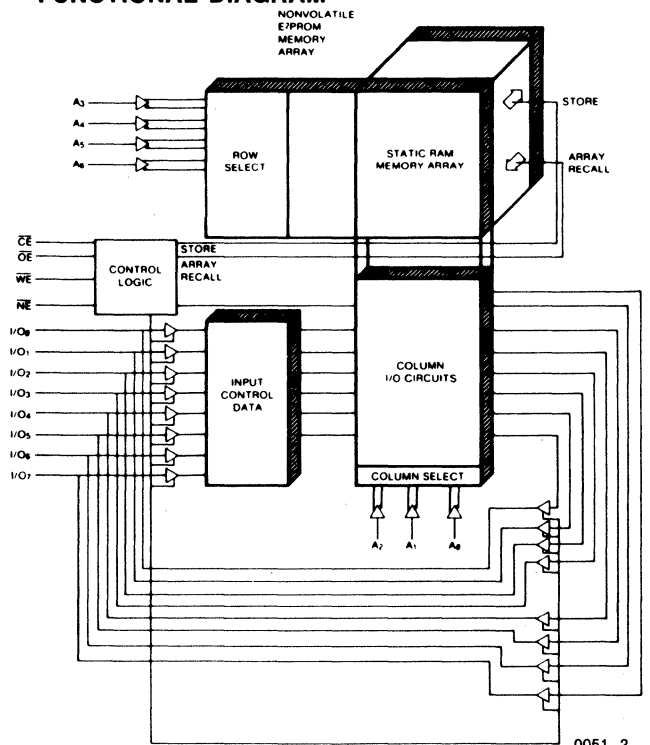


0051-1

PIN NAMES

A ₀ -A ₆	Address Inputs
I/O ₀ -I/O ₇	Data Inputs/Outputs
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
\overline{WE}	Write Enable
\overline{NE}	Nonvolatile Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0051-2

4K

Commercial
Industrial

X2004
X2004I

512 x 8 Bit

Nonvolatile Static RAM

FEATURES

- Nonvolatile Data Integrity
- Automatic Store Timing
- Store and Array Recall Combined on One Line (\overline{NE})
- Enhanced Store Protection
- Infinite E²PROM Array Recall, and RAM Read and Write Cycles
- Single 5V Supply
- High Reliability
 - Store Cycles: 100,000
 - Data Retention: 100 Years
- Fast Access Time: 200 ns Max.
- Automatic Recall on Power-Up
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

The Xicor X2004 is a byte-wide NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile electrically erasable PROM (E²PROM). The X2004

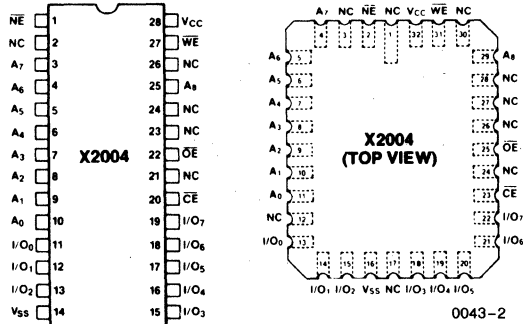
is fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V programmable nonvolatile memories. The X2004 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs, EPROMs and E²PROMs.

The NOVRAM design allows data to be easily transferred from RAM to E²PROM (store) and E²PROM to RAM (recall). With \overline{NE} LOW, these functions are performed in the same manner as RAM read and write operations. The store operation is completed in 10 ms or less and the recall operation is completed in 5 μ s or less.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM, and a minimum 100,000 store operations to the E²PROM. Data retention is specified to be greater than 100 years. Refer to RR-520, RR-504 and RR-515 for details on Xicor nonvolatile memory endurance and data retention characteristics.

Xicor

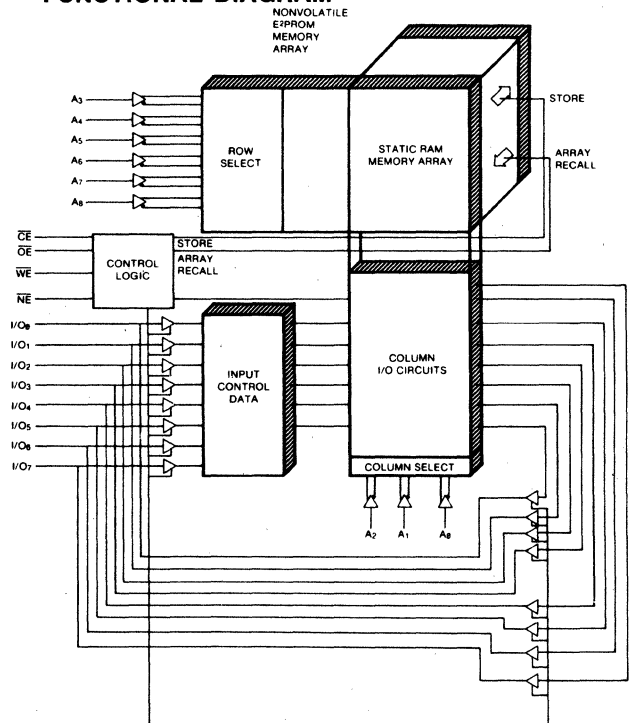
PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₈	Address Inputs
I/O ₀ -I/O ₇	Data Inputs/Outputs
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
\overline{WE}	Write Enable
\overline{NE}	Nonvolatile Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



256 Bit Commercial X2444 16 x 16 Bit
 Industrial X2444I

Nonvolatile Static RAM

FEATURES

- Ideal for use with Single Chip Microcomputers
 - Static Timing
 - Minimum I/O Interface
 - Serial Port Compatible (COPSTM, 8051)
 - Easily Interfaces to Microcontroller Ports
 - Minimum Support Circuits
- Software and Hardware Control of Nonvolatile Functions
 - Maximum Store Protection
- TTL Compatible
- 16 x 16 Organization
- Low Power Dissipation
 - Active Current: 15 mA Typical
 - Store Current: 8 mA Typical
 - Standby Current: 6 mA Typical
 - Sleep Current: 5 mA Typical
- High Reliability
 - Store Cycles: 100,000
 - Data Retention: 100 Years
- 8 Pin Mini-DIP and 8 Lead SOIC Packages

DESCRIPTION

The Xicor X2444 is a serial 256 bit NOVRAM featuring a static RAM configured 16 x 16, overlaid bit for bit with a nonvolatile E²PROM array. The X2444 is fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V nonvolatile memories.

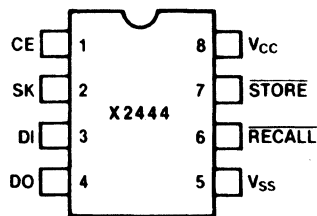
The Xicor NOVRAM design allows data to be transferred between the two memory arrays by means of software commands or external hardware inputs. A store operation (RAM data to E²PROM) is completed in 10 ms or less and a recall operation (E²PROM data to RAM) is completed in 2.5 μs or less.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM and a minimum 100,000 store operations. Data retention is specified to be greater than 100 years. Refer to RR-520 and RR-515 for details on Xicor nonvolatile memory endurance and data retention characteristics.

COPSTM is a trademark of National Semiconductor Corp.

Xicor

PIN CONFIGURATION

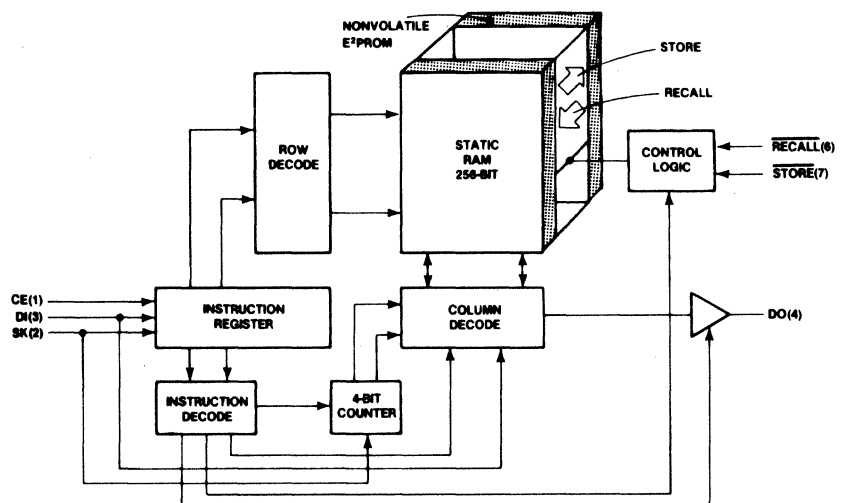


0042-1

PIN NAMES

CE	Chip Enable
SK	Serial Clock
DI	Serial Data In
DO	Serial Data Out
RECALL	Recall
STORE	Store
V _{CC}	+5V
V _{SS}	Ground

FUNCTIONAL DIAGRAM



0042-2

256 Bit Commercial X24C44 16 x 16 Bit
 Industrial X24C44I

Nonvolatile Static RAM

FEATURES

- Advanced CMOS Version of Xicor's X2444
- 16 x 16 Organization
- Single 5 Volt Supply
- Ideal for use with Single Chip Microcomputers
 - Static Timing
 - Minimum I/O Interface
 - Serial Port Compatible (COPSTM, 8051)
 - Easily Interfaced to Microcontroller Ports
- Software and Hardware Control of Nonvolatile Functions
- Auto Recall on Power-Up
- TTL and CMOS Compatible
- Low Power Dissipation
 - Active Current: 2 mA
 - Standby Current: 50 μ A
- 8 Pin Mini-DIP and 8 Lead SOIC Packages
- High Reliability
 - Store Cycles: 1,000,000
 - Data Retention: 100 Years

DESCRIPTION

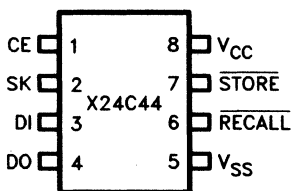
The Xicor X24C44 is a serial 256 bit NOVRAM featuring a static RAM configured 16 x 16, overlaid bit by bit with a nonvolatile E²PROM array. The X24C44 is fabricated with Xicor's Advanced CMOS Floating Gate technology.

The Xicor NOVRAM design allows data to be transferred between the two memory arrays by means of software commands or external hardware inputs. A store operation (RAM data to E²PROM) is completed in 5 ms or less and a recall operation (E²PROM data to RAM) is completed in 2 μ s or less.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM and a minimum 1,000,000 store operations. Inherent data retention is specified to be greater than 100 years. Refer to RR-520 and RR-515 for details of endurance and data retention characteristics for Xicor nonvolatile memories.

COPSTM is a trademark of National Semiconductor Corp.

PIN CONFIGURATION



0121-1

PIN NAMES

CE	Chip Enable
SK	Serial Clock
DI	Serial Data In
DO	Serial Data Out
<u>RECALL</u>	Recall Input
<u>STORE</u>	Store Input
V _{CC}	+5V
V _{SS}	Ground

256 Bit Commercial X24C45 16 x 16 Bit
Industrial X24C45I

Nonvolatile Static RAM

FEATURES

- **Autostore™**
 - Automatically Performs a Store Operation Upon Loss of V_{CC}
- **Single 5 Volt Supply**
- **Ideal for use with Single Chip Microcomputers**
 - Minimum I/O Interface
 - Serial Port Compatible (COPSTM, 8051)
 - Easily Interfaced to Microcontroller Ports
- **Software and Hardware Control of Nonvolatile Functions**
- **Auto Recall on Power-Up**
- **TTL and CMOS Compatible**
- **Low Power Dissipation**
 - Active Current: 2 mA
 - Standby Current: 50 μ A
- **8 Pin Mini-DIP and 8 Lead SOIC Packages**
- **High Reliability**
 - Store Cycles: 1,000,000
 - Data Retention: 100 Years

DESCRIPTION

The Xicor X24C45 is a serial 256 bit NOVRAM featuring a static RAM configured 16 x 16, overlaid bit by bit with a nonvolatile E²PROM array. The X24C45 is fabricated with Xicor's Advanced CMOS Floating Gate technology.

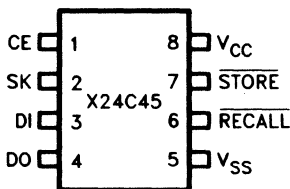
The Xicor NOVRAM design allows data to be transferred between the two memory arrays by means of software commands or external hardware inputs. A store operation (RAM data to E²PROM) is completed in 5 ms or less and a recall operation (E²PROM data to RAM) is completed in 2 μ s or less.

The X24C45 also features Autostore, a user selectable feature that will automatically perform a store operation when V_{CC} falls below a preset threshold.

Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM and a minimum 1,000,000 store operations. Inherent data retention is specified to be greater than 100 years. Refer to RR-520 and RR-515 for details of endurance and data retention characteristics for Xicor nonvolatile memories.

Xicor

PIN CONFIGURATION



0127-1

PIN NAMES

CE	Chip Enable
SK	Serial Clock
DI	Serial Data In
DO	Serial Data Out
RECALL	Recall Input
STORE	Store Input
V_{CC}	+5V
V_{SS}	Ground

2K Commercial Industrial X2402 X2402I 256 x 8 Bit

Electrically Erasable PROM

TYPICAL FEATURES

- Internally Organized 256 x 8
- 2 Wire Serial Interface
- Provides Bidirectional Data Transfer Protocol
- Eight Byte Page Write Mode
 - Minimizes Total Write Time Per Byte
- Self Timed Write Cycle
 - Typical Write Cycle Time of 5 ms
- High Reliability
 - Endurance: 100,000 Writes Per Byte
 - Data Retention: 100 Years
- 8 Pin Mini-DIP and 14 Lead SOIC Packages

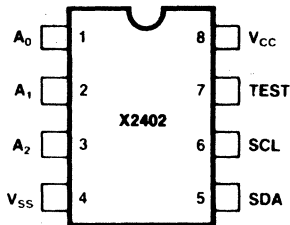
DESCRIPTION

The X2402 is a 2048 bit serial E²PROM, internally organized as one 256 x 8 page. The X2402 is fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V programmable nonvolatile memories.

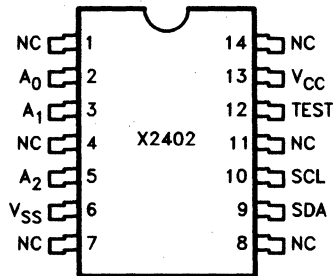
The X2402 features a serial interface and software protocol allowing operation on a two wire bus.

Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 100,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

PIN CONFIGURATIONS



0035-1



0035-11

PIN NAMES

A ₀ to A ₂	Address Inputs
V _{SS}	Ground
SDA	Serial Data
SCL	Serial Clock
Test	Input to V _{SS}
V _{CC}	Supply Voltage

4K	Commercial Industrial	X2404 X2404I	512 x 8 Bit
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Electrically Erasable PROM

TYPICAL FEATURES

- **Internally Organized as Two Pages**
—Each 256 x 8
- **2 Wire Serial Interface**
- **Provides Bidirectional Data Transfer Protocol**
- **Eight Byte Page Write Mode**
—Minimizes Total Write Time Per Byte
- **Self Timed Write Cycle**
—Typical Write Cycle Time of 5 ms
- **High Reliability**
—Endurance: 100,000 Writes Per Byte
—Data Retention: 100 Years
- **8 Pin Mini-DIP and 14 Lead SOIC Packages**

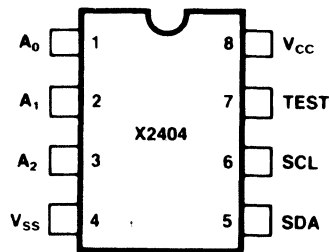
DESCRIPTION

The X2404 is a 4096 bit serial E²PROM, internally organized as two 256 x 8 pages. The X2404 is fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V programmable nonvolatile memories.

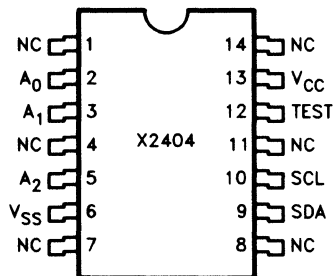
The X2404 features a serial interface and software protocol allowing operation on a two wire bus.

Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 100,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

PIN CONFIGURATIONS



0041-1



0041-19

PIN NAMES

A ₀ to A ₂	Address Inputs
V _{SS}	Ground
SDA	Serial Data
SCL	Serial Clock
Test	Input to V_{SS}
V _{CC}	Supply Voltage

Xicor

1K	Commercial Industrial	X24C01 X24C01I	128 x 8 Bit
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Electrically Erasable PROM

TYPICAL FEATURES

- **Low Power CMOS**
 - Active Current Less Than 1 mA
 - Standby Current Less Than 50 μ A
- **Internally Organized 128 x 8**
- **2 Wire Serial Interface**
 - Bidirectional Data Transfer Protocol
- **Four Byte Page Write Mode**
- **Self Timed Write Cycle**
 - Typical Write Cycle Time of 5 ms
- **High Reliability**
 - Endurance: 100,000 Cycles Per Byte
 - Data Retention: 100 Years
- **8-Pin Mini-DIP and 8-Pin SOIC Packages**

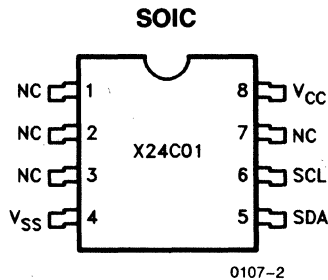
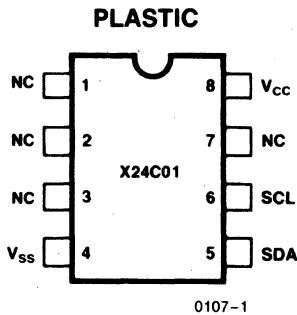
DESCRIPTION

The X24C01 is a CMOS 1024 bit serial E²PROM, internally organized as 128 x 8. The X24C01 features a serial interface and software protocol allowing operation on a simple two wire bus.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics, and RR-520 for endurance cycling information for Xicor nonvolatile memories.

PIN CONFIGURATIONS

Xicor



PIN NAMES

NC	No Connect
V _{SS}	Ground
V _{CC}	Supply Voltage
SDA	Serial Data
SCL	Serial Clock

2K	Commercial Industrial	X24C02 X24C02I	256 x 8 Bit
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Electrically Erasable PROM

TYPICAL FEATURES

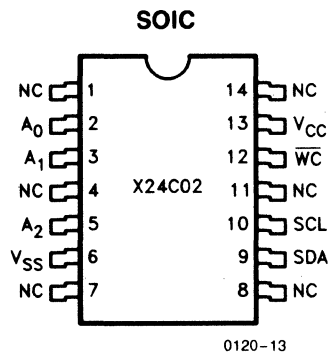
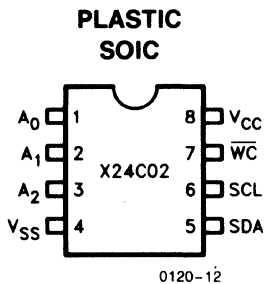
- **Low Power CMOS**
 - Active Current Less Than 1 mA
 - Standby Current Less Than 50 μ A
- **Internally Organized 256 x 8**
- **Self Timed Write Cycle**
 - Typical Write Cycle Time of 5 ms
- **2 Wire Serial Interface**
 - Bidirectional Data Transfer Protocol
- **Four Byte Page Write Operation**
 - Minimizes Total Write Time Per Byte
- **High Reliability**
 - Endurance: 100,000 Cycles Per Byte
 - Data Retention: 100 Years
- **New Hardware - Write Control Function**

DESCRIPTION

The X24C02 is a 2048 bit serial E²PROM, internally organized as one 256 x 8 page. The X24C02 features a serial interface and software protocol allowing operation on a simple two wire bus.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics, and RR-520 for endurance cycling information for Xicor nonvolatile memories.

PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₂	Address Inputs
SDA	Serial Data
SCL	Serial Clock
WC	Write Control
V _{SS}	Ground
V _{CC}	+5V

4K Commercial X24C04 512 x 8 Bit
Industrial X24C04I

Electrically Erasable PROM

TYPICAL FEATURES

- **Low Power CMOS**
 - Active Current Less Than 1 mA
 - Standby Current Less Than 50 μ A
- **Internally Organized as Two Pages**
 - Each 256 x 8
- **2 Wire Serial Interface**
 - Bidirectional Data Transfer Protocol
- **Sixteen Byte Page Write Mode**
 - Minimizes Total Write Time Per Byte
- **Self Timed Write Cycle**
 - Typical Write Cycle Time of 5 ms
- **High Reliability**
 - Endurance: 100,000 Cycles Per Byte
 - Data Retention: 100 Years
- **8 Pin Mini-DIP and 14 Pin SOIC Packages**

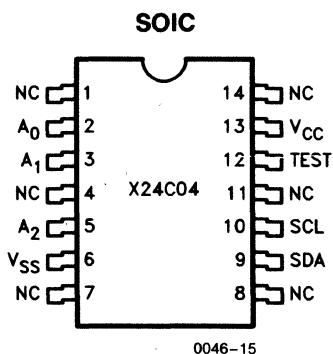
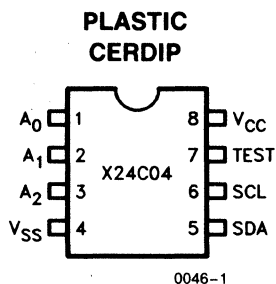
DESCRIPTION

The X24C04 is a CMOS 4096 bit serial E²PROM, internally organized as two 256 x 8 memory banks. The X24C04 features a serial interface and software protocol allowing operation on a simple two wire bus.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics and RR-520 for endurance cycling information for Xicor nonvolatile memories.

Xicor

PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₂	Address Inputs
SDA	Serial Data
SCL	Serial Clock
TEST	Hold at V _{SS}
V _{SS}	Ground
V _{CC}	Supply Voltage
NC	No Connect

16K Commercial Industrial X24C16 X24C16I 2048 x 8 Bit

Electrically Erasable PROM

TYPICAL FEATURES

- **Low Power CMOS**
 - Active Current Less Than 1 mA
 - Standby Current Less Than 50 μ A
- **Internally Organized as Eight Pages**
 - Each 256 x 8
- **2 Wire Serial Interface**
- **Bidirectional Data Transfer Protocol**
- **Sixteen Byte Page Write Mode**
 - Minimizes Total Write Time Per Byte
- **Self Timed Write Cycle**
 - Typical Write Cycle Time of 5 ms
- **High Reliability**
 - Endurance: 10,000 Cycles Per Byte
 - Data Retention: 100 Years
- **8 Pin Mini-DIP and 14 Pin SOIC Packages**

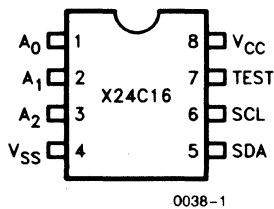
DESCRIPTION

The X24C16 is a CMOS 16,384 bit serial E²PROM, internally organized as eight 256 x 8 memory banks. The X24C16 features a serial interface and software protocol allowing operation on a simple two wire bus.

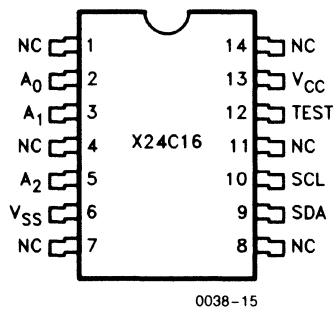
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics, and RR-520 for endurance cycling information for Xicor nonvolatile memories.

PIN CONFIGURATIONS

PLASTIC CERDIP



SOIC



PIN NAMES

A ₀ –A ₂	Address Inputs
SDA	Serial Data
SCL	Serial Clock
TEST	Hold at V _{SS}
V _{SS}	Ground
V _{CC}	Supply Voltage
NC	No Connect

4K

Commercial
Industrial

X2804A
X2804AI

512 x 8 Bit

Electrically Erasable PROM

FEATURES

- **Simple Byte Write Operation**
 - Internally Latched Address and Data
 - Self Timed Write
 - Noise Protected \overline{WE} Pin
- **Reliable N-Channel Floating Gate MOS Technology**
- **Single 5V Supply**
- **High Reliability**
 - Endurance: 10,000 Writes Per Byte
 - Data Retention: 100 Years
- **Byte Write Time: 10 ms Max.**
- **Fast Access Time: 250 ns Max.**
- **Low Power Dissipation**
 - Active Current: 80 mA Max.
 - Standby Current: 50 mA Max.

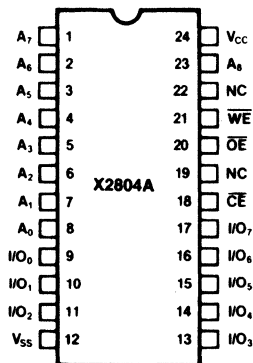
DESCRIPTION

The Xicor X2804A is a 512 x 8 E²PROM, fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V programmable nonvolatile memories. The X2804A is compatible with the JEDEC approved pinout for byte-wide memories.

Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 10,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

Xicor

PIN CONFIGURATION

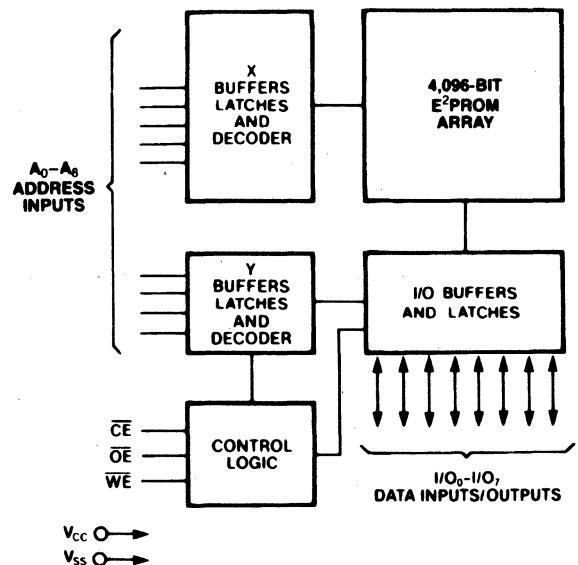


0044-1

PIN NAMES

A ₀ -A ₈	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
\overline{WE}	Write Enable
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0044-2

16K Commercial X2816B 2048 x 8 Bit
Industrial X2816BI

Electrically Erasable PROM

FEATURES

- 250 ns Access Time
- High Performance Advanced NMOS Technology
- Fast Write Cycle Times
 - 16-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 640 ms Typical
 - Effective Byte Write Cycle Time of 300 μ s Typical
- DATA Polling
 - Allows User to Minimize Write Cycle Time
- High Reliability
 - Endurance: 10,000 Writes Per Byte
 - Data Retention: 100 Years
- Simple Byte and Page Write
 - Single TTL Level \overline{WE} Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

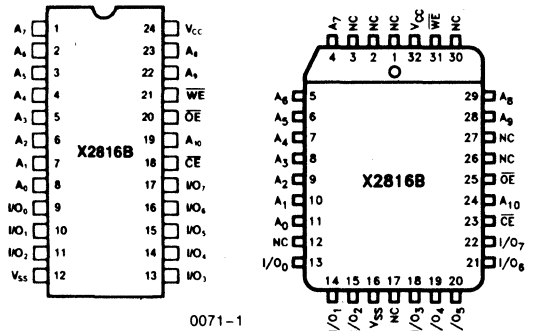
The Xicor X2816B is a 2K x 8 E²PROM, fabricated with an advanced, high performance N-channel floating gate MOS technology. Like all Xicor programmable nonvolatile memories it is a 5V only device. The X2816B features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs and EPROMs.

The X2816B supports a 16-byte page write operation, typically providing a 300 μ s/byte write cycle, enabling the entire memory to be written in less than 640 ms. The X2816B also features \overline{DATA} Polling, a system software support scheme used to indicate the early completion of a write cycle.

Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 10,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

Xicor

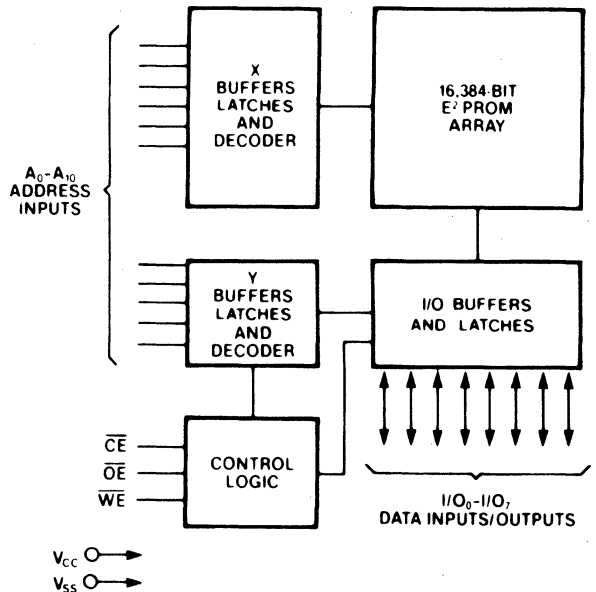
PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₁₀	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
\overline{WE}	Write Enable
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0071-3

16K

Commercial
Industrial

X2816C
X2816CI

2048 x 8 Bit

Electrically Erasable PROM

FEATURES

- 200 ns Access Time
- High Performance Advanced NMOS Technology
- Fast Write Cycle Times
 - 16-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 640 ms Typical
 - Effective Byte Write Cycle Time of 300 μ s Typical
- DATA Polling
 - Allows User to Minimize Write Cycle Time
- Simple Byte and Page Write
 - Single TTL Level WE Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout
- High Reliability
 - Endurance: 10,000 Cycles
 - Data Retention: 100 Years

DESCRIPTION

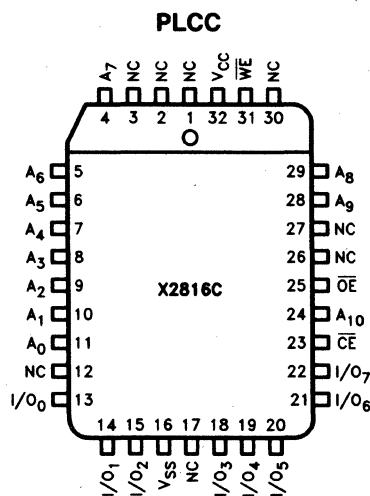
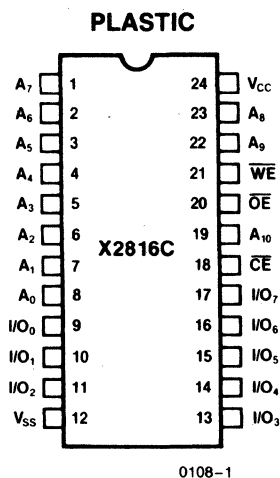
The Xicor X2816C is a 2K x 8 E²PROM, fabricated with an advanced, high performance N-channel floating gate MOS technology. Like all Xicor programmable nonvolatile memories it is a 5V only device. The X2816C features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs and EPROMs.

The X2816C supports a 16-byte page write operation, typically providing a 300 μ s/byte write cycle, enabling the entire memory to be written in less than 640 ms. The X2816C also features DATA Polling, a system software support scheme used to indicate the early completion of a write cycle.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics for Xicor non-volatile memories.

Xicor

PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₁₀	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

Electrically Erasable PROM

FEATURES

- 250 ns Access Time
- Fast Write Cycle Times
 - 16-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 2.6 Sec. Typical
 - Effective Byte Write Cycle Time of 300 μ s Typical
- DATA Polling
 - Allows User to Minimize Write Cycle Time
- High Reliability
 - Endurance: 10,000 Writes Per Byte
 - Data Retention: 100 Years
- Simple Byte and Page Write
 - Single TTL Level WE Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

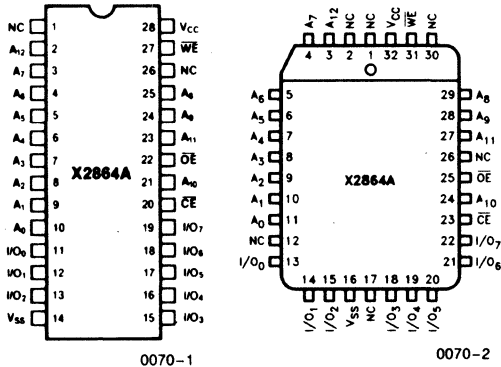
The Xicor X2864A is a 8K x 8 E²PROM, fabricated with the same reliable N-channel floating gate MOS technology used in all Xicor 5V programmable nonvolatile memories. The X2864A features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs and EPROMs.

The X2864A supports a 16-byte page write operation, effectively providing a 300 μ s/byte write and enabling the entire memory to be written in less than 2.6 seconds. The X2864A also features DATA Polling, a system software support scheme used to indicate the early completion of a write cycle.

Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 10,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

Xicor

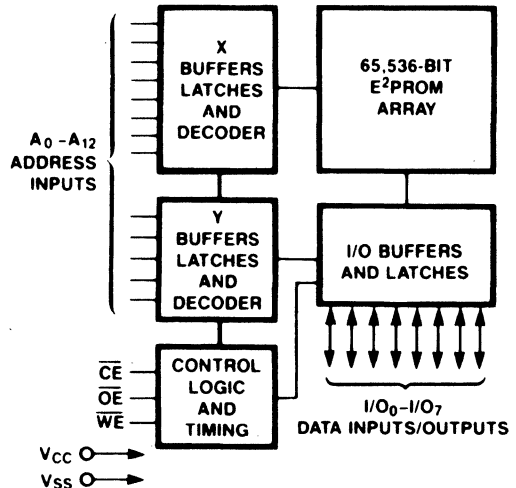
PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₁₂	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0070-3

64K

Commercial
Industrial

X2864B
X2864BI

8192 x 8 Bit

Electrically Erasable PROM

TYPICAL FEATURES

- 120 ns Access Time
- High Performance Scaled NMOS Technology
- Fast Write Cycle Times
 - 32-Byte Page Write Operation
 - Byte or Page Write Cycle: 3 ms Typical
 - Complete Memory Rewrite: 750 ms Typical
 - Effective Byte Write Cycle Time of 95 μ s Typical
- DATA Polling
 - Allows User to Minimize Write Cycle Time
- Simple Byte and Page Write
 - Single TTL Level \overline{WE} Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout
- High Reliability
 - Endurance: 10,000 Cycles
 - Data Retention: 100 Years

DESCRIPTION

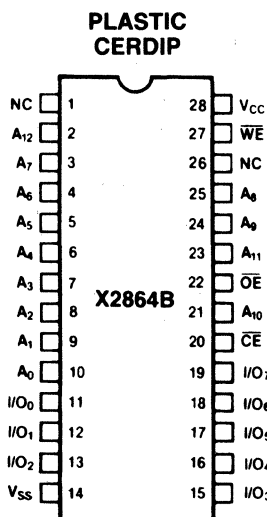
The Xicor X2864B is a 8K x 8 E²PROM, fabricated with an advanced, high performance N-channel floating gate MOS technology. Like all Xicor programmable nonvolatile memories it is a 5V only device. The X2864B features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs and EPROMs.

The X2864B supports a 32-byte page write operation, effectively providing a 95 μ s/byte write cycle and enabling the entire memory to be written in less than 750 ms. The X2864B also features \overline{DATA} Polling, a system software support scheme used to indicate the early completion of a write cycle.

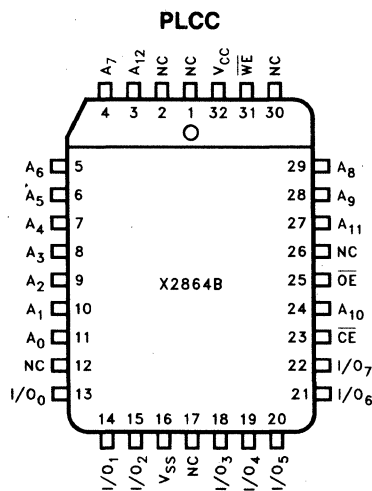
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics for Xicor non-volatile memories.

Xicor

PIN CONFIGURATIONS



0031-1



0031-2

PIN NAMES

A ₀ -A ₁₂	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
\overline{WE}	Write Enable
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

64K Commercial Industrial X2864H X2864HI 8192 x 8 Bit

Electrically Erasable PROM

TYPICAL FEATURES

- 70 ns Access Time
- High Performance Scaled NMOS Technology
- Fast Write Cycle Times
 - 32-Byte Page Write Operation
 - Byte or Page Write Cycle: 3 ms Typical
 - Complete Memory Rewrite: 750 ms Typical
 - Effective Byte Write Cycle Time of 95 μ s Typical
- DATA Polling
 - Allows User to Minimize Write Cycle Time
- High Reliability
 - Endurance: 10,000 Writes Per Byte
 - Data Retention: 100 Years
- Simple Byte and Page Write
 - Single TTL Level WE Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

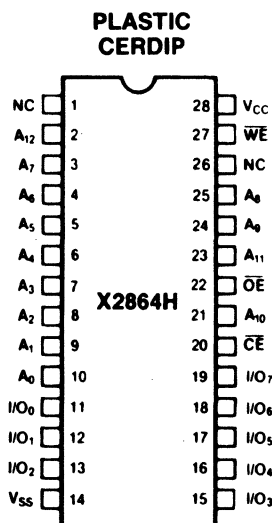
The Xicor X2864H is a high speed 8K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, N-channel floating gate MOS technology. Like all Xicor programmable nonvolatile memories it is a 5V only device. The X2864H features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs, and EPROMs.

The X2864H supports a 32-byte page write operation, effectively providing a 95 μ s/byte write cycle and enabling the entire memory to be written in less than 750 ms. The X2864H also features DATA Polling, a system software support scheme used to indicate the early completion of a write cycle.

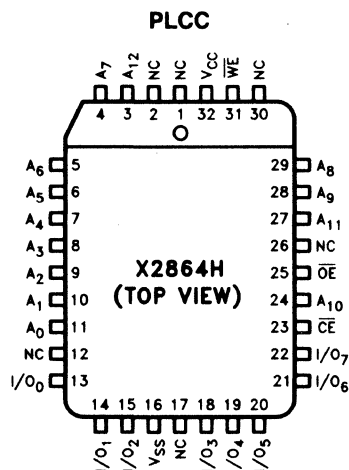
Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 10,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

Xicor

PIN CONFIGURATIONS



0034-1



0034-2

PIN NAMES

A ₀ -A ₁₂	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

64K

Commercial
Industrial

X28C64
X28C64I

8K x 8 Bit

Electrically Erasable PROM

FEATURES

- 120 ns Access Time
- LOW Power CMOS
 - 60 mA Active Current Max.
 - 200 μ A Standby Current Max.
- Fast Write Cycle Times
 - 64-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 0.625 Sec. Typical
 - Effective Byte Write Cycle Time: 78 μ s Typical
- Software Data Protection
- End of Write Detection
 - DATA Polling
 - Toggle Bit
- High Reliability
 - Endurance: 10,000 Cycles
 - Data Retention: 100 Years
- Simple Byte and Page Write
 - Single TTL Compatible \overline{WE} Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout

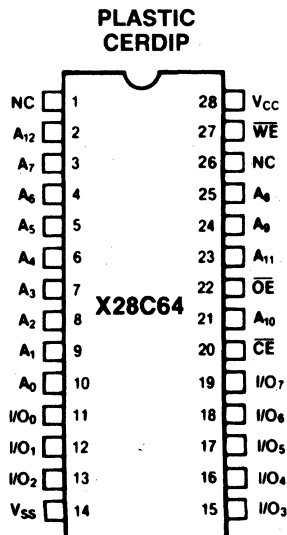
DESCRIPTION

The Xicor X28C64 is a 8K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable non-volatile memories the X28C64 is a 5V only device. The X28C64 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs.

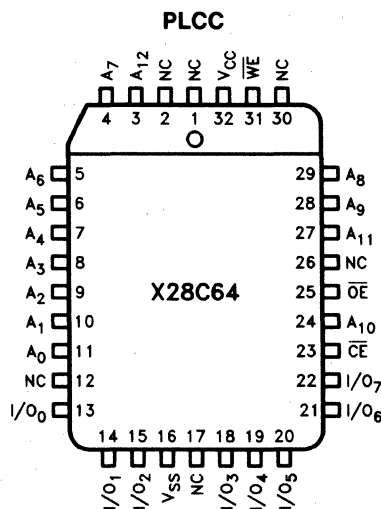
The X28C64 supports a 64-byte page write operation, effectively providing a 78 μ s/byte write cycle and enabling the entire memory to be typically written in 0.625 seconds. The X28C64 also features \overline{DATA} Polling, a system software support scheme used to indicate the early completion of a write cycle. In addition, the X28C64 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics for Xicor non-volatile memories.

PIN CONFIGURATIONS

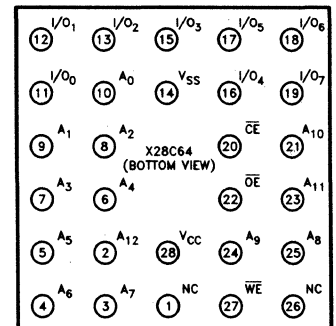


0111-1



0111-2

PGA



0111-3

PIN NAMES

A ₀ -A ₁₂	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
\overline{WE}	Write Enable
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

Electrically Erasable PROM

FEATURES

- 250 ns Access Time
- Fast Write Cycle Times
 - 64-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 2.5 Sec. Typical
 - Effective Byte Write Cycle Time: 78 μ s Typical
- Software Data Protection
- End of Write Detection
 - DATA Polling
 - Toggle Bit
- High Reliability
 - Endurance: 10,000 Writes Per Byte
 - Data Retention: 100 Years
- Simple Byte and Page Write
 - Single TTL Level WE Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- Upward Compatible with X2864A
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

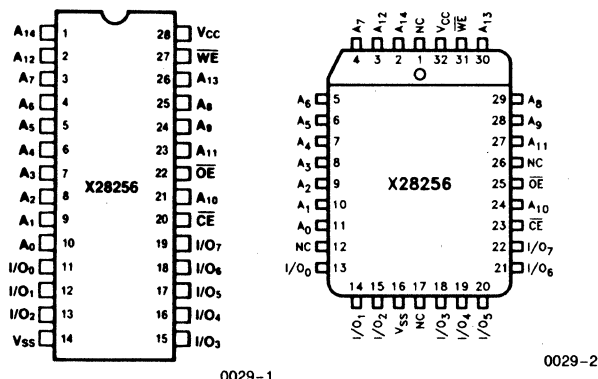
The Xicor X28256 is a 32K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, N-channel floating gate MOS technology. Like all Xicor programmable nonvolatile memories the X28256 is a 5V only device. The X28256 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs.

The X28256 supports a 64-byte page write operation, effectively providing a 78 μ s/byte write cycle and enabling the entire memory to be typically written in less than 2.5 seconds. The X28256 also features DATA Polling, a system software support scheme used to indicate the early completion of a write cycle. In addition, the X28256 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

Xicor E²PROMs are designed and tested for applications requiring extended endurance and data retention. Endurance is specified as 10,000 cycles per byte minimum and data retention is specified as 100 years minimum. Refer to Xicor reliability reports RR-520 and RR-515 for details of endurance and data retention characteristics.

Xicor

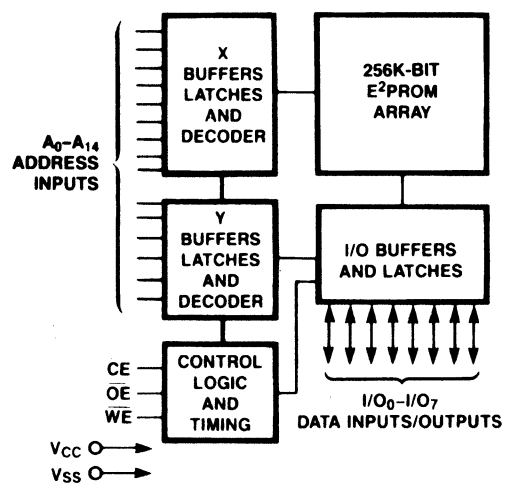
PIN CONFIGURATIONS



PIN NAMES

A ₀ -A ₁₄	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0029-3

256K

Commercial
Industrial

X28C256
X28C256I

32K x 8 Bit

Electrically Erasable PROM

FEATURES

- 150 ns Access Time
- LOW Power CMOS
 - 60 mA Active Current Max.
 - 200 μ A Standby Current Max.
- Fast Write Cycle Times
 - 64-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 2.5 Sec. Typical
 - Effective Byte Write Cycle Time: 78 μ s Typical
- Software Data Protection
- End of Write Detection
 - DATA Polling
 - Toggle Bit
- Simple Byte and Page Write
 - Single TTL Compatible \overline{WE} Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- High Reliability
 - Endurance: 10,000 Cycles
 - Data Retention: 100 Years
- Upward Compatible with X2864A
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

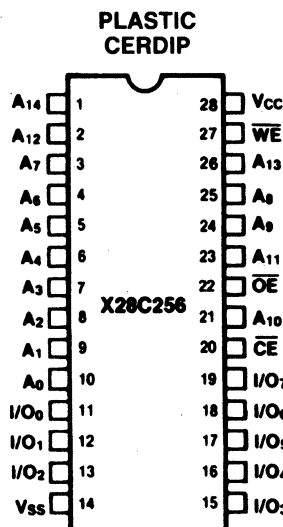
The Xicor X28C256 is a 32K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable non-volatile memories the X28C256 is a 5V only device. The X28C256 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs.

The X28C256 supports a 64-byte page write operation, effectively providing a 78 μ s/byte write cycle and enabling the entire memory to be typically written in less than 2.5 seconds. The X28C256 also features DATA Polling, a system software support scheme used to indicate the early completion of a write cycle. In addition, the X28C256 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

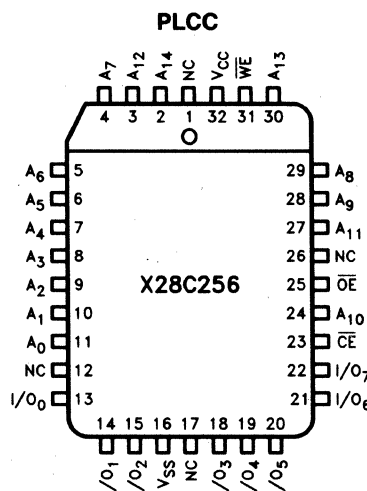
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics for Xicor non-volatile memories.

Xicor

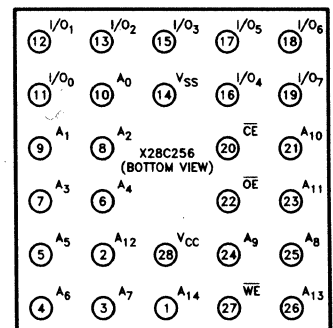
PIN CONFIGURATIONS



0098-1



0098-2



0098-21

PIN NAMES

A ₀ -A ₁₄	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
\overline{WE}	Write Enable
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

512K Commercial X28C512 64K x 8 Bit
Industrial X28C512I

Electrically Erasable PROM

FEATURES

- **Low Power CMOS**
 - 50 mA Active Current Max.
 - 500 μ A Standby Current Max.
- **Enhanced, High Speed Page Write Operation**
- **Fast Write Cycle Times**
 - 128-Byte Page Size
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 2.5 Sec.
 - Effective Byte Write Cycle Time: 39 μ s
- **End of Write Detection**
 - $\overline{\text{DATA}}$ Polling
 - Toggle Bit Testing Preferred for:
 - Multiprocessor Applications
 - Large Memory Arrays
 - Interrupt Driven Systems
- **Software Data Protection**

- **Two PLCC Pinouts**
 - X28C512—UVEPROM Replacements
 - X28C513—X28C256 Upgrades
- **Inherent 100+ Years Data Retention**

DESCRIPTION

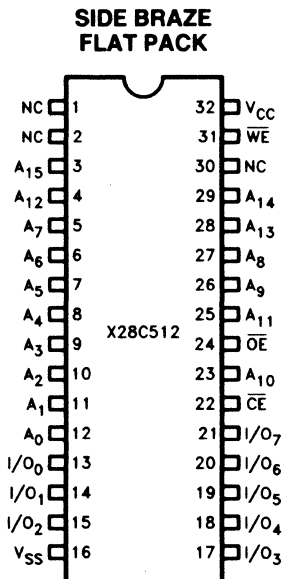
The Xicor X28C512 is a 64K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable non-volatile memories the X28C512 is a 5V only device.

The X28C512 supports a 128-byte page write operation, effectively providing a 39 μ s/byte write cycle and enabling the entire memory to be written in less than 2.5 seconds. The X28C512 also features $\overline{\text{DATA}}$ Polling and Toggle Bit testing, system software support schemes used to indicate the early completion of a write cycle. In addition, the X28C512 supports the Software Data Protection option.

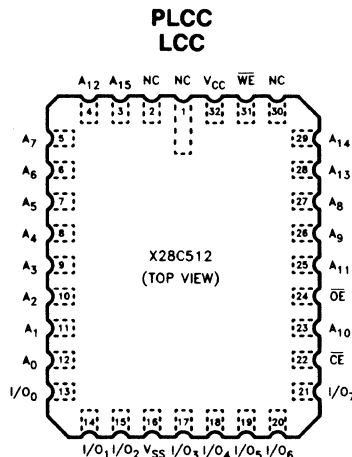
Xicor E²PROMs are designed and tested for applications requiring extended endurance.

Xicor

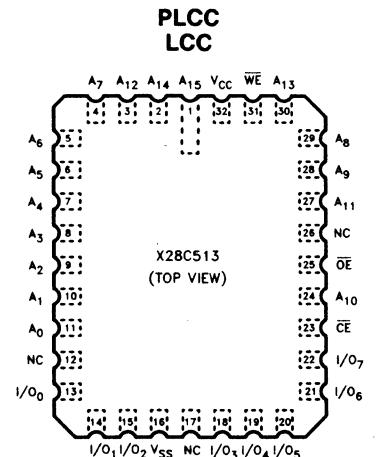
PIN CONFIGURATIONS



0117-1



0117-2



0117-3

PIN NAMES

A ₀ -A ₁₅	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+ 5V
V _{SS}	Ground
NC	No Connect

1M

Commercial

X28C010

128K x 8 Bit

Electrically Erasable PROM

FEATURES

- 200 ns Access Time
- LOW Power CMOS
 - 80 mA Active Current Typical
 - 500 μ A Standby Current Typical
- Fast Write Cycle Times
 - 128-Byte Page Write Operation
 - Byte or Page Write Cycle: 5 ms Typical
 - Complete Memory Rewrite: 5 Sec. Typical
 - Effective Byte Write Cycle Time: 39 μ s Typical
- Software Data Protection
- End of Write Detection
 - DATA Polling
 - Toggle Bit
- Simple Byte and Page Write
 - Single TTL Compatible \overline{WE} Signal
 - Internally Latched Address and Data
 - Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout

DESCRIPTION

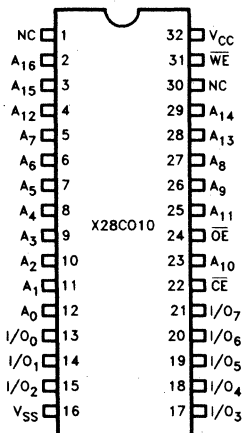
The Xicor X28C010 is a 128K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable non-volatile memories the X28C010 is a 5V only device. The X28C010 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard EPROMs.

The X28C010 supports a 128-byte page write operation, effectively providing a 39 μ s/byte write cycle and enabling the entire memory to be typically written in less than 5 seconds. The X28C010 also features DATA Polling, a system software support scheme used to indicate the early completion of a write cycle. In addition, the X28C010 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Data retention is specified to be greater than 10 years.

Xicor

PIN CONFIGURATION

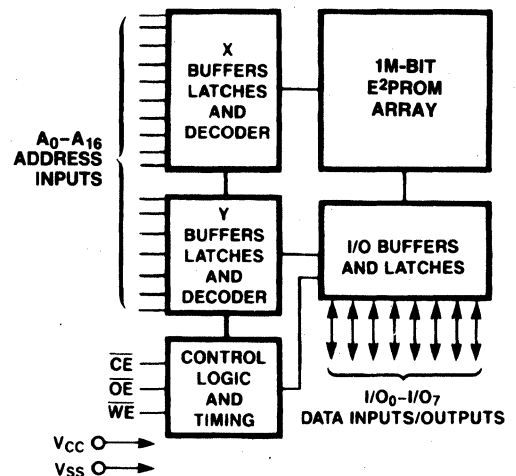


0084-1

PIN NAMES

A ₀ -A ₁₆	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
\overline{WE}	Write Enable
\overline{CE}	Chip Enable
\overline{OE}	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



0084-2

**Commercial
Industrial**

**X9MME
X9MMEI**

E2POT™ Digitally Controlled Potentiometer

FEATURES

- Solid State Reliability
- Single Chip MOS Implementation
- Three Wire TTL Control
- Operates From Standard 5V Supply
- 99 Resistive Elements
 - Temperature Compensated
 - ± 20% End to End Resistance Range
- 100 Wiper Tap Points
 - Wiper Position Digitally Controlled
 - Wiper Position Stored in Nonvolatile Memory Then Automatically Recalled on Power-Up
- 100 Year Wiper Position Retention
- 8 Pin Mini-DIP Package
- 14 Pin SOIC Package

DESCRIPTION

The Xicor X9MME is a solid state nonvolatile potentiometer and is ideal for digitally controlled resistance trimming.

The X9MME is a resistor array composed of 99 resistive elements. Between each element and at either end are tap points accessible to the wiper element. The position of the wiper element on the array is controlled by the \overline{CS} , U/\overline{D} , and \overline{INC} inputs. The position of the wiper can be stored in nonvolatile memory and is recalled upon a subsequent power-up.

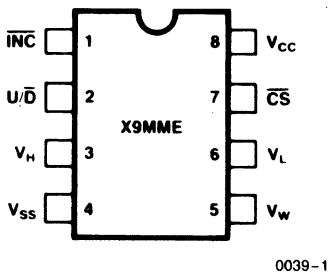
The resolution of the X9MME is equal to the maximum resistance value divided by 99. As an example; for the X9503 (50 K Ω) each tap point represents 505 Ω .

Xicor E² products are designed and tested for applications requiring extended endurance. Refer to Xicor reliability reports for further endurance information.

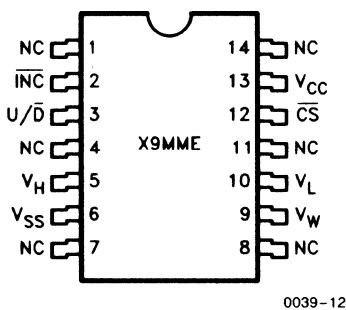
Xicor

PIN CONFIGURATIONS

PLASTIC



SOIC



PIN NAMES

V_H	High Terminal of Pot
V_W	Wiper Terminal of Pot
V_L	Low Terminal of Pot
V_{SS}	Ground
V_{CC}	System Power
U/\overline{D}	Up/Down Control
\overline{INC}	Wiper Movement Control
\overline{CS}	Chip Select for Wiper Movement/Storage
NC	No Connect

64K Commercial X88C64 8192 x 8 Bit
Industrial X88C64I

E² Micro-Peripheral

FEATURES

- **Concurrent Software Execution While Writing**
 - Dual Plane Architecture
 - Isolates Read/Write Functions Between Planes
 - Allows Continuous Execution of Code From One Plane While Writing in the Other Plane
- **Multiplexed Address/Data Bus**
 - Direct Interface to Popular 8-Bit Microcontrollers, e.g.
 - Intel MCS®-51 Family
 - Motorola M6801/03, M68HC11 Family
- **High Performance CMOS**
 - Fast Access Time, 120 ns
 - Low Power
 - 40 mA Active
 - 100 μ A Standby
- **Software Data Protection**
 - Protect Entire Array During Power-Up/-Down
- **Block Protect Register**
 - Individually Set Write Lock Out in 1K Blocks
- **Toggle Bit**
 - Early End of Write Detection

• Page Mode Write

- Allows up to 32 Bytes to be Written in One Write Cycle

DESCRIPTION

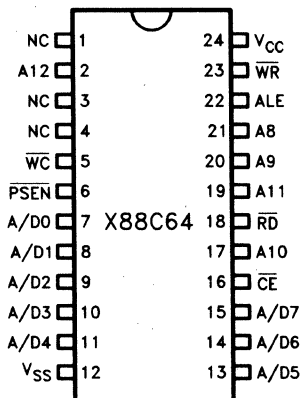
The X88C64 is an 8K x 8 E²PROM fabricated with advanced CMOS Textured Poly Floating Gate Technology. The X88C64 features a Multiplexed Address and Data bus allowing direct interface to a variety of popular single-chip microcontrollers operating in expanded multiplexed mode without the need for additional interface circuitry.

The X88C64 is internally configured as two independent 4K x 8 memory arrays. This feature provides the ability to perform nonvolatile memory updates in one array and continue operation out of code stored in the other array; effectively eliminating the need for an auxiliary memory device for code storage.

The X88C64 also provides a second generation software data protection scheme called Block Protect. Block Protect can provide write lockout of the entire device or selected 1K blocks. There are 8 1K x 8 blocks that can be write protected individually in any combination required by the user. Block Protect, in addition to the Write Control input, allows the different segments of the memory to have varying degrees of alterability in normal system operation.

Xicor

PIN CONFIGURATION



PIN NAMES

ALE	Address Latch Enable
AD ₀ -AD ₇	Address Inputs/Data I/O
A ₈ -A ₁₂	Address Inputs
\overline{RD}	Read Input
\overline{WR}	Write Input
PSEN	Program Store Enable Input
\overline{CE}	Chip Enable
\overline{WC}	Write Control
V _{SS}	Ground

0125-1

1Megabit Module

XM28C010

128K x 8 Bit

Electrically Erasable PROM

FEATURES

- High Density 1Megabit (128K x 8) E²PROM Module
- Access Time of 250 ns at -55°C to +125°C
- Base Memory Component: Xicor CMOS X28C256
- JEDEC Standard 32-Pin 600 Mil Wide Ceramic Side Braze Package
- Pin Compatible with the X28C010 1Megabit Monolithic CMOS E²PROM
- Fast Write Cycle Times Supported by:
 - Internal Program Cycle 10 ms Max.
 - 64-Byte Page
 - DATA Polling
 - Toggle Status Bit
- High Rel Module Available with:
 - 100% MIL-STD-883 Compliant Components
 - 100% Screening and MIL-STD-883 Processing of Modules
- Software Data Protection

DESCRIPTION

The XM28C010 is a high density 1Megabit E²PROM comprised of four X28C256 32K x 8 LCCs mounted on a co-fired multilayered ceramic substrate. The XM28C010 is configured 128K x 8 bit and features the JEDEC approved pinout for byte-wide memories, compatible with the monolithic X28C010.

The XM28C010 is available in commercial, industrial and military temperature ranges. The military temperature range module is built with MIL-STD-883 Class B microcircuit components. In addition, after being assembled all High Rel modules undergo 100% screening.

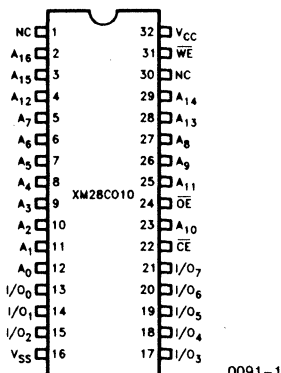
The XM28C010 supports a 64-byte page write operation, this, combined with DATA Polling or Toggle Bit testing, effectively provides a 78 μs/byte write cycle, enabling the module memory array to be rewritten in 10 seconds.

The XM28C010 will also support Software Data Protection, a user-optional method of protecting data during power transitions.

The XM28C010 provides the same high endurance and data retention as the base memory components.

Xicor

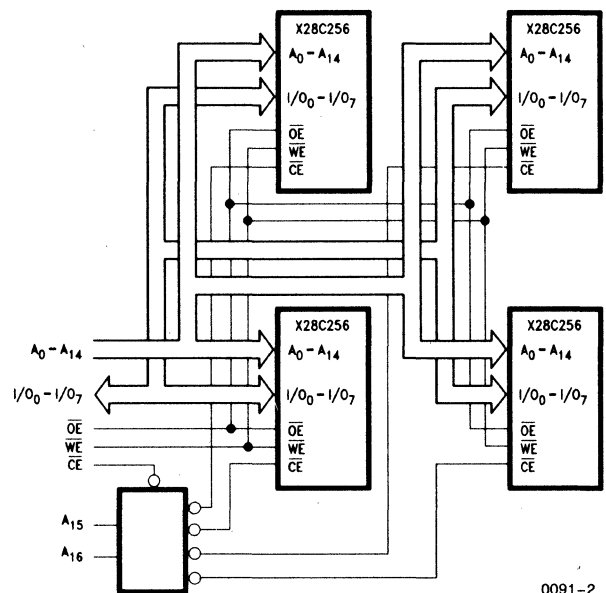
PIN CONFIGURATION



PIN NAMES

A ₀ -A ₁₆	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

FUNCTIONAL DIAGRAM



2Megabit Module

XM28C020

256K x 8 Bit

Electrically Erasable PROM

FEATURES

- High Density 2Megabit (256K x 8) E²PROM Module
- Access Time of 200 ns at -40°C to +85°C
- Base Memory Component: Xicor CMOS X28C513
- JEDEC Standard 32-Pin 600 Mil Wide Ceramic Side Braze Package
- Fast Write Cycle Times Supported by:
 - Internal Program Cycle 10 ms Max.
 - 128-Byte Page
 - DATA Polling
 - Toggle Status Bit
- Software Data Protection

DESCRIPTION

The XM28C020 is a high density 2Megabit E²PROM comprised of four X28C513 32K x 8 LCCs mounted on a co-fired multilayered ceramic substrate. The XM28C020 is configured 256K x 8 bit.

The XM28C020 is available in commercial and industrial temperature ranges.

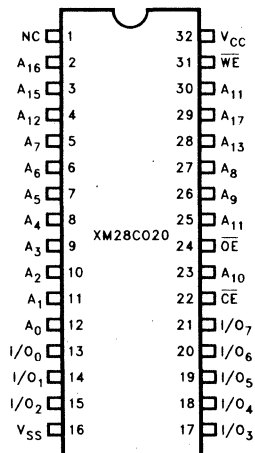
The XM28C020 supports a 128-byte page write operation. This, combined with DATA Polling or Toggle Bit testing, effectively provides a 40 μs/byte write cycle, enabling the module memory array to be rewritten in 10 seconds.

The XM28C020 will also support Software Data Protection, a user-optional method of protecting data during power transitions.

The XM28C020 provides the same high endurance and data retention as the base memory components.

Xicor

PIN CONFIGURATION

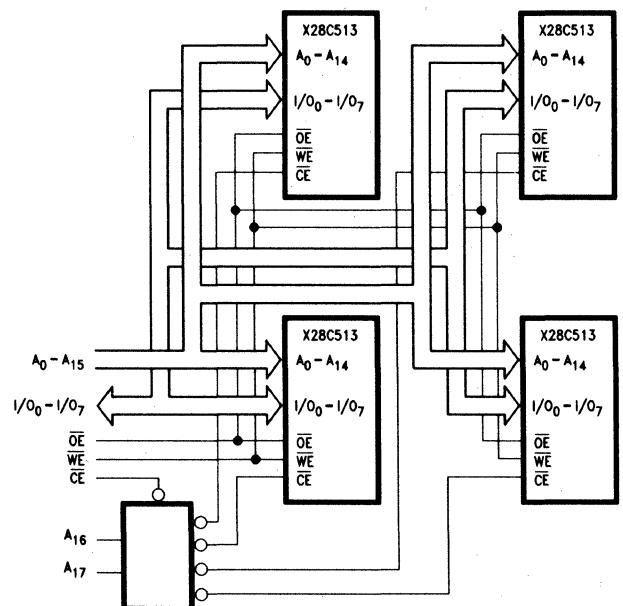


0126-1

PIN NAMES

A ₀ -A ₁₇	Address Inputs
I/O ₀ -I/O ₇	Data Input/Output
WE	Write Enable
CE	Chip Enable
OE	Output Enable
V _{CC}	+5V
V _{SS}	Ground
NC	No Connect

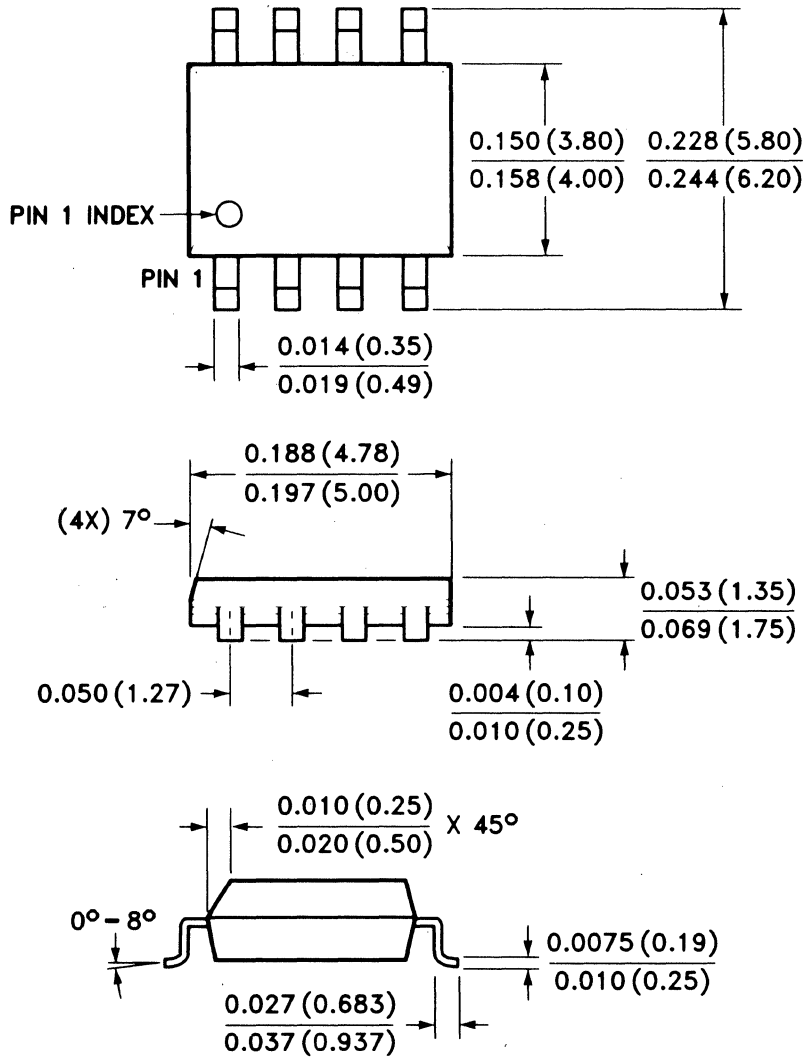
FUNCTIONAL DIAGRAM



0126-2

Packaging Information

8-LEAD PLASTIC SMALL OUTLINE GULL WING PACKAGE TYPE S



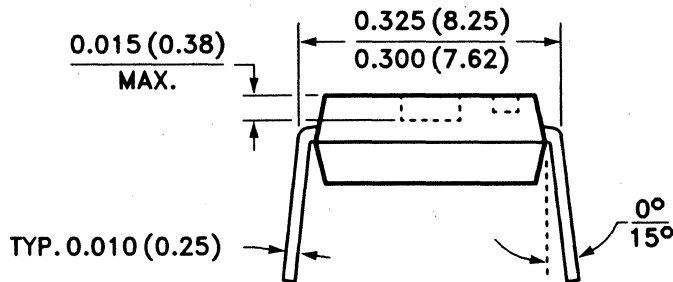
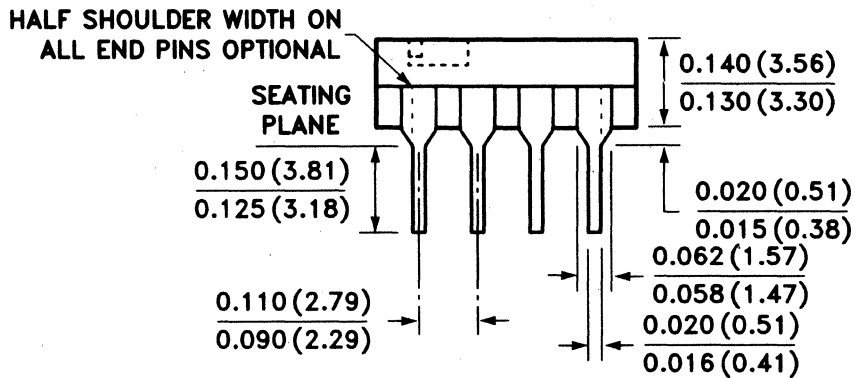
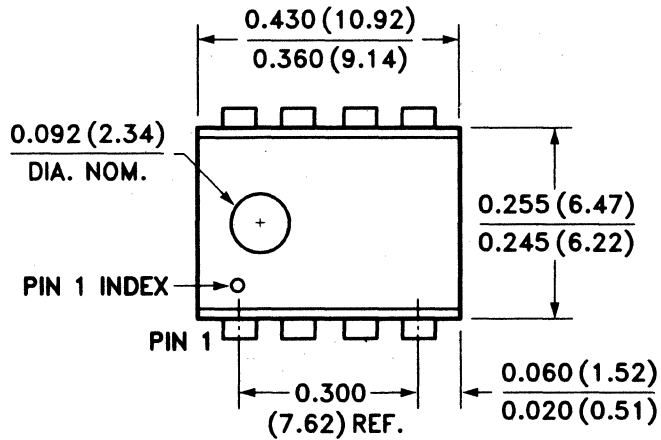
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

PSE008

Xicor

Packaging Information

8-LEAD PLASTIC DUAL IN-LINE PACKAGE TYPE P



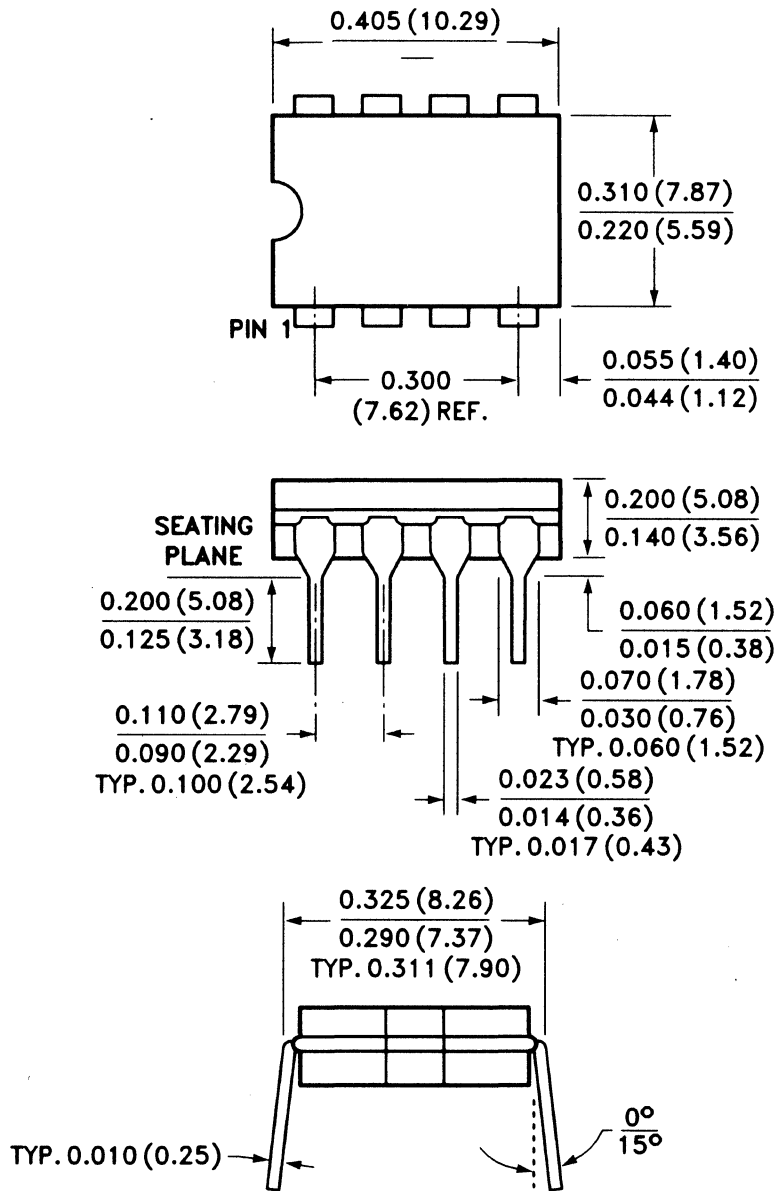
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

PPI008

Xicor

Packaging Information

8-LEAD HERMETIC DUAL IN-LINE PACKAGE TYPE D



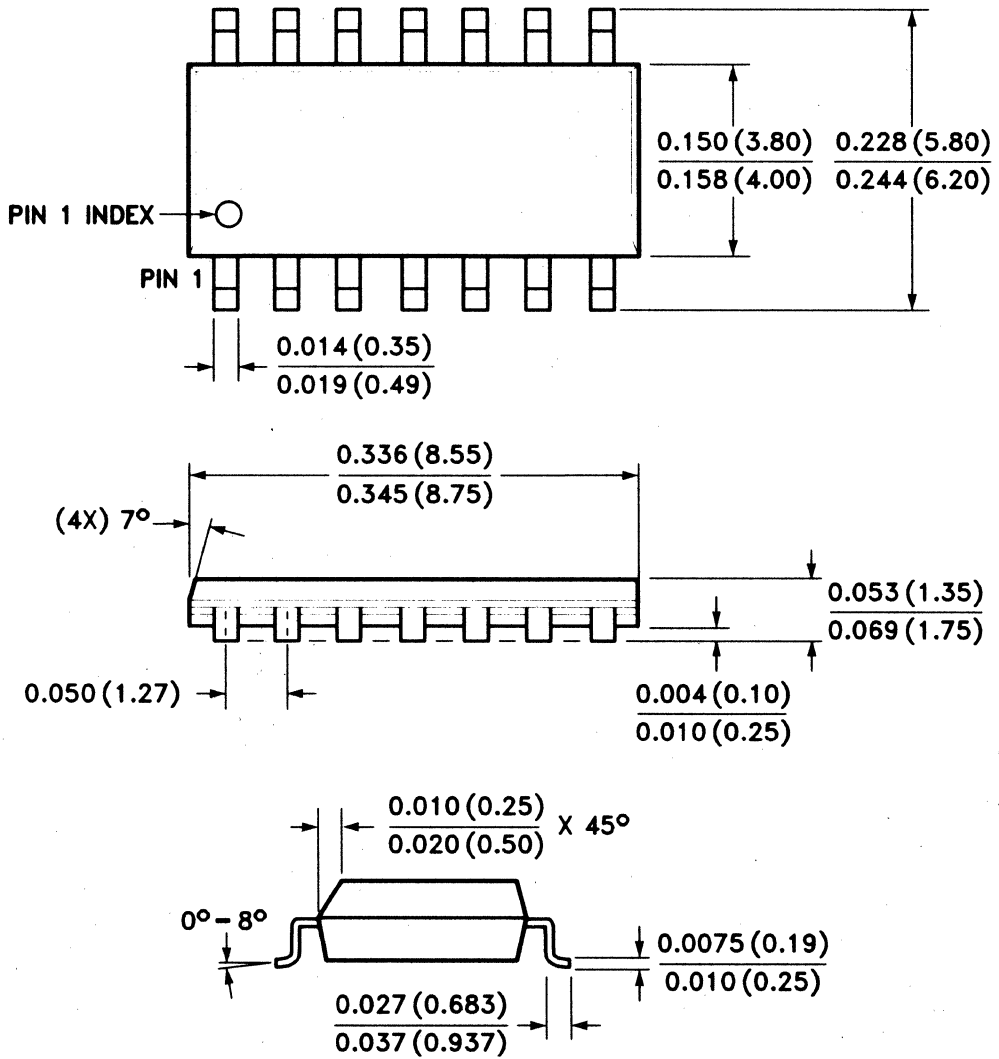
HD1008

NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

Xicor

Packaging Information

14-LEAD PLASTIC SMALL OUTLINE GULL WING PACKAGE TYPE S



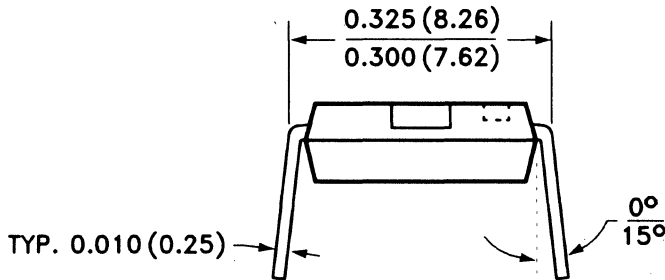
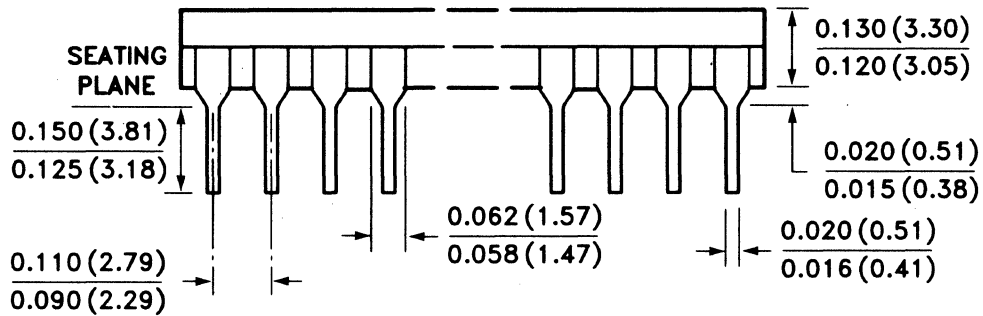
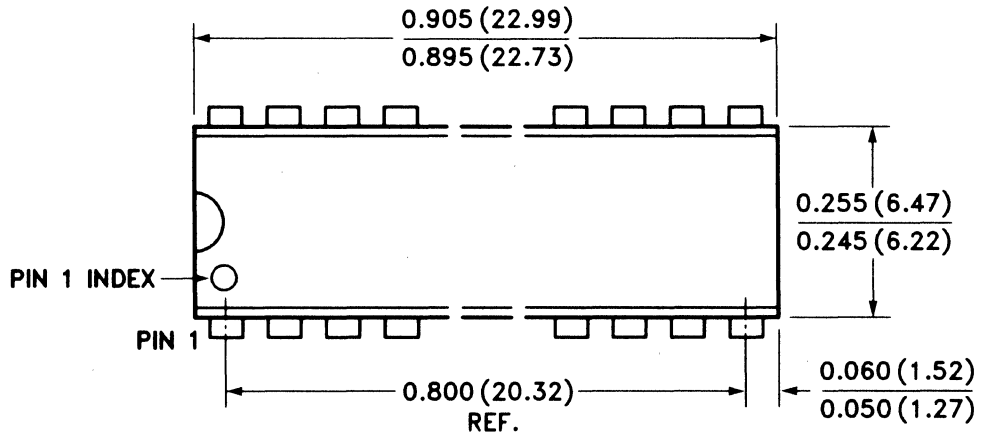
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

PSE014

Xicor

Packaging Information

18-LEAD PLASTIC DUAL IN-LINE PACKAGE TYPE P



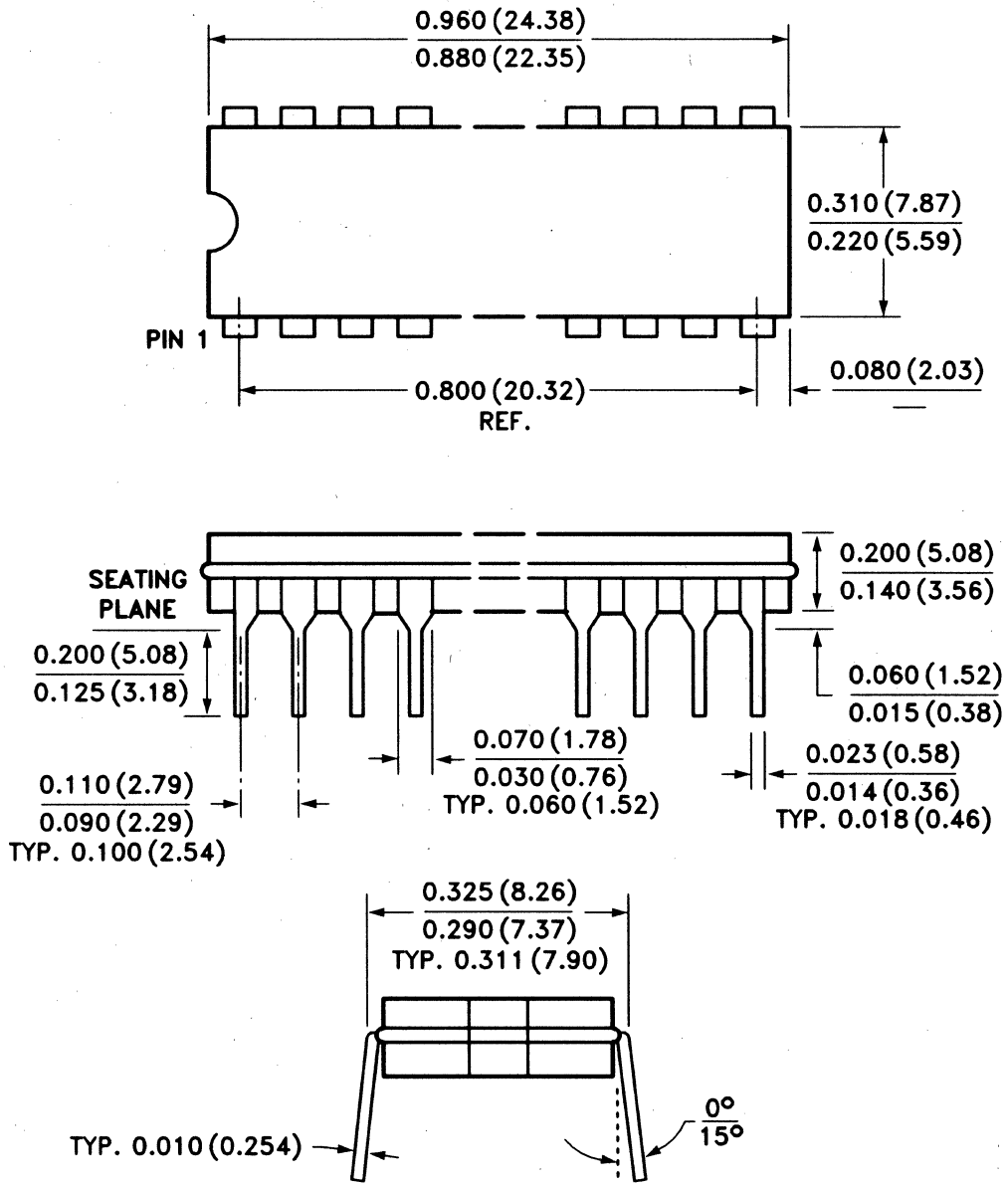
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

PPI018

Xicor

Packaging Information

18-LEAD HERMETIC DUAL IN-LINE PACKAGE TYPE D



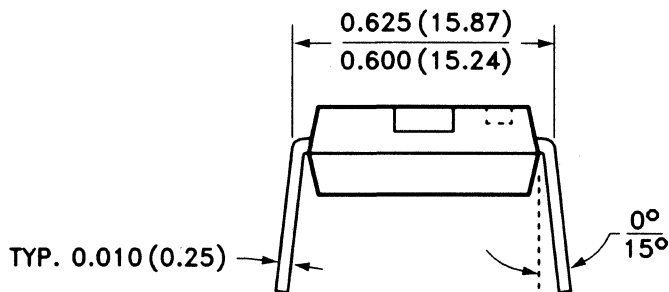
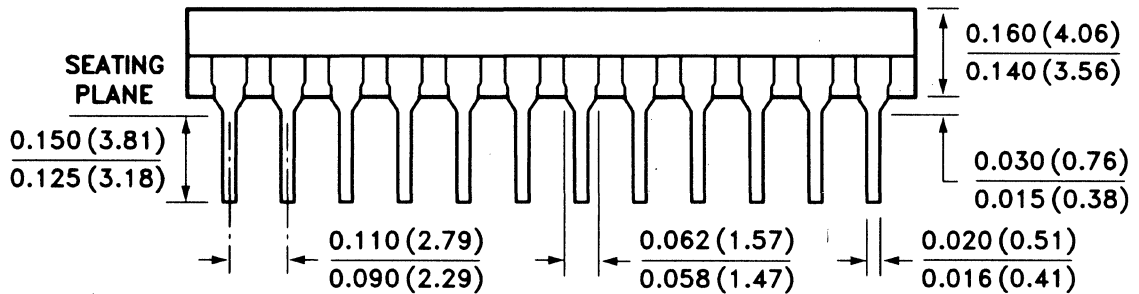
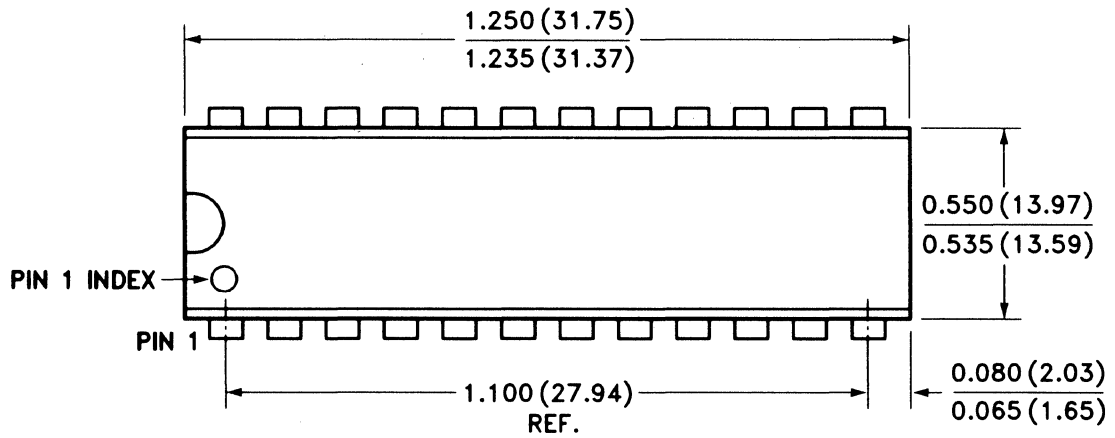
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

HD1018

Xicor

Packaging Information

24-LEAD PLASTIC DUAL IN-LINE PACKAGE TYPE P



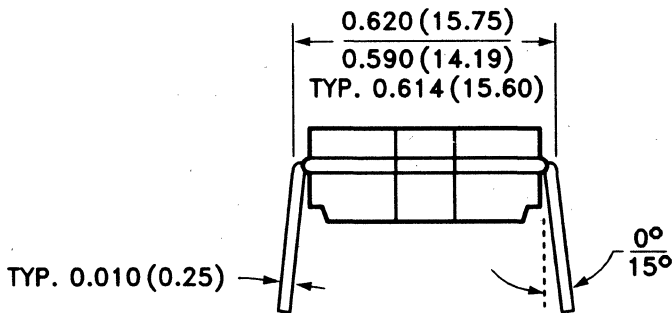
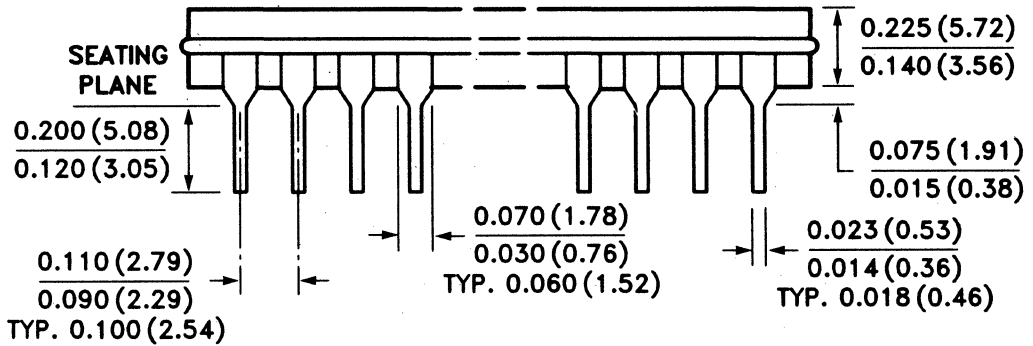
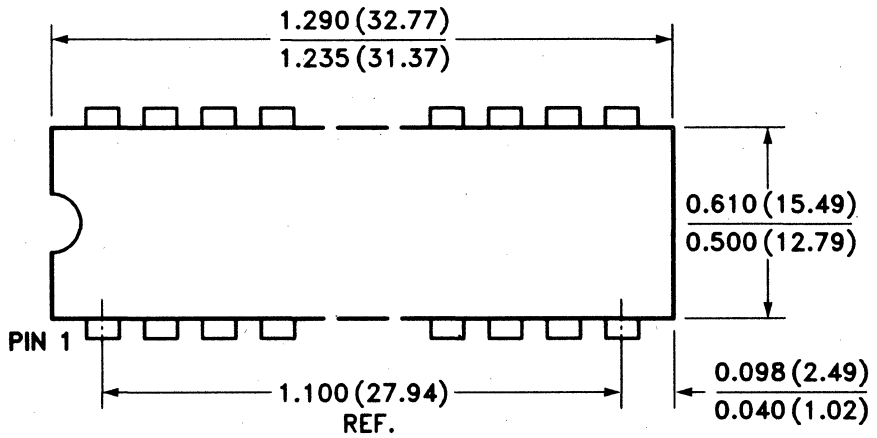
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

PPI024

Xicor

Packaging Information

24-LEAD HERMETIC DUAL IN-LINE PACKAGE TYPE D



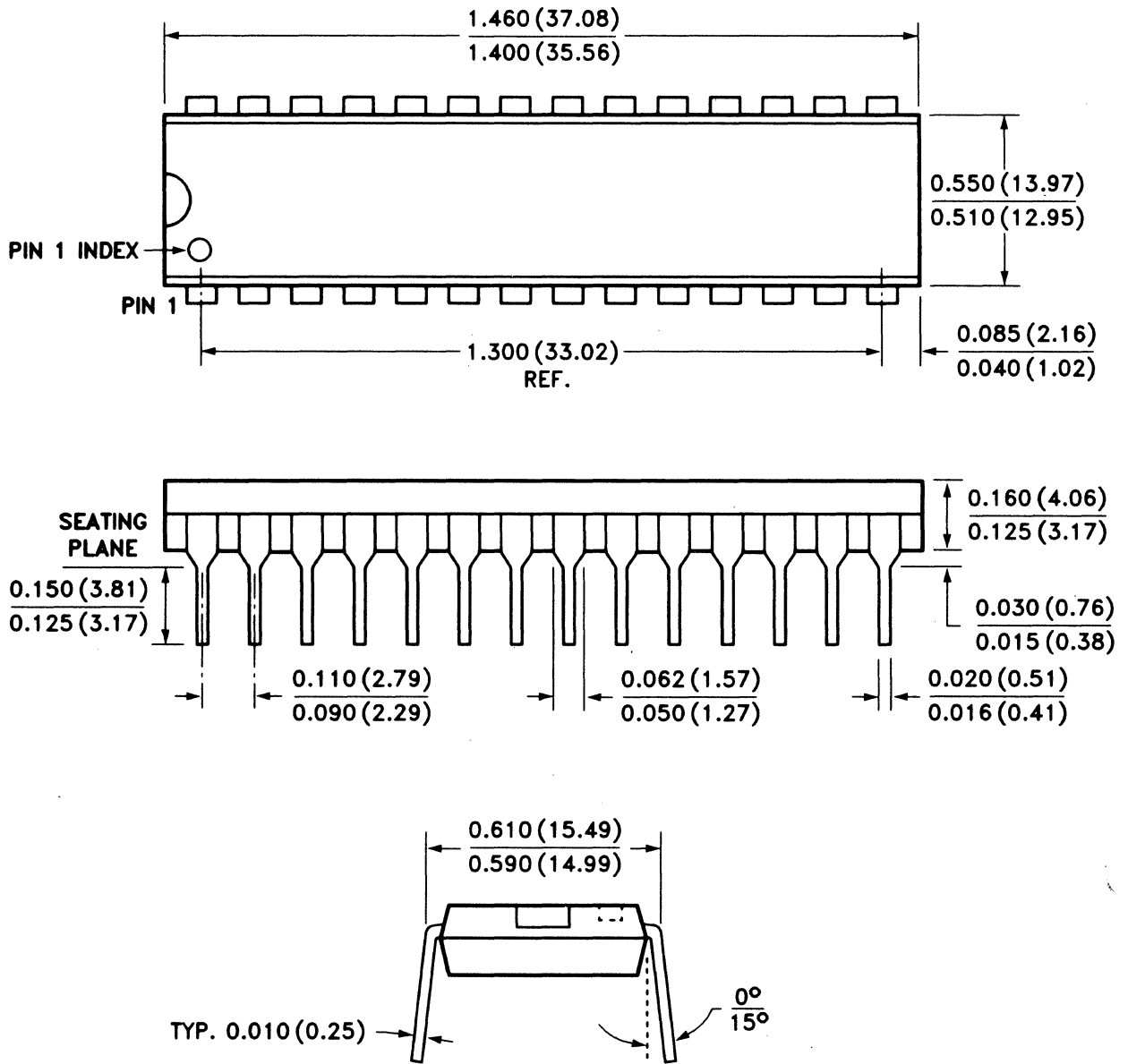
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

HDI024

Xicor

Packaging Information

28-LEAD PLASTIC DUAL IN-LINE PACKAGE TYPE P



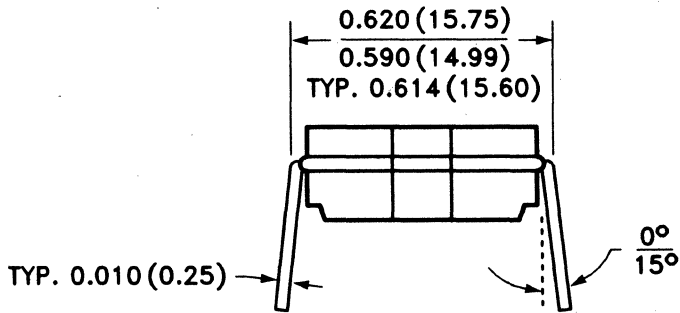
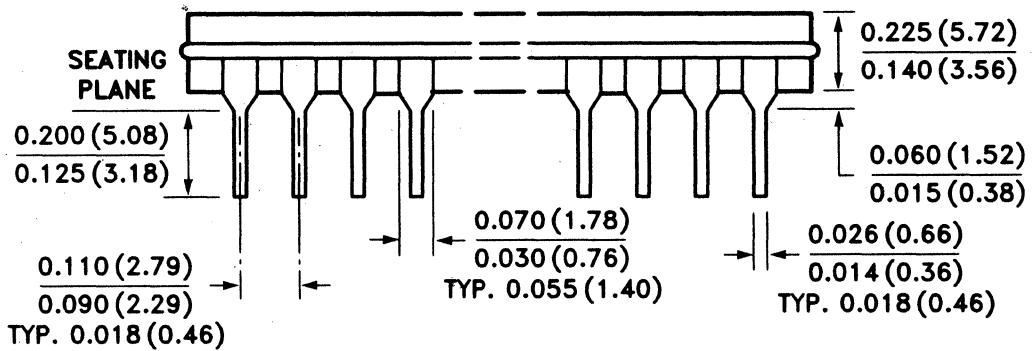
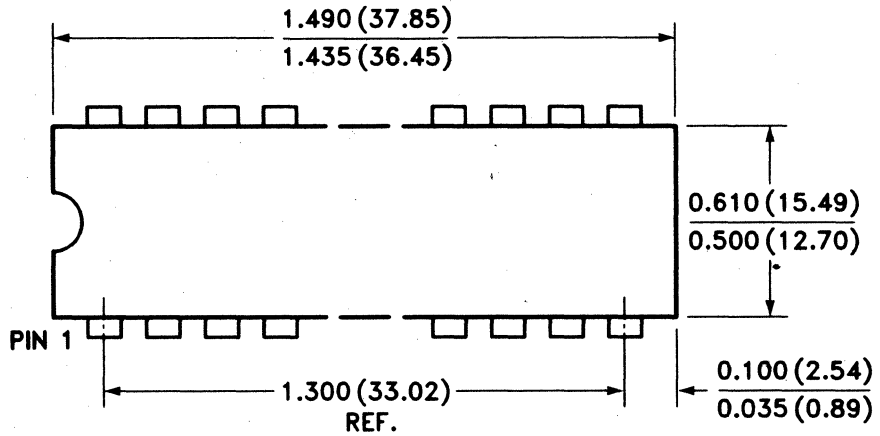
Xicor

PPI028

NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

Packaging Information

28-LEAD HERMETIC DUAL IN-LINE PACKAGE TYPE D



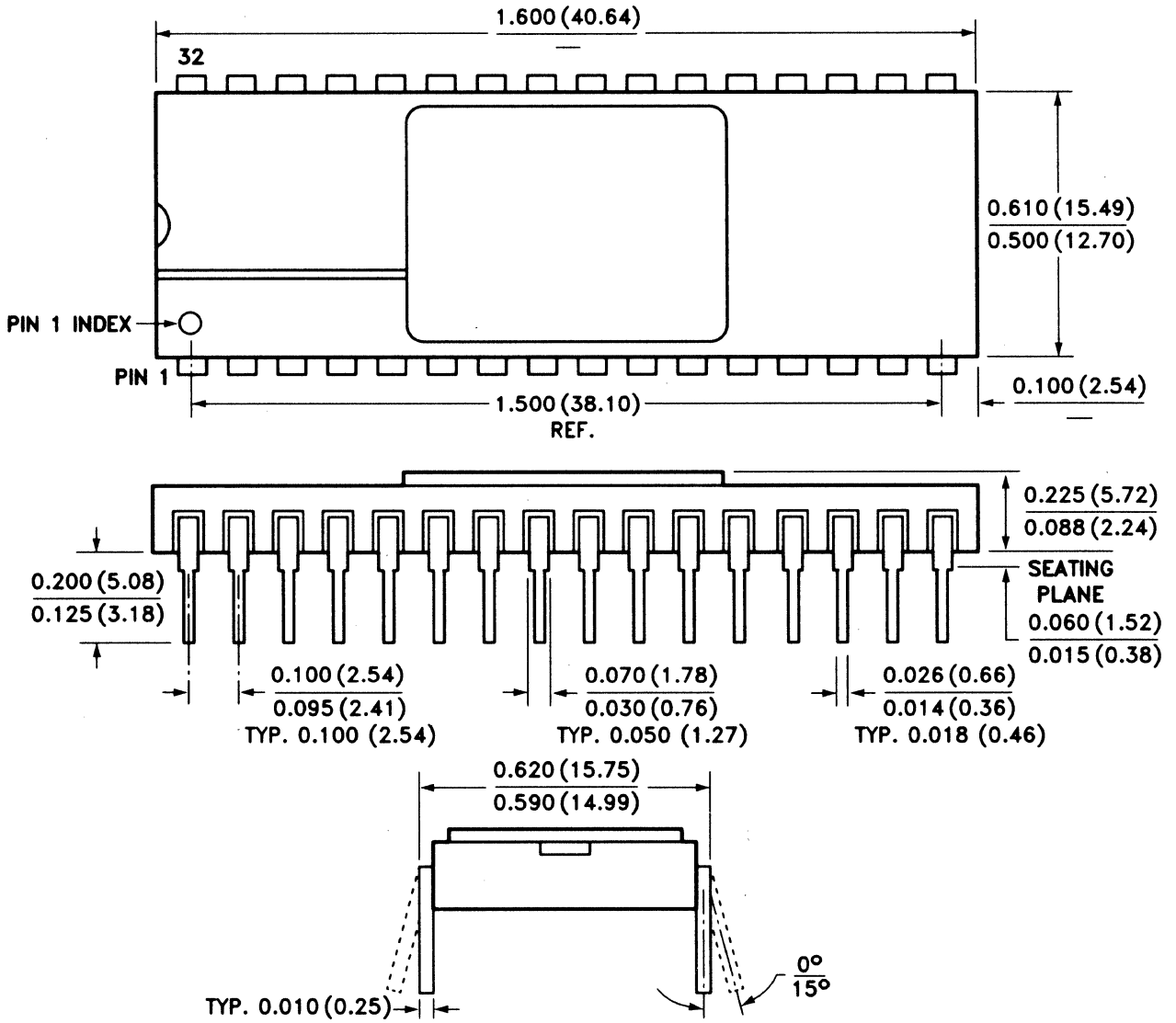
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

HDI028

Xicor

Packaging Information

32-LEAD SIDE BRAZE PACKAGE TYPE C



Xicor

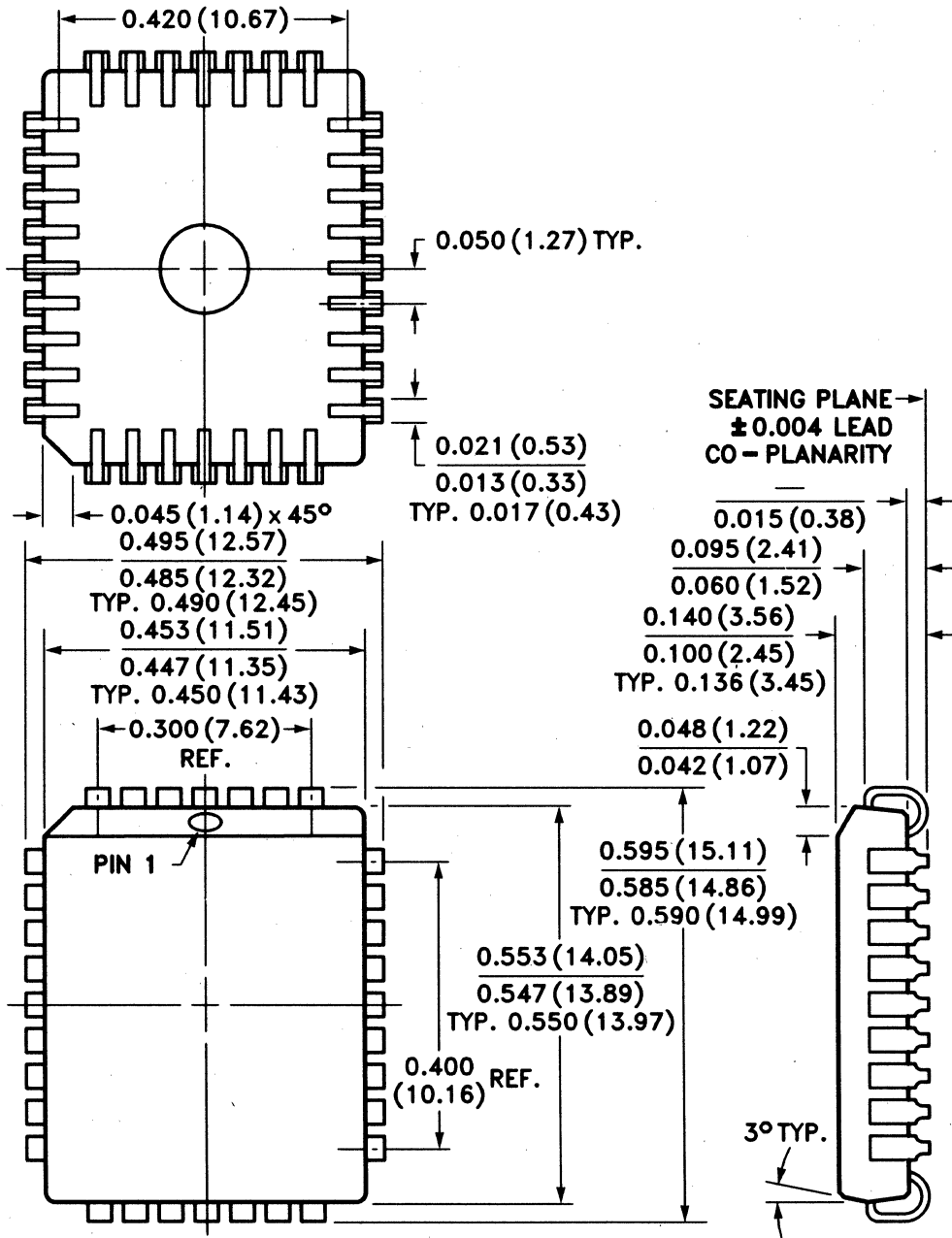
0CJ032

NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

Packaging Information

32-LEAD PLASTIC LEADED CHIP CARRIER PACKAGE TYPE J

Xicor



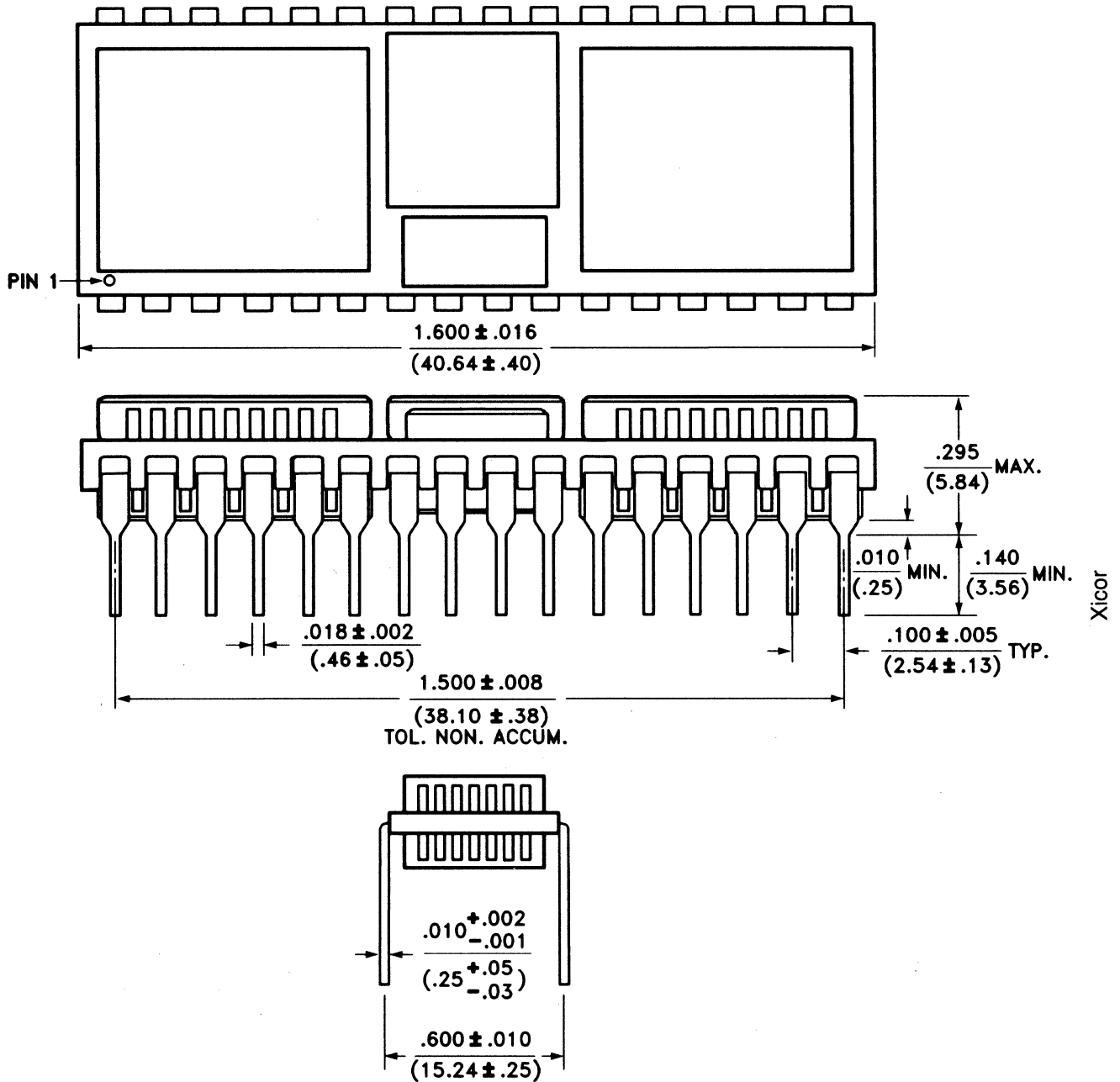
NOTES:

1. ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)
2. DIMENSIONS WITH NO TOLERANCE FOR REFERENCE ONLY

PJG032

Packaging Information

32-PIN DUAL-IN-LINE PACKAGE CERAMIC LEADLESS CHIP CARRIERS ON SIDE BRAZED CERAMIC SUBSTRATE

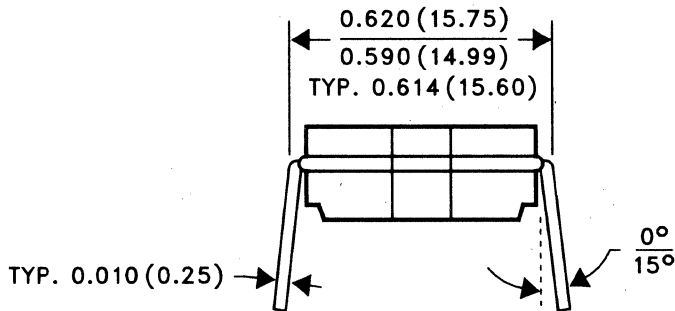
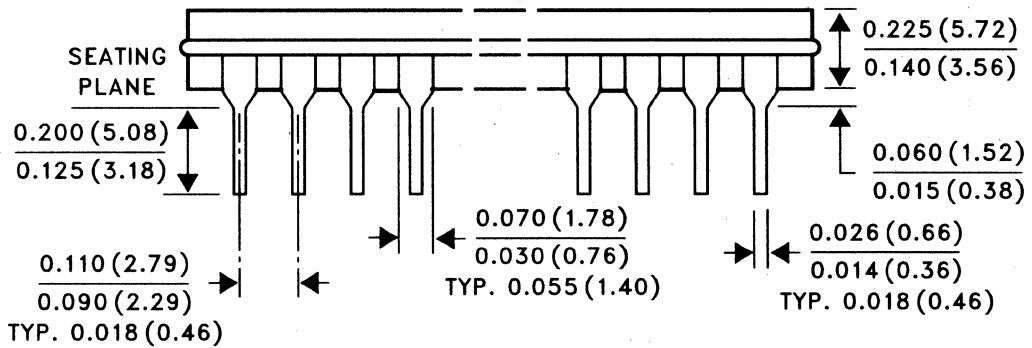
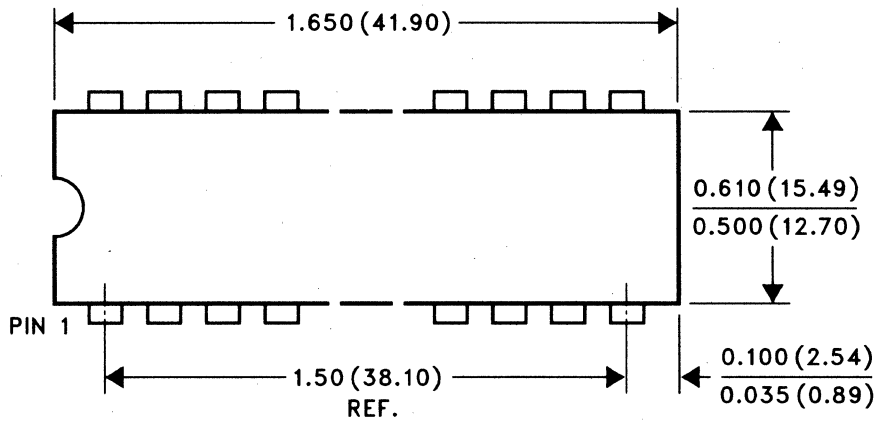


CEAA32

NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

Packaging Information

32-LEAD HERMETIC DUAL IN-LINE PACKAGE TYPE D



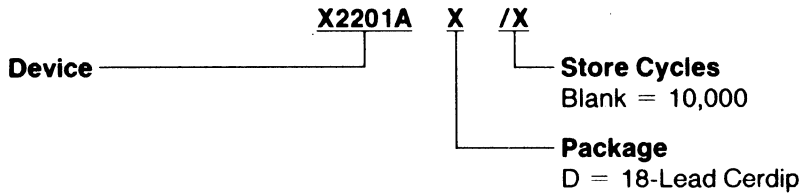
NOTE: ALL DIMENSIONS IN INCHES (IN PARENTHESES IN MILLIMETERS)

HDI032

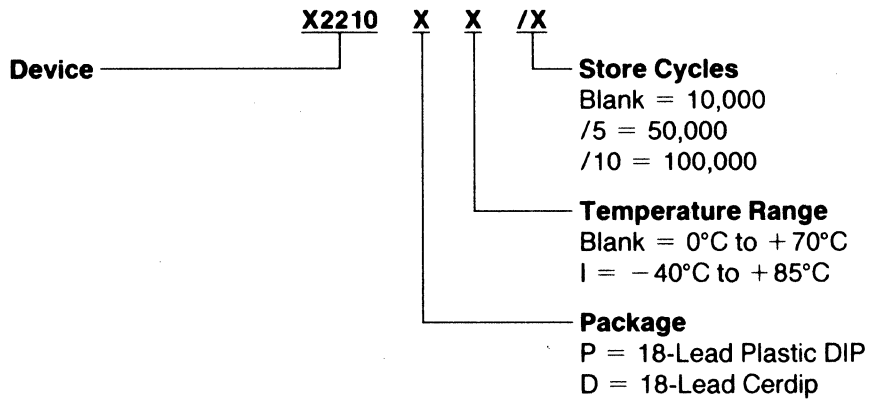
Xicor

Ordering Information

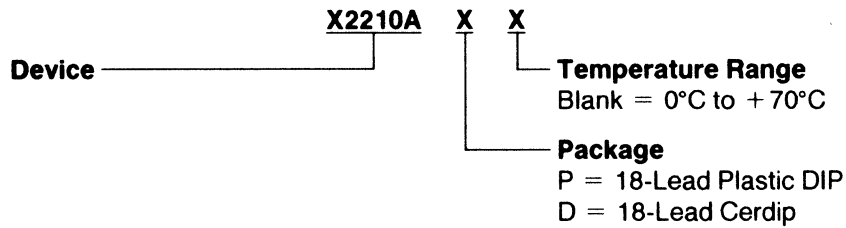
X2201A: 1024 x 1 NOVRAM



X2210: 64 x 4 NOVRAM



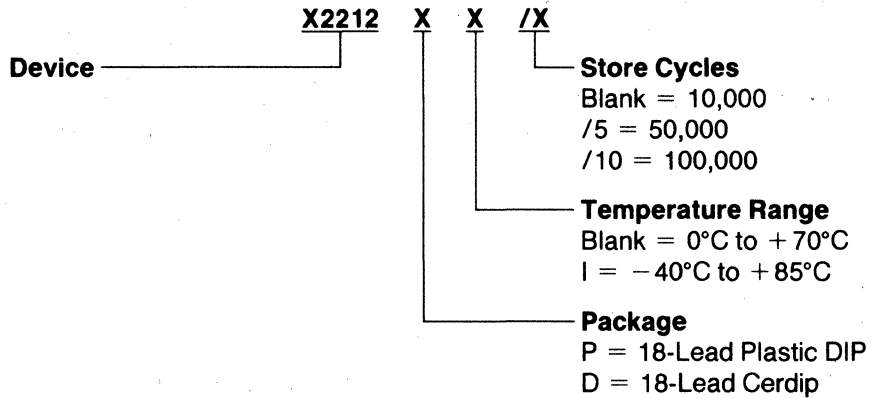
X2210A: 64 x 4 NOVRAM



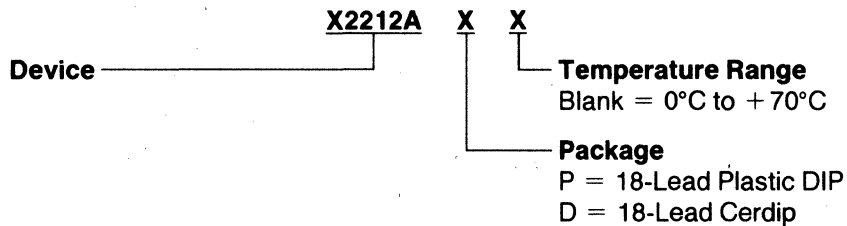
Xicor

Ordering Information

X2212: 256 x 4 NOVRAM

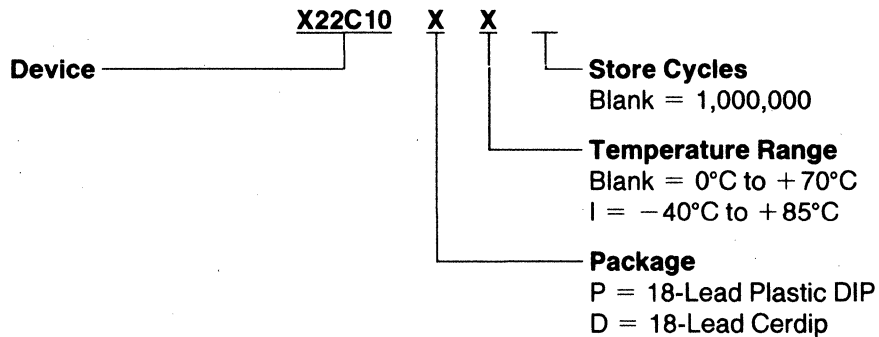


X2212A: 256 x 4 NOVRAM



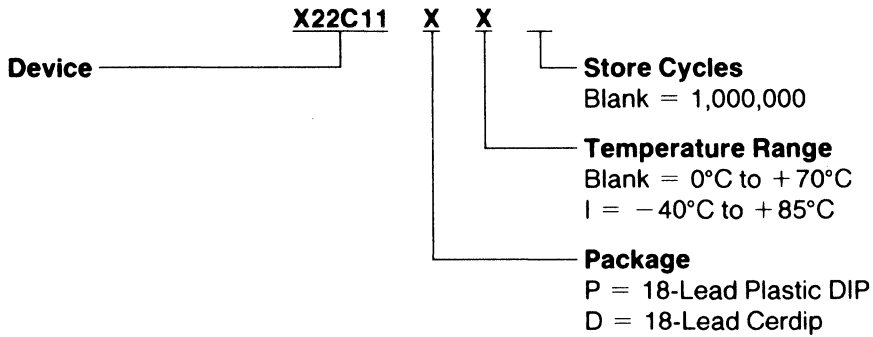
Xicor

X22C10: 64 x 4 CMOS NOVRAM

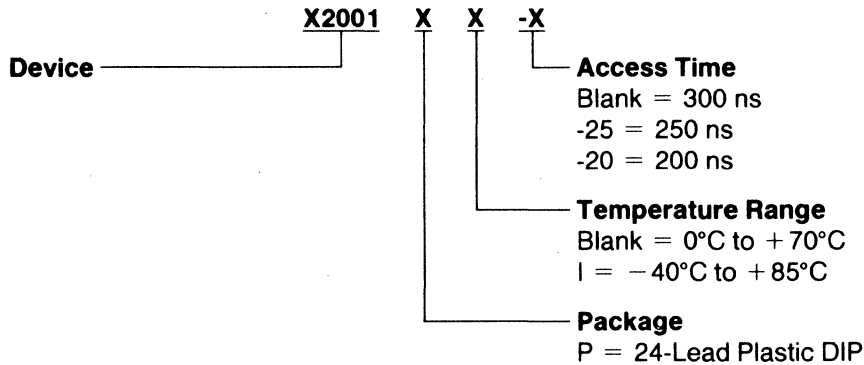


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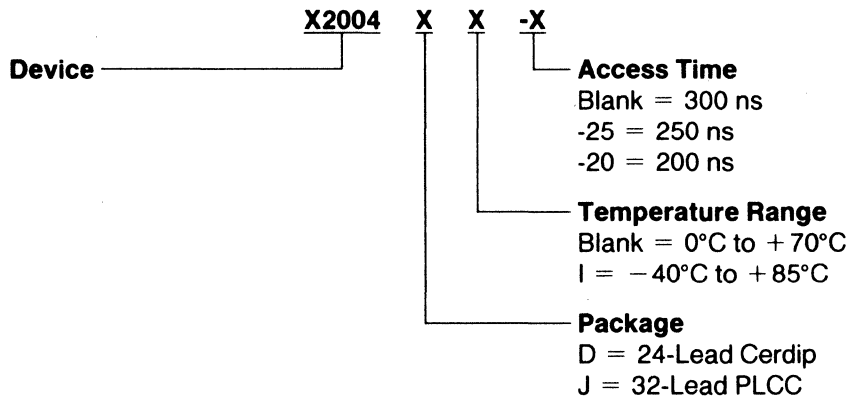
X22C11: 64 x 4 CMOS NOVRAM



X2001: 128 x 8 NOVRAM



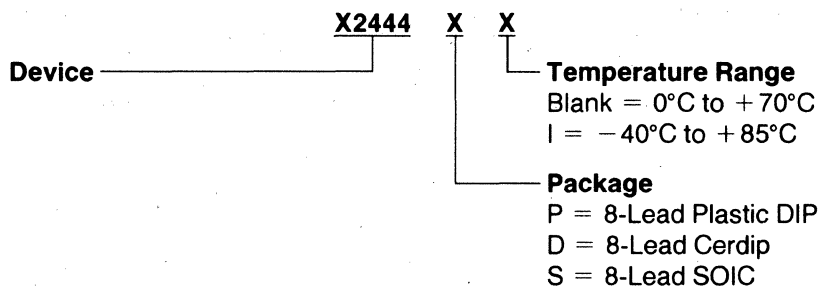
X2004: 512 x 8 NOVRAM



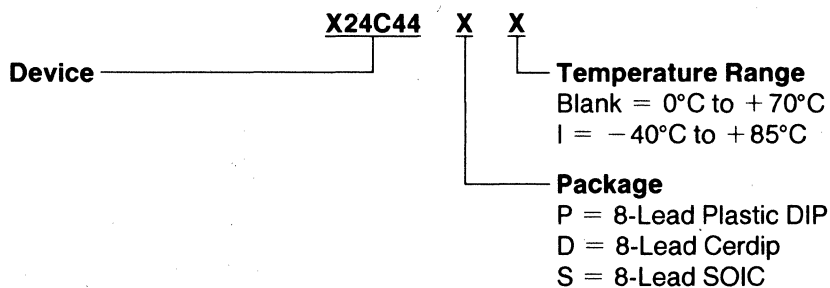
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Ordering Information

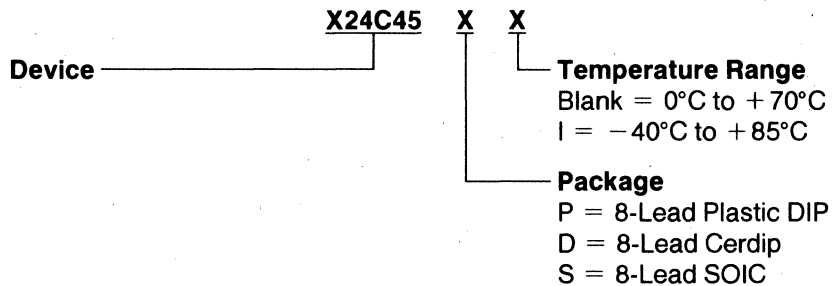
X2444: 16 x 16 Serial NOVRAM



X24C44: 16 x 16 CMOS Serial NOVRAM



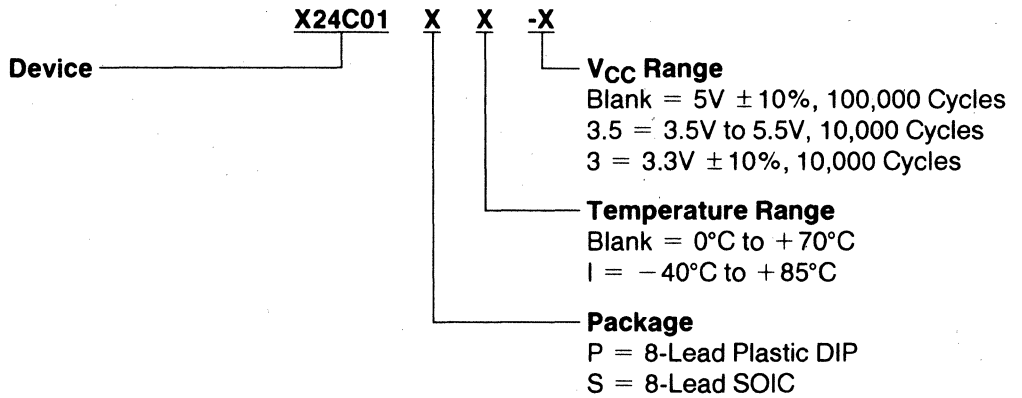
X24C45: 16 x 16 CMOS Serial NOVRAM



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Ordering Information

X24C01: 128 x 8 CMOS Serial E²PROM



Part Mark Convention

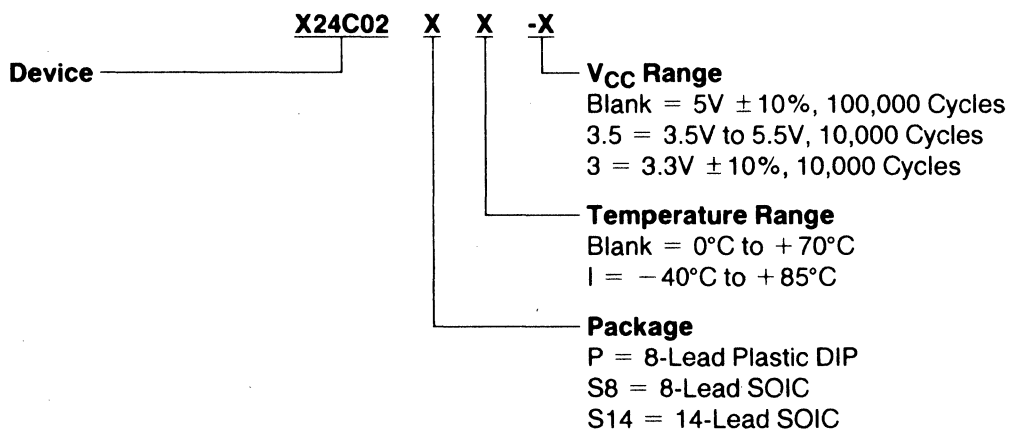
X24C01 X — Blank = 8-Lead SOIC
P = 8-Lead Plastic DIP

X
Blank = 5V ± 10%, 0°C to +70°C
I = 5V ± 10%, -40°C to +85°C
B = 3.5V to 5.5V, 0°C to +70°C
C = 3.5V to 5.5V, -40°C to +85°C
D = 3.3V ± 10%, 0°C to +70°C
E = 3.3V ± 10%, -40°C to +85°C

Xicor

Ordering Information

X24C02: 256 x 8 CMOS Serial E²PROM



Part Mark Convention

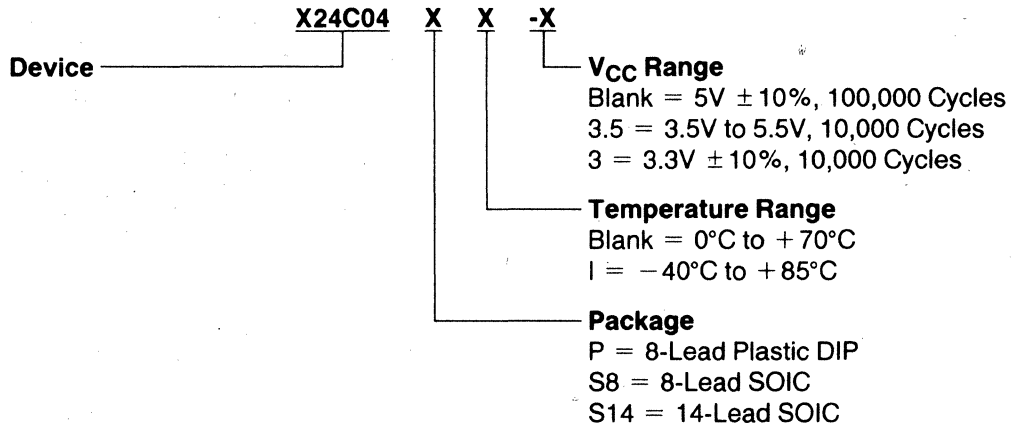
X24C02 X — Blank = 8-Lead SOIC
P = 8-Lead Plastic DIP
S = 14-Lead SOIC

X
Blank = 5V ± 10%, 0°C to +70°C
I = 5V ± 10%, -40°C to +85°C
B = 3.5V to 5.5V, 0°C to +70°C
C = 3.5V to 5.5V, -40°C to +85°C
D = 3.3V ± 10%, 0°C to +70°C
E = 3.3V ± 10%, -40°C to +85°C

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Ordering Information

X24C04: 512 x 8 CMOS Serial E²PROM



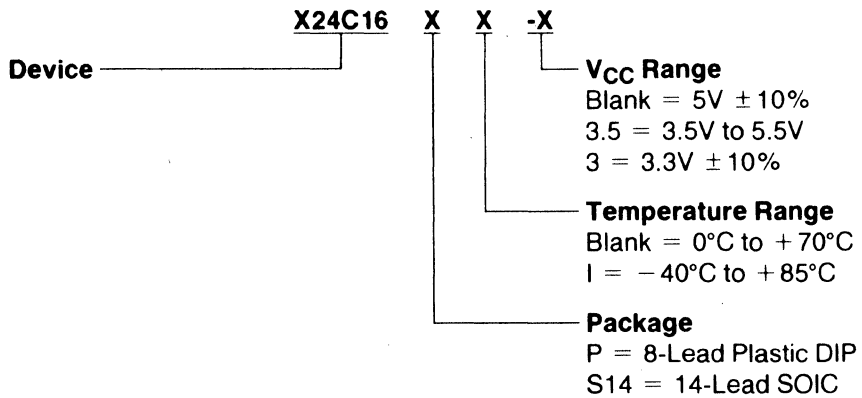
Part Mark Convention

X24C04 X — Blank = 8-Lead SOIC
P = 8-Lead Plastic DIP
S = 14-Lead SOIC

X
Blank = 5V ± 10%, 0°C to +70°C
I = 5V ± 10%, -40°C to +85°C
B = 3.5V to 5.5V, 0°C to +70°C
C = 3.5V to 5.5V, -40°C to +85°C
D = 3.3V ± 10%, 0°C to +70°C
E = 3.3V ± 10%, -40°C to +85°C

Ordering Information

X24C16: 2K x 8 CMOS Serial E²PROM



Part Mark Convention

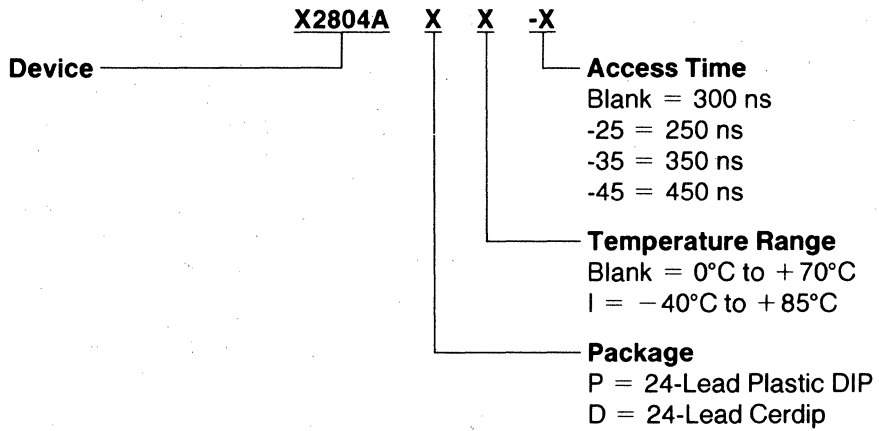
X24C16 X — P = 8-Lead Plastic DIP
S = 14-Lead SOIC

X
Blank = 5V ± 10%, 0°C to +70°C
I = 5V ± 10%, -40°C to +85°C
B = 3.5V to 5.5V, 0°C to +70°C
C = 3.5V to 5.5V, -40°C to +85°C
D = 3.3V ± 10%, 0°C to +70°C
E = 3.3V ± 10%, -40°C to +85°C

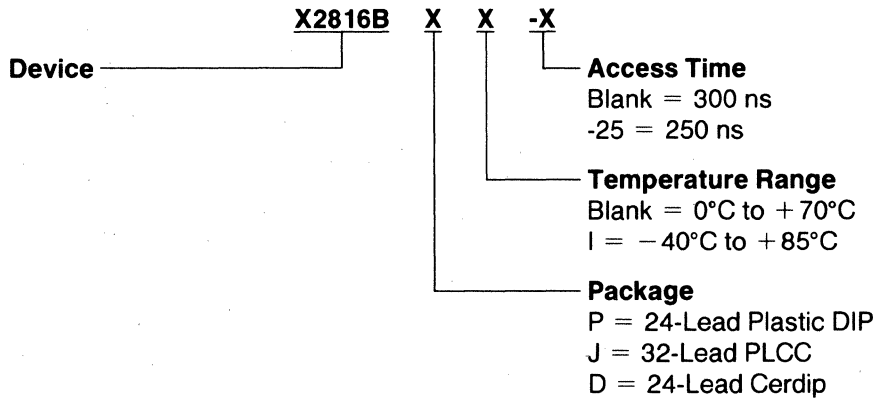
Xicor

Ordering Information

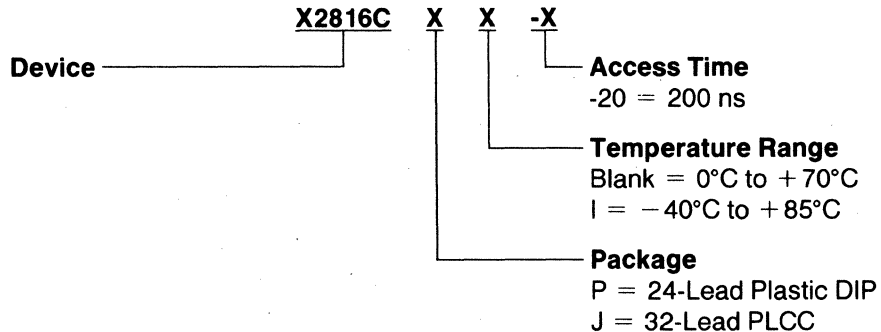
X2804A: 512 x 8 E²PROM



X2816B: 2K x 8 E²PROM



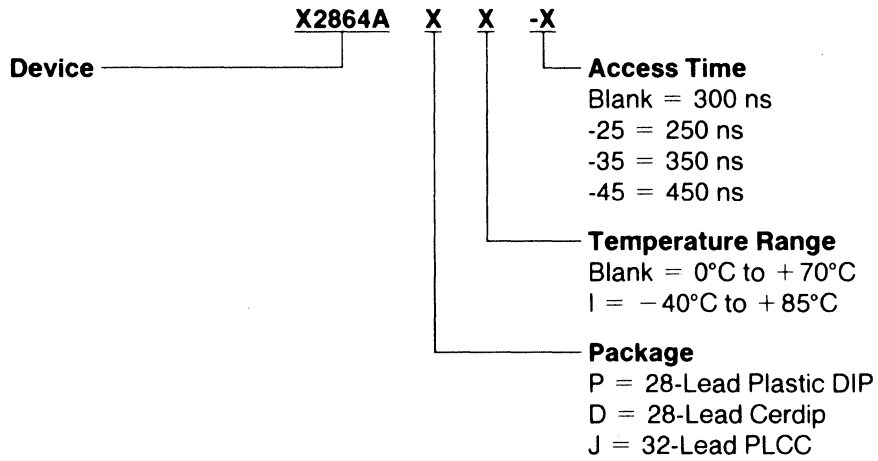
X2816C: 2K x 8 E²PROM



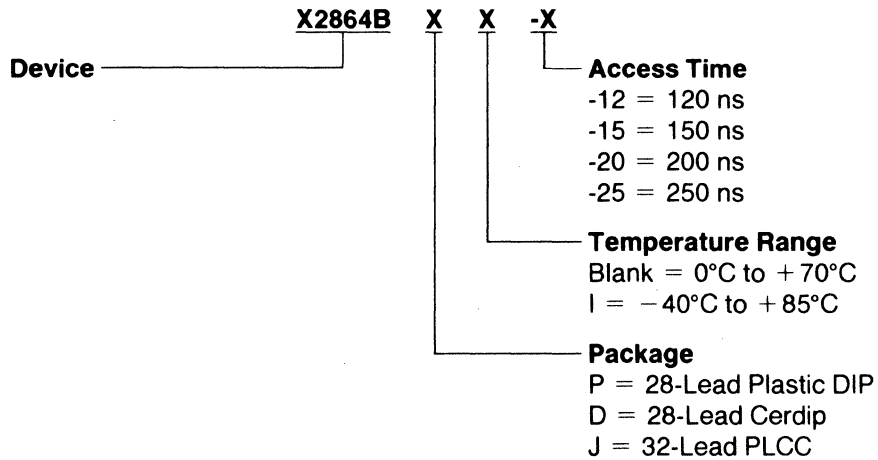
Xicor

Ordering Information

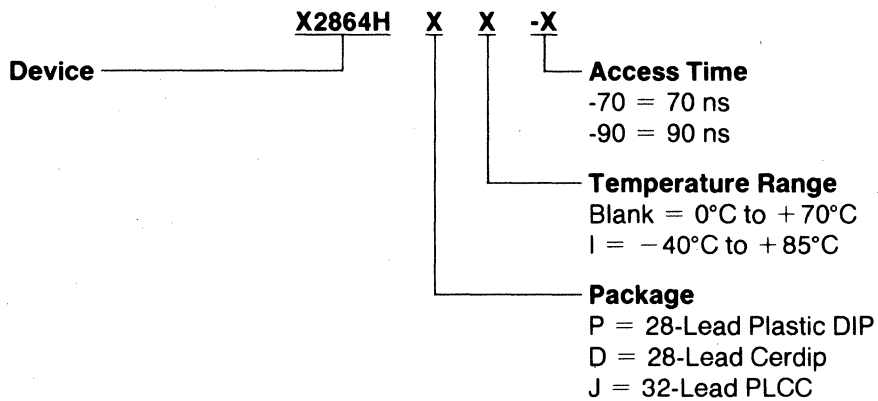
X2864A: 8K x 8 E²PROM



X2864B: 8K x 8 E²PROM



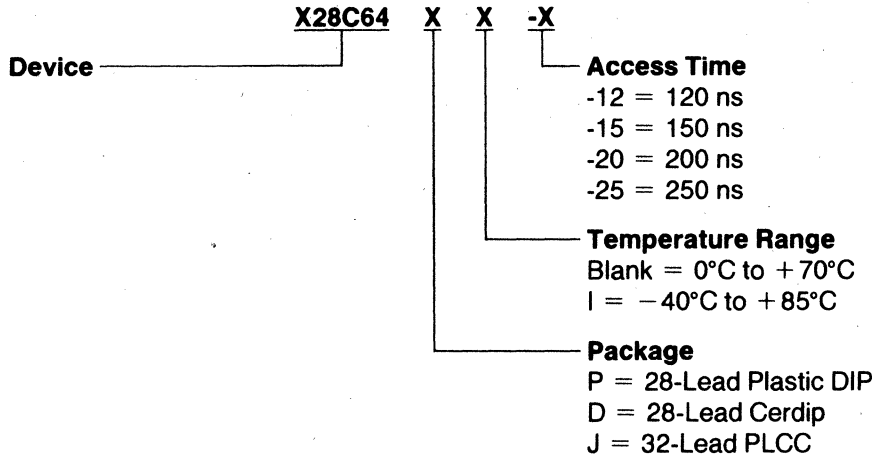
X2864H: 8K x 8 E²PROM



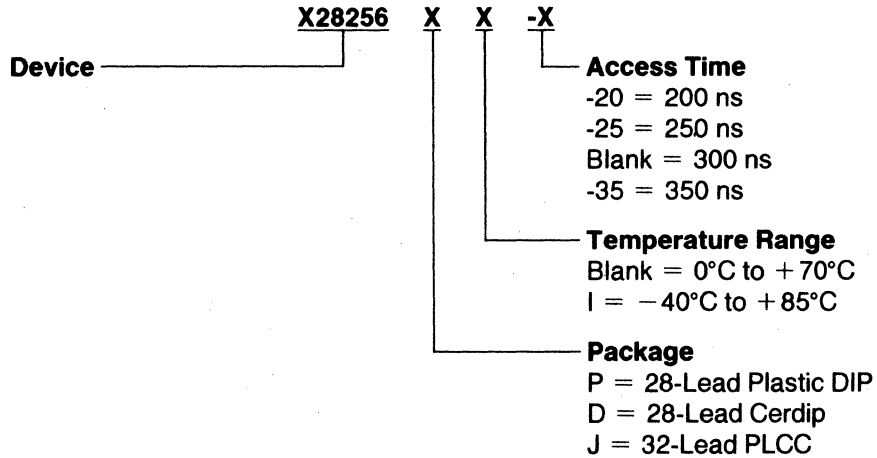
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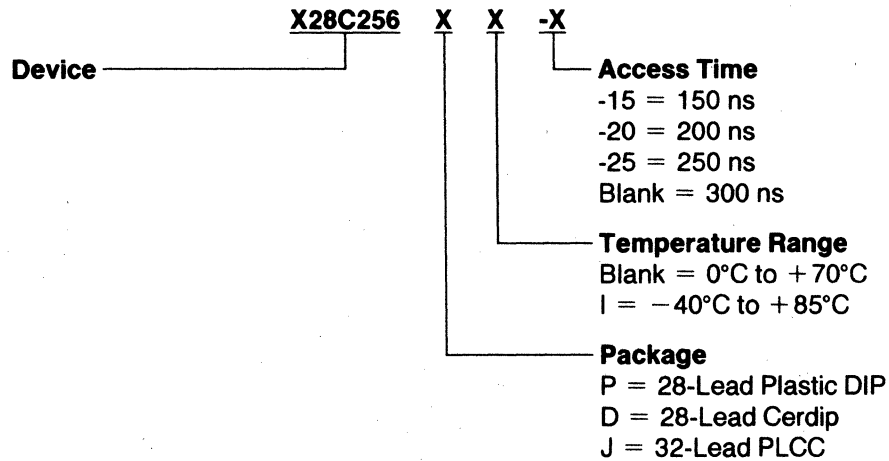
X28C64: 8K x 8 CMOS E²PROM



X28256: 32K x 8 E²PROM



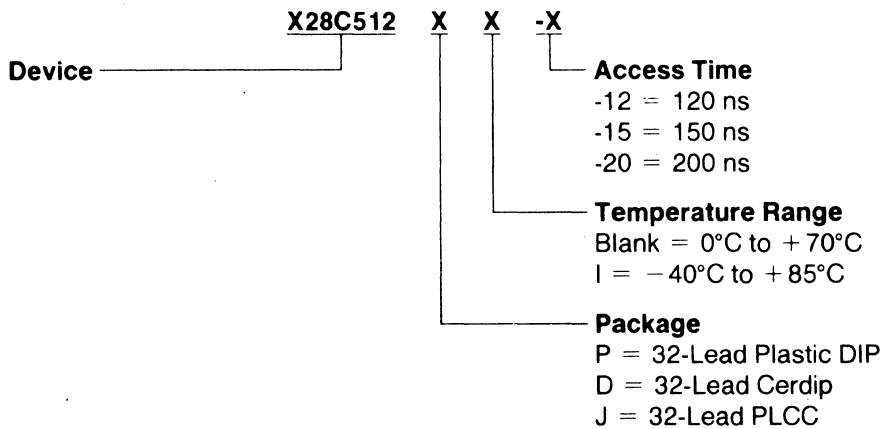
X28C256: 32K x 8 CMOS E²PROM



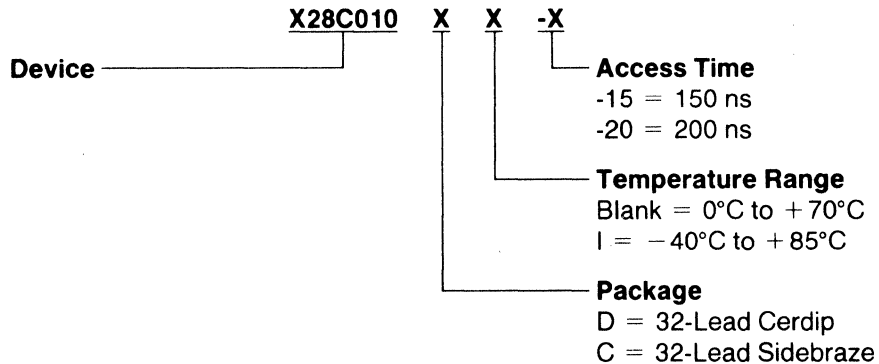
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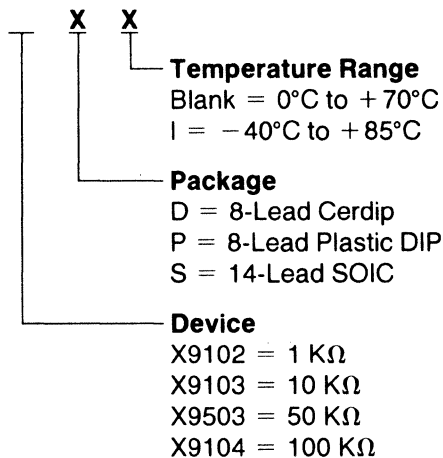
X28C512: 64K x 8 CMOS E²PROM



X28C010: 128K x 8 CMOS E²PROM



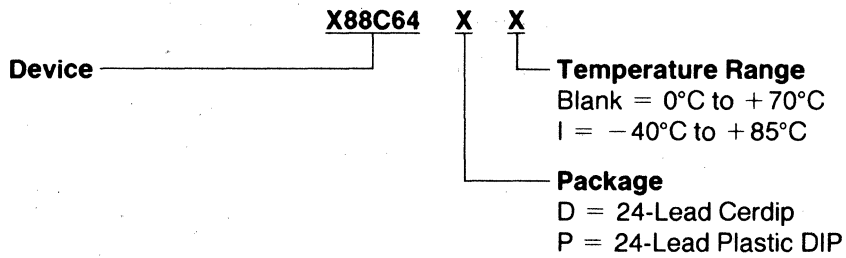
X9MME: E²POT 1K, 10K, 50K, 100K Ohms



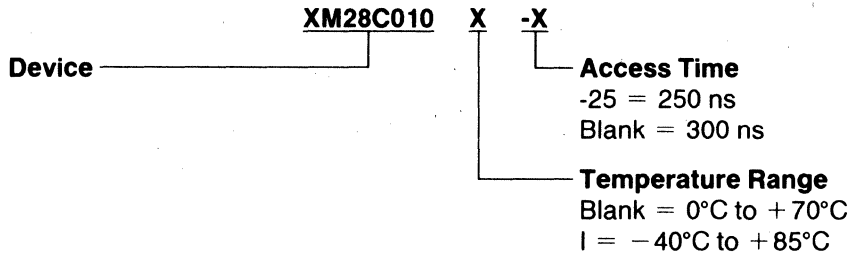
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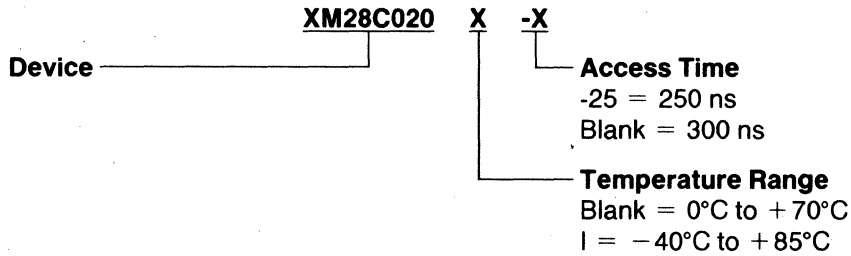
X88C64: 8K x 8 CMOS Peripheral E²PROM



XM28C010: 128K x 8 CMOS E²PROM Memory Module



XM28C020: 128K x 8 CMOS E²PROM Memory Module



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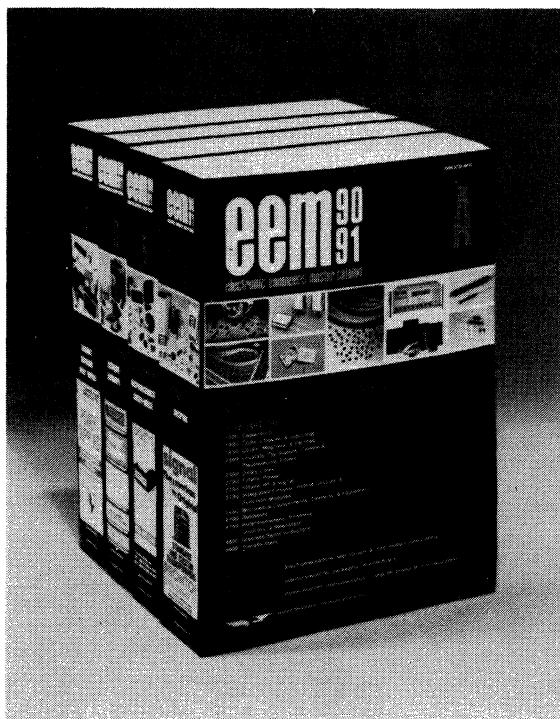
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XC4000 Logic Cell™ Array Family

Preliminary Product Description

FEATURES

- Third generation Field-Programmable Gate Array
 - Abundant flip-flops
 - Flexible function generators
 - On-chip fast RAM
 - Dedicated high-speed carry propagation circuit
 - Fast, wide decoders
 - Unlimited number of logic levels
 - Hierarchy of interconnect lines
 - Internal 3-state bus capability
- Flexible Array Architecture
 - Programmable logic blocks and I/O blocks
 - Programmable interconnects and wide decoders
- Sub-micron CMOS Process
 - High speed
(toggle/shift rate >100 MHz, counters >50 MHz)
 - Low power consumption
- Systems-Oriented Features
 - Slew-rate limited outputs
 - Programmable input pull-up or pull-down resistors
 - 24-mA output sink current from paired outputs
- Configured by Loading Binary File
 - Unlimited re-programmability
 - Six programming modes
- XACT™ Development system runs on '386-type PC and on Apollo, Sun-3, Sun-4, and DECstation 3100
 - Interfaces to popular design environments like FutureNet, VIEWlogic, Mentor Graphics and OrCAD
 - Fully automatic partitioning, placement and routing
 - Interactive design editor for design optimization
 - 276 soft macros, 50 hard macros, RAM/ROM compiler

Xilinx

DESCRIPTION

The XC4000 family of Field Programmable Gate Arrays provides the benefits of custom CMOS VLSI, while avoiding the initial cost, time delay, and inherent risk of a conventional masked gate array.

The result of experience gained with two successful previous FPGA families (XC2000 and XC3000), the XC4000 family provides a regular, flexible, programmable architecture of Configurable Logic Blocks, interconnected by a powerful hierarchy of versatile and abundant routing resources, and surrounded by a perimeter of programmable I/O blocks.

The devices are customized by loading configuration data into the internal memory cells. The FPGA can either actively read its configuration data out of external serial or byte-parallel PROM (master modes), or the configuration data can be written into the FPGA (slave and peripheral modes).

The XC4000 family is supported by powerful and sophisticated software, covering every aspect of design: from schematic entry, to simulation, to automatic block placement and routing of interconnects, and finally the creation of the configuration bit stream.

Since Xilinx FPGAs can be re-programmed an unlimited number of times, they can be used in innovative designs where hardware is changed dynamically, or where hardware must be adapted to different user applications.

FPGAs are ideal for shortening the design and development cycle, but they also offer a cost-effective solution for production rates well beyond 1000 systems per month.

Device:	XC4002	4003	4004	4005	4006	4008	4010	4013	4016	4020
Appr. Gate Count:	2,000	3,000	4,000	5,000	6,000	8,000	10,000	13,000	16,000	20,000
CLB Matrix:	8 x 8	10 x 10	12 x 12	14 x 14	16 x 16	18 x 18	20 x 20	24 x 24	26 x 26	30 x 30
Number of CLBs:	64	100	144	196	256	324	400	576	676	900
Max RAM bits:	2,048	3,200	4,608	6,272	8,192	10,368	12,800	18,432	21,632	28,800
Number of IOBs	64	80	96	112	128	144	160	192	208	240

Table 1. The XC4000 Family of Field-Programmable Gate Arrays

XILINX INC., 2100 LOGIC DRIVE, SAN JOSE, CA 95124 (408) 559-7778

XC4000 Compared to XC3000

For those readers already familiar with the XC3000 family of Xilinx Field Programmable Gate Arrays, here is a concise list of the major new features in the XC4000 family.

CLB has two **Independent** 4-input function generators. A **third** function generator combines the outputs of the two other function generators with a ninth input. All function inputs are swappable, all have full access; none are mutually exclusive.

CLB has **very fast arithmetic carry** capability. CLB function generator table can be used as high-speed **RAM**.

CLB flip-flops have asynchronous set or reset. CLB has **four outputs**, two flip-flops, two combinatorial. CLB connections symmetrically located on all **four edges**.

IOB has more versatile clocking. IOB has programmable input set-up time: **long** to avoid potential hold time problems, **short** to improve performance.

IOB has Long Line access through special TBUF. Outputs are **n-channel only**, lower VOH increases speed, outputs do not clamp to Vcc.

Outputs can be paired to increase sink current to **24 mA**.

IEEE 1149.1- type **boundary scan** is supported in the I/O.

Wide decoders on all four edges of the LCA.

Greatly increased number of **Interconnect resources**. All CLB inputs and outputs have access to most **Interconnect lines**.

Switch Matrices are simplified to increase speed. **Eight global nets** can be used for clocking or distributing logic signals.

TBUF output configuration is more versatile and 3-state control less confined.

Program is single-function input pin, overrides everything. **INIT Pin** also acts as Configuration Error output.

Synchronous Peripheral Mode (8 bit) has been added. **Asynchronous Peripheral Mode** has improved hand-shake.

Start-up can be **synchronized** to the system clock (configuration option).

No Powerdown, but instead a **Global 3-state Input** that does not reset any flip-flops.

No on-chip **XTAL oscillator** amplifier.

Configuration Bit Stream includes **CRC error checking**. **Configuration Clock** can be sped up to **>8 MHz**.

Configuration Clock is **fully static**, no constraint on the maximum Low time.

Readback either ignores flip-flop content (avoids need for masking) or it takes a **snapshot** of all flip-flops at the start of Readback.

Readback has same **polarity** as Configuration and can be **aborted**.

Xilinx

Parameter	XC4000	XC3000	XC2000
Max number of flip-flops	2280	928	174
Max number of user I/O	240	144	74
Max number of RAM bits	28,800	0	0
Function generators per CLB	3	2	2
Number of logic inputs per CLB	9	5	4
Number of logic outputs per CLB	4	2	2
Number of low-skew global nets	8	2	2
Dedicated decoders	yes	no	no
Fast carry logic	yes	no	no
Internal 3-state drivers	yes	yes	no
Output slew-rate control	yes	yes	no
Power-down option	no	yes	yes
Crystal oscillator circuit	no	yes	yes

Table 2. Three Generations of Xilinx Field-Programmable Gate Array Families

Product Brief

FEATURES

- Fully user-programmable CMOS gate array
 - Flexible internal array architecture
 - 2000–9000 equivalent gates
 - 256–928 Flip-flops
 - 58–144 user Input/Outputs
- Minimum risk
 - Standard product; 100% factory tested
 - No customization
- Second generation architecture
 - 5 input-variable CLB's
 - 2 flip-flops per CLB and IOB
 - Enhanced routing resources
 - Tri-state drivers for wide AND's
- Complete development system support
 - XACT Design Editor
 - XACTOR In Circuit Design Verifier
 - Library and User Macros
 - Delay Path Calculator
 - Logic and Timing Simulation
 - Auto Place/Route
 - Schematic Capture for design entry

DESCRIPTION

The XC30XX Logic Cell™ Array (LCA) is a second generation, high performance, static, CMOS integrated circuit. Its extendable, user-programmable array architecture is composed of a configuration program store plus three types of configurable elements: a perimeter of I/O Blocks, a core array of Logic Blocks and an interleaved Interconnect. The XACT development system allows the user to define the logic functions of the device. Schematic capture and auto place-and-route are available for design entry, while logic and timing simulation, and in-circuit debugging are available for design verification. XACT is used to compile the data pattern which represents the configuration program. This data can then be converted to a PROM programmer format file to create the configuration program storage.

The Logic Cell Array's user logic functions and interconnections are determined by the configuration program data stored in internal static memory cells. The program can be loaded in any of several modes to accommodate various system requirements. The 30XX's resources are

programmed to form networks carrying logic signals among blocks, analogous to traces on a printed circuit board connecting MSI/SSI packages.

CONFIGURATION MEMORY

Compared with other programming alternatives, static memory provides the best combination of high density, high performance, high reliability and comprehensive testability. The static memory cell used for the configuration memory in the LCA has been designed specifically for high reliability and noise immunity. The basic memory cell consists of two CMOS inverters plus a pass transistor used for writing and reading cell data. The cell is only written during configuration and only read during readback. During normal operation the pass transistor is "off" and does not affect the stability of the cell.

The memory cell outputs Q and \bar{Q} use full Ground and Vcc levels and provide continuous, direct control. The additional capacitive load together with the absence of address decoding and sense amplifiers provide stability to the cell. Due to the structure of the configuration memory cells they are not affected by extreme power supply excursions or very high levels of alpha particle radiation. In reliability testing no soft errors have been observed, even in the presence of very high doses of alpha radiation.

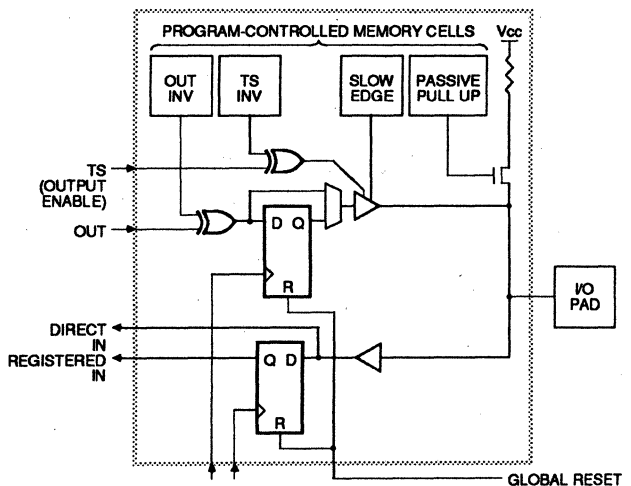


Figure 1. I/O Block

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I/O BLOCK

Each of the user configurable I/O Blocks (IOB) provides an interface between the external package pin of the device and the internal user logic. The I/O Block includes both registered and direct input paths. Each package pin provides a programmable three-state output buffer which may be driven by a registered or direct output signal. Configuration options allow inversion, slew rate selection and a high impedance pull-up. See Figure 1.

CONFIGURABLE LOGIC BLOCK

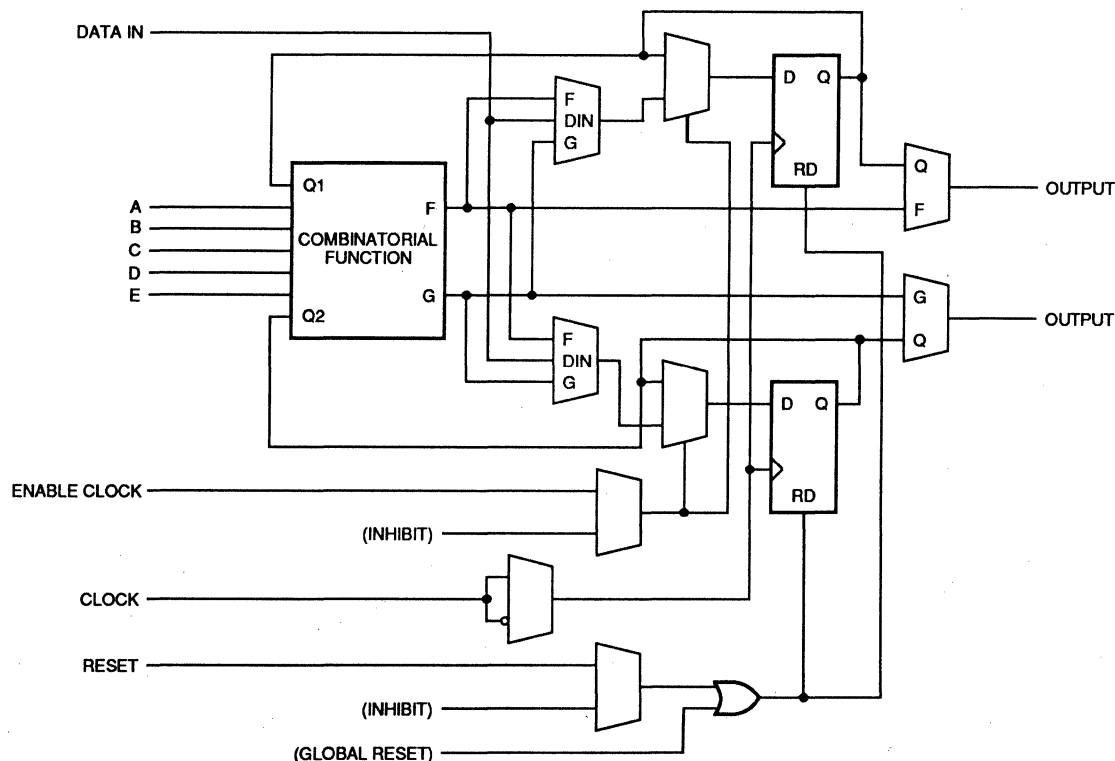
The array of Configurable Logic Blocks (CLBs) provides the functional elements from which the user's logic is constructed. Each configurable logic block has a combinatorial logic section, two flip-flops, and an internal control section. See Figure 2. There are: five logic inputs (A–E); a common clock; an asynchronous direct reset; an enable clock; and a direct flip-flop input, all of which may be driven from the interconnect resources. Each CLB also has two outputs which drive interconnect networks. Data input for either flip-flop within a CLB is supplied from the function F

or G outputs of the combinatorial logic, or the block input, data-in.

The combinatorial logic portion of the CLB uses a program memory 32 by 1 table look-up to implement Boolean functions. Variables selected from the five logic inputs and two internal block flip-flops are used as table address inputs. The combinatorial propagation delay through the network is independent of the logic function generated and is spike free for single input variable changes. This technique can generate two independent logic functions of up to four variables each, or a single function of five variables, or some functions of seven variables.

PROGRAMMABLE INTERCONNECT

Programmable Interconnection resources in the Logic Cell Array provide routing paths to connect inputs and outputs of the I/O and logic blocks into logical networks. All interconnections between blocks are composed from a grid of metal segments. Specially designed pass transistors, each controlled by a configuration bit, allow the configuration program to determine the networks.



Xilinx

485 01

Figure 2. 3000 Series Configurable Logic Block (CLB)

Product Brief

FEATURES

- Fully user-programmable:
 - I/O functions
 - Digital logic functions
 - Interconnections
- General-purpose array architecture
- Complete user control of design cycle
- Compatible arrays with logic cell complexity equivalent to 1200 and 1800 usable gates
- Standard product availability
- 100% factory-tested
- Selectable configuration modes
- Low-power, CMOS, static memory technology
- Three performance options: 33 MHz, 50 MHz, 70 MHz
- TTL or CMOS input thresholds
- Complete development system support
 - XACT Design Editor
 - Schematic Entry
 - XACTOR In Circuit Debugger
 - Macro Library
 - Timing Calculator
 - Logic and Timing Simulator
 - Auto Place / Route

DESCRIPTION

The Logic Cell™ Array (LCA) is a high density CMOS programmable gate array. Its patented array architecture is made up of three types of configurable elements: Input/Output Blocks, Configurable Logic Blocks and Interconnect. The designer can define individual I/O blocks for interface to external circuitry, define logic blocks to implement logic functions and define interconnection networks to compose larger scale logic functions. The XACT™ Development System provides interactive graphic design capture and automatic routing. Both logic simulation and in-circuit emulation are available for design verification.

Part Number	Logic Capacity (usable gates)	Configurable Logic Blocks	User I/O's	Configuration Program (bits)
XC2064	1200	64	58	12038
XC2018	1800	100	74	17878

PROGRAMMING

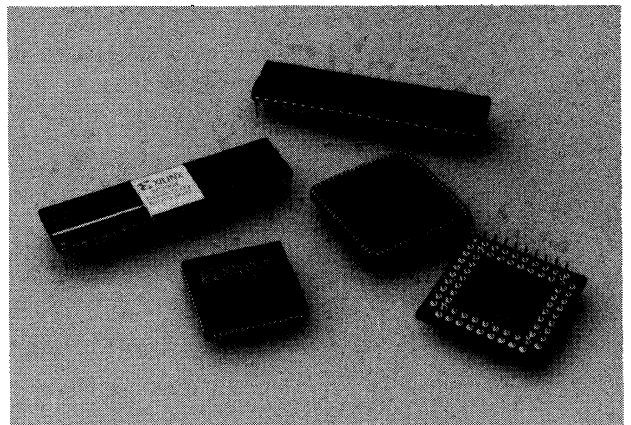
The Logic Cell Array's logic functions and interconnections are determined by a configuration program stored in internal static memory cells. On-chip logic provides for automatic loading of configuration data at power-up or on command. The program data can reside in an EEPROM, EPROM or ROM on the circuit board or on a floppy disk or hard disk.

Several methods of automatically loading the required data are designed into the Logic Cell Array and are determined by logic levels applied to mode selection pins at configuration time. The form of the data may be either serial or parallel, depending on the configuration mode. The programming data are independent of the configuration mode selected.

The Logic Cell Array is available in a variety of logic capacities, package styles, temperature ranges and speed grades.

INPUT/OUTPUT BLOCK

Each user-configurable I/O block (IOB) provides an interface between the external package pin of the device and the internal logic. Each I/O block includes a programmable input path and a programmable output buffer. It also provides input clamping diodes to provide protection from electro-static damage, and circuits to protect the LCA from latch-up due to input currents.



The input buffer portion of each I/O block provides threshold detection to translate external signals applied to the package pin to internal logic levels. The input buffer threshold of the I/O blocks can be programmed to be compatible with either TTL (1.4 V) or CMOS (2.2 V) levels.

Output buffers in the I/O blocks provide 4 mA drive for high fan-out CMOS or TTL compatible signal levels.

CONFIGURABLE LOGIC BLOCK

An array of Configurable Logic Blocks (CLBs) provides the functional elements from which the user's logic is constructed. The Logic Blocks are arranged in a matrix in the center of the device. The XC2064 has 64 such blocks arranged in an 8-row by 8-column matrix. The XC2018 has 100 logic blocks arranged in a 10 by 10 matrix.

Each logic block has a combinatorial logic section, a storage element, and an internal routing and control section. Each CLB has four general-purpose inputs: A, B, C and D; and a special clock input (K), which may be driven from the interconnect adjacent to the block. Each CLB also has two outputs, X and Y, which may drive interconnect networks. The Figure below shows

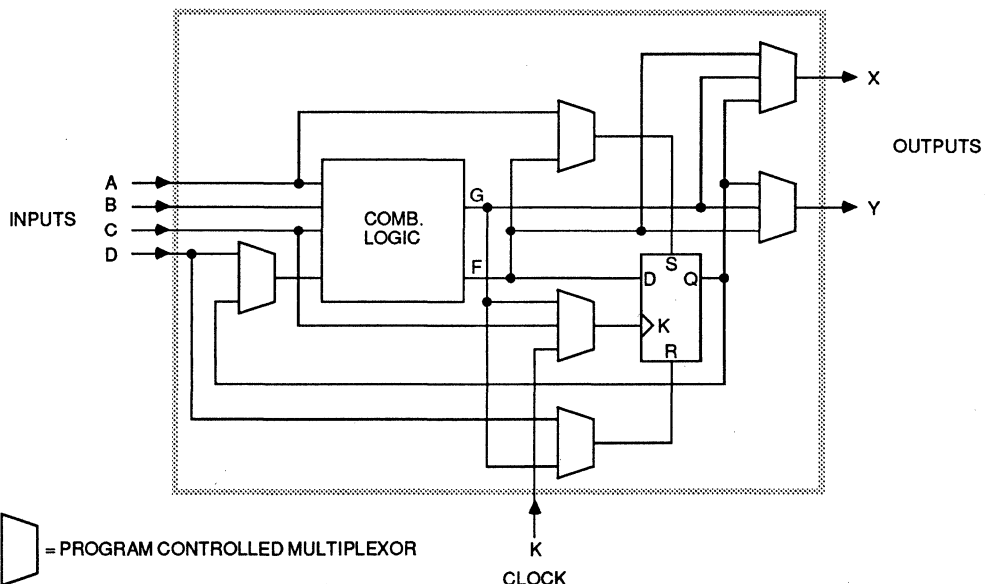
the resources of a Configurable Logic Block.

The logic block combinatorial logic uses a table look-up memory to implement Boolean functions. This technique can generate any logic function of up to four variables with a high speed sixteen-bit memory. The propagation delay through the combinatorial network is independent of the function generated. Each block can perform any function of four variables or any two functions of three variables each. The variables may be selected from among the four inputs and the block's storage element output "Q".

PROGRAMMABLE INTERCONNECT

Programmable interconnection resources in the Logic Cell Array provide routing paths to connect inputs and outputs of the I/O and logic blocks into desired networks. All interconnections are composed of metal segments, with programmable switching points provided to implement the necessary routing. Three types of resources accommodate different types of networks:

- General purpose interconnect
- Long lines
- Direct connection



Configurable Logic Block

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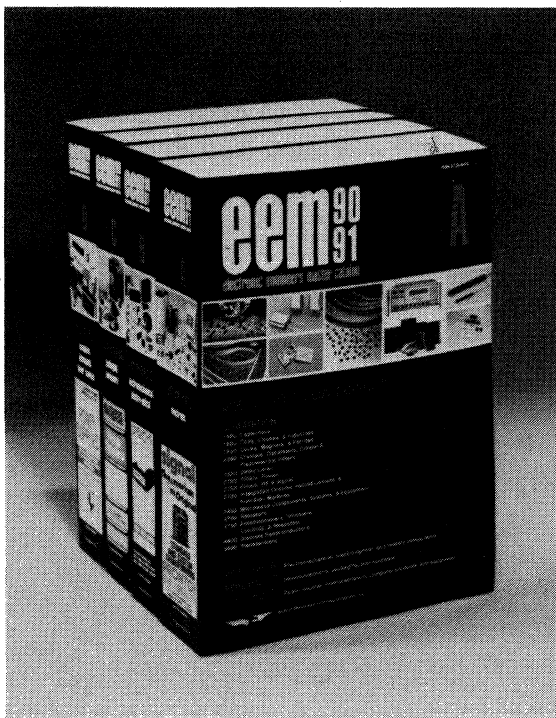
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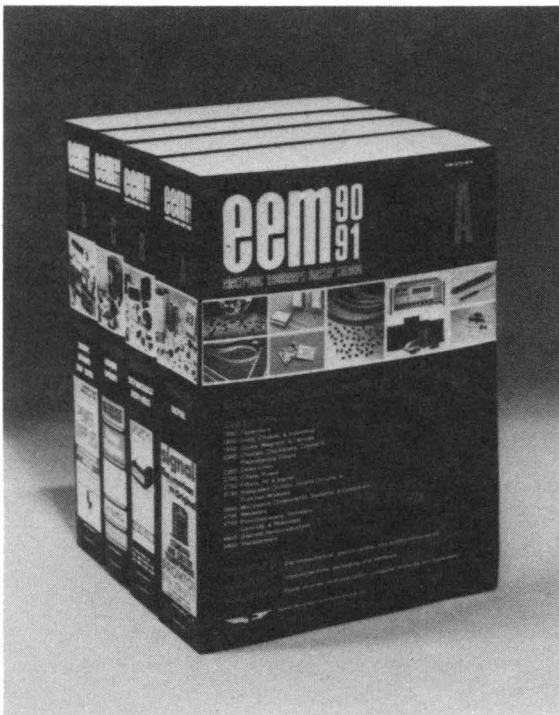
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