DataGeneral

Technical Manual

COMPONENTS GUIDE

015-000028-02

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DATA GENERAL TECHNICAL MANUAL

COMPONENTS GUIDE

Ordering No. 015-000028-02

Rev. 02, June 1974

	DGC NO. SERIES
INTEGRATED CIRCUITS	100'S
SEMICONDUCTORS	101'S
RESISTORS	102'S
CAPACITORS	103'S
TRANSFORMERS AND COILS	104'S
SWITCHES AND RELAYS	110'S
CONNECTORS	111'S
FUSES AND CIRCUIT BREAKERS	113'S
INDICATORS AND BULBS	114'S
MOTORS, BLOWERS AND FANS	115'S
CIRCUIT MODULES	116'S
CRYSTALS	121'S

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The purpose of this manual is to provide part number identification of components used in Data General equipment. Pin connections, logic diagrams, truth tables and functional descriptions are included in the Integrated Circuits section. In the Circuit Modules section, pin connections and block diagrams are furnished.

It is not the purpose of this manual to provide manufacturers' specifications or circuit parameters.

TABLE OF CONTENTS

NUMERICAL INDEX

INTEGRATED CIRCUITS

REV. 02

FUNCTIONAL INDEX

INTEGRATED CIRCUITS

REV. 02

DGC Part Number	Function	Page Number
100000281	Quadruple 2-Input Positive-NAND Schmitt Trigger	100-254
100000066	Dual 4-Input Positive-NAND Schmitt Trigger	100-61
100000116	Quadruple 2-Input Positive-NAND Buffer	100-108
100000081	Quadruple 2-Input Positive-NAND Buffer	100-78
100000264	Dual 4-Input Positive-NAND Buffer	100-248
100000078	Quadruple 2-Input Positive-NAND Buffer With Open-Collector Outputs	100-75
100000063	Quad 2-Input OR Gate	100-60
100000072	Quad 2-Input OR Gate	100-67
100000045	Quad 2-Input NOR Gate	100-46
100000061	Quad 2-Input NOR Gate	100-58
100000262	Quadruple 2-Input Positive-NOR Gate	100-245
100000070	Dual 4-Input NOR Gate	100-65
100000107	Quad NOR Gate	100-101
100000123	Triple 3-Input NOR Gate	100-115
100000260	Triple 3-Input Positive-NOR Gate	100-243
100000069	Single 7-Input NOR Gate	100-64
100000196	Quadruple 2-Input Positive-NOR Buffer With Open-Collector Outputs	100-191
100000181	Expandable 4-Wide AND-OR Gate	100-177
100000182	4-2-3-2-Input AND-OR-INVERT Gate	100-178
100000008	Single Extendable AND-OR-INVERT Gate	100-23
100000221	Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	100-206
100000006	Dual Extendable AND-OR-INVERT Gate	100-21
100000049	Expandable 4-Input AND-OR-INVERT Gate	100-51
100000039	Dual Extender AND-OR-INVERT Gate	100-40
100000020) 100000071)	Hex Inverter	100-32 100-66
100000076	Hex Inverter	100-73
100000090	6-Input Hex Inverter	100-87
100000159	Hex Inverter	100-154
100000098	Quad Hex Inverter	100-93
100000121	CMOS Hex Inverter	100-113
100000133	Hex Inverter	100-130
100000188) 100000284)	Hex Inverter With Open-Collector Outputs	100-183 100-257
100000265	Hex Schmitt-Trigger Inverter	100-249

REV. 02

REV. 02

DGC Part Number	Function	Page Number
100000214	2048-Bit MOS LSI Random Access Memory	100-203, 100-204
100000211	16-Bit Associative-Content Addressable Memory	100-202
100000140)	256-Bit Bipolar Read Only Memory	100-136
100000141)		100-136
100000142)		100-136
100000148)		100-144
100000149)		100-144
100000215)		100-205
100000216)		100-205
100000217)		100-205
100000218)		100-205
100000219)		100-205
100000269)		100-253
100000270)		100-253
100000271)		100-253
100000272)		100-253
100000273)		100-253
100000274)		100-253
100000275)		100-253
100000276)		100-253
100000277)		100-253
100000278)		100-253
100000279)		100-253
100000280)		100-253
100000095)	256-Bit Bipolar Read Only Memory	100-92
100000096)		100-92
100000191	High Speed Fully Decoded 1024-Bit Read Only Memory	100-186
100000208	256-Bit Bipolar Programmable ROM (32x8 PROM)	100-201
100000258	256-Bit Bipolar (32x8) Electrically Programmable Read Only Memory	100-241
100000256	1024-Bit Programmable Bipolar Read Only Memory	100-239
100000232	1024-Bit Field Programmable Bipolar PROM	100-217
100000245	1024-Bit Bipolar Programmable ROM (256x4 PROM, Open Collector)	100-231
100000192	High Speed Electrically Programmable 1024-Bit Read Only Memory	100-187
100000001	PNP Quad Core Driver	100-16
100000041	NPN Quad Core Driver	100-42
	MULTIPLEXERS	
100000167)	Quadruple 2-Line-To-1-Line Data Selector/Multiplexer	100-162
100000187)		100-182
100000233)	Quadruple 2-Line-To-1-Line Data Selector/Multiplexer	100-218
100000240)		100-225
100000166	Dual 4-Line-To-1-Line Data Selector/Multiplexer	100-161
100000165	Data Selector/Multiplexer with 3-State Outputs	100-160
100000186	8-Line-To-1-Line Data Selector/Multiplexer	100-181
100000297	Data Selector/Multiplexer	100-265
100000057)	2-Input, 4-Bit Digital Multiplexer	100-55
100000108)		100-102

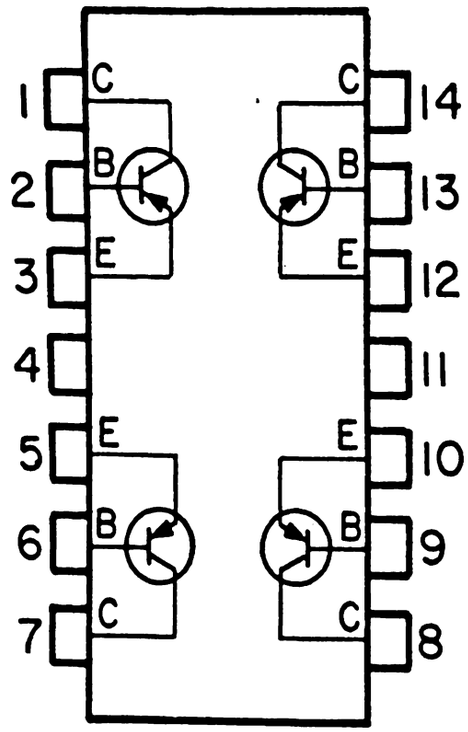
DGC Part Number	Function	Page Number
100000083	2-Input, 4-Bit Digital Multiplexer	100-80
100000236	2-Input, 4-Bit Digital Multiplexer	100-222
100000282	2-Input, 4-Bit Digital Multiplexer	100-255
100000129) 100000044)	3-Input, 4-Bit Digital Multiplexer	100-122 100-45
100000086	Quad Two-Input Multiplexer	100-85
100000201	Quadruple 2-Input Multiplexer With Storage	100-196
100000048	Dual Four-Input Multiplexer	100-50
100000075	Eight-Input Multiplexer	100-71, 100-72
100000168	Dual 4-Line-To-1-Line Multiplexer	100-163
100000225	8-Channel Differential Analog Multiplexer Complementary MOS (CMOS)	100-211
100000224	16-Channel Analog Multiplexer Complementary MOS (CMOS)	100-210
	OPERATIONAL AMPLIFIERS	
100000293	Operational Amplifier	100-261
100000294	Operational Amplifier	100-262
100000267	Operational Amplifier	100-251
100000156	High Performance Operational Amplifier	100-151
100000268	Dual Operational Amplifier	100-252
100000093	Monolithic Dual Operational Amplifier	100-90
100000242	Four Channel Programmable Amplifier	100-228
100000243	Wide Band, High Impedance Operational Amplifier	100-229
100000244	High Slew Rate F. E. T. Input Operational Amplifier	100-230
	PHASE LOCKED LOOP	
100000261	Phase Locked Loop	100-244
100000120	Phase Locked Loop	100-112
	REGISTERS	
100000042	4-Bit Shift Register	100-43
100000012	4-Bit Shift Register	100-26
100000134	4-Bit Data Selector/Storage Register	100-131
100000137	8-Bit Position Scaler	100-135
100000085	4-By-4 Register File	100-84
100000135) 100000234)	4-Bit Bidirectional Universal Shift Registers	100-132, 100-133 100-219, 100-220
100000101	8-Bit Shift Register	100-95
100000111) 100000109) 100000125)	Buffer Registers	100-103 100-103 100-117

REV. 02

100000001

PNP Quad Core Driver

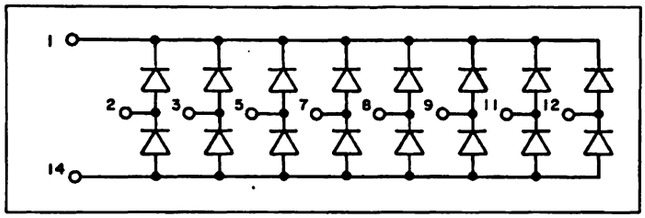
Pin Configuration



100000002

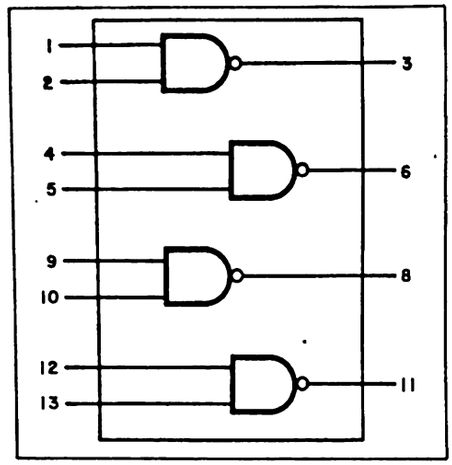
16 Diode Array

Logic Diagram



100000003

Pin Configuration



Quad 2-Input NAND Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

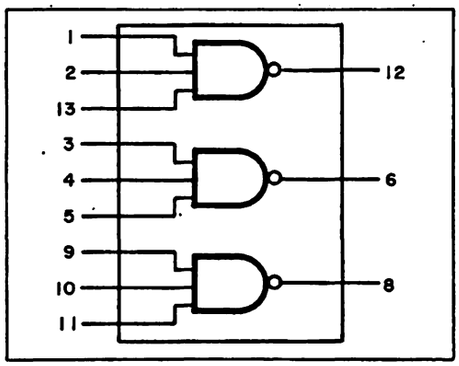
Truth Table

All Inputs High = Low Out
Any Input Low = High Out

100000004

Triple 3-Input NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

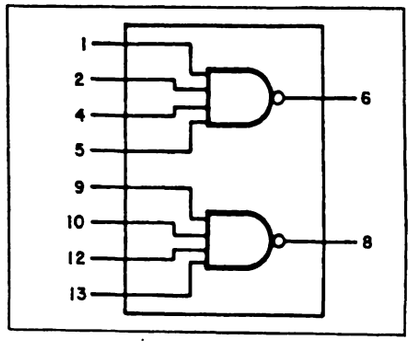
Truth Table

All Inputs High = Low Out
Any Input Low = High Out

100000005 100000009 100000040

Dual 4-Input NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

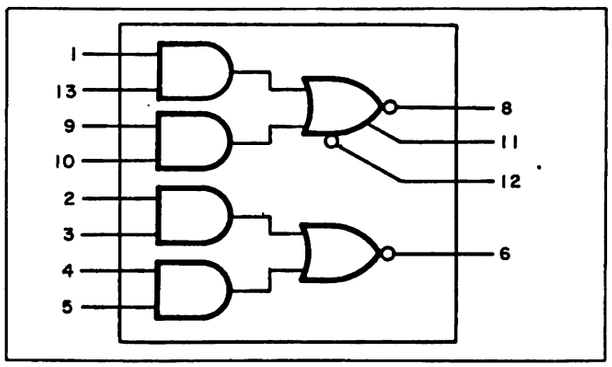
All Inputs High = Low Out
Any Input Low = High Out

The 100000009 device has higher input-output loading parameters than 100000005.

100000006

Dual Extendable AND-OR-INVERT Gates

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

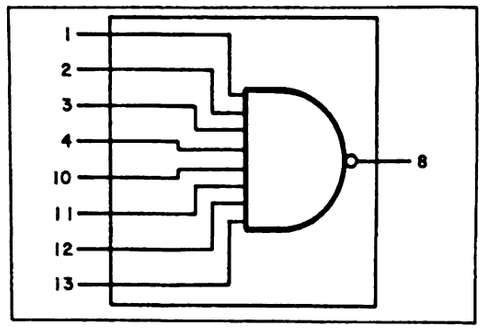
$(2 \cdot 3) \cdot (4 \cdot 5) = \overline{6}$

$(\overline{2} + \overline{3}) + (\overline{4} + \overline{5}) = 6$

Four extenders may be tied to these terminals.

100000007

Logic Diagram



8 - Input NAND Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

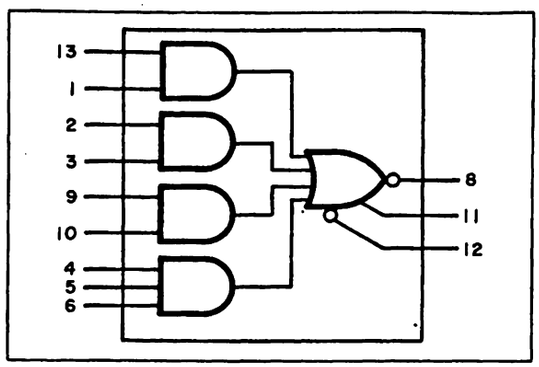
Truth Table

All Inputs High = Low Out
Any Input Low = High Out

100000008

Single Extendable AND-OR-INVERT Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

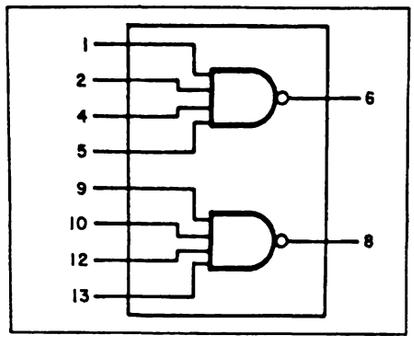
$$(1 \cdot 13) \cdot (2 \cdot 3) \cdot (9 \cdot 10) \cdot (4 \cdot 5 \cdot 6) = \overline{8}$$

$$(1 + 13) + (2 + 3) + (9 + 10) + (4 + 5 + 6) = 8$$

Four extenders (100000039) may be tied to these terminals.

100000005 100000009 100000040

Pin Configuration



Dual 4-Input NAND Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

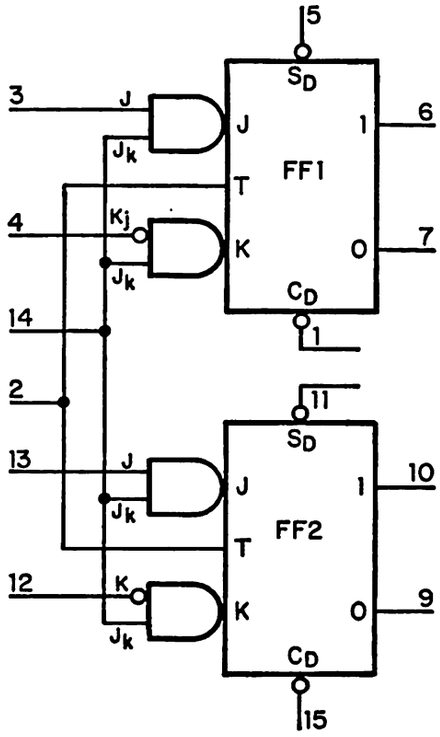
All Inputs High = Low Out
Any Input Low = High Out

The 100000009 device has higher input-output loading parameters than 100000005.

100000011

Dual J-K Flip-Flop

Functional Block Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Tables

Synchronous Operation

Before Clock Outputs One	Zero	Inputs J	K	After Clock Outputs One	Zero
L	H	L*	X	L	H
L	H	H*	X	H	L
H	L	X	L*	H	L
H	L	X	H*	L	H

Asynchronous Operation

Inputs S_D	C_D	Outputs One	Zero
L	L	H	H
L	H	H	L
H	L	L	H
H	H	Synchronous Inputs	Control

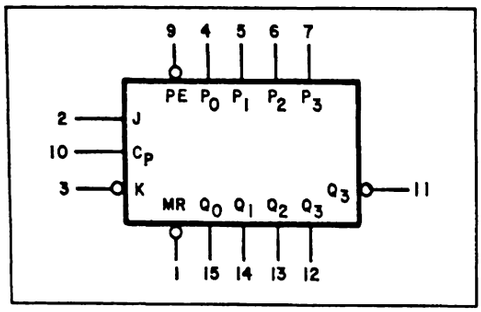
Synchronous Operation: The truth table defines the next state of the flip-flop after a Low to High transition of the clock pulse. The next state is a function of the present state and the J and K inputs as shown in the table.

The L* symbol means that input does not go High at any time while the clock is Low. The H* symbol means that the input is High at some time while the clock is Low. The X symbol indicates that the condition of that input has no effect on the next state of the flip-flop. The H and L symbols refer to steady state High and Low voltage levels, respectively.

100000012

4-Bit Shift Register

Logic Symbol



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Nomenclature

$\overline{PE}$	Parallel Enable (Active Low) Input
P_0, P_1, P_2, P_3	Parallel Inputs
J	First Stage J (Active High) Input
$\overline{K}$	First Stage K (Active Low) Input
Cp	Clock Active High Going Edge Input
$\overline{MR}$	Master Reset (Active Low) Input
Q_0, Q_1, Q_2, Q_3	Parallel Outputs
$\overline{Q_3}$	Complementary Last Stage Output

Truth Table
For Serial Entry

J	$\overline{K}$	Q_o at $t_{(n+1)}$
L	L	L
L	H	Q_o at t_n (no change)
H	L	$\overline{Q}_o$ at t_n (toggles)
H	H	H

$\overline{PE}$ = High, $\overline{MR}$ = High, (n+1) indicates state after next clock.

Data entry is synchronous with the registers changing state after each low to high transition of the clock. With the parallel enable low, the parallel inputs determine the next condition of the shift register. When the parallel enable input is high the shift register performs a one-bit shift to the right, with data entering the first stage flip-flop through $\overline{JK}$ inputs. By tying the two inputs together D type entry is obtained.

The asynchronous active low master reset when activated overrides all other input conditions and clears the register.

100000013

One-Of-Ten Decoder

Logic Diagram/Pin Designations

V_{CC} = Pin 16

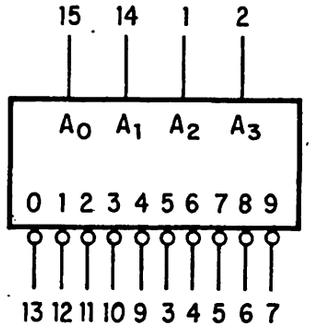
Gnd = Pin 8

Pin Names

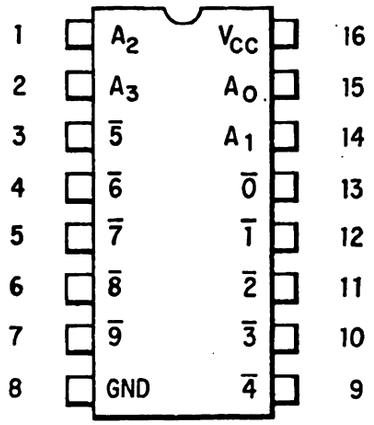
A_0, A_1, A_2, A_3 = Addressed Inputs

$\overline{0}$ to $\overline{9}$ = Outputs, Active LOW

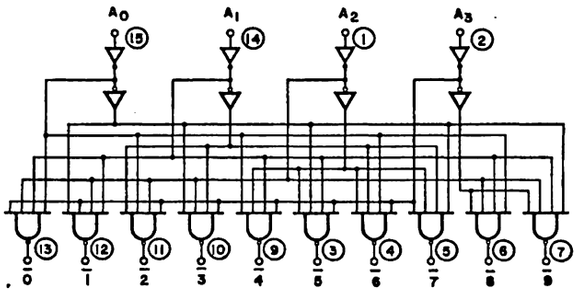
Logic Symbol



Pin Configuration



Logic Diagram



○ = PIN NUMBER

Truth Table

A_0	A_1	A_2	A_3	$\overline{0}$	$\overline{1}$	$\overline{2}$	$\overline{3}$	$\overline{4}$	$\overline{5}$	$\overline{6}$	$\overline{7}$	$\overline{8}$	$\overline{9}$
L	L	L	L	L	H	H	H	H	H	H	H	H	H
H	L	L	L	H	L	H	H	H	H	H	H	H	H
L	H	L	L	H	H	L	H	H	H	H	H	H	H
H	H	L	L	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	H	H	H	L	H	H	H	H	H
H	L	H	L	H	H	H	H	H	L	H	H	H	H
L	H	H	L	H	H	H	H	H	H	L	H	H	H
H	H	H	L	H	H	H	H	H	H	H	L	H	H
L	L	L	H	H	H	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L
L	H	L	H	H	H	H	H	H	H	H	H	H	H
H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H
H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H	H	H

The 100000013 is a multipurpose decoder designed to accept four active HIGH BCD inputs and to provide ten mutually exclusive active LOW outputs, as shown by the logic symbol.

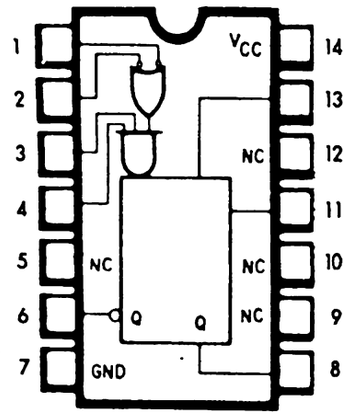
The logic design ensures that all outputs are HIGH when binary codes greater than nine are applied to the inputs.

The most significant A_3 input produces a useful inhibit function when the device is used as a one-of-eight decoder.

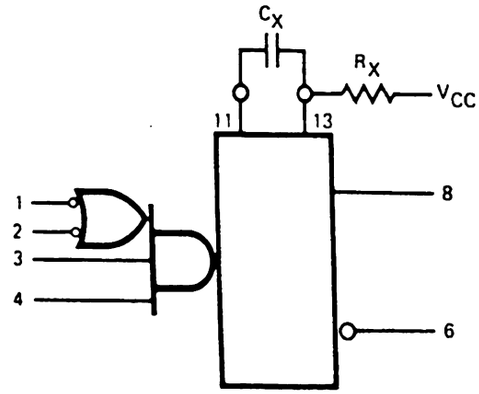
100000015

Retriggerable Monostable Multivibrator

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Triggering Truth Table

Pin Numbers 1	2	3	4	Operation
H→L	H	H	H	Trigger
H	H→L	H	H	Trigger
L	X	L→H	H	Trigger
X	L	L→H	H	Trigger
L	X	H	L→H	Trigger
X	L	H	L→H	Trigger

$T\ (\text{trigger}) = (\overline{1} + \overline{2}) \cdot 3 \cdot 4$

Change of T from FALSE to TRUE causes trigger.

H = HIGH voltage level $\geqslant V_{IH}$

L = LOW voltage $\leqslant V_{IL}$

L→H = transition from LOW to HIGH voltage level

H→L = transition from HIGH to LOW voltage level

X = Don't care (either HIGH or LOW voltage level)

This retriggerable monostable multivibrator provides an output pulse whose duration and accuracy is a function of external timing components.

This device has four inputs, two active HIGH and two active LOW. This allows a choice of leading edge or trailing edge triggering. The TTL inputs make triggering independent of input transition times. When input conditions for triggering are met, a new cycle starts and the external capacitor is rapidly discharged and then allowed to charge. An input cycle time shorter than the output cycle time will retrigger the device and result in a continuous true output. Retriggering may be inhibited by tying the negation (Q) output to an active LOW input. Active pullups are provided on the outputs for good drive capability into capacitive loads.

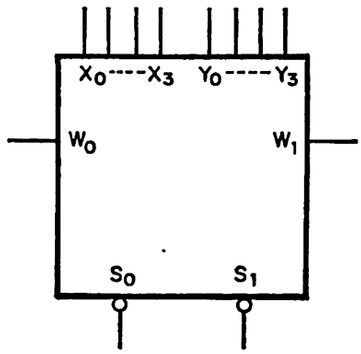
100000016

16-Bit Coincident Select Read-Write Memory

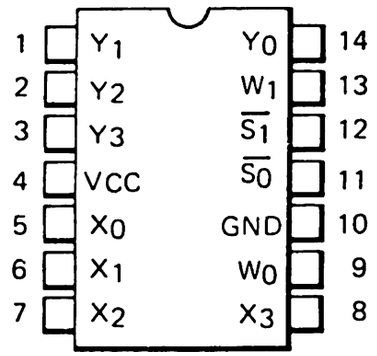
Logic Diagram/Pin Designations

V_{CC} = Pin 4
Gnd = Pin 10

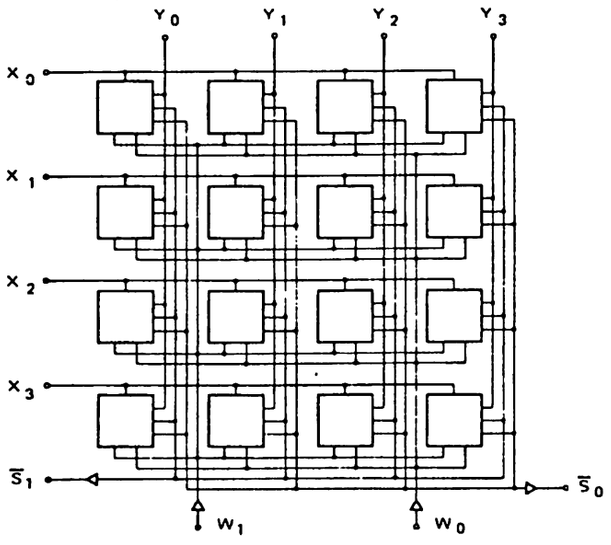
Logic Symbol



Pin Configuration



Logic Diagram



Each square represents one bit of storage.

X,Y — Address
W — Write Input
S — Sense Output

This device is comprised of 16-bit, bit-oriented, non-destructive readout memory cells. These memory cells, organized as 16 words by one bit, are designed for high speed scratch-pad memory applications.

The memory cell consists of 16 RS flip-flops arranged in an addressable four-by-four matrix. The desired bit location is selected by raising the coincident X-Y address lines to a logic "H" level (>2.1 volts) and holding the non-selected address lines at logic "L" level (<0.7 volts). As many as four locations may be addressed simultaneously without destroying stored information. The stored data and its complement at the addressed bit location may be read at the output terminals. If the addressed bit location contains a "1", the $\overline{S_1}$ output will be LOW and the $\overline{S_0}$ output will be HIGH. If the addressed bit location contains a "0", the $\overline{S_1}$ output will be HIGH and the $\overline{S_0}$ output will be LOW.

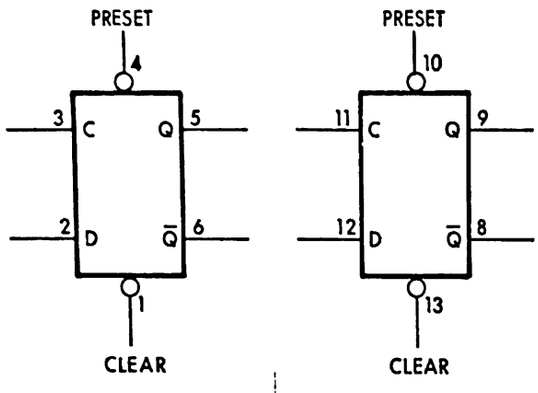
Writing is accomplished by activating one of the write amplifiers. To write a "1", the desired bit location is addressed and the input of the "write one" (W_1) amplifier is raised to a HIGH level. To write a "0", the input of the "write zero" (W_0) amplifier is raised to a HIGH level.

The outputs are open-collector, which may be wired OR for word expansion. (The output transistors are off when none of the bits are selected.) An external resistor should be returned to V_{CC} to pull-up the wired OR outputs.

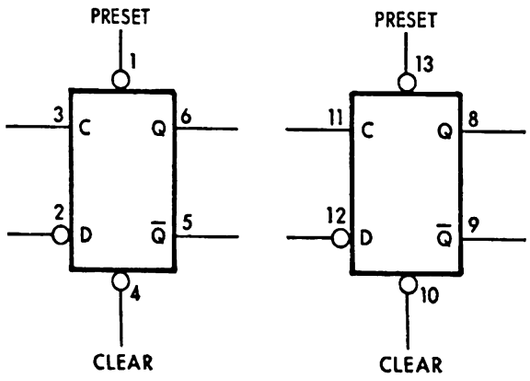
100000017 100000257

Dual D-Type Edge-Triggered Flip-Flop

Pin Connections



Alternate Pin Connections



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Function Table

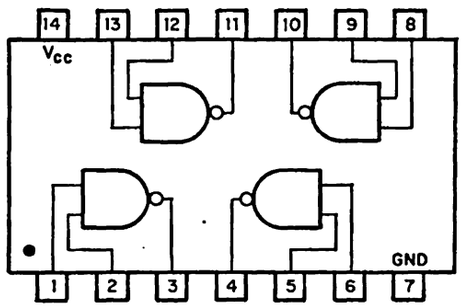
Inputs				Outputs	
Preset	Clear	Clock	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q}_0$

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated input conditions were established.
* = This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

100000019

Quad 2-Input NAND Interface Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

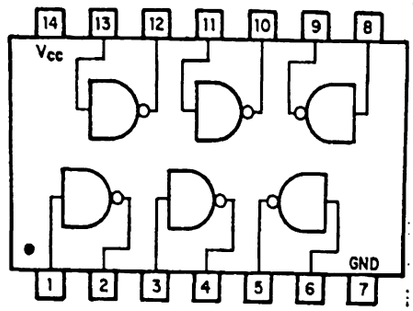
Truth Table

V_{IN}	V_{IN}	V_{OUT}
L	L	H
L	H	H
H	L	H
H	H	L

100000020 100000071

Hex Inverter

Pin Configuration



Logic Diagram/Pin Designations

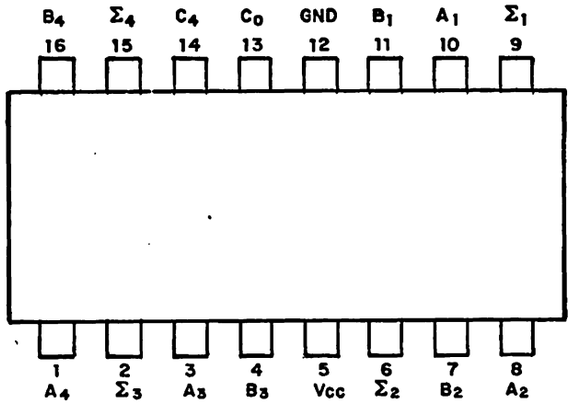
V_{CC} = Pin 14

Gnd = Pin 7

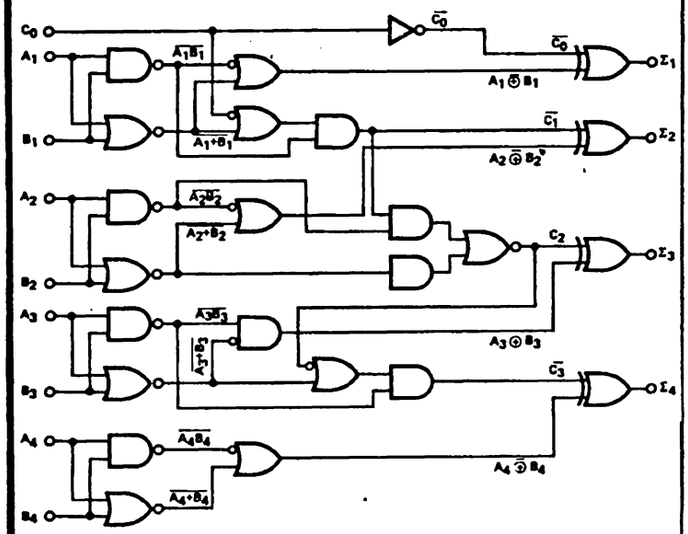
100000021

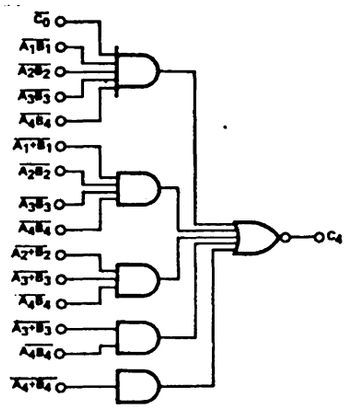
4-Bit Binary Full Adder (Look Ahead Carry)

Pin Configuration



Logic Diagrams





Logic Diagram/Pin Designations

V_{CC} = Pin 5

Gnd = Pin 12

Truth Table

INPUT				OUTPUT					
				WHEN $C_0 = 0$ / WHEN $C_2 = 0$			WHEN $C_0 = 1$ / WHEN $C_2 = 1$		
A_1 / A_3	B_1 / B_3	A_2 / A_4	B_2 / B_4	Σ_1 / Σ_3	Σ_2 / Σ_4	C_2 / C_4	Σ_1 / Σ_3	Σ_2 / Σ_4	C_2 / C_4
0	0	0	0	0	0	0	1	0	0
1	0	0	0	1	0	0	0	1	0
0	1	0	0	1	0	0	0	1	0
1	1	0	0	0	1	0	1	1	0
0	0	1	0	0	1	0	1	1	0
1	0	1	0	1	1	0	0	0	1
0	1	1	0	1	1	0	0	0	1
1	1	1	0	0	0	1	1	0	1
0	0	0	1	0	1	0	1	1	0
1	0	0	1	1	1	0	0	0	1
0	1	0	1	1	1	0	0	0	1
1	1	0	1	0	0	1	1	0	1
0	0	1	1	0	0	1	1	0	1
1	0	1	1	1	0	1	0	1	1
0	1	1	1	1	0	1	0	1	1
1	1	1	1	0	1	1	1	1	1

Note:

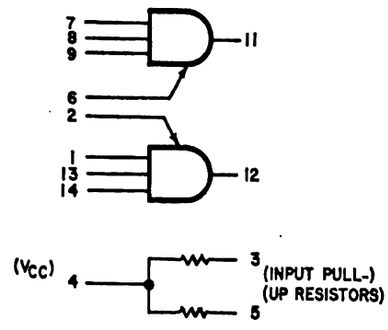
Input conditions at A_1, A_2, B_1, B_2, and C_0 are used to determine outputs Σ_1 and Σ_2, and the value of the internal carry C_2. The values at C_2, A_3, B_3, A_4 and B_4 are then used to determine outputs Σ_3, Σ_4 and C_4.

The 100000021 is a 4-Bit Binary Full Adder for adding two four bit binary numbers. A Carry Look Ahead circuit is included to provide minimum carry propagation delays.

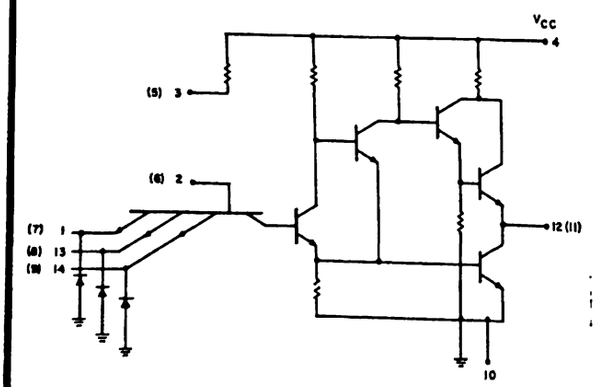
100000023

Dual Pulse Shaper-Delay AND Gate

Logic Diagram



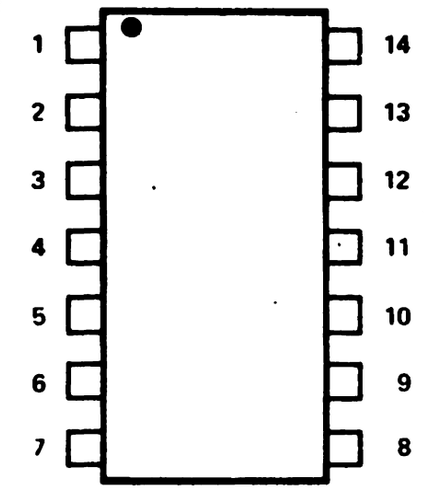
Schematic



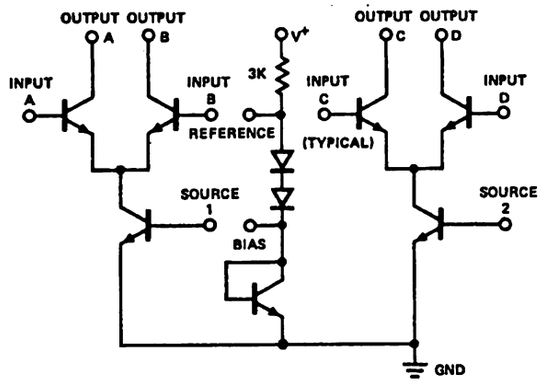
100000024

Dual Differential Amplifier

Pin Configuration



Basic Circuit Schematic



Pin Designations

1.	Output B	8.	Source 2
2.	Output A	9.	Bias
3.	Input A	10.	Input D
4.	Input B	11.	Input C
5.	Reference	12.	Output C
6.	Source 1	13.	Output D
7.	Ground	14.	V^+

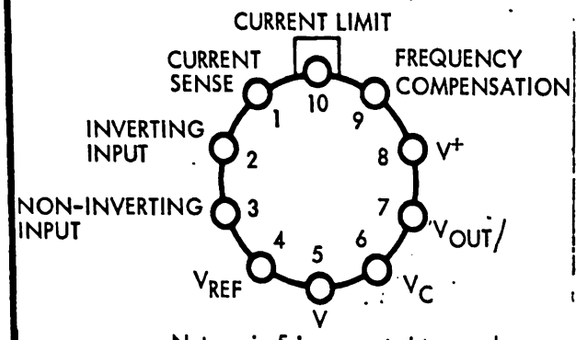
The 100000024 is a dual high-frequency differential amplifier with associated constant current sources and biasing elements contained within a silicon monolithic epitaxial substrate. This device is intended for RF-IF amplifier service to beyond 100mHz. Circuit layout provides for connection as either a high-gain, common-emitter, common-base, cascade amplifier or a common-collector, common-base, differential amplifier. Automatic gain control may be applied to either circuit.

100000026 100000094

Precision Voltage Regulator

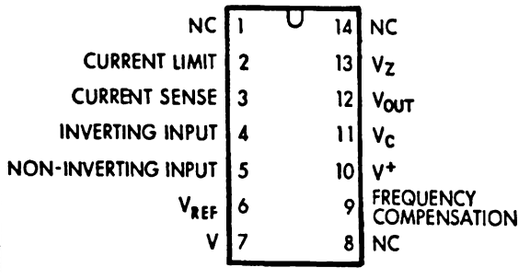
The 100000026(Can) and 100000094(DIP) are monolithic voltage regulators, consisting of a temperature compensated reference amplifier, error amplifier, power series pass transistor and current limit circuitry. Additional NPN or PNP pass elements may be used when output currents exceeding 150mA are required. Provisions are made for adjustable current limiting and remote shutdown.

Pin Configurations



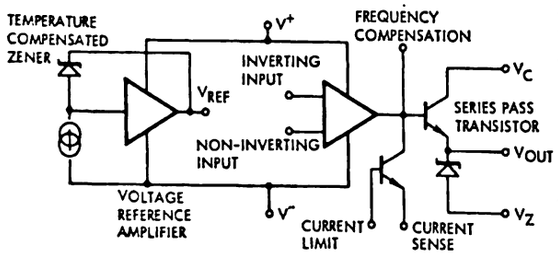
Note: pin 5 is connected to case

100000026



100000094

Equivalent Circuit

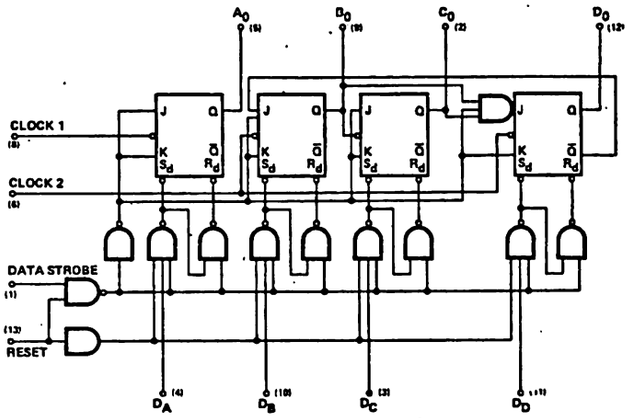


100000038 100000028

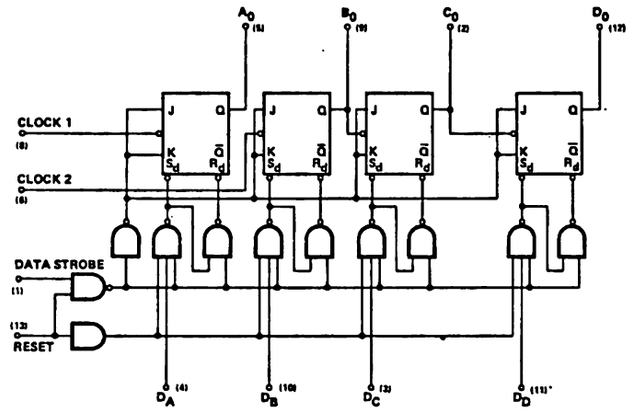
BCD Decade Counter/Storage Element
4-Bit Binary Counter/Storage Element

Logic Diagrams

100000038



100000028



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

The 100000038 Decade Counter and the 100000028 16-State Binary Counter are four-bit subsystems.

The Decade Counter can be connected in the BCD counting mode, in a divide-by-two and divide-by-five configuration or in the Bi-Quinary mode.

The Binary Counter may be connected as a divide-by-two, eight, or sixteen counter.

Both devices have strobed parallel-entry capability so that the counter may be set to any desired output state. A "1" or "0" at a data input will be transferred to the associated output when the strobe input is put at the "0" level.

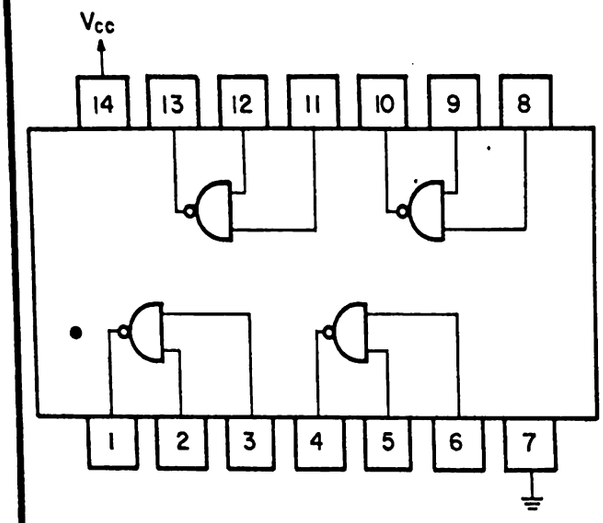
Both units are provided with a reset input which is common to all four bits. A "0" on the reset line produces "0" at all four outputs.

The counting operation is performed on the falling (negative-going) edge of the input clock pulse; however, there is no restriction on the transition time since the individual binaries are level-sensitive.

100000036

Quad 2-Input NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

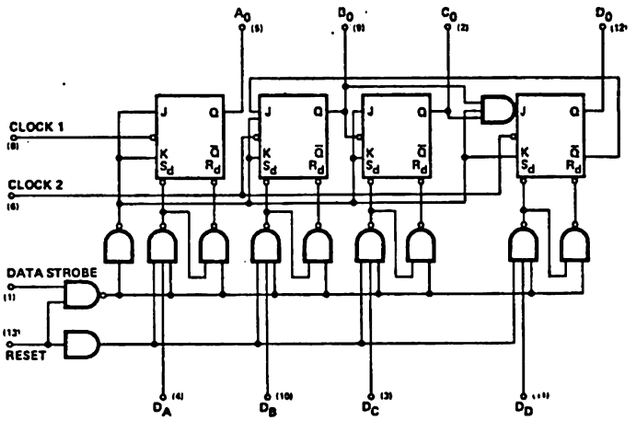
Gnd = Pin 7

100000038 100000028

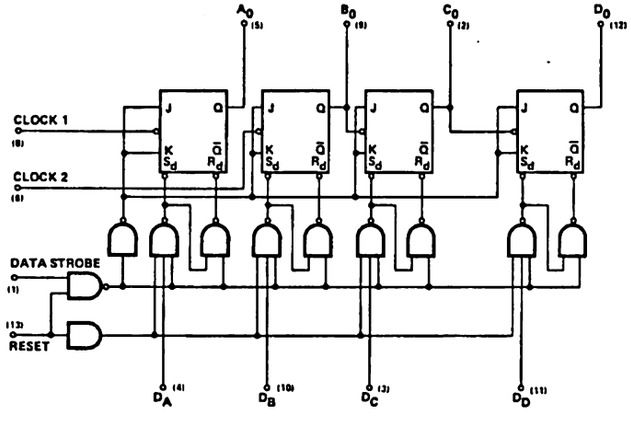
BCD Decade Counter/Storage Element
4-Bit Binary Counter/Storage Element

Logic Diagrams

100000038



100000028



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

The 100000038 Decade Counter and the 100000028 16-State Binary Counter are four-bit subsystems.

The Decade Counter can be connected in the BCD counting mode, in a divide-by-two and divide-by-five configuration or in the Bi-Quinary mode.

The Binary Counter may be connected as a divide-by-two, eight, or sixteen counter.

Both devices have strobed parallel-entry capability so that the counter may be set to any desired output state. A "1" or "0" at a data input will be transferred to the associated output when the strobe input is put at the "0" level.

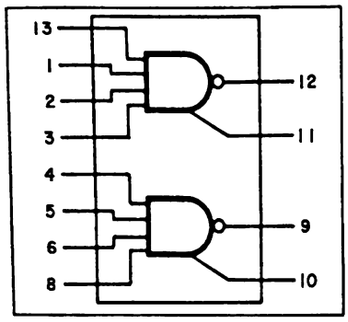
Both units are provided with a reset input which is common to all four bits. A "0" on the reset line produces "0" at all four outputs.

The counting operation is performed on the falling (negative-going) edge of the input clock pulse; however, there is no restriction on the transition time since the individual binaries are level-sensitive.

100000039

Dual Extender AND-OR-INVERT Gates

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

$4 \cdot 5 \cdot 6 \cdot 8 = \overline{9}$

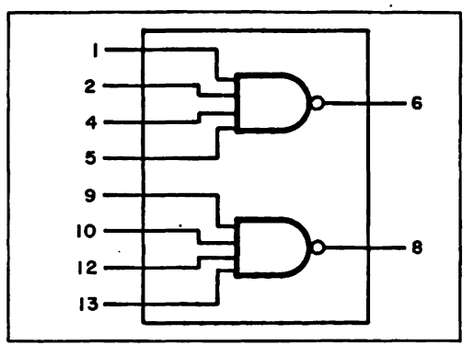
$\overline{4} + \overline{5} + \overline{6} + \overline{8} = 9$

Extender for use with 100000006 and 100000008.

100000005 100000009 100000040

Dual 4-Input NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

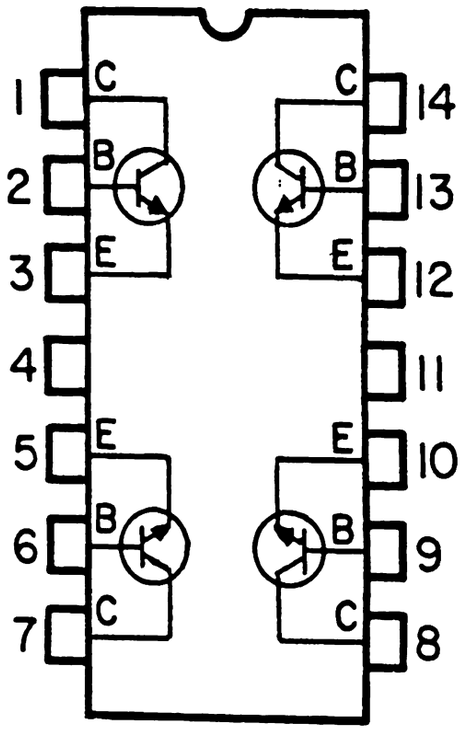
All Inputs High = Low Out
Any Input Low = High Out

The 100000009 device has higher input-output loading parameters than 100000005.

100000041

NPN Quad Core Driver

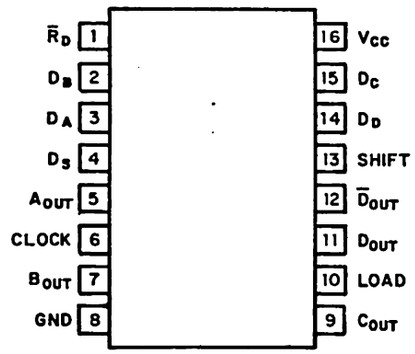
Pin Configuration



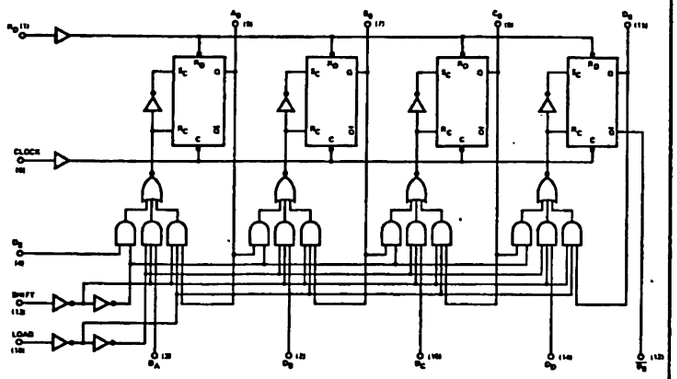
100000042

4-Bit Shift Register

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Truth Table

Control State	Load	Shift
Hold	0	0
Parallel Entry	1	0
Shift Right	0	1
Shift Right	1	1

This 4-bit shift register has both a serial and a parallel data entry capability.

The data input lines are single-ended true input data lines which condition their specific register bit location after an enabled clocking transition. Since data transfer is synchronous with clock, data may be transferred in any serial/parallel input/output relationship.

This device provides a direct reset (R_D) and a $\overline{D}_{out}$ line.

The internal design uses level sensitive binaries which respond to the negative-going clock transition. A buffer clock driver is included to minimize input clock loading.

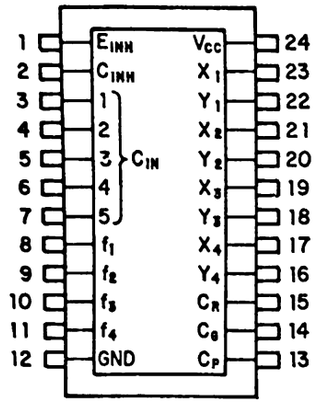
Mode control logic is available to determine three possible control states. These register states are serial shift right mode, parallel enter mode, and no change or hold mode. These states accomplish logical decoding for system control. The control modes are shown in the truth table.

For applications not requiring the hold mode, the load input may be tied high and the shift input used as the mode control.

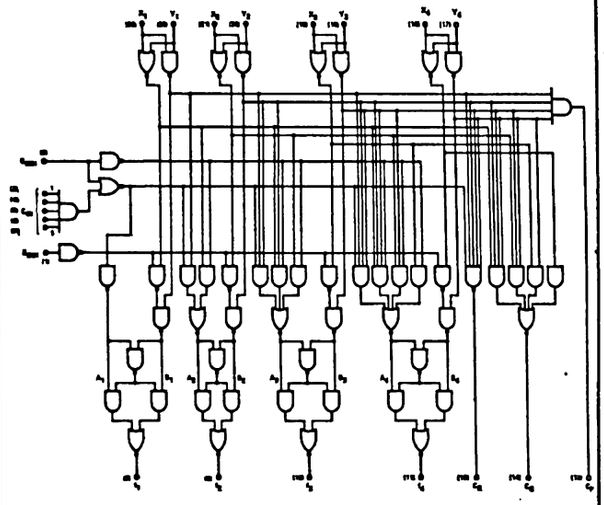
100000043

Arithmetic Logic Element

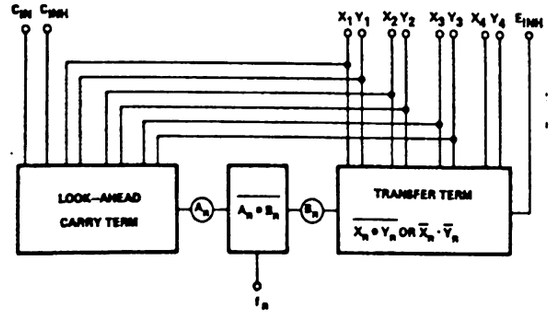
Pin Configuration



Logic Diagram



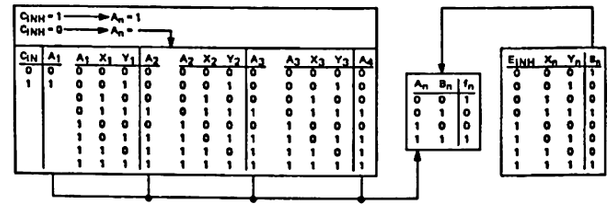
Functional Block Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 24
Gnd = Pin 12

Truth Table



This arithmetic logic element is a monolithic gate array incorporating four full-adders structured in a look-ahead mode. The device may be used as four mutually independent exclusive NOR or AND gates by proper addressing of the inhibit lines.

As a four-bit adder, this device permits high speed parallel addition of four sets of data and has both simultaneous addition on a character to character and on a bit to bit basis.

When true input variables are used, the true sum is formed at the f output. Inverted input variables produce the complement of the sum of the true variables.

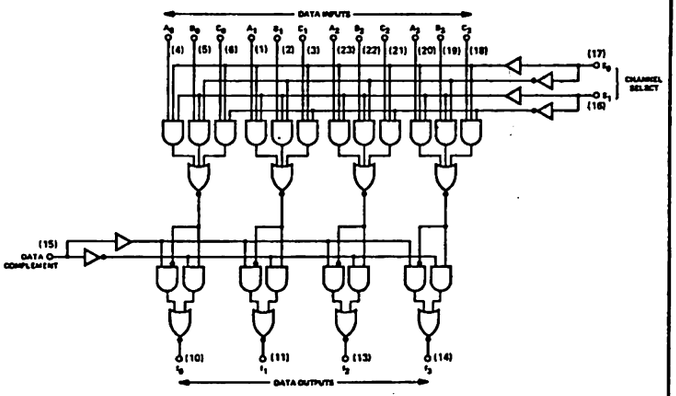
The carry-outs available are: Internally Generated (C_G), Propagated (C_p) and Ripple (C_R).

100000129 100000044

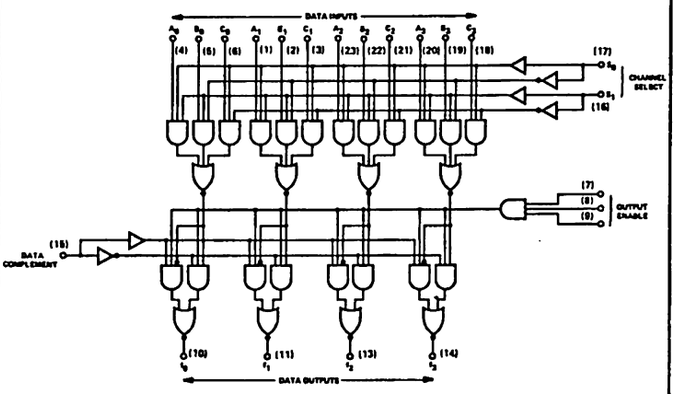
3-Input, 4-Bit Digital Multiplexer

Logic Diagrams

100000129
(Active Pull-up)



100000044
(Open Collector)



Logic Diagram/Pin Designations

V_{CC} = Pin 24
Gnd = Pin 12

Truth Table

Data Input A_n B_n C_n	Channel Select S_0	S_1	Data Complement	Output Enable '044	Data Outputs
A_n x x	1	1	0	1	A_n
x B_n x	0	1	0	1	B_n
x x C_n	1	0	0	1	C_n
x x x	0	0	0	1	0
A_n x x	1	1	1	1	$\overline{A}_n$
x B_n x	0	1	1	1	$\overline{B}_n$
x x C_n	1	0	1	1	$\overline{C}_n$
x x x	0	0	1	1	1
x x x	x	x	x	0	1

X = Either state.

The 3-input, 4-bit multiplexer is a gating array whose function is analogous to that of a 4-pole, 3-position switch. Four bits of digital data are selected from one of three inputs. A 2-bit channel-selection code determines which input is to be active.

The data complement input controls the conditional complement circuit at the multiplexer output to effect either inverting or non-inverting data flow.

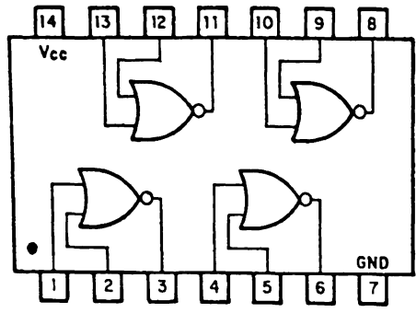
The 100000129 employs active output structures to effect minimum delays; the 100000044 utilizes bare collector outputs for expansion of input terms.

The 100000044 may be expanded by connecting its outputs to the outputs of another 100000044. Provision is made for use of a 3-bit code to determine which multiplexer is selected; thus, eight multiplexers may be commoned to effect a 4-pole, 24-position switch.

100000045

Quad 2-Input NOR Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

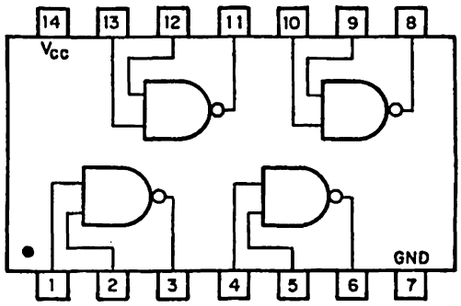
Truth Table

V_{IN}	V_{IN}	V_{OUT}
H	H	L
H	L	L
L	H	L
L	L	H

100000046

Quad 2-Input NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

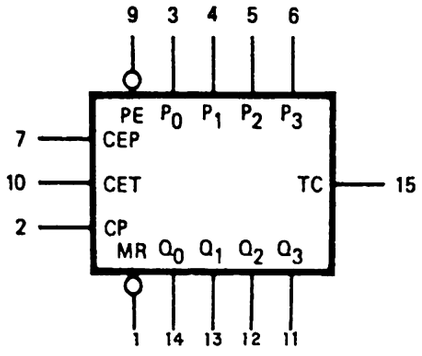
V_{CC} = Pin 14

Gnd = Pin 7

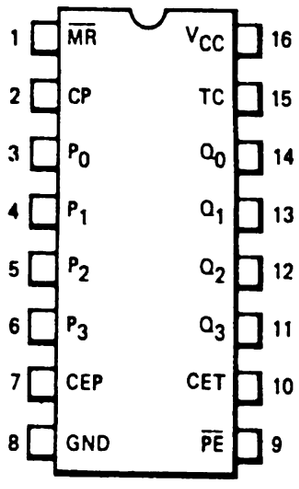
100000153 100000047

BCD Decade Counter-4 Bit Binary Counter

Logic Symbol

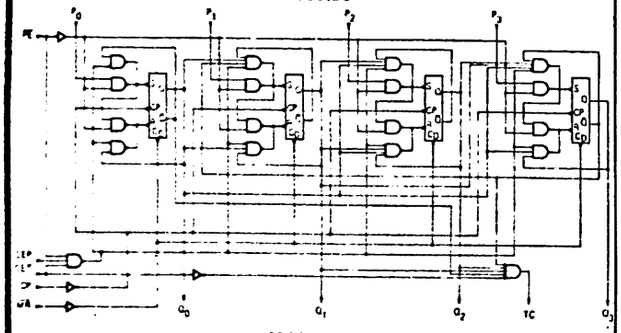


Pin Configuration

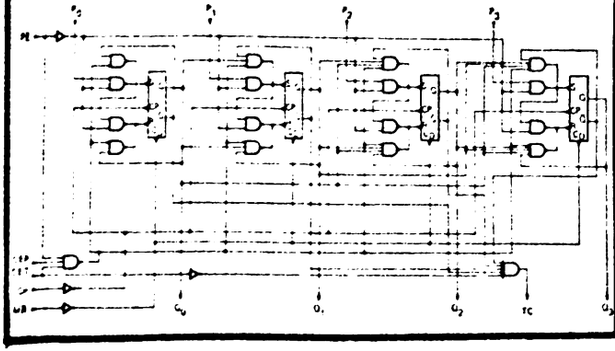


Logic Diagrams

100000153



100000047



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names

$\overline{PE}$..... Parallel Enable (Active LOW) Input

P_0, P_1, P_2, P_3.. Parallel Inputs

CEP ..... Count Enable Parallel Input

CET ..... Count Enable Trickle Input

CP..... Clock (Active HIGH Going Edge) Input

$\overline{MR}$ ..... Master Reset (Active LOW) Input

Q_0, Q_1, Q_2, Q_3.. Parallel Outputs

TC..... Terminal Count Outputs

Mode Selection

$\overline{PE}$	CEP	CET	Mode
L	L	L	Preset
L	L	H	Preset
L	H	L	Preset
L	H	H	Preset
H	L	L	No Change
H	L	H	No Change
H	H	L	No Change
H	H	H	Count

($\overline{MR}$ = HIGH)

Terminal Count Generation

CET	100000153 $(Q_0 \cdot \overline{Q}_1 \cdot \overline{Q}_2 \cdot Q_3)$	100000047 $(Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3)$	TC
L	L	L	L
L	H	H	L
H	L	L	L
H	H	H	H

$TC = CET \cdot Q_0 \cdot \overline{Q}_1 \cdot \overline{Q}_2 \cdot Q_3$ (100000153)

$TC = CET \cdot Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3$ (100000047)

Positive Logic:

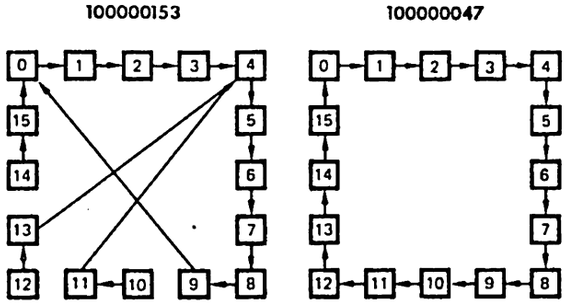
H = HIGH Voltage Level
L = LOW Voltage Level

The 100000153 is a high speed BCD decade counter and the 100000047 is a high speed binary counter. Both counters are fully synchronous with the clock pulse driving four master/slave flip-flops in parallel through a clock buffer. During the

Continued ...

100000153 100000047

Continued



Logic Equations

Count Enable = CEP · CET · PE
TC for 100000153 = CET · Q_0 · $\overline{Q_1}$ · $\overline{Q_2}$ · Q_3
TC for 100000047 = CET · Q_0 · Q_1 · Q_2 · Q_3
Preset = $\overline{PE}$ · CP + (rising clock edge)
Reset = $\overline{MR}$

Note: The 100000153 can be preset to any state but will not count beyond 9. If preset to state 10, 11, 12, 13, 14 or 15, it will return to its normal sequence within two clock pulses.

LOW to HIGH transition of the clock, the master is inhibited from further change. After the masters are locked out, data is transferred from the master to the slaves and reflected at the outputs. When the clock is HIGH, the masters are inhibited and the master/slave data path remains established. During the HIGH to LOW transition of the clock, the slave is inhibited from further change, followed by the enabling of the masters for the acceptance of data from the counting logic or the parallel entry logic.

The three control inputs, Parallel Enable ($\overline{PE}$), Count Enable Parallel (CEP), and Count Enable Trickle (CET), select the mode of operation. When the conditions for counting are satisfied, the rising edge of a clock pulse will change the counters to the next state of the count sequence shown in the State Diagram. The Count Mode is enabled when CEP and CET inputs and $\overline{PE}$ are HIGH.

These devices can be synchronously preset from the four Parallel inputs (P_{0-3}) when $\overline{PE}$ is LOW. When the Parallel Enable and Clock are LOW, each master of the flip-flops is connected to the appropriate parallel input (P_{0-3}) and the slaves (outputs) are steady in their previous state. When the clock goes HIGH, the masters are inhibited and this information is transferred to the slaves and reflected at the outputs. The parallel enable input overrides both count enable inputs, presetting the counter when LOW.

Terminal count is HIGH when the counter is at terminal count (state 9 for 100000153 and state 15 for 100000047), and Count Enable Trickle is HIGH, as shown in the logic equations.

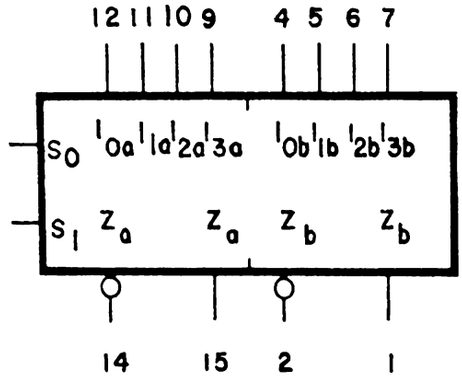
When LOW, the asynchronous master reset overrides all other inputs resetting the four outputs LOW.

Conventional operation, as shown in the Mode Selection table, requires that the mode control inputs ($\overline{PE}$, CEP, CET) are stable while the clock is LOW.

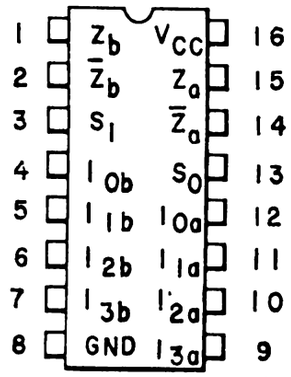
100000048

Dual Four-Input Multiplexer

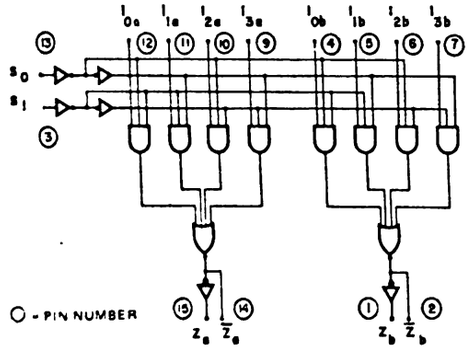
Logic Symbol



Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names

S_0, S_1 ..... Common Select Inputs

Multiplexer A

I_{0a}, I_{1a}, I_{2a}, I_{3a} .. Multiplexer Inputs
Z_a ..... Multiplexer Output
$\overline{Z}_a$ ..... Complementary Multiplexer Output

Multiplexer B

I_{0b}, I_{1b}, I_{2b}, I_{3b} ... Multiplexer Inputs
Z_b ..... Multiplexer Output
$\overline{Z}_b$ ..... Complementary Multiplexer Output

Truth Table

Select Inputs		Inputs				Outputs	
S_0	S_1	I_{0a}	I_{1a}	I_{2a}	I_{3a}	Z_a	$\overline{Z}_a$
L	L	L	X	X	X	L	H
L	L	H	X	X	X	H	L
H	L	X	L	X	X	L	H
H	L	X	H	X	X	H	L
L	H	X	X	L	X	L	H
L	H	X	X	H	X	H	L
H	H	X	X	X	L	L	H
H	H	X	X	X	H	H	L
S_0	S_1	I_{0b}	I_{1b}	I_{2b}	I_{3b}	Z_b	$\overline{Z}_b$
L	L	L	X	X	X	L	H
L	L	H	X	X	X	H	L
H	L	X	L	X	X	L	H
H	L	X	H	X	X	H	L
L	H	X	X	L	X	L	H
L	H	X	X	H	X	H	L
H	H	X	X	X	L	L	H
H	H	X	X	X	H	H	L

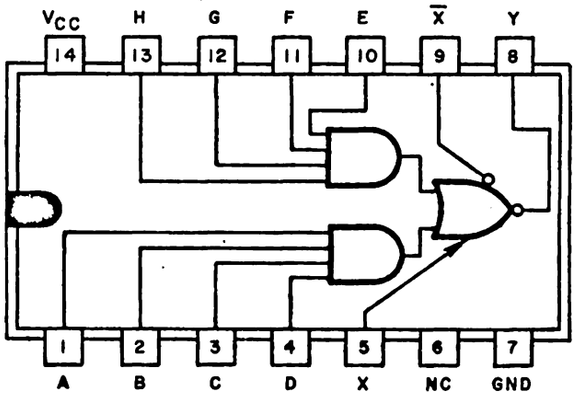
L = LOW Voltage Level
H = HIGH Voltage Level
X = Either HIGH or LOW Logic Level

The 100000048 is a monolithic, high speed, Dual Four-Input Multiplexer circuit, consisting of two multiplexing circuits with common input select logic. Each circuit contains four inputs and fully buffered complementary outputs. This device can generate any two functions of three variables. It may be cascaded to multiple levels so that any number of lines can be multiplexed on to a single output bus.

100000049

Expandable 4-Input AND-OR-INVERT Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

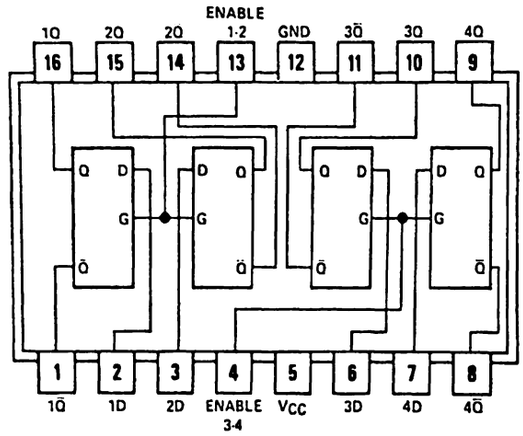
Both expander inputs are used simultaneously for expanding. If expander is not used, leave X and $\overline{X}$ pins open.

Positive logic: Y = (ABCD) + (EFGH) + (X)

100000050

4-Bit Bistable Latches

Pin Configuration



3-4

Logic Diagram/Pin Designations

V_{CC} = Pin 5

Gnd = Pin 12

Function Table
(Each Latch)

Inputs		Ouputs	
D	G	Q	$\overline{Q}$
L	H	L	H
H	H	H	L
X	L	Q_0	$\overline{Q}_0$

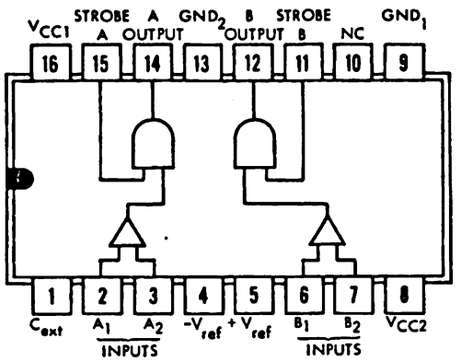
H = high level; L = low level; X = irrelevant.
Q_0 = the level of Q before the high-to-low transition of G.

These latches are suited for use as temporary storage for binary information between processing units and input/output or indicator units. Information present at a data (D) input is transferred to the Q output when the enable (G) is high, and the Q output will follow the data input as long as the enable remains high. When the enable goes low, the information (that was present at the data input at the time the transition occurred) is retained at the Q output until the enable is permitted to go high.

100C00052

Dual Sense Amplifier

Pin Configuration



Logic Diagram/Pin Designations

V_{CC1} = Pin 16

V_{CC2} = Pin 8

Gnd 1 = Pin 9

Gnd 2 = Pin 13

Truth Table

$IN_A \cdot$ STROBE A = OUT A
$\overline{IN_A} \cdot$ STROBE A = $\overline{\text{OUT A}}$
$IN_B \cdot$ STROBE B = OUT B
$\overline{IN_B} \cdot$ STROBE B = $\overline{\text{OUT B}}$

100000053

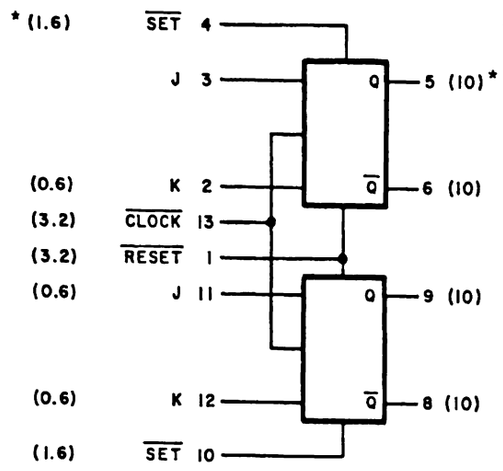
Dual J-K Flip-Flop

Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Logic Diagram



*Loading Max. Shown in Parenthesis

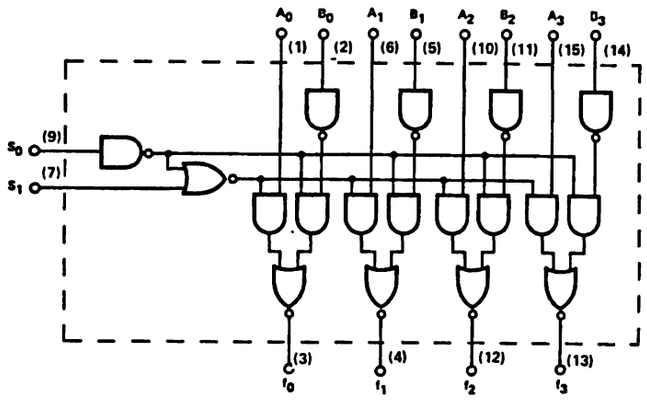
Truth Table

J	K	Q_N	Q_{N+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

100000057 100000108

2-Input, 4-Bit Digital Multiplexer

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

Select Lines		Outputs
S_0	S_1	f_n (0, 1, 2, 3)
0	0	B_n
0	1	B_n
1	0	$\overline{A}_n$
1	1	1

The 2-Input, 4-Bit Digital Multiplexer is a monolithic array utilizing TTL circuit structures. The 100000108 features a bare-collector output to allow expansion with other devices.

The multiplexer is able to choose from two different input sources, each containing 4 bits: A = (A_0, A_1, A_2, A_3); B = (B_0, B_1, B_2, B_3). The selection is controlled by the input S_0, while the second control input, S_1, is held at zero.

For conditional complementing, the two inputs (A_n, B_n) are tied together to form the function TRUE/COMPLEMENT, which is needed in conjunction with added elements to perform Addition/Subtraction. Further, the inhibit state $S_0 = S_1 = 1$ can be used to facilitate transfer operations in an arithmetic section.

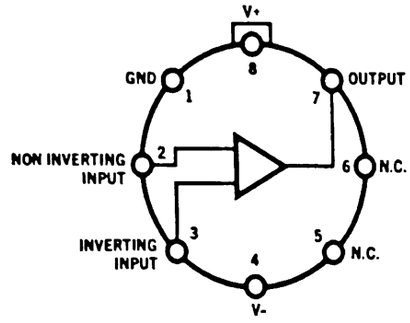
100000059 100000157

High-Speed Differential Comparator

The 100000059 (Can) and 100000157 (DIP) are differential voltage comparators intended for applications requiring high accuracy and fast response times. Constructed on a single silicon chip, the devices are useful as a variable threshold Schmitt trigger, a pulse height discriminator, a voltage comparator in high-speed A/D converters, a memory sense amplifier or a high-noise immunity line receiver.

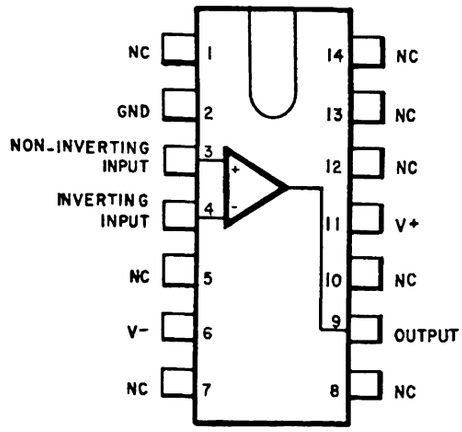
Pin Configurations

100000059



Note: Pin 4 connected to case.

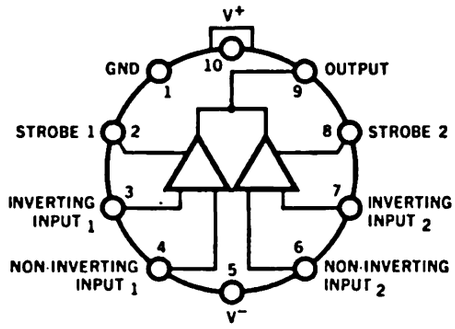
100000157



100000060

Dual Comparator

Pin Configuration



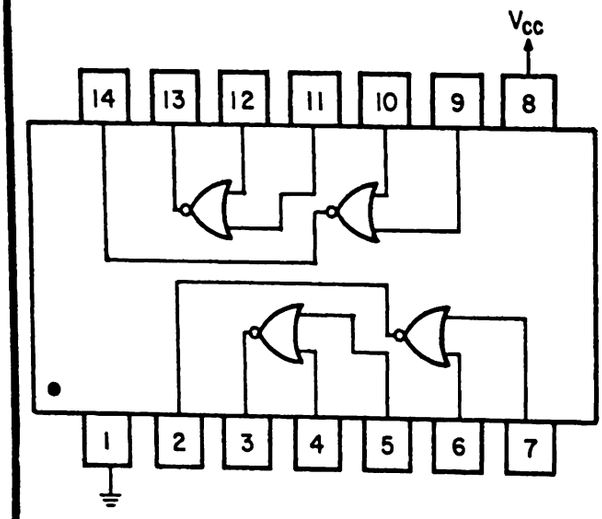
The 100000060 is a dual, differential voltage comparator intended primarily for core-memory sense amplifier applications. The device features high accuracy, fast response times, large input voltage range, low power consumption and compatibility with practically all integrated logic forms.

When used as a sense amplifier, the threshold voltage can be adjusted over a wide range, almost independent of the integrated circuit characteristics. Independent strobing of each comparator channel is provided.

100000061

Quad 2-Input NOR Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 8

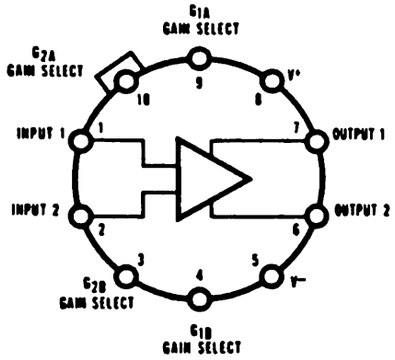
Gnd = Pin 1

100000062

Differential Video Amplifier

Pin Configuration

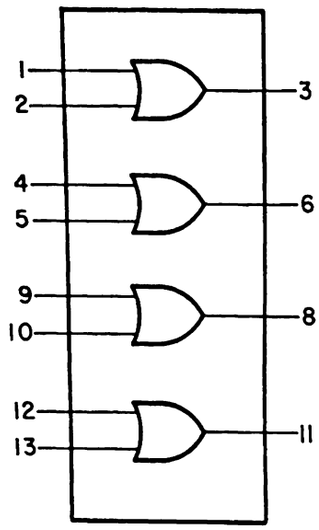
Top View



The 100000062 is a monolithic two-stage differential input, differential output video amplifier. Emitter follower outputs enable the device to drive capacitive loads and all stages are current-source biased to obtain high power supply and common mode rejection ratios. This device provides fixed gains of 10, 100 or 400 without external components, and adjustable gains from 10 to 400 by the use of a single external resistor. No external frequency compensation components are required for any gain option.

100000063

Pin Configuration



Quad 2-Input OR Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14

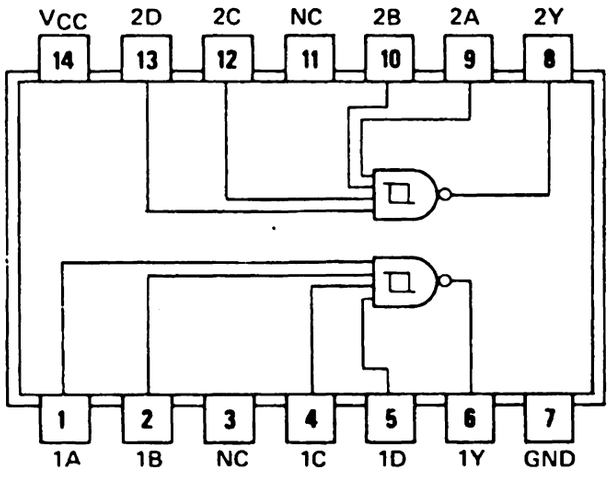
Gnd = Pin 7

3 = 1 + 2

100000066

Dual 4-Input Positive-NAND Schmitt Trigger

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

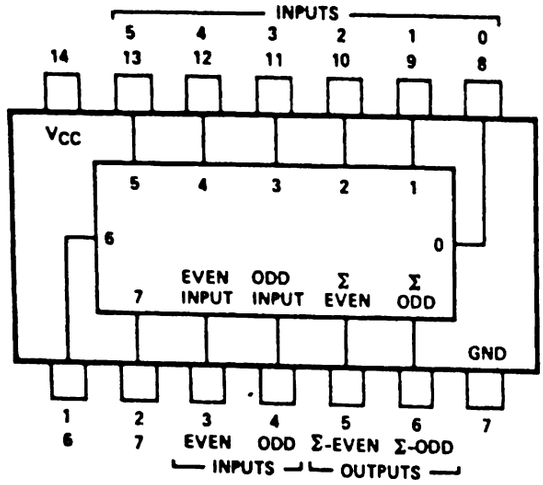
NC = No internal connection

Positive logic: $Y = \overline{ABCD}$

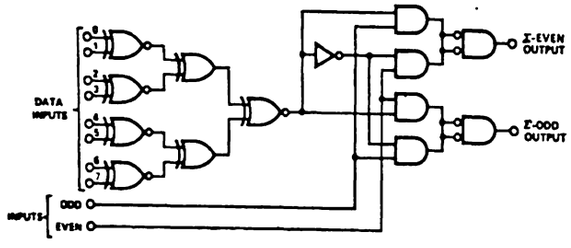
100000067

8-Bit Odd/Even Parity Generator/Checker

Pin Configuration



Logic Diagram



Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Truth Table

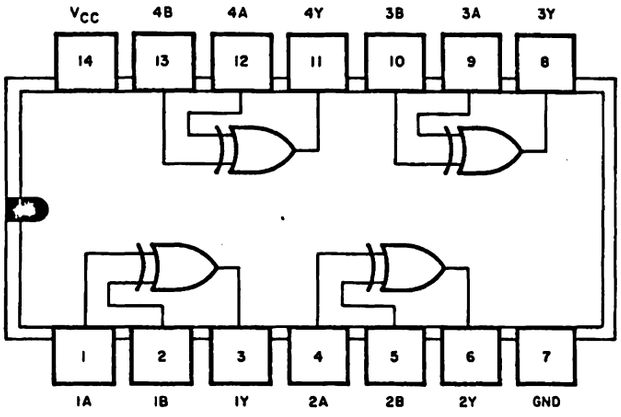
Inputs			Outputs	
Σof 1's at 0 thru 7	Even	Odd	Σ Even	Σ Odd
Even	1	0	1	0
Odd	1	0	0	1
Even	0	1	0	1
Odd	0	1	1	0
X	1	1	0	0
X	0	0	1	1

X = irrelevant.

100000068

Quadruple 2-Input Exclusive-OR Gate

Pin Configuration



Logic Diagram/Pin Designations

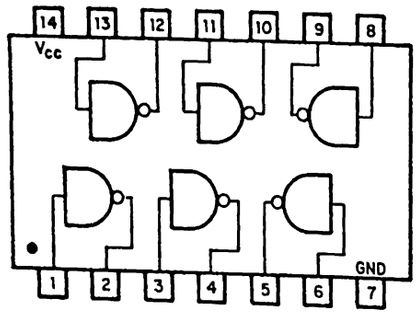
V_{CC} = Pin 14

Gnd = Pin 7

Positive logic: $Y = A \oplus B$

100000020 100000071

Pin Configuration



Hex Inverter

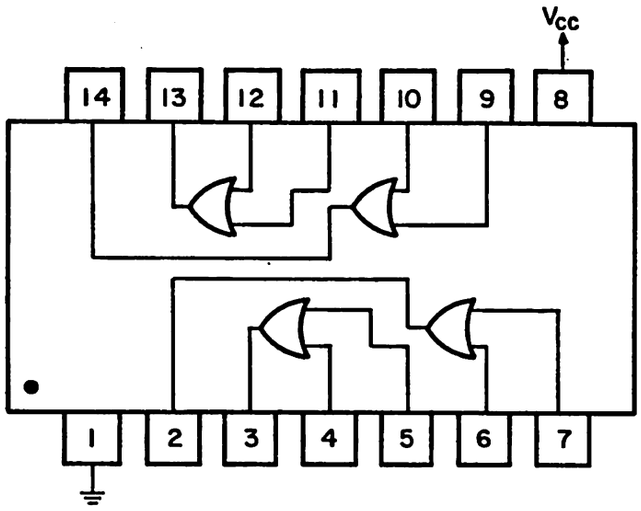
Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

100000072

Pin Configuration



Quad 2-Input OR Gate

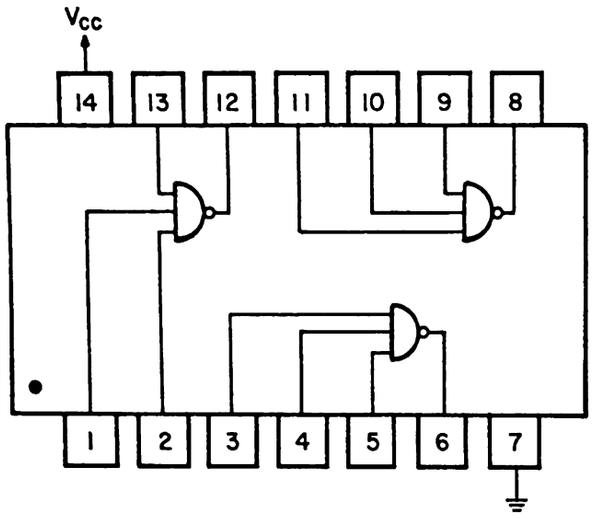
Logic Diagram/Pin Designations

V_{CC} = Pin 8
Gnd = Pin 1

100000073

Triple 3-Input NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

100000074

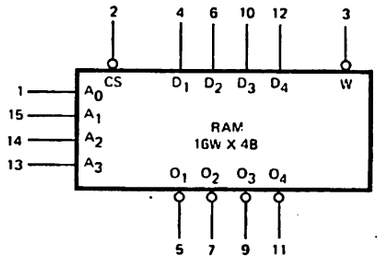
64-Bit Random Access Memory

Logic Diagram/Pin Designations

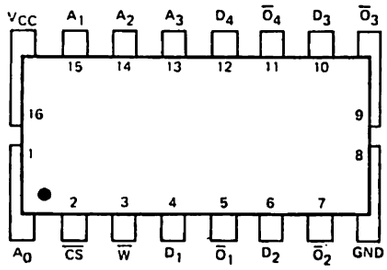
V_{CC} = Pin 16

Gnd = Pin 8

Logic Symbol



Pin Configuration



NOTE: PIN 1 is marked for orientation.

Truth Table

Inputs			Outputs	Mode	
$\overline{CS}$	$\overline{W}$	D_i	$\overline{O}_i$		
H	L	L	H	No Selection)	Note
H	L	H	L	No Selection)	
H	H	X	H	No Selection	
L	L	L	H	Write "0"	
L	L	H	L	Write "1"	
L	H	X	$\overline{D}_i(t_{n-x})$	Read	

H = HIGH Voltage Level
L = LOW Voltage Level

Note: When the chip select $\overline{CS}$ input is HIGH and the Write Enable $\overline{W}$ is LOW data is not written into the memory. However, the data outputs do follow the data inputs inverted.

The 100000074 is a 64-bit RAM, using Schottky diode clamped transistors. The memory is organized as a fully decoded 16-word memory of 4 bits per word. Memory expansion is provided by an active LOW Chip Select ($\overline{CS}$) input and open collector OR tieable outputs. Chip selection for large memory systems can be controlled by active LOW output decoders.

An active LOW Write line ($\overline{W}$) controls the writing/reading operation of the memory. When the Chip Select and Write lines are LOW the information on the four Data Inputs, D_1 to D_4, is written into the addressed memory word.

Reading is performed with the Chip Select line LOW and the Write line HIGH. The information stored in the addressed word is read out on the four inverting inputs, $\overline{O}_1$ to $\overline{O}_4$.

Whenever the write enable is LOW the four outputs of the memory follow the four data input lines inverted.

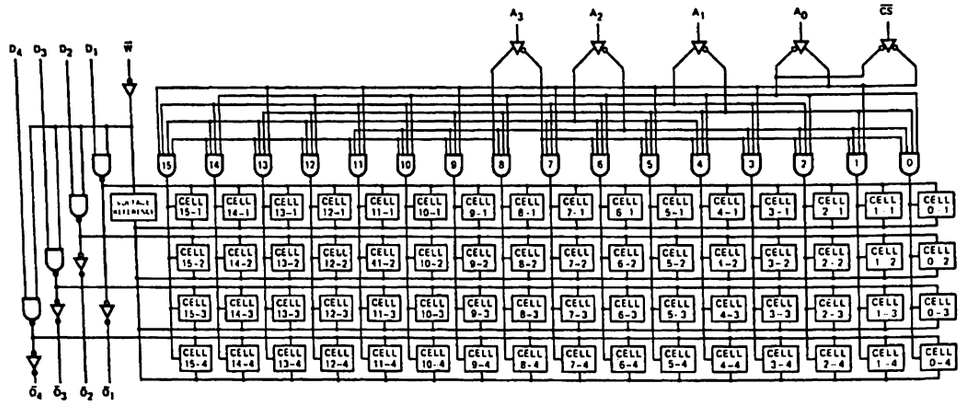
Any time the chip select is HIGH and the write enable is HIGH, all four outputs go HIGH.

Continued ...

100000074

Continued

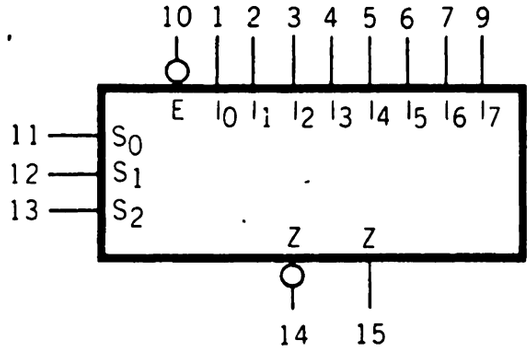
Logic Diagram



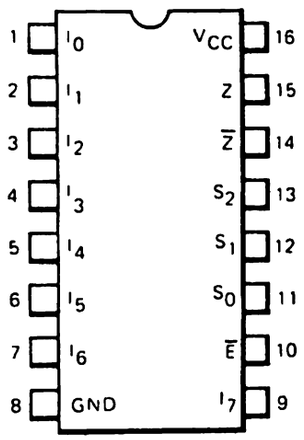
100000075

Eight-Input Multiplexer

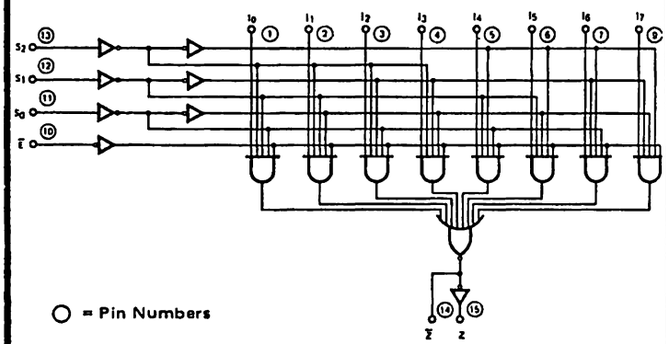
Logic Symbol



Pin Configuration



Logic Diagram



○ = Pin Numbers

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names

S_0, S_1, S_2 ...	Select Inputs
$\overline{E}$.....	Enable (Active LOW) Input
I_0 to I_7	Multiplexer Inputs
Z.....	Multiplexer Output
$\overline{Z}$.....	Complementary Multiplexer Output

Truth Table

$\overline{E}$	S_2	S_1	S_0	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7	$\overline{Z}$	Z
H	X	X	X	X	X	X	X	X	X	X	X	H	L
L	L	L	L	L	X	X	X	X	X	X	X	H	L
L	L	L	L	H	X	X	X	X	X	X	X	L	H
L	L	L	H	X	L	X	X	X	X	X	X	H	L
L	L	L	H	X	H	X	X	X	X	X	X	L	H
L	L	H	L	X	X	L	X	X	X	X	X	H	L
L	L	H	L	X	X	H	X	X	X	X	X	L	H
L	L	H	H	X	X	X	L	X	X	X	X	H	L
L	L	H	H	X	X	X	H	X	X	X	X	L	H
L	H	L	L	X	X	X	X	L	X	X	X	H	L
L	H	L	L	X	X	X	X	H	X	X	X	L	H
L	H	L	H	X	X	X	X	X	L	X	X	H	L
L	H	L	H	X	X	X	X	X	H	X	X	L	H
L	H	H	L	X	X	X	X	X	X	L	X	H	L
L	H	H	L	X	X	X	X	X	X	H	X	L	H
L	H	H	H	X	X	X	X	X	X	X	L	H	L
L	H	H	H	X	X	X	X	X	X	X	H	L	H

H = HIGH voltage level
L = LOW voltage level
X = Level does not affect output.

The 100000075 is a monolithic, high speed, eight-input digital multiplexer circuit. It can be used as a universal function generator to generate any logic function of four variables. It is a logical implementation of a single-pole, 8-position switch with the switch position controlled by the state of three Select Inputs, S_0, S_1 and S_2. Both assertion and negation outputs are provided. The Enable Input ($\overline{E}$) is active LOW. When it is not activated the negation output is HIGH and the assertion output is LOW, regardless of all other inputs.

Continued ....

100000075

Continued

The logic function provided at the output is:

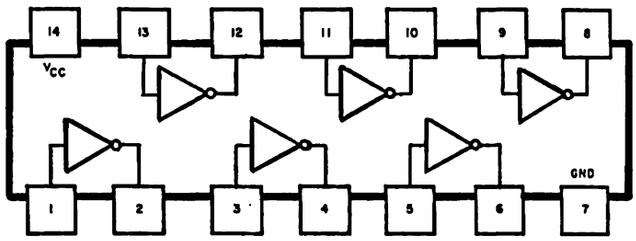
$$Z = E \cdot (I_0 \cdot \overline{S}_0 \cdot \overline{S}_1 \cdot \overline{S}_2 + I_1 \cdot S_0 \cdot \overline{S}_1 \cdot \overline{S}_2 + I_2 \cdot \overline{S}_0 \cdot S_1 \cdot \overline{S}_2 + I_3 \cdot S_0 \cdot S_1 \cdot \overline{S}_2 + I_4 \cdot \overline{S}_0 \cdot \overline{S}_1 \cdot S_2 + I_5 \cdot S_0 \cdot \overline{S}_1 \cdot S_2 + I_6 \cdot \overline{S}_0 \cdot S_1 \cdot S_2 + I_7 \cdot S_0 \cdot S_1 \cdot S_2).$$

This device provides the ability, in one package, to select from eight sources of data or control information. Proper manipulation of the inputs can provide any logic function of four variables and its negation.

100000076

Hex Inverter

Pin Configurations



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Truth Table

Any Input Low = High Out
Any Input High = Low Out

100000077

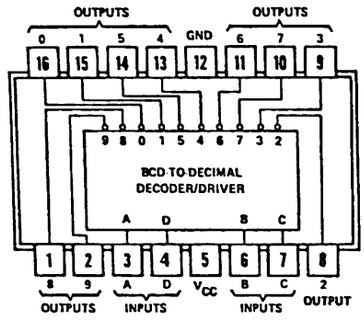
BCD-To-Decimal Decoder-Driver

Pin Designations

V_{CC} = Pin 5

Gnd = Pin 12

Pin Configuration



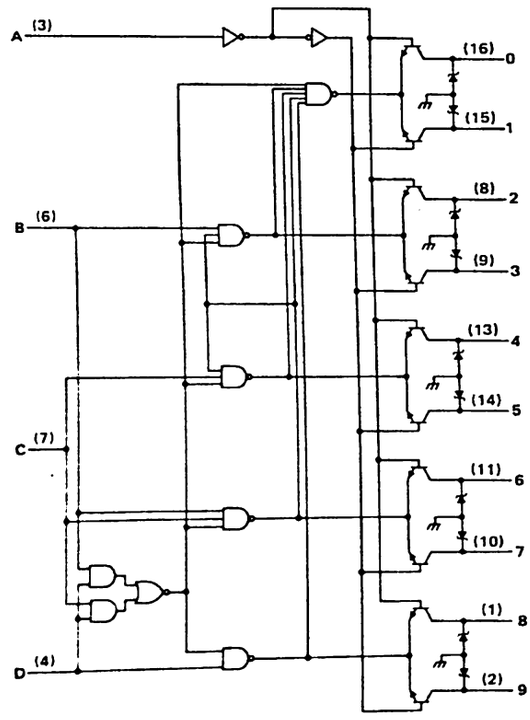
Positive Logic See Function Table

Function Table

Input				Output
D	C	B	A	On*
L	L	L	L	0
L	L	L	H	1
L	L	H	L	2
L	L	H	H	3
L	H	L	L	4
L	H	L	H	5
L	H	H	L	6
L	H	H	H	7
H	L	L	L	8
H	L	L	H	9
H	L	H	L	None
H	L	H	H	None
H	H	L	L	None
H	H	L	H	None
H	H	H	L	None
H	H	H	H	None

H = high level; L = low level.
* All other outputs are off.

Functional Schematic

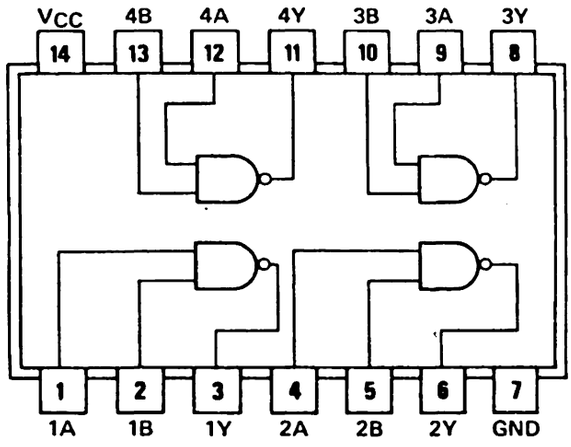


The 100000077 is a second-generation BCD-to-decimal decoder designed specifically to drive cold-cathode indicator tubes.

Full decoding is provided for all possible input states. For binary inputs 10 through 15, all the outputs are off. Therefore, this device, combined with a minimum of external circuitry, can use these invalid codes in blanking leading- and/or trailing edge zeroes in a display. The ten high-performance, n-p-n output transistors have a maximum reverse current of 50 microamperes at 55 volts.

100000078

Pin Configuration



Quadruple 2-Input Positive-NAND Buffer With Open-Collector Outputs

Logic Diagram/Pin Designations

V_{CC} = Pin 14

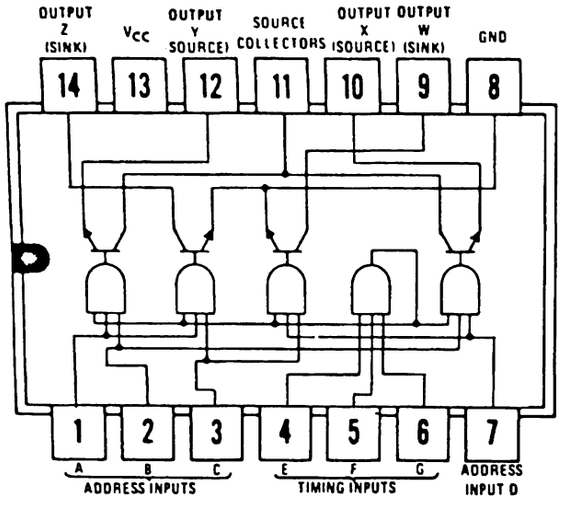
Gnd = Pin 7

Positive logic: $Y = \overline{AB}$

100000079

Memory Driver with Decode Inputs

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 13

Gnd = Pin 8

Truth Table

Inputs							Outputs			
Address				Timing			Sink	Sources		Sink
A	B	C	D	E	F	G	W	X	Y	Z
0	0	1	1	1	1	1	On	Off	Off	Off
0	1	0	1	1	1	1	Off	On	Off	Off
1	1	0	0	1	1	1	Off	Off	On	Off
1	0	1	0	1	1	1	Off	Off	Off	On
X	X	X	X	0	X	X	Off	Off	Off	Off
X	X	X	X	X	0	X	Off	Off	Off	Off
X	X	X	X	X	X	0	Off	Off	Off	Off

Notes:

X = Logical 1 or logical 0.

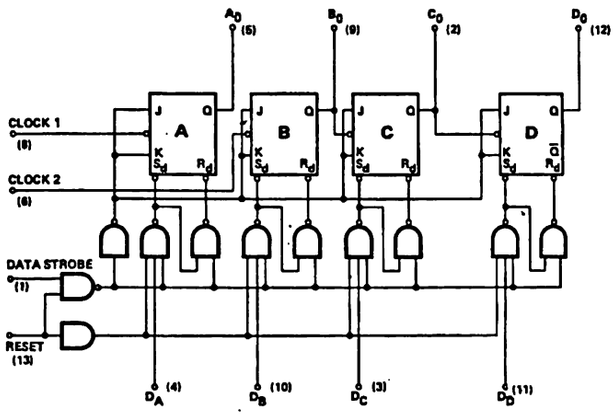
Not more than one output is allowed to be On at one time: When all timing inputs are at a logical 1, two of the address inputs must be at a logical 0.

This monolithic memory driver with decode inputs is designed for use with magnetic memories. The device contains two 400 milliampere (source/sink) switch pairs, with decoding capability from four address lines. Two address inputs (B and C) are used for mode selection; i. e., source or sink. The other two address inputs (A and D) are used for switch-pair selection; i. e., output switch-pair Y/Z or W/X, respectively.

100000080 100000227

Presettable High Speed Binary Counter

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Truth Table

Input	A_0	B_0	C_0	D_0
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1
10	0	1	0	1
11	1	1	0	1
12	0	0	1	1
13	1	0	1	1
14	0	1	1	1
15	1	1	1	1

The 100000080 Presettable High Speed Binary Counter may be connected as a divide-by-two, four, eight or sixteen counter.

This device has strobed parallel-entry capability so that the counter may be set to any desired output state. A "1" or "0" at a data input will be transferred to the associated output when the strobe input is put at the "0" level. This unit is provided with a reset input which is common to all four bits. A "0" on the reset lines produces "0" at all four outputs.

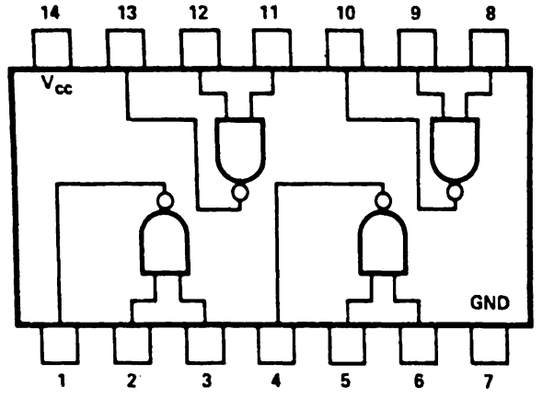
The counting operation is performed on the falling (negative-going) edge of the input clock pulse.

Note: The 100000227 is a Shottky device.

100000081

Quadruple 2-Input Positive-NAND Buffer

Pin Configuration



Logic Diagram/Pin Designations

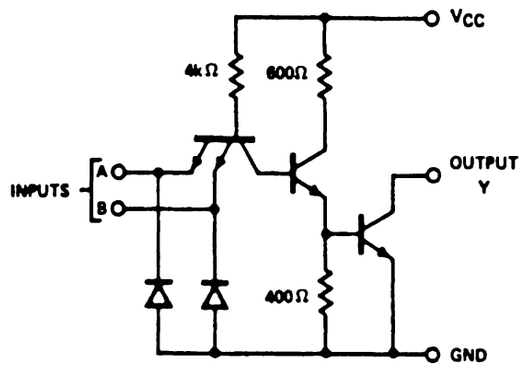
V_{CC} = Pin 14

Gnd = Pin 7

Positive logic: $Y = \overline{AB}$

The 100000081 is a NAND Gate with an open-collector output for "WIRE-AND" applications.

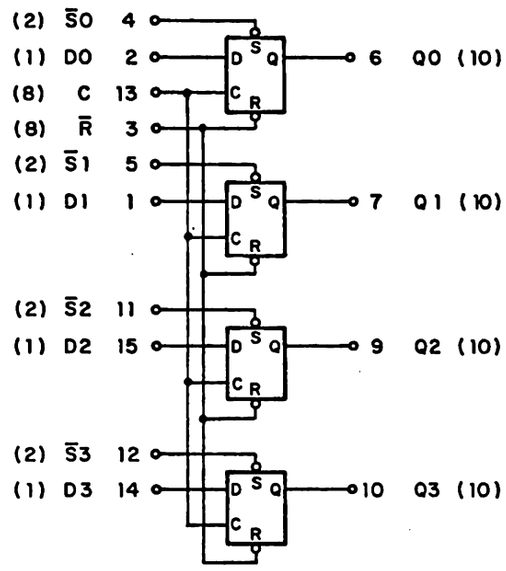
Schematic (Each Buffer)



100000082

Quad D Type Flip-Flop

Logic Diagram



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

Q	Q_{n-1}	Q_n
0	0	0
0	1	0
1	0	1
1	1	1

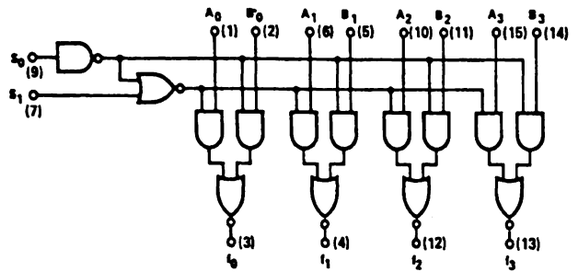
Q_{n-1} = Time period prior to clock pulse

Q_n = Time period following clock pulse

100000083

2-Input, 4-Bit Digital Multiplexer

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

S_0	S_1	f_n
0	0	$\overline{B}$
1	0	$\overline{A}$
0	1	$\overline{B}$
1	1	1

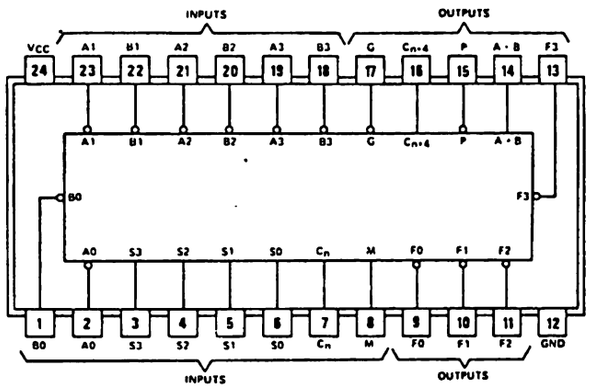
This multiplexer has inverting data paths. It has open collector outputs which permit direct wiring to other open collector outputs (collector logic) to yield "free" four-bit words. As many as one hundred four-bit words can be multiplexed by using fifty of these devices in the WIRED-AND mode.

The inhibit state $S_0 = S_1 = 1$ can be used to facilitate transfer operations in an arithmetic section.

100000084 100000169 100000306

Arithmetic Logic Units/Function Generators

Pin Configuration



Pin Designations

Designation	Pin Nos.	Function
A3, A2, A1, A0	19, 21, 23, 2	Word A Inputs
B3, B2, B1, B0	18, 20, 22, 1	Word B Inputs
S3, S2, S1, S0	3, 4, 5, 6	Function-Select Inputs
C_n	7	Inv. Carry Input
M	8	Mode Control Input
F3, F2, F1, F0	13, 11, 10, 9	Function Outputs
A=B	14	Comparator Output
P	15	Carry Propagate Output
C_{n+4}	16	Inv. Carry Output
G	17	Carry Generate Output
V_{CC}	24	Supply Voltage
Gnd	12	Ground

These arithmetic logic units (ALU)/function generators have a complexity of 75 equivalent gates on a monolithic chip, and perform 16 binary arithmetic operations on two 4-bit words as shown in Tables 1 and 2. These operations are selected by the four function-select lines (S0, S1, S2, S3) and include addition, subtraction, decrement and straight transfer. When performing arithmetic manipulations, the internal carries must be enabled by applying a low-level voltage to the mode control input (M). A full carry look-ahead scheme is made available for fast, simultaneous carry generation by means of two cascade-outputs (pins 15 and 17) for the four bits in the package. When used in conjunction with 100000100 or 100000170, full carry look-ahead circuits, high-speed arithmetic operations can be performed. If high speed is not of importance, a ripple-carry input (C_n) and a ripple-carry output (C_{n+4}) are available. However, the ripple-carry delay is minimized so that arithmetic manipulations for small word lengths can be performed without external circuitry.

These devices will accommodate active-high or active-low data if the pin designations are interpreted as follows:

Continued.....

Table 1

Selection S3 S2 S1 S0	M = H Logic Functions	Active-High Data M = L; Arithmetic Operations	
		C_n = H (no carry)	C_n = L (with carry)
L L L L	F = $\overline{A}$	F = A	F = A Plus 1
L L L H	F = $\overline{A + B}$	F = A + B	F = (A + B) Plus 1
L L H L	F = $\overline{A}B$	F = A + $\overline{B}$	F = (A + $\overline{B}$) Plus 1
L L H H	F = 0	F = Minus 1 (2's Compl)	F = Zero
L H L L	F = $\overline{AB}$	F = A Plus A$\overline{B}$	F = A Plus A$\overline{B}$ Plus 1
L H L H	F = $\overline{B}$	F = (A + B) Plus A$\overline{B}$	F = (A + B) Plus A$\overline{B}$ Plus 1
L H H L	F = A$\odot$B	F = A Minus B Minus 1	F = A Minus B
L H H H	F = A$\overline{B}$	F = A$\overline{B}$ Minus 1	F = A$\overline{B}$
H L L L	F = $\overline{A}$ + B	F = A Plus AB	F = A Plus AB Plus 1
H L L H	F = $\overline{A\odot B}$	F = A Plus B	F = A Plus B Plus 1
H L H L	F = B	F = (A + $\overline{B}$) Plus AB	F = (A + $\overline{B}$) Plus AB Plus 1
H L H H	F = AB	F = AB Minus 1	F = AB
H H L L	F = 1	F = A Plus A*	F = A Plus A Plus 1
H H L H	F = A + $\overline{B}$	F = (A + B) Plus A	F = (A + B) Plus A Plus 1
H H H L	F = A + B	F = (A + $\overline{B}$) Plus A	F = (A + $\overline{B}$) Plus A Plus 1
H H H H	F = A	F = A Minus 1	F = A

* Each bit is shifted to the next more significant position.

Table 2

Selection S3 S2 S1 S0	M = H Logic Functions	Active-Low Data M = L; Arithmetic Operations	
		C_n = L (no carry)	C_n = H (with carry)
L L L L	F = $\overline{A}$	F = A Minus 1	F = A
L L L H	F = $\overline{AB}$	F = AB Minus 1	F = AB
L L H L	F = $\overline{A}$ + B	F = A$\overline{B}$ Minus 1	F = A$\overline{B}$
L L H H	F = 1	F = Minus 1 (2's Comp)	F = Zero
L H L L	F = $\overline{A + B}$	F = A Plus (A + $\overline{B}$)	F = A Plus (A + $\overline{B}$) Plus 1
L H L H	F = $\overline{B}$	F = AB Plus (A + $\overline{B}$)	F = AB Plus (A + $\overline{B}$) Plus 1
L H H L	F = $\overline{A\odot B}$	F = A Minus B Minus 1	F = A Minus B
L H H H	F = A + $\overline{B}$	F = A + $\overline{B}$	F = (A + $\overline{B}$) Plus 1
H L L L	F = $\overline{A}$B	F = A Plus (A + B)	F = A Plus (A + B) Plus 1
H L L H	F = A$\odot$B	F = A Plus B	F = A Plus B Plus 1
H L H L	F = B	F = A$\overline{B}$ Plus (A + B)	F = A$\overline{B}$ Plus (A + B) Plus 1
H L H H	F = A + B	F = A + B	F = (A + B) Plus 1
H H L L	F = 0	F = A Plus A*	F = A Plus A Plus 1
H H L H	F = A$\overline{B}$	F = AB Plus A	F = AB Plus A Plus 1
H H H L	F = AB	F = A$\overline{B}$ Plus A	F = A$\overline{B}$ Plus A Plus 1
H H H H	F = A	F = A	F = A Plus 1

* Each bit is shifted to the next more significant position.

Continued....

Pin No.	Active-high data Table 1	Active-low data Table 2
2	A_0	$\overline{A}_0$
1	B_0	$\overline{B}_0$
23	A_1	$\overline{A}_1$
22	B_1	$\overline{B}_1$
21	A_2	$\overline{A}_2$
20	B_2	$\overline{B}_2$
19	A_3	$\overline{A}_3$
18	B_3	$\overline{B}_3$
9	F_0	$\overline{F}_0$
10	F_1	$\overline{F}_1$
11	F_2	$\overline{F}_2$
13	F_3	$\overline{F}_3$
7	$\overline{C}_n$	C_n
16	$\overline{C}_{n+4}$	C_{n+4}
15	X	$\overline{P}$
17	Y	$\overline{G}$

Subtraction is accomplished by 1's complement addition where the 1's complement of the subtrahend is generated internally. The resultant output is A-B-1, which requires an end-around or forced carry to provide A-B.

These devices can also be utilized as comparators. The A=B output is internally decoded from the function outputs (F0, F1, F2, F3) so that when two words of equal magnitude are applied at the A and B inputs, it will assume a high level to indicate equality (A = B). The ALU should be in the subtract mode with C_n = H when performing this comparison. The A = B output is open-collector so that it can be wire-AND connected to give a comparison for more than four bits. The carry output (C_{n+4}) can also be used to supply relative magnitude information. Again, the ALU should be placed in the subtract mode by placing the function select inputs S3, S2, S1, S0 at L, H, H, L, respectively.

Input C_n	Output C_{n+4}	(Figure 1) Active-high Data	(Figure 2) Active-low Data
H	H	A $\leqslant$ B	A $\geqslant$ B
H	L	A > B	A < B
L	H	A < B	A > B
L	L	A $\geqslant$ B	A $\leqslant$ B

100000084 100000169 100000306

Continued

Figure 1

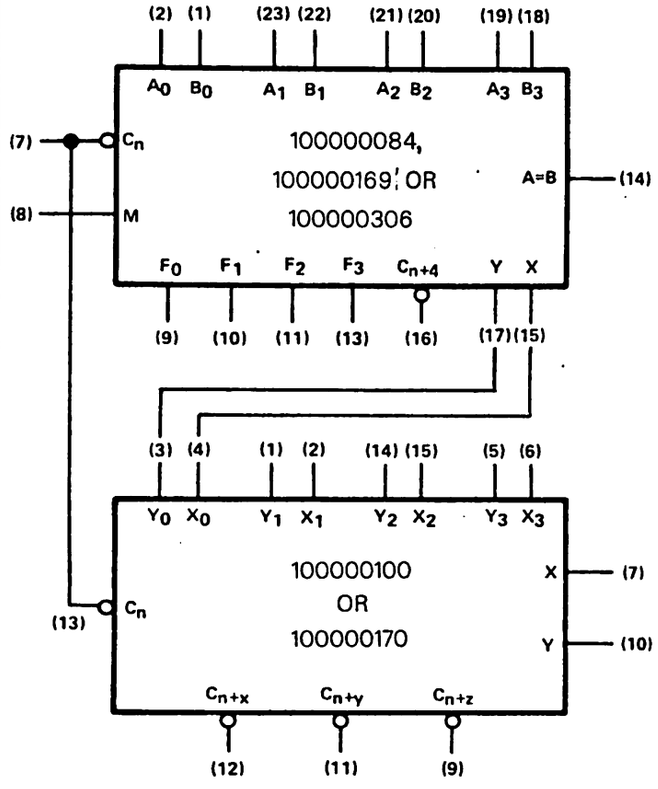
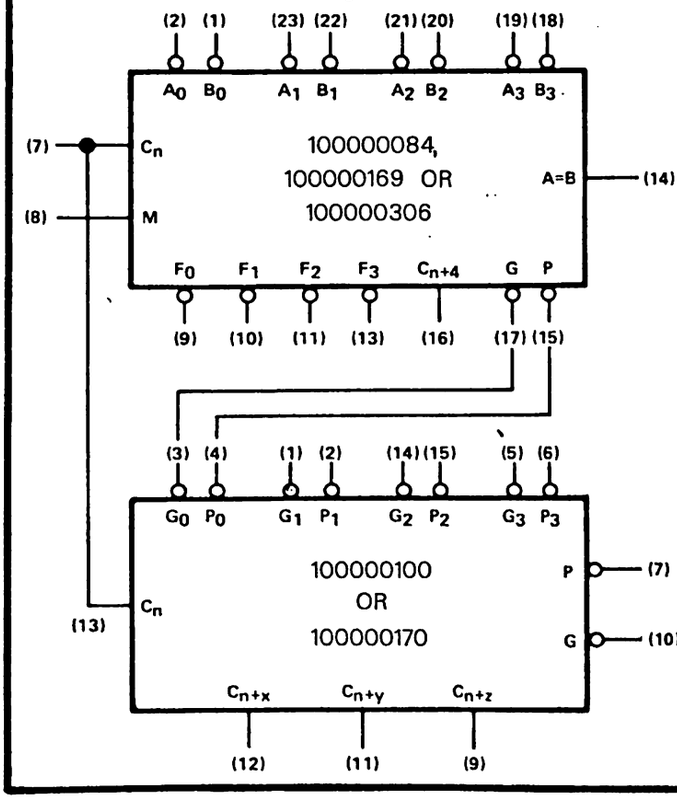


Figure 2



These circuits have been designed to provide 16 possible functions of two Boolean variables without the use of external circuitry. These logic functions are selected by use of the four function-select inputs (S0, S1, S2, S3) with the mode-control input (M) at a high level to disable the internal carry. The 16 logic functions are detailed in Tables 1 and 2 and include exclusive-OR, NAND, AND, NOR and OR functions.

ALU Signal Designations

These devices can be used with the signal designations of either Figure 1 or Figure 2. The logic functions and arithmetic operations obtained with the signal designations of Figure 1 are given in Table 1; those obtained with the signal designations of Figure 2 are given in Table 2.

Note: The 100000169 is a Shottky device.

100000085

4-By-4 Register File

Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

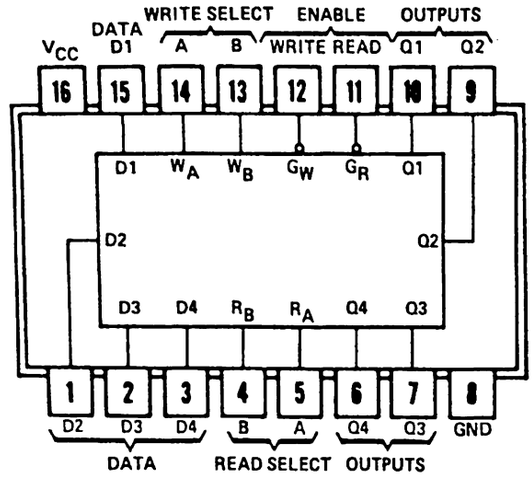
The 100000085 16-bit TTL register file is organized as 4 words of 4 bits each. Separate on-chip decoding is provided for addressing the four word locations to either write-in or retrieve data; this permits simultaneous writing into one location and reading from another word location. The register file has a nondestructive readout in that data is not lost when addressed.

Four data inputs are available which are used to supply 4-bit words to be stored. Location of the word is determined by the write address inputs A and B in conjunction with a write-enable signal. Data applied at the inputs should be in its true form; that is, if a high-level signal is desired from the output, a high-level is applied at the data input for that particular bit location. The latch inputs are arranged so that new data will be accepted only if both internal address gate inputs are high. When this condition exists, data at the D input is transferred to the latch output. When the write enable input, G_W, is high, the data inputs are inhibited and their levels can cause no change in the information stored in the internal latches. When the read enable input, G_R, is high, the data outputs are inhibited and remain high.

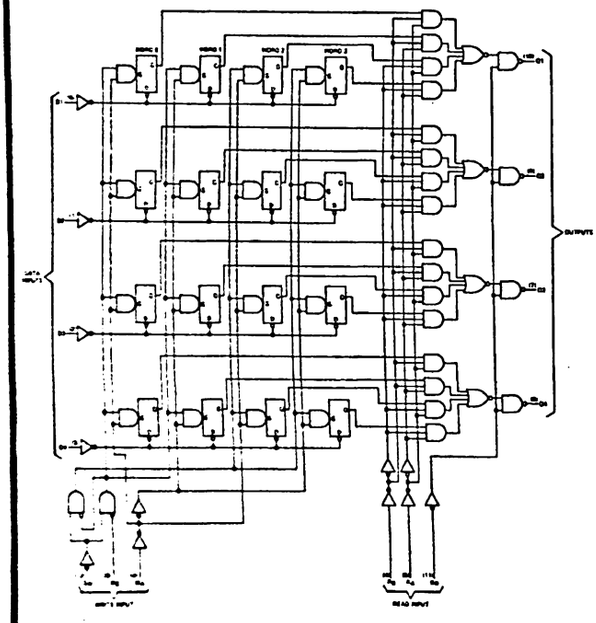
The individual address lines permit direct acquisition of data stored in any four of the latches. Four individual decoding gates are used to complete the address for reading a word. When the read address is made in conjunction with the read-enable signal, the word appears at the four outputs.

High-speed, double-ended AND-OR-INVERT gates are employed for the read-address function and drive high-sink-current, open-collector outputs. Up to 256 of these outputs may be wire-AND connected for increasing the capacity up to 1024 words. Any number of registers may be paralleled to provide n-bit word length.

Pin Configuration



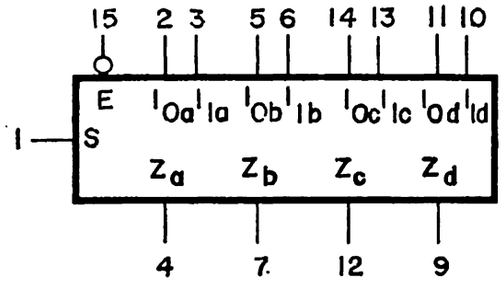
Logic Diagram



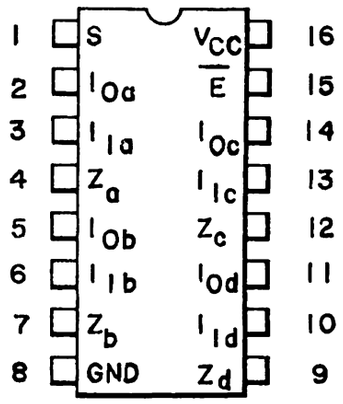
100000086

Quad Two-Input Multiplexer

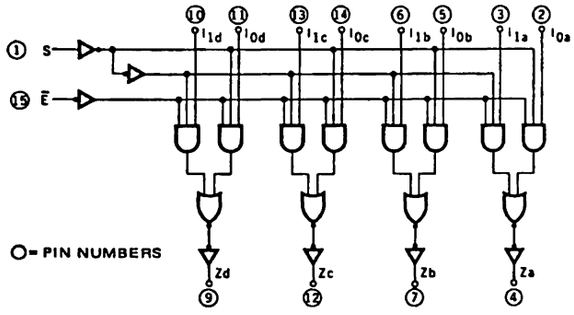
Logic Symbol



Logic Diagram



Logic Diagram



Logic Diagram/Pin Designations

VCC = Pin 16

Gnd = Pin 8

Pin Names

$\overline{S}$	Common Selected Input
$\overline{E}$	Enable (Active LOW)Inputs
I_{0a}, I_{1a}, I_{0b}, I_{1b}) I_{0c}, I_{1c}, I_{0d}, I_{1d})	Multiplexer Inputs
Z_a, Z_b, Z_c, Z_d	Multiplexer Output

Truth Table

Enable	Select Input	Inputs		Output
$\overline{E}$	S	I_{0X}	I_{1X}	Z_X
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

H = HIGH Voltage Level
L = LOW Voltage Level
X = Either HIGH or LOW Logic Level

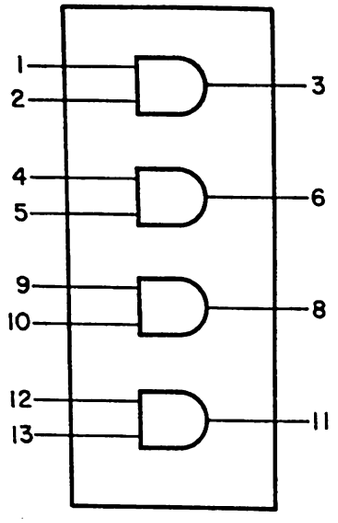
The 100000086 Quad Two-Input Multiplexer consists of four multiplexing circuits with common select and enable logic; each circuit contains two inputs and one output. The Enable input ($\overline{E}$) is active LOW. When not activated, all outputs (Z) are LOW regardless of other inputs.

The multiplexer is the logical implementation of a four-pole, two-position switch, with the position of the switch being set by the logic levels supplied to the one select input. The logic equations for the outputs follow:

$$Z_a = E \cdot (I_{1a} \cdot S + I_{0a} \cdot \overline{S})$$
$$Z_b = E \cdot (I_{1b} \cdot S + I_{0b} \cdot \overline{S})$$
$$Z_c = E \cdot (I_{1c} \cdot S + I_{0c} \cdot \overline{S})$$
$$Z_d = E \cdot (I_{1d} \cdot S + I_{0d} \cdot \overline{S})$$

100000089

Pin Configuration



Quad 2-Input AND Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14

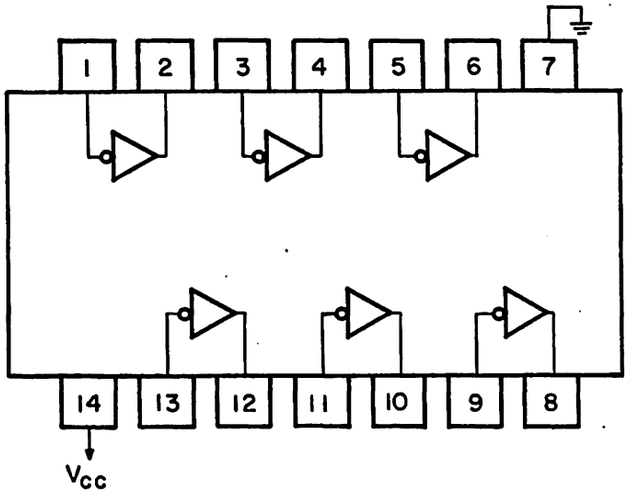
Gnd = Pin 7

3 = 1 · 2

100000090

6-Input Hex Inverter

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

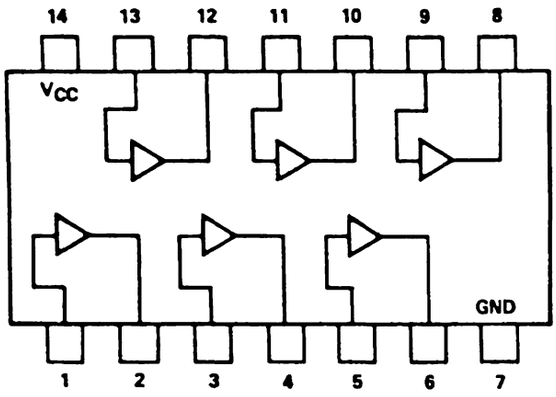
Gnd = Pin 7

Positive logic: $Y = \overline{AB}$

100000091

Hex Buffer/Driver with Open Collector High Voltage Outputs

Pin Configuration



Logic Diagram/Pin Designations

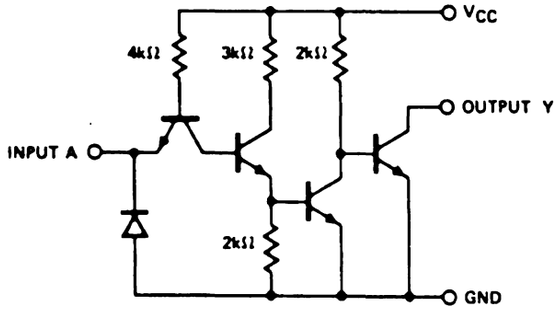
V_{CC} = Pin 14

Gnd = Pin 7

Positive logic: Y = A

The 100000091 has standard TTL inputs with non-inverted high voltage, high current open collector outputs for interface with MOS, lamps or relays.

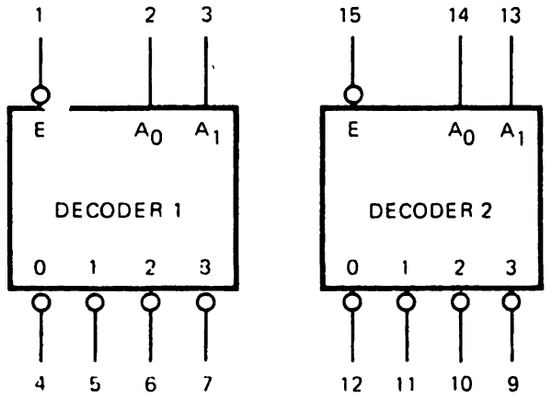
Schematic (Each Buffer/Driver)



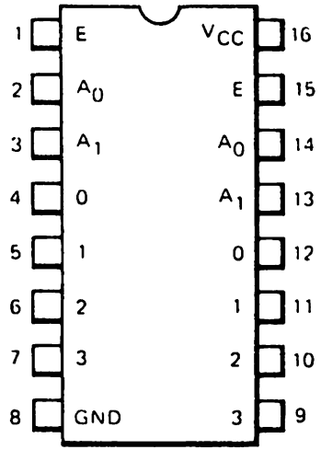
100000092

Dual One-of-Four Decoder

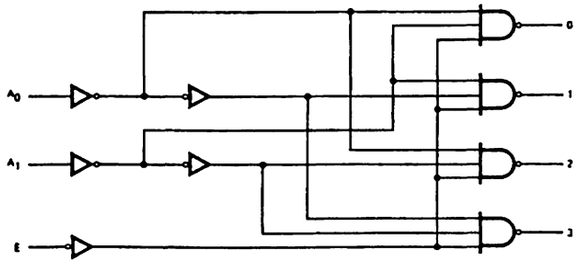
Logic Symbol



Pin Configuration



Logic Diagram



Note: Only one Decoder shown.

Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Pin Names

Decoder 1 and 2

$\overline{E}$ ..... Enable (Active LOW) Input
A_0, A_1 ..... Address Inputs
$\overline{0}, \overline{1}, \overline{2}, \overline{3}$ ..... (Active LOW) Outputs

Truth Table
Decoder 1 & 2

$\overline{E}$	A_0	A_1	$\overline{0}$	$\overline{1}$	$\overline{2}$	$\overline{3}$
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L
H	X	X	H	H	H	H

H = HIGH Voltage Level
L = LOW Voltage Level
X = Level Does Not Affect Output

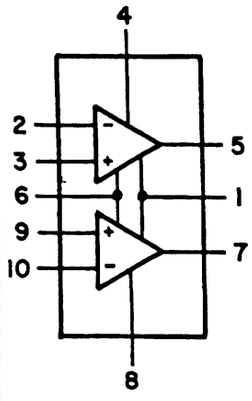
The 100000092 consists of two independent multipurpose decoders, each designed to accept two binary weighted inputs and provide four mutually exclusive active LOW outputs. Each decoder can be used as a 4-output demultiplexer by using the enable as a data input.

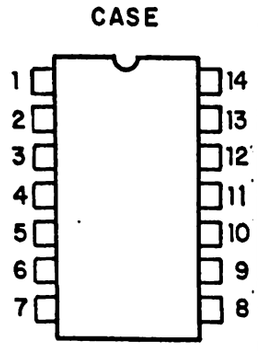
The active LOW outputs facilitate memory addressing for units such as the 100000211 associative memory.

100000093

Monolithic Dual Operational Amplifier

Pin Configuration



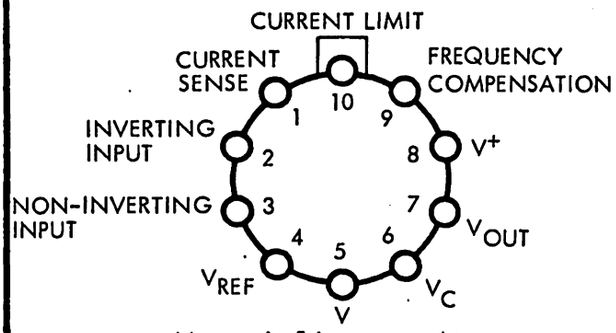


100000026 100000094

Precision Voltage Regulator

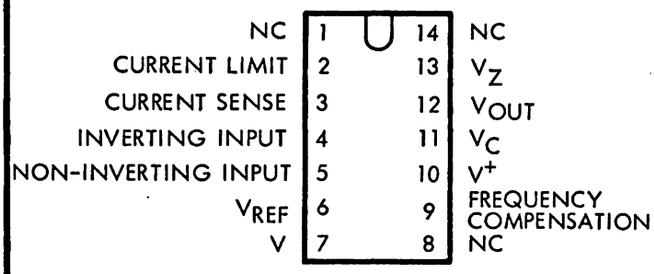
The 100000026(Can) and 100000094(DIP) are monolithic voltage regulators, consisting of a temperature compensated reference amplifier, error amplifier, power series pass transistor and current limit circuitry. Additional NPN or PNP pass elements may be used when output currents exceeding 150mA are required. Provisions are made for adjustable current limiting and remote shutdown.

Pin Configurations



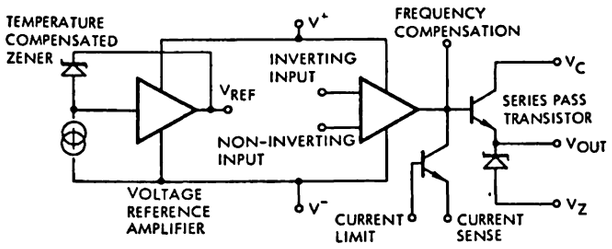
Note: pin 5 is connected to case

100000026



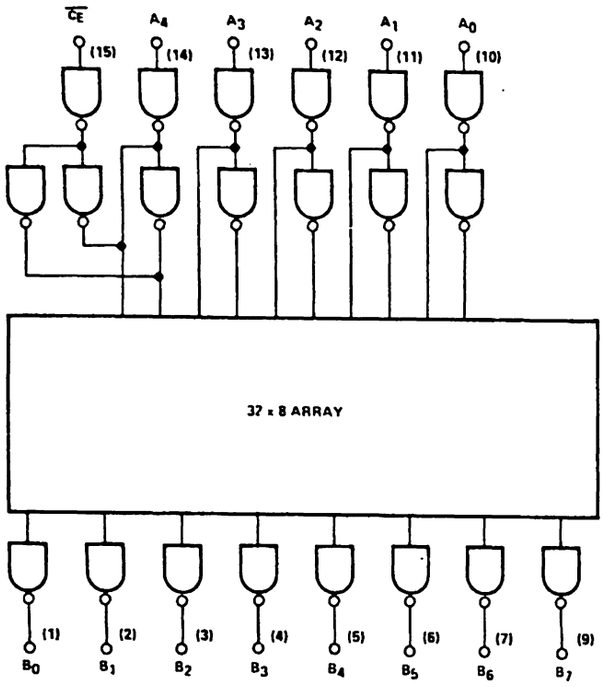
100000094

Equivalent Circuit



100000095 100000096

Logic Diagram



256-Bit Bipolar ROM

Logic Diagram/Pin Designations

V_{CC} = Pin 16

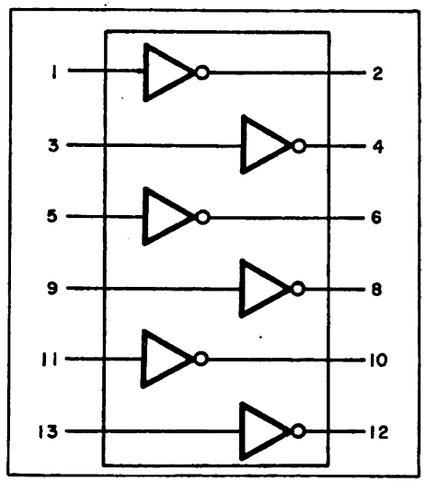
Gnd = Pin 8

These TTL 256-bit read only memories are organized as 32 words with 8 bits per word. The words are selected by five binary address lines with full word decoding incorporated on the chip. A Chip Enable input is provided for additional decoding flexibility, which will cause all eight outputs to go to the high state when the Chip Enable input is taken high.

The 100000095 and 100000096 are fully TTL or DTL compatible. The outputs are uncommitted collectors, which allows wired-AND operation with the outputs of other TTL or DTL devices.

100000098

Pin Configuration



Quad Hex Inverter

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

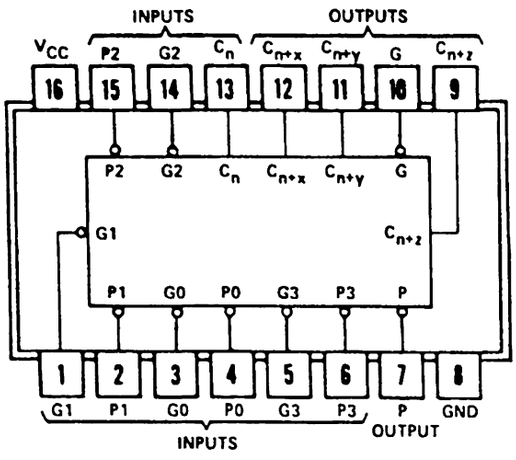
Truth Table

Any Input Low = High Out
Any Input High = Low Out

100000100 100000170

Look-Ahead Carry Generators

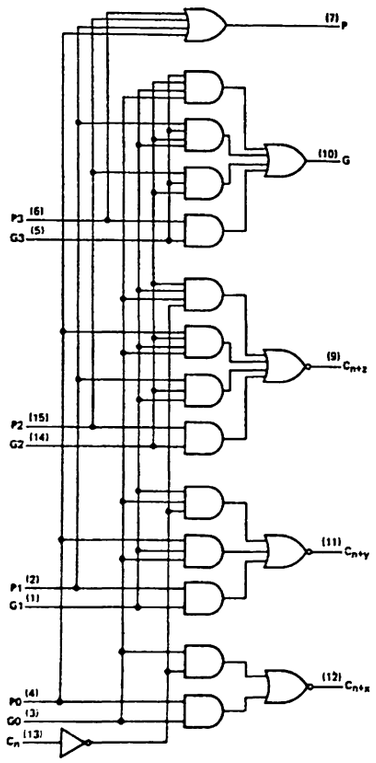
Pin Configuration



Pin Designations

Designation	Pin Nos.	Function
G0, G1, G2, G3	3, 1, 14, 5	Active-Low Carry Generate Inputs
P0, P1, P2, P3	4, 2, 15, 6	Active-Low Carry Propagate Inputs
C_n	13	Carry Input
C_{n+x}, C_{n+y}, C_{n+z}	12, 11, 9	Carry Outputs
G	10	Active-Low Carry Generate Output
P	7	Active-Low Carry Propagate Output
V_{CC}	16	Supply Voltage
Gnd	8	Ground

Logic Diagram



Positive Logic:

$$C_{n+x} = \overline{G}_0 + \overline{P}_0 C_n$$

$$C_{n+y} = \overline{G}_1 + \overline{P}_1\overline{G}_0 + \overline{P}_1\overline{P}_0 C_n$$

$$C_{n+z} = \overline{G}_2 + \overline{P}_2\overline{G}_1 + \overline{P}_2\overline{P}_1\overline{G}_0 + \overline{P}_2\overline{P}_1\overline{P}_0 C_n$$

$$\overline{G} = \overline{G}_3(\overline{P}_3+\overline{G}_2)(\overline{P}_3+\overline{P}_2+\overline{G}_1)(\overline{P}_3+\overline{P}_2+\overline{P}_1+\overline{G}_0)$$

$$\overline{P} = \overline{P}_3\overline{P}_2\overline{P}_1\overline{P}_0$$

These devices are high-speed, look-ahead carry generators capable of anticipating a carry across four binary adders or group of adders. They are cascadable to perform full look-ahead across n-bit adders. Carry, generate-carry and propagate-carry functions are provided as enumerated in the pin designation table above.

When used in conjunction with arithmetic logic units, 100000084 or 100000169, these generators provide high-speed carry look-ahead capability for any word length.

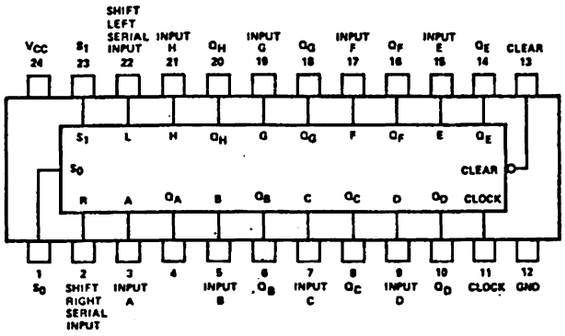
Carry input and output of the 100000084 or 100000169 are in their true form and the carry propagate (P) and carry generate (G) are in negated form; therefore, the carry functions (inputs, outputs, generate and propagate) of the look-ahead generators are implemented in the compatible forms for direct connection to the ALU.

Note: The 100000170 is a Shottky device.

100000101

8-Bit Shift Register

Pin Configuration



Pin Designations

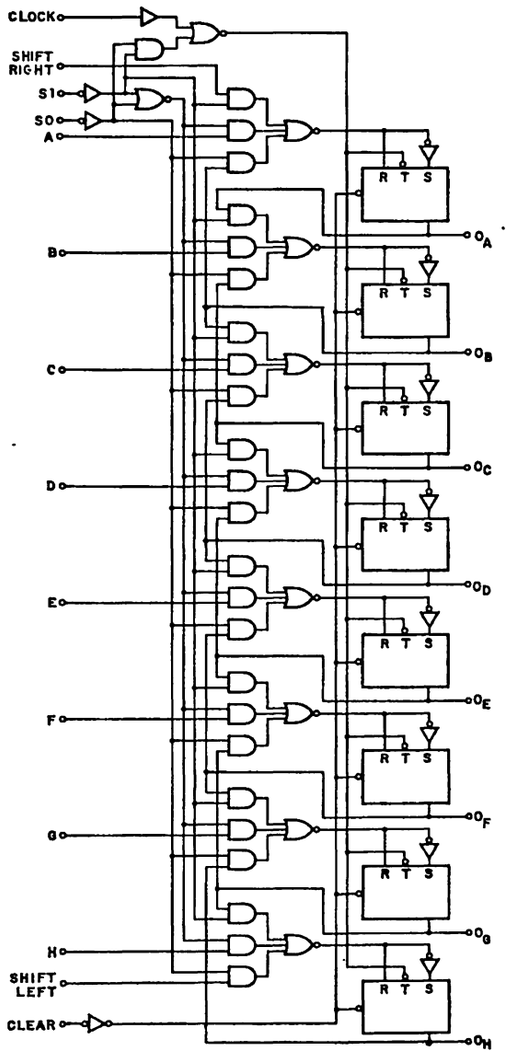
V_{CC} = Pin 24

Gnd = Pin 12

Truth Table

Operation of Mode Control		
Inputs		
S_1	S_0	Mode
L	L	Inhibit Clock
H	L	Shift Left
L	H	Shift Right
H	H	Parallel Load

Logic Diagram



This 8-bit shift register contains 87 equivalent gates and features parallel inputs, parallel outputs, right-shift and left-shift serial inputs, operating-mode-control inputs and a direct overriding clear line. The register has four distinct modes of operation, namely:

Parallel (Broadside) Load

Shift Right (in the direction Q_A toward Q_H)

Shift Left (in the direction Q_H toward Q_A)

Inhibit Clock (do nothing)

Synchronous parallel loading is accomplished by applying the 8 bits of data and taking both mode control inputs, S_0 and S_1, high. The data is loaded into the associated flip-flop and appears at the outputs after the positive transition of the clock input. During loading, serial data flow is inhibited.

Shift right is accomplished synchronously with the rising edge of the clock pulse when S_0 is high and S_1 is low. Serial data for this mode is entered at the shift-right data input. When S_0 is low and S_1 is high, data shifts left synchronously and new data is entered at the shift-left serial input.

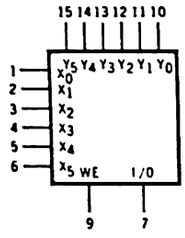
Clocking of the flip-flop is inhibited when both mode control inputs are low. The mode controls should be changed only while the clock input is high.

REV. 02

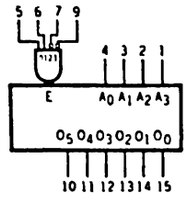
100000102 100000103

256-Bit Read/Write Memory & Decoder/Driver

Logic Symbols

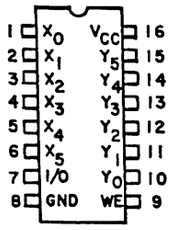


100000102

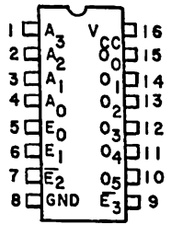


100000103

Connection Diagrams

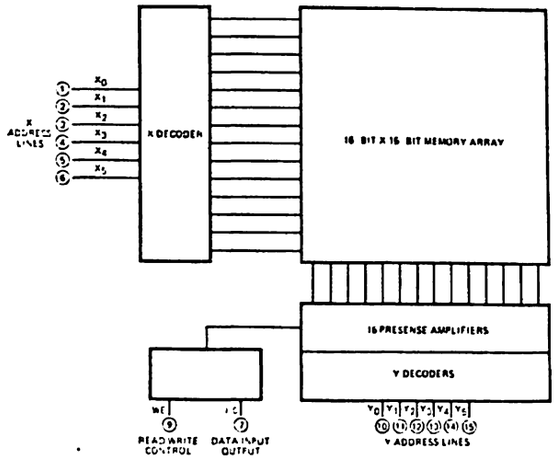


100000102



100000103

Logic Diagram



○ = PIN NUMBERS

Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

Binary Input To 100000103				3 of 6 Code Output of 100000103 Input to 100000102 (L = O or X or Y)						100000102 Internal X or Y Address
A3	A2	A1	A0	L0	L1	L2	L3	L4	L5	Row or Column
L	L	L	L	H	H	L	L	L	H	0
L	L	L	H	H	L	H	L	L	H	1
L	L	H	L	H	L	L	H	L	H	2
L	L	H	H	H	L	L	L	H	H	3
L	H	L	L	H	H	H	L	L	L	4
L	H	L	H	H	L	H	L	H	L	5
L	H	H	L	H	H	L	H	L	L	6
L	H	H	H	H	L	L	H	H	L	7
H	L	L	L	L	H	L	H	L	H	8
H	L	L	H	L	H	H	L	L	H	9
H	L	H	L	L	L	L	H	H	H	10
H	L	H	H	L	L	H	L	H	H	11
H	H	L	L	L	H	H	H	L	L	12
H	H	L	H	L	H	H	L	H	L	13
H	H	H	L	L	H	L	H	H	L	14
H	H	H	H	L	L	H	H	H	L	15

Note: Enables on 100000103 must be LLHH. Any other state on the enable inputs causes the Decoder/Driver outputs to go LOW, and addresses no internal row or column in the 100000102 memory matrix.

The 100000102 256-Bit Read/Write Memory and the 100000103 Decoder/Driver are components for use in high speed memory systems.

The 100000102 contains 256 bipolar storage cells arranged in a 16 by 16 format. Any one of the 256 cells may be accessed by supplying an address code on the X address inputs and the Y address inputs. Internal decoders decode the X and Y addresses into one of 16 rows and one of 16 columns in the matrix of storage cells. Data may be written into or read out from the cell lying at the intersection of the selected row and column.

The X and Y addresses supplied to the memory are partially decoded in a "3 of 6" code. Of the six X address lines and the six Y address lines there are always three lines HIGH and three

Continued ....

100000102 100000103

Continued

lines LOW. There are 20 such combinations, 16 are decoded by the internal row and column decoders. The four unused combinations of 3 of 6 will not select any row or column. If there are more than three lines HIGH in either the X or Y address, then multiple row or column selection will occur. The sixteen 3 of 6 codes used by the 100000102 memory are generated by the 100000103 decoder/driver.

Data enters and leaves the memory on a single input/output (I/O) line (pin 7). The I/O line is an open collector output, so many 100000102 I/O lines can be connected together in a wired-OR configuration. Input data must be applied to the I/O lines through an open collector gate. Each I/O line requires a pull-up resistor to V_{CC}. The magnitude of the pull-up resistor is determined by the number of memory I/O lines tied together. The I/O of the memory which is not addressed will be HIGH.

Read/Write selection is determined by the state of pin 9, the active HIGH write enable. When WE is HIGH, the data on the I/O line will be written into the selected address in the 100000102. When the Write Enable line is LOW, data will be read out of the addressed location.

The 100000103 is a partial decoder and driver for the 100000102. It accepts a 4-bit binary code on the address inputs (A_0-A_3) and produces a 3 of 6 code on the six output pins (O_0-O_5). The decoder also features four separate enables, two active HIGH and two active LOW. All four enables must be active before the decoder will produce a 3 of 6 code. Since two of the enables are HIGH and two are LOW, it is possible to route two binary coded lines to four different 100000103's to get two additional bits of decoding with no extra packages.

Ordinarily in memory systems, 100000102 memory devices will be arranged in a matrix of rows and columns. Each column will store a particular bit and each row of 100000102's will be 256 words. A 100000103 driver will be used for each row and each column in the matrix. One 100000103 can drive up to 32 100000102 X or Y address lines. The usual driving scheme is to connect the four LSB's of address to each of the column decoders. The next four bits of address are connected to each of the row decoders. Additional address bits are decoded to the chip selects on the row decoders. Each column decoder drives the Y address lines on up to 32 100000102's in a column. Each row decoder drives the address lines on up to 32 100000102's in a row.

The Three of Six Code

The "3 of 6" code used in the 100000102 and produced by the 100000103 is a trade-off between chip complexity and pin count. The simplest 256-bit memory chip would be a 16 by 16 matrix of storage cells, with all 16 rows and 16 column select lines brought off chip. The lowest pin count for a 256-bit memory chip would be achieved by fully decoded X and Y select lines, reducing the 32 lines of the simple scheme to only 8 lines. However, full binary decoding of the X and Y lines on chip significantly increases the complexity of the memory chip. The 100000102 and 100000103 are designed to gain the good features of both alternatives. The 16 X and Y lines are decoded into 6 lines each, allowing the memory to fit into a 16-lead package and still keeping the memory chip fairly simple, since the 3 of 6 code does not require a complex decoder. The truth table shows the conversion of 4-bit binary to 3 of 6 code by the 100000103, and also the internal column or row selected by the 3 of 6 to 1 of 16 decoder inside the memory.

Code Conversion Equations

$$O_0 = \overline{A_3}$$

$$O_1 = \overline{(A_1 + A_0)\ (\overline{A_3} + A_1)\ (\overline{A_2} + A_0)}$$

$$O_2 = \overline{(A_1 + \overline{A_0})\ (\overline{A_3} + \overline{A_0})\ (A_2 + \overline{A_1})}$$

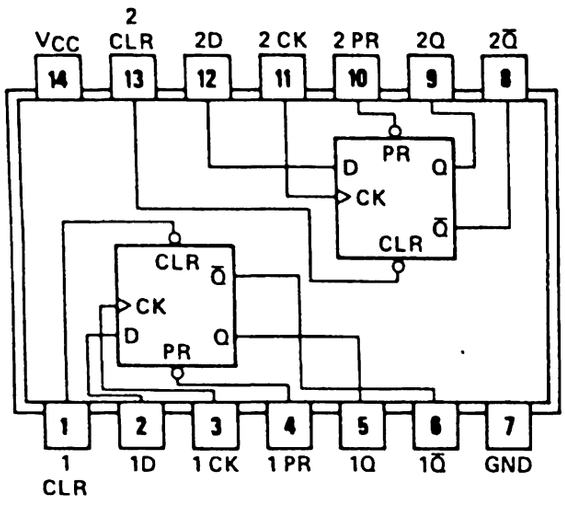
$$O_3 = \overline{(\overline{A_1} + A_0)\ (\overline{A_3} + A_0)\ (\overline{A_2} + \overline{A_1})}$$

$$O_4 = \overline{(\overline{A_1} + \overline{A_0})\ (\overline{A_3} + \overline{A_1})\ (\overline{A_2} + \overline{A_0})}$$

$$O_5 = \overline{A_2}$$

100000104

Pin Configuration



Dual D-Type Positive-Edge-Triggered Flip-Flops With Preset and Clear

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Function Table

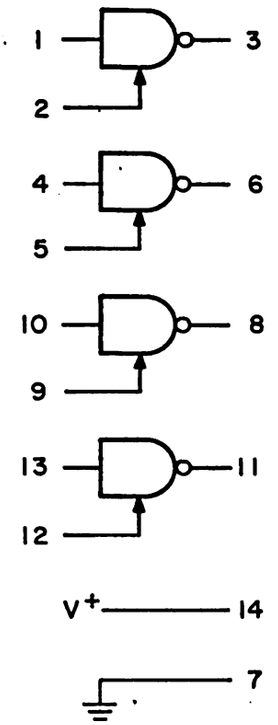
Inputs				Outputs	
Preset	Clear	Clock	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q}_0$

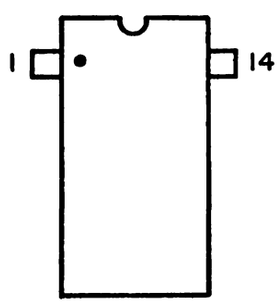
H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated input conditions were established.
* = This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

100000105

Quad Line Receivers

Logic Diagram

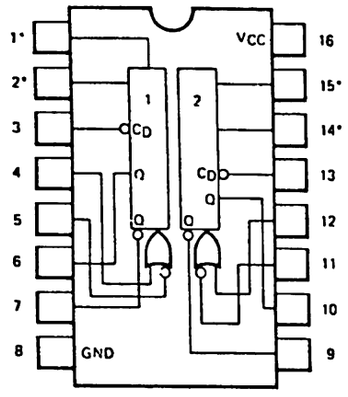




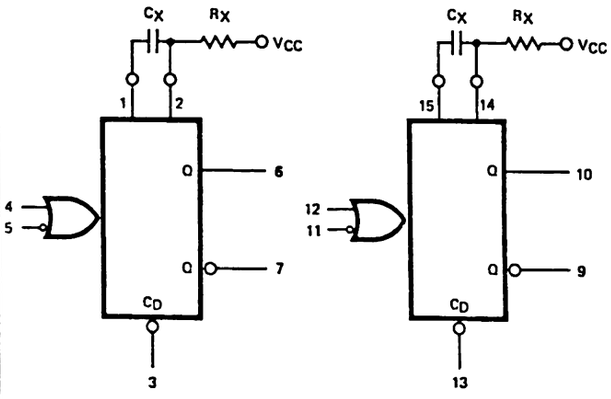
100000106

Dual Retriggerable Resettable Monostable Multivibrator

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Triggering Truth Table

Pin Numbers 5(11)	4(12)	3(13)	Operation
H→L	L	H	Trigger
H	L→H	H	Trigger
X	X	L	Reset

H = HIGH Voltage Level $\geq V_{IH}$

L = LOW Voltage Level $\leq V_{IL}$

X = Don't Care

H→L = HIGH to LOW Voltage Level transition

L→H = LOW to HIGH Voltage Level transition

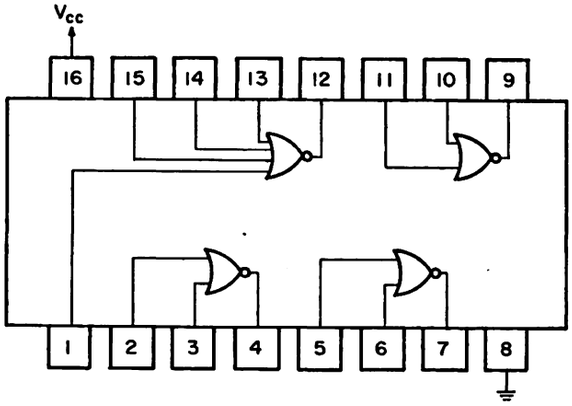
The Dual Retriggerable, Resettable Monostable Multivibrator provides an output pulse whose duration and accuracy is a function of external timing components.

This device has two inputs per function, one active LOW and one active HIGH. This allows leading edge or trailing edge triggering. The TTL inputs make triggering independent of input transition times. When input conditions for triggering are met, a new cycle starts and the external capacitor is rapidly discharged and then allowed to charge. An input cycle time shorter than the output cycle time will retrigger the device and result in a continuous true output. The output pulse may be terminated at any time by connecting the reset pin to a logic level LOW. Retriggering may be inhibited by tying $\overline{Q}$ output to an active level LOW input or the Q output to the active level HIGH input.

100000107

Quad NOR Gate

Pin Configuration



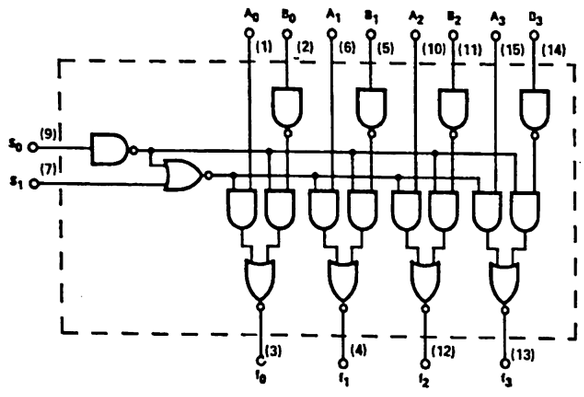
Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

The 100000107 consists of three 2-input and one 4-input NOR gates. The NOR gate produces a Low output if any of the inputs are High.

100000057 100000108

Logic Diagram



2-Input, 4-Bit Digital Multiplexer

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

Select Lines		Outputs
S_0	S_1	f_n (0, 1, 2, 3)
0	0	B_n
0	1	B_n
1	0	$\overline{A}_n$
1	1	1

The 2-Input, 4-Bit Digital Multiplexer is a monolithic array utilizing TTL circuit structures. The 100000108 features a bare-collector output to allow expansion with other devices.

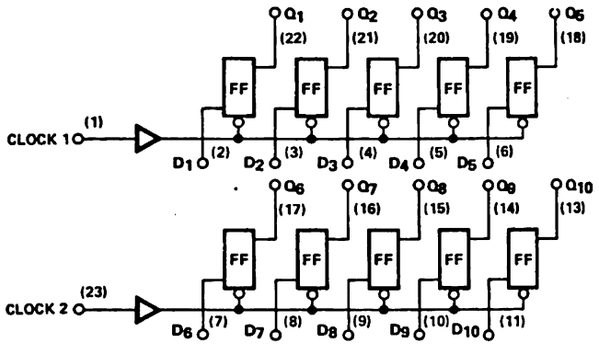
The multiplexer is able to choose from two different input sources, each containing 4 bits: A = (A_0, A_1, A_2, A_3); B = (B_0, B_1, B_2, B_3). The selection is controlled by the input S_0, while the second control input, S_1, is held at zero.

For conditional complementing, the two inputs (A_n, B_n) are tied together to form the function TRUE/COMPLEMENT, which is needed in conjunction with added elements to perform Addition/Subtraction. Further, the inhibit state $S_0 = S_1 = 1$ can be used to facilitate transfer operations in an arithmetic section.

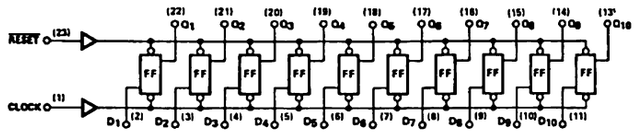
100000111 100000109 100000125

Logic Diagrams

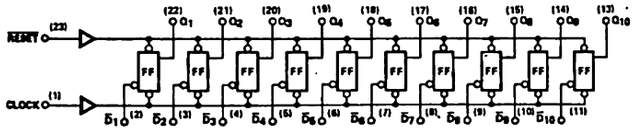
100000111



100000109



100000125



Buffer Registers

Logic Diagram/Pin Designations

V_{CC} = Pin 24
Gnd = Pin 12

Truth Tables

Dual 5-Bit Buffer Register No. 100000111

D_n	Q_{n+1}
1	1
0	0

10-Bit Buffer Register No. 100000109

D_n	$\overline{RESET}$	Q_{n+1}
1	1	1
0	1	0

10-Bit Buffer Register-Inverted Inputs No. 100000125

D_n	$\overline{RESET}$	Q_{n+1}
0	1	1
1	1	0

Notes:

$\overline{RESET} = 0 \Rightarrow Q = 0$ (overrides clock).
n is time prior to clock.
n+1 is time following clock.

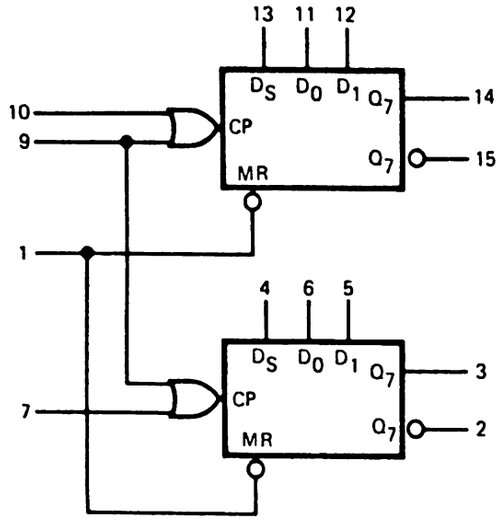
These buffer registers are arrays of ten clocked "D" flip-flops. The flip-flops are arranged as a dual 5 array (100000111) and single 10 arrays with reset (100000109 and 100000125).

The 100000111 and 100000109 have true "D" inputs. The logic state presented at these "D" inputs will appear at the Q outputs after a negative transition of the clock. The 100000125 has complementing "D" inputs ("$\overline{D}$"). The logic state presented at these "$\overline{D}$" inputs will invert and appear at the Q outputs after a negative-going transition of the clock. The complementing input ("$\overline{D}$") permits the use of standard AND-OR-INVERT gates to achieve the AND-OR function without additional gate delays.

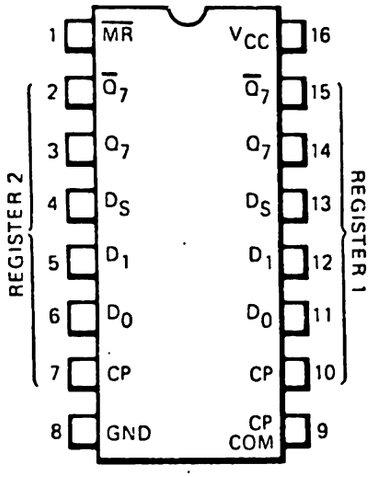
100000112

Dual 8-Bit Shift Register

Logic Symbol



Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names

DS.....Data Select Input
D0, D1....Data Inputs
CP.....Clock (Active HIGH) Going Edge Input
Common (Pin 9)
Separate (Pins 7 and 10)
$\overline{MR}$.....Master Reset (Active LOW) Input
Q7 .....Last Stage Output
$\overline{Q7}$ .....Complementary Output

Truth Table
Shift Selection

D_S	D_0	D_1	Q_7 (t_n+8)
L	L	X	L
L	H	X	H
H	X	L	L
H	X	H	H

n+8 = Indicates state after eight clock pulse.
L = LOW voltage level
H = HIGH voltage level
X = Either HIGH or LOW voltage level

This device is a high speed serial storage element providing 16 bits of storage in the form of two 8-bit registers that will shift at greater than 20 MHz rates. The multi-functional capability of this device is provided by several features: 1) Additional gating is provided at the input to both shift registers so that the input is easily multiplexed between two sources. 2) The clock of each register may be provided separately or together. 3) Both the true and complementary outputs are provided from each 8-bit register, and both registers may be master cleared from a common input.

The two 8-bit shift registers have a common clock input (pin 9) and separate clock inputs (pins 10 and 7). The clocking of each register is controlled by the OR function of the separate and the common clock input. Each register is composed of eight clocked RS master/slave flip-flops and a number of gates. The clock OR gate drives the eight clock inputs of the flip-flops in parallel. When the two clock inputs (the separate and the common) to the OR gate are LOW, the slave latches are steady, but data can enter the master latches via the R and S input. During the first LOW to HIGH transition of either, or both simultaneously, of the two clock inputs, the data inputs (R and S) are inhibited so that a later

Continued....

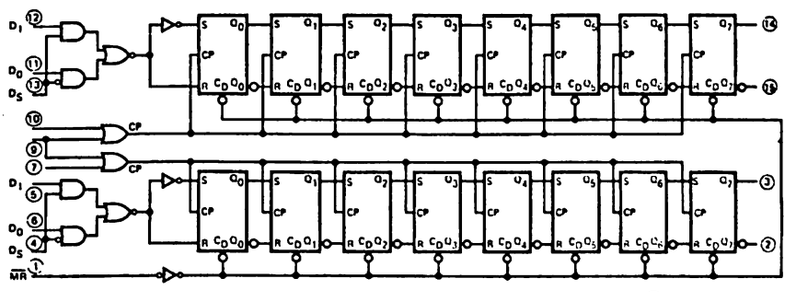
100000112
Continued

change in input data will not affect the master; then the now trapped information in the master is transferred to the slave. When the transfer is complete, both the master and the slave are steady as long as either or both clock inputs remain HIGH. During the HIGH to LOW transition of the last remaining HIGH clock input, the transfer path from master to slave is inhibited first, leaving the slave steady in its present state. The data inputs (R and S) are enabled so that new data can enter the master. Either of the clock inputs can be used as clock inhibit inputs by applying a logic HIGH signal. Each 8-bit shift register has a two input multiplexer in front of the serial data input. The two data inputs, D_0 and D_1, are controlled by the data select input (D_S) following the Boolean expression:

$$\text{Serial data in: } S_D = \overline{D}_S D_0 + D_S D_1$$

An asynchronous master reset is provided which, when activated by a LOW logic level, will clear all sixteen stages independently of any other input signal.

Logic Diagram

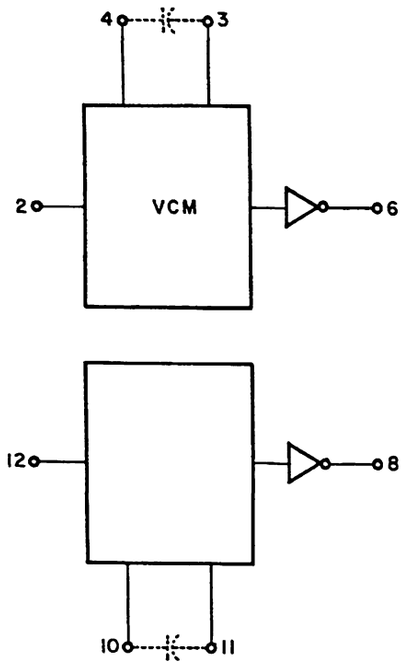


○ = Pin Numbers

100000114

Dual Voltage Controlled Multivibrator

Functional Block Diagram



Pin Designations

V_{CC}: VCM = 1, 3
Output Buffer = 14

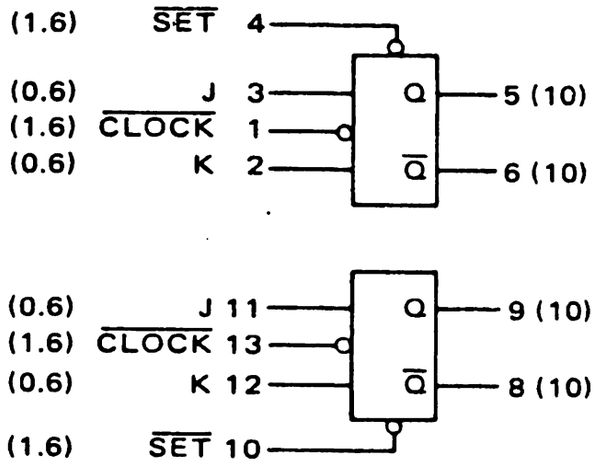
Gnd: VCM = 5, 9
Output Buffer = 7

External capacitor for frequency range determination.

100000115

Dual J-K Flip-Flop

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

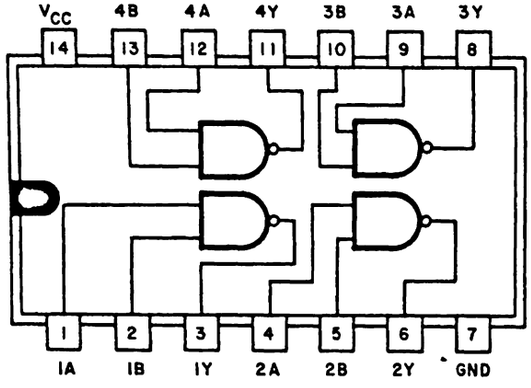
Truth Table

J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

100000116

Quadruple 2-Input Positive-NAND Buffer

Pin Configuration



Logic Diagram/Pin Designations

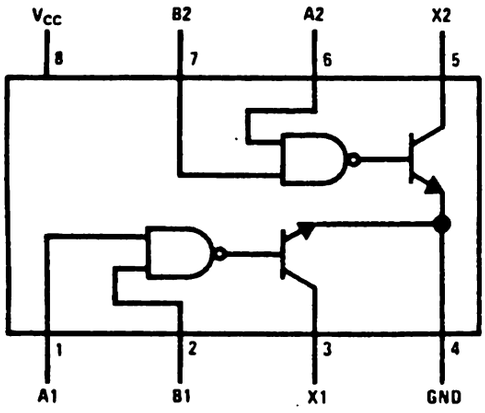
V_{CC} = Pin 14

Gnd = Pin 7

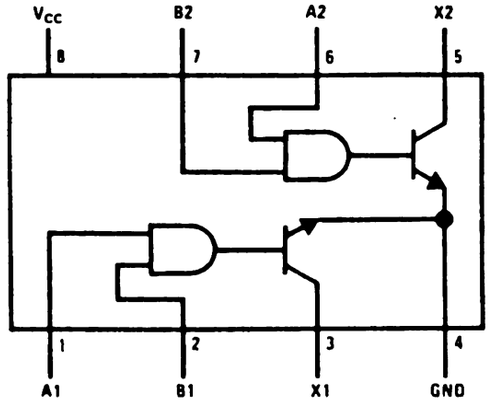
Positive logic: $Y = \overline{AB}$

100000247 100000238
100000154 100000117

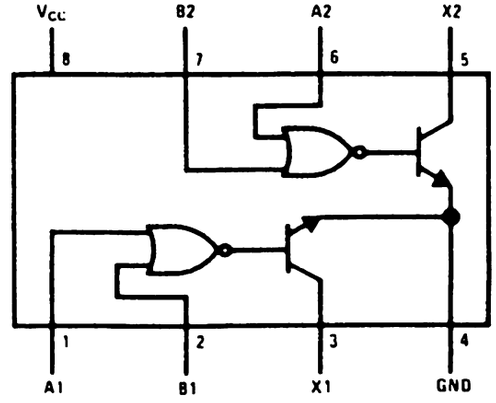
Pin Configurations



100000247/100000238



100000154



100000117

Dual Peripheral Drivers

Pin Designations

V_{CC} = Pin 8

Gnd = Pin 4

Truth Tables

100000247 and 100000238

Positive logic: AB=X

A	B	Output X*
0	0	0
1	0	0
0	1	0
1	1	1

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000154

Positive logic: $\overline{AB}$=X

A	B	Output X*
0	0	1
1	0	1
0	1	1
1	1	0

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000117

Positive logic: A + B = X

A	B	Output X*
0	0	0
1	0	1
0	1	1
1	1	1

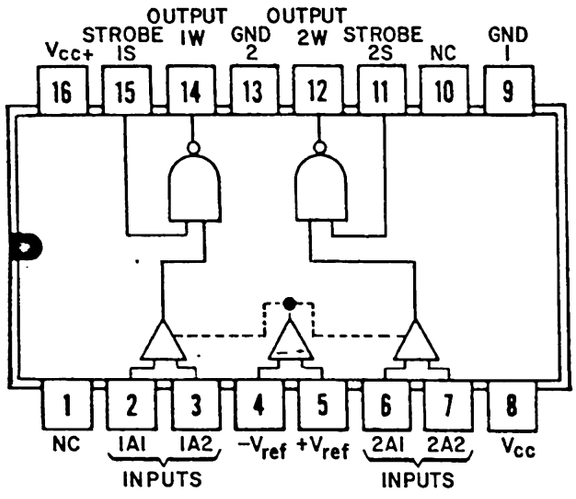
*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

These devices are general purpose dual peripheral drivers, each capable of sinking two independent 300mA loads to ground. In the off state (or with V_{CC} = 0V) the outputs will withstand 30V. Inputs are fully DTL/TTL compatible.

100000118 100000229
100000298 100000299

Dual Sense Amplifiers

Pin Configuration



Logic Diagram/Pin Designations

V_{CC+} = Pin 16

V_{CC} = Pin 8

Gnd 1 = Pin 9

Gnd 2 = Pin 13

NC = No internal connection

Positive logic: $W = \overline{AS}$

Truth Table

Inputs		Output
A	S	W
H	H	L
L	X	H
X	L	H

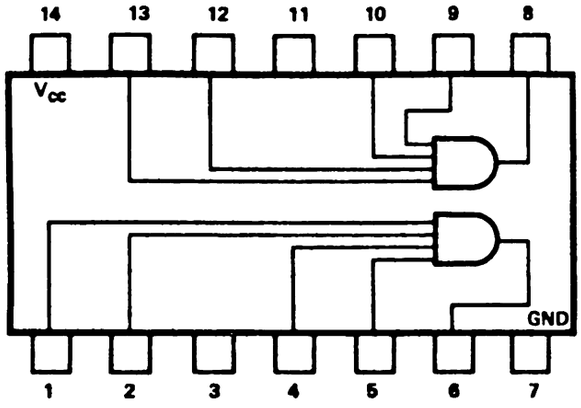
Definition of logic levels:

Input	H	L	X
A*	$V_{ID} \geqslant V_{Tmax}$	$V_{ID} \leqslant V_{Tmin}$	Irrelevant
S	$V_I \geqslant V_{IHmin}$	$V_I \leqslant V_{ILmax}$	Irrelevant

* A is a differential voltage (V_{ID}) between A1 and A2. For these circuits, V_{ID} is considered positive regardless of which terminal is positive with respect to the other.

100000119

Pin Configuration



Dual 4-Input Positive-AND Gate

Logic Diagram/Pin Designations

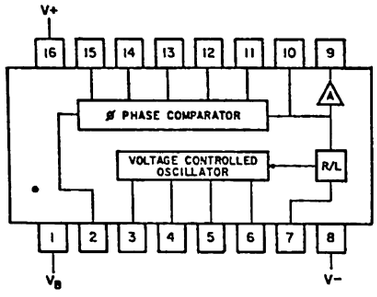
V_{CC} = Pin 14
Gnd = Pin 7

Positive logic: Y = ABCD

100000120

Phase Locked Loop

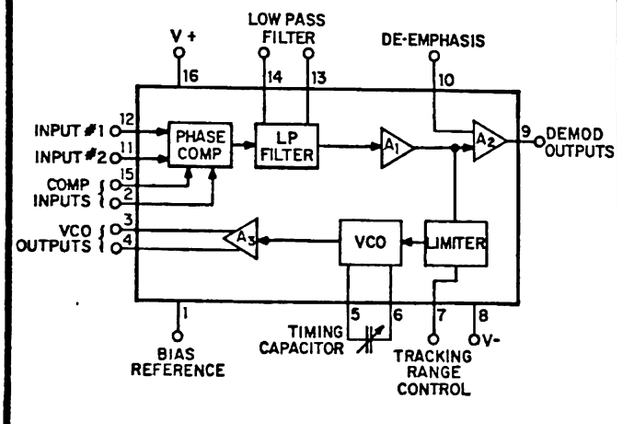
Pin Configuration



Pin Designations

1. Bias Reference Voltage
2. Phase Comparator Input #1
3. VCO Output #1
4. VCO Output #2
5. VCO Timing Capacitor
6. VCO Timing Capacitor
7. Range Control
8. Negative Power Supply (Ground)
9. Demodulated FM Output (Open Emitter)
10. De-emphasis (Auto Bandshaping)
11. RF Input #1
12. RF Input #2
13. Low Pass Loop Filter
14. Low Pass Loop Filter
15. Phase Comparator Input #2
16. Positive Power Supply

Block Diagram



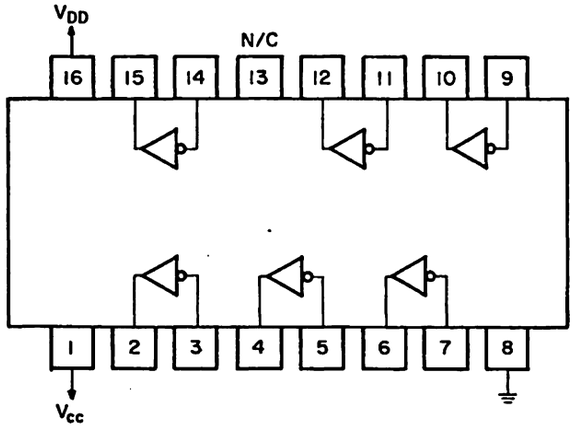
The 100000120 Phase Locked Loop is a monolithic signal conditioner and demodulator system, comprising a VCO, phase comparator, amplifier and low pass filter.

The center frequency of the Phase Locked Loop is determined by the free running frequency of the VCO. This VCO frequency is set by an external capacitor. The low pass filter, which determines the capture characteristics of the loop, is formed by two capacitors and two resistors at the phase comparator output. This Phase Locked Loop has two sets of differential inputs, one for the FM/RF input and one for the phase comparator local oscillator input. Both sets of inputs can be used in either a differential or single-ended mode. The FM/RF inputs to the comparator are self-biased. An internally regulated voltage source is provided to bias the phase comparator local oscillator inputs. The VCO output, at high level and in differential form, is available for driving logic circuits.

100000121

CMOS Hex Inverter

Pin Configuration



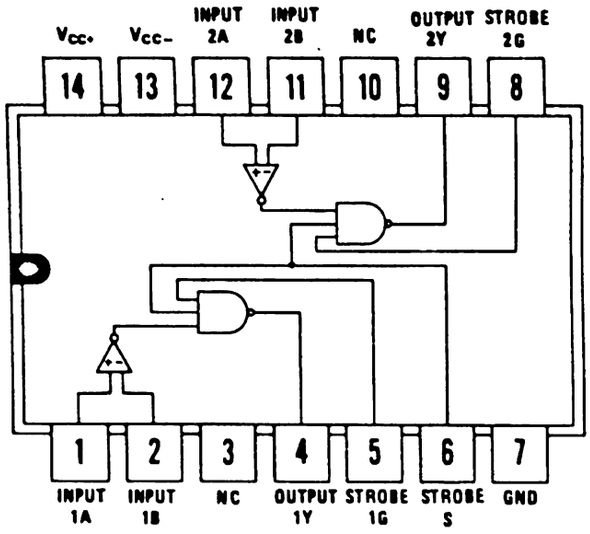
Logic Diagram/Pin Designations

V_{CC} = Pin 1
V_{DD} = Pin 16
Gnd = Pin 8

100000122

Dual Line Receiver

Pin Configuration



Logic Diagram/Pin Designations

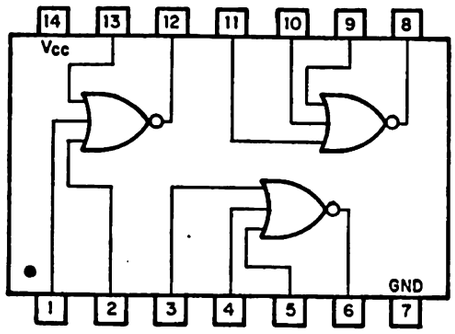
V_{CC+} = Pin 14
V_{CC-} = Pin 13
Gnd = Pin 7
NC = No internal connection

Truth Table

Differential Inputs A-B	Strobes G	Strobes S	Output Y
$V_{ID} \geqslant 25mV$	L or H	L or H	H
$-25mV < V_{ID} < 25mV$	L or H	L	H
	L	L or H	H
	H	H	Indeterminate
$V_{ID} \leqslant -25mV$	L or H	L	H
	L	L or H	H
	H	H	L

100000123

Pin Configuration



Triple 3-Input NOR Gate

Logic Diagram/Pin Designations

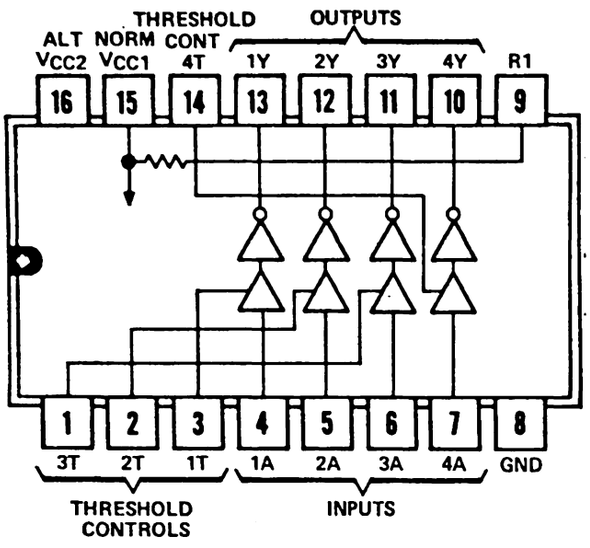
V_{CC} = Pin 14

Gnd = Pin 7

100000124

Quadruple Line Receiver

Pin Configuration



Logic Diagram/Pin Designations

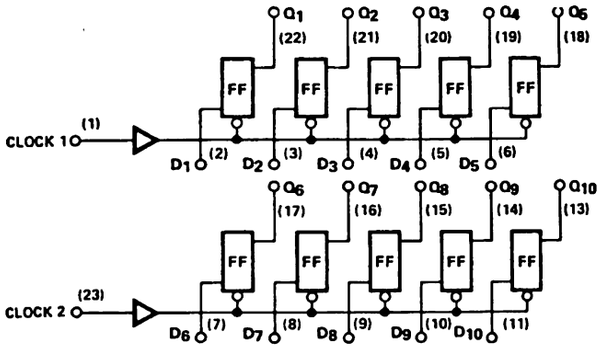
V_{CC1} = Pin 15
V_{CC2} = Pin 16
Gnd = Pin 8

Logic: $Y = \overline{A}$

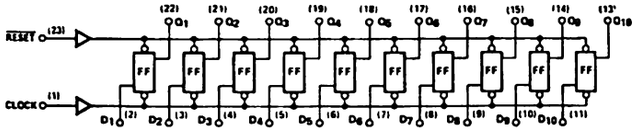
100000111 100000109 100000125

Logic Diagrams

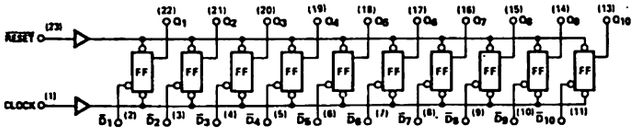
100000111



100000109



100000125



Buffer Registers

Logic Diagram/Pin Designations

V_{CC} = Pin 24
Gnd = Pin 12

Truth Tables

Dual 5-Bit Buffer Register No. 100000111

D_n	Q_{n+1}
1	1
0	0

10-Bit Buffer Register No. 100000109

D_n	$\overline{RESET}$	Q_{n+1}
1	1	1
0	1	0

10-Bit Buffer Register-Inverted Inputs No. 100000125

D_n	$\overline{RESET}$	Q_{n+1}
0	1	1
1	1	0

Notes:

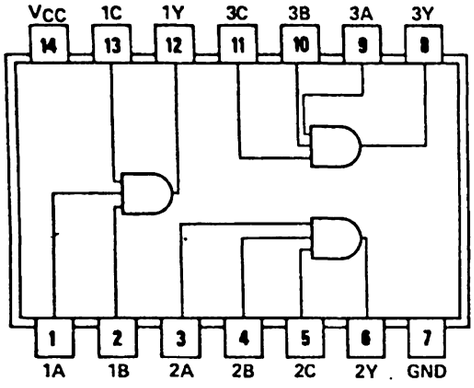
$\overline{RESET}$ = 0 ⇒ Q = 0 (overrides clock).
n is time prior to clock.
n+1 is time following clock.

These buffer registers are arrays of ten clocked "D" flip-flops. The flip-flops are arranged as a dual 5 array (100000111) and single 10 arrays with reset (100000109 and 100000125).

The 100000111 and 100000109 have true "D" inputs. The logic state presented at these "D" inputs will appear at the Q outputs after a negative transition of the clock. The 100000125 has complementing "D" inputs ("$\overline{D}$"). The logic state presented at these "$\overline{D}$" inputs will invert and appear at the Q outputs after a negative-going transition of the clock. The complementing input ("$\overline{D}$") permits the use of standard AND-OR-INVERT gates to achieve the AND-OR function without additional gate delays.

100000126

Pin Configuration



Triple 3-Input AND Gate

Logic Diagram/Pin Designations

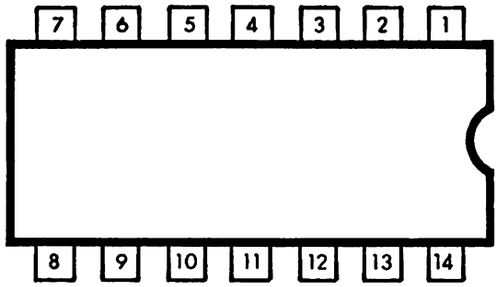
V_{CC} = Pin 14
Gnd = Pin 7

Positive logic: Y = ABC

100000127

Zero Voltage Switch

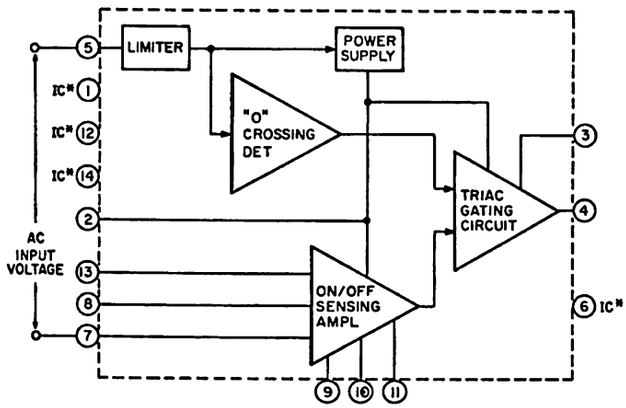
Pin Configuration



The 100000127 zero voltage switch is a monolithic integrated circuit designed to control a thyristor in a variety of AC power switching applications for AC input voltages of 24V, 120V, 208/230V and 277V at 50/60 and 400Hz. This switch incorporates four functional blocks:

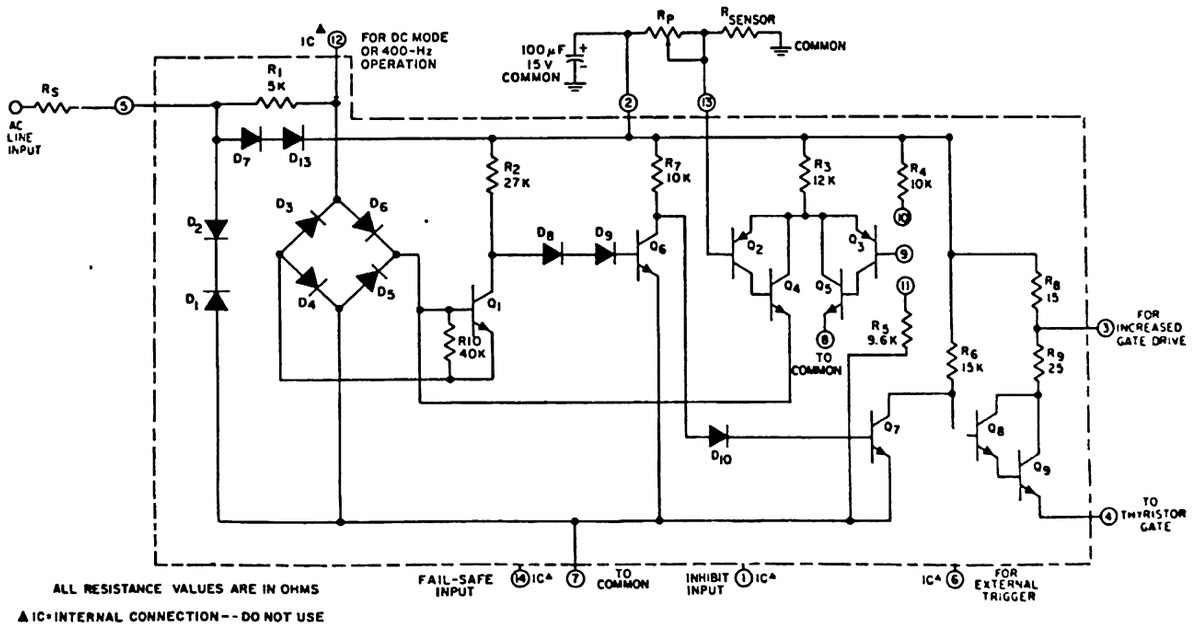
1. Limiter-Power Supply -- permits operation directly from an AC line.
2. Differential On/Off Sensing Amplifier -- tests the condition of external sensors or command signals.
3. Zero-Crossing Detector -- synchronizes the output pulses of the circuit at the time when the AC cycle is at zero voltage point.
4. Triac Gating Circuit -- Provides high-current pulses to the gate of the power controlling thyristor.

Functional Block Diagram



IC▲ = INTERNAL CONNECTION DO NOT USE

Schematic



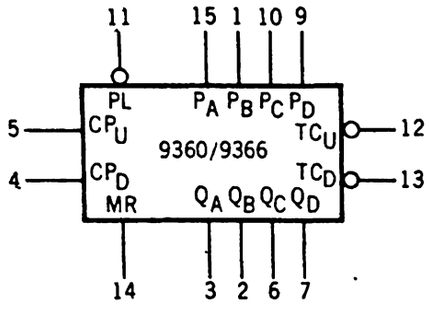
ALL RESISTANCE VALUES ARE IN OHMS

▲ IC▲ INTERNAL CONNECTION -- DO NOT USE

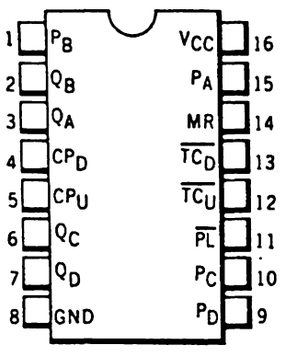
100000252 100000128

Up/Down Decade and Binary Counters

Logic Symbol

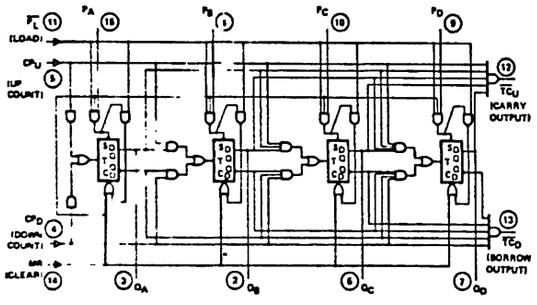


Pin Configuration

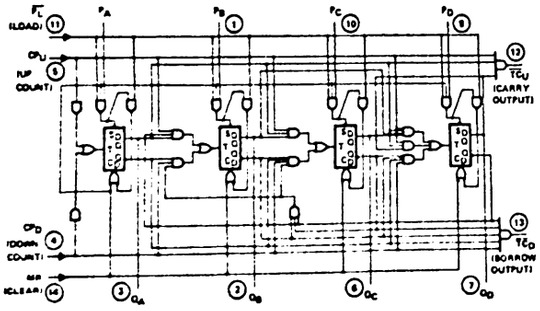


Logic Diagrams

100000252



100000128



○ - PIN NUMBER

Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Mode Selection
(Both Counters)

MR	$\overline{PL}$	CP_U	CP_D	Mode
H	X	X	X	Preset (Asyn.)
L	L	X	X	Preset (Asyn.)
L	H	H	H	No Change
L	H	CP	H	Count Up
L	H	H	CP	Count Down

Notes:

H = High voltage level
L = Low voltage level
X = Don't care condition
CP = Clock pulse.

The 100000252 is a synchronous Up/Down BCD Decade Counter and the 100000128 is a synchronous Up/Down 4-Bit Binary Counter. Both counters have separate up/down clocks, parallel load facility, terminal count outputs for multidecade operation and an asynchronous overriding master reset.

These counters can be reset, preset and count up or down. The operating modes are tabulated in the Mode Selection table. The operating modes of both devices are identical; the only difference between the devices is the count sequences.

Counting is synchronous, with the outputs changing state after the Low to High transition of either the Count-Up Clock (CP_U) or Count-Down Clock (CP_D). The direction of counting is determined by which clock input is pulsed while the other clock input is High. (Incorrect counting will occur if both the count-up clock and count-down clock inputs are Low simultaneously.) Both counters will respond to a clock pulse on either input by changing to the next appropriate state of the count sequence. The state diagram for the 100000252 shows the regular sequence and in addition shows the sequence of states if a code greater than nine is present in the counter.

Continued ....

100000252 100000128

Continued

Logic Equations for Terminal Count

100000252

$$TC_U = Q_0 \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot Q_3 \cdot \overline{CP_U}$$

$$TC_D = \overline{Q_0} \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot \overline{Q_3} \cdot \overline{CP_D}$$

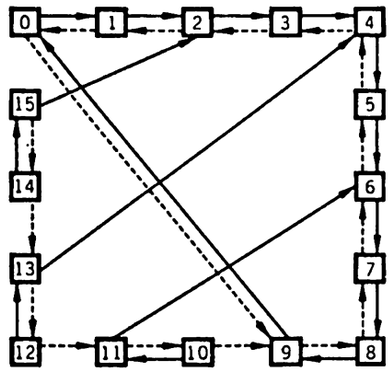
100000128

$$TC_U = Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3 \cdot \overline{CP_U}$$

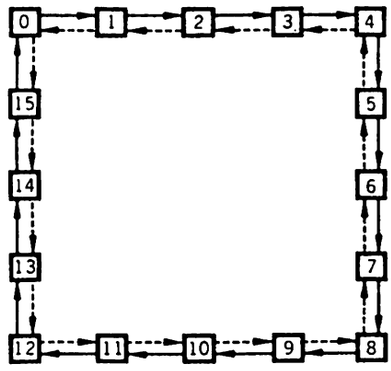
$$TC_D = \overline{Q_0} \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot \overline{Q_3} \cdot \overline{CP_D}$$

State Diagrams

100000252



100000128



COUNT UP ——

COUNT DOWN -------

Both counters have a parallel load (asynchronous) facility which permits the device to be preset. Whenever the parallel load ($\overline{PL}$) input is Low, and Master Reset is Low, the information present on the Parallel Data inputs (P_A, P_B, P_C, P_D) will be loaded into the counters and appear on the outputs independent of the conditions of the clock inputs. When the Parallel Load Input goes High, this information is stored in the counters and when the counters are clocked they change to the next appropriate state in the count sequence. The Parallel Data inputs are inhibited when the Parallel Load is High and have no effect on the counters.

The Terminal Count-Up ($\overline{TC_U}$) and Terminal Count-Down ($\overline{TC_D}$) outputs (carry and borrow, respectively) allow multidecade counter operations without additional logic. The counters are cascaded by feeding the terminal count-up output to the count-up clock input and terminal count-down clock input of the following counter.

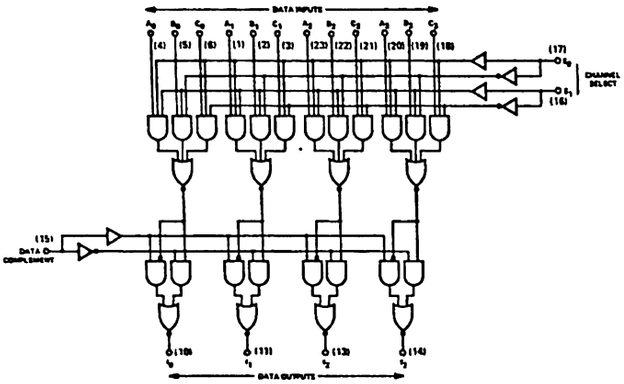
The terminal count-up outputs are Low when their count-up clock inputs are Low and the counters are in state nine (100000252) and state fifteen (100000128). Similarly, the terminal count-down outputs are Low when their count-down clock inputs are Low and both counters are in state zero. Thus, when the 100000252 counter is in state nine and the 100000128 counter is in state fifteen and both are counting up, or both counters are in state zero and counting down, a clock pulse will change the counter's state on the rising edge and simultaneously clock the following counter through the appriate active Low terminal count output. There are two gate delays per state when these counters are cascaded.

The asynchronous Master Reset input (MR), when High, overrides all input and clears the counters. Master reset overrides parallel load so that when both are activated the counters will be reset. (Obviously, both parallel load and master reset must not be deactivated simultaneously for predictable operation.)

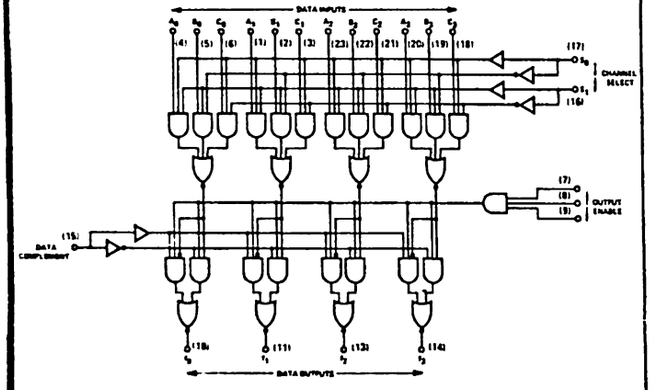
100000129 100000044

Logic Diagrams

100000129
(Active Pull-up)



100000044
(Open Collector)



3-Input, 4-Bit Digital Multiplexer

Logic Diagram/Pin Designations

V_{CC} = Pin 24
Gnd = Pin 12

Truth Table

Data Input A_n B_n C_n	Channel Select S_0	S_1	Data Complement	Output Enable '044	Data Outputs
A_n x x	1	1	0	1	A_n
x B_n x	0	1	0	1	B_n
x x C_n	1	0	0	1	C_n
x x x	0	0	0	1	0
A_n x x	1	1	1	1	$\overline{A}_n$
x B_n x	0	1	1	1	$\overline{B}_n$
x x C_n	1	0	1	1	$\overline{C}_n$
x x x	0	0	1	1	1
x x x	x	x	x	0	1

X = Either state.

The 3-input, 4-bit multiplexer is a gating array whose function is analogous to that of a 4-pole, 3-position switch. Four bits of digital data are selected from one of three inputs. A 2-bit channel-selection code determines which input is to be active.

The data complement input controls the conditional complement circuit at the multiplexer output to effect either inverting or non-inverting data flow.

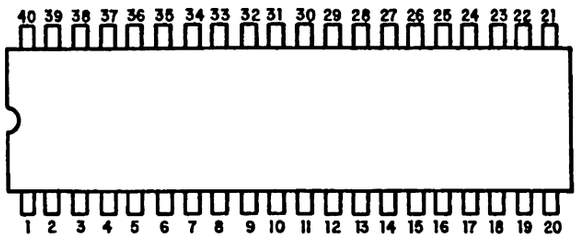
The 100000129 employs active output structures to effect minimum delays; the 100000044 utilizes bare collector outputs for expansion of input terms.

The 100000044 may be expanded by connecting its outputs to the outputs of another 100000044. Provision is made for use of a 3-bit code to determine which multiplexer is selected; thus, eight multiplexers may be commoned to effect a 4-pole, 24-position switch.

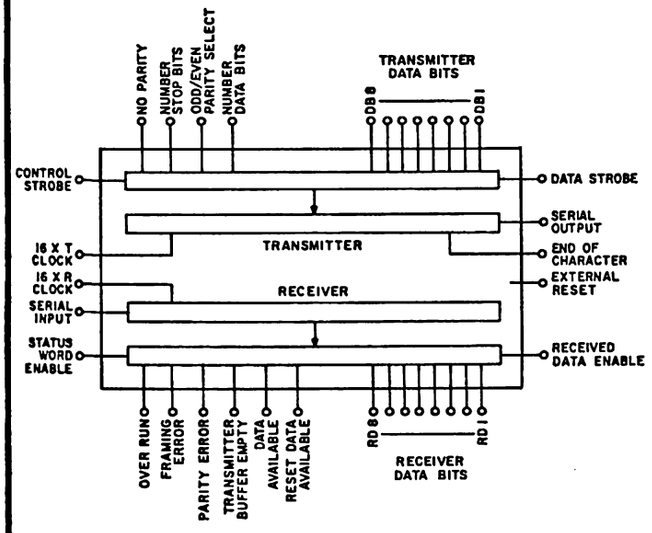
100000130

Asynchronous Receiver/Transmitter

Pin Configuration



Block Diagram



The Asynchronous Receiver/Transmitter is an LSI subsystem which accepts binary characters from either a terminal device or a computer and receives/transmits this character with appended control and error detecting bits. All characters contain a start bit, 5 to 8 data bits, one or two stop bits and either odd/even parity or no parity. The baud rate (bits per word), parity mode and the number of stop bits are externally selectable.

Description of Pin Functions

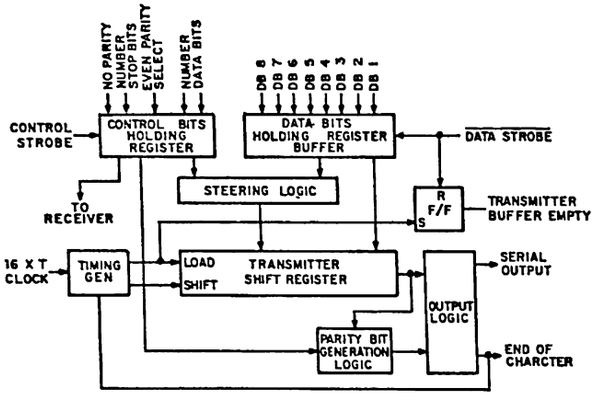
Pin No.	Name	Symbol	Function
1	V_{cc} Power Supply	V_{cc}	+5V Supply
2	V_{gg} Power Supply	V_{gg}	-12V Supply
3	Ground	V_{gr}	Ground
4	Received Data Enable	$\overline{RDE}$	A logic "0" on the receiver enable line places the received data onto the output lines.
5-12	Received Data Bits	RD8-RD1	These are the 8 data output lines. Received characters are right justified, the LSB always appears on RD1. These lines have tri-state outputs; i.e., they have the normal TTL output characteristics when RDE is "0" and a high impedance state when RDE is "1". Thus, the data output lines can be bus structure oriented.
13	Receive Parity Error	PE	This line goes to a logic "1" if the received character parity does not agree with the selected POE.
14	Framing Error	FE	This line goes to a logic "1" if the received character has no valid stop bit.
15	Over-Run	OR	This line goes to a logic "1" if the previously received character is not read (DA line not reset) before the present character is transferred to the receiver holding register.
16	Status Word Enable	$\overline{SWE}$	A logic "0" on this line places the status word bits (PE, FE, OR, DA, TBMT) onto the output lines. These are tri-state also.
17	Receiver Clock	RCP	This line will contain a clock whose frequency is 16 times (16X) the desired receiver baud rate.
18	Reset Data Available	$\overline{RDA}$	A logic "0" will reset the DA line.
19	Receive Data Available	DA	This line goes to a logic "1" when an entire character has been received and transferred to the receiver holding register.
20	Serial Input	SI	This line accepts the serial bit input stream. A Marking (logic "1") to spacing (logic "0") transition is required for initiation of data reception.
21	External Reset	XR	Resets all registers. Sets SO, EOC, and TBMT to a logic "1".
22	Transmitter Buffer Empty	TBMT	The transmitter buffer empty flag goes to a logic "1" when the data bits holding register may be loaded with another character.
23	Data Strobe	$\overline{DS}$	A strobe on this line will enter the data bits into the data bits holding register. Initial data transmission is initiated by the rising edge of DS.
24	End of Character	EOC	This line goes to a logic "1" each time a full character is transmitted. It remains at this level until the start of transmission of the next character.
25	Serial Output	SO	This line will serially, by bit, provide the entire transmitted character. It will remain at a logic "1" when no data is being transmitted.

Continued ....

100000130

Continued

Transmitter Block Diagram

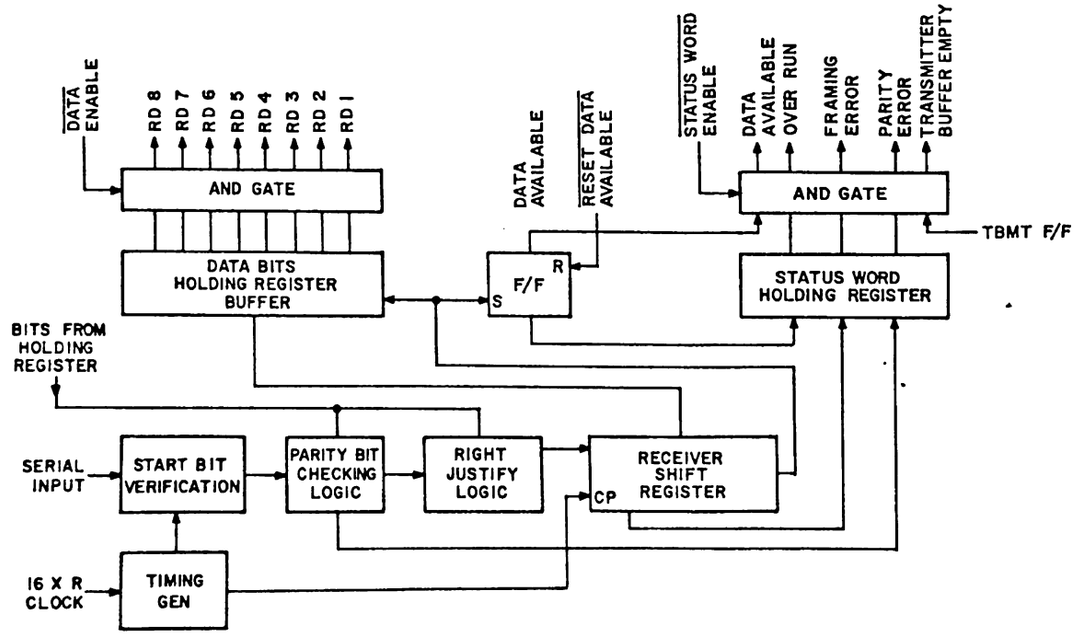


Description of Pin Functions (Continued)

Pin No.	Name	Symbol	Function
26-33	Data Bit Inputs	DB1-DB8	There are up to 8 data bit input lines available.
34	Control Strobe	CS	A logic "1" on this lead will enter the control bits (EPS, NB1, NB2, TSB, NP) into the control bits holding register. This line can be strobed or hard wired to a logic "1" level.
35	No Parity	NP	A logic "1" on this lead will eliminate the parity bit from the transmitted and received character (no PE indication). The stop bit(s) will immediately follow the last data bit. If not used, this lead must be tied to a logic "0".
36	Number of Stop Bits	TSB	This lead will select the number of stop bits, 1 or 2, to be appended immediately after the parity bit. A logic "0" will insert 1 stop bit and a logic "1" will insert 2 stop bits.
37-38	Number of Bits/ Character	NB2, NB1	These two leads will be internally decoded to select either 5, 6, 7 or 8 data bits character. NB1 NB2 Bits Character 0 0 5 1 0 6 0 1 7 1 1 8
39	Odd/Even Parity	EPS	The logic level on this pin selects the type of parity which will be appended immediately after the data bits. It also determines the parity that will be checked by the receiver. A logic "0" will insert odd parity and a logic "1" will insert even parity.
40	Transmitter Clock Line	TCP	This line will contain a clock whose frequency is 16 times (16X) the desired transmitter baud rate.

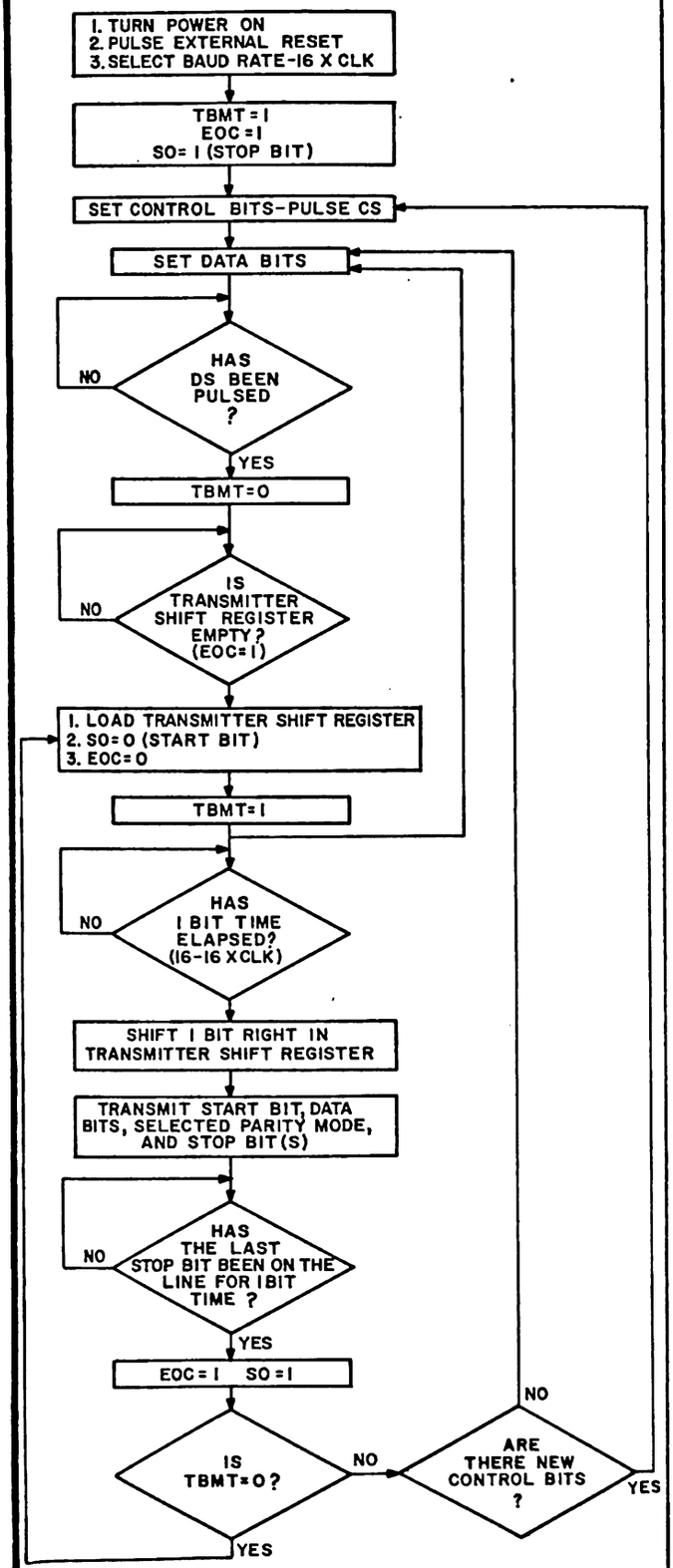
Continued....

Receiver Block Diagram



100000130

Continued



Transmitter Operation

Initializing

Power is applied, external reset is enabled and clock pulse is applied having a frequency of 16 times the desired baud rate. The above conditions will set TBMT, EOC and SO to logic "1" (line is marking).

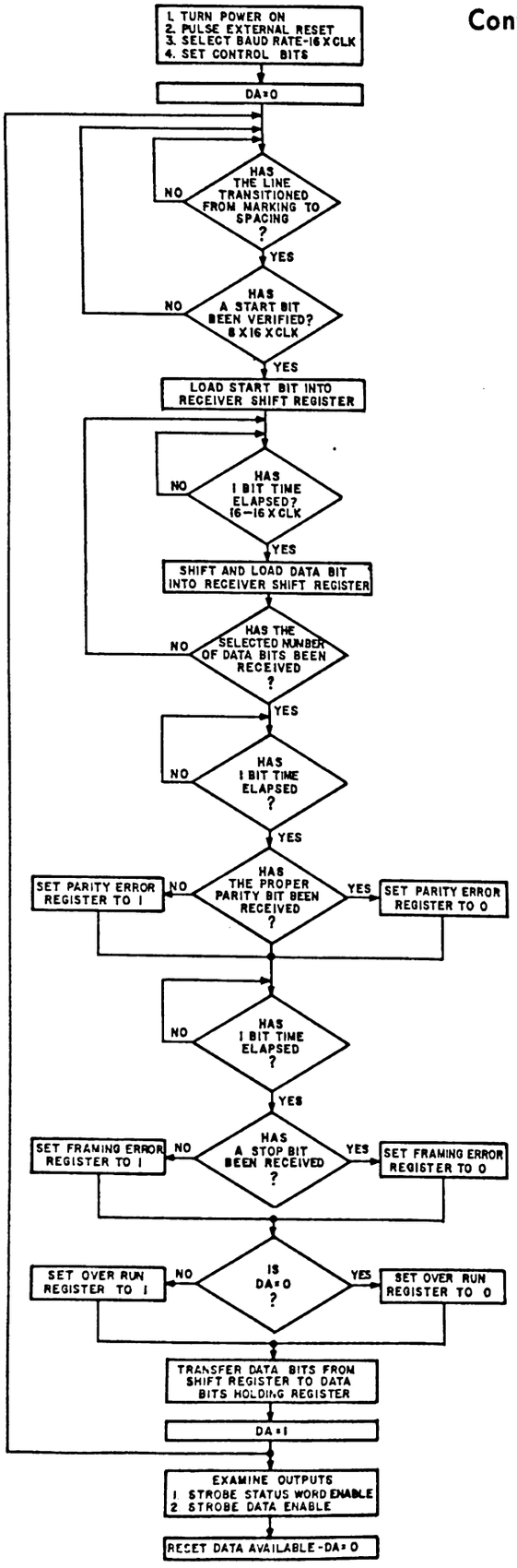
After initializing is completed, user may set control bits and data bits with control bits selection normally occurring before data bits selection. However, one may set both $\overline{DS}$ and CS simultaneously if minimum pulse width specifications are followed. Once data strobe ($\overline{DS}$) is pulsed the TBMT signal will change from a logic "1" to a logic "0" indicating that the data bits holding register is filled with a previous character and is unable to receive new data bits, and transmitter shift register is transmitting previously loaded data. TBMT will return to a logic "1". When transmitter shift register is empty, data bits in the holding register are immediately loaded into the transmitter shift register for transmission. The shifting of information from the holding register to the transmitter shift register will be followed by SO and EOC going to a logic "0", and TBMT will also go to a logic "1" indicating that the shifting operation is completed and that the data bits holding register is ready to accept new data. It should be remembered that one full character time is now available for loading of the next character without loss in transmission speed due to double buffering, (separate data bits holding register and transmitter shift register).

Data transmission is initiated with transmission of a start bit, data bits, parity bit (if desired) and stop bit(s). When the last stop bit has been on line for one bit time, EOC will go to a logic "1" indicating that new character is ready for transmission. This new character will be transmitted only if TBMT is a logic "0" as was previously mentioned.

Continued....

100000130

Continued



Receiver Operation

Initializing

Power is applied, external reset is enabled, and clock pulse is applied having a frequency of 16 times the desired baud rate. The previous conditions will set data available (DA) to a logic "0".

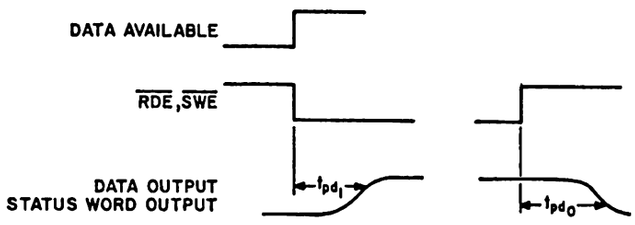
After initializing is completed, user should note that one set of control bits will be used for both receiver and transmitter making individual control bit setting unnecessary. Data reception starts when serial input signal changes from Marking (logic "1") to spacing (logic "0") which initiates start bit. The start bit is valid if, after transition from logic "1" to logic "0", the SI line continues to be at logic "0", when center sampled, 8 clock pulses later. If, however, line is at a logic "1" when center sampling occurs the start bit verification process will be reset. If the Serial Input line transitions from a logic "1" to a logic "0" (marking to spacing) when the 16X clock is in a logic "1" state, the bit time for center sampling will begin when the clock line transitions from a logic "1" to a logic "0" state. After verification of a genuine start bit, data bit reception, parity bit reception and stop bit(s), reception proceeds in an orderly manner.

While receiving parity and stop bit(s) the receiver will compare transmitted parity and stop bit(s) with control data bits (parity and number of stop bits) previously set and indicate an error by changing the parity error flip-flop and/or the framing error flip-flop to a logic "1". It should be noted that if the No Parity Mode is selected the PE (parity error) will be unconditioning set to a logic "0".

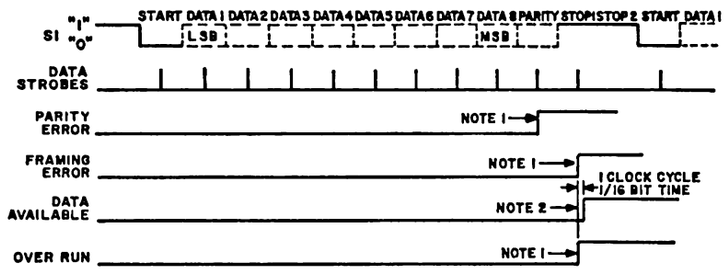
Once a full character is received, internal logic looks at the data available (DA) signal to determine if data has been read out. If the DA signal is at a logic "1" the receiver will assume data has not been read out and the overrun flip-flop of the status word holding register will be set to a logic "1". If the DA signal is at a logic "0" the receiver will assume that data has been read out. After DA goes to a logic "1", the receiver shift register is now ready to accept the next character and has one full character time to remove the received character.

Continued....

Receiver Propagation Delay Timing Diagram



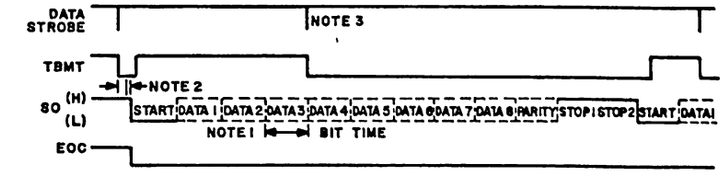
Receiver Timing Diagram



NOTES:

1. THIS IS THE TIME WHEN THE ERROR CONDITIONS ARE DETECTED, IF ERROR OCCURS.
2. DATA AVAILABLE IS SET ONLY WHEN THE RECEIVED DATA, PE, FE, OR HAS BEEN TRANSFERRED TO THE HOLDING REGISTERS. (SEE RECEIVER BLOCK DIAGRAM).
3. ALL INFORMATION IS GOOD IN HOLDING REGISTER UNTIL DATA AVAILABLE TRIES TO SET FOR NEXT CHARACTER.
4. ABOVE SHOWN FOR 8 LEVEL CODE PARITY AND TWO STOP. FOR NO PARITY, STOP BITS FOLLOW DATA.
5. FOR ALL LEVEL CODE THE DATA IN THE HOLDING REGISTER IS *RIGH JUSTIFIED*; THAT IS, LSB ALWAYS APPEARS IN RD 1 (PIN 12).

Transmitter Timing Diagram



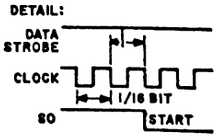
NOTE: TRANSMITTER INITIALLY ASSUMED INACTIVE AT START OF DIAGRAM. SHOWN FOR 8 LEVEL CODE AND PARITY AND TWO STOPS.

1: BIT TIME = 16 CLOCK CYCLES.

2: IF TRANSMITTER IS INACTIVE THE START PULSE WILL APPEAR ON LINE WITHIN 1 CLOCK CYCLE OF TIME DATA STROBE OCCURS. SEE DETAIL.

3: SINCE TRANSMITTER IS DOUBLE BUFFERED ANOTHER DATA STROBE CAN OCCUR ANYWHERE DURING TRANSMISSION OF CHARACTER 1.

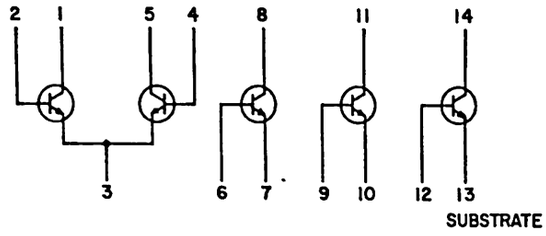
DETAIL:



100000131

General Purpose Transistor Array

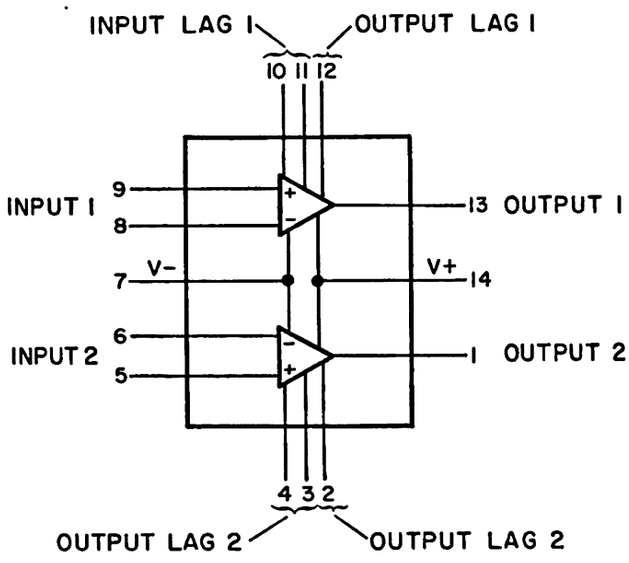
Schematic



100000132

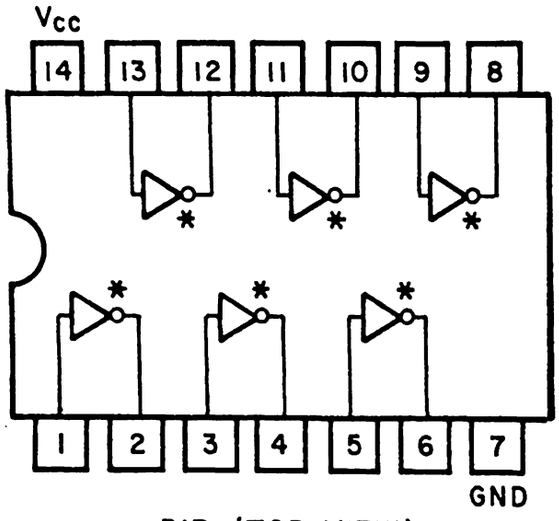
Dual Stereo Preamplifier

Pin Configuration



100000133

Pin Configuration



DIP (TOP VIEW)

*Open collector

Hex Inverter

Logic Diagram/Pin Designations

V_{CC} = Pin 14

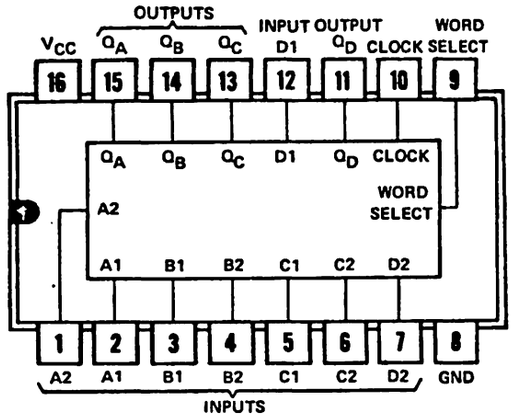
Gnd = Pin 7

Positive logic: $Y = \overline{A}$

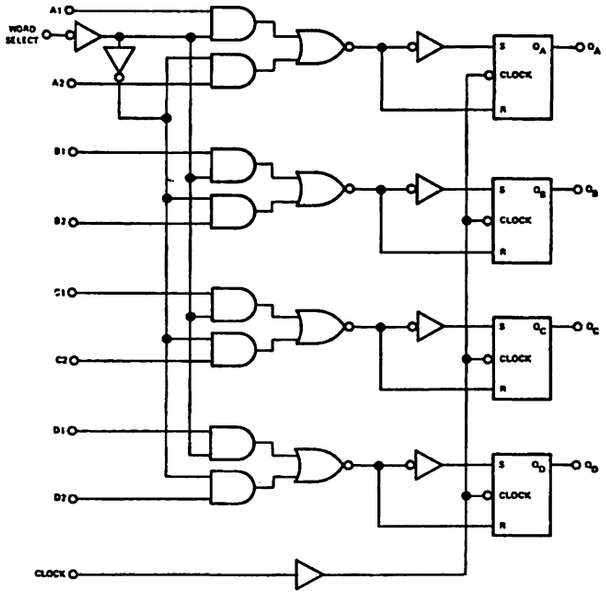
100000134

4-Bit Data Selector/Storage Register

Pin Configuration



Logic Diagram



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Positive logic: word select low for word 1, word select high for word 2.

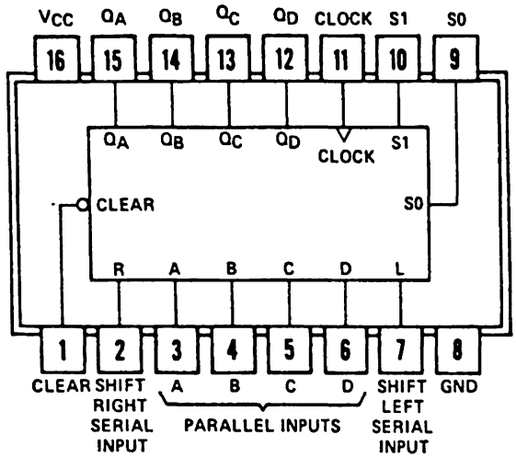
This monolithic data selector/storage register is composed of four S-R master-slave flip-flops, four AND-OR-INVERT gates, one buffer and six inverter/drivers.

When the word select input is low, word 1 (A1, B1, C1, D1) is applied to the flip-flops. A high input to word select will cause the selection of word 2 (A2, B2, C2, D2). The selected word is shifted to the output terminals on the negative-going edge of the clock pulse.

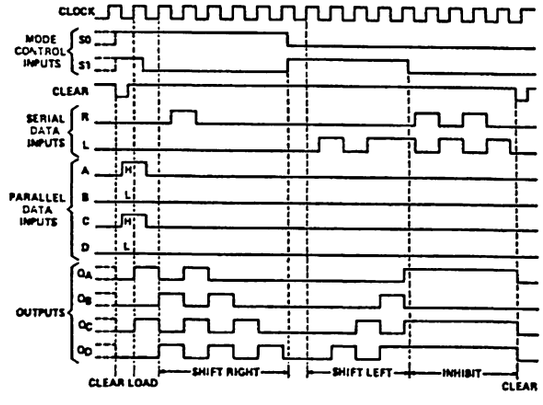
100000135 100000234

4-Bit Bidirectional Universal Shift Registers

Pin Configuration



Typical Clear, Load, Right-Shift, Left-Shift, Inhibit, and Clear Sequences



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table

INPUTS											OUTPUTS			
CLEAR	MODE		CLOCK	SERIAL		PARALLEL								
	S_1	S_0		LEFT	RIGHT	A	B	C	D		Q_A	Q_B	Q_C	Q_D
L	X	X	X	X	X	X	X	X	X		L	L	L	L
H	X	X	L	X	X	X	X	X	X		Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
H	H	H	↑	X	X	a	b	c	d		a	b	c	d
H	L	H	↑	X	H	X	X	X	X		H	Q_{An}	Q_{Bn}	Q_{Cn}
H	L	H	↑	X	L	X	X	X	X		L	Q_{An}	Q_{Bn}	Q_{Cn}
H	H	L	↑	H	X	X	X	X	X		Q_{Bn}	Q_{Cn}	Q_{Dn}	H
H	H	L	↑	L	X	X	X	X	X		Q_{Bn}	Q_{Cn}	Q_{Dn}	L
H	L	L	X	X	X	X	X	X	X		Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}

H = high level (steady state).

L = low level (steady state).

X = irrelevant (any input, including transitions).

↑ = transition from low to high level.

a, b, c, d = the level of steady-state input at inputs A, B, C or D, respectively.

Q_{A0}, Q_{B0}, Q_{C0}, Q_{D0} = the level of Q_A, Q_B, Q_C or Q_D, respectively, before the indicated steady-state input conditions were established.

Q_{An}, Q_{Bn}, Q_{Cn}, Q_{Dn} = the level of Q_A, Q_B, Q_C or Q_D, respectively, before the most recent ↑ transition of the clock.

Note: The 100000234 is a Shottky device.

The circuit contains 46 equivalent gates and features parallel inputs, parallel outputs, right-shift and left-shift serial inputs, operating-mode-control inputs, and a direct overriding clear line. The register has four distinct modes of operation:

Parallel (Broadside) Load

Shift Right (in the direction Q_A toward Q_D)

Shift Left (in the direction Q_D toward Q_A)

Inhibit Clock (Do nothing)

Continued....

100000135 100000234

Continued

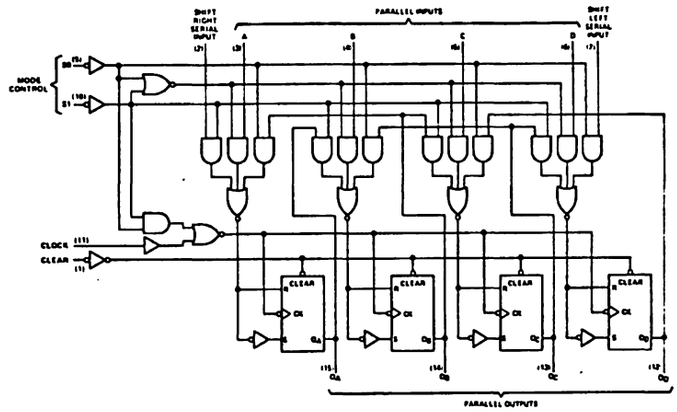
Synchronous parallel loading is accomplished by applying the four bits of data and taking both mode control inputs, S_0 and S_1, high. The data is loaded into the associated flip-flop and appears at the outputs after the positive transition of the clock input. During loading, serial data flow is inhibited.

Shift right is accomplished synchronously with the rising edge of the clock pulse when S_0 is high and S_1 is low. Serial data for this mode is entered at the shift-right data input. When S_0 is low and S_1 is high, data shifts left synchronously and new data is entered at the shift-left serial input.

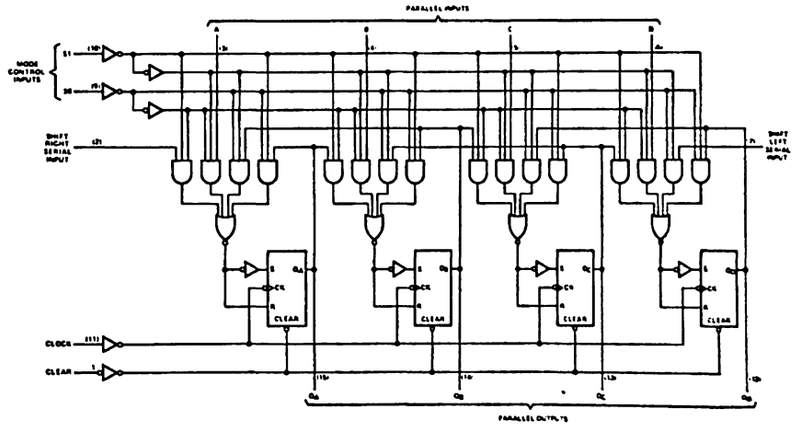
Clocking of the flip-flop is inhibited when both mode control units are low. The mode controls of the 100000135 should be changed only while the clock input is high.

Logic Diagrams

100000135



100000234



⌽ . . . . dynamic input activated by a transition from a high level to a low level.

100000136

Eight-Input Priority Encoder

Logic Diagram/Pin Designations

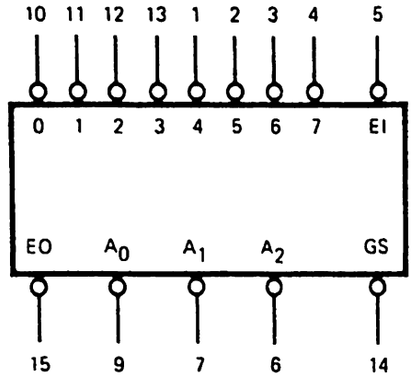
V_{CC} = Pin 16

Gnd = Pin 8

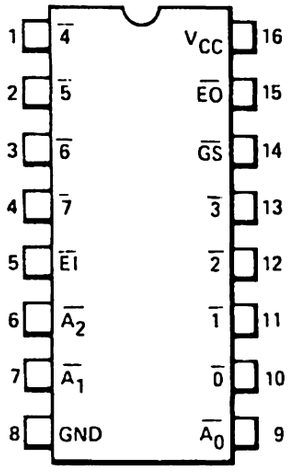
Pin Names

$\overline{0}$..... Priority (Active LOW) Input
$\overline{1}$ to $\overline{7}$..... Priority (Active LOW) Inputs
$\overline{EI}$..... Enable (Active LOW) Input
$\overline{EO}$ ..... Enable (Active LOW) Output
$\overline{GS}$ ..... Group Select (Active LOW) Output
$\overline{A_0}$, $\overline{A_1}$, $\overline{A_2}$. Address (Active LOW) Outputs

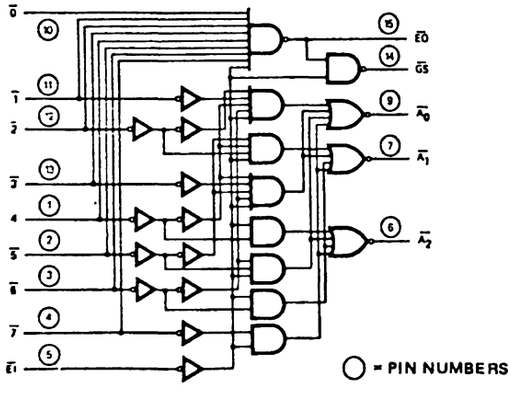
Logic Symbol



Pin Configuration



Logic Diagram



Truth Table

$\overline{EI}$	$\overline{0}$	$\overline{1}$	$\overline{2}$	$\overline{3}$	$\overline{4}$	$\overline{5}$	$\overline{6}$	$\overline{7}$	$\overline{GS}$	$\overline{A_0}$	$\overline{A_1}$	$\overline{A_2}$	$\overline{EO}$
H	X	X	X	X	X	X	X	X	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	X	L	H	L	H	L	L	H
L	X	X	X	X	X	L	H	H	L	L	H	L	H
L	X	X	X	X	L	H	H	H	L	H	H	L	H
L	X	X	X	L	H	H	H	H	L	L	L	H	H
L	X	X	L	H	H	H	H	H	L	H	L	H	H
L	X	L	H	H	H	H	H	H	L	L	H	H	H
L	L	H	H	H	H	H	H	H	L	H	H	H	H

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care

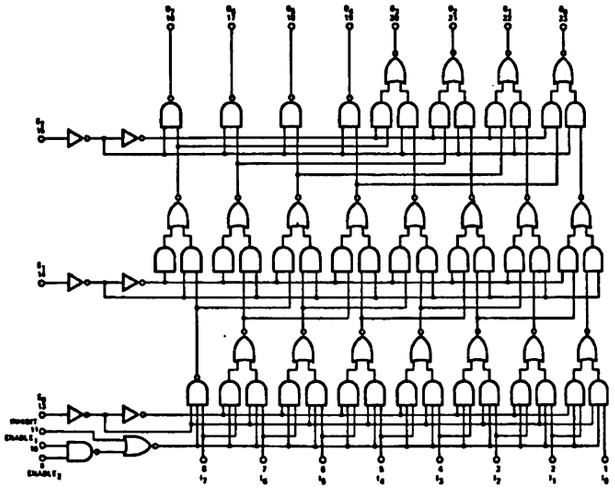
The 100000136 is a multipurpose 8-input priority encoder designed to accept data from eight active LOW inputs and provides a binary representation on the three active LOW outputs. A priority is assigned to each input so that when two or more inputs are simultaneously active, the input with the highest priority is represented on the output, with input line 7 having the highest priority.

A HIGH on the Input Enable ($\overline{EI}$) will force all outputs to the inactive (HIGH) state and allow new data to settle without producing erroneous information at the outputs.

A Group Signal output ($\overline{GS}$) and an Enable Output ($\overline{EO}$) are provided with the three data outputs. The $\overline{GS}$ is active level LOW when any input is LOW; this indicates when any input is active. The $\overline{EO}$ is active level LOW when all inputs are HIGH. Using the output enable along with the input enable allows priority encoding of N input signals. Both $\overline{EO}$ and $\overline{GS}$ are inactive HIGH when the input enable is HIGH.

100000137

Logic Diagram



NOTE: All inputs have diode clamps.

8-Bit Position Scaler

Logic Diagram/Pin Designations

V_{CC} = Pin 24
Gnd = Pin 12

Truth Table

INHIBIT	ENABLE 1 & 2	S_0	S_1	S_2	O_0	O_1	O_2	O_3	O_4	O_5	O_6	O_7
0	1	0	0	0	$\overline{I}_0$	$\overline{I}_1$	$\overline{I}_2$	$\overline{I}_3$	$\overline{I}_4$	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$
0	1	1	0	0	$\overline{I}_1$	$\overline{I}_2$	$\overline{I}_3$	$\overline{I}_4$	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$	1
0	1	0	1	0	$\overline{I}_2$	$\overline{I}_3$	$\overline{I}_4$	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$	1	1
0	1	1	1	0	$\overline{I}_3$	$\overline{I}_4$	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$	1	1	1
0	1	0	0	1	$\overline{I}_4$	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$	1	1	1	1
0	1	1	0	1	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$	1	1	1	1	1
0	1	0	1	1	$\overline{I}_6$	$\overline{I}_7$	1	1	1	1	1	1
0	1	1	1	1	$\overline{I}_7$	1	1	1	1	1	1	1
1	X	X	X	X	1	1	1	1	1	1	1	1
X	0	X	X	X	1	1	1	1	1	1	1	1

Note:

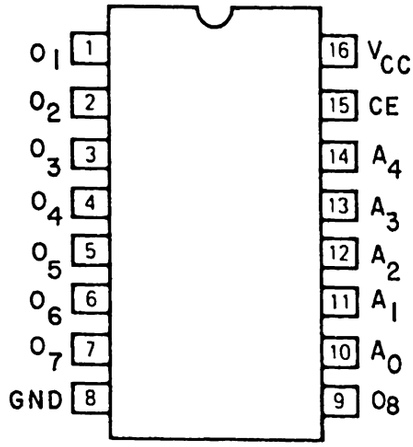
X indicates either logic "1" or logic "0" may be present.

The 8-bit position scaler is an MSI array of approximately 70 gate complexity. The primary function of this device is to scale (or shift) data bit positions by a selection of a 3-bit binary selector code.

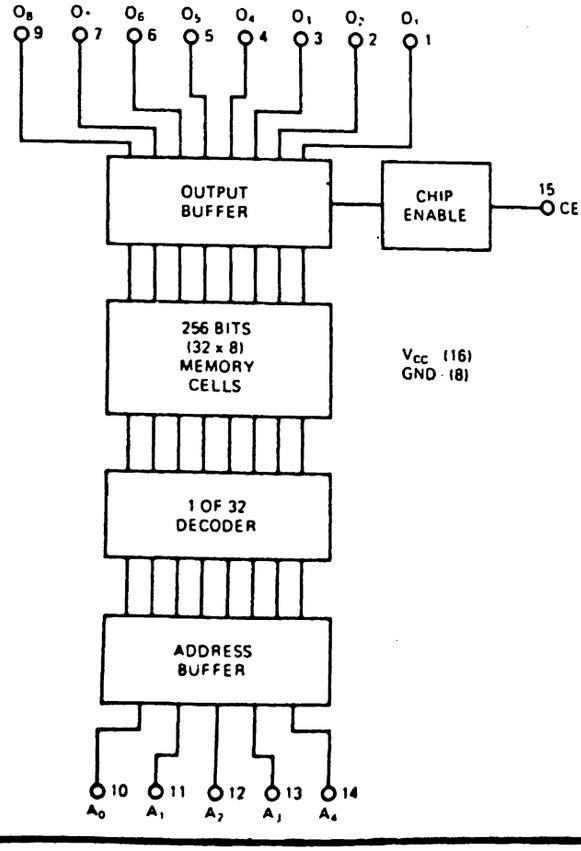
The most significant bit input (I_7) may be shifted 8 positions to the least significant bit output (O_0). At zero shift, or scale select, all eight input data bits are transferred and inverted to their respective outputs, (I_0 to O_0, I_1 to O_1, I_2 to O_2, etc.) At a shift, or scale select, of one, each input bit (I_n) will shift to the next lower output bit (O_{n-1}). See truth table for other shift codes.

100000140 100000141 100000142 100000148 100000149 100000215 100000216 100000217 100000218 100000219

Pin Configuration



Functional Block Diagram



256-Bit Bipolar Read Only Memory

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

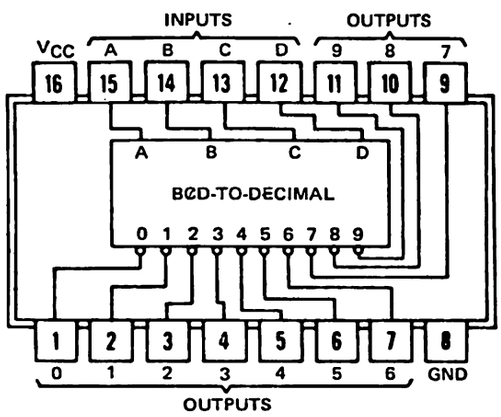
These high speed, electrically programmable, fully decoded TTL bipolar 256-bit read only memories are organized as 32 words by 8 bits.

Memory expansion is simple; three-state outputs are provided on the 100000215; uncommitted collector outputs are provided on all other devices. Each device has on-chip address decoding and chip enable. The memory is fabricated with all logic level zeroes(low); logic level ones (high) can be electrically programmed in the selected bit locations. The same address inputs are used for both programming and reading.

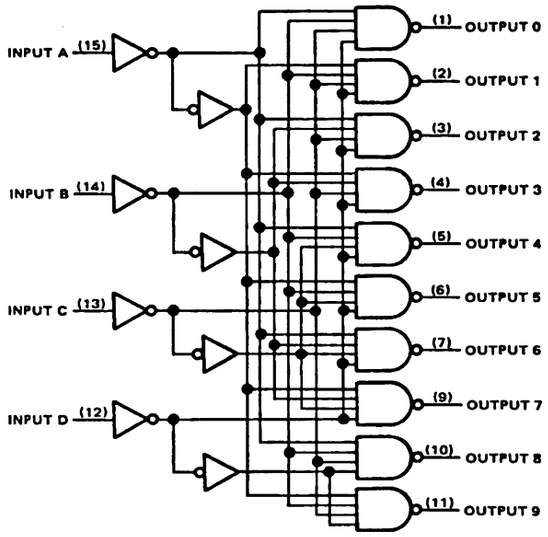
100000143

BCD-To-Decimal Decoder-Driver

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table

	Inputs				Outputs									
No.	D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H
3	L	L	H	H	H	H	H	L	H	H	H	H	H	H
4	L	H	L	L	H	H	H	H	L	H	H	H	H	H
5	L	H	L	H	H	H	H	H	H	L	H	H	H	H
6	L	H	H	L	H	H	H	H	H	H	L	H	H	H
7	L	H	H	H	H	H	H	H	H	H	H	L	H	H
8	H	L	L	L	H	H	H	H	H	H	H	H	L	H
9	H	L	L	H	H	H	H	H	H	H	H	H	H	L
Invalid	H	L	H	L	H	H	H	H	H	H	H	H	H	H
	H	L	H	H	H	H	H	H	H	H	H	H	H	H
	H	H	L	L	H	H	H	H	H	H	H	H	H	H
	H	H	L	H	H	H	H	H	H	H	H	H	H	H
	H	H	H	L	H	H	H	H	H	H	H	H	H	H
	H	H	H	H	H	H	H	H	H	H	H	H	H	H

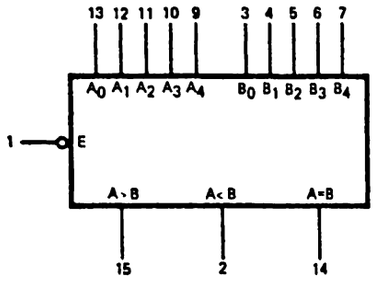
H = high level (off); L = low level (on).

This monolithic BCD-to-decimal decoder/driver consists of eight inverters and ten four-input NAND gates. The inverters are connected in pairs to make BCD input data available for decoding by the NAND gates. Full decoding of valid BCD input logic ensures that all outputs remain off for all invalid binary input conditions.

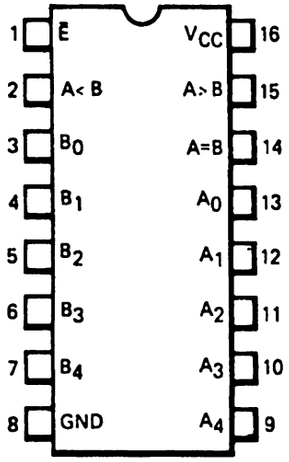
100000144

5-Bit Comparator

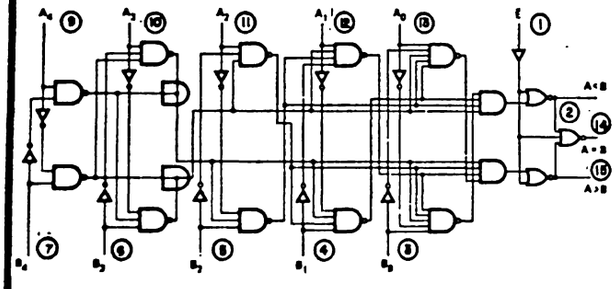
Logic Symbol



Pin Configuration



Logic Diagram



○ = PIN NUMBERS

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names

$\overline{E}$ ..... Enable (Active LOW) Input

A_0, A_1, A_2, A_3, A_4 .... Word A Parallel Inputs

B_0, B_1, B_2, B_3, B_4 .... Word B Parallel Inputs

A < B ..... A Less Than B Output

A > B ..... A Greater Than B Output

A = B ..... A Equal to B Output

Truth Table

$\overline{E}$	Ay	By	A<B	A>B	A=B
H	X	X	L	L	L
L	Word A =	Word B	L	L	H
L	Word A >	Word B	L	H	L
L	Word B >	Word A	H	L	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Either HIGH or LOW Voltage Level

The 100000144 is a high speed expandable comparator which provides comparison between two 5-bit words and gives three outputs, "less than", "greater than" and "equal to". A HIGH level on the active LOW enable input forces all three outputs LOW.

This 5-bit comparator uses combinational circuitry to directly generate "A greater than B" and "A less than B" outputs. As evident from the logic diagram, these outputs are generated in only three gate delays. The "A equals B" output is generated in one additional gate delay by decoding the "A neither less than nor greater than B" condition with a NOR gate. All three outputs are activated by the active LOW Enable input ($\overline{E}$).

Tying the A > B output from one device into an A input on another device and the A < B output into the corresponding B input permits easy expansion.

The A_4 and B_4 inputs are the most significant inputs, and A_0 and B_0 are the least significant. Thus, if A_4 is HIGH and B_4 is LOW, the A > B output will be HIGH regardless of all other inputs except $\overline{E}$.

100000145

8-Bit Addressable Latch

Logic Diagram/Pin Designations

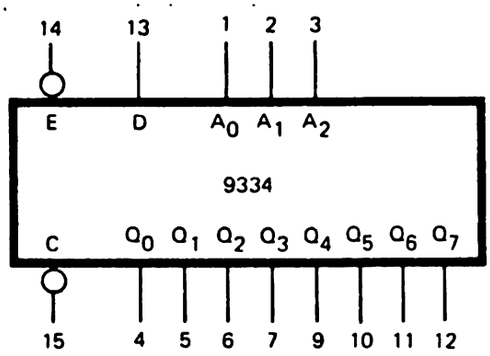
V_{CC} = Pin 16

Gnd = Pin 8

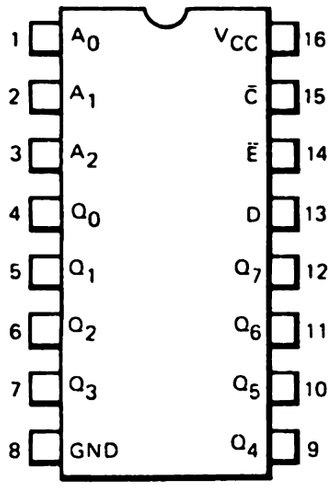
Pin Names

A_0, A_1, A_2..... Address Inputs
D..... Data Input
$\overline{E}$..... Enable (Active LOW) Input
$\overline{C}$..... Clear (Active LOW) Input
Q_0 to Q_7..... Parallel Latch Outputs

Logic Symbol



Pin Configuration



Truth Table

						Present Output States								
$\overline{C}$	$\overline{E}$	D	A_0	A_1	A_2	Q_0	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Mode
L	H	X	X	X	X	L	L	L	L	L	L	L	L	Clear
L	L	L	L	L	L	L	L	L	L	L	L	L	L	Demultiplex
L	L	H	L	L	L	H	L	L	L	L	L	L	L	
L	L	L	H	L	L	L	L	L	L	L	L	L	L	
L	L	H	H	L	L	L	H	L	L	L	L	L	L	
.	.	.	.						.					
.	.	.	.						.					
.	.	.	.						.					
L	L	H	H	H	H	L	L	L	L	L	L	L	H	
H	H	X	X	X	X	Q_{N-1} →								Memory
H	L	L	L	L	L	L	Q_{N-1}	Q_{N-1}	Q_{N-1} →					Addressable
H	L	H	L	L	L	H	Q_{N-1}	Q_{N-1} →						Latch
H	L	L	H	L	L	Q_{N-1}	L	Q_{N-1} →						
H	L	H	H	L	L	Q_{N-1}	H	Q_{N-1} →						
.	.	.	.					.						
.	.	.	.					.						
.	.	.	.					.						
H	L	L	H	H	H	Q_{N-1} →						Q_{N-1}	L	
H	L	H	H	H	H	Q_{N-1} →						Q_{N-1}	H	

X = Don't Care Condition
L = LOW Voltage Level
H = HIGH Voltage Level
Q_{N-1} = Previous Output State

Mode Selection

$\overline{E}$	$\overline{C}$	Mode
L	H	Addressable Latch
H	H	Memory
L	L	Active HIGH Eight-Channel Demultiplexer
H	L	Clear

The 100000145 is a high speed 8-bit addressable latch designed for general purpose storage applications in digital systems. It is a multifunctional device capable of storing single line data in eight addressable latches, and being a one-of-eight decoder and demultiplexer with active level HIGH outputs. The device also incorporates an active level LOW common clear for resetting all latches as well as an active level LOW enable.

This latch has four modes of operation, which are shown in the mode selection table. In the addressable latch mode, data on the data line (D)

Continued ....

100000145

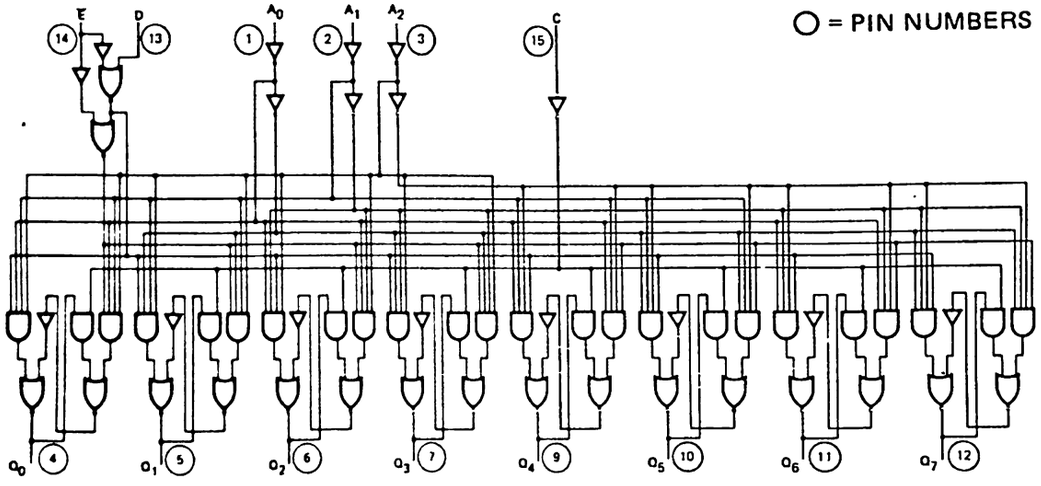
Continued

is written into the addressed latch. The addressed latch will follow the data input with all non-addressed latches remaining in their previous states. In the memory mode, all latches remain in their previous state and are unaffected by the data or address inputs.

In the one-of-eight decoding or demultiplexing mode, the addressed output will follow the state of the D input with all other outputs in the LOW state. In the clear mode all outputs are LOW and unaffected by the address and data inputs.

When operating this device as an addressable latch, changing more than one bit of the address could impose a transient wrong address. Therefore, this should only be done while in the memory mode.

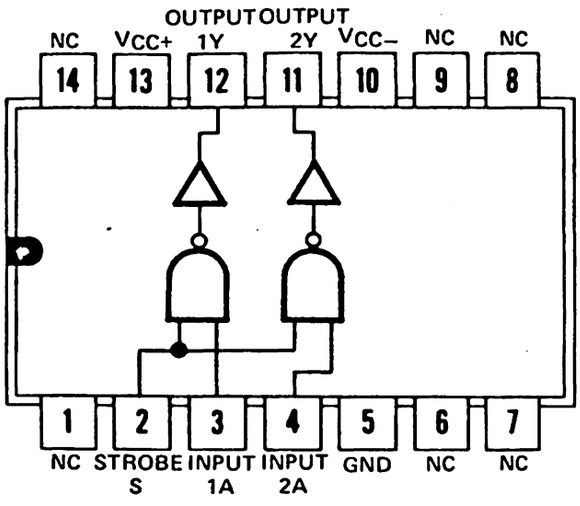
Logic Diagram



100000146

Dual Line Driver

Pin Configuration



Pin Designations

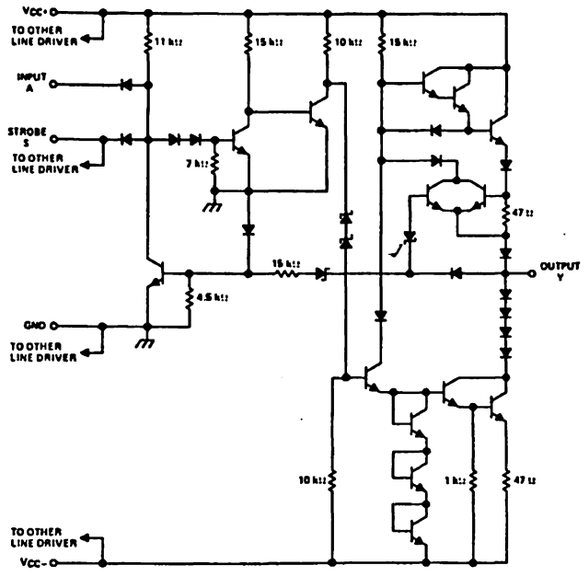
V_{CC+} = Pin 13
V_{CC-} = Pin 10
Gnd = Pin 5
NC = No Internal Connection

Positive logic: $Y = \overline{AS}$

This device is a monolithic dual line driver which satisfies the requirements of the standard interface between data terminal equipment and data communication equipment as defined by EIA Standard RS-232-C.

A rate of 20,000 bits per second can be transmitted with a full 2500pF load.

Schematic (Each Line Driver)

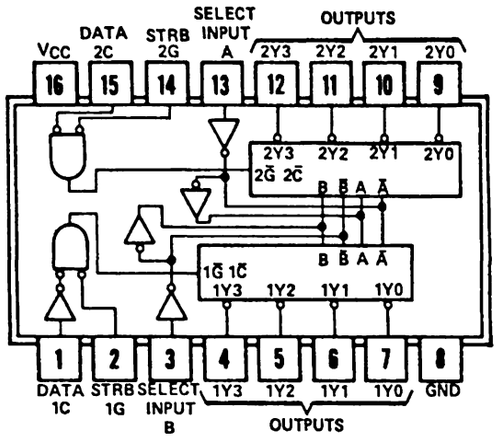


Component values shown are nominal.

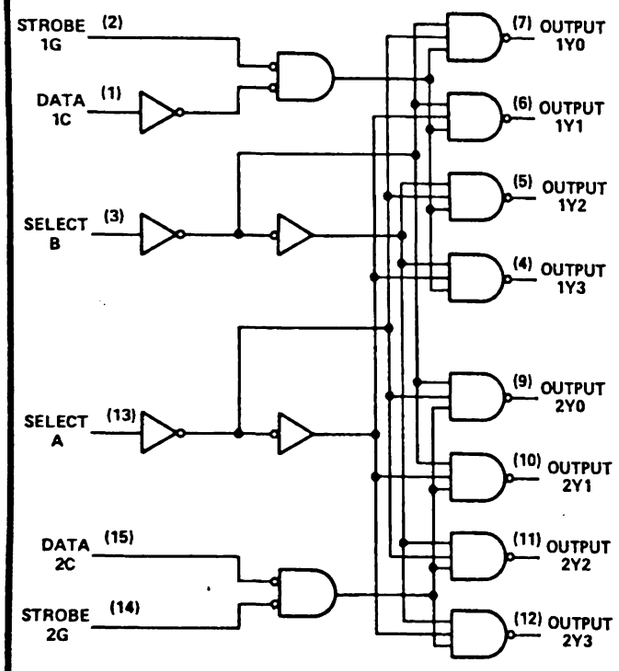
100000147

Dual 2-Line-To-4-Line Decoder/Demultiplexer

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Tables
2-Line-To-4-Line Decoder or 1-Line-To-4-Line Demultiplexer

Inputs				Outputs			
Select		Strobe	Data				
B	A	1G	1C	1Y0	1Y1	1Y2	1Y3
X	X	H	X	H	H	H	H
L	L	L	H	L	H	H	H
L	H	L	H	H	L	H	H
H	L	L	H	H	H	L	H
H	H	L	H	H	H	H	L
X	X	X	L	H	H	H	H

Inputs				Outputs			
Select		Strobe	Data				
B	A	2G	2C	2Y0	2Y1	2Y2	2Y3
X	X	H	X	H	H	H	H
L	L	L	L	L	H	H	H
L	H	L	L	H	L	H	H
H	L	L	L	H	H	L	H
H	H	L	L	H	H	H	L
X	X	X	H	H	H	H	H

Function Table
3-Line-To-8-Line Decoder or 1-Line-To-8-Line Demultiplexer

Inputs				Outputs							
Select			Strobe or Data	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
C*	B	A	G**	2Y0	2Y1	2Y2	2Y3	1Y0	1Y1	1Y2	1Y3
X	X	X	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H
L	H	L	L	H	H	L	H	H	H	H	H
L	H	H	L	H	H	H	L	H	H	H	H
H	L	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	L	H	H
H	H	L	L	H	H	H	H	H	H	L	H
H	H	H	L	H	H	H	H	H	H	H	L

Notes: *C = inputs 1C and 2C connected together.
**G = inputs 1G and 2G connected together.
H = high level, L = low level,
X = irrelevant.

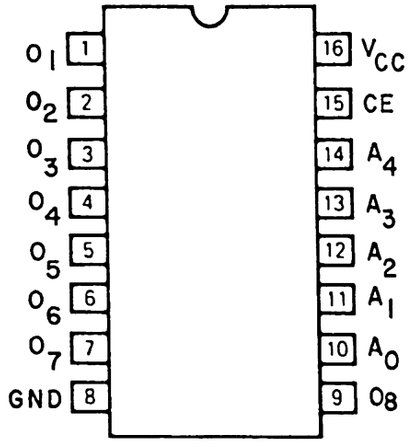
The 100000147 monolithic TTL circuit features dual 1-line-to-4-line demultiplexers with individual strobes and common binary-address inputs in a single 16-pin package. When both sections

Continued ....

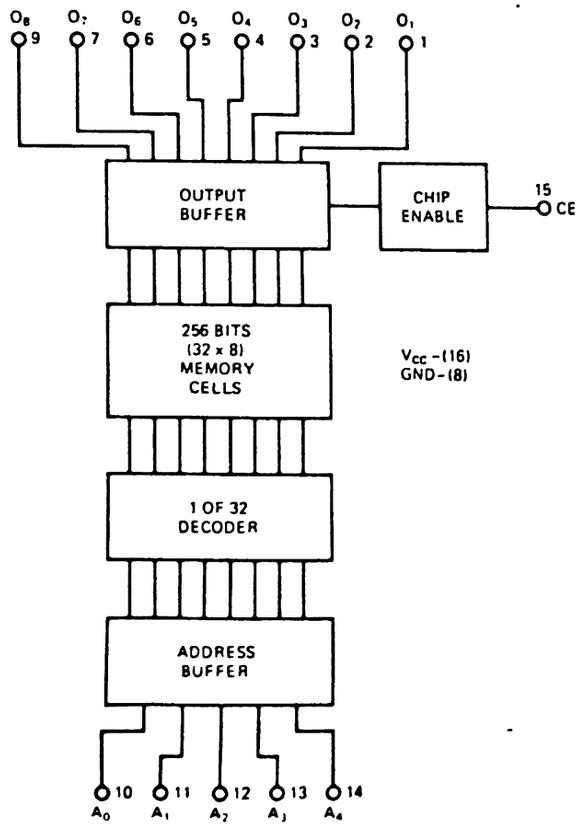
are enabled by the strobes, the common binary-address inputs sequentially select and route associated input data to the appropriate output of each section. The individual strobes permit activating or inhibiting each of the 4-bit sections as desired. Data applied to input 1C is inverted at its outputs and data applied at 2C is not inverted through its outputs. The inverter following the 1C data input permits use as a 3-to-8-line decoder or 1-to-8-line demultiplexer without external gating. Input clamping diodes are provided to minimize transmission-line effects and simplify system design.

100000140 100000141 100000142 100000148 100000149 100000215 100000216 100000217 100000218 100000219 100000269 100000270 100000271 100000272 100000273 100000274 100000275 100000276 100000277 100000278 100000279 100000280

Pin Configuration



Functional Block Diagram



256-Bit Bipolar Read Only Memory

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

These high speed, electrically programmable, fully decoded TTL bipolar 256-bit read only memories are organized as 32 words by 8 bits.

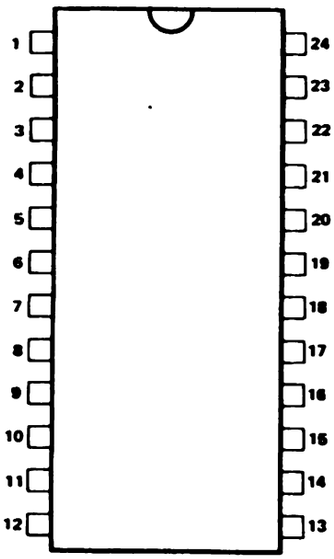
Memory expansion is simple; three-state outputs are provided on the 100000215; uncommitted collector outputs are provided on all other devices. Each device has on-chip address decoding and chip enable. The memory is fabricated with all logic level zeroes(low); logic level ones (high) can be electrically programmed in the selected bit locations. The same address inputs are used for both programming and reading.

REV. 02

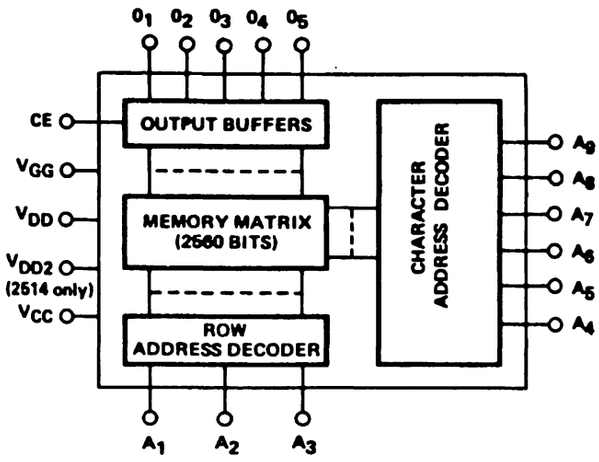
100000150

High Speed 64 X 7 X 5 Character Generator

Pin Configuration



Block Diagram



CE	OUTPUT
0	DATA
1	OPEN

Pin Designations

1.	V_{GG}	24.	V_{CC}
2.	NC	23.	NC
3.	NC	22.	Address 9
4.	Out 1	21.	Address 8
5.	Out 2	20.	Address 7
6.	Out 3	19.	Address 6
7.	Out 4	18.	Address 5
8.	Out 5	17.	Address 4
9.	NC	16.	Address 3
10.	Ground	15.	Address 2
11.	Chip Enable	14.	Address 1
12.	V_{DD}	13.	NC

Character Format

Row Address

A_3	A_2	A_1
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

Character Address

	A_4	A_5	A_6	A_7	A_8	A_9
ASCII Character	1	1	0	0	1	0

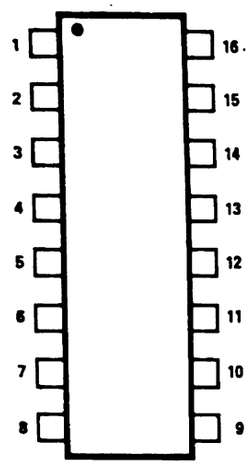
The 100000150 is a high speed 2560-bit static ROM. The 64x7x5 character organization is formed on a 64x8x5 field.

The product uses +5V, -5V and -12V power supplies, 5V TTL level input signals and tri-state outputs.

100000151

Hex 40-Bit Static Shift Register

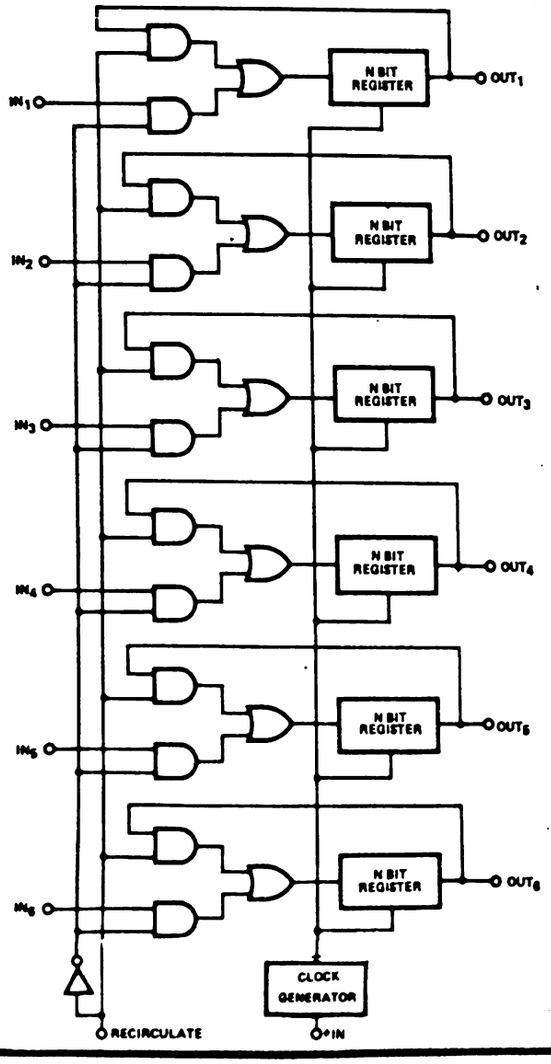
Pin Configuration



Pin Designations

1.	IN_4	16.	V_{CC}
2.	IN_5	15.	IN_3
3.	IN_6	14.	IN_2
4.	Recirculate	13.	IN_1
5.	V_{GG}	12.	OUT_1
6.	Clock	11.	OUT_2
7.	OUT_6	10.	OUT_3
8.	OUT_5	9.	OUT_4

Functional Block Diagram



Truth Table

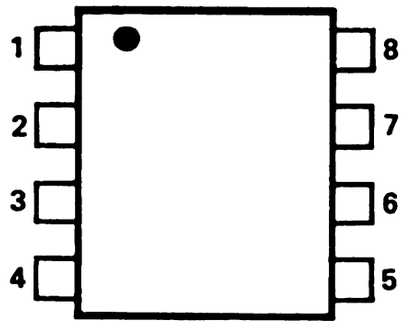
Recirculate	Input	Function
1	0	Recirculate
1	1	Recirculate
0	0	"0" is Written
0	1	"1" is Written

The Hex 40-bit recirculating static shift register consists of enhancement mode P-channel silicon gate MOS devices integrated on a single monolithic chip. Internal recirculation logic plus TTL/DTL level clock signals are provided for interfacing capability.

100000152

1024-Bit Recirculating Dynamic Shift Register

Package



Pin Designations

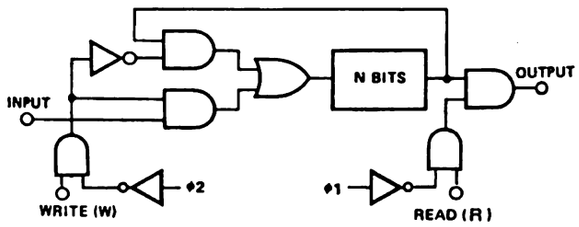
1. 0_2 Input clock
2. Output
3. Read
4. V_{DD}
8. V_{CC}
7. 0_1 Output clock
6. Input
5. Write

Truth Table

Write	Read	Function
0	0	Recirculate, Output is "0"
0	1	Recirculate, Output is Data
1	0	Write Mode, Output is "0"
1	1	Read Mode, Output is Data

The 1024 bit recirculating dynamic shift register consists of enhancement mode P-channel MOS devices integrated on a single monolithic chip. Internal recirculation logic plus write and read controls are included on the chip.

Block Diagram

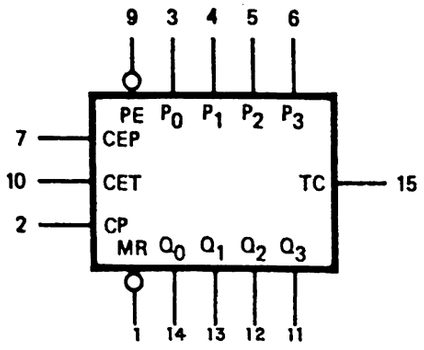


NOTE:
N = 1024 '0' = 0V, '1' = +5V

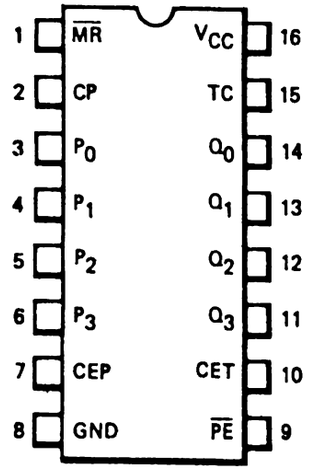
100000153 | 100000047

BCD Decade Counter-4 Bit Binary Counter

Logic Symbol

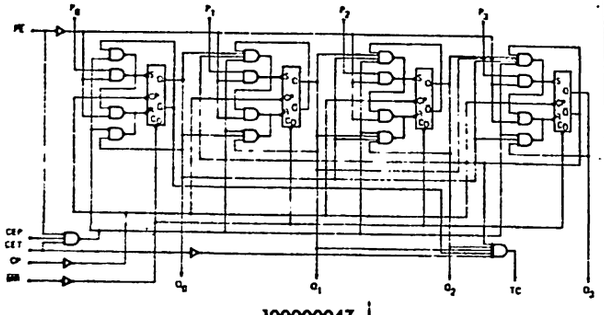


Pin Configuration

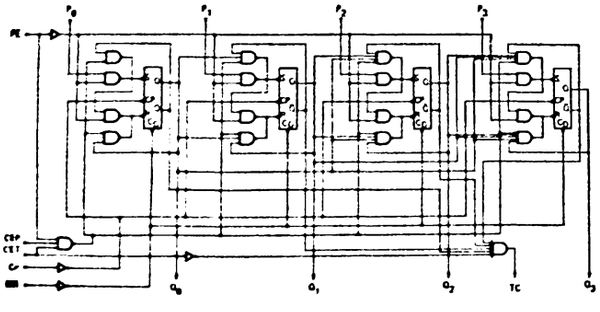


Logic Diagrams

100000153



100000047



Logic Diagram/Pin Designations

VCC = Pin 16

Gnd = Pin 8

Pin Names

$\overline{PE}$..... Parallel Enable (Active LOW) Input

P_0, P_1, P_2, P_3.. Parallel Inputs

CEP ..... Count Enable Parallel Input

CET ..... Count Enable Trickle Input

CP..... Clock (Active HIGH Going Edge) Input

$\overline{MR}$ ..... Master Reset (Active LOW) Input

Q_0, Q_1, Q_2, Q_3.. Parallel Outputs

TC..... Terminal Count Outputs

Mode Selection

$\overline{PE}$	CEP	CET	Mode
L	L	L	Preset
L	L	H	Preset
L	H	L	Preset
L	H	H	Preset
H	L	L	No Change
H	L	H	No Change
H	H	L	No Change
H	H	H	Count

($\overline{MR}$ = HIGH)

Terminal Count Generation

CET	100000153 $(Q_0 \cdot \overline{Q}_1 \cdot \overline{Q}_2 \cdot Q_3)$	100000047 $(Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3)$	TC
L	L	L	L
L	H	H	L
H	L	L	L
H	H	H	H

$TC = CET \cdot Q_0 \cdot \overline{Q}_1 \cdot \overline{Q}_2 \cdot Q_3$ (100000153)

$TC = CET \cdot Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3$ (100000047)

Positive Logic:

H = HIGH Voltage Level
L = LOW Voltage Level

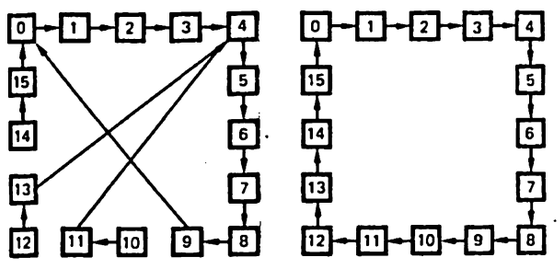
The 100000153 is a high speed BCD decade counter, and the 100000047 is a high speed binary counter. Both counters are fully synchronous with the clock pulse driving four master/slave flip-flops in parallel through a clock buffer. During the

Continued ...

100000153 100000047

Continued

100000153 100000047



Logic Equations

Count Enable = CEP · CET · $\overline{PE}$

TC for 100000153 = CET · Q_0 · $\overline{Q_1}$ · $\overline{Q_2}$ · Q_3

TC for 100000047 = CET · Q_0 · Q_1 · Q_2 · Q_3

Preset = $\overline{PE}$ · CP + (rising clock edge)

Reset = $\overline{MR}$

Note: The 100000153 can be preset to any state but will not count beyond 9. If preset to state 10, 11, 12, 13, 14 or 15, it will return to its normal sequence within two clock pulses.

LOW to HIGH transition of the clock, the master is inhibited from further change. After the masters are locked out, data is transferred from the master to the slaves and reflected at the outputs. When the clock is HIGH, the masters are inhibited and the master/slave data path remains established. During the HIGH to LOW transition of the clock, the slave is inhibited from further change, followed by the enabling of the masters for the acceptance of data from the counting logic or the parallel entry logic.

The three control inputs, Parallel Enable ($\overline{PE}$), Count Enable Parallel (CEP), and Count Enable Trickle (CET), select the mode of operation. When the conditions for counting are satisfied, the rising edge of a clock pulse will change the counters to the next state of the count sequence shown in the State Diagram. The Count Mode is enabled when CEP and CET inputs and $\overline{PE}$ are HIGH.

These devices can be synchronously preset from the four Parallel inputs (P_{0-3}) when $\overline{PE}$ is LOW. When the Parallel Enable and Clock are LOW, each master of the flip-flops is connected to the appropriate parallel input (P_{0-3}) and the slaves (outputs) are steady in their previous state. When the clock goes HIGH, the masters are inhibited and this information is transferred to the slaves and reflected at the outputs. The parallel enable input overrides both count enable inputs, presetting the counter when LOW.

Terminal count is HIGH when the counter is at terminal count (state 9 for 100000153 and state 15 for 100000047), and Count Enable Trickle is HIGH, as shown in the logic equations.

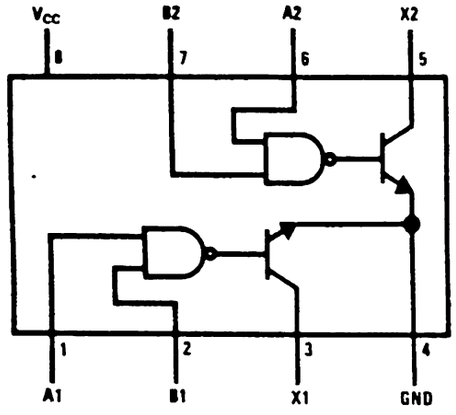
When LOW, the asynchronous master reset overrides all other inputs resetting the four outputs LOW.

Conventional operation, as shown in the Mode Selection table, requires that the mode control inputs ($\overline{PE}$, CEP, CET) are stable while the clock is LOW.

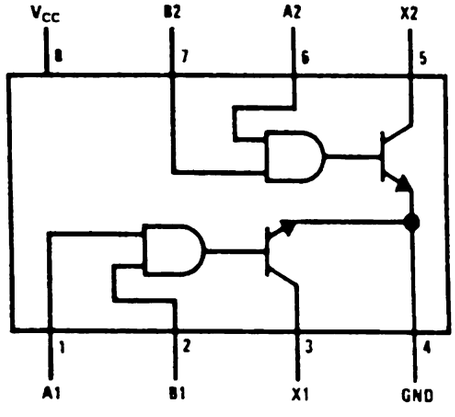
100000247 100000238
100000154 100000117

Dual Peripheral Drivers

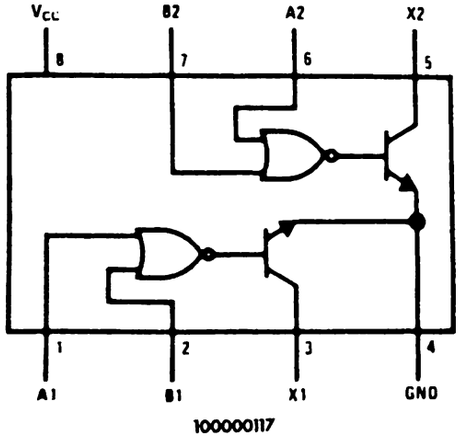
Pin Configurations



100000247/100000238



100000154



100000117

Pin Designations

V_{CC} = Pin 8

Gnd = Pin 4

Truth Tables

100000247 and 100000238

Positive logic: AB=X

A	B	Output X*
0	0	0
1	0	0
0	1	0
1	1	1

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000154

Positive logic: $\overline{AB}$=X

A	B	Output X*
0	0	1
1	0	1
0	1	1
1	1	0

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000117

Positive logic: A + B = X

A	B	Output X*
0	0	0
1	0	1
0	1	1
1	1	1

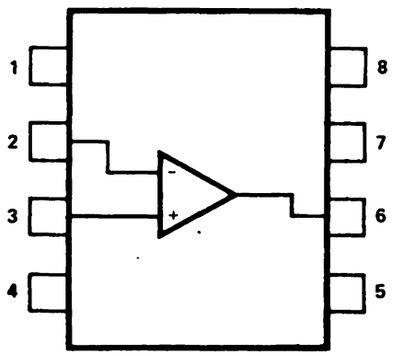
*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

These devices are general purpose dual peripheral drivers, each capable of sinking two independent 300mA loads to ground. In the off state (or with V_{CC} = 0V) the outputs will withstand 30V. Inputs are fully DTL/TTL compatible.

100000156

High Performance Operational Amplifier

Pin Configuration



Pin Designations

1. Offset Null	5. Offset Null
2. Inv. Input	6. Output
3. Non-Inv. Input	7. V^+
4. V^-	8. NC

The 100000156 is a high performance operational amplifier with high open loop gain, internal compensation, high common mode range and temperature stability.

The device is short-circuit protected and allows for nulling of offset voltage.

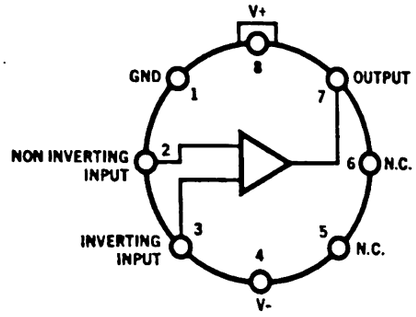
100000059 100000157

High-Speed Differential Comparator

The 100000059 (Can) and 100000157 (DIP) are differential voltage comparators intended for applications requiring high accuracy and fast response times. Constructed on a single silicon chip, the devices are useful as a variable threshold Schmitt trigger, a pulse height discriminator, a voltage comparator in high-speed A/D converters, a memory sense amplifier or a high-noise immunity line receiver.

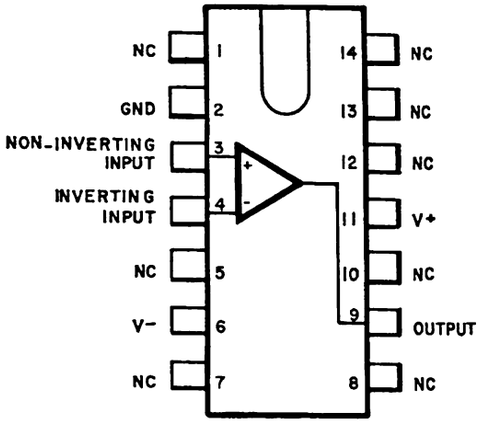
Pin Configurations

100000059



Note: Pin 4 connected to case.

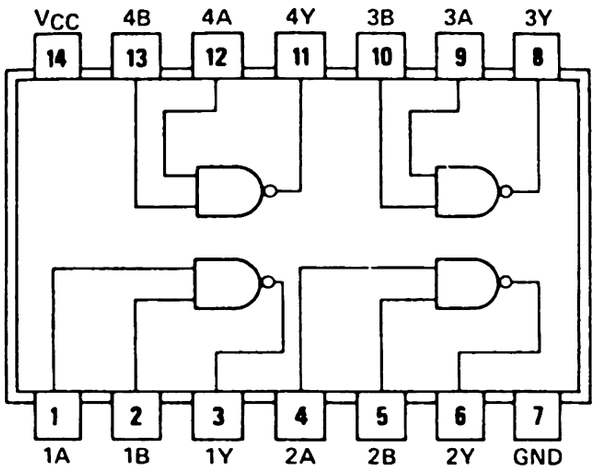
100000157



100000158

Quadruple 2-Input Positive-NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

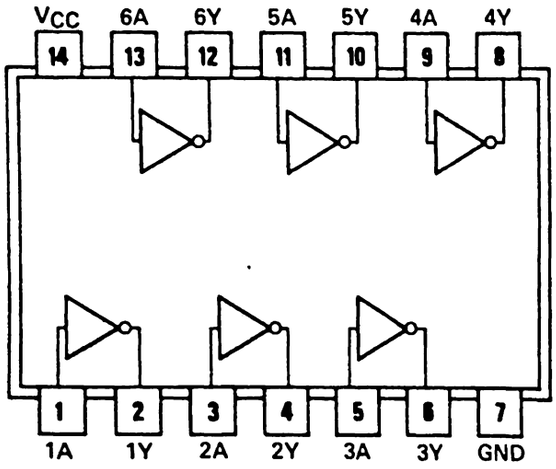
Gnd = Pin 7

Positive logic: $Y = \overline{AB}$

Note: The 100000158 is a Schottky device.

100000159

Pin Configuration



Hex Inverter

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

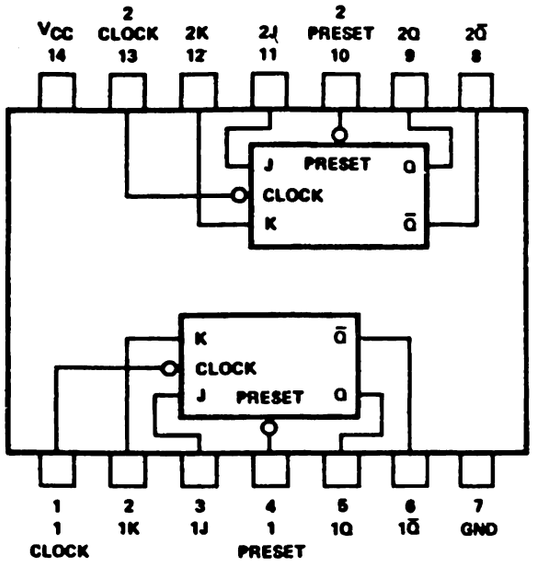
Positive logic: $Y = \overline{A}$

Note: The 100000159 is a Schottky device.

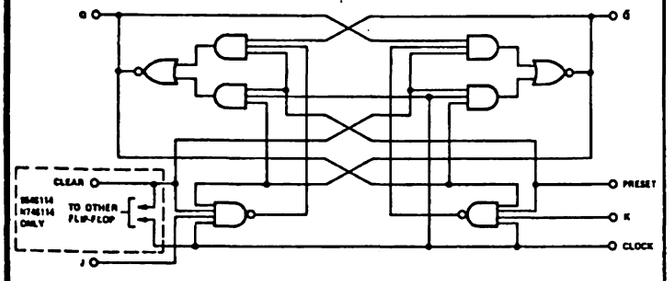
100000160

Dual J-K Edge-Triggered Flip-Flops

Pin Configuration



Logic Diagram (Each Flip-Flop)



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

t_n		t_{n+1}
J	K	Q
L	L	Q_n
L	H	L
H	L	H
H	H	$\overline{Q}_n$

Notes:

t_n = bit time before clock pulse.
t_{n+1} = bit time after clock pulse.

These monolithic dual flip-flops are designed so that when the clock goes high, the inputs are enabled and data will be accepted. The logic level of the J and K inputs may be allowed to change when the clock pulse is high and the bistable will perform according to the truth table as long as minimum setup times are observed. Input data is transferred to the outputs on the negative-going edge of the clock pulse.

Note: The 100000160 is a Shottky device.

100000161

Divide-By-Twelve Counter (Divide-By-Two and Divide-By-Six)

Logic Diagram/Pin Designations

V_{CC} = Pin 5

Gnd = Pin 10

N. C. = Pins 2, 3, 4, 13

Pin Names

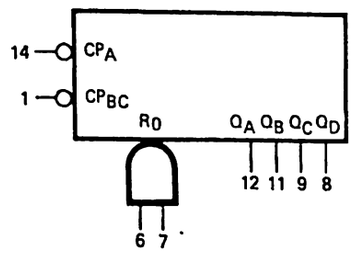
R_0 ..... Reset-Zero Inputs

$\overline{CP}_A$ ..... Clock Input

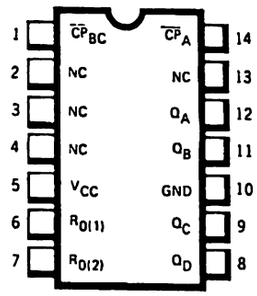
$\overline{CP}_{BC}$ ..... Clock Input

Q_A, Q_B, Q_C, Q_D .... Count Outputs

Logic Symbol



Connection Diagram Dip (Top View)



NC = No internal connection

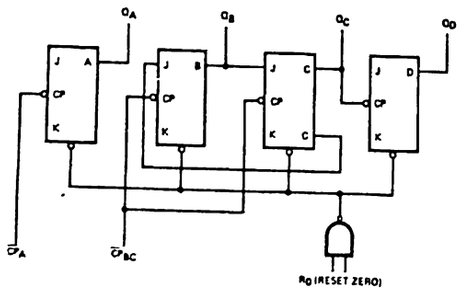
Truth Table

Count	Output			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	H	L	L	L
7	H	L	L	H
8	H	L	H	L
9	H	L	H	H
10	H	H	L	L
11	H	H	L	H

Notes:

1. Output Q_A connected to input $\overline{CP}_{BC}$.
2. To reset all outputs to Low level both $R_{0(1)}$ and $R_{0(2)}$ inputs must be at High level state.
3. Either (or both) reset inputs $R_{0(1)}$ and $R_{0(2)}$ must be at a Low level to count.

Logic Diagram



The 100000161 is a 4-Bit Binary Counter consisting of four master slave flip-flops which are internally interconnected to provide a divide-by-two counter and a divide-by-six counter. A grated direct reset line is provided which inhibits the count inputs and simultaneously returns the four flip-flop outputs to a Low level. As the output from flip-flop A is not internally connected to the succeeding flip-flops, the counter may be operated in two independent modes:

Continued ....

100000161

(Continued)

A. When used as a divide-by-twelve counter, output Q_A must be externally connected to input $\overline{CP}_{BC}$. The input count pulses are applied to input $\overline{CP}_A$. Simultaneous divisions of 2, 6 and 12 are performed at the Q_A, Q_C and Q_D outputs as shown in the truth table.

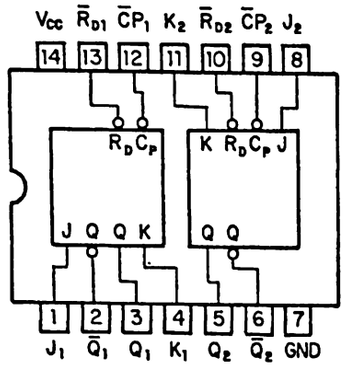
B. When used as a divide-by-six counter, the input count pulses are applied to input $\overline{CP}_{BC}$. Simultaneously, frequency divisions of 3 and 6 are available at the Q_C and Q_D outputs. Independent use of flip-flop A is available if the reset function coincides with reset of the divide-by-six counter.

These circuits are completely compatible with TTL and DTL logic families.

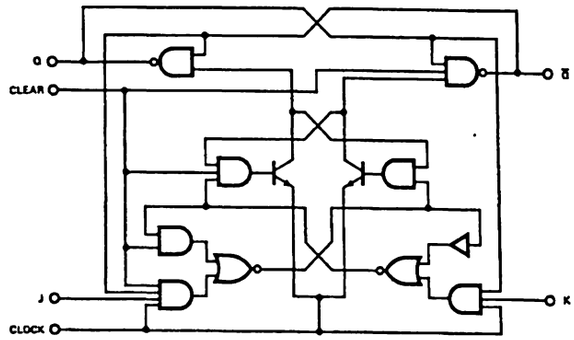
100000162

Dual JK Master/Slave Flip-Flop With Separate Clears and Clocks

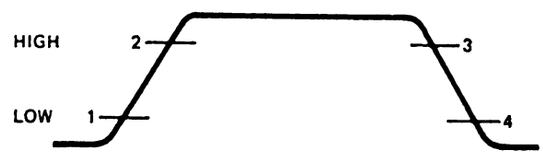
Pin Configuration



Logic Diagram
(Each Flip-Flop)



Clock Waveform



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Positive logic:

LOW input to clear sets Q to LOW level. Clear is independent of clock.

Truth Table

t_n		t_{n+1}
J	K	Q
L	L	Q_n
L	H	L
H	L	H
H	H	$\overline{Q}_n$

Notes:

t_n = Bit time before clock pulse.

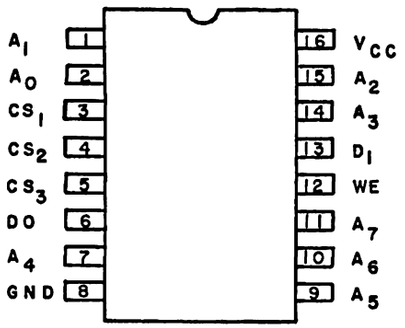
t_{n+1} = Bit time after clock pulse.

These Dual JK Master/Slave flip-flops have a separate clear and a separate clock for each flip-flop. Inputs to the master section are controlled by the clock pulse. The clock pulse also regulates the state of the coupling transistors which connect the master and slave sections. The sequence of operation is as follows: 1) Isolate slave from master; 2) enter information from J and K inputs to master; 3) disable J and K inputs; and 4) transfer information from master to slave.

100000164

256-Bit Bipolar Random Access Memory

Pin Configuration



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Memory Function Table

Chip Selects	Write Enable	Operation	Output
All "0"	"0"	Write	Logical "1" State
All "0"	"1"	Read	Complement of data written in memory
One or More "1"	X	Hold	Logical "1" State

The 100000164 integrated circuit is a high speed, fully decoded, static bipolar 256-bit random access memory in a 256x1 organization. This device provides uncommitted collector output and three chip selects.

Operation

Read

The memory is addressed through the A_0-A_7 inputs which select one of the 256 words. The chip is enabled by placing all chip selects (CS) to logic "0". If any or all CS inputs are logic "1", then the device will be disabled. If the write enable (WE) is at logic "1" the stored bit is read out of DO.

Write

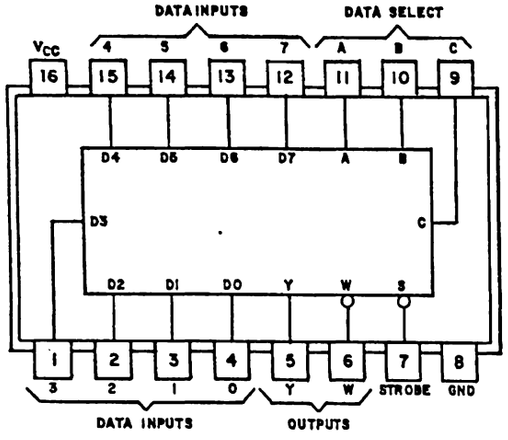
The memory is addressed through the A_0-A_7 inputs which select one of the 256 words. The chip is enabled by placing all the CS inputs to logic "0". If the WE input is at logic "0", the data on terminal DI is written into the addressed word.

When WE returns to logic "1", the information that was written in is now read out; however, each word read out is the complement of what was written in.

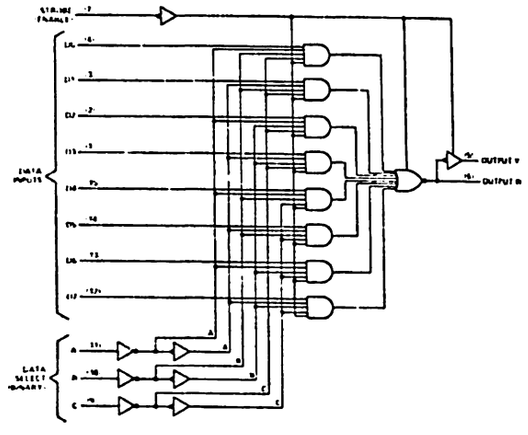
100000165

Data Selector/Multiplexer With 3-State Outputs

Pin Configuration



Logic Diagram



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Function Table

Inputs				Outputs	
Select			Strobe		
C	B	A	S	Y	W
X	X	X	H	Z	Z
L	L	L	L	D0	$\overline{D0}$
L	L	H	L	D1	$\overline{D1}$
L	H	L	L	D2	$\overline{D2}$
L	H	H	L	D3	$\overline{D3}$
H	L	L	L	D4	$\overline{D4}$
H	L	H	L	D5	$\overline{D5}$
H	H	L	L	D6	$\overline{D6}$
H	H	H	L	D7	$\overline{D7}$

H = high logic level, L = low logic level
X = irrelevant, Z = high impedance (off).
D0, D1 .... D7 = the level of the respective D input.

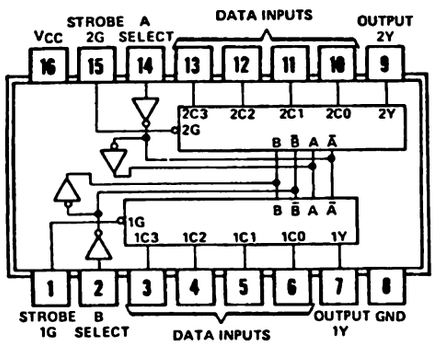
This monolithic data selector/multiplexer contains full on-chip binary decoding to select one-of-eight data sources and a strobe-controlled three-state output. The strobe must be at a low logic level to enable these devices. The three-state outputs permit a number of outputs to be connected to a common bus. When the strobe input is high, both outputs are in a high-impedance state in which both the upper and lower transistors of each totem-pole output are off, and the output neither drives nor loads the bus significantly. When the strobe is low, the outputs are activated and operate as standard TTL totem-pole outputs.

Note: The 100000165 is a Schottky device.

100000166

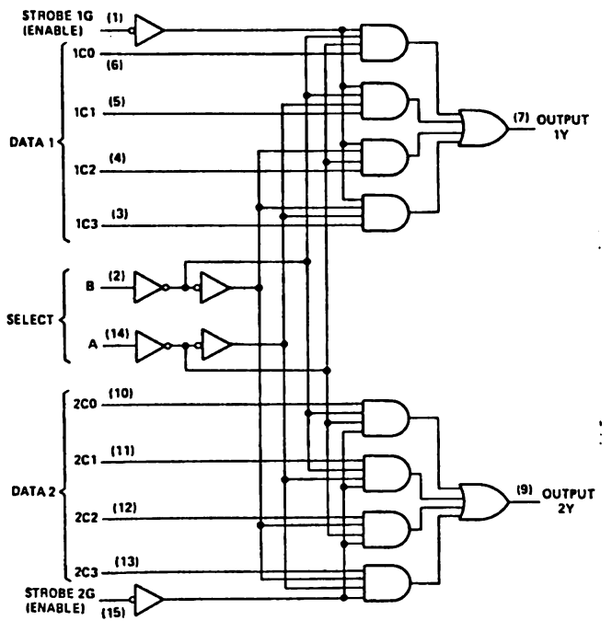
Dual 4-Line-To-1-Line Data Selector - Multiplexer

Pin Configuration



Positive Logic: See Function Table

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table

Select Inputs		Data Inputs				Strobe	Output
B	A	C0	C1	C2	C3	G	Y
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
L	H	X	L	X	X	L	L
L	H	X	H	X	X	L	H
H	L	X	X	L	X	L	L
H	L	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

Select Inputs A and B are common to both sections.

H = high level; L = low level; X = irrelevant.

This monolithic, data selector-multiplexer contains inverters and drivers to supply fully complementary, on-chip, binary decoding data selection to the AND-OR-invert gates.

Separate strobe inputs are provided for each of the two four-line sections.

Note: The 100000166 is a Shottky device.

100000167 100000187

Quadruple 2-Line-To-1-Line Data Selectors/Multiplexers

Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Function Table

Inputs			Output Y	
Output Control	Select	A B	'167	'187
H	X	X X	Z	Z
L	L	L X	L	H
L	L	H X	H	L
L	H	X L	L	H
L	H	X H	H	L

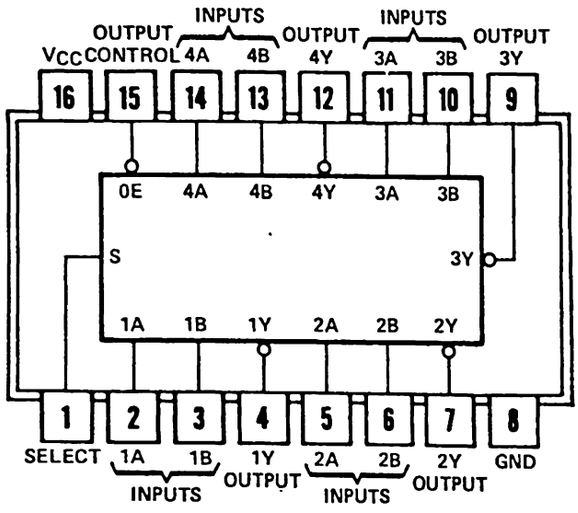
H = high level, L = low level, X = irrelevant, Z = high impedance (off).

These Schottky-clamped multiplexers have three-state outputs which can interface directly with and drive data lines of bus-organized systems. With all but one of the common outputs disabled (at a high-impedance state), the low impedance of the single enabled output will drive the bus line to a high or low logic level.

This three-state output means that n-bit (paralleled) data selectors with up to 258 sources can be implemented for data buses. It also permits the use of standard TTL registers for data retention throughout the system.

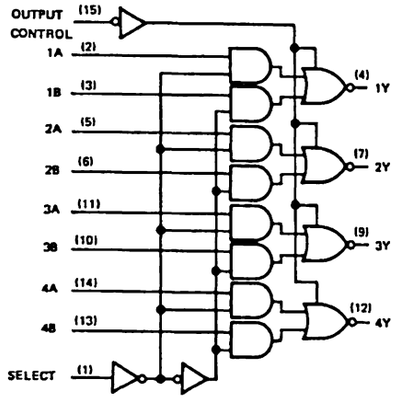
Pin Configuration

100000167/100000187



Logic Diagram

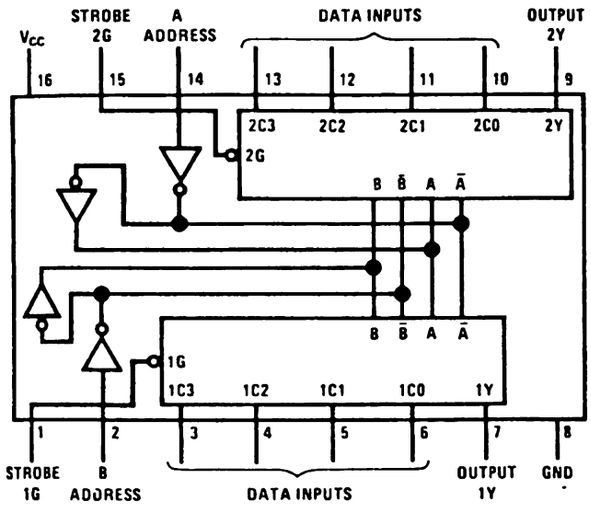
100000167/100000187



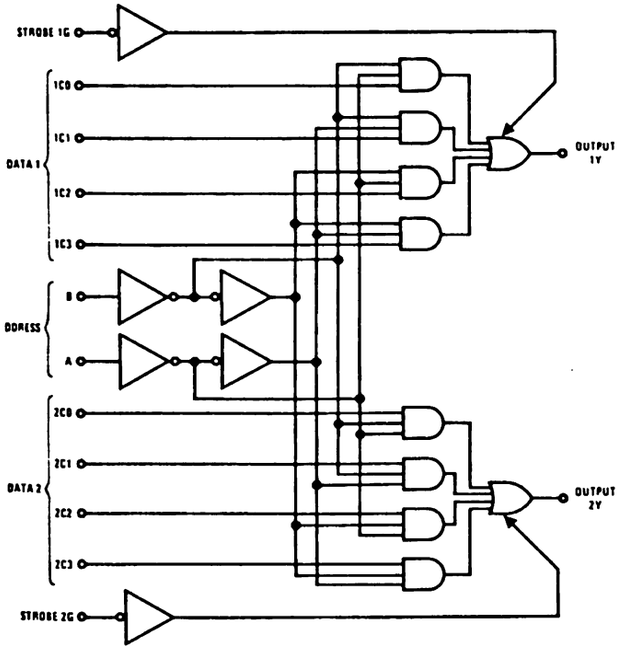
100000168

Dual 4-Line-To-1-Line Multiplexer

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

Address Inputs		Data Inputs				Strobe	Output
B	A	C0	C1	C2	C3	G	Y
X	X	X	X	X	X	1	Hi-Z
0	0	0	X	X	X	0	0
0	0	1	X	X	X	0	1
0	1	X	0	X	X	0	0
0	1	X	1	X	X	0	1
1	0	X	X	0	X	0	0
1	0	X	X	1	X	0	1
1	1	X	X	X	0	0	0
1	1	X	X	X	1	0	1

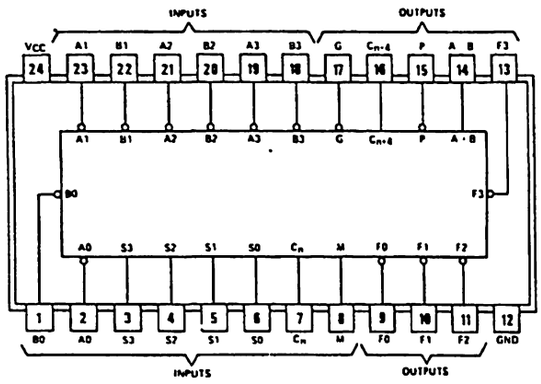
X = Don't care.

This device acts as a double-pole four-throw switch. One data line is selected from each of two four-line inputs. Two select lines determine which of the four inputs is chosen; however, the same input of both four-line selections will be selected. The logic allows outputs of the device to be tied to outputs of similar devices and connected to a common bus-line. Nominal TTL outputs cannot be connected due to the low-impedance logical "1" output current which one device would have to sink from the other. If, however, on all but one of the connected devices both the upper and lower output transistors are turned off, then the one remaining device in the normal low-impedance state will have to supply to or sink from the other devices only a small amount of leakage current. The strobe input is used to place the output in the high-impedance state.

100000084 100000169 100000306

Arithmetic Logic Units/Function Generators

Pin Configuration



Pin Designations

Designation	Pin Nos.	Function
A3, A2, A1, A0	19, 21, 23, 2	Word A Inputs
B3, B2, B1, B0	18, 20, 22, 1	Word B Inputs
S3, S2, S1, S0	3, 4, 5, 6	Function-Select Inputs
C_n	7	Inv. Carry Input
M	8	Mode Control Input
F3, F2, F1, F0	13, 11, 10, 9	Function Outputs
A=B	14	Comparator Output
P	15	Carry Propagate Output
C_{n+4}	16	Inv. Carry Output
G	17	Carry Generate Output
V_{CC}	24	Supply Voltage
Gnd	12	Ground

These arithmetic logic units (ALU)/function generators have a complexity of 75 equivalent gates on a monolithic chip, and perform 16 binary arithmetic operations on two 4-bit words as shown in Tables 1 and 2. These operations are selected by the four function-select lines (S0, S1, S2, S3) and include addition, subtraction, decrement and straight transfer. When performing arithmetic manipulations, the internal carries must be enabled by applying a low-level voltage to the mode control input (M). A full carry look-ahead scheme is made available for fast, simultaneous carry generation by means of two cascade-outputs (pins 15 and 17) for the four bits in the package. When used in conjunction with 100000100 or 100000170, full carry look-ahead circuits, high-speed arithmetic operations can be performed. If high speed is not of importance, a ripple-carry input (C_n) and a ripple-carry output (C_{n+4}) are available. However, the ripple-carry delay is minimized so that arithmetic manipulations for small word lengths can be performed without external circuitry.

These devices will accommodate active-high or active-low data if the pin designations are interpreted as follows:

Continued.....

Table 1

Selection S3 S2 S1 S0	M = H Logic Functions	Active-High Data M = L: Arithmetic Operations	
		C_n = H (no carry)	C_n = L (with carry)
L L L L	F = $\overline{A}$	F = A	F = A Plus 1
L L L H	F = $\overline{A + B}$	F = A + B	F = (A + $\overline{B}$) Plus 1
L L H L	F = $\overline{A}B$	F = A + $\overline{B}$	F = (A + $\overline{B}$) Plus 1
L L H H	F = 0	F = Minus 1 (2's Compl)	F = Zero
L H L L	F = $\overline{AB}$	F = A Plus A$\overline{B}$	F = A Plus A$\overline{B}$ Plus 1
L H L H	F = $\overline{B}$	F = (A + B) Plus A$\overline{B}$	F = (A + B) Plus A$\overline{B}$ Plus 1
L H H L	F = A⊙B	F = A Minus B Minus 1	F = A Minus B
L H H H	F = A$\overline{B}$	F = A$\overline{B}$ Minus 1	F = A$\overline{B}$
H L L L	F = $\overline{A}$ + B	F = A Plus AB	F = A Plus AB Plus 1
H L L H	F = $\overline{A⊙B}$	F = A Plus B	F = A Plus B Plus 1
H L H L	F = B	F = (A + $\overline{B}$) Plus AB	F = (A + $\overline{B}$) Plus AB Plus 1
H L H H	F = AB	F = AB Minus 1	F = AB
H H L L	F = 1	F = A Plus A*	F = A Plus A Plus 1
H H L H	F = A + $\overline{B}$	F = (A + B) Plus A	F = (A + B) Plus A Plus 1
H H H L	F = A + B	F = (A + $\overline{B}$) Plus A	F = (A + $\overline{B}$) Plus A Plus 1
H H H H	F = A	F = A Minus 1	F = A

* Each bit is shifted to the next more significant position.

Table 2

Selection S3 S2 S1 S0	M = H Logic Functions	Active-Low Data M = L: Arithmetic Operations	
		C_n = L (no carry)	C_n = H (with carry)
L L L L	F = $\overline{A}$	F = A Minus 1	F = A
L L L H	F = $\overline{AB}$	F = AB Minus 1	F = AB
L L H L	F = $\overline{A}$ + B	F = A$\overline{B}$ Minus 1	F = A$\overline{B}$
L L H H	F = 1	F = Minus 1 (2's Comp)	F = Zero
L H L L	F = $\overline{A + B}$	F = A Plus (A + $\overline{B}$)	F = A Plus (A + $\overline{B}$) Plus 1
L H L H	F = $\overline{B}$	F = AB Plus (A + $\overline{B}$)	F = AB Plus (A + $\overline{B}$) Plus 1
L H H L	F = $\overline{A⊙B}$	F = A Minus B Minus 1	F = A Minus B
L H H H	F = A + $\overline{B}$	F = A + $\overline{B}$	F = (A + $\overline{B}$) Plus 1
H L L L	F = $\overline{A}$B	F = A Plus (A + B)	F = A Plus (A + B) Plus 1
H L L H	F = A⊙B	F = A Plus B	F = A Plus B Plus 1
H L H L	F = B	F = A$\overline{B}$ Plus (A + B)	F = A$\overline{B}$ Plus (A + B) Plus 1
H L H H	F = A + B	F = A + B	F = (A + B) Plus 1
H H L L	F = 0	F = A Plus A*	F = A Plus A Plus 1
H H L H	F = A$\overline{B}$	F = AB Plus A	F = AB Plus A Plus 1
H H H L	F = AB	F = A$\overline{B}$ Plus A	F = A$\overline{B}$ Plus A Plus 1
H H H H	F = A	F = A	F = A Plus 1

* Each bit is shifted to the next more significant position.

Continued....

Pin No.	Active-high data Table 1	Active-low data Table 2
2	A_0	$\overline{A}_0$
1	B_0	$\overline{B}_0$
23	A_1	$\overline{A}_1$
22	B_1	$\overline{B}_1$
21	A_2	$\overline{A}_2$
20	B_2	$\overline{B}_2$
19	A_3	$\overline{A}_3$
18	B_3	$\overline{B}_3$
9	F_0	$\overline{F}_0$
10	F_1	$\overline{F}_1$
11	F_2	$\overline{F}_2$
13	F_3	$\overline{F}_3$
7	$\overline{C}_n$	C_n
16	$\overline{C}_{n+4}$	C_{n+4}
15	X	$\overline{P}$
17	Y	$\overline{G}$

Subtraction is accomplished by 1's complement addition where the 1's complement of the subtrahend is generated internally. The resultant output is A-B-1, which requires an end-around or forced carry to provide A-B.

These devices can also be utilized as comparators. The A=B output is internally decoded from the function outputs (F0, F1, F2, F3) so that when two words of equal magnitude are applied at the A and B inputs, it will assume a high level to indicate equality (A = B). The ALU should be in the subtract mode with C_n = H when performing this comparison. The A = B output is open-collector so that it can be wire-AND connected to give a comparison for more than four bits. The carry output (C_{n+4}) can also be used to supply relative magnitude information. Again, the ALU should be placed in the subtract mode by placing the function select inputs S3, S2, S1, S0 at L, H, H, L, respectively.

Input C_n	Output C_{n+4}	(Figure 1) Active-high Data	(Figure 2) Active-low Data
H	H	A $\leqslant$ B	A $\geqslant$ B
H	L	A > B	A < B
L	H	A < B	A > B
L	L	A $\geqslant$ B	A $\leqslant$ B

100000084 100000169 100000306

Continued

Figure 1

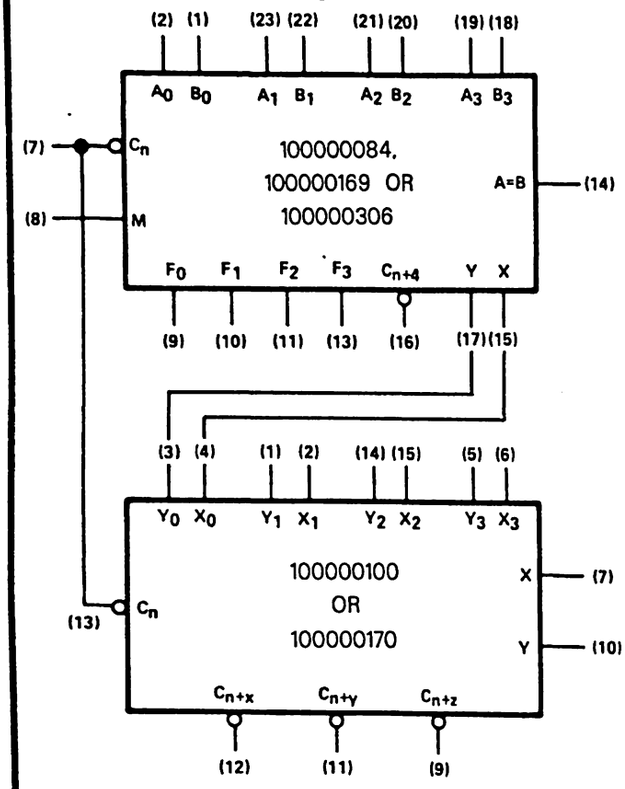
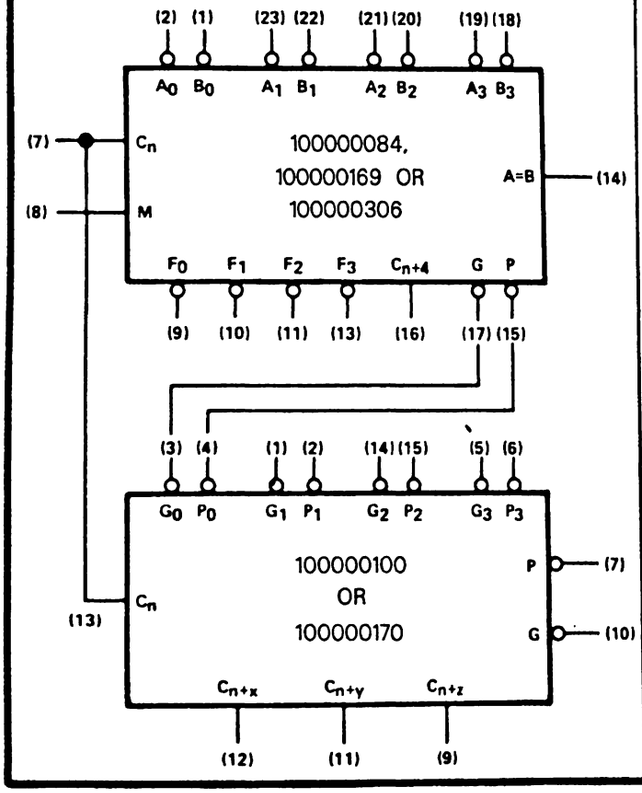


Figure 2



These circuits have been designed to provide 16 possible functions of two Boolean variables without the use of external circuitry. These logic functions are selected by use of the four function-select inputs (S0, S1, S2, S3) with the mode-control input (M) at a high level to disable the internal carry. The 16 logic functions are detailed in Tables 1 and 2 and include exclusive-OR, NAND, AND, NOR and OR functions.

ALU Signal Designations

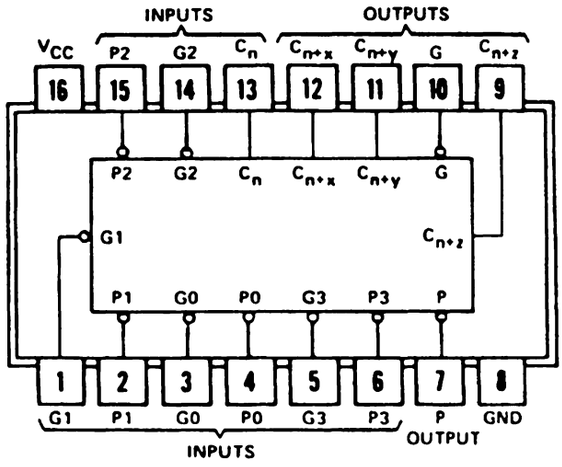
These devices can be used with the signal designations of either Figure 1 or Figure 2. The logic functions and arithmetic operations obtained with the signal designations of Figure 1 are given in Table 1; those obtained with the signal designations of Figure 2 are given in Table 2.

Note: The 100000169 is a Shottky device.

100000100 100000170

Look-Ahead Carry Generators

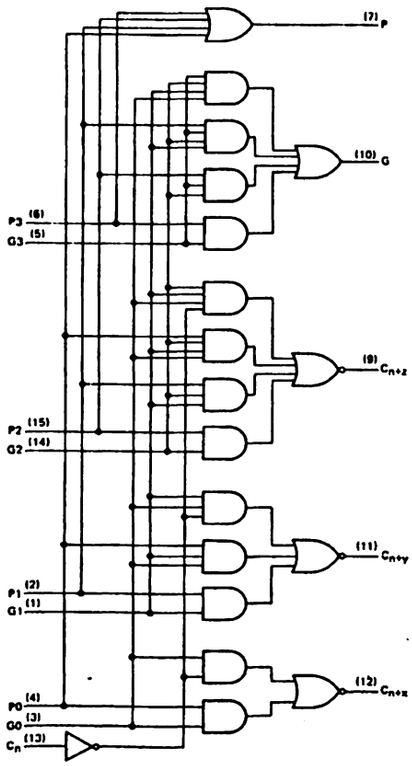
Pin Configuration



Pin Designations

Designation	Pin Nos.	Function
G0, G1, G2, G3	3, 1, 14, 5	Active-Low Carry Generate Inputs
P0, P1, P2, P3	4, 2, 15, 6	Active-Low Carry Propagate Inputs
C_n	13	Carry Input
C_{n+x}, C_{n+y}, C_{n+z}	12, 11, 9	Carry Outputs
G	10	Active-Low Carry Generate Output
P	7	Active-Low Carry Propagate Output
V_{CC}	16	Supply Voltage
Gnd	8	Ground

Logic Diagram



Positive Logic:

$$C_{n+x} = \overline{G}_0 + \overline{P}_0 C_n$$

$$C_{n+y} = \overline{G}_1 + \overline{P}_1\overline{G}_0 + \overline{P}_1\overline{P}_0 C_n$$

$$C_{n+z} = \overline{G}_2 + \overline{P}_2\overline{G}_1 + \overline{P}_2\overline{P}_1\overline{G}_0 + \overline{P}_2\overline{P}_1\overline{P}_0 C_n$$

$$\overline{G} = \overline{G}_3(\overline{P}_3+\overline{G}_2)(\overline{P}_3+\overline{P}_2+\overline{G}_1)(\overline{P}_3+\overline{P}_2+\overline{P}_1+\overline{G}_0)$$

$$\overline{P} = \overline{P}_3\overline{P}_2\overline{P}_1\overline{P}_0$$

These devices are high-speed, look-ahead carry generators capable of anticipating a carry across four binary adders or group of adders. They are cascadable to perform full look-ahead across n-bit adders. Carry, generate-carry and propagate-carry functions are provided as enumerated in the pin designation table above.

When used in conjunction with arithmetic logic units, 100000084 or 100000169, these generators provide high-speed carry look-ahead capability for any word length.

Carry input and output of the 100000084 or 100000169 are in their true form and the carry propagate (P) and carry generate (G) are in negated form; therefore, the carry functions (inputs, outputs, generate and propagate) of the look-ahead generators are implemented in the compatible forms for direct connection to the ALU.

Note: The 100000170 is a Shottky device.

100000171

16-Bit Multiple-Port Register File With 3-State Outputs

Pin Designations

V_{CC} = Pin 24

Gnd = Pin 12

Pin Configuration

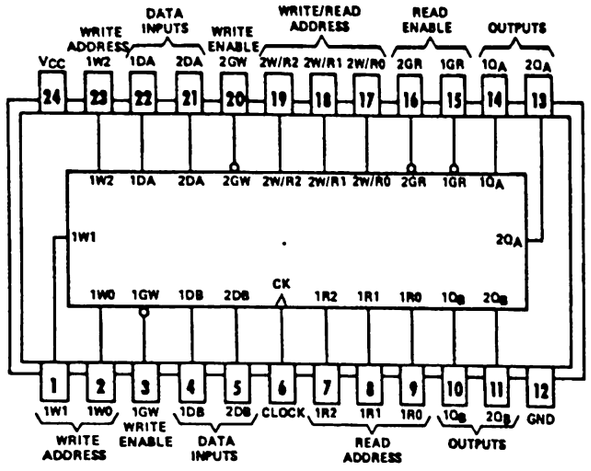
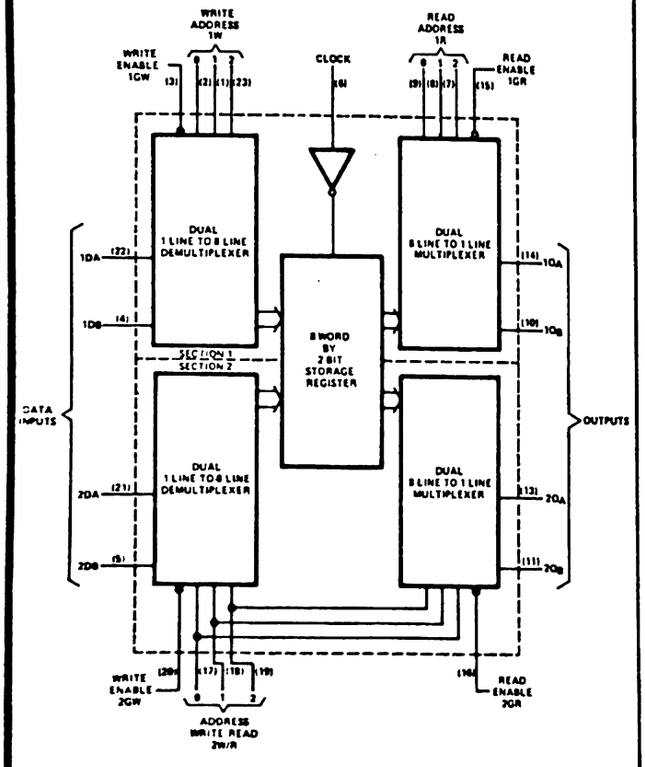


Figure A



The 100000171 is a high-performance 16-bit register file organized as eight words of two bits each.

Multiple address decoding circuitry is used so that the read and write operation can be performed independently on two word locations. This provides a true simultaneous read/write capability. Basically, the file consists of two distinct sections (see Figure A).

Section 1 permits the writing of data into any two-bit word location while reading two bits of data from another location simultaneously. To provide this flexibility, independent decoding is incorporated.

Section 2 of the register file is similar to section 1 with the exception that common read/write address circuitry is employed. This means that section 2 can be utilized in one of three modes:

1) Writing new data into two bits.
2) Reading from two bits.
3) Writing into and simultaneously reading from the same two bits.

Regardless of the mode, the operation of section 2 is entirely independent of section 1.

The three-state outputs of this register file permit connection of up to 129 compatible outputs to a common system bus. The outputs are controlled by the read-enable circuitry so that they operate as standard TTL totem-pole outputs when the appropriate read-enable input is low or they are placed in a high-impedance state when the associated read-enable input is at a high logic level.

Functions of the inputs and outputs are as shown in the following table:

Continued ....

100000171

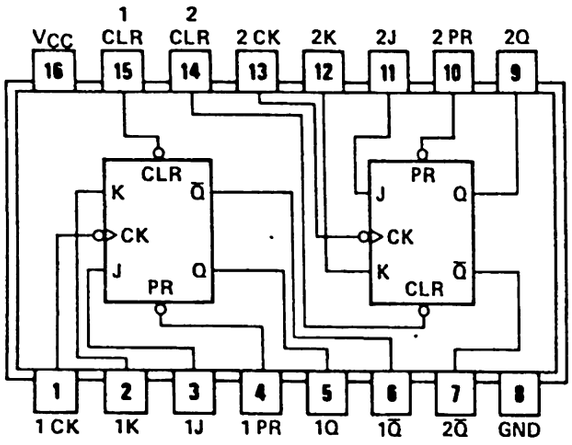
Continued

Function	Section 1	Section 2	Description
Write Address	1W0, 1W1, 1W2	2W/R0, 2W/R1, 2W/R2	Binary write address selects one of eight two-bit word locations.
Write Enable	1GW	2GW	When low, permits the writing of new data into the selected word location on a positive transition of the clock input.
Data Inputs	1DA, 1DB	2DA, 2DB	Data at these inputs is entered on a positive transition of the clock input into the location selected by the write address inputs if the write enable input is low. Since the two sections are independent, it is possible for both write functions to be activated with both write addresses selecting the same word location. If this occurs and the information at the data inputs is not the same for both sections (i.e., 1DA $\neq$ 2DA and/or 1DB $\neq$ 2DB) the low-level data will predominate in each bit and be stored.
Read Address	1R0, 1R1, 1R2	Common with write address	Binary write address selects one of eight two-bit word locations.
Read Enable	1GR	2GR	When read enable is low, the outputs assume the levels of the data stored in the location selected by read address inputs. When read enable is high, the associated outputs remain in the high-impedance state and neither significantly load nor drive the lines to which they are connected.
Data Outputs	$1Q_A$, $1Q_B$	$2Q_A$, $2Q_B$	
Clock	CK		The positive-going transition of the clock input will enter new data into the addressed location if the write enable input is low. The clock is common to both sections.

100000172

Dual J-K Negative-Edge-Triggered Flip-Flops with Preset and Clear

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Function Table

Inputs					Outputs	
Preset	Clear	Clock	J	K	Q	$\overline{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H*	H*
H	H	↓	L	L	Q_0	$\overline{Q}_0$
H	H	↓	H	L	H	L
H	H	↓	L	H	L	H
H	H	↓	H	H	TOGGLE	
H	H	H	X	X	Q_0	$\overline{Q}_0$

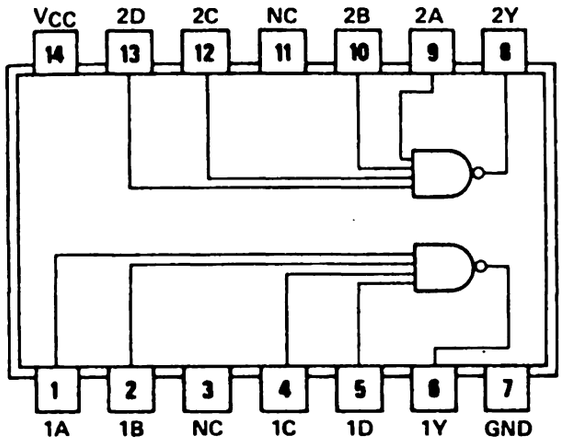
Notes:

H = high level (steady state).
L = low level (steady state).
X = irrelevant.
↓ = transition from high to low level.
Q_0 = the level of Q before the indicated input conditions were established.
TOGGLE = Each output changes to the complement of its previous level on each active transition of the clock.
* = This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

Note: The 100000172 is a Shottky device.

100000173

Pin Configuration



Dual 4-Input Positive-NAND 50 Ohm Line Driver

Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

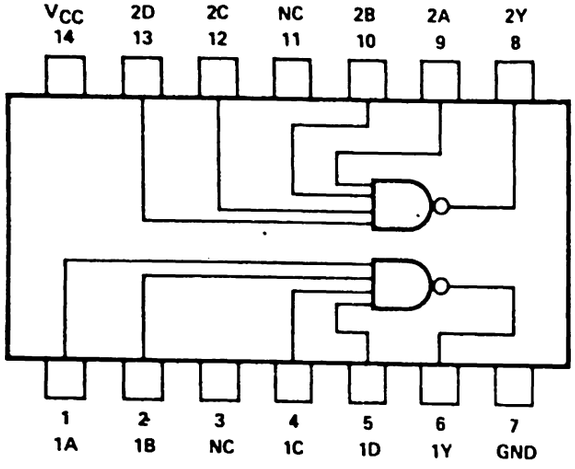
NC = No internal connection

Positive logic: $Y = \overline{ABCD}$

Note: The 100000173 is a Shottky device.

100000174

Pin Configuration



Positive-NAND Gate With Open-Collector Outputs

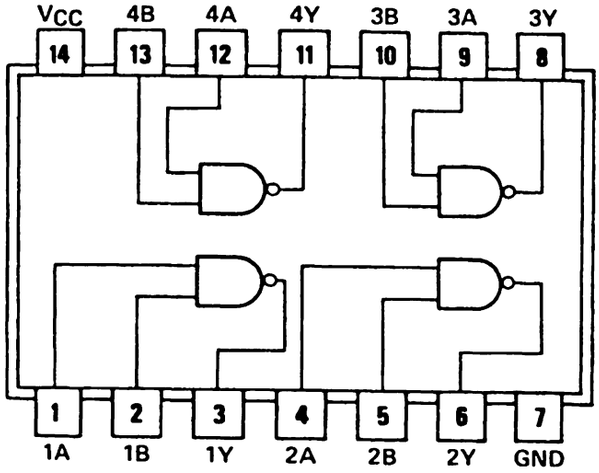
Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Note: The 100000174 is a Shottky device.

100000175

Pin Configuration



Quadruple 2-Input Positive-NAND Gate With Open-Collector Outputs

Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Positive logic: $Y = \overline{AB}$

Note: The 100000175 is a Schottky device.

100000178

BCD-To-Decimal Decoder

Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Truth Table

Input State				Output States									
A	B	C	D	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
1	0	0	0	1	0	1	1	1	1	1	1	1	1
0	1	0	0	1	1	0	1	1	1	1	1	1	1
1	1	0	0	1	1	1	0	1	1	1	1	1	1
0	0	1	0	1	1	1	1	0	1	1	1	1	1
1	0	1	0	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
1	1	1	0	1	1	1	1	1	1	1	0	1	1
0	0	0	1	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0
0	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
0	0	1	1	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

The 100000178 is a gate array for decoding and logic conversion.

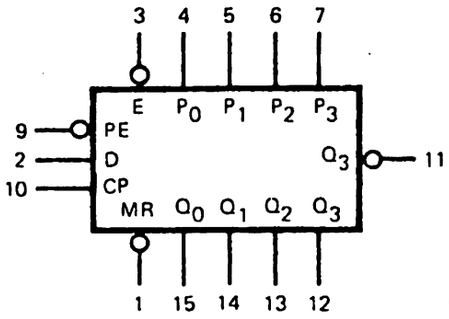
This device converts a 4-line input code (with 1-2-4-8 weighting) to a one-of-ten output, as shown in the Truth Table.

Note: The 100000178 is a Shottky device.

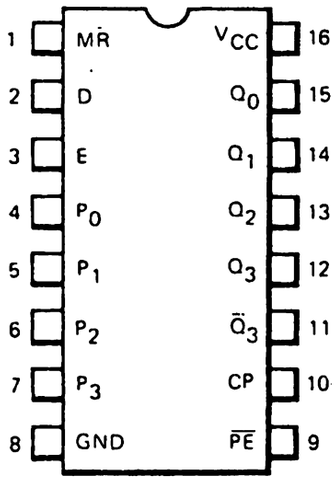
100000180

High Speed 4-Bit Shift Register With Enable

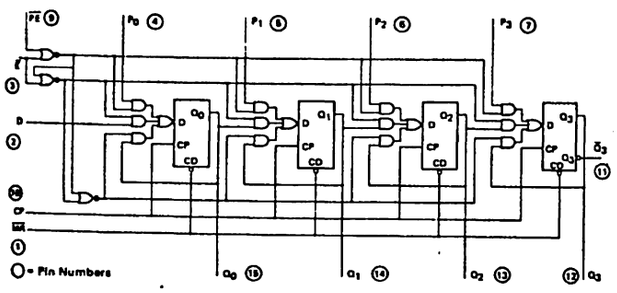
Logic Symbol



Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names

$\overline{E}$	Active LOW Enable Input
$\overline{PE}$	Active LOW Parallel Enable Input
P_0, P_1, P_2, P_3	Parallel Data Inputs
CP	Clock Input
$\overline{MR}$	Active LOW Master Reset Input
Q_0 to Q_3	Parallel Outputs
$\overline{Q}_3$	Last Stage Complementary Output
D	Serial Data Input

The 100000180 High Speed 4-Bit Shift Register is a multifunctional sequential logic block which is useful in a wide variety of register applications. It may be used in serial-serial, shift left, shift right, serial-parallel, parallel-serial and parallel-parallel data transfers.

This device has three synchronous modes of operation: shift, parallel load and hold (do nothing). The hold capability permits information storage in the register independent of the clock.

The register is fully synchronous with any output change occurring after the rising clock edge. It features edge triggered type characteristics on all inputs (except $\overline{MR}$), which means there are no restrictions on the activity of these inputs ($\overline{PE}$, $\overline{E}$, P_0, P_1, P_2, P_3, D) for logic operation except for the set up requirements prior to the LOW to HIGH clock transition.

The mode of operation is determined by the two inputs, parallel enable ($\overline{PE}$) and enable ($\overline{E}$), as shown in Table 1. The active LOW enable when HIGH places the register in the hold mode with the register flip-flops retaining their information. When the enable is activated (LOW) the parallel enable ($\overline{PE}$) determines whether the register operates in a shift or parallel data entry mode.

When the enable is LOW and the parallel enable input is LOW, the parallel inputs are selected and will determine the next condition of the register synchronously with the clock as shown in Table 2. In this mode the element appears as four common clocked D flip-flops. With $\overline{E}$ LOW and the $\overline{PE}$

Continued....

input HIGH the device acts as a 4-bit shift register with serial data entry through the D input shown in Table 3. In both cases the next state of the flip-flops occurs after the LOW to HIGH transition of the clock input.

The asynchronous active LOW master reset overrides all inputs and clears the register forcing outputs Q_{0-3} LOW and $\overline{Q}_3$ HIGH.

To provide for left shift operation, P3 is used as the serial data input and Q_0 is the serial data output. The other outputs are tied back to the previous parallel inputs, with Q_3 tied to P_2, Q_2 tied to P_1 and Q_1 tied to P_0.

Table 1
Mode Selection

Mode		$\overline{MR}$	$\overline{E}$	$\overline{PE}$	P_0 P_1 P_2 P_3	D
Synchronous	Parallel Load	H	L	L	Parallel Data Entry	X
	Serial Shift	H	L	H	X X X X	Serial Data Entry
	Hold	H	H	L	X X X X	X
	Hold	H	H	H	X X X X	X
Asynchronous	Reset	L	X	X	All Outputs set LOW	

Table 2
Parallel Data Entry

P_0, P_1, P_2 or P_3 Input at t_n	Q at t_{n+1}
L	L
H	H

Table 3
Serial Data Entry

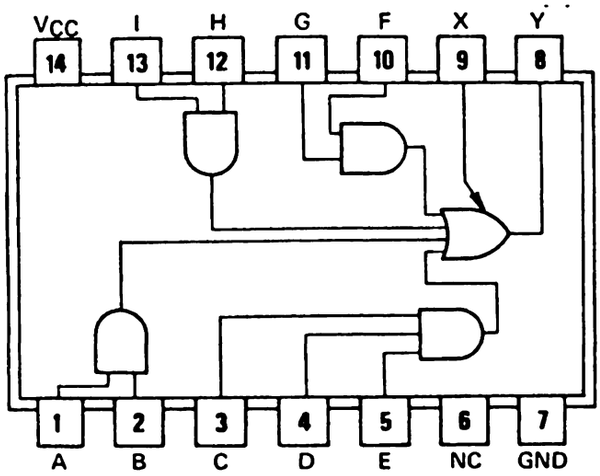
D Input at t_n	Q_0 at t_{n+1}
L	L
H	H

L = LOW Voltage Level
H = HIGH Voltage Level
X = Don't Care
t_n = Present State
t_n+1 = State after Next Clock

100000181

Expandable 4-Wide AND-OR Gates

Pin Configuration



Logic Diagram/Pin Designations

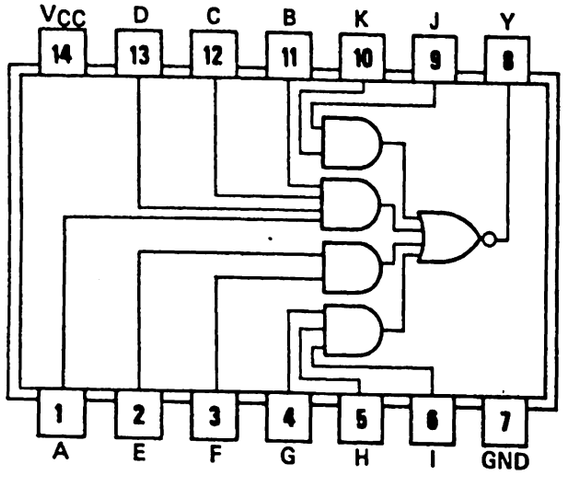
V_{CC} = Pin 14

Gnd = Pin 7

Positive logic: Y = AB+CDE+FG+HI+X

100000182

Pin Configuration



4-2-3-2-Input AND-OR-INVERT Gates

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

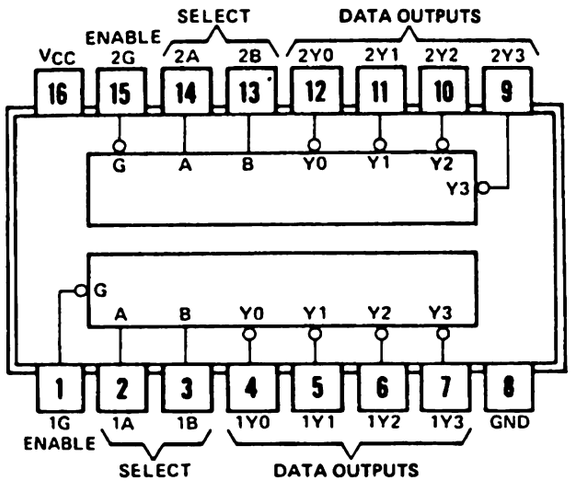
Positive logic: $Y = \overline{ABCD+EF+GHI+JK}$

Note: The 100000182 is a Shottky device.

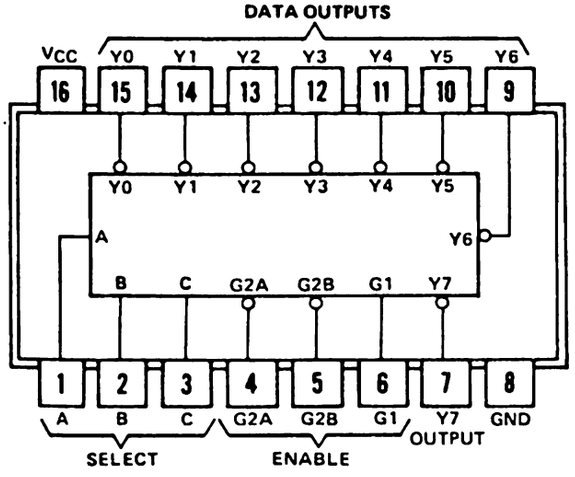
100000185 100000223

Pin Configurations

100000185



100000223



Decoders-Demultiplexers

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table - 100000223

Inputs					Outputs							
Enable		Select										
G1	G2*	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

*G2 = G2A + G2B

H = high level; L = low level; X = irrelevant

Function Table - 100000185
(Each Decoder/Demultiplexer)

Inputs			Outputs			
Enable	Select					
G	B	A	Y0	Y1	Y2	Y3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

H = high level; L = low level; X = irrelevant

These Schottky-clamped TTL MSI circuits are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high performance memory systems these decoders can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced by the Schottky-clamped system decoder is negligible.

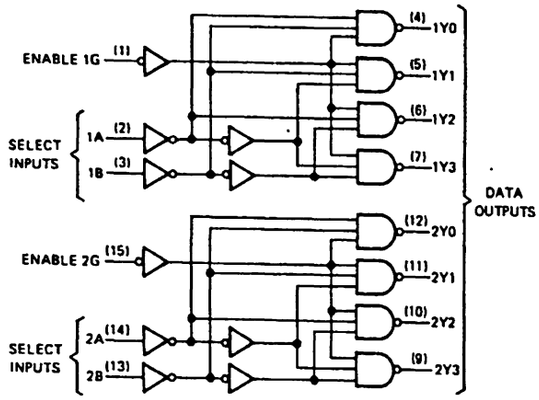
Continued....

100000185 100000223

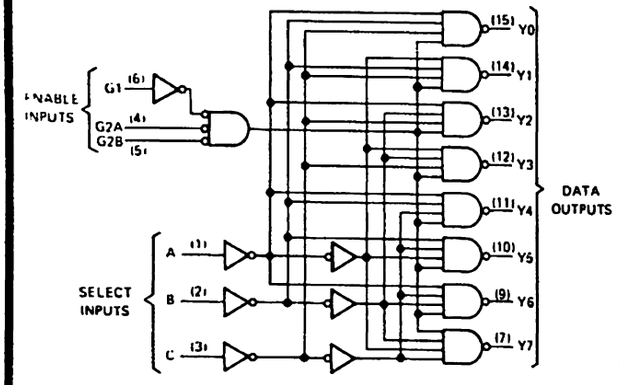
Continued

Logic Diagrams

100000185



100000223



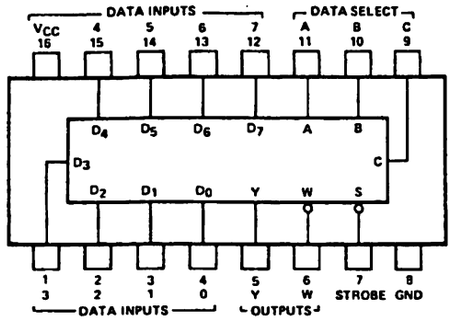
The 100000223 decodes one-of-eight lines, depending on the conditions at the three binary select inputs and the three enable inputs. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

The 100000185 is comprised of two individual two-line-to-four-line decoders in a single package. The active-low enable input can be used as a data line in demultiplexing applications.

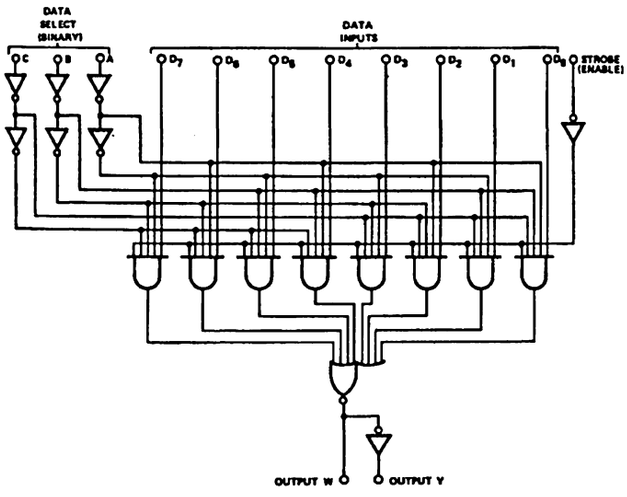
100000186

8-Line-to-1-Line Data Selector/Multiplexer

Pin Configuration



Logic Symbol



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

Inputs												Outputs	
C	B	A	Strobe	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	Y	W
X	X	X	1	X	X	X	X	X	X	X	X	0	1
0	0	0	0	0	X	X	X	X	X	X	X	0	1
0	0	0	0	1	X	X	X	X	X	X	X	1	0
0	0	1	0	X	0	X	X	X	X	X	X	0	1
0	0	1	0	X	1	X	X	X	X	X	X	1	0
0	1	0	0	X	X	0	X	X	X	X	X	0	1
0	1	0	0	X	X	1	X	X	X	X	X	1	0
0	1	1	0	X	X	X	0	X	X	X	X	0	1
0	1	1	0	X	X	X	1	X	X	X	X	1	0
1	0	0	0	X	X	X	X	0	X	X	X	0	1
1	0	0	0	X	X	X	X	1	X	X	X	1	0
1	0	1	0	X	X	X	X	X	0	X	X	0	1
1	0	1	0	X	X	X	X	X	1	X	X	1	0
1	1	0	0	X	X	X	X	X	X	0	X	0	1
1	1	0	0	X	X	X	X	X	X	1	X	1	0
1	1	1	0	X	X	X	X	X	X	X	0	0	1
1	1	1	0	X	X	X	X	X	X	X	1	1	0

Note: When used to indicate an input, X = irrelevant.

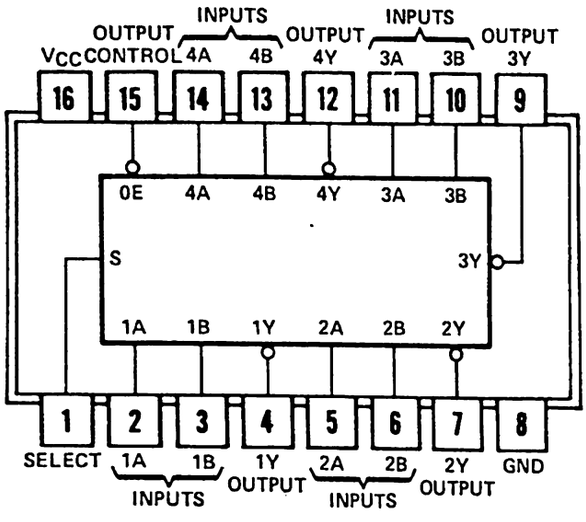
The 100000186 is a one-of-eight data selector which performs parallel-to-serial data conversion. The unit incorporates an enable circuit for chip select. This allows multiplexing from N-lines to one-line.

100000167 100000187

Quadruple 2-Line-To-1-Line Data Selectors/Multiplexers

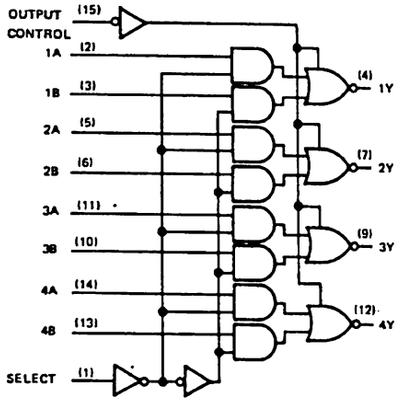
Pin Configuration

100000167/100000187



Logic Diagram

100000167/100000187



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Function Table

Inputs			Output Y	
Output Control	Select	A B	'167	'187
H	X	X X	Z	Z
L	L	L X	L	H
L	L	H X	H	L
L	H	X L	L	H
L	H	X H	H	L

H = high level, L = low level, X = irrelevant, Z = high impedance (off).

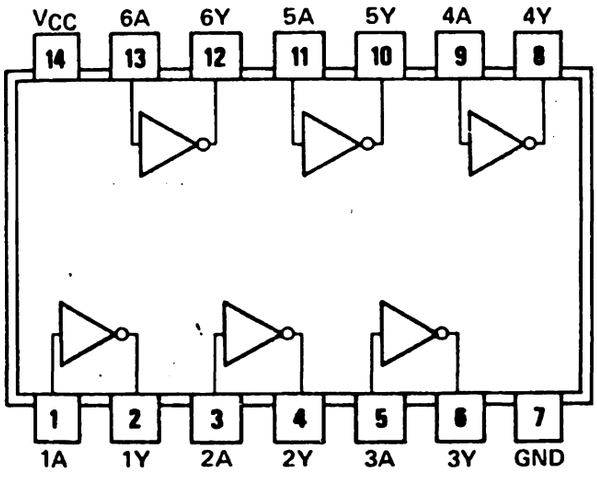
These Schottky-clamped multiplexers have three-state outputs which can interface directly with and drive data lines of bus-organized systems. With all but one of the common outputs disabled (at a high-impedance state), the low impedance of the single enabled output will drive the bus line to a high or low logic level.

This three-state output means that n-bit (paralleled) data selectors with up to 258 sources can be implemented for data buses. It also permits the use of standard TTL registers for data retention throughout the system.

100000188 100000284

Hex Inverter
With Open-Collector Outputs

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Positive logic: $Y = \overline{A}$

Note: The 100000188 is a Shottky device.

100000189

One-Of-Ten Decoder With Open Collector Output

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

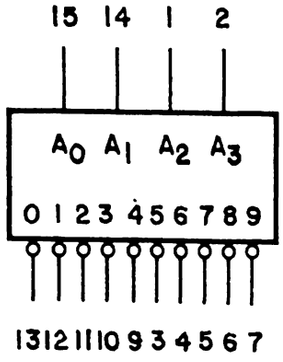
Pin Names

A_0, A_1, A_2, A_3 = Address Inputs

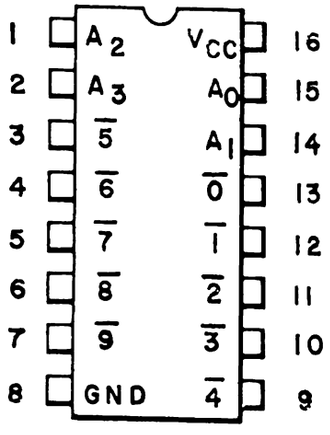
$\overline{0}$ to $\overline{9}$ = Outputs, Active LOW*

* An external pull-up resistor is needed to provide HIGH level drive capability.

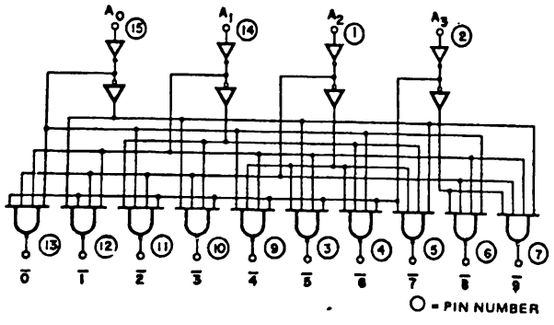
Logic Symbol



Pin Configuration



Logic Diagram



Truth Table

A_0	A_1	A_2	A_3	$\overline{0}$	$\overline{1}$	$\overline{2}$	$\overline{3}$	$\overline{4}$	$\overline{5}$	$\overline{6}$	$\overline{7}$	$\overline{8}$	$\overline{9}$
L	L	L	L	L	H	H	H	H	H	H	H	H	H
H	L	L	L	H	L	H	H	H	H	H	H	H	H
L	H	L	L	H	H	L	H	H	H	H	H	H	H
H	H	L	L	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	H	H	H	L	H	H	H	H	H
H	L	H	L	H	H	H	H	H	L	H	H	H	H
L	H	H	L	H	H	H	H	H	H	L	H	H	H
H	H	H	L	H	H	H	H	H	H	H	L	H	H
L	L	L	H	H	H	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L
L	H	L	H	H	H	H	H	H	H	H	H	H	H
H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H
H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = HIGH Voltage Level
L = LOW Voltage Level

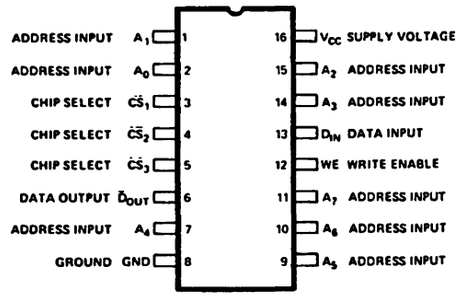
The 100000189 is a multipurpose decoder which accepts four active HIGH BCD inputs and provides ten mutually exclusive active LOW outputs. The open collector outputs provide summing of input terms. This device provides the capability in one package to generate and sum any or all of the minterms of three variables, or the first 10-of-16 minterms of four variables.

The logic design ensures that all outputs are HIGH when binary codes greater than nine are applied to the inputs.

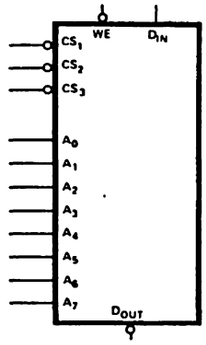
100000190

High Speed Fully Decoded 256-Bit RAM

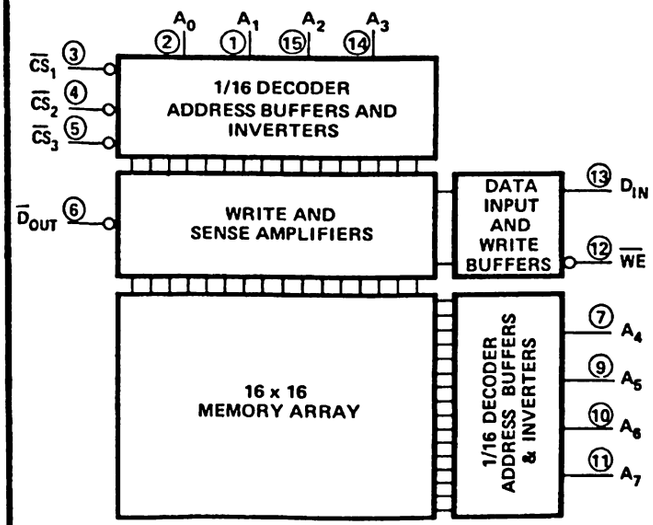
Pin Configuration



Logic Symbol



Functional Block Diagram



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Pin Names:

D_{IN}	Data Input
A_0-A_7	Address Inputs
$\overline{WE}$	Write Enable Input
$\overline{CS}_1$-$\overline{CS}_3$	Chip Select
$\overline{D}_{OUT}$	Data Output

Truth Table

Chip Select	Write Enable	Operation	Output
All Low	Low	Write	Complement of data input
All Low	High	Read	Complement of written data
One or more High	Don't Care	Hold	High Impedance State

The 100000190 is a high speed, fully decoded, 256 bit read/write random access memory. The device features three chip-select inputs and a three-state output.

100000191

High Speed Fully Decoded 1024-Bit Read Only Memory

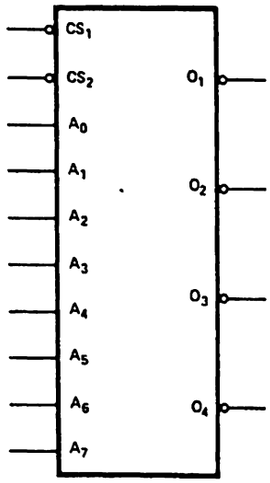
Pin Designations

V_{CC} = Pin 16

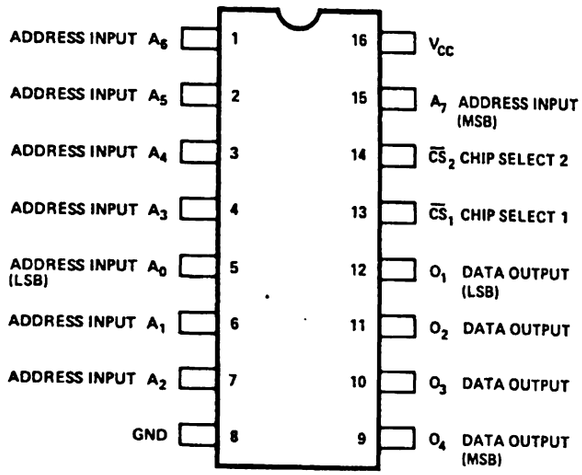
Gnd = Pin 8

The 100000191 is a fully decoded 1024-bit read only memory organized as 256 words by 4 bits.

Logic Symbol



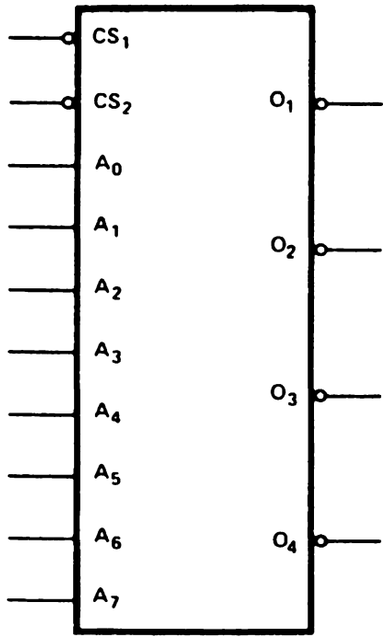
Pin Configuration



100000192

High Speed Electrically Programmable 1024-Bit Read Only Memory

Logic Symbol



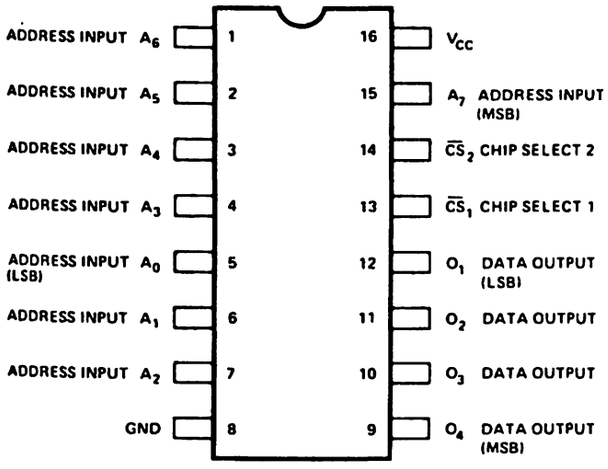
Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

The 100000192 is a 1024-bit (256 word by 4 bit) electrically programmable ROM. All outputs are low; logic output high levels can be electrically programmed in selected bit locations.

The same address inputs are used for both programming and reading.

Pin Configuration



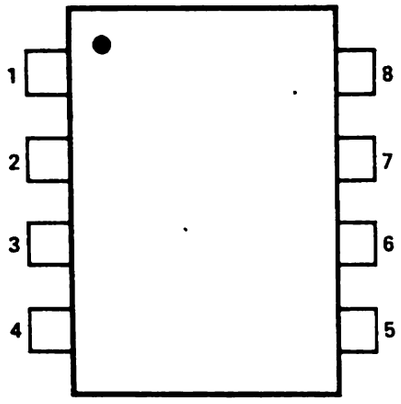
100000193

Timer

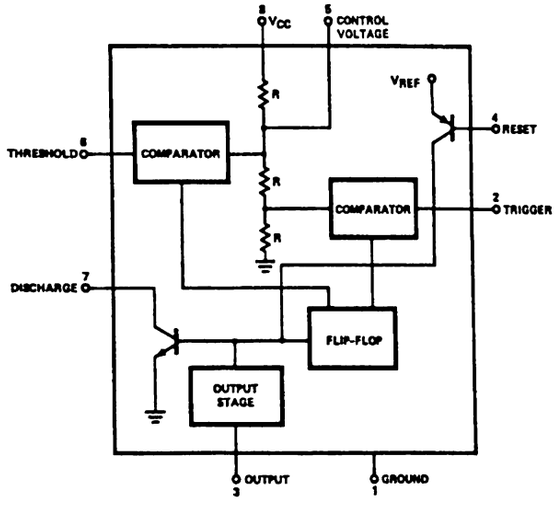
Pin Designations

1. Ground
2. Trigger
3. Output
4. Reset
5. Control Voltage
6. Threshold
7. Discharge
8. V_{CC}

Pin Configuration



Functional Block Diagram



The 100000193 monolithic timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. Additional terminals are provided for triggering or resetting, if desired.

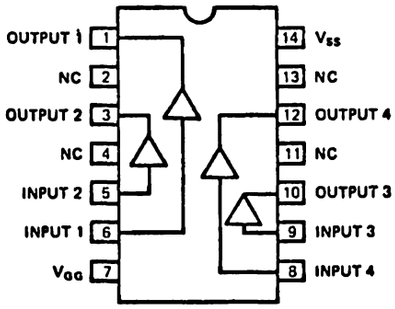
In the time delay mode of operation, the time is precisely controlled by one external resistor and one capacitor. For a stable operation as an oscillator, the free-running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor.

The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA or drive TTL circuits.

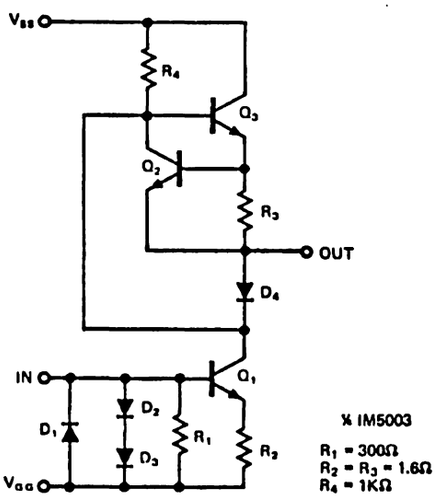
100000194

Quad MOS Clock Driver

Pin Configuration



Schematic Diagram



Logic Diagram/Pin Designations

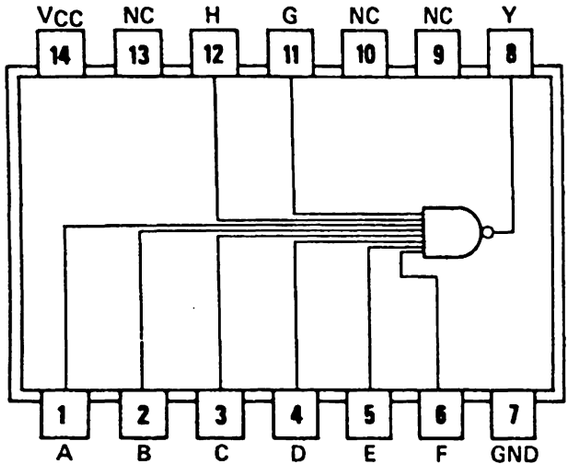
V_{SS} = Pin 14

V_{GG} = Pin 7

The 100000194 is a monolithic quad driver designed primarily for use as a MOS clock driver. It can be driven by high current TTL buffers or drivers, either directly or through input coupling capacitors, if level shifting is required.

100000195

Pin Configuration



8-Input Positive-NAND Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

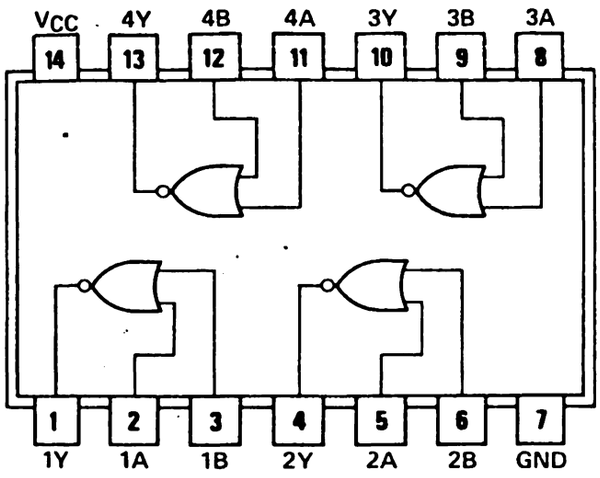
NC = No internal connection

Positive logic: $Y = \overline{ABCDEFGH}$

100000196

Quadruple 2-Input Positive-NOR Buffers With Open-Collector Outputs

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Positive logic: $Y = \overline{A+B}$

100000197

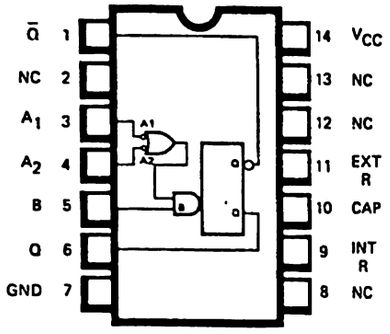
Monostable Multivibrator

Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Pin Configuration



Truth Table

t_n Input			t_{n+1} Input			Output
A_1	A_2	B	A_1	A_2	B	
H	H	L	H	H	H	Inhibit
L	X	H	L	X	L	Inhibit
X	L	H	X	L	L	Inhibit
L	X	L	L	X	H	One Shot
X	L	L	X	L	H	One Shot
H	H	H	X	L	H	One Shot
H	H	H	L	X	H	One Shot
X	L	L	X	H	L	Inhibit
L	X	L	H	X	L	Inhibit
X	L	H	H	H	H	Inhibit
L	X	H	H	H	H	Inhibit
H	H	L	X	L	L	Inhibit
H	H	L	L	X	L	Inhibit

H = $V_{IH} \geq 2V$

L = $V_{IL} \leq 0.8V$

Notes:

1. t_n = time before input transition.
2. t_{n+1} = time after input transition.
3. X indicates that either a High or Low may be present.
4. NC = No internal connection.
5. A_1 and A_2 are negative edge triggered-logic inputs and will trigger the one shot when either or both go to Low level with B at High level.
6. B is a positive Schmitt-trigger input for slow edges or level detection and will trigger the one shot when B goes to High level with either A_1 or A_2 at Low level. (See Truth Table.)
7. External timing capacitor may be connected between pin 10 (positive) and pin 11. With no external capacitance, an output pulse width of typically 30ns is obtained.
8. To use the internal timing resistor (2kΩ nominal), connect pin 9 to pin 14.
9. To obtain variable pulse width, connect external variable resistance between pin 9 and pin 14. No external current limiting is needed.
10. For accurate repeatable pulse widths, connect an external resistor between pin 11 and pin 14 with pin 9 open-circuit.

Continued....

100000197

Continued

The 100000197 is a TTL Monostable Multivibrator with dc triggering from positive or gated negative going inputs and with inhibit facility. Both positive and negative going output pulses are provided with full fan out to 10 normalized loads.

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. Schmitt-trigger input circuitry for the B input allows jitter-free triggering from inputs with transition times as slow as 1.0 V/s, providing the circuit with noise immunity of typically 1.2V. A high immunity to V_{CC} noise of typically 1.5V is also provided by internal latching circuitry.

Once fired, the outputs are independent of further transitions on the inputs and are a function only of the timing components. Input pulses may be of any duration relative to the output pulse. Output pulse lengths may be varied from 40ns to 40s by choosing appropriate timing components. With no external timing components (i.e., pin 9 connected to pin 14, pins 10, 11 open) an output pulse of typically 30ns is achieved which may be used as a dc triggered reset signal. Output rise and fall times are TTL compatible and independent of pulse length.

Jitter-free operation is maintained over the full temperature and V_{CC} range for more than six decades of timing capacitance (10pF to 10μF) and more than one decade of timing resistance (2kΩ to 40kΩ). Throughout these ranges, pulse width is defined by the relationship $t_{p(out)} = C_T, R_T \log_e 2$. Duty cycles as high as 90% are achieved when using R_T = 40kΩ. Higher duty cycles are achievable if a certain amount of pulse-width jitter is allowed.

100000198

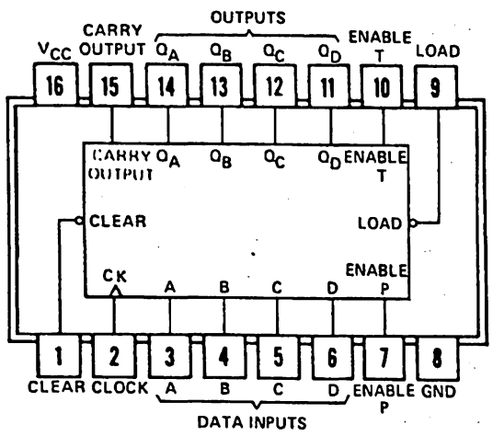
Synchronous 4-Bit Counter

Pin Designations

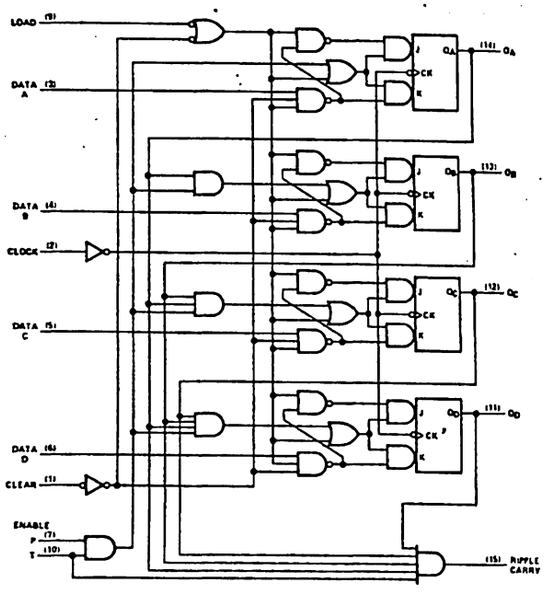
V_{CC} = Pin 16

Gnd = Pin 8

Pin Configuration



Logic Diagram



This synchronous, presettable 4-bit binary counter features an internal carry look-ahead for application in high-speed counting schemes.

Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when so instructed by the count-enable inputs and internal gating. This mode of operation eliminates the output counting spikes which are normally associated with asynchronous (ripple clock) counters. A buffered clock input triggers the four J-K master-slave flip-flops on the rising (positive-going) edge of the clock input waveform.

This counter is fully programmable; that is, the outputs may be preset to either level. As presetting is synchronous, setting up a low level at the load input disables the counter and causes the outputs to agree with the setup data after the next clock pulse regardless of the levels of the enable inputs. Low-to-high transitions at the load input should be avoided when the clock is low if the enable inputs are high at or before the transition. The clear function is synchronous and a low level at the clear input sets all four of the flip-flop outputs low after the next clock pulse, regardless of the levels of the enable inputs. This synchronous clear allows the count length to be modified easily as decoding the maximum count desired can be accomplished with one external NAND gate. The gate output is connected to the clear input to synchronously clear the counter to 0000(LLLL).

The carry look-ahead circuitry provides for cascading counters for n-bit synchronous applications without additional gating. Instrumental in accomplishing this function are two count-enable inputs and a carry output. Both count-enable inputs (P and T) must be high to count, and input T is fed forward to enable the carry output. The carry output thus enabled will produce a positive output pulse with a duration approximately equal to the positive portion of the Q_A output. This positive overflow carry pulse can be used to enable successive cascaded stages. High-to-low transitions at the enable P or T inputs should occur only when the clock input is high.

100000199 100000200 100000204 100000205

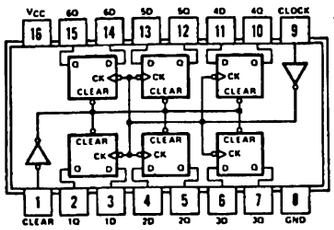
Hex-Quadruple D-Type Flip-Flops with Clear

Note: 100000199 and 100000204 - Hex

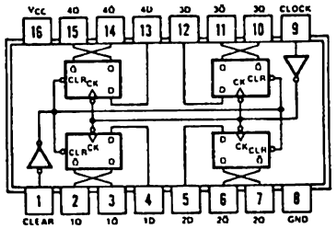
100000200 and 100000205 - Quadruple

Pin Configurations

100000199/100000204



100000200/100000205



Pin Designations

100000199 and 100000204

V_{CC} = Pin 16

Gnd = Pin 8

100000200 and 100000205

V_{CC} = Pin 16

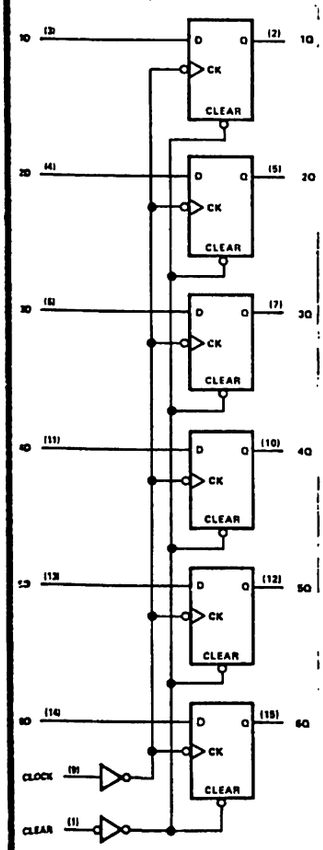
Gnd = Pin 8

Function Table
(Each Flip-Flop)

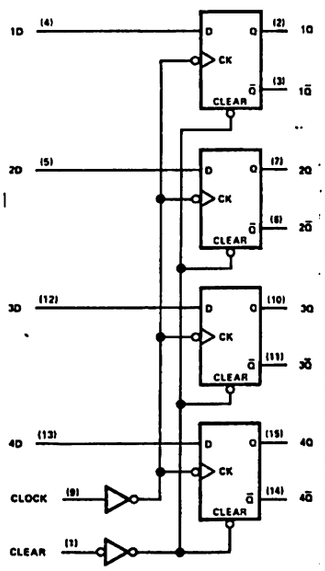
Inputs			Outputs	
Clear	Clock	D	Q	$\overline{Q}$*
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q_0	$\overline{Q}_0$

Functional Block Diagrams

100000199/100000204



100000200/100000205



⋯ dynamic input activated by transition from a high level to a low level.

Notes:

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated steady state input conditions were established.
* = Type 100000200 and 100000205 only.

These monolithic, positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic. All have a direct clear input, and the Quadruple devices feature complementary outputs from each flip-flop.

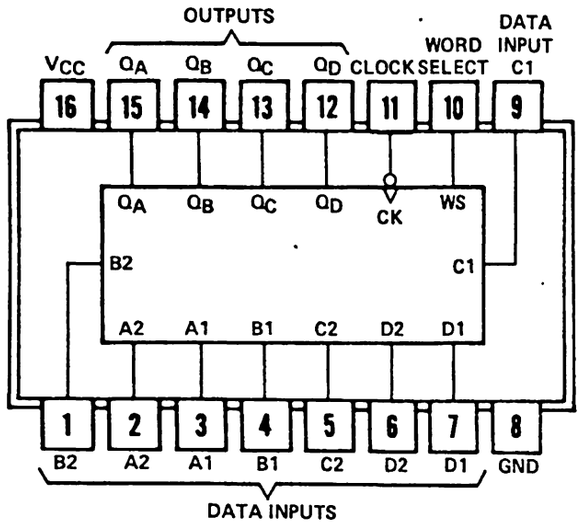
Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output.

Note: The 100000204 and 100000205 are Shottky devices.

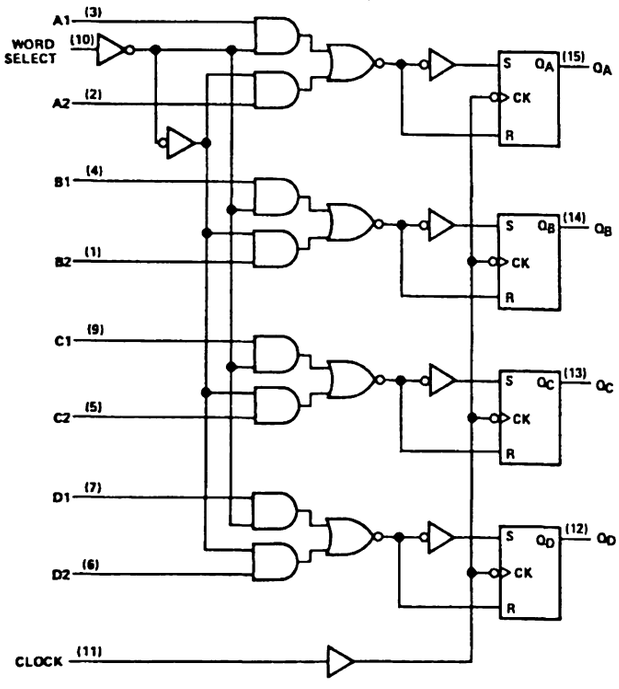
100000201

Quadruple 2-Input Multiplexer With Storage

Pin Configuration



Logic Diagram



↓ . . . Dynamic input activated by a transition from a high level to a low level

Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Function Table

Inputs		Outputs			
Word Select	Clock	Q_A	Q_B	Q_C	Q_D
L	↓	a1	b1	c1	d1
H	↓	a2	b2	c2	d2
X	H	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}

Notes:

H = high level (steady state).
L = low level (steady state).
X = irrelevant (any input, including transitions).
↓ = transition from high to low level.
a1, a2, etc. = the level of steady-state input at A1, A2, etc.
Q_{A0}, Q_{B0}, etc. = the level of Q_A, Q_B, etc., entered on the most recent ↓ transition of the clock input.

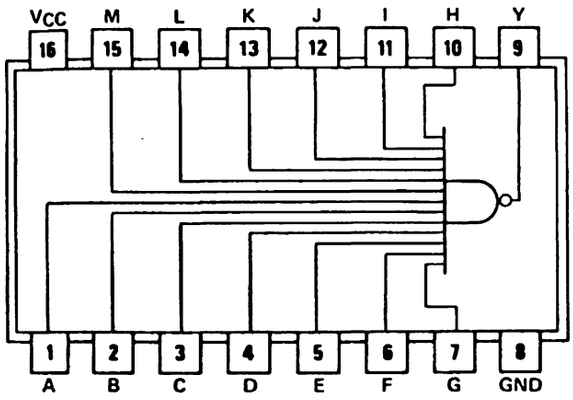
This monolithic quadruple two-input multiplexer with storage provides essentially the equivalent functional capabilities of two separate MSI functions (100000240 and 100000200) in a single 16-pin package.

When the word-select input is low, word 1 (A1, B1, C1, D1) is applied to the flip-flops. A high input to word select will cause the selection of word 2 (A2, B2, C2, D2). The selected word is clocked to the output terminals on the negative-going edge of the clock pulse.

100000203

13-Input Positive-NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Positive logic: $Y = \overline{ABCDEFGHIJKLM}$

Note: The 100000203 is a Shottky device.

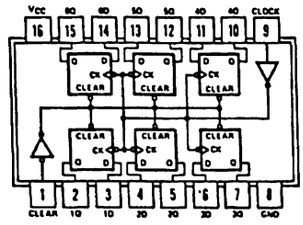
100000199 100000200 100000204 100000205

Hex-Quadruple D-Type Flip-Flops with Clear

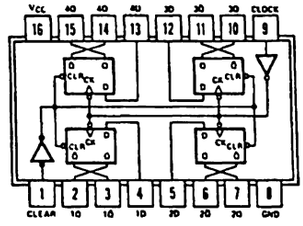
Note: 100000199 and 100000204 - Hex
100000200 and 100000205 - Quadruple

Pin Configurations

100000199/100000204



100000200/100000205



Pin Designations

100000199 and 100000204

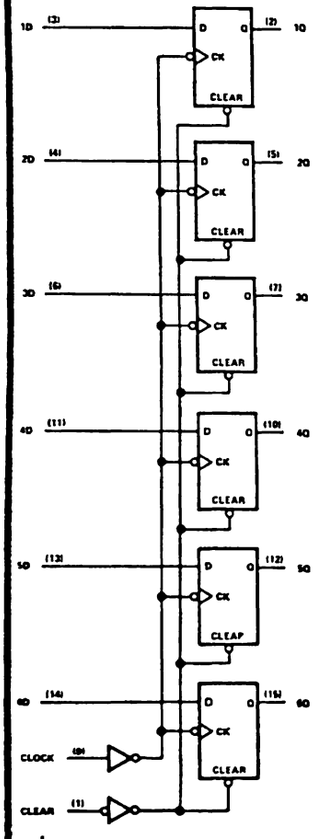
V_{CC} = Pin 16
Gnd = Pin 8

100000200 and 100000205

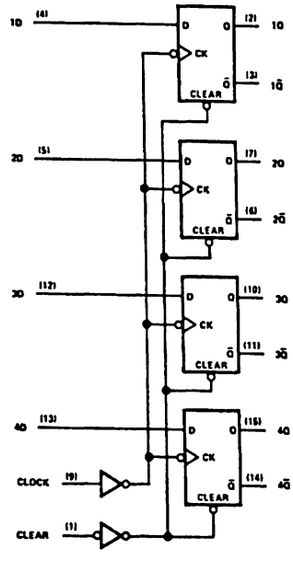
V_{CC} = Pin 16
Gnd = Pin 8

Functional Block Diagrams

100000199/100000204



100000200/100000205



. . . dynamic input activated by transition from a high level to a low level.

Function Table
(Each Flip-Flop)

Inputs			Outputs	
Clear	Clock	D	Q	$\overline{Q}$*
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q_0	$\overline{Q}_0$

Notes:

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated steady state input conditions were established.
* = Type 100000200 and 100000205 only.

These monolithic, positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic. All have a direct clear input, and the Quadruple devices feature complementary outputs from each flip-flop.

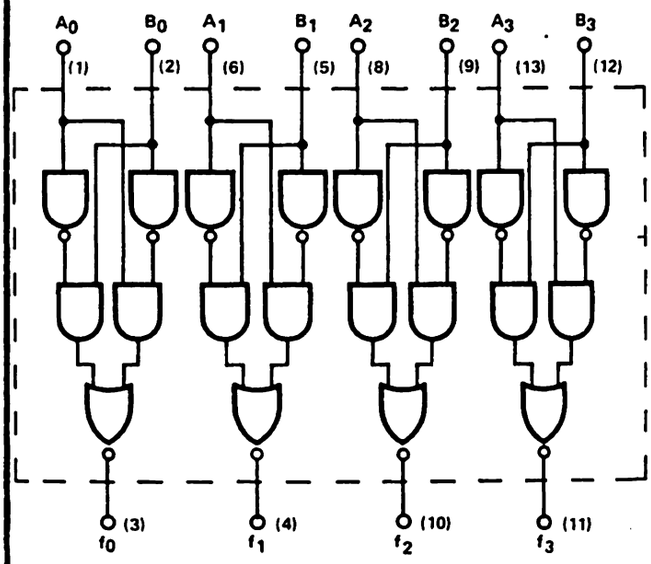
Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output.

Note: The 100000204 and 100000205 are Shottky devices.

100000206

4-Bit Quad Exclusive-NOR

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

Truth Table

A	B	f
0	0	1
1	0	0
0	1	0
1	1	1

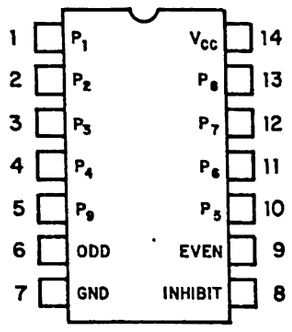
The 100000206 contains four independent Exclusive-NOR gates which may be used to implement digital comparison functions. The device outputs are open collector to facilitate implementation of multiple-bit comparisons; a 4-bit comparison is made by connecting the outputs of the four independent gates together.

Note: The 100000206 is a Shottky device.

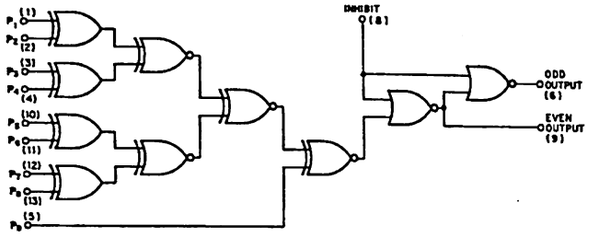
100000207

9-Bit Parity Generator and Checker

Pin Configuration



Logic Diagram



( )=Denotes Pin Number

Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Logic Equations:

Odd =

$$P_1 \oplus P_2 \oplus P_3 \oplus P_4 \oplus P_5 \oplus P_6 \oplus P_7 \oplus P_8 \oplus P_9$$

Even =

$$\overline{P_1 \oplus P_2 \oplus P_3 \oplus P_4 \oplus P_5 \oplus P_6 \oplus P_7 \oplus P_8 \oplus P_9}$$

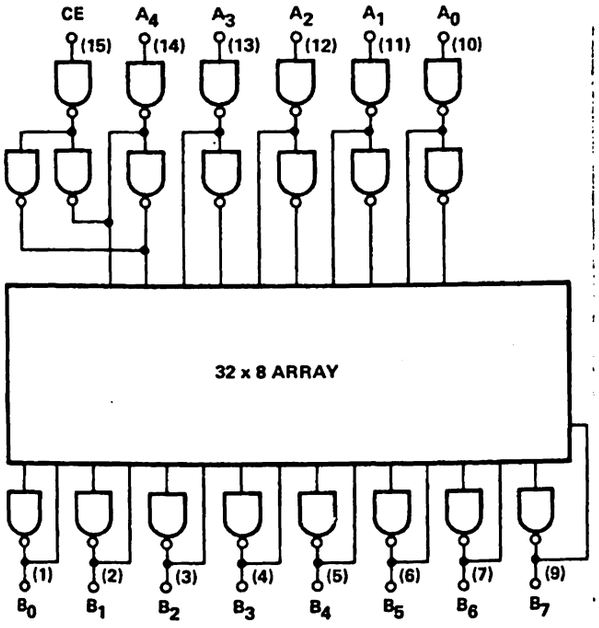
The 100000207 9-Input Parity Generator/Parity Checker is an ultra high speed Schottky MSI device commonly used to detect errors in data transmission or in data retrieval. Two outputs (EVEN and ODD) are provided. An INHIBIT input is provided to disable both outputs of the device. (A logic 1 on the INHIBIT input forces both outputs to a logic 0).

When used as a Parity Generator, the 100000207 supplies a parity bit which is transmitted together with the data word.

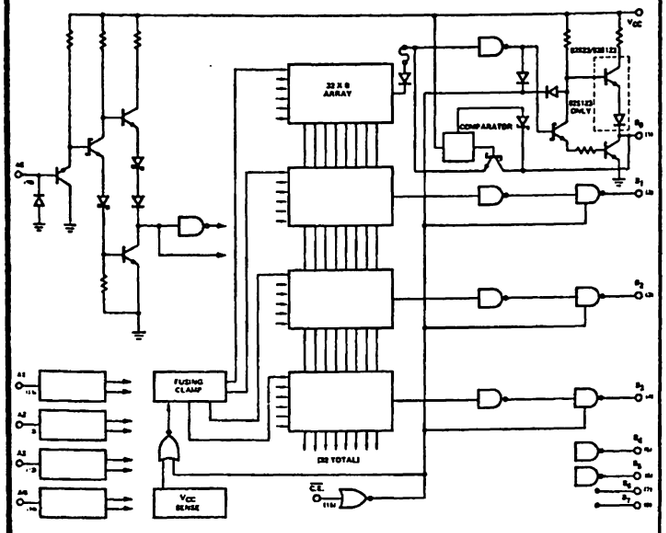
At the receiving end, the device acts as a Parity Checker and indicates that data has been received correctly or that an error has been detected.

100000208

Logic Diagram



Functional Block Diagram



256-Bit Bipolar Programmable ROM (32 x 8 PROM)

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

The 100000208 is a Bipolar 256-Bit Read Only Memory organized as 32 words by 8 bits per word. A chip enable line is provided, and the outputs are Tristate to allow for memory expansion capability.

Note: The 100000208 is a Shottky device.

100000211

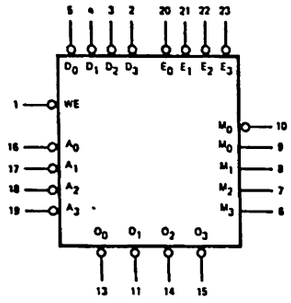
16-Bit Associative-Content Addressable Memory

Logic Diagram/Pin Designations

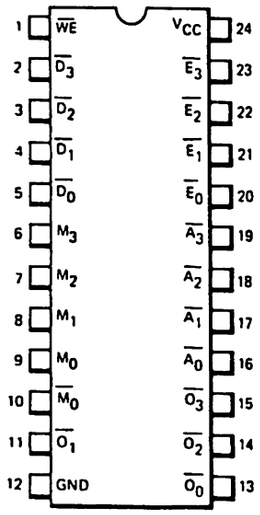
V_{CC} = Pin 24

Gnd = Pin 12

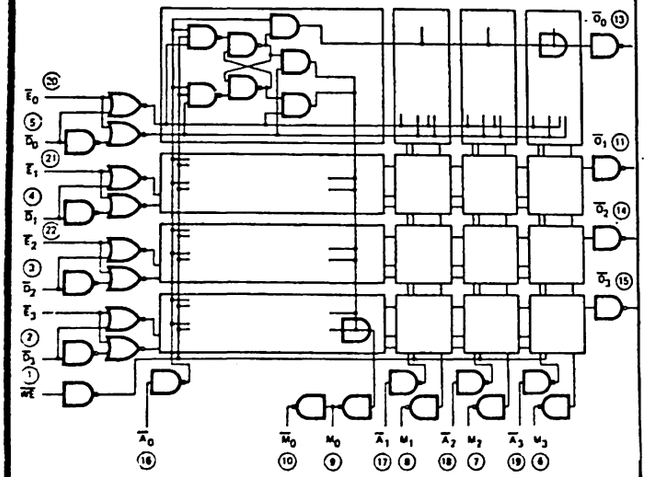
Logic Symbol



Pin Configuration



Logic Diagram



○ = PIN NUMBERS

The 100000211 is a high speed 16-bit associative random access memory. It is a linear select 4-word by 4-bit array which performs the equality search on all bits in parallel.

With the bit enable lines ($\overline{E}_0$ - $\overline{E}_3$) LOW, the outputs (M_0 - M_3) go HIGH if associated stored data matches the descriptor bits ($\overline{D}_0$ - $\overline{D}_3$). If a bit enable line is held HIGH, a match is forced on the corresponding bit in all the words regardless of the state of the descriptor bit ($\overline{D}_0$ - $\overline{D}_3$). An inverter is connected to the match output M_0 to give its negation $\overline{M}_0$.

A word is addressed by having an active LOW on the appropriate address line ($\overline{A}_0$ - $\overline{A}_3$). Any number of words may be addressed simultaneously.

Data can be written into the memory through the data inputs ($\overline{D}_0$ - $\overline{D}_3$) under control of the address inputs and the appropriate bit enable ($\overline{E}_0$ - $\overline{E}_3$) when the write enable ($\overline{WE}$) is LOW.

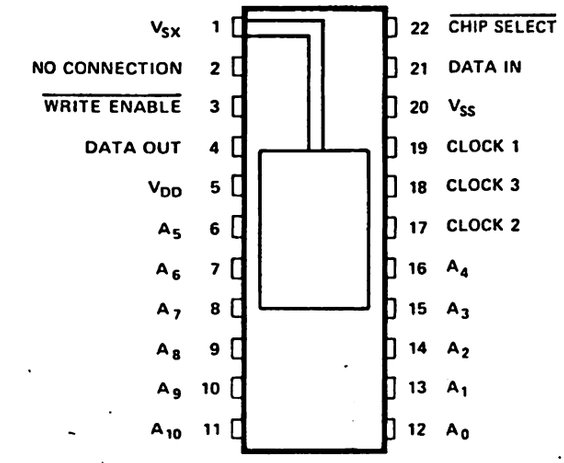
Reading can occur either during an equality search or a write operation. If a single word is addressed that word will appear at the data outputs ($\overline{O}_0$ - $\overline{O}_3$). If multiple addressing is used, the word appearing at the data output is the AND (positive logic) or the OR (negative logic) of the addressed words.

All outputs are uncommitted collectors allowing maximum flexibility in output connection. In many applications, such as memory expansion, the outputs of many of these devices can be tied together. In other applications the wired-OR is not used. In either case, an external pull up resistor must be used to attain a HIGH at an output.

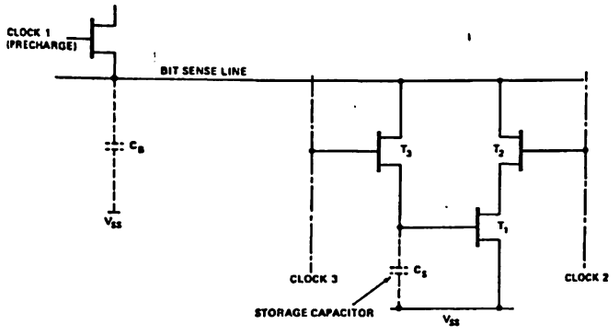
100000214

2048-Bit MOS LSI
Random Access Memory

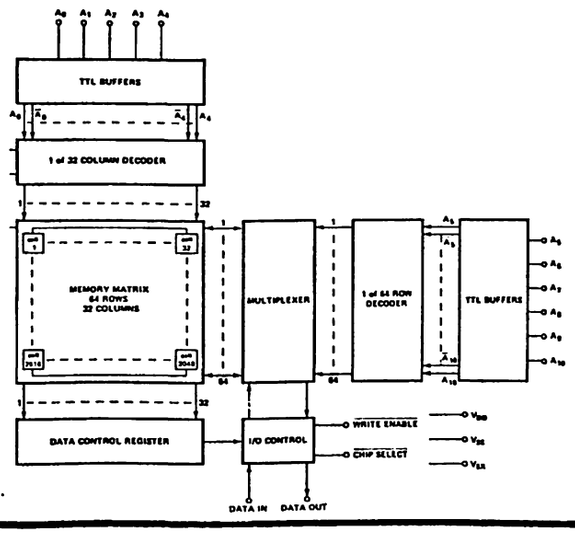
Pin Configuration



Schematic



Block Diagram



The 100000214 is a dynamic MOS random access memory device which utilizes the gate capacitance of a MOS device as a storage medium. The storage cell consists of the storage device T_1, the read select device T_2 and the write select device T_3.

The cycle begins with the negative transition of clock 1. During this time precharge is taking place. In addition, the address inputs, which must be stable during the last 65ns of clock 1 are inverted and amplified. At the end of clock 1 the internal address lines become stable. One of 64 row decoders and one of 32 column decoders are activated during t_{12}, the clock 1 to clock 2 delay time.

Clock 2, the read clock, is channeled by the decoders to the addressed column where T_2, the read select device, is turned on. The condition of the storage device T_1, (on or off) can now be sensed by the bit sense line. The addressed bit sense line is multiplexed to the I/O control circuit which then generates the Data Out. Data In, which must be valid 50ns before clock 3, is conditioned and amplified in the I/O control circuit. During clock 3, the write driver transmits the input data through the multiplexer to the addressed bit sense line.

Clock 3, the write clock, is channeled by the decoders to the addressed column where T_3, the write select device, is turned on. Any information on the bit sense line is, therefore, transferred to the C_S, the gate capacitance of the storage device.

The refresh cycle consists of clock 1, clock 2 and clock 3. Clock 1 precharges the bit sense line. Clock 2 senses the status of the storage device T_1, which is operating in the inverter mode, and places the inverted state of the storage device on the bit sense line. Clock 3, by turning on T_3, transfers the information from the bit sense line to the storage device. Note, each refresh cycle will result in the inversion of the stored data. To refresh all 2048 cells, each of the 32 columns must be selected for a refresh cycle by exercising all 32 combinations of the low order addresses (A_0 - A_4).

The read cycle may consist only of clock 1 and clock 2. Since each refresh cycle inverts the data in the storage cells in an accessed column, a control circuit, the Data Control Register, is used. The Data Control Register, which is basically another set of memory cells, is slaved

Continued ....

100000214

Continued

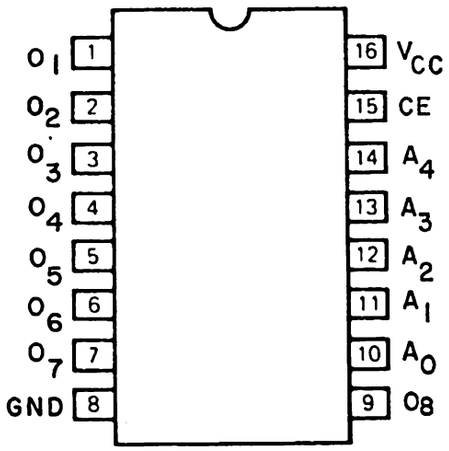
to the memory array. The state of the Data Control Register will provide information as to whether a column of storage cells is in a non-inverting or inverting state.

Clock 1 of the read cycle precharges the device. Clock 2 is transmitted by the column decoders to the addressed column. At this time, data from both the storage cell and the Data Control Register is sensed. The row multiplexer transfers the data from the addressed row to the I/O Control circuit. In the I/O Control circuit, an exclusive-OR function of the data from the memory array and the Data Control Register is performed. The output of the exclusive-OR is then amplified and presented to the Data Out pin. The output data is held in a register until the initiation of the next memory cycle. A new memory cycle may begin 20ns after clock 2 has returned to a positive state. The 100000214 is a non-inverting device; i. e., TTL "high" Data-In will result in an output high current.

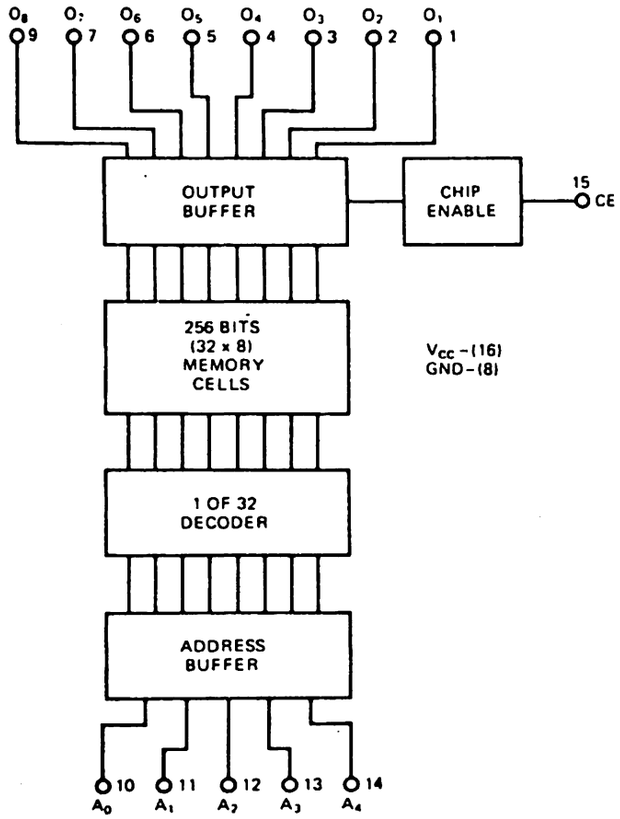
The write cycle consists of clock 1, clock 2 and clock 3. During clock 1 the precharge operation takes place. During clock 2 the Data Control Register is read to determine whether the accessed column is in a true or inverted state. At the beginning of clock 3 the exclusive-OR function of Data-In and the content of the Data Control Register is performed in the I/O Control circuit. The output of the input exclusive-OR is then amplified and transmitted to the addressed cell by the write-driver. A new memory cycle may begin 20ns after clock 3 has returned to the positive state.

100000140 100000141 100000142 100000148 100000149 100000215 100000216 100000217 100000218 100000219 100000269 100000270 100000271 100000272 100000273 100000274 100000275 100000276 100000277 100000278 100000279 100000280

Pin Configuration



Functional Block Diagram



256-Bit Bipolar Read Only Memory

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

These high speed, electrically programmable, fully decoded TTL bipolar 256-bit read only memories are organized as 32 words by 8 bits.

Memory expansion is simple; three-state outputs are provided on the 100000215; uncommitted collector outputs are provided on all other devices. Each device has on-chip address decoding and chip enable. The memory is fabricated with all logic level zeroes(low); logic level ones (high) can be electrically programmed in the selected bit locations. The same address inputs are used for both programming and reading.

100000221

Expandable Dual 2-Wide 2-Input AND-OR-Invert Gate

Logic Diagram

Positive Logic:

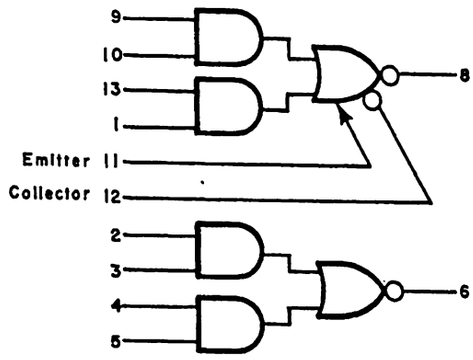
$$\overline{8 = (9 \cdot 10) + (13 \cdot 1) + (\text{Expanders})}$$

Negative Logic:

$$\overline{8 = (9 + 10) \cdot (13 + 1) \cdot (\text{Expanders})}$$

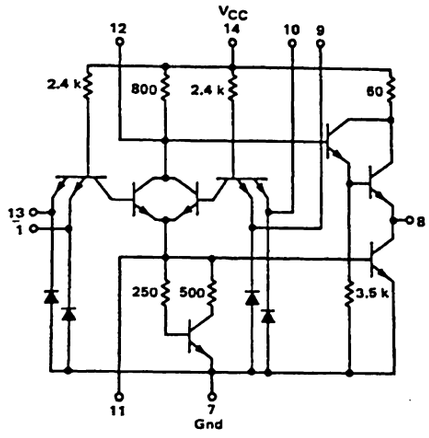
One side of this dual device consists of two 2-input AND gates ORed together and driving an output inverter. The other side consists of two 2-input gates ORed together, driving an output inverter, and the ORing nodes are available for expansion.

Logic Diagram



Circuit Schematic

1/2 OF CIRCUIT SHOWN†

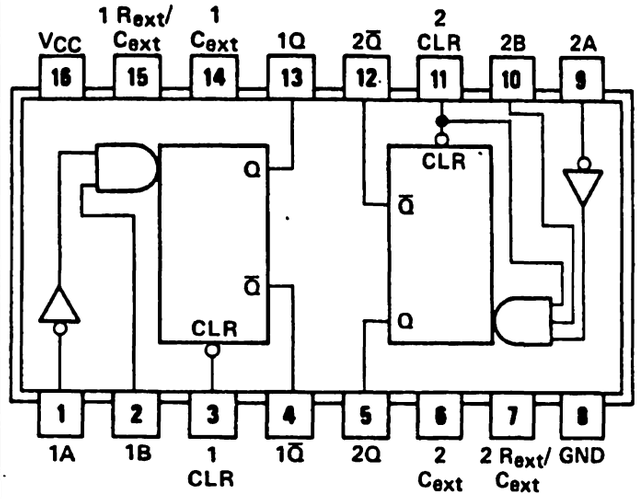


†Other half of circuit omits expander inputs.

100000222

Dual Retriggerable Monostable Multivibrator with Clear

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

Inputs			Outputs	
Clear	A	B	Q	$\overline{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎎
H	↓	H	⎍	⎎
↑	L	H	⎍	⎎

Notes:

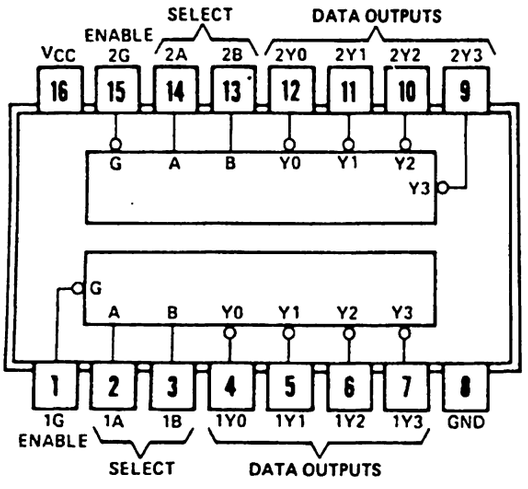
H = high level (steady state).
L = low level (steady state).
↑ = transition from low to high level.
↓ = transition from high to low level.
⎍ = one high-level pulse.
⎎ = one low-level pulse.
X = irrelevant (any input, including transitions).

An external timing capacitor may be connected between C_{ext} and R_{ext}/C_{ext} (positive).

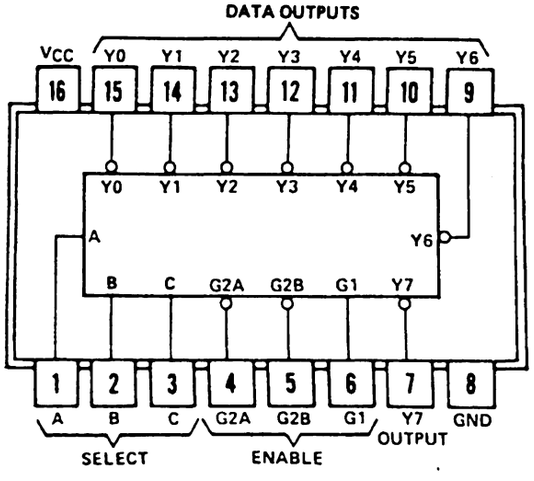
100000185 100000223

Pin Configurations

100000185



100000223



Decoders-Demultiplexers

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table - 100000223

Inputs					Outputs							
Enable		Select										
G1	G2*	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

*G2 = G2A + G2B

H = high level; L = low level; X = irrelevant

Function Table - 100000185
(Each Decoder/Demultiplexer)

Inputs			Outputs			
Enable	Select					
G	B	A	Y0	Y1	Y2	Y3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

H = high level; L = low level; X = irrelevant

These Schottky-clamped TTL MSI circuits are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high performance memory systems these decoders can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced by the Schottky-clamped system decoder is negligible.

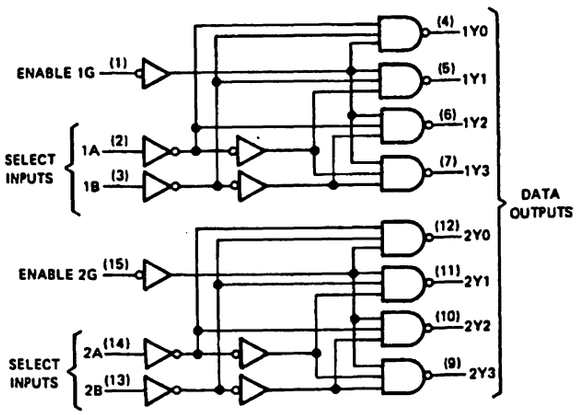
Continued....

100000185 100000223

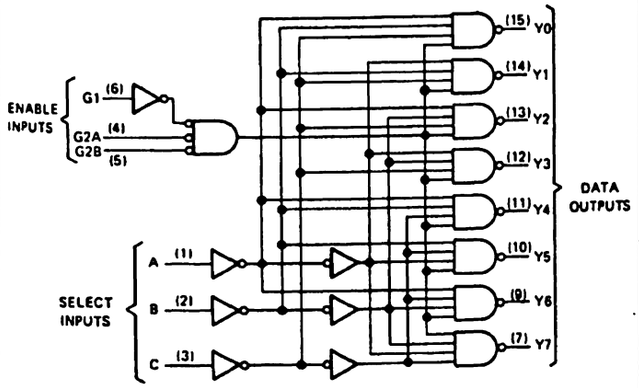
Continued

Logic Diagrams

100000185



100000223



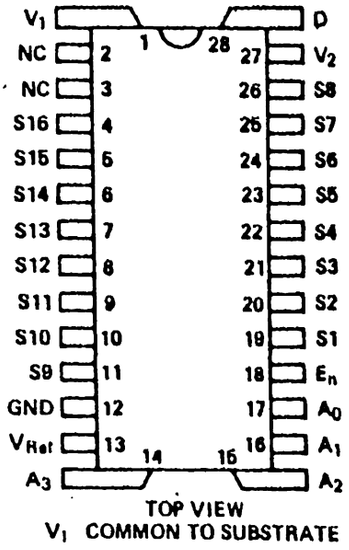
The 100000223 decodes one-of-eight lines, depending on the conditions at the three binary select inputs and the three enable inputs. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

The 100000185 is comprised of two individual two-line-to-four-line decoders in a single package. The active-low enable input can be used as a data line in demultiplexing applications.

100000224

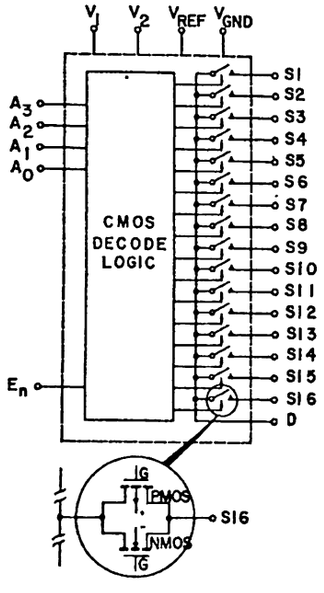
16-Channel Analog Multiplexer Complementary MOS (CMOS)

Pin Configuration



TOP VIEW
V_1 COMMON TO SUBSTRATE

Functional Diagram



Decode Truth Table

A_3	A_2	A_1	A_0	E_n	On Switch
X	X	X	X	0	None
0	0	0	0	1	1
0	0	0	1	1	2
0	0	1	0	1	3
0	0	1	1	1	4
0	1	0	0	1	5
0	1	0	1	1	6
0	1	1	0	1	7
0	1	1	1	1	8
1	0	0	0	1	9
1	0	0	1	1	10
1	0	1	0	1	11
1	0	1	1	1	12
1	1	0	0	1	13
1	1	0	1	1	14
1	1	1	0	1	15
1	1	1	1	1	16

Logic "1" = $V_{AH} > 2.4V$

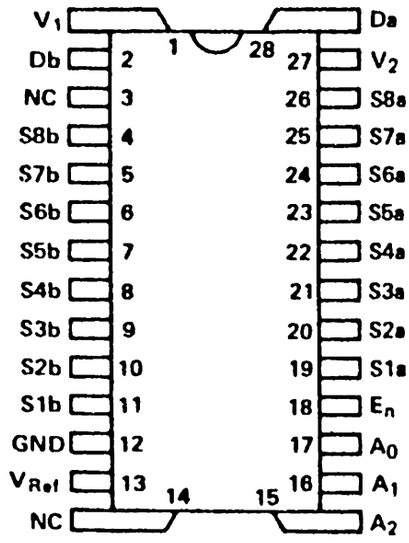
Logic "0" = $V_{AL} < 0.8V$

The 100000224 is a single-pole 16-position (plus OFF) electronic switch array which employs 16 pairs of complementary MOS (CMOS) field-effect transistors designed to function as analog switches. In the ON condition each switch will conduct current in either direction; in the OFF condition each switch will block voltages up to 30V peak-to-peak. The ON-OFF state of each switch is controlled by drivers, which are in turn controlled by a 4-bit binary word input plus an Enable-Inhibit input. The truth table shows the binary word required to select any one of the 16 switch positions, provided a positive logic "1" is present at the Enable input. With logic "0" at the Enable input all switches will be OFF. The logic decoder and the Enable inputs will recognize voltages between -0.3 and 0.8V as logic "0" voltages, and voltages between 2 and 15V as logic "1" voltages. The input can thus be directly interfaced with TTL, DTL, RTL, CMOS and certain special P-MOS circuits. Switch action is break-before-make.

100000225

8-Channel Differential Analog Multiplexer Complementary MOS (CMOS)

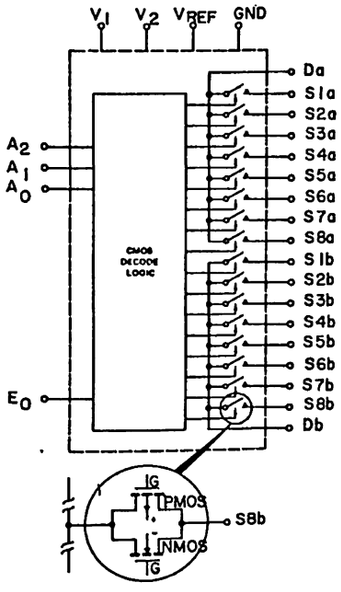
Pin Configuration



TOP VIEW

V_1 COMMON TO SUBSTRATE

Functional Diagram



Decode Truth Table

A_2	A_1	A_0	E_n	On Switch Pair
X	X	X	0	None
0	0	0	1	1
0	0	1	1	2
0	1	0	1	3
0	1	1	1	4
1	0	0	1	5
1	0	1	1	6
1	1	0	1	7
1	1	1	1	8

Logic "1" = $V_{AH} > 2.4V$

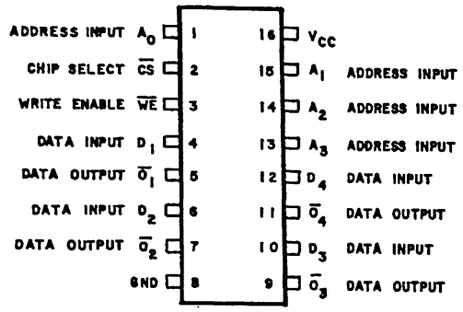
Logic "0" = $V_{AL} < 0.8V$

The 100000225 is a double-pole 8-position (plus OFF) electronic switch array which employs 16 pairs of complementary MOS (CMOS) field-effect transistors designed to function as analog switches In the ON condition each switch will conduct current in either direction; in the OFF condition each switch will block voltages up to 30V peak-to-peak. The ON-OFF state of each switch is controlled by drivers, which are in turn controlled by a 3-bit binary word input plus an Enable-Inhibit input. The truth table shows the binary word required to select any one of the eight switch positions, provided a positive logic "1" is present at the Enable input. With logic "0" at the Enable input all switches will be OFF. The logic decoder and the Enable inputs will recognize voltages between -0.3 and 0.8V as logic "0" voltages, and voltages between 2 and 15V as logic "1" voltages. The input can thus be directly interfaced with TTL, DTL, RTL, CMOS and certain special P-MOS circuits. Switch action is break-before-make.

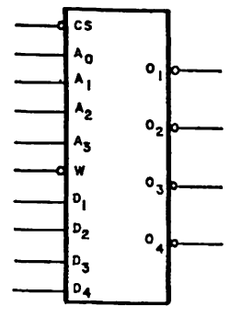
100000226

High Speed Fully Decoded 64-Bit Memory

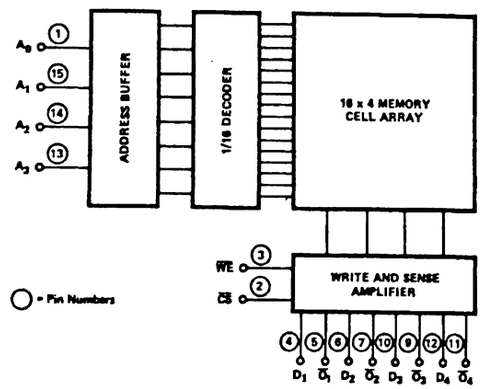
Pin Configuration



Logic Symbol



Block Diagram



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Pin Names

D_1-D_4	Data Inputs
A_0-A_3	Address Inputs
$\overline{WE}$	Write Enable
$\overline{CS}$	Chip Select Input
$\overline{O_1}$-$\overline{O_4}$	Data Outputs
V_{CC}	Power (+5V)

The 100000226 is a high speed, fully decoded 64-bit random access memory, using Schottky barrier diode clamped transistors. Organization is 16 words by 4 bits.

An unselected chip will not generate noise at its output during writing of a selected chip. The output is held high on an unselected chip regardless of the state of the read/write signal.

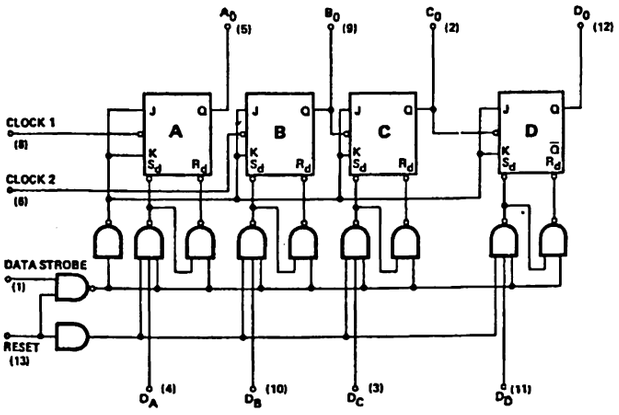
The storage cells are addressed through an on-chip 1 of 16 binary decoder using four input address leads.

A separate Chip Select lead allows selection of an individual package when outputs are OR-tied. In addition to the address leads and the Chip Select lead, there is a write input which allows data presented at the data leads to be entered at the addressed storage cells.

100000080 100000227

Presettable High Speed Binary Counter

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Truth Table

Input	A_0	B_0	C_0	D_0
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1
10	0	1	0	1
11	1	1	0	1
12	0	0	1	1
13	1	0	1	1
14	0	1	1	1
15	1	1	1	1

The 100000080 Presettable High Speed Binary Counter may be connected as a divide-by-two, four, eight or sixteen counter.

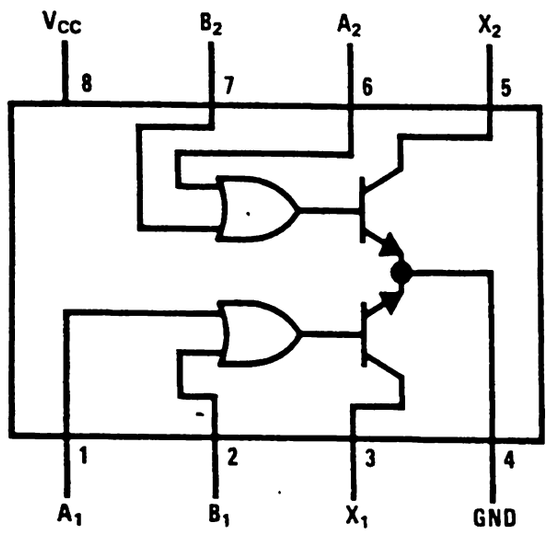
This device has strobed parallel-entry capability so that the counter may be set to any desired output state. A "1" or "0" at a data input will be transferred to the associated output when the strobe input is put at the "0" level. This unit is provided with a reset input which is common to all four bits. A "0" on the reset lines produces "0" at all four outputs.

The counting operation is performed on the falling (negative-going) edge of the input clock pulse.

Note: The 100000227 is a Shottky device.

100000228

Pin Configuration



Dual Peripheral Driver

Pin Designations

V_{CC} = Pin 8

Gnd = Pin 4

Truth Table

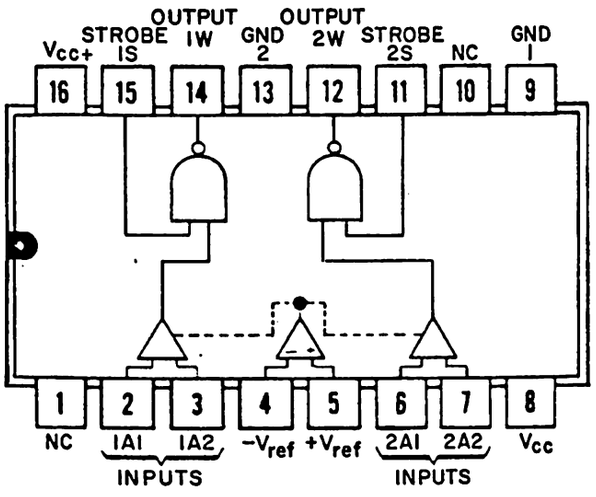
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

The 100000228 is a dual NOR peripheral line driver with output transistors rated up to 300mA continuous current. Both output transistors can sink this current time at the same time, bringing maximum chip power dissipation to 820mW. Switching speeds are compatible with standard TTL and logic levels interface directly with TTL, DTL and LPTTL logic families.

100000118 100000229
100000298 100000299

Dual Sense Amplifiers

Pin Configuration



Logic Diagram/Pin Designations

V_{CC+} = Pin 16

V_{CC} = Pin 8

Gnd 1 = Pin 9

Gnd 2 = Pin 13

NC = No internal connection

Positive logic: $W = \overline{AS}$

Truth Table

Inputs A	Inputs S	Output W
H	H	L
L	X	H
X	L	H

Definition of logic levels:

Input	H	L	X
A*	$V_{ID} \geq V_{Tmax}$	$V_{ID} \leq V_{Tmin}$	Irrelevant
S	$V_I \geq V_{IHmin}$	$V_I \leq V_{ILmax}$	Irrelevant

* A is a differential voltage (V_{ID}) between A1 and A2. For these circuits, V_{ID} is considered positive regardless of which terminal is positive with respect to the other.

100000231

Dual Peripheral Driver

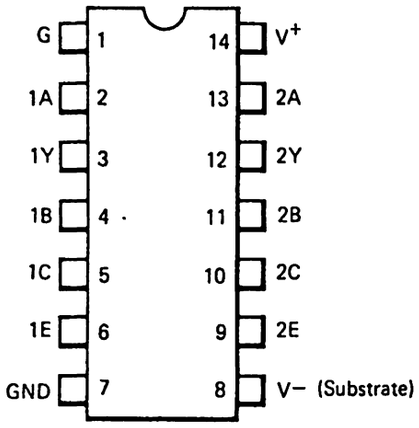
Pin Designations

V+ = Pin 14

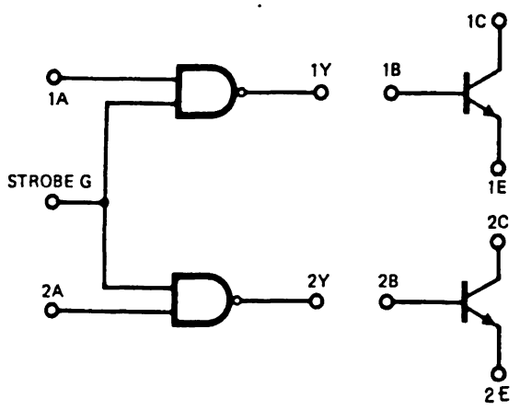
V- = Pin 8

Gnd = Pin 7

Pin Configuration



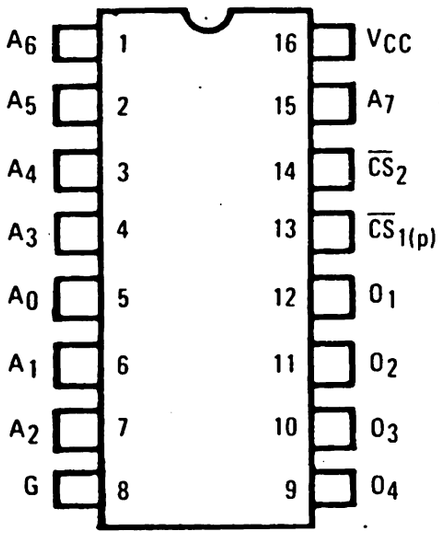
Functional Block Diagram



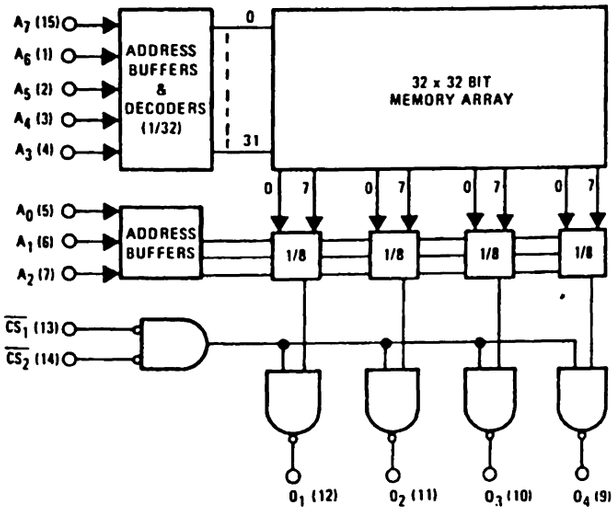
100000232

1024-Bit Field Programmable Bipolar PROM

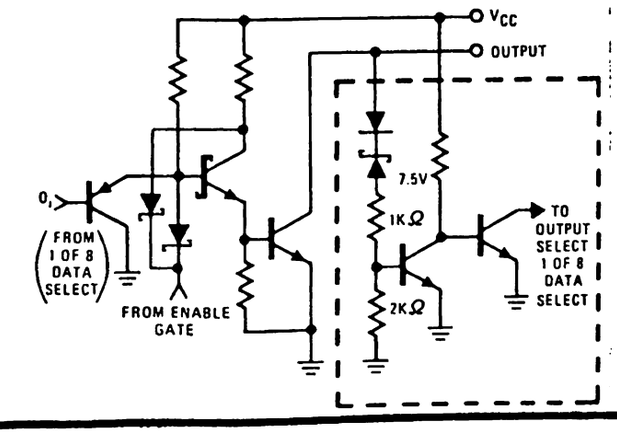
Pin Configuration



Functional Block Diagram



Schematic Output Circuit



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

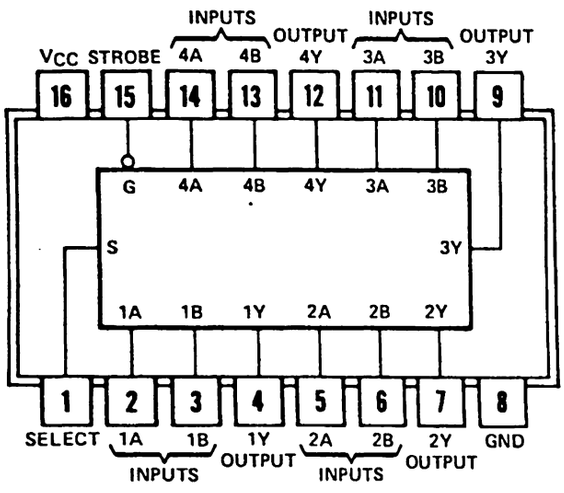
The 100000232 is a fully decoded, high speed, 1024-bit, field programmable ROM, organized as 256 words by 4 bits per word. The device has an open collector output.

This PROM is supplied with all bits storing a logical "1" (output high) and can be selectively programmed for a logical "0" (output low). The addressing scheme for programming and reading the information in the system is the same.

100000233 · 100000240

Quadruple 2-Line-To-1-Line Data Selector/Multiplexer

Pin Configuration



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Positive logic:

Low logic level at S selects A inputs.

High logic level at S selects B inputs.

Function Table

Inputs				Output
Strobe	Select	A	B	Y
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

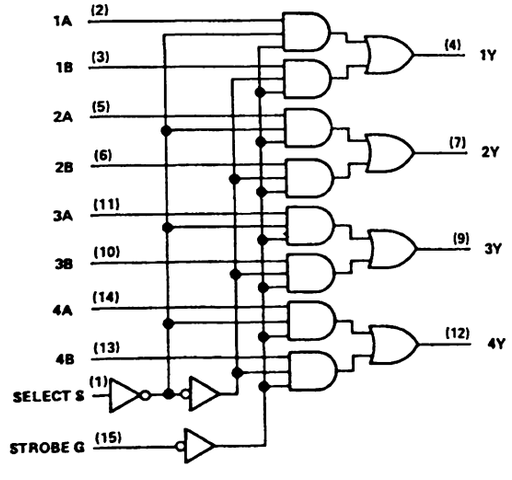
Notes:

H = high level; L = low level; X = irrelevant.

These monolithic data selectors/multiplexors contain inverters and drivers to supply full on-chip data selection to the four output gates. A separate strobe input is provided. A 4-bit word is selected from one of two sources and is routed to the four outputs. These devices present true data.

Note: The 100000233 is a Shottky device.

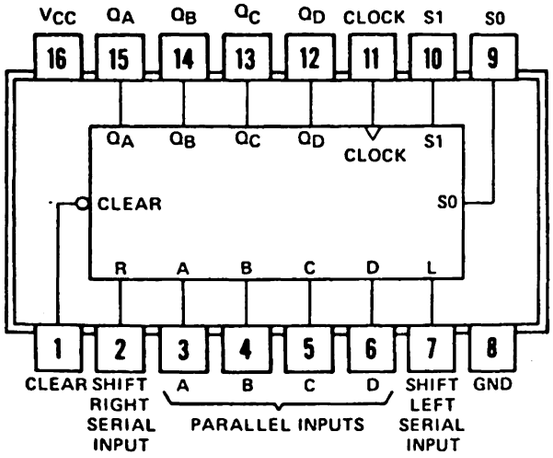
Logic Diagram



100000135 100000234

4-Bit Bidirectional Universal Shift Registers

Pin Configuration



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table

INPUTS											OUTPUTS			
CLEAR	MODE		CLOCK	SERIAL		PARALLEL					Q_A	Q_B	Q_C	Q_D
	S_1	S_0		LEFT	RIGHT	A	B	C	D					
L	X	X	X	X	X	X	X	X	X		L	L	L	L
H	X	X	L	X	X	X	X	X	X		Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
H	H	H	↑	X	X	a	b	c	d		a	b	c	d
H	L	H	↑	X	H	X	X	X	X		H	Q_{An}	Q_{Bn}	Q_{Cn}
H	L	H	↑	X	L	X	X	X	X		L	Q_{An}	Q_{Bn}	Q_{Cn}
H	H	L	↑	H	X	X	X	X	X		Q_{Bn}	Q_{Cn}	Q_{Dn}	H
H	H	L	↑	L	X	X	X	X	X		Q_{Bn}	Q_{Cn}	Q_{Dn}	L
H	L	L	X	X	X	X	X	X	X		Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}

H = high level (steady state).

L = low level (steady state).

X = irrelevant (any input, including transitions).

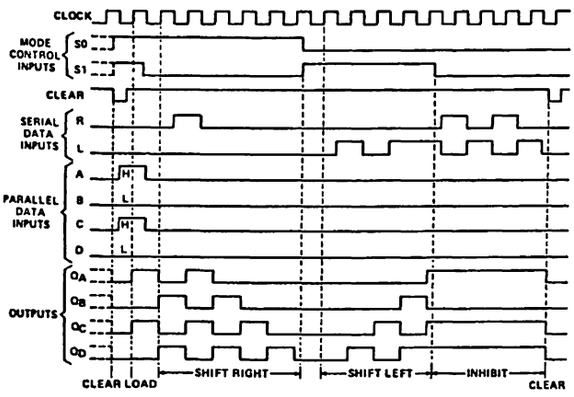
↑ = transition from low to high level.

a, b, c, d = the level of steady-state input at inputs A, B, C or D, respectively.

Q_{A0}, Q_{B0}, Q_{C0}, Q_{D0} = the level of Q_A, Q_B, Q_C or Q_D, respectively, before the indicated steady-state input conditions were established.

Q_{An}, Q_{Bn}, Q_{Cn}, Q_{Dn} = the level of Q_A, Q_B, Q_C or Q_D, respectively, before the most recent ↑ transition of the clock.

Typical Clear, Load, Right-Shift, Left-Shift, Inhibit, and Clear Sequences



Note: The 100000234 is a Shottky device.

The circuit contains 46 equivalent gates and features parallel inputs, parallel outputs, right-shift and left-shift serial inputs, operating-mode-control inputs, and a direct overriding clear line. The register has four distinct modes of operation:

Parallel (Broadside) Load

Shift Right (in the direction Q_A toward Q_D)

Shift Left (in the direction Q_D toward Q_A)

Inhibit Clock (Do nothing)

Continued....

100000135 100000234

Continued

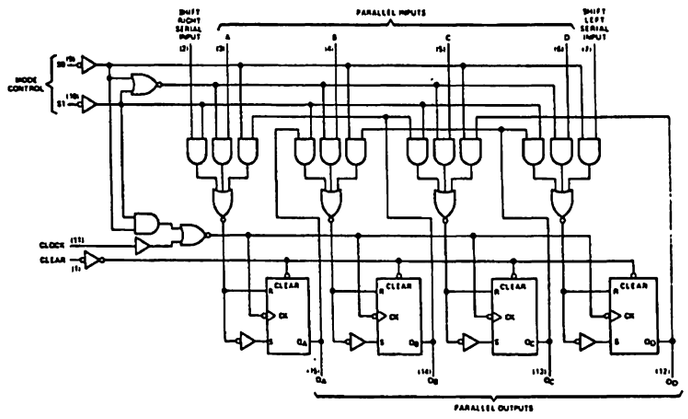
Synchronous parallel loading is accomplished by applying the four bits of data and taking both mode control inputs, S_0 and S_1, high. The data is loaded into the associated flip-flop and appears at the outputs after the positive transition of the clock input. During loading, serial data flow is inhibited.

Shift right is accomplished synchronously with the rising edge of the clock pulse when S_0 is high and S_1 is low. Serial data for this mode is entered at the shift-right data input. When S_0 is low and S_1 is high, data shifts left synchronously and new data is entered at the shift-left serial input.

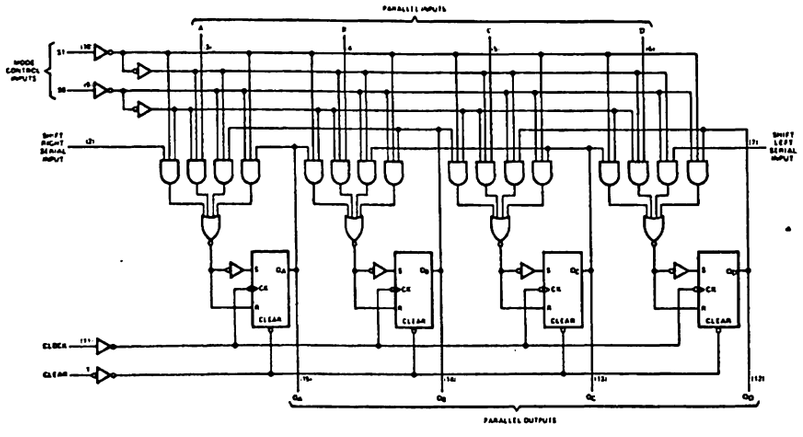
Clocking of the flip-flop is inhibited when both mode control units are low. The mode controls of the 100000135 should be changed only while the clock input is high.

Logic Diagrams

100000135



100000234

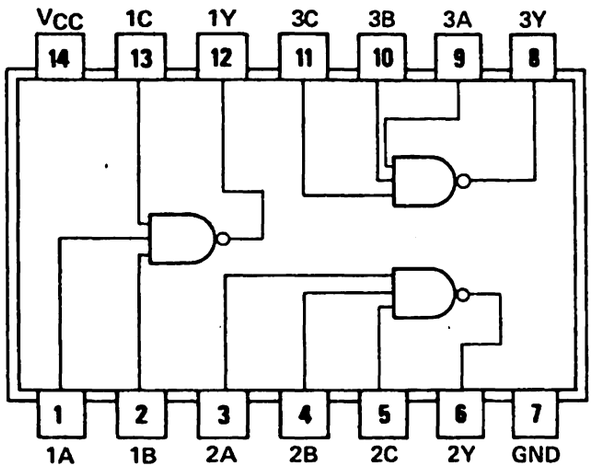


◇ .... dynamic input activated by a transition from a high level to a low level.

100000235

Triple 3-Input Positive-NAND Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

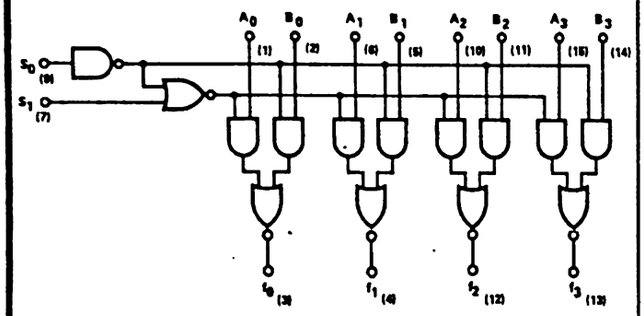
Gnd = Pin 7

Positive logic: $Y = \overline{ABC}$

Note: 100000235 is a Shottky device.

100000236

Logic Diagram



2-Input, 4-Bit Digital Multiplexer

Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Truth Table

S_0	S_1	f_n
0	0	$\overline{B}$
1	0	$\overline{A}$
0	1	$\overline{B}$
1	1	1

This 2-Input, 4-Bit Digital Multiplexer features inverting data paths.

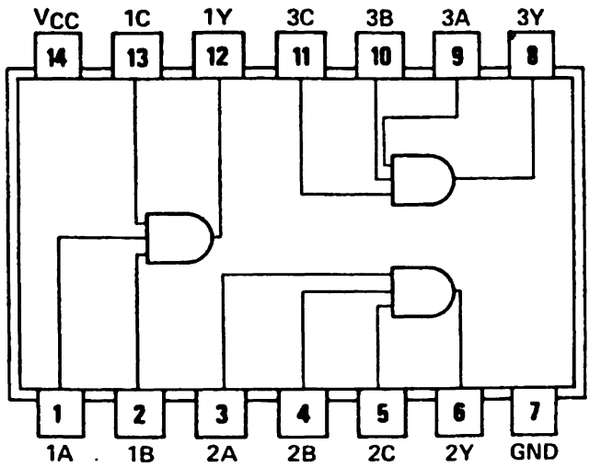
The 100000236 has open collector outputs which permit direct wiring to other open collector outputs (collector logic) to yield "free" four-bit words. As many as forty four-bit words can be multiplexed by using twenty of these devices in the WIRED-AND mode.

The inhibit state $S_0 = S_1 = 1$ can be used to facilitate transfer operations in an arithmetic section.

Note: The 100000236 is a Shottky device.

100000237

Pin Configuration



Triple 3-Input Positive-AND Gate

Logic Diagram/Pin Designations

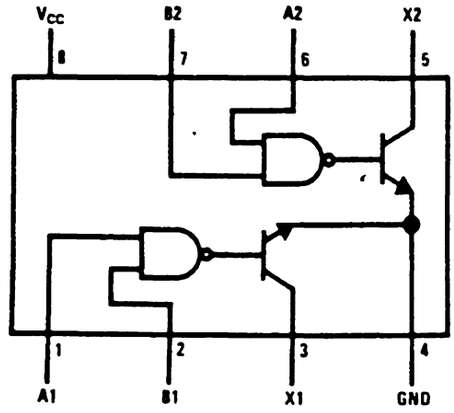
V_{CC} = Pin 14
Gnd = Pin 7

Positive logic: Y = ABC

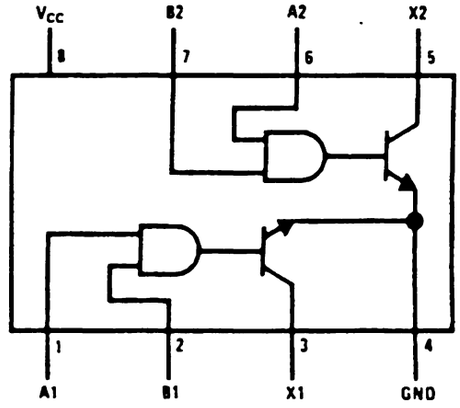
Note: The 100000237 is a Shottky device.

100000247 100000238
100000154 100000117

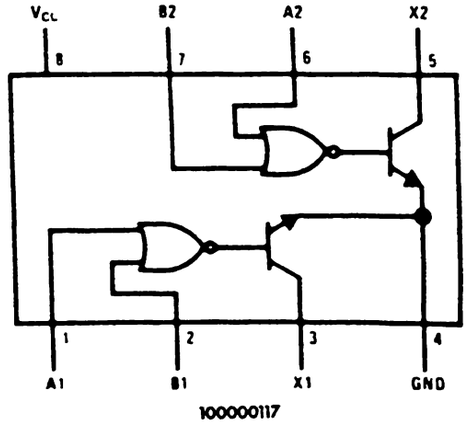
Pin Configurations



100000247/100000238



100000154



100000117

Dual Peripheral Drivers

Pin Designations

V_{CC} = Pin 8

Gnd = Pin 4

Truth Tables

100000247 and 100000238

Positive logic: AB=X

A	B	Output X*
0	0	0
1	0	0
0	1	0
1	1	1

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000154

Positive logic: $\overline{AB}$=X

A	B	Output X*
0	0	1
1	0	1
0	1	1
1	1	0

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000117

Positive logic: A + B = X

A	B	Output X*
0	0	0
1	0	1
0	1	1
1	1	1

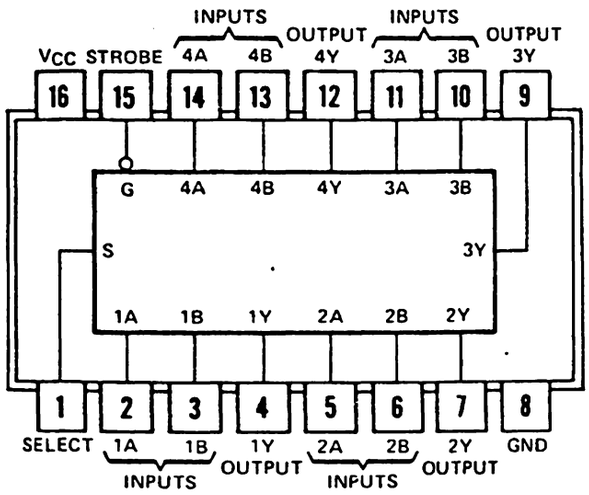
*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

These devices are general purpose dual peripheral drivers, each capable of sinking two independent 300mA loads to ground. In the off state (or with V_{CC} = 0V) the outputs will withstand 30V. Inputs are fully DTL/TTL compatible.

100000233 100000240

Quadruple 2-Line-To-1-Line Data Selector/Multiplexer

Pin Configuration



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Positive logic:

Low logic level at S selects A inputs.

High logic level at S selects B inputs.

Function Table

Inputs				Output
Strobe	Select	A	B	Y
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

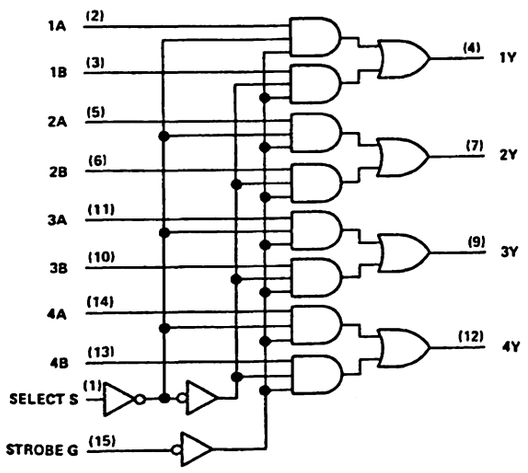
Notes:

H = high level; L = low level; X = irrelevant.

These monolithic data selectors/multiplexors contain inverters and drivers to supply full on-chip data selection to the four output gates. A separate strobe input is provided. A 4-bit word is selected from one of two sources and is routed to the four outputs. These devices present true data.

Note: The 100000233 is a Shottky device.

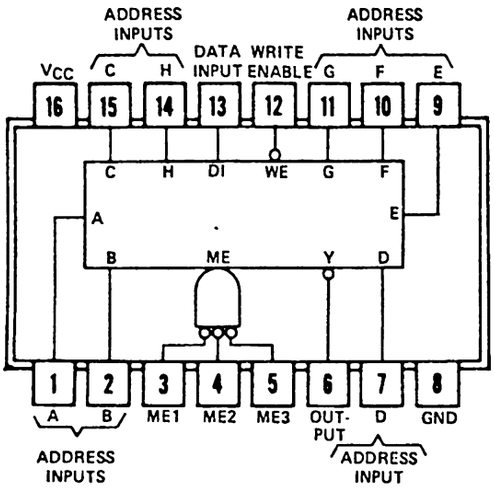
Logic Diagram



100000241

256-Bit Read-Write Memory With 3-State Outputs

Pin Configuration



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Positive logic:

Data out is complement of data which was applied at data input.

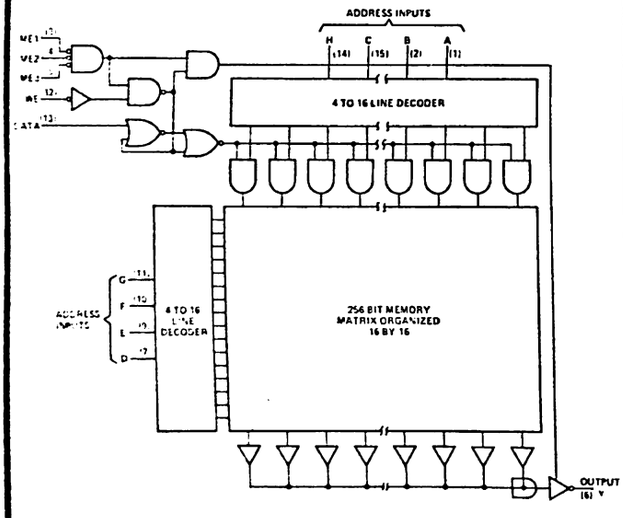
Function Table

Function	Inputs: Memory Enable*	Inputs: Write Enable	Output
Write (Store complement of data)	L	L	High Impedance
Read	L	H	Stored Data
Inhibit	H	X	High Impedance

H = high level
L = low level
X = irrelevant
* For memory enable:

L = all ME inputs low
H = one or more ME inputs high

Functional Block Diagram



This 256-bit active-element memory is a monolithic TTL array organized as 256 words of one bit each. It is fully decoded and has three gated memory-enable inputs to simplify decoding required to achieve the desired system organization. The memory-enable circuitry is implemented with minimal delay times to compensate for added system decoding.

Write Cycle

The complement of the information at the data input is written into the selected location when all memory-enable inputs and write-enable input are low. While the write enable input is low, the output is in the high-impedance state. When a number of outputs are bus-connected, this high-impedance output state will neither load nor drive the bus line, but it will allow the bus line to be driven by another active output or a passive pull-up if desired.

Read Cycle

The stored information (complement of information applied at the data input during the write

Continued ....

100000241

Continued

cycle) is available at the output when the write-enable input is high and the three memory-enable inputs are low. When any one of the memory enable inputs is high, the output will be in the high-impedance state.

The high capacitive drive capability of the three-state bus-connectable output permits expansion up to 66, 304 words of N-bits without additional output buffering. The functional capability of the output being at a high impedance during writing and the data input being inhibited during reading means that both data inputs and outputs can be connected to the data lines of a bus-organized system without the need for interface circuits.

Word Capacity Vs. Loads

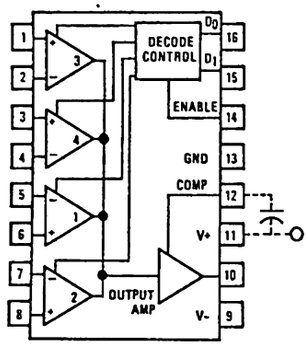
Loads	Maximum Number of Common Outputs	Maximum Number of Words
1	259	66, 304
2	220	56, 320
3	180	46, 080
4	140	35, 840
5	100	25, 600
6	60	15, 360
7	20	5, 120

Note: The 100000241 is a Shottky device.

100000242

Four Channel Programmable Amplifier

Pin Configuration



Truth Table

D_1	D_0	EN	Selected Channel
L	L	H	1
L	H	H	2
H	L	H	3
H	H	H	4
X	X	L	None

This operational amplifier has four identical input stages, any one (or none) of which may be electronically connected to the single output stage. The "ON" channel is selected through DTL/TTL compatible address inputs. The unselected amplifier inputs are effectively "floating".

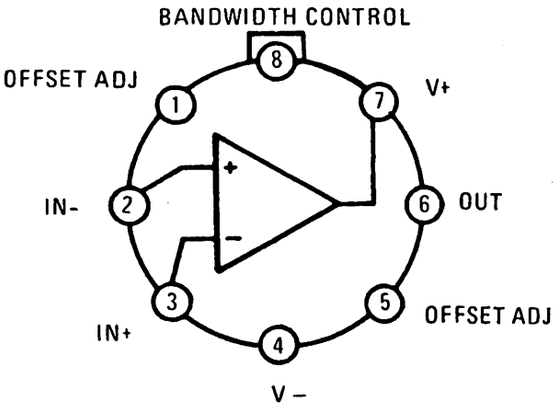
This device can be used as an analog signal selector, sampler or multiplexer with built in buffering or signal conditioning. By connecting different feedback networks from the output to each input pair, it can be used as a single or multiple channel amplifier with programmable feedback characteristics.

100000243

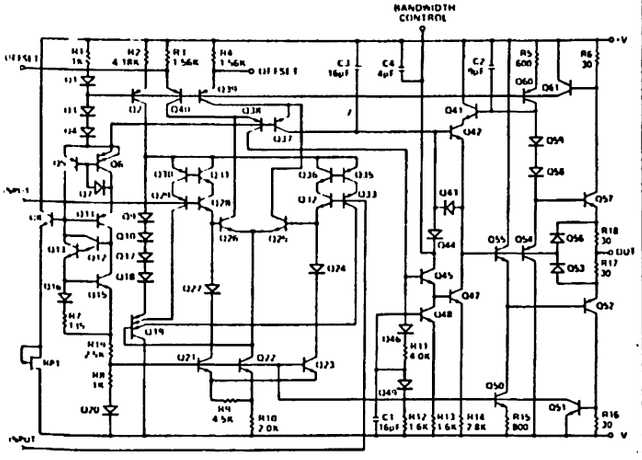
Wide Band, High Impedance Operational Amplifier

This operational amplifier has very low input bias current and is intended for use as a high impedance comparator and a wide band amplifier. The device provides very high gain, very high slew rate and output short circuit protection.

Pin Configuration



Schematic



100000244

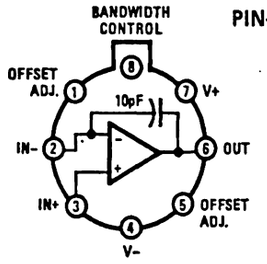
High Slew Rate F.E.T. Input Operational Amplifier

This operational amplifier combines very high slew rate and wide bandwidth with ultra-low input current and high input resistance.

The device may be operated inverting or non-inverting. External compensation is required only when operated at closed loop gains less than three. An internal feedback capacitor is provided to cancel phase shift in the feedback loop due to input capacitance.

Pin Configuration

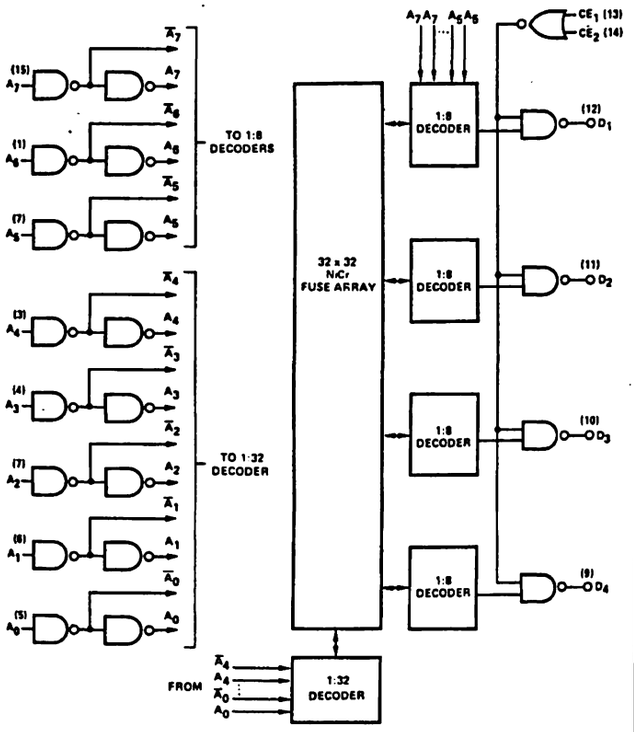
PIN-OUT



(TOP VIEW)

100000245

Functional Block Diagram



1024-Bit Bipolar Programmable ROM (256 × 4 PROM, Open Collector)

Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

The 100000245 is a Bipolar 1024 Bit Read Only Memory organized as 256 words by 4 bits per word, with open collector outputs. This device is field-programmable.

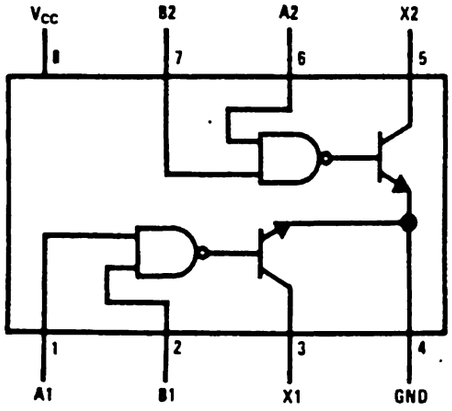
Two chip enable lines are provided and the outputs are bussable to allow for memory expansion capability.

Note: The 100000245 is a Shottky device.

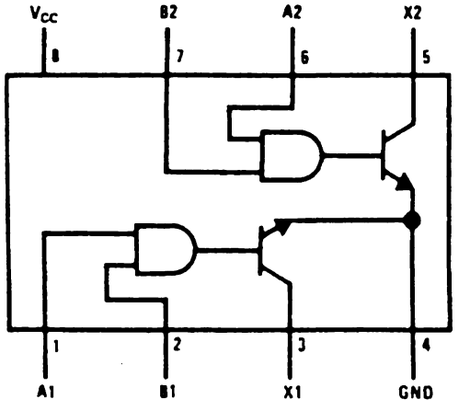
100000247 100000238
100000154 100000117

Dual Peripheral Drivers

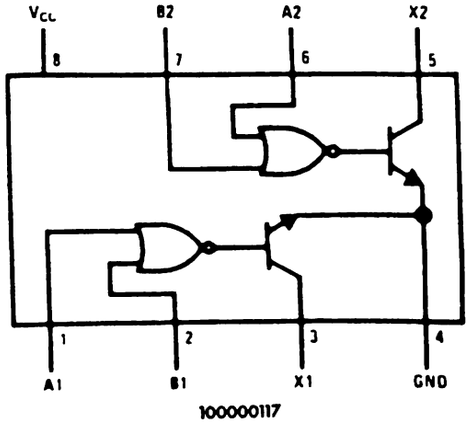
Pin Configurations



100000247/100000238



100000154



100000117

Pin Designations

V_{CC} = Pin 8

Gnd = Pin 4

Truth Tables

100000247 and 100000238

Positive logic: AB=X

A	B	Output X*
0	0	0
1	0	0
0	1	0
1	1	1

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000154

Positive logic: $\overline{AB}$=X

A	B	Output X*
0	0	1
1	0	1
0	1	1
1	1	0

*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

100000117

Positive logic: A + B = X

A	B	Output X*
0	0	0
1	0	1
0	1	1
1	1	1

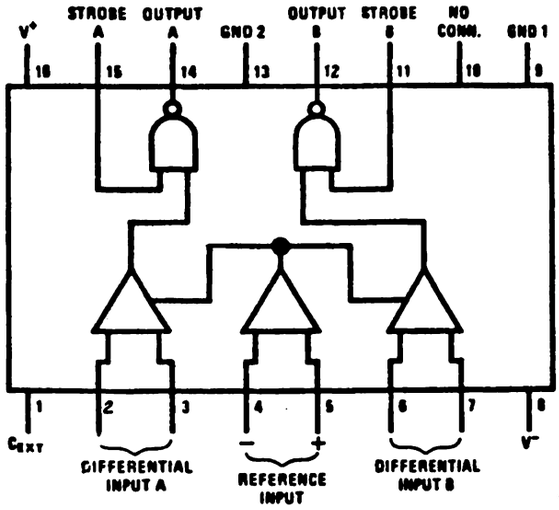
*"0" Output $\leq$ 0.7V
"1" Output $\leq$ 100μA

These devices are general purpose dual peripheral drivers, each capable of sinking two independent 300mA loads to ground. In the off state (or with V_{CC} = 0V) the outputs will withstand 30V. Inputs are fully DTL/TTL compatible.

100000248

Sense Amplifier

Pin Configuration



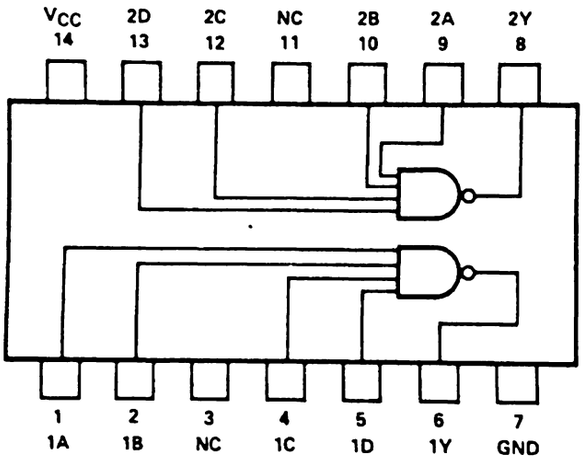
Pin Designations

V+	= Pin 16
V-	= Pin 8
Gnd 1	= Pin 9
Gnd 2	= Pin 13

These dual core sense amplifiers convert bipolar millivolt-level memory sense signals to saturated logic levels. The design employs a common reference input which allows the input threshold voltage level of both amplifiers to be adjusted. Separate strobe inputs provide time discrimination for each channel. Logic inputs and outputs are DTL/TTL compatible.

100000249

Pin Configuration



Positive-NAND Gate

Logic Diagram/Pin Designations

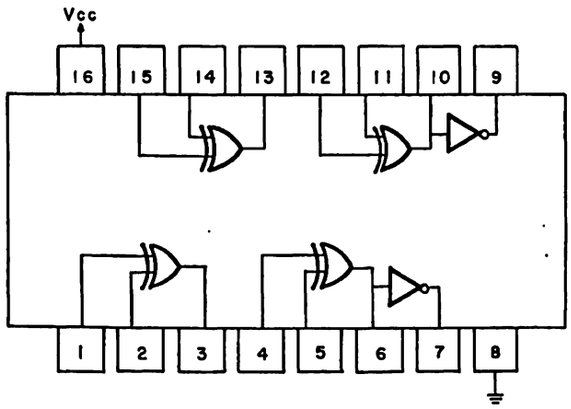
V_{CC} = Pin 14
Gnd = Pin 7

Note: The 100000249 is a Shottky device.

100000250

Quad Exclusive-OR Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Truth Table

A	B	Z	$\overline{Z}$
L	L	L	H
L	H	H	L
H	L	H	L
H	H	L	H

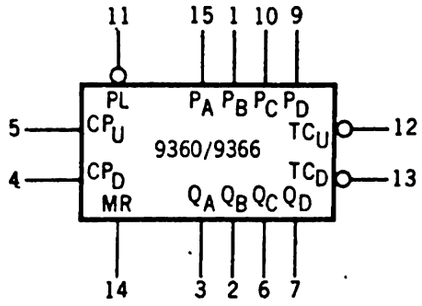
H = High Voltage Level
L = Low Voltage Level

The exclusive OR gate produces an output when the inputs are complementary. Two gates have an additional inverted output which provides directly a compare capability. The Boolean expressions for the gates are: $Z = A\overline{B} + \overline{A}B$; $\overline{Z} = AB + \overline{A}\overline{B}$.

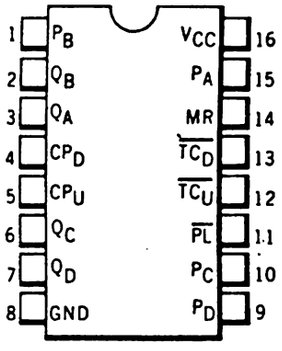
100000252 100000128

Up/Down Decade and Binary Counters

Logic Symbol

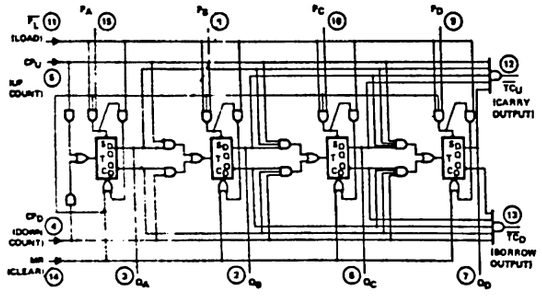


Pin Configuration

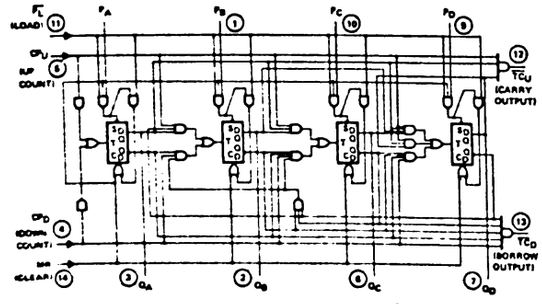


Logic Diagrams

100000128



100000252



○ - PIN NUMBER

Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Mode Selection (Both Counters)

MR	$\overline{PL}$	CP_U	CP_D	Mode
H	X	X	X	Preset (Asyn.)
L	L	X	X	Preset (Asyn.)
L	H	H	H	No Change
L	H	CP	H	Count Up
L	H	H	CP	Count Down

Notes:

H = High voltage level
L = Low voltage level
X = Don't care condition
CP = Clock pulse.

The 100000252 is a synchronous Up/Down BCD Decade Counter and the 100000128 is a synchronous Up/Down 4-Bit Binary Counter. Both counters have separate up/down clocks, parallel load facility, terminal count outputs for multidecade operation and an asynchronous overriding master reset.

These counters can be reset, preset and count up or down. The operating modes are tabulated in the Mode Selection table. The operating modes of both devices are identical; the only difference between the devices is the count sequences.

Counting is synchronous, with the outputs changing state after the Low to High transition of either the Count-Up Clock (CP_U) or Count-Down Clock (CP_D). The direction of counting is determined by which clock input is pulsed while the other clock input is High. (Incorrect counting will occur if both the count-up clock and count-down clock inputs are Low simultaneously.) Both counters will respond to a clock pulse on either input by changing to the next appropriate state of the count sequence. The state diagram for the 100000252 shows the regular sequence and in addition shows the sequence of states if a code greater than nine is present in the counter.

Continued ....

100000252 100000128

Continued

Logic Equations for Terminal Count

100000252

$$TC_U = Q_0 \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot Q_3 \cdot \overline{CP_U}$$

$$TC_D = \overline{Q_0} \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot \overline{Q_3} \cdot \overline{CP_D}$$

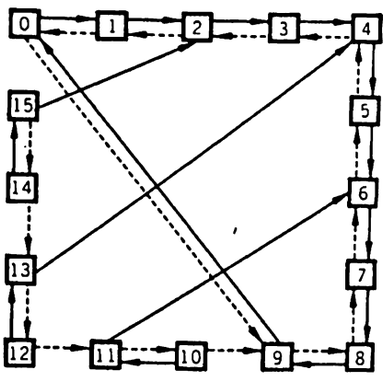
100000128

$$TC_U = Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3 \cdot \overline{CP_U}$$

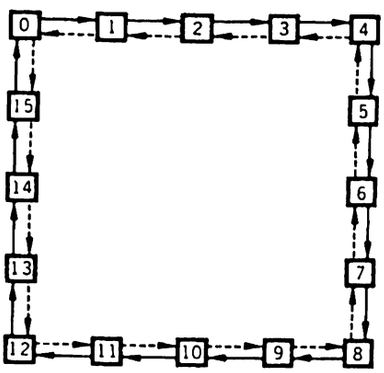
$$TC_D = \overline{Q_0} \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot \overline{Q_3} \cdot \overline{CP_D}$$

State Diagrams

100000252



100000128



COUNT UP ——

COUNT DOWN -------

Both counters have a parallel load (asynchronous) facility which permits the device to be preset. Whenever the parallel load ($\overline{PL}$) input is Low, and Master Reset is Low, the information present on the Parallel Data inputs (P_A, P_B, P_C, P_D) will be loaded into the counters and appear on the outputs independent of the conditions of the clock inputs. When the Parallel Load Input goes High, this information is stored in the counters and when the counters are clocked they change to the next appropriate state in the count sequence. The Parallel Data inputs are inhibited when the Parallel Load is High and have no effect on the counters.

The Terminal Count-Up ($\overline{TC_U}$) and Terminal Count-Down ($\overline{TC_D}$) outputs (carry and borrow, respectively) allow multidecade counter operations without additional logic. The counters are cascaded by feeding the terminal count-up output to the count-up clock input and terminal count-down clock input of the following counter.

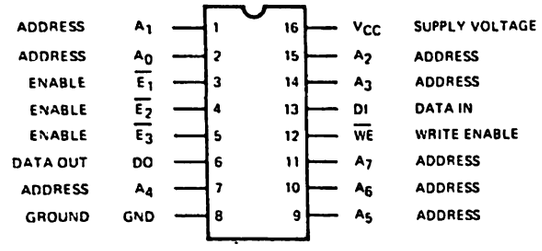
The terminal count-up outputs are Low when their count-up clock inputs are Low and the counters are in state nine (100000252) and state fifteen (100000128). Similarly, the terminal count-down outputs are Low when their count-down clock inputs are Low and both counters are in state zero. Thus, when the 100000252 counter is in state nine and the 100000128 counter is in state fifteen and both are counting up, or both counters are in state zero and counting down, a clock pulse will change the counter's state on the rising edge and simultaneously clock the following counter through the appriate active Low terminal count output. There are two gate delays per state when these counters are cascaded.

The asynchronous Master Reset input (MR), when High, overrides all input and clears the counters. Master reset overrides parallel load so that when both are activated the counters will be reset. (Obviously, both parallel load and master reset must not be deactivated simultaneously for predictable operation.)

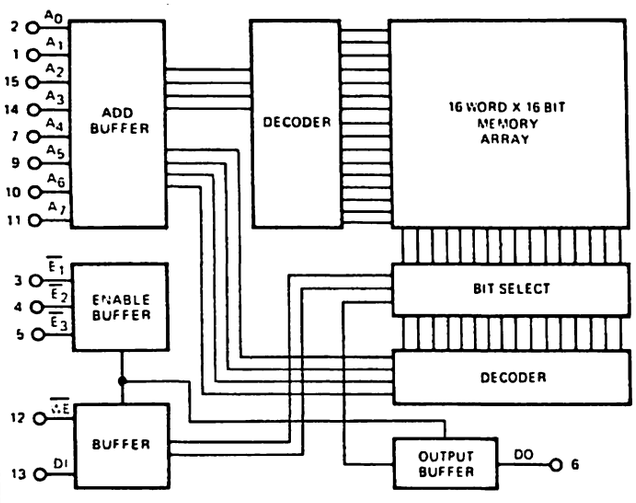
100000255

256 Bit Bipolar Random Access Memory

Pin Configuration



Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

Chip Select	Write Enable	Operation	Output
All Low	Low	Write	Complement of data input
All Low	High	Read	Complement of written data
One or More High	Don't Care	Hold	High

The 100000255 is a fully decoded static bipolar random access memory organized 256 words by 1 bit, with open-collector outputs. The open-collector parts have 3 chip enables for easy expansion to larger size memories.

Memory Operation

Read

The memory is addressed with the A_0-A_7 inputs which select one of the 256 words. The chip is enabled by making all chip enables low. If any or all chip enables are high the chip is disabled. If the write enable is high and the chip is enabled the stored data is read out on the data out pin. The data read out is the complement of the data written in during the write cycle.

Write

The memory is addressed with the A_0-A_7 inputs which select one of the 256 words. The chip is enabled as in the read cycle. If the write enable is low the data on the data input pin is written into the addressed word. The data out of the memory during the write cycle is the complement of the data written in. This allows checking of the stored data during the write cycle.

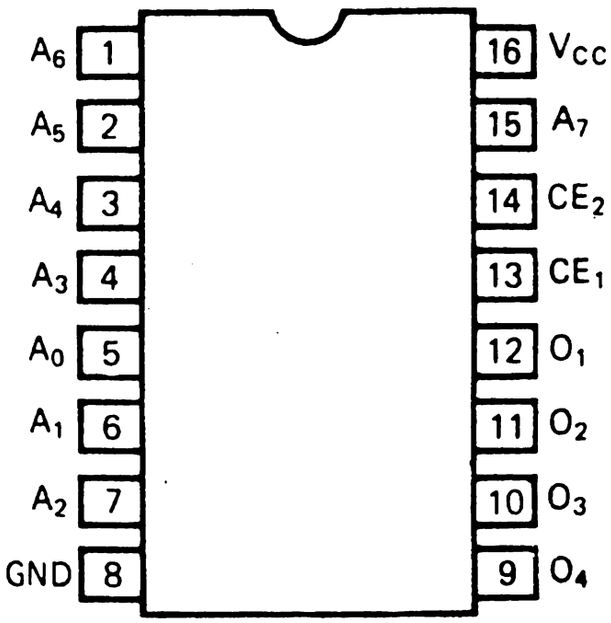
Memory Expansion Rules

1. To expand the number of bits in the word: tie corresponding address pins together, tie write enable pins together, and bring data in and data out independently.
2. To expand the number of words: tie corresponding address pins together, tie write enable pins and corresponding data in and data out pins together, and use the higher order system addresses in conjunction with the chip enables to pick one row of packages.

100000256

1024-Bit Programmable Bipolar Read Only Memory

Pin Configuration



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

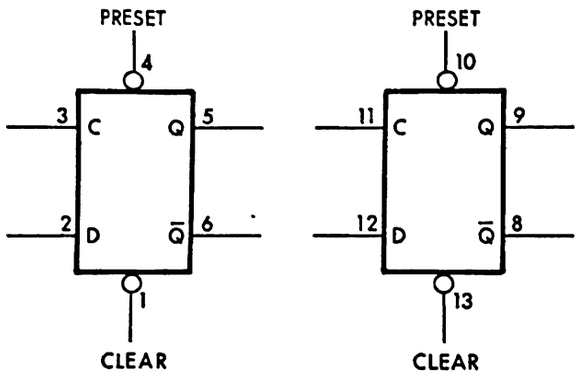
The 100000256 integrated circuit is a high speed, electrically programmable, fully decoded TTL bipolar 1024-bit read only memory, organized as 256 words by 4 bits. On chip address decoding, two chip enable inputs and uncommitted collector outputs are provided.

The same address inputs are used for both programming and reading.

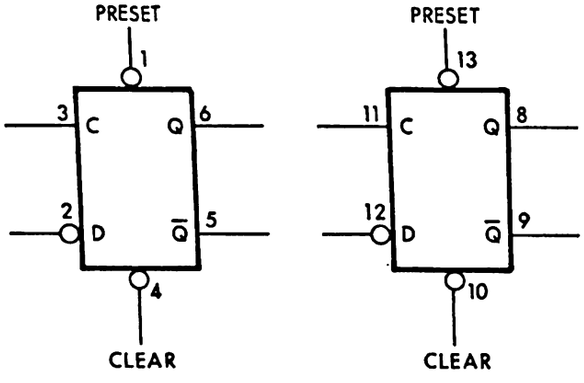
100000017 100000257

Dual D-Type Edge-Triggered Flip-Flop

Pin Connections



Alternate Pin Connections



Logic Diagram/Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

Function Table

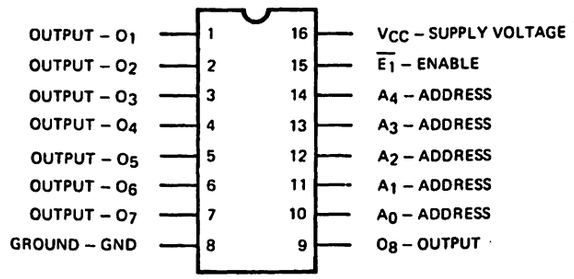
Inputs				Outputs	
Preset	Clear	Clock	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q}_0$

H = high level (steady state)
L = low level (steady state)
X = irrelevant
↑ = transition from low to high level
Q_0 = the level of Q before the indicated input conditions were established.
* = This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (high) level.

100000258

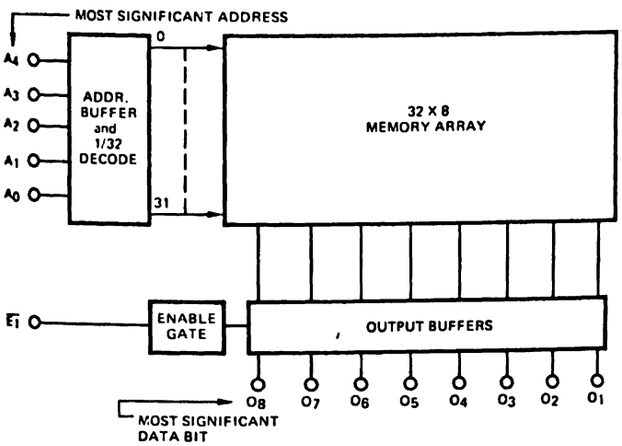
256 Bit Bipolar (32x8) Electrically Programmable Read Only Memory

Pin Configuration



Low = Enable

Block Diagram



Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

The 100000258 is a field programmable, 256-bit, DTL and TTL compatible, bipolar read only memory.

The three-state output of this device provides a low impedance driver Q_2 for driving capacitance on the memory output; no pullup resistor is required. When the chip enable is low, D_1 and D_2 are off and either Q_1 or Q_2 is on, depending upon the data in the memory array. When the chip enable is high, D_1 and D_2 are on and Q_1 and Q_2 are off, permitting wire ORing of memory outputs. In a system environment, up to 21 memory outputs of the 100000258 can be connected to a common bus. All of the devices, except one, are placed in the high impedance state. The selected device is enabled and has the characteristics of a TTL totem pole output.

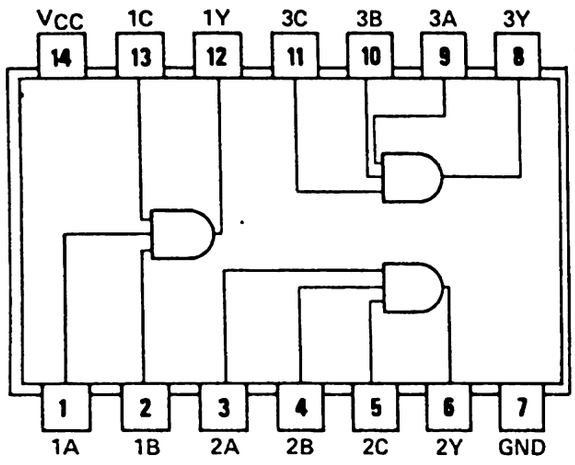
Memory Operation

The memory is addressed with inputs A_0 through A_4 which select one of 32 words. To enable the outputs for a readout, enable $\overline{E1}$ must be low. If the enable is high, the outputs are held off permitting wire "OR"ing of the three-state outputs of several packages. The use of the enable permits expansion to greater than 32 words.

100000259

Triple 3-Input Positive-AND Gate With Open-Collector Outputs

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

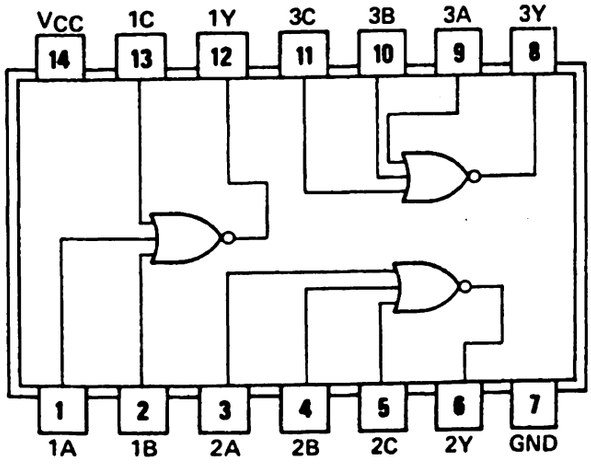
Positive logic: Y = ABC

Note: The 100000259 is a Shottky device.

100000260

Triple 3-Input Positive-NOR Gate

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

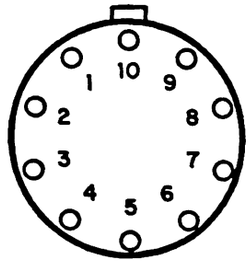
Gnd = Pin 7

Positive logic: $Y = \overline{A+B+C}$

100000261

Phase Locked Loop

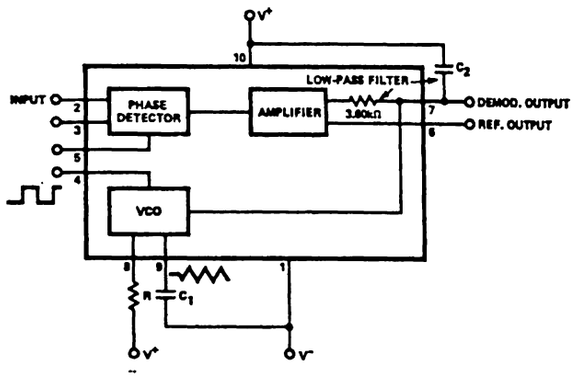
Pin Configuration



Pin Designations

1. V^-
2. Input
3. Input
4. VCO Output
5. Phase Comparator VCO Input
6. Reference Output
7. Demodulated Output
8. External R for VCO
9. External C for VCO
10. V^+

Functional Block Diagram

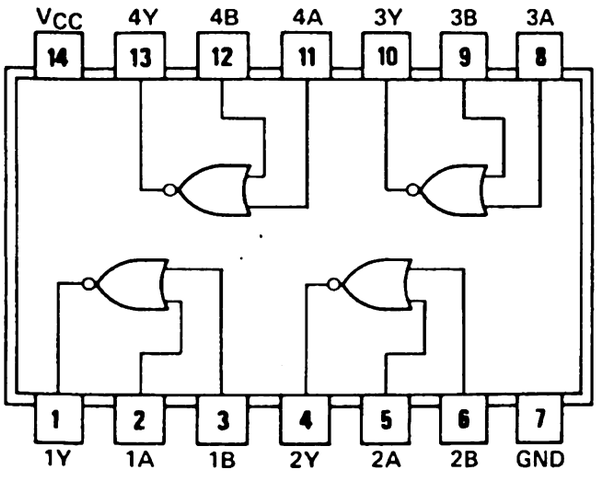


This Phase Locked Loop is a self-contained, adaptable filter and demodulator for the frequency range 0.001Hz to 500kHz. The circuit comprises a voltage-controlled oscillator, a phase comparator, an amplifier and a low-pass filter.

The center frequency of the device is determined by the free-running frequency of the VCO; this frequency can be adjusted externally with a resistor or a capacitor. The low-pass filter, which determines the capture characteristics of the loop, is formed by an internal resistor and an external capacitor.

100000262

Pin Configuration



Quadruple 2-Input Positive-NOR Gate

Logic Diagram/Pin Designations

V_{CC} = Pin 14

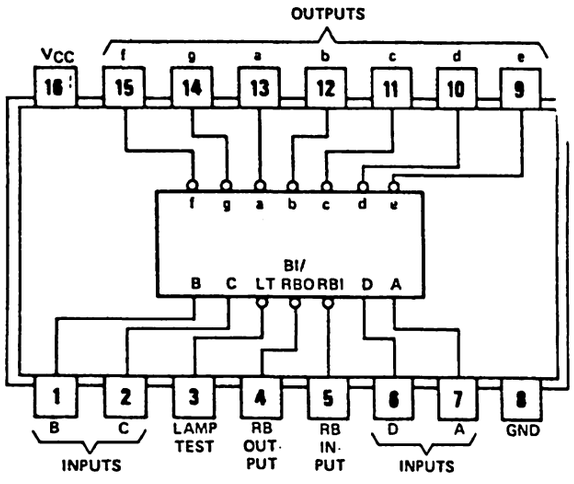
Gnd = Pin 7

Positive logic: $Y = \overline{A+B}$

100000263

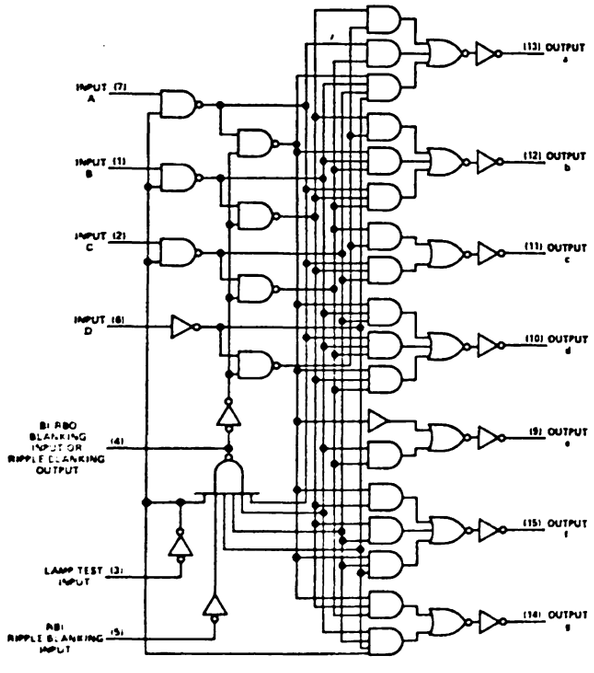
BCD-To-Seven-Segment Decoder - Driver

Pin Configuration



Positive Logic: See Function Table.

Logic Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Function Table

Decimal or Function	Inputs						BI/RBO*	Outputs							Note
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	On	On	On	On	On	On	Off	1
1	H	X	L	L	L	H	H	Off	On	On	Off	Off	Off	Off	1
2	H	X	L	L	H	L	H	On	On	Off	On	On	Off	On	
3	H	X	L	L	H	H	H	On	On	On	On	Off	Off	On	
4	H	X	L	H	L	L	H	Off	On	On	Off	Off	On	On	
5	H	X	L	H	L	H	H	On	Off	On	On	Off	On	On	
6	H	X	L	H	H	L	H	Off	Off	On	On	On	On	On	
7	H	X	L	H	H	H	H	On	On	On	Off	Off	Off	Off	
8	H	X	H	L	L	L	H	On	On	On	On	On	On	On	
9	H	X	H	L	L	H	H	On	On	On	Off	Off	On	On	
10	H	X	H	L	H	L	H	Off	Off	Off	On	On	Off	On	
11	H	X	H	L	H	H	H	Off	Off	On	On	Off	Off	On	
12	H	X	H	H	L	L	H	Off	On	Off	Off	Off	On	On	
13	H	X	H	H	L	H	H	On	Off	Off	On	Off	On	On	
14	H	X	H	H	H	L	H	Off	Off	Off	On	On	On	On	
15	H	X	H	H	H	H	H	Off	Off	Off	Off	Off	Off	Off	
BI	X	X	X	X	X	X	L	Off	Off	Off	Off	Off	Off	Off	2
RBI	H	L	L	L	L	L	L	Off	Off	Off	Off	Off	Off	Off	3
LT	L	X	X	X	X	X	H	On	On	On	On	On	On	On	4

H = High level; L = Low level; X = irrelevant.

Notes:

1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.

2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are off regardless of the level of any other input.

3. When ripple-blanking input (RBI) and inputs A, B, C and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output (RBO) goes to a low level (response condition).

4. When the blanking input/ripple blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

* BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

Continued....

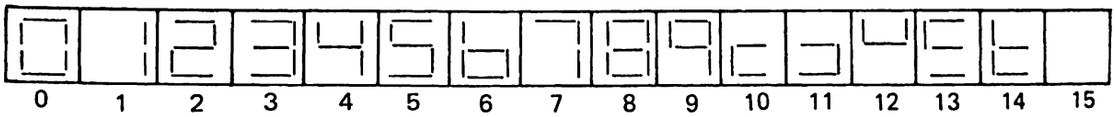
100000263

Continued

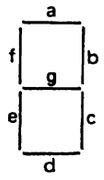
This circuit has full ripple-blanking input/output controls and a lamp test input. Display patterns for BCD input counts above 9 are unique symbols to authenticate input conditions.

Automatic leading and/or trailing-edge zero-blanking control (RBI and RBO) is incorporated in this device. A lamp test (LT) may be performed at any time when the BI/RBO is at a high level. An overriding blanking input (BI) can be used to control the lamp intensity by pulsing or to inhibit the outputs. Inputs and outputs are compatible for use with TTL or DTL logic outputs.

Numerical Designations and Resultant Displays

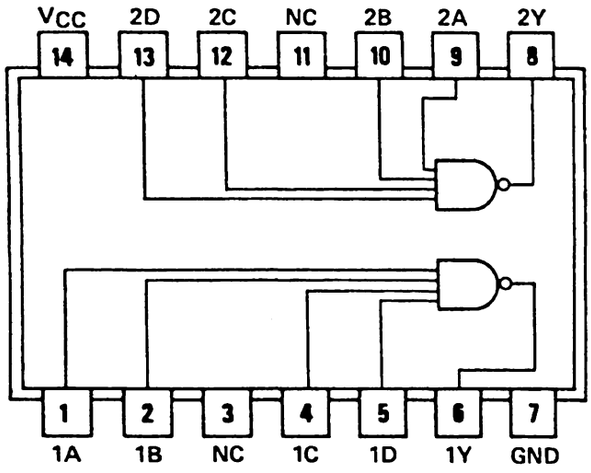


Segment Identification



100000264

Pin Configuration



Dual 4-Input Positive-NAND Buffer

Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

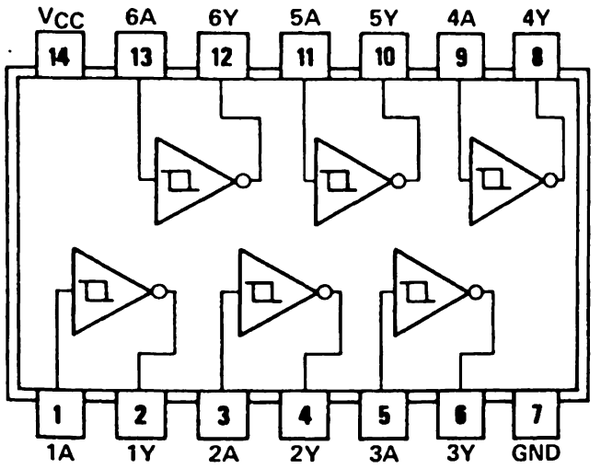
Positive logic: $Y = \overline{ABCD}$

Note: The 100000264 is a Shottky device.

100000265

Hex Schmitt-Trigger Inverter

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14

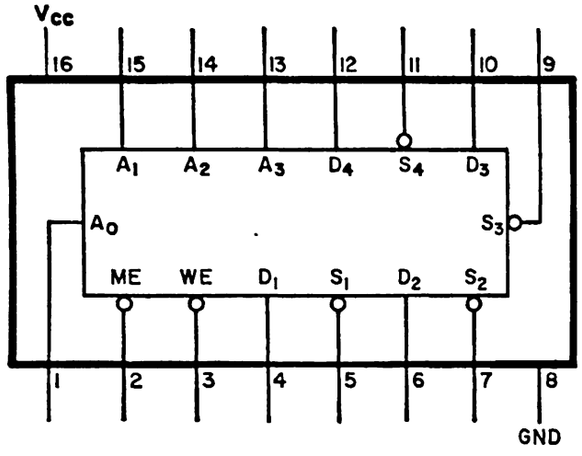
Gnd = Pin 7

Positive logic: $Y = \overline{A}$

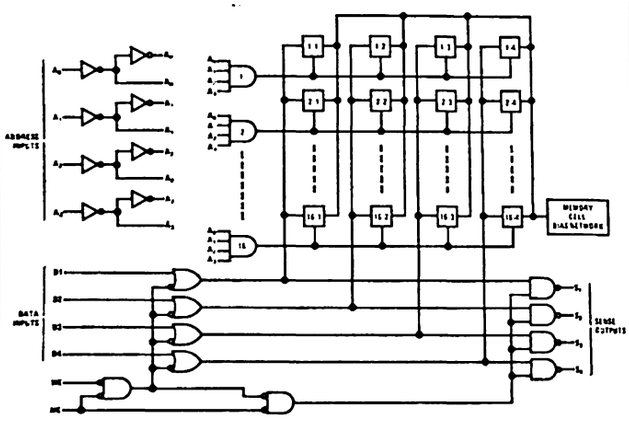
100000266

64-Bit Random Access Read/Write Memory

Pin Configuration



Functional Block Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

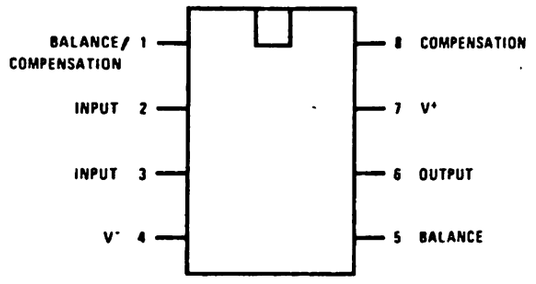
Truth Table

Memory Enable	Write Enable	Operation	Outputs
0	0	Write	Hi-Z State
0	1	Read	Complement of Data Stored in Memory
1	X	Hold	Hi-Z State

The 100000266 is a fully decoded 64-bit RAM organized as 16 4-bit words. The memory is addressed by applying a binary number to the four Address inputs. After addressing, information may be either written into or read from the memory. To write, both the Memory Enable and the Write Enable inputs must be in the logical "0" state. Information applied to the four Write inputs will then be written into the addressed location. To read information from the memory the Memory Enable input must be in the logical "0" state and the Write Enable input in the logical "1" state. Information will be read as the complement of what was written into the memory. When the Memory Enable input is in the logical "1" state, the outputs will go to the high-impedance state. This allows up to 128 memories to be connected to a common bus-line without the use of pull-up resistors. All memories except one are gated into the high-impedance while the one selected memory exhibits the normally totem-pole low impedance output characteristics of TTL.

100000267

Pin Configuration



Operational Amplifier

Pin Designations

V+ = Pin 7

V- = Pin 4

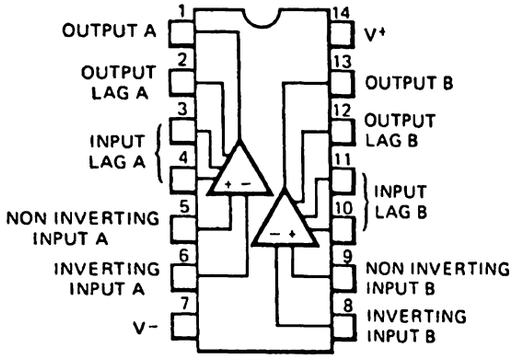
The 100000267 is a general purpose operational amplifier. This amplifier offers overload protection on the input and output, no latch-up when the common mode range is exceeded, freedom from oscillations and compensation with a single 30pF capacitor.

In addition, the circuit can be used as a comparator with differential inputs up to ±30V, and the output can be clamped at any desired level to make it compatible with logic circuits.

100000268

Dual Operational Amplifier

Pin Configuration

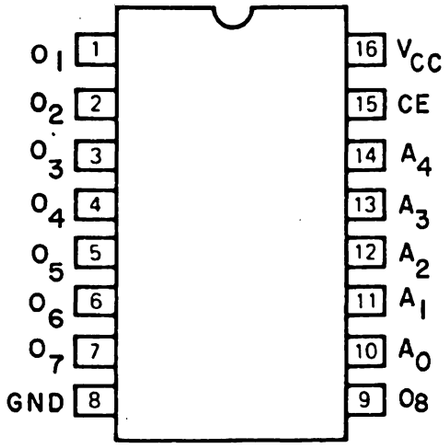


The 100000268 consists of two identical high gain operational amplifiers. These three-stage amplifiers use class A PNP transistor output stages with uncommitted collectors. The outputs may be ORed for use as a dual comparator or they may function as diodes in low threshold rectifying circuits.

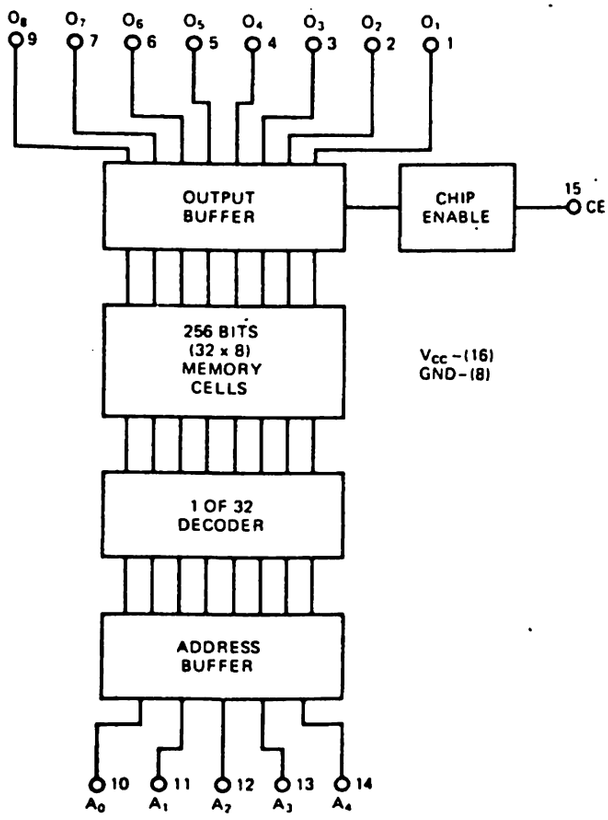
100000140 100000141 100000142 100000148 100000149 100000215 100000216 100000217 100000218 100000219 100000269 100000270 100000271 100000272 100000273 100000274 100000275 100000276 100000277 100000278 100000279 100000280

256-Bit Bipolar Read Only Memory

Pin Configuration



Functional Block Diagram



Logic Diagram/Pin Designations

V_{CC} = Pin 16

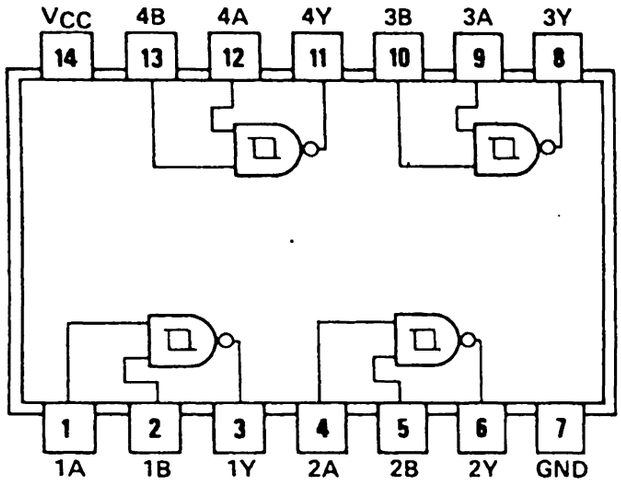
Gnd = Pin 8

These high speed, electrically programmable, fully decoded TTL bipolar 256-bit read only memories are organized as 32 words by 8 bits.

Memory expansion is simple; three-state outputs are provided on the 100000215; uncommitted collector outputs are provided on all other devices. Each device has on-chip address decoding and chip enable. The memory is fabricated with all logic level zeroes(low); logic level ones (high) can be electrically programmed in the selected bit locations. The same address inputs are used for both programming and reading.

100000281

Pin Configuration



Quadruple 2-Input Positive-NAND Schmitt Trigger

Logic Diagram/Pin Designations

V_{CC} = Pin 14

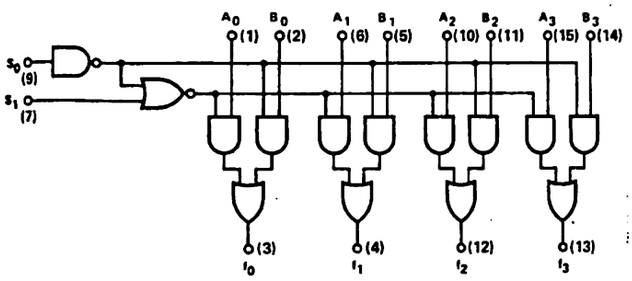
Gnd = Pin 7

Positive logic: $Y = \overline{AB}$

Note: The 100000281 is a Shottky device.

100000282

Logic Diagram



2-Input 4-Bit Digital Multiplexer

Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Truth Table

S_0	S_1	f_n
0	0	B
1	0	A
0	1	B
1	1	0

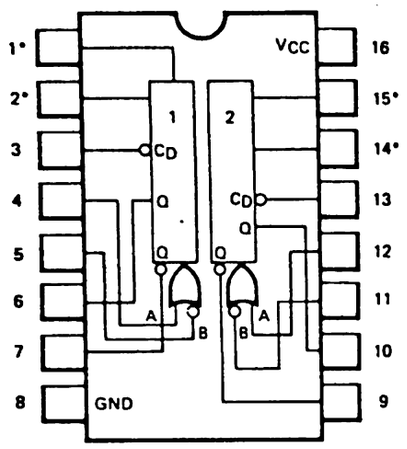
This 2-input, 4-bit digital multiplexer features non-inverting data paths.

The inhibit state $S_0 = S_1 = 1$ can be used to facilitate transfer operations in an arithmetic section.

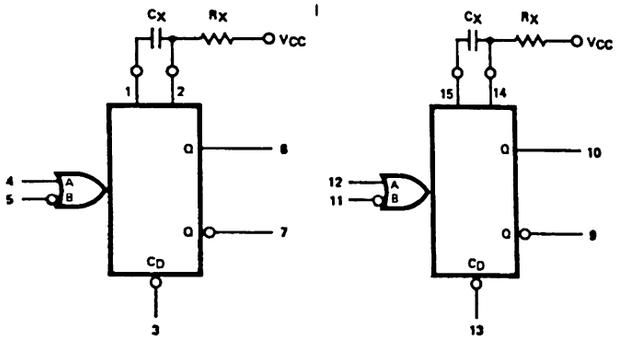
100000283

Low Power Dual Retriggerable Resettable Monostable Multivibrator

Pin Configuration



Functional Schematic



Logic Diagram/Pin Designations

V_{CC} = Pin 16

Gnd = Pin 8

Triggering Truth Table

Pin Numbers			
5(11)	4(12)	3(13)	Operation
H→L	L	H	Trigger
H	L→H	H	Trigger
X	X	L	Reset

Notes:

H = High Voltage Level $\geqslant V_{IH}$

L = Low Voltage Level $\leqslant V_{IL}$

X = Don't Care (either H or L)

H→L = High to Low Voltage Level transition

L→H = Low to High Voltage Level transition

This dual resettable, retriggerable monostable multivibrator has two inputs per function, one active Low and one active High. This allows leading edge of trailing edge triggering. The TTL inputs make triggering independent of input transition times. When input conditions for triggering are met, a new cycle starts and the external capacitor is rapidly discharged and then allowed to charge. An input cycle time shorter than the output cycle time will retrigger this device and result in a continuous true output.

The output pulse may be terminated at any time by connecting the reset pin to a logic level Low. Active pullups are provided on the outputs for good drive capability into capacitive loads.

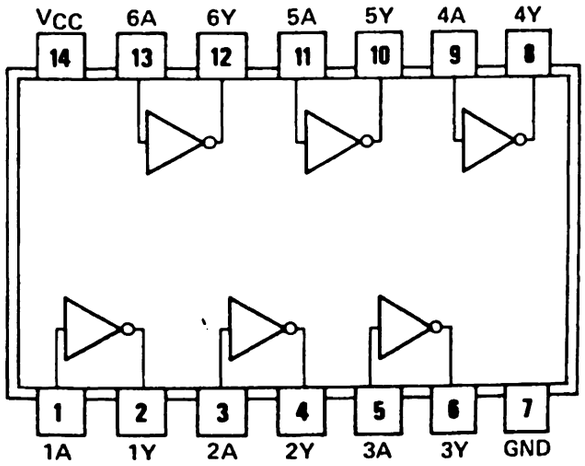
Retriggering may be inhibited by tying the $\overline{Q}$ output to the active level Low input or the Q output to the active level High input.

REV. 02

100000188 100000284

Hex Inverter
With Open-Collector Outputs

Pin Configuration



Logic Diagram/Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7

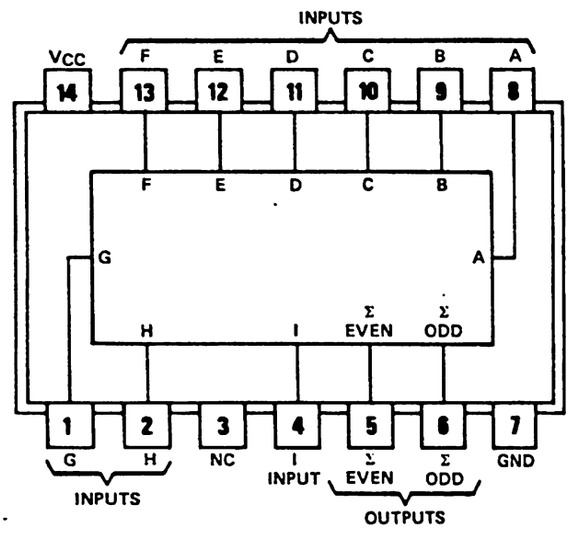
Positive logic: $Y = \overline{A}$

Note: The 100000188 is a Shottky device.

100000287

9-Bit Odd/Even Parity Generator/Checker

Pin Configuration



Pin Designations

V_{CC} = Pin 14
Gnd = Pin 7
NC = No internal connection

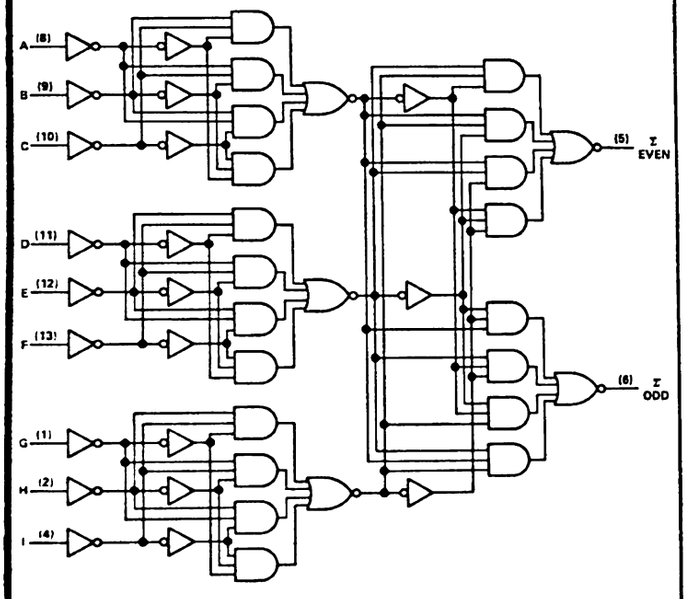
Function Table

Number of Inputs A Thru I That Are High	Outputs Σ Even	Outputs Σ Odd
0, 2, 4, 6, 8	H	L
1, 3, 5, 7, 9	L	H

H = high level
L = low level

This universal, monolithic, nine-bit parity generator/checker utilizes Schottky-clamped TTL circuitry and features odd/even outputs to facilitate operation of either odd or even parity applications. The word-length capability is expanded by cascading.

Logic Diagram

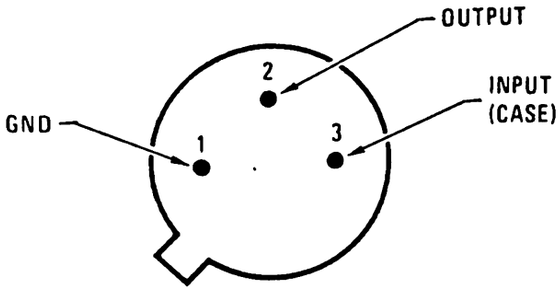


100000290

Three-Terminal Negative Regulator

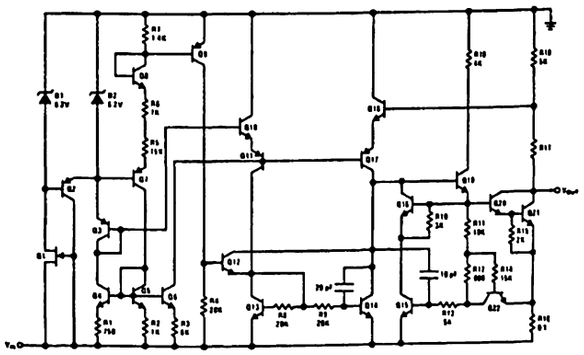
The 100000290 is a three-terminal negative regulator with a fixed output voltage of -12V. This device needs only one external component -- a compensation capacitor at the output.

Pin Configuration
3-Lead Metal Box



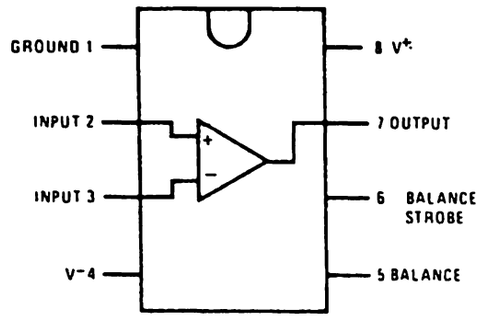
BOTTOM VIEW

Schematic



100000292

Pin Configuration



Voltage Comparator/Buffer

Pin Designations

V+ = Pin 8

V- = Pin 4

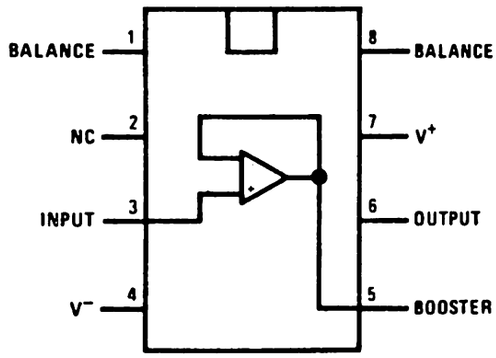
Gnd = Pin 1

This voltage comparator is designed to operate over a wide range of supply voltages. Its output is compatible with RTL, DTL and TTL as well as MOS circuits.

Both the input and output can be isolated from system ground, and the output can drive loads referred to ground, the positive supply or the negative supply. Offset balancing and strobe capability are provided and outputs can be wire OR'd.

100000293

Pin Configuration



Operational Amplifier

Pin Designations

V+ = Pin 7

V- = Pin 4

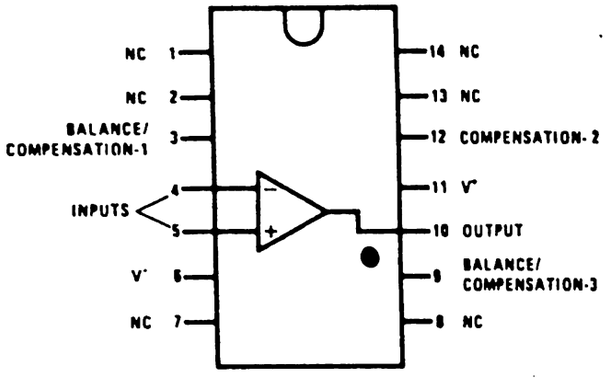
The 100000293 is a monolithic operational amplifier internally connected as a unity-gain non-inverting amplifier. The device has internal frequency compensation and provision for offset balancing.

REV. 02

100000294

Operational Amplifier

Pin Configuration



Pin Designations

V+ = Pin 11

V- = Pin 6

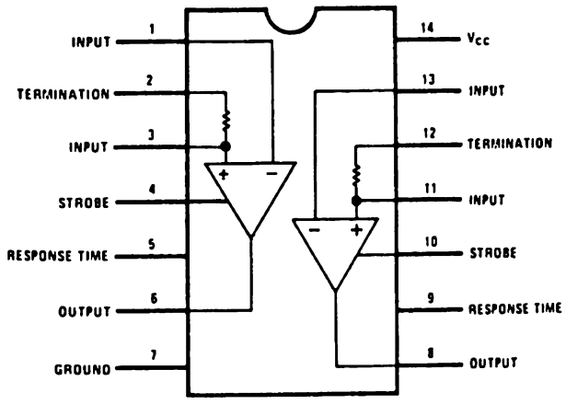
This precision high-speed operational amplifier has internal unity gain frequency compensation, which simplifies its application since no external components are necessary for operation. However, external frequency compensation may be added for optimum performance.

For inverting applications, feed-forward compensation will boost the slew rate to over 150V/μs and almost double the bandwidth. Overcompensation can be used with the amplifier for greater stability when maximum bandwidth is not needed. A single capacitor can be added to reduce the 0.1% settling time to under 1μs.

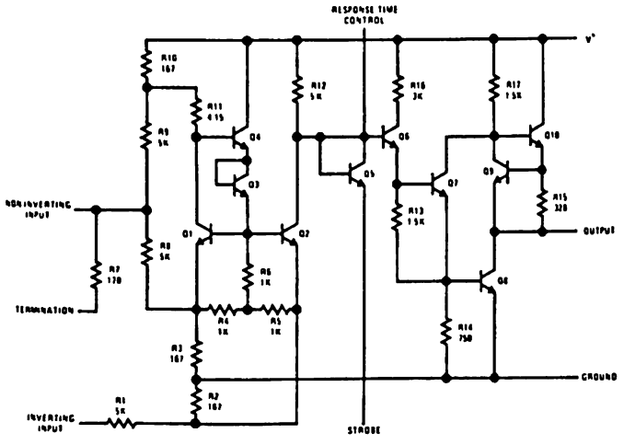
100000295

Dual Line Receiver

Pin Configuration



Schematic



Pin Designations

V_{CC} = Pin 14

Gnd = Pin 7

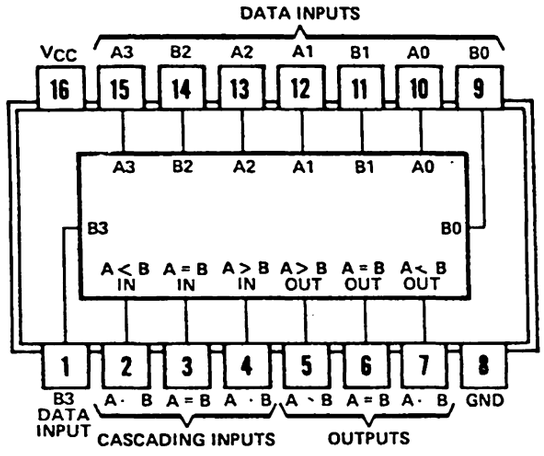
The 100000295 is a digital line receiver. The response time can be controlled with an external capacitor to eliminate noise spikes. The output is directly compatible with RTL, DTL or TTL integrated circuits.

REV. 02

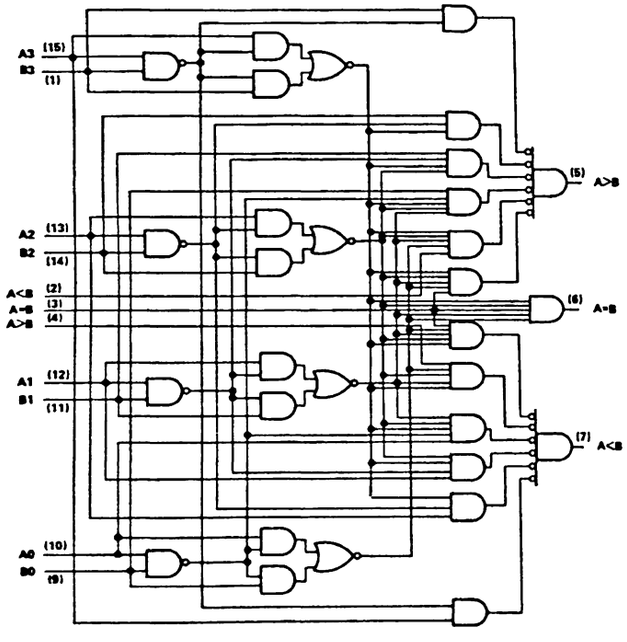
100000296

4-Bit Magnitude Comparator

Pin Configuration



Logic Diagram



Pin Designations

V_{CC} = Pin 16
Gnd = Pin 8

Function Table

Comparing Inputs				Cascading Inputs			Outputs		
A3, B3	A2, B2	A1, B1	A0, B0	A>B	A<B	A=B	A>B	A<B	A=B
A3>B3	X	X	X	X	X	X	H	L	L
A3<B3	X	X	X	X	X	X	L	H	L
A3= B3	A2>B2	X	X	X	X	X	H	L	L
A3= B3	A2<B2	X	X	X	X	X	L	H	L
A3= B2	A2= B2	A1>B1	X	X	X	X	H	L	L
A3= B3	A2= B2	A1<B1	X	X	X	X	L	H	L
A3= B3	A2= B2	A1= B1	A0>B0	X	X	X	H	L	L
A3= B3	A2= B2	A1= B1	A0<B0	X	X	X	L	H	L
A3= B3	A2= B2	A1= B1	A0= B0	H	L	L	H	L	L
A3= B3	A2= B2	A1= B1	A0= B0	L	H	L	L	H	L
A3= B3	A2= B2	A1= B1	A0= B0	L	L	H	L	L	H
A3= B3	A2= B2	A1= B1	A0= B0	X	X	H	L	L	H
A3= B3	A2= B2	A1= B1	A0= B0	H	H	L	L	L	L
A3= B3	A2= B2	A1= B1	A0= B0	L	L	L	H	H	L

H = high level
L = low level
X = irrelevant

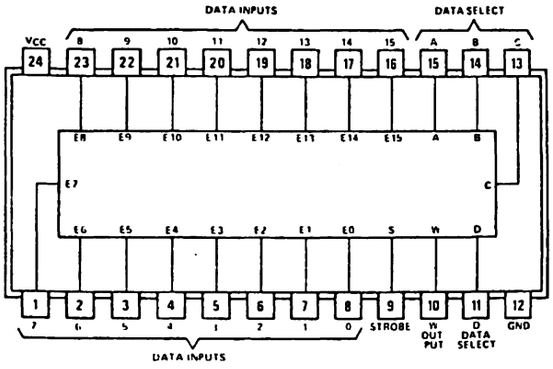
This four-bit magnitude comparator performs comparison of straight binary and straight BCD (8-4-2-1) codes. Three fully decoded decisions for two 4-bit words (A, B) are made and are externally available at three outputs. This device is fully expandable to any number of bits without external gates. Words of greater length may be compared by connecting comparators in cascade. The A>B, A<B, and A=B outputs of a stage handling less-significant bits are connected to the corresponding A>B, A<B, and A=B inputs of the next stage handling more-significant bits. The stage handling the least-significant bits must have a high-level voltage applied to the A=B input.

Note: The 100000296 is a Shottky device.

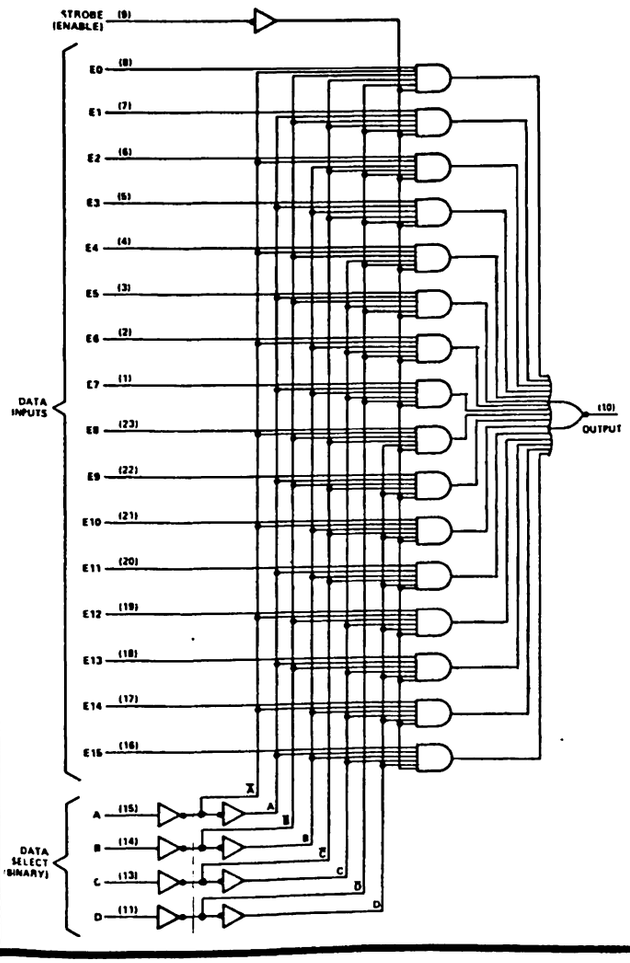
100000297

Data Selector/Multiplexer

Pin Configuration



Logic Diagram



Pin Designations

V_{CC} = Pin 24

Gnd = Pin 12

Function Table

Inputs					
Select				Strobe	Output
D	C	B	A	S	W
X	X	X	X	H	H
L	L	L	L	L	$\overline{E0}$
L	L	L	H	L	$\overline{E1}$
L	L	H	L	L	$\overline{E2}$
L	L	H	H	L	$\overline{E3}$
L	H	L	L	L	$\overline{E4}$
L	H	L	H	L	$\overline{E5}$
L	H	H	L	L	$\overline{E6}$
L	H	H	H	L	$\overline{E7}$
H	L	L	L	L	$\overline{E8}$
H	L	L	H	L	$\overline{E9}$
H	L	H	L	L	$\overline{E10}$
H	L	H	H	L	$\overline{E11}$
H	H	L	L	L	$\overline{E12}$
H	H	L	H	L	$\overline{E13}$
H	H	H	L	L	$\overline{E14}$
H	H	H	H	L	$\overline{E15}$

H = high level, L = low level, X = irrelevant.

$\overline{E0}$, $\overline{E1}$ .... $\overline{E15}$ = the complement of the level of the respective E input.

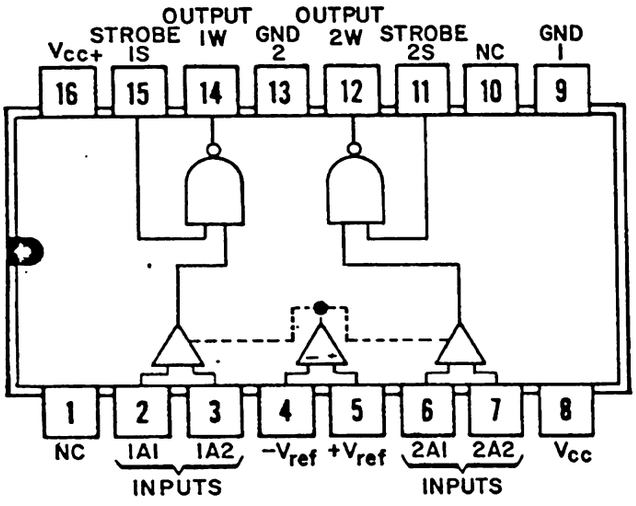
This monolithic data selector/multiplexer contains full on-chip binary decoding to select one-of-sixteen data sources. The strobe input must be at a low logic level to enable this device. A high level at the strobe forces the W output high and the Y output low. The 100000297 has an inverted (W) output only.

REV. 02

100000118 100000229
100000298 100000299

Dual Sense Amplifiers

Pin Configuration



Logic Diagram/Pin Designations

V_{CC+} = Pin 16

V_{CC} = Pin 8

Gnd 1 = Pin 9

Gnd 2 = Pin 13

NC = No internal connection

Positive logic: $W = \overline{AS}$

Truth Table

Inputs		Output
A	S	W
H	H	L
L	X	H
X	L	H

Definition of logic levels:

Input	H	L	X
A*	$V_{ID} \geqslant V_{Tmax}$	$V_{ID} \leqslant V_{Tmin}$	Irrelevant
S	$V_I \geqslant V_{IHmin}$	$V_I \leqslant V_{ILmax}$	Irrelevant

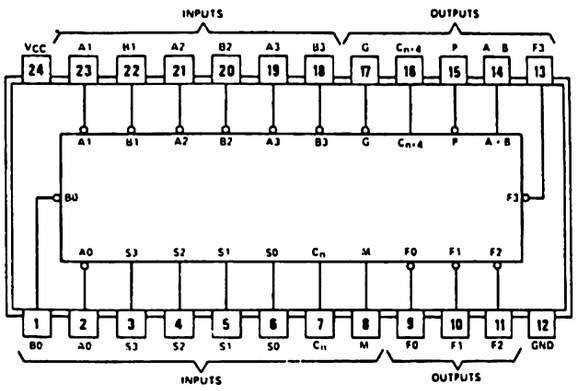
* A is a differential voltage (V_{ID}) between A1 and A2. For these circuits, V_{ID} is considered positive regardless of which terminal is positive with respect to the other.

REV. 02

100000084 100000169 100000306

Arithmetic Logic Units/Function Generators

Pin Configuration



Pin Designations

Designation	Pin Nos.	Function
A3, A2, A1, A0	19, 21, 23, 2	Word A Inputs
B3, B2, B1, B0	18, 20, 22, 1	Word B Inputs
S3, S2, S1, S0	3, 4, 5, 6	Function-Select Inputs
C_n	7	Inv. Carry Input
M	8	Mode Control Input
F3, F2, F1, F0	13, 11, 10, 9	Function Outputs
A=B	14	Comparator Output
P	15	Carry Propagate Output
C_{n+4}	16	Inv. Carry Output
G	17	Carry Generate Output
V_{CC}	24	Supply Voltage
Gnd	12	Ground

These arithmetic logic units (ALU)/function generators have a complexity of 75 equivalent gates on a monolithic chip, and perform 16 binary arithmetic operations on two 4-bit words as shown in Tables 1 and 2. These operations are selected by the four function-select lines (S0, S1, S2, S3) and include addition, subtraction, decrement and straight transfer. When performing arithmetic manipulations, the internal carries must be enabled by applying a low-level voltage to the mode control input (M). A full carry look-ahead scheme is made available for fast, simultaneous carry generation by means of two cascade-outputs (pins 15 and 17) for the four bits in the package. When used in conjunction with 100000100 or 100000170, full carry look-ahead circuits, high-speed arithmetic operations can be performed. If high speed is not of importance, a ripple-carry input (C_n) and a ripple-carry output (C_{n+4}) are available. However, the ripple-carry delay is minimized so that arithmetic manipulations for small word lengths can be performed without external circuitry.

These devices will accommodate active-high or active-low data if the pin designations are interpreted as follows:

Continued.....

100000084 100000169 100000306

Continued

Table 1

Selection S3 S2 S1 S0	M = H Logic Functions	Active-High Data M = L: Arithmetic Operations	
		C_n = H (no carry)	C_n = L (with carry)
L L L L	$F = \overline{A}$	F = A	F = A Plus 1
L L L H	$F = \overline{A + B}$	F = A + B	F = (A + B) Plus 1
L L H L	$F = \overline{A}B$	$F = A + \overline{B}$	$F = (A + \overline{B})$ Plus 1
L L H H	F = 0	F = Minus 1 (2's Compl)	F = Zero
L H L L	$F = \overline{AB}$	$F = A$ Plus $A\overline{B}$	$F = A$ Plus $A\overline{B}$ Plus 1
L H L H	$F = \overline{B}$	$F = (A + B)$ Plus $A\overline{B}$	$F = (A + B)$ Plus $A\overline{B}$ Plus 1
L H H L	$F = A \oplus B$	F = A Minus B Minus 1	F = A Minus B
L H H H	$F = A\overline{B}$	$F = A\overline{B}$ Minus 1	$F = A\overline{B}$
H L L L	$F = \overline{A} + B$	F = A Plus AB	F = A Plus AB Plus 1
H L L H	$F = \overline{A \oplus B}$	F = A Plus B	F = A Plus B Plus 1
H L H L	F = B	$F = (A + \overline{B})$ Plus AB	$F = (A + \overline{B})$ Plus AB Plus 1
H L H H	F = AB	F = AB Minus 1	F = AB
H H L L	F = 1	F = A Plus A*	F = A Plus A Plus 1
H H L H	$F = A + \overline{B}$	$F = (A + B)$ Plus A	$F = (A + B)$ Plus A Plus 1
H H H L	F = A + B	$F = (A + \overline{B})$ Plus A	$F = (A + \overline{B})$ Plus A Plus 1
H H H H	F = A	F = A Minus 1	F = A

* Each bit is shifted to the next more significant position.

Table 2

Selection S3 S2 S1 S0	M = H Logic Functions	Active-Low Data M = L: Arithmetic Operations	
		C_n = L (no carry)	C_n = H (with carry)
L L L L	$F = \overline{A}$	F = A Minus 1	F = A
L L L H	$F = \overline{AB}$	F = AB Minus 1	F = AB
L L H L	$F = \overline{A} + B$	$F = A\overline{B}$ Minus 1	$F = A\overline{B}$
L L H H	F = 1	F = Minus 1 (2's Comp)	F = Zero
L H L L	$F = \overline{A + B}$	$F = A$ Plus $(A + \overline{B})$	$F = A$ Plus $(A + \overline{B})$ Plus 1
L H L H	$F = \overline{B}$	$F = AB$ Plus $(A + \overline{B})$	$F = AB$ Plus $(A + \overline{B})$ Plus 1
L H H L	$F = \overline{A \oplus B}$	F = A Minus B Minus 1	F = A Minus B
L H H H	$F = A + \overline{B}$	$F = A + \overline{B}$	$F = (A + \overline{B})$ Plus 1
H L L L	$F = \overline{A}B$	$F = A$ Plus $(A + B)$	$F = A$ Plus $(A + B)$ Plus 1
H L L H	$F = A \oplus B$	F = A Plus B	F = A Plus B Plus 1
H L H L	F = B	$F = A\overline{B}$ Plus $(A + B)$	$F = A\overline{B}$ Plus $(A + B)$ Plus 1
H L H H	F = A + B	F = A + B	$F = (A + B)$ Plus 1
H H L L	F = 0	F = A Plus A*	F = A Plus A Plus 1
H H L H	$F = A\overline{B}$	F = AB Plus A	F = AB Plus A Plus 1
H H H L	F = AB	$F = A\overline{B}$ Plus A	$F = A\overline{B}$ Plus A Plus 1
H H H H	F = A	F = A	F = A Plus 1

* Each bit is shifted to the next more significant position.

Continued....

Pin No.	Active-high data Table 1	Active-low data Table 2
2	A_0	$\overline{A}_0$
1	B_0	$\overline{B}_0$
23	A_1	$\overline{A}_1$
22	B_1	$\overline{B}_1$
21	A_2	$\overline{A}_2$
20	B_2	$\overline{B}_2$
19	A_3	$\overline{A}_3$
18	B_3	$\overline{B}_3$
9	F_0	$\overline{F}_0$
10	F_1	$\overline{F}_1$
11	F_2	$\overline{F}_2$
13	F_3	$\overline{F}_3$
7	$\overline{C}_n$	C_n
16	$\overline{C}_{n+4}$	C_{n+4}
15	X	$\overline{P}$
17	Y	$\overline{G}$

Subtraction is accomplished by 1's complement addition where the 1's complement of the subtrahend is generated internally. The resultant output is A-B-1, which requires an end-around or forced carry to provide A-B.

These devices can also be utilized as comparators. The A=B output is internally decoded from the function outputs (F0, F1, F2, F3) so that when two words of equal magnitude are applied at the A and B inputs, it will assume a high level to indicate equality (A = B). The ALU should be in the subtract mode with C_n = H when performing this comparison. The A = B output is open-collector so that it can be wire-AND connected to give a comparison for more than four bits. The carry output (C_{n+4}) can also be used to supply relative magnitude information. Again, the ALU should be placed in the subtract mode by placing the function select inputs S3, S2, S1, S0 at L, H, H, L, respectively.

Input C_n	Output C_{n+4}	(Figure 1) Active-high Data	(Figure 2) Active-low Data
H	H	$A \leqslant B$	$A \geqslant B$
H	L	$A > B$	$A < B$
L	H	$A < B$	$A > B$
L	L	$A \geqslant B$	$A \leqslant B$

100000084 100000169 100000306

Continued

Figure 1

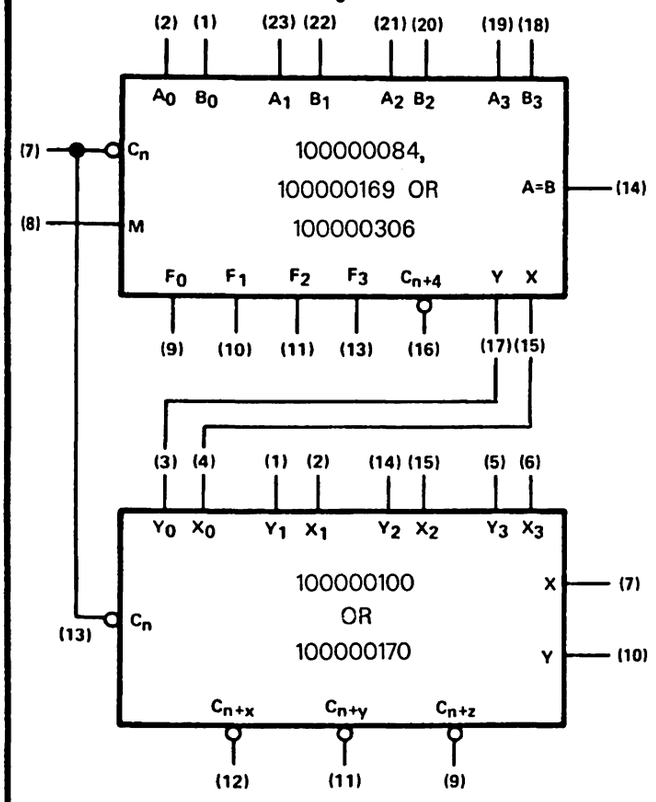
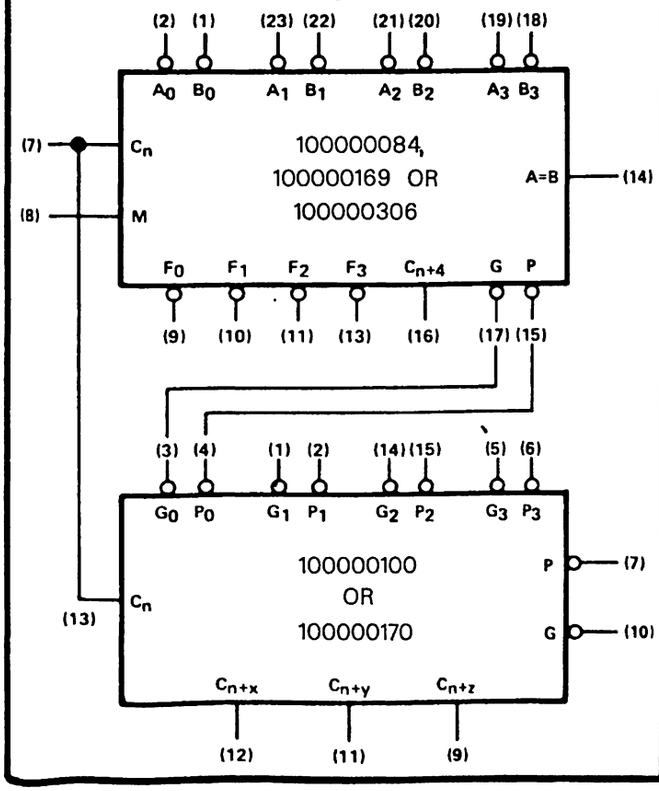


Figure 2



These circuits have been designed to provide 16 possible functions of two Boolean variables without the use of external circuitry. These logic functions are selected by use of the four function-select inputs (S0, S1, S2, S3) with the mode-control input (M) at a high level to disable the internal carry. The 16 logic functions are detailed in Tables 1 and 2 and include exclusive-OR, NAND, AND, NOR and OR functions.

ALU Signal Designations

These devices can be used with the signal designations of either Figure 1 or Figure 2. The logic functions and arithmetic operations obtained with the signal designations of Figure 1 are given in Table 1; those obtained with the signal designations of Figure 2 are given in Table 2.

Note: The 100000169 is a Shottky device.

PART NUMBER	REV	DESCRIPTION
101000002	00	DIODE CD81148/FDH600
101000003	00	XISTOR 2N4125
101000004	00	XISTOR 2N4441
101000006	00	XISTOR 2N4922
101000015	00	XISTOR 2N3725
101000016	00	XISTOR 2N4123
101000017	00	DIODE 1N5231
101000019	00	XISTOR 2N5302
101000021	00	XISTOR 2N3715
101000022	00	DIODE 1N4997
101000023	00	DIODE BRIDGE MDA 962-1
101000024	00	DIODE MDA 950-1
101000026	00	DIODE 1N3879R
101000027	00	DIODE 1N5231 20%
101000028	00	DIODE 1N5240
101000031	00	DIODE ZENER 1N5248B 18V 5%
101000032	00	DIODE 1N5228B
101000038	00	XISTOR 40526/40691 TRIAC
101000039	00	XISTOR SC45B TRIAC
101000045	00	XISTOR MPS 3646/2N3646
101000046	00	XISTOR TZ8065
101000049	00	DIODE 1N52438
101000050	00	DIODE CD332864/.5N5/.1ZS1 1%
101000051	00	XISTOR MPS3640
101000052	00	XISTOR 2N4403
101000058	00	DIODE 1N5250B 20V 1%
101000059	00	XISTOR 2N3789
101000061	00	XISTOR 2N4919
101000062	01	XISTOR DG5022
101000063	00	XISTOR 2N4399 PNP PWR
101000064	00	XISTOR D43C5 PNP
101000065	00	DIODE 1N3899R 20AMP
101000066	00	DIODE MDA 970-1FW BRIDGE
101000067	00	DIODE ZENER 1N5234B 6.2V
101000068	00	DIODE MDA 962A-1
101000069	00	DIODE 1N52358/1N754A GLASS
101000070	00	XISTOR 2N4400
101000071	00	DIODE ZENER 1N5251B 22V 5%
101000072	00	DIODE 1N52528/.5M24ZSE 2%
101000073	00	XISTOR TIP 34
101000074	00	XISTOR TIP 36 PNP
101000075	00	DIODE 1N4001
101000076	00	DIODE L209 (LED) LIGHT ADMITTING
101000077	00	XISTOR TIP 31 NPN
101000079	00	XISTOR 40668
101000081	00	DIODE 1N53488
101000082	00	XISTOR GED 45C5
101000083	00	XISTOR 2N4398
101000084	00	DIODE 1N3909R
101000085	00	DIODE 1N3469
101000086	00	DIODE ZENER 1N5248 18V 10%
101000087	00	DIODE ZENER 1N5348 11V
101000088	00	XISTOR 2N2646
101000089	00	DIODE 1N5241B
101000090	00	DIODE 1N5225B
101000091	00	RECT BRDG MOTOROLA MDA 990-1
101000092	00	DIODE 1N4003
101000093	00	DIODE 5245
101000094	00	XISTOR MPS A13
101000097	00	XISTOR CN3566
101000098	00	XISTOR 2N6005
101000099	00	XISTOR 2N6010
101000100	00	DIODE 1N5349
101000101	00	MDA 980-1 BRIDGE RECTIFIER
101000102	00	DIODE 1N3889R
101000103	00	DIODE 1N5231B ZENER
101000104	00	XISTOR TIP 30
101000105	00	XISTOR TIP 29
101000106	00	XISTOR TIP 35
101000107	00	DIODE 40108
101000108	00	DIODE 1N4448
101000109	00	XISTOR TIP 36B
101000110	00	DIODE 1N5242
101000111	00	XISTOR TIP 42A W/INSUL H/W
101000112	00	DIODE 1N5341
101000114	00	DIODE CD4148
101000115	00	XISTOR TEXAS INST TIP33
101000116	00	DIODE MOTOROLA MR1210SL
101000120	00	DIODE 1N4004
101000121	00	MR 1200 50A SILICON RECTIFIER
101000122	00	XISTOR 2N6164
101000123	00	XISTOR TIP 29A
101000124	00	XISTOR TIP 31A
101000125	00	DIODE 1N5347
101000126	00	DIODE 1N5355
101000127	01	XISTOR PHOTO NPN PLANAR SILICON
101000128	00	XISTOR TIP 36A
101000129	00	XISTOR 40669
101000130	00	XISTOR 40527/40692/L4001,5
101000131	00	DIODE 1N3880
101000132	01	DIODE NETWORK 4-CD8(148)
101000133	00	RECT MR 1210SL 80A SILICON RECT
101000134	00	DIODE ZENER 7.5V 1% .5M7.5ZS1
101000135	00	DIODE MR831 MOTOROLA

PART NUMBER	REV	DESCRIPTION
101000136	00	DIODE 1N5236B
101000137	00	XISTOR TIP 141
101000138	00	XISTOR TIP 146
101000139	00	DIODE 1N4735
101000140	00	XISTOR 2N4393
101000141	00	DIODE ZENER 1N5239B
101000142	00	DIODE RECTIFIER 1N4933 MOTOROLA
101000143	00	DIODE ZENER 1N5347B 10V 5W +5-5%
101000144	00	DIODE ZENER 1N5238B 8.7V 5%
101000145	00	DIODE 1N5259
101000146	00	DIODE 1N4947
101000147	00	DIODE 1N5438B
101000148	00	DIODE 1N4934
101000149	00	DIODE ZENER IN4754
101000150	00	DIODE ZENER IN52298
101000151	00	DIODE MLED500
101000152	00	XISTOR SC45D TRIAC
101000153	00	XISTOR TIP 35A
101000154	00	XISTOR KE4393 TYPE FET
101000155	00	XISTOR 2N4059
101000156	00	DIODE LED RT ANGLE (HP#5082-4415)
101000157	00	XISTOR TIP 48
101000158	00	XISTOR MPS A-42
101000159	00	XISTOR MPS A-92
101000160	00	XISTOR 2N4888
101000161	00	DIODE IN4007 1000V
101000162	00	DIODE IN5223
101000163	00	DIODE ZENER 1N5342B
101000164	00	XISTOR MJE 1100
101000165	00	TRIAC 40663 (30A STUDMTG)
101000166	00	XISTOR PWR PUP
101000167	00	XISTOR PWR NPN
101000168	00	XISTOR D45H4 PNP
101000169	00	XISTOR TA8327 PNP
101000170	00	XISTOR NJE 2955 PNP
101000171	00	XISTOR RCA TIP 31 NPN
101000172	00	XISTOR D44C5 NPN
101000173	00	XISTOR 2N6122 NPN
101000174	00	XISTOR 2N6125 NPN
101000175	00	XISTOR D45H7 PNP
101000176	00	XISTOR 2N6133 PNP
101000177	00	DIODE IN53438 ZENER
101000178	00	XISTOR 2N6126 PNP
101000179	00	XISTOR D44H7 NPN
101000180	00	XISTOR 2N5883 PNP
101000181	00	XISTOR 2N3772 PNP
101000182	00	XISTOR EP1285 NPN
101000183	00	XISTOR 2N6129 NPN
101000184	00	XISTOR 2N5987 PNP
101000185	00	DIODE ZENER 1N5221B
101000186	00	DIODE ZENER 1N5222B
101000187	00	DIODE ZENER 1N5223B
101000188	00	DIODE ZENER 1N5224B
101000189	00	DIODE ZENER 1N5226B
101000190	00	DIODE ZENER 1N5227B
101000191	00	DIODE ZENER 1N5230B
101000192	00	DIODE ZENER 1N5232B
101000193	00	DIODE ZENER 1N5233B
101000194	00	DIODE ZENER 1N5237B
101000195	00	DIODE ZENER 1N5240B
101000196	00	DIODE ZENER 1N5242B
101000197	00	DIODE ZENER 1N5244B
101000198	00	DIODE ZENER 1N5245B
101000199	00	XISTOR TIP 41B NPN PWR
101000200	00	XISTOR RCA 41B NPN POWER
101000201	00	XISTOR 2N6131 UPN POWER
101000202	00	XISTOR RCA 42A PNP POWER
101000204	00	XISTOR BF 338
101000205	00	XISTOR BDY 95
101000206	00	XISTOR PHOTO OP 640
101000207	00	DIODE ZENER 9.1V 5W +5% IN5346B
101000208	00	DIODE TIL209A (LED) LT ADMTG
101000209	00	XISTOR 2N3906
101000210	00	XISTOR 2N3904
101000211	00	DIODE 1N5246
101000212	00	XISTOR 2N4442
101000213	00	XISTOR TD 101 NPN DUAL
101000214	00	XISTOR 2N2219 NPN
101000215	00	XISTOR 2N3053 PNP
101000216	00	XISTOR 2N3055 NPN
101000217	00	XISTOR 2N4037 PNP
101000218	00	XISTOR MPS U51 NPN
101000219	00	XISTOR 2N3771 NPN
101000220	00	DIODE IN 914 ITT-600DPD
101000221	00	DIODE IN 752
101000222	00	DIODE IN4736A
101000223	00	DIODE IN3208
101000224	00	DIODE IN5221
101000225	00	DIODE SCR RCA 40654
101000226	00	DIODE RECT BRAKE ASSY
101000227	00	XISTOR MJE 2955
101000228	00	XISTOR MJE 3055
101000229	00	DIODE SZ 3V1 2 W1N52
101000230	00	XISTOR 2N 3643

PART NUMBER	REV	DESCRIPTION
101000231	00	XISTOR 2N5189
101000232	00	XISTOR 2N 4916
101000233	00	XISTOR 2N 3644
101000234	00	DIODE A14F
101000235	00	XISTOR MPS U01
101000236	00	XISTOR MPS U51 SELECTED
101000237	00	DIODE RECT UCC ASR 33
101000238	00	XISTOR TTY UCC ASR 33
101000239	00	XISTOR TTY
101000240	00	XISTOR 2N5022 FOR NOVA 2
101000241	00	XISTOR MDA 980-2 BRIDGE
101000242	00	DIODE HOT CARRIER HEWLETT-PACKARD
101000243	00	TRIAC 2N6165
101000244	00	XISTOR HAMMER DRIVE 2310
101000245	00	XISTOR 2310
101000246	00	XISTOR 2310
101000247	00	XISTOR 2310
101000248	00	XISTOR 2310
101000249	00	XISTOR 2310
101000250	00	XISTOR 2310
101000251	00	XISTOR THYRISTOR 2310
101000252	00	XISTOR THYRISTOR 2310
101000253	00	XISTOR 2N683
101000254	00	XISTOR THYRISTOR 2310
101000255	00	DIODE 2310
101000256	00	DIODE HAMMER PR 2310
101000257	00	DIODE AENER 2310
101000258	00	DIODE 2310
101000259	00	DIODE 2310
101000260	00	DIODE 2310
101000261	00	XISTOR 2N4249
101000262	00	XISTOR 2N3565
101000263	00	DIODE 3A200
101000264	00	DIODE 1N5231B
101000265	00	DIODE TVPE125
101000266	00	DIODE 1N2069A
101000267	00	DIODE 1N4748A ZENER

PART NUMBER	REV	DESCRIPTION				
102000001	00	RES	2.70	OHM	1/4W	5%
102000002	00	RES	3.00	OHM	1/4W	5%
102000003	00	RES	3.30	OHM	1/4W	5%
102000004	00	RES	3.60	OHM	1/4W	5%
102000005	00	RES	3.90	OHM	1/4W	5%
102000006	00	RES	4.30	OHM	1/4W	5%
102000007	00	RES	4.70	OHM	1/4W	5%
102000008	00	RES	5.10	OHM	1/4W	5%
102000009	00	RES	5.60	OHM	1/4W	5%
102000010	00	RES	6.20	OHM	1/4W	5%
102000011	00	RES	6.80	OHM	1/4W	5%
102000012	00	RES	7.50	OHM	1/4W	5%
102000013	00	RES	8.20	OHM	1/4W	5%
102000014	00	RES	9.10	OHM	1/4W	5%
102000015	00	RES	10.00	OHM	1/4W	5%
102000016	00	RES	11.00	OHM	1/4W	5%
102000017	00	RES	12.00	OHM	1/4W	5%
102000018	00	RES	13.00	OHM	1/4W	5%
102000019	00	RES	15.00	OHM	1/4W	5%
102000020	00	RES	16.00	OHM	1/4W	5%
102000021	00	RES	18.00	OHM	1/4W	5%
102000022	00	RES	20.00	OHM	1/4W	5%
102000023	00	RES	22.00	OHM	1/4W	5%
102000024	00	RES	24.00	OHM	1/4W	5%
102000025	00	RES	27.00	OHM	1/4W	5%
102000026	00	RES	30.00	OHM	1/4W	5%
102000027	00	RES	33.00	OHM	1/4W	5%
102000028	00	RES	36.00	OHM	1/4W	5%
102000029	00	RES	39.00	OHM	1/4W	5%
102000030	00	RES	43.00	OHM	1/4W	5%
102000031	00	RES	47.00	OHM	1/4W	5%
102000032	00	RES	51.00	OHM	1/4W	5%
102000033	00	RES	56.00	OHM	1/4W	5%
102000034	00	RES	62.00	OHM	1/4W	5%
102000035	00	RES	68.00	OHM	1/4W	5%
102000036	00	RES	75.00	OHM	1/4W	5%
102000037	00	RES	82.00	OHM	1/4W	5%
102000038	00	RES	91.00	OHM	1/4W	5%
102000039	00	RES	100.00	OHM	1/4W	5%
102000040	00	RES	110.00	OHM	1/4W	5%
102000041	00	RES	120.00	OHM	1/4W	5%
102000042	00	RES	130.00	OHM	1/4W	5%
102000043	00	RES	150.00	OHM	1/4W	5%
102000044	00	RES	160.00	OHM	1/4W	5%
102000045	00	RES	180.00	OHM	1/4W	5%
102000046	00	RES	200.00	OHM	1/4W	5%
102000047	00	RES	220.00	OHM	1/4W	5%
102000048	00	RES	240.00	OHM	1/4W	5%
102000049	00	RES	270.00	OHM	1/4W	5%
102000050	00	RES	300.00	OHM	1/4W	5%
102000051	00	RES	330.00	OHM	1/4W	5%
102000052	00	RES	360.00	OHM	1/4W	5%
102000053	00	RES	390.00	OHM	1/4W	5%
102000054	00	RES	430.00	OHM	1/4W	5%
102000055	00	RES	470.00	OHM	1/4W	5%
102000056	00	RES	510.00	OHM	1/4W	5%
102000057	00	RES	560.00	OHM	1/4W	5%
102000058	00	RES	620.00	OHM	1/4W	5%
102000059	00	RES	680.00	OHM	1/4W	5%
102000060	00	RES	750.00	OHM	1/4W	5%
102000061	00	RES	820.00	OHM	1/4W	5%
102000062	00	RES	910.00	OHM	1/4W	5%
102000063	00	RES	1.00K	OHM	1/4W	5%
102000064	00	RES	1.10K	OHM	1/4W	5%
102000065	00	RES	1.20K	OHM	1/4W	5%
102000066	00	RES	1.30K	OHM	1/4W	5%
102000067	00	RES	1.50K	OHM	1/4W	5%
102000068	00	RES	1.60K	OHM	1/4W	5%
102000069	00	RES	1.80K	OHM	1/4W	5%
102000070	00	RES	2.00K	OHM	1/4W	5%
102000071	00	RES	2.20K	OHM	1/4W	5%
102000072	00	RES	2.40K	OHM	1/4W	5%
102000073	00	RES	2.70K	OHM	1/4W	5%
102000074	00	RES	3.00K	OHM	1/4W	5%
102000075	00	RES	3.30K	OHM	1/4W	5%
102000076	00	RES	3.60K	OHM	1/4W	5%
102000077	00	RES	4.30K	OHM	1/4W	5%
102000078	00	RES	4.70K	OHM	1/4W	5%
102000079	00	RES	5.10K	OHM	1/4W	5%
102000080	00	RES	5.60K	OHM	1/4W	5%
102000081	00	RES	6.20K	OHM	1/4W	5%
102000082	00	RES	6.80K	OHM	1/4W	5%
102000083	00	RES	7.50K	OHM	1/4W	5%
102000084	00	RES	8.20K	OHM	1/4W	5%
102000085	00	RES	9.10K	OHM	1/4W	5%
102000086	00	RES	10.00K	OHM	1/4W	5%
102000087	00	RES	11.00K	OHM	1/4W	5%
102000088	00	RES	12.00K	OHM	1/4W	5%
102000089	00	RES	13.00K	OHM	1/4W	5%
102000090	00	RES	15.00K	OHM	1/4W	5%
102000091	00	RES	16.00K	OHM	1/4W	5%
102000092	00	RES	18.00K	OHM	1/4W	5%
102000093	00	RES	20.00K	OHM	1/4W	5%
102000094	00	RES	22.00K	OHM	1/4W	5%
102000095	00	RES	24.00K	OHM	1/4W	5%
102000096	00	RES	27.00K	OHM	1/4W	5%
102000097	00	RES	30.00K	OHM	1/4W	5%
102000098	00	RES	33.00K	OHM	1/4W	5%
102000099	00	RES	36.00K	OHM	1/4W	5%
102000100	00	RES	39.00K	OHM	1/4W	5%
102000101	00	RES	43.00K	OHM	1/4W	5%
102000102	00	RES	47.00K	OHM	1/4W	5%
102000103	00	RES	51.00K	OHM	1/4W	5%
102000104	00	RES	56.00K	OHM	1/4W	5%
102000105	00	RES	62.00K	OHM	1/4W	5%
102000106	00	RES	68.00K	OHM	1/4W	5%
102000107	00	RES	75.00K	OHM	1/4W	5%
102000108	00	RES	82.00K	OHM	1/4W	5%
102000109	00	RES	91.00K	OHM	1/4W	5%
102000110	00	RES	100.00K	OHM	1/4W	5%
102000111	00	RES	110.00K	OHM	1/4W	5%
102000112	00	RES	120.00K	OHM	1/4W	5%
102000113	00	RES	130.00K	OHM	1/4W	5%
102000114	00	RES	150.00K	OHM	1/4W	5%
102000115	00	RES	116.00K	OHM	1/4W	5%
102000116	00	RES	118.00K	OHM	1/4W	5%
102000117	00	RES	200.00K	OHM	1/4W	5%
102000118	00	RES	220.00K	OHM	1/4W	5%
102000119	00	RES	240.00K	OHM	1/4W	5%
102000120	00	RES	270.00K	OHM	1/4W	5%
102000121	00	RES	300.00K	OHM	1/4W	5%
102000122	00	RES	330.00K	OHM	1/4W	5%
102000123	00	RES	360.00K	OHM	1/4W	5%
102000124	00	RES	390.00K	OHM	1/4W	5%
102000125	00	RES	430.00K	OHM	1/4W	5%
102000126	00	RES	470.00K	OHM	1/4W	5%
102000127	00	RES	510.00K	OHM	1/4W	5%
102000128	00	RES	560.00K	OHM	1/4W	5%
102000129	00	RES	620.00K	OHM	1/4W	5%
102000130	00	RES	680.00K	OHM	1/4W	5%
102000131	00	RES	750.00K	OHM	1/4W	5%
102000132	00	RES	820.00K	OHM	1/4W	5%
102000133	00	RES	910.00K	OHM	1/4W	5%
102000134	00	RES	1.00M	OHM	1/4W	5%
102000135	00	RES	1.10M	OHM	1/4W	5%
102000136	00	RES	1.20M	OHM	1/4W	5%
102000137	00	RES	1.30M	OHM	1/4W	5%
102000138	00	RES	1.50M	OHM	1/4W	5%
102000139	00	RES	1.60M	OHM	1/4W	5%
102000140	00	RES	1.80M	OHM	1/4W	5%
102000141	00	RES	2.00M	OHM	1/4W	5%
102000142	00	RES	2.20M	OHM	1/4W	5%
102000143	00	RES	2.40M	OHM	1/4W	5%
102000144	00	RES	2.70M	OHM	1/4W	5%
102000145	00	RES	3.00M	OHM	1/4W	5%
102000146	00	RES	3.30M	OHM	1/4W	5%
102000147	00	RES	3.60M	OHM	1/4W	5%
102000148	00	RES	3.90M	OHM	1/4W	5%
102000149	00	RES	4.30M	OHM	1/4W	5%
102000150	00	RES	4.70M	OHM	1/4W	5%
102000151	00	RES	5.10M	OHM	1/4W	5%
102000152	00	RES	5.60M	OHM	1/4W	5%
102000153	00	RES	6.20M	OHM	1/4W	5%
102000154	00	RES	6.80M	OHM	1/4W	5%
102000155	00	RES	7.50M	OHM	1/4W	5%
102000156	00	RES	8.20M	OHM	1/4W	5%
102000157	00	RES	9.10M	OHM	1/4W	5%
102000158	00	RES	10.00M	OHM	1/4W	5%
102000159	00	RES	11.00M	OHM	1/4W	5%
102000160	00	RES	12.00M	OHM	1/4W	5%
102000161	00	RES	13.00M	OHM	1/4W	5%
102000162	00	RES	15.00M	OHM	1/4W	5%
102000163	00	RES	16.00M	OHM	1/4W	5%
102000164	00	RES	18.00M	OHM	1/4W	5%
102000165	00	RES	20.00M	OHM	1/4W	5%
102000166	00	RES	22.00M	OHM	1/4W	5%
102000167	00	RES	24.00M	OHM	1/4W	5%
102000168	00	RES	27.00M	OHM	1/4W	5%
102000169	00	RES	30.00M	OHM	1/4W	5%
102000170	00	RES	33.00M	OHM	1/4W	5%
102000171	00	RES	36.00M	OHM	1/4W	5%
102000172	00	RES	39.00M	OHM	1/4W	5%
102000173	00	RES	43.00M	OHM	1/4W	5%
102000174	00	RES	47.00M	OHM	1/4W	5%
102000175	00	RES	51.00M	OHM	1/4W	5%
102000176	00	RES	56.00M	OHM	1/4W	5%
102000177	00	RES	62.00M	OHM	1/4W	5%
102000178	00	RES	68.00M	OHM	1/4W	5%
102000179	00	RES	75.00M	OHM	1/4W	5%
102000180	00	RES	82.00M	OHM	1/4W	5%

PART NUMBER	REV	DESCRIPTION					
102000181	00	RES	91.00M	OHM	1/4W	5%	
102000182	00	RES	100.00M	OHM	1/4W	5%	
102000183	00	RES	5.00	OHM	1/4W	5%	
102000185	00	RES	150.00	OHM	1/10W	1%	
102000186	00	RES	17.50	OHM	3W	1%	
102000188	00	RES	.10	OHM	2W	1%	
102000189	00	RES	1.00	OHM	3W	5%	
102000192	00	RES	180.00	OHM	3W	5%	
102000193	00	RES	330.00	OHM	3W	5%	
102000194	00	RES	470.00	OHM	3W	5%	
102000195	00	RES	600.00	OHM	3W	5%	
102000200	00	RES	.00	OHM	W	%	THMC
102000201	00	RES	3.90K	OHM	1/4W	5%	
102000205	00	RES	14.00	OHM	W	1%	
102000206	00	RES	680.00	OHM	2W		
102000209	00	RES	470.00	OHM	1W	5%	
102000210	00	RES	1.50K	OHM	1/8W	1%	
102000211	00	RES	1.65K	OHM	1/8W	1%	
102000212	00	RES	1.82K	OHM	1/8W	1%	
102000213	00	RES	2.00K	OHM	1/8W	1%	
102000214	00	RES	2.21K	OHM	1/8W	1%	
102000215	00	RES	15.00K	OHM	1/8W	1%	
102000216	00	RES	1.30K	OHM	1/8W	1%	
102000217	00	RES	200.00	OHM	1/8W	5%	
102000218	00	RES	240.00	OHM	1/8W	5%	
102000219	00	RES	330.00	OHM	1/8W	5%	
102000220	00	RES	390.00	OHM	1/8W	5%	
102000221	00	POT	2.00K	OHM	1W	10%	
102000222	00	POT	20.00K	OHM	1W	10%	
102000224	00	I/C	SDG50622/506BR/HI506A-5/50618				
102000225	00	I/C	SDG50707/50706/507BR/HI507A-5				
102000226	00	RES	95.30	OHM	1/2W	1%	
102000227	00	RES	25.00	OHM	3W	5%	
102000228	00	RES	8.00	OHM	4W	3%	
102000229	00	RES	30.00	OHM	3W	1%	
102000230	00	RES	.20	OHM	10W	5%	
102000232	00	RES	4.00	OHM	5W	5%	
102000233	00	RES	390.00	OHM	1/2W	5%	
102000234	00	RES	10.00	OHM	1/2W	5%	
102000235	00	POT	100.00	OHM	1/2W	10%	
102000236	00	RES	390.00	OHM	3W	5%	
102000237	00	RES	180.00	OHM	1W	5%	
102000238	00	RES	11.00	OHM	4W	3%	
102000239	00	RES	14.00	OHM	3W	1%	
102000240	00	RES	53.60	OHM	3W	1%	
102000241	00	RES	10.00K	OHM	1/8W	1%	
102000242	00	RES	3.32K	OHM	1/8W	1%	
102000243	00	RES	12.10K	OHM	1/8W	1%	
102000244	00	RES	5.62K	OHM	1/8W	1%	
102000245	00	THM	5.00K	OHM	W	%	THMC
102000246	00	RES	17.50	OHM	3W	1%	
102000247	00	RES	75.00	OHM	3W	1%	
102000248	00	RES	100.00	OHM	3W	1%	
102000249	00	RES	10.00	OHM	1/8W	1%	
102000250	00	RES	6.81K	OHM	1/8W	1%	
102000251	00	RES	1.50	OHM	3W	5%	W.W.
102000252	00	RES	270.00	OHM	1W	5%	CARBON
102000253	00	RES	91.00	OHM	1/4W	5%	PIH/COR
102000254	00	RES	30.00	OHM	1/4W	5%	
102000255	00	RES	91.00	OHM	1/2W	5%	
102000256	00	RES	7.87K	OHM	1/8W	1%	
102000257	00	RES	38.00	OHM	3W	1%	A-P WOU
102000258	00	RES	47.00	OHM	1/2W	5%	
102000259	00	RES	3.60	OHM	1W	5%	CARBON
102000260	00	RES	50.00	OHM	5W	5%	
102000261	00	RES	130.00	OHM	1/4W	5%	PIHER
102000262	00	RES	3.00	OHM	1W	5%	CARBON
102000263	00	RES	33.00	OHM	1/4W	5%	PIHER
102000265	00	RES	27.00	OHM	1/2W	5%	(1/2WR)
102000266	00	RES	150.00	OHM	3W	1%	A-P WOU
102000267	00	RES	220.00	OHM	1/2W	5%	CARBON
102000268	00	RES	30.00	OHM	1/2W	5%	
102000269	00	RES	510.00	OHM	1/2W	5%	CARBON
102000271	00	RES	34.00	OHM	1/4W	2%	
102000272	00	RES	.05	OHM	5W	5%	W/W
102000273	00	RES	470.00	OHM	1/2W	5%	
102000274	00	RES	1.50	OHM	1/2W	5%	CARBON
102000275	00	RES	1.50	OHM	20W		
102000276	00	RES	15.00	OHM	12W		
102000277	00	RES	50.00	OHM	20W		
102000278	00	DUM					DUMMY
102000279	00	RES	120.00	OHM	1/2W	5%	PIHER
102000280	00	RES	140.00	OHM	1/2W	2%	
102000281	00	RES	5.10K	OHM	2W	5%	CARBON
102000282	00	RES	10.00K	OHM	2W	5%	CARBON
102000283	00	RES	1.00K	OHM	1/2W	5%	
102000284	00	POT	5.00K	OHM			
102000285	00	POT	500.00K	OHM			
102000286	00	RES	36.00	OHM	TPR	5%	P1/C RL20
102000287	00	RES	39.00	OHM	1/4W	5%	PIHER
102000288	00	POT	50.00	OHM	1W	10%	
102000289	00	RES	.10	OHM	10W	5%	
102000290	00	RES	75.00	OHM	1W	5%	

PART NUMBER	REV	DESCRIPTION					
102000291	00	RES	0.50	OHM	10W	5%	
102000292	00	RES	82.00	OHM	1/2W	5%	
102000293	00	POT	500.00	OHM	W	%	
102000294	00	POT	1.00K	OHM		5%	
102000295	00	POT	10.00K	OHM		5%	
102000296	00	RES	50.00	OHM	50W	5%	
102000297	00	RES	150.00	OHM	1/8W	1%	
102000298	00	RES	6.80K	OHM	1/8W	1%	
102000300	00	RES	6.80	OHM	1/2W	5%	
102000301	00	RES	150.00	OHM	2W	5%	
102000302	00	RES	12.00	OHM	5W	5%	
102000303	00	POT	500.00	OHM	1W	10%	
102000304	00	RES	1.00K	OHM	1/8W	5%	
102000305	00	POT	10.00K	OHM	3/4W		
102000306	00	POT	20.00K	OHM	3/4W		
102000307	00	POT	100.00K	OHM	3/4W		
102000308	00	NET	RES NTWK300145-6K-6K				
102000309	00	POT	1.00K	OHM	1/2W	20%	
102000310	00	RES	20.00K	OHM	2W	5%	
102000311	00	RES	51.00	OHM	1/2W	5%	PIHER
102000312	00	RES	7.32K	OHM	1/8W	1%	
102000313	00	RES	100.00	OHM	3W	5%	
102000314	00	RES	125.00	OHM	3W	5%	
102000315	00	RES	330.00	OHM	1/2W	2%	
102000316	00	RES	6.8K	OHM	1/2W	5%	
102000317	00	RES	110.00	OHM	3W	5%	
102000318	00	RES	14.70	OHM	1/8W	1%	
102000320	00	RES	68.00	OHM	1/2W	5%	
102000321	00	RES	3.01K	OHM	1/8W	1%	
102000322	00	RES	511.00	OHM	1/8W	1%	
102000323	00	RES	1.47K	OHM	1/8W	1%	
102000324	00	RES	1.96K	OHM	1/4W	1%	METFILM
102000325	00	RFS	3.24K	OHM	1/4W	1%	METFILM
102000326	00	RES	4.42K	OHM	1/4W	1%	METFILM
102000327	00	RES	4.99K	OHM	1/4W	1%	METFILM
102000328	00	RES	2222.00	OHM	1/10W	.02%	
102000329	00	RES	1778.00	OHM	1/10W	.02%	
102000330	00	RES	2667.00	OHM	1/10W	.02%	
102000331	00	RES	3333.00	OHM	1/10W	.02%	
102000332	00	RES	10.00K	OHM	1/10W	.02%	
102000333	00	VRIS	HV SURGE SUPPR				
102000334	00	RES	30.00	OHM	3W	5%	
102000335	00	RES	30.00	OHM	1W	5%	
102000336	00	RES	1.00	OHM	25W	5%	
102000337	00	RES	8.00	OHM	4W	1%	
102000338	00	RES	30.00	OHM	10W	5%	
102000339	00	RES	14.00	OHM	10W	1%	
102000340	00	RES	.10	OHM	5W	5%	
102000341	00	RES	5.00K	OHM	5W	1%	
102000342	00	RES	510.00	OHM	2W	10%	
102000343	00	RES	1.05K	OHM	1/8W	1%	
102000344	00	RES	1.21K	OHM	1/8W	1%	
102000345	00	RES	4.02K	OHM	1/8W	1%	
102000346	00	RES	2.05K	OHM	1/8W	1%	
102000347	00	RES	5.11K	OHM	1/8W	1%	
102000348	00	RES	1.00	OHM	30W	5%	
102000349	00	RES	10.00	OHM	30W	5%	
102000350	00	RES	50.00	OHM	5W	5%	
102000351	00	RES	14.00	OHM	10W	5%	
102000352	00	RES	8.00	OHM	5W	1%	
102000353	00	RES	33.00	OHM	10W	5%	
102000355	00	RES	330.00	OHM	1/8W	1%	
102000356	00	RES	140.00	OHM	1/8W	1%	
102000357	00	RES	10.00	OHM	5W	5%	
102000358	00	POT	20.00K	OHM	1/2W	20%	
102000359	01	NET	4-105+-2%		1/10W		
102000360	00	RES	20.00K	OHM	5W	5%	
102000361	00	RES	10.00K	OHM	5W	5%	
102000362	00	RES	11.100	OHM	4W	5%	
102000363	00	POT	500.00	OHM	1/4W	10%	
102000364	00	RES	12.00	OHM	4W	5%	NON-IND
102000365	00	RES	15.00	OHM	3W	5%	
102000367	00	RES	180.00	OHM	1/2W	5%	
102000368	00	RES	110.00	OHM	5W	5%	
102000369	00	RES	2.37K	OHM	1/8W	1%	
102000370	00	THM	230.00	OHM	.006W	5%	KB22L2
102000371	00	RES	196.00	OHM	1/8W	1%	
102000372	00	RES	464.00	OHM	1/8W	1%	
102000373	00	RES	300.00	OHM	1W	5%	
102000374	00	RES	51.10K	OHM	1/4W	1%	
102000375	00	POT	200.00	OHM	1W	10%	
102000376	00	RES	150.00	OHM	1W	5%	
102000377	00	RES	3.00	OHM	2.5W	5%	ELZH
102000378	00	POT	100.00	OHM	3/4W	10%	CERMET
102000379	00	RES	1210.00	OHM	1/4W	1%	
102000380	00	RES	931.00	OHM	1/4W	1%	
102000381	00	RES	475.00	OHM	1/4W	1%	
102000382	00	RES	442.00	OHM	1/4W	1%	
102000383	00	RES	316.00	OHM	1/4W	1%	
102000384	00	RES	150.00	OHM	1/4W	1%	
102000385	00	RES	118.00	OHM	1/4W	1%	
102000386	00	RES	100.00	OHM	1/2W	5%	
102000387	00	RES	1.00	OHM	10W	5%	

PART NUMBER	REV	DESCRIPTION				
102000388	00	RES	1.00K	OHM	1W 5%	
102000389	00	RES	330.00	OHM	1/2W 5%	
102000390	00	RES	.10	OHM	2 1/2W 3%	
102000391	00	RES	82.00	OHM	SW 1%	
102000392	00	RES	680.00	OHM	1W 5%	COMP
102000393	00	RES	.20	OHM	1W 5%	
102000394	00	POT	100.00	OHM	25T SQ 10%	CERMET
102000395	00	RES	110.00	OHM	1/2W 5%	
102000396	00	RES	5.00	OHM	225W	OHMITE ADJ.
102000397	00	RES	33.00K	OHM	1/2W 5%	
102000398	00	RES	30.00	OHM	1/8W 1%	
102000399	00	RES	510.00	OHM	2W 5%	WR WND
102000400	00	RES	5.00	OHM	25W +5%	
102000401	00	RES	2.00	OHM	25W +5%	
102000402	00	POT	4.00	OHM	3W 10%	
102000403	00	RES	13.50K	OHM	1/4W 1%	
102000404	00	POT	5.00K	OHM	100069-502	
102000405	00	POT	20.00K	OHM	100069-203	
102000406	00	POT	500.00	OHM	100163-501	
102000407	00	POT	1.00K	OHM	100063-102	
102000408	00	POT	5.00K	OHM	100163-502	
102000409	00	POT	10.00K	OHM	100163-103	
102000410	00	POT	20.00K	OHM	100163-203	
102000411	00	POT	50.00	OHM	100069-500	
102000412	00	RES	4.00	OHM	10W	
102000413	00	RES	.20	OHM	2W	
102000414	00	RES	2.2K	OHM	1/2W	0% W/W
102000415	00	RES	HAMMER DRIVER		2310	800210-001
102000416	00	RES	34.00	OHM	1/4W	+5%
102000417	00	RES	50.000	OHM	100W	TR-AN500D
102000418	00	RES	15.00	OHM	25W	TRAI150D
102000419	00	RES	1.10	OHM	1/2W	+5%
102000420	00	RES	22.00	OHM	1/2W	+5%
102000421	00	RES	10.00	OHM	10W	+5% W/W
102000422	00	RES RWR	.30	OHM	7W	+1%

PART NUMBER	REV		DESCRIPTION			
103000001	00	CAP	.0100MF	+80-20%	50V	CER
103000002	00	CAP	6.8000MF	+10-10%	35V	TANT
103000003	00	CAP	.2200MF	+10-10%	20V	TANT
103000004	00	CAP	470.0000PF	+5- 5%	500V	MICA
103000005	00	CAP	820.0000PF	+5- 5%	300V	MICA
103000006	00	CAP	220.0000PF	+5- 5%	500V	MICA
103000007	00	CAP	50.0000MF	+5- 5%	50V	TANT
103000012	00	CAP	.1000MF	+5- 5%	250V	FIL
103000013	00	CAP	.5000			
103000015	00	CAP	.0022MF	+5- 5%	1000V	
103000016	00	CAP	1.0000MF	+10-10%	35V	TANT
103000018	00	CAP	6.8000MF	+10-10%	6V	TANT
103000026	00	CAP	21000.0000MF	+20-20%	40V	ELEC
103000027	00	CAP	6000.0000MF	+20-20%	10V	ELEC
103000031	00	CAP	100.0000PF	+5- 5%	500V	MICA
103000032	00	CAP				
103000033	00	CAP				
103000035	00	CAP	1200.0000PF	+5- 5%	500V	MICA
103000036	00	CAP	8.0000MF	+20-20%	50V	TANT
103000037	00	CAP	47.0000MF	+20-20%	20V	TANT
103000038	00	CAP				
103000039	00	CAP	.0500MF	+20-20%	12V	CER
103000040	00	CAP	33.0000PF	+5- 5%	500V	MICA
103000041	00	CAP	560.0000PF	+5- 5%	300V	MICA
103000042	00	CAP	300.0000PF			
103000043	00	CAP	21000.0000MF	+20-20%	25V	ELEC
103000044	00	CAP	12.0000PF	+5- 5%	500V	MICA
103000045	00	CAP	2.2000MF	+20-20%	20V	TANT
103000046	00	CAP	330.0000PF	+5- 5%	100V	MICA
103000047	00	CAP	.0068MF	+10-10%	100V	RCAP
103000048	00	CAP	24000.0000MF	+20-20%	40V	ELEC
103000049	00	CAP	38000.0000MF	+20-20%	20V	ELEC
103000051	00	CAP	20000.0000MF	+20-20%	10V	ELEC
103000052	00	CAP	47.0000MF	+20-20%	6V	TANT
103000053	00	CAP	68.0000PF	+5- 5%	500V	MICA
103000054	00	CAP	.0100MF	+10-10%	50V	RCAP
103000055	00	CAP	100.0000PF	+5- 5%	100V	RCAP
103000056	00	CAP	82.0000PF	+5- 5%	500V	MICA
103000057	00	CAP	6.8000MF	+50-20%	6.3V	T/T
103000059	00	CAP	110.0000MF		40V	
103000060	00	CAP	31000.0000MF	+20-20%	40V	ELEC
103000061	00	CAP	20000.0000MF	+20-20%	20V	ELEC
103000062	00	CAP	6.8000MF	+50-20%	35V	T/T
103000063	00	CAP	161-193MF		110V	60HZ
103000064	00	CAP		%	V	
103000065	00	CAP	1.0000MF	+10-10%	35V	T/T
103000066	00	CAP	6300.0000	%	20V	ELEC
103000067	00	CAP	33000.0000	%	50V	ELEC
103000068	00	CAP	47.0000MF	+50-20%	6.3V	T/T
103000069	00	CAP	1.5000MF	+20-20%	35V	ELEC
103000070	00	CAP	.0220MF	+10-10%	100V	RCAP
103000071	00	CAP	27.0000PF	+5- 5%	500V	MICA
103000072	00	CAP	150.0000PF	+5- 5%	500V	MICA
103000073	00	CAP	.1000MF	+5- 5%	50V	MYLAR
103000074	00	CAP	100.0000MF	%	15V	TANT
103000075	00	CAP	4.7000MF	+50-20%	50V	TAG
103000076	00	CAP	7000.0000MF	%	20V	ELEC
103000077	00	CAP	.1000MF	+10-10%	200V	TANT
103000078	00	CAP	130-156MF		110V	60HZ
103000079	00	CAP	5600.0000PF	+10-10%	200V	
103000080	00	CAP	47-56MF		200V	60HZ
103000081	00	CAP	1200.0000MF	%	40V	ELEC
103000082	00	CAP	1200.0000MF	%	20V	ELEC
103000083	00	CAP	20000.0000MF		10V	ELEC
103000084	00	CAP	22.0000MF		10V	TAG
103000085	00	CAP	.2200MF		100V	MYLAR
103000086	00	CAP	.1000MF		50V	
103000087	00	CAP	.4700MF		50V	
103000088	00	CAP	3600.0000MF		50V	
103000089	00	CAP	800.0000MF		50V	ELEC
103000090	00	CAP	.2000FD	+75-10%	10V	
103000091	00	CAP	98000.0000MF	+75-10%	20V	
103000092	00	CAP	66000.0000MF	+75-10%	20V	
103000093	00	CAP	NOT ASSIGNED			
103000094	00	CAP	.0010MF	+10-10%	1000V	
103000095	00	CAP	.1000MF	+10-10%	400V	MYLAR
103000096	00	CAP	12000.0000MF	+75-10%	20V	SANG
103000097	00	CAP	12000.0000MF	+75-10%	40V	SANG
103000098	00	CAP	5.0000PF	+5- 5%	500V	MICA
103000099	00	CAP	6.0000PF	+5- 5%	500V	MICA
103000100	00	CAP	10.0000PF	+5- 5%	500V	MICA
103000101	00	CAP	51.0000PF	+5- 5%	500V	MICA
103000102	00	CAP	270.0000PF	+5- 5%	500V	MICA
103000103	00	CAP	.0150MF	+10-10%	100V	
103000104	00	CAP	77000.0000MF	+75-10%	20V	ELEC
103000105	00	CAP	71000MF/63000MF			
103000107	00	CAP	13000.0000MF		40V	
103000108	00	CAP	22.0000MF		16V	TAG
103000110	00	CAP	77000.0000MF	+75-10%	20V	ELEC
103000111	00	CAP	.2300FD	+75-10%	20V	ELEC
103000112	00	CAP	.6300FD	+75-10%	6V	ELEC
103000113	00	CAP	15.0000PF	+5- 5%	500V	MICA
103000114	00	CAP	1.0000MF	+20-20%	50V	TANT
103000115	00	CAP	4.0000MF	+50-20%	660V	60HZ

PART NUMBER	REV		DESCRIPTION			
103000116	00	CAP	.0500MF	+50-20%	25V	DISC
103000117	00	CAP	.1000MF		250V	60HZ
103000118	00	CAP	.4000MF		660V	
103000119	00	CAP	AC LINE FILTER, RFI PWRLINE +20K6			
103000120	00	CAP	160.0000PF	+5- 5%	500V	MICA
103000121	00	CAP	12.5000MF	+6- 6%	370V	
103000122	00	CAP	.0470MF	+10-10%	100V	MYLAR
103000123	00	CAP	.0033MF	+10-10%	100V	MYLAR
103000124	00	CAP	1.0000MF	+10-10%	50V	MYLAR
103000125	00	CAP	2.2000MF	+50-20%	35V	T/T
103000126	00	CAP	.1500FD	+75-10%	6V	ELEC
103000127	00	CAP	.0220MF	+10-10%	100V	MYLAR
103000128	00	CAP	.3300MF	+10-10%	50V	MYLAR
103000129	00	CAP	98000.0000MF	+75-10%	20V	ELEC
103000130	00	CAP	6.0000MF		660V	OIL FILLED
103000131	00	CAP	.01 MF		400V	
103000132	00	CAP	500MF		25V	
103000133	00	CAP	10MF		660V	
103000134	00	CAP	150.000MF		6V	
103000135	00	CAP	1600.0000PF	+5- 5%	500V	MICA
103000136	00	CAP	1.0000MF		400V	
103000139	00	CAP	1000 UF 25WV CRAMER WHB1000-25			
103000140	00	CAP	15MFD 200-365 VACGE45F165			
103000141	00	CAP	5MFD 366-410VAC GE 45F273			
103000142	00	CAP	1.0000PF	+ 5-5%	500V	MICA
103000143	00	CAP	2.0000PF	+ 5-5%	500V	MICA
103000144	00	CAP	3.0000PF	+ 5-5%	500V	MICA
103000145	00	CAP	4.0000PF	+ 5-5%	500V	MICA
103000146	00	CAP	7.0000PF	+ 5-5%	500V	MICA
103000147	00	CAP	8.0000PF	+ 5-5%	500V	MICA
103000148	00	CAP	18.0000PF	+ 5-5%	500V	MICA
103000149	00	CAP	20.0000PF	+ 5-5%	500V	MICA
103000150	00	CAP	22.0000PF	+ 5-5%	500V	MICA
103000151	00	CAP	24.0000PF	+ 5-5%	500V	MICA
103000152	00	CAP	30.0000PF	+ 5-5%	500V	MICA
103000153	00	CAP	36.0000PF	+ 5-5%	500V	MICA
103000154	00	CAP	39.0000PF	+ 5-5%	500V	MICA
103000155	00	CAP	43.0000PF	+ 5-5%	500V	MICA
103000156	00	CAP	47.0000PF	+ 5-5%	500V	MICA
103000157	00	CAP	62.0000PF	+ 5-5%	500V	MICA
103000158	00	CAP	75.0000PF	+ 5-5%	500V	MICA
103000159	00	CAP	91.0000PF	+ 5-5%	500V	MICA
103000160	00	CAP	110.0000PF	+ 5-5%	500V	MICA
103000161	00	CAP	120.0000PF	+ 5-5%	500V	MICA
103000162	00	CAP	130.0000PF	+ 5-5%	500V	MICA
103000163	00	CAP	180.0000PF	+ 5-5%	500V	MICA
103000164	00	CAP	200.0000PF	+ 5-5%	500V	MICA
103000165	00	CAP	240.0000PF	+ 5-5%	500V	MICA
103000166	00	CAP	300.0000PF	+ 5-5%	500V	MICA
103000167	00	CAP	360.0000PF	+ 5-5%	500V	MICA
103000168	00	CAP	390.0000PF	+ 5-5%	500V	MICA
103000169	00	CAP	430.0000PF	+ 5-5%	500V	MICA
103000170	00	CAP	510.0000PF	+ 5-5%	500V	MICA
103000171	00	CAP	620.0000PF	+ 5-5%	500V	MICA
103000172	00	CAP	680.0000PF	+ 5-5%	500V	MICA
103000173	00	CAP	750.0000PF	+ 5-5%	500V	MICA
103000174	00	CAP	910.0000PF	+ 5-5%	500V	MICA
103000175	00	CAP	1000.0000PF	+ 5-5%	500V	MICA
103000176	00	CAP	1100.0000PF	+ 5-5%	500V	MICA
103000177	00	CAP	1300.0000PF	+ 5-5%	500V	MICA
103000178	00	CAP	1500.0000PF	+ 5-5%	500V	MICA
103000179	00	CAP	1800.0000PF	+ 5-5%	500V	MICA
103000180	00	CAP	2000.0000PF	+ 5-5%	500V	MICA
103000181	00	CAP	2200.0000PF	+ 5-5%	500V	MICA
103000182	00	CAP	2400.0000PF	+ 5-5%	500V	MICA
103000183	00	CAP	2700.0000PF	+ 5-5%	500V	MICA
103000184	00	CAP	3000.0000PF	+ 5-5%	500V	MICA
103000185	00	CAP	3300.0000PF	+ 5-5%	500V	MICA
103000186	00	CAP	3600.0000PF	+ 5-5%	500V	MICA
103000187	00	CAP	3900.0000PF	+ 5-5%	500V	MICA
103000188	00	CAP	4300.0000PF	+ 5-5%	500V	MICA
103000189	00	CAP	4700.0000PF	+ 5-5%	500V	MICA
103000190	00	CAP	5100.0000PF	+ 5-5%	500V	MICA
103000191	00	CAP	5600.0000PF	+ 5-5%	500V	MICA
103000192	00	CAP	6200.0000PF	+ 5-5%	500V	MICA
103000193	00	CAP	6800.0000PF	+ 5-5%	500V	MICA
103000194	00	CAP	7500.0000PF	+ 5-5%	500V	MICA
103000195	00	CAP	8200.0000PF	+ 5-5%	500V	MICA
103000196	00	CAP	.0010MF	+10-10%	100V	MYLAR
103000197	00	CAP	.0012MF	+10-10%	100V	MYLAR
103000198	00	CAP	.0015MF	+10-10%	100V	MYLAR
103000199	00	CAP	.0018MF	+10-10%	100V	MYLAR
103000200	00	CAP	.0022MF	+10-10%	100V	MYLAR
103000201	00	CAP	.0027MF	+10-10%	100V	MYLAR
103000202	00	CAP	.0039MF	+10-10%	100V	MYLAR
103000203	00	CAP	.0047MF	+10-10%	100V	MYLAR
103000204	00	CAP	.0050MF	+10-10%	100V	MYLAR
103000205	00	CAP	.0056MF	+10-10%	100V	MYLAR
103000206	00	CAP	.0068MF	+10-10%	100V	MYLAR
103000207	00	CAP	.0082MF	+10-10%	100V	MYLAR
103000208	00	CAP	.0100MF	+10-10%	100V	MYLAR
103000209	00	CAP	.0120MF	+10-10%	100V	MYLAR
103000210	00	CAP	.0150MF	+10-10%	100V	MYLAR
103000211	00	CAP	.0180MF	+10-10%	100V	MYLAR

PART NUMBER	REV	DESCRIPTION			
103000212	00	CAP	.0270MF	+10-10%	100V MYLAR
103000213	00	CAP	.0330MF	+10-10%	100V MYLAR
103000214	00	CAP	.0390MF	+10-10%	100V MYLAR
103000215	00	CAP	.0500MF	+10-10%	100V MYLAR
103000216	00	CAP	.0560MF	+10-10%	100V MYLAR
103000217	00	CAP	.0820MF	+10-10%	100V MYLAR
103000218	00	CAP	.1000PF	+10-10%	100V MYLAR
103000219	00	CAP	.1200MF	+10-10%	100V MYLAR
103000220	00	CAP	.1500MF	+10-10%	100V MYLAR
103000221	00	CAP	.1800MF	+10-10%	100V MYLAR
103000222	00	CAP	.2700MF	+10-10%	100V MYLAR
103000223	00	CAP	.3300MF	+10-10%	100V MYLAR
103000224	00	CAP	.4700MF	+10-10%	100V MYLAR
103000225	00	CAP	.5000MF	+10-10%	100V MYLAR
103000226	00	CAP	.5600MF	+10-10%	100V MYLAR
103000227	00	CAP	.6800MF	+10-10%	100V MYLAR
103000228	00	CAP	.8200MF	+10-10%	100V MYLAR
103000229	00	CAP	1.0000MF	+10-10%	100V MYLAR
103000230	00	CAP	1.2500MF	+10-10%	100V MYLAR
103000231	00	CAP	1.5000MF	+10-10%	100V MYLAR
103000232	00	CAP	2.0000MF	+10-10%	100V MYLAR
103000233	00	CAP	3.0000MF	+10-10%	100V MYLAR
103000234	00	CAP	4.0000MF	+10-10%	100V MYLAR
103000235	00	CAP	.0680MF	+10-10%	100V MYLAR
103000236	00	CAP	.3900MF	+10-10%	100V MYLAR
103000237	00	CAP	50.0000PF	+ 5-5 %	500V MICA
103000238	00	CAP	2500.0000PF	+ 5-5 %	500V MICA
103000239	00	CAP	500.0000PF	+ 5-5 %	500V MICA
103000240	01	CAP	LINE FILTER EMI-F-0441		
103000241	00	CAP	27.0000PF	;5%	300V MICA
103000242	00	CAP	.1000MF	+20-20%	200V FILM
103000243	00	CAP	LINE FILTER RFI EMI-F-0458		
103000244	00	CAP	.1 MF		16V 21104001
103000245	00	CAP	MOTOR START 101/A		525064001
103000246	00	CAP	88-108 UF UP ASR 33		181384
103000247	00	CAP	4600.0000MF	M600L	00000200
103000248	00	CAP	10.0000MF	M600L	00000880
103000249	00	CAP	17.5000MF	M600L	00000202
103000250	00	CAP	3.0000MF	M600L	00000205
103000251	00	CAP	4.0000MF	M600L	00000204
103000252	00	CAP	.1000MF	-20%	50V CER
103000253	00	CAP	6.8000MF	;10%	6V T/T
103000254	00	CAP	3.0000MF	+10%	370V
103000255	00	CAP	9000.0000UF	40WVDC	AT382
103000256	00	CAP	160.0000UF	25WVDC	TC-WE167
103000257	00	CAP	50.0000UF	100WVDC	TC-HH506E
103000258	00	CAP	250.0000UF	16WVDC	TCWA257V

PART NUMBER	REV	DESCRIPTION	
104000001	00	XFMR	BALON NOVA
104000002	00	XFMR	3:1
104000003	00	XFMR	1:1
104000004	00	XFMR	F-109U
104000005	05	XFMR	F-60U
104000006	00	XFMR	CHOKE CLOCK S/N
104000010	03	XFMR	PWR-S/N
104000012	01	XFMR	MEMORY
104000013	00	XFMR	BALON S/N
104000014	00	XFMR	F-106Z
104000016	00	XFMR	ISOLATION 230/115
104000018	00	XFMR	CHOKE 100MH +5-5%
104000022	04	XFMR	PWR-1210
104000023	02	XFMR	PWR-1220/820
104000026	00	XFMR	F-108U 115V-24V 96VA
104000028	01	XFMR	CENTER TAP BIFILAR COIL
104000029	00	XFMR	SINGLE WOUND COIL
104000030	00	XFMR	STEP DOWN
104000031	00	XFMR	STEP DOWN 230/115 50/60HZ VA1000
104000032	00	XFMR	15 MH COIL
104000033	00	XFMR	1MH COIL
104000034	EE	XFMR	COIL ASSY +- 15MHD
104000035	EE	XFMR	COIL ASSY +5 MHD
104000036	00	COIL	HOLD ELECTROMAGNET 4000 TURNS
104000037	00	XFMR	TRIAD F107Z
104000038	01	XFMR	MMC-4814
104000039	00	XFMR	5-28/15-10
104000040	00	XFMR	CONSTANT VOLTAGE 5-35/15-10
104000041	00	XFMR	PWR LINEAR 170W
104000042	E1	XFMR	CONSTANT VOLTAGE
104000043	03	XFMR	36VOLT 16AMP & 36VOLT 13AMP
104000044	00	XFMR	50HZ CVT 600 VA
104000045	00	XFMR	CVT 5-60/15-15 60HZ
104000046	00	XFMR	CVT 5-60/15-15 50HZ
104000047	01	XFMR	COIL
104000048	00	XFMR	24:8
104000049	00	XFMR	110/220V 50HZ
104000050	00	XFMR	PULSE, BH ELECTRONICS
104000051	00	XFMR	115V TO 230V, STEP UP, 1000 VA
104000052	00	XFMR	MMC 5030 1:12
104000053	00	COIL	CLOCK HEAD 35 TURNS
104000054	00	XFMR	25.2V CT .060A MICROTRAN 2512
104000055	00	INDTR	.10 MH +10-10%
104000056	00	INDTR	.12 MH +10-10%
104000057	00	INDTR	.15 MH +10-10%
104000058	00	INDTR	.18 MH +10-10%
104000059	00	INDTR	.22 MH +10-10%
104000060	00	INDTR	.27 MH +10-10%
104000061	00	INDTR	.33 MH +10-10%
104000062	00	INDTR	.39 MH +10-10%
104000063	00	INDTR	.47 MH +10-10%
104000064	00	INDTR	.56 MH +10-10%
104000065	00	INDTR	.68 MH +10-10%
104000066	00	INDTR	.82 MH +10-10%
104000067	00	INDTR	1.20 MH +10-10%
104000068	00	INDTR	1.50 MH +10-10%
104000069	00	INDTR	1.80 MH +10-10%
104000070	00	INDTR	2.20 MH +10-10%
104000071	00	INDTR	2.70 MH +10-10%
104000072	00	INDTR	3.30 MH +10-10%
104000073	00	INDTR	3.90 MH +10-10%
104000074	00	INDTR	4.70 MH +10-10%
104000075	00	INDTR	5.60 MH +10-10%
104000076	00	INDTR	6.80 MH +10-10%
104000077	00	INDTR	8.20 MH +10-10%
104000078	00	INDTR	10.00 MH +10-10%
104000079	00	INDTR	12.00 MH +10-10%
104000080	00	INDTR	18.00 MH +10-10%
104000081	00	INDTR	22.00 MH +10-10%
104000082	00	INDTR	27.00 MH + 5-5 %
104000083	00	INDTR	33.00 MH + 5-5 %
104000084	00	INDTR	39.00 MH + 5-5 %
104000085	00	INDTR	47.00 MH + 5-5 %
104000086	00	INDTR	56.00 MH + 5-5 %
104000087	00	INDTR	68.00 MH + 5-5 %
104000088	00	INDTR	82.00 MH + 5-5 %

PART NUMBER	REV	DESCRIPTION	
104000089	00	INDTR	120.00 MH + 5-5 %
104000090	00	INDTR	150.00 MH + 5-5 %
104000091	00	INDTR	180.00 MH + 5-5 %
104000092	00	INDTR	220.00 MH + 5-5 %
104000093	00	INDTR	270.00 MH + 5-5 %
104000094	00	INDTR	330.00 MH + 5-5 %
104000095	00	INDTR	390.00 MH + 5-5 %
104000096	00	INDTR	470.00 MH + 5-5 %
104000097	00	INDTR	560.00 MH + 5-5 %
104000098	00	INDTR	680.00 MH + 5-5 %
104000099	00	INDTR	820.00 MH + 5-5 %
104000100	00	INDTR	1000.00 MH + 5-5 %
104000101	00	INDTR	1200.00 MH +10-10%
104000102	00	INDTR	1500.00 MH +10-10%
104000103	00	INDTR	1800.00 MH +10-10%
104000104	00	INDTR	2200.00 MH +10-10%
104000105	00	INDTR	2700.00 MH +10-10%
104000106	00	INDTR	3300.00 MH +10-10%
104000107	00	INDTR	3900.00 MH +10-10%
104000108	00	INDTR	4700.00 MH +10-10%
104000109	00	INDTR	5600.00 MH +10-10%
104000110	00	INDTR	6800.00 MH +10-10%
104000111	00	INDTR	8200.00 MH +10-10%
104000112	00	INDTR	10000.00 MH +10-10%
104000113	00	XFMR	POWER MERRIMACK
104000114	00	XFMR	ASSY 12-115V
104000115	00	XFMR	ASSY 24-115V
104000116	00	XFMR	50/60HZ 115V
104000117	00	INDTR	300.00MH -10%
104000118	00	XFMR	LINEAR PWR CRT 6010, 12
104000119	00	XFMR	BT383

PART NUMBER	REV	DESCRIPTION
110000002	00	RELAY, BRSR1-901
110000004	00	SWITCH, MICRO 1321D8
110000005	00	SWITCH, MICRO V32308
110000006	00	ACTUATOR KIT, MICRO JV-91
110000010	00	ACTUATOR, AH H 83503
110000011	00	CONTACT BLOCK, 83500-90
110000013	00	LENS, AH H 83500-90
110000014	00	SWITCH, AH H 82603
110000015	00	SWITCH, AH H 82613
110000016	01	SWITCH, C & K 7101CSP
110000017	01	SWITCH, C & K 7105CSP
110000018	01	SWITCH, C & K 7205CSP
110000019	00	SWITCH, C & K 7103A
110000020	00	SWITCH, EECO 177608
110000021	00	SWITCH, C & H 7691K74-F27
110000022	00	HARDWARE KIT, 76SG
110000023	00	SWITCH, C & K 7201A
110000024	00	SWITCH, CH 7561K74-F27
110000025	00	SWITCH, CH 7561K54-F27
110000026	01	SWITCH, CK 7105SYPZ
110000027	01	SWITCH, CK 7211SYPZ
110000028	01	SWITCH, CK 7301SYPZ
110000029	01	SWITCH, CK 7109SYPZ
110000030	01	SWITCH, CK 7101SYPZ
110000032	00	RELAY, REED P B JOT4100
110000033	00	PB, JOT 4000 RELAY
110000034	01	SWITCH, CK 7215SYPZ
110000035	00	SWITCH, TOGGLE CK 7101CSPX-EQUIV
110000036	00	SWITCH, CK 7105CSPX SATIN OR EQUIV
110000037	00	SWITCH, CK 7205 CSPX SATIN OR EQUIV
110000038	00	SWITCH, MICRO HONEYWELL 1SM1
110000039	00	RELAY, POTTER BRUMFIELD 6VAC DPST PR
110000040	00	RELAY, POTTER BRUMFIELD 6VAC PMT 17A
110000041	00	RELAY, JRM 1000 PB 1AMP 10WATT
110000042	00	RELAY, 4897-990
110000043	00	RELUCTANCE PICK-UP 6815013
110000044	00	SWITCH, THUMBWHEEL #189220 1 POLE DEC.
110000045	00	SWITCH, 7103SY PWGEAV-2-X
110000046	00	RELAY, RBM 91252-103
110000047	00	RELAY, 50HZ 230V
110000048	00	SWITCH, 435166-1
110000049	00	SWITCH DIP, 8 POSITION AMP
110000050	00	SWITCH DIP, 4 POSITION AMP
110000051	00	SWITCH CK 73034ZQEJ2
110000052	00	AMP DISTRIBUTOR 4325166-3
110000053	00	SWITCH, 5 POS, AMP
110000054	00	RELAY, DRY REED W103MPCX-4
110000055	00	RELAY, DRY REED W101MPCX-3
110000056	00	RELAY, MERC WETTED W131MPCX-4
110000057	00	RELAY, MERC WETTED W132MPCX-4
110000058	00	SWITCH, 7203ZQEJ2 C&K
110000059	00	SWITCH, DP3P ROCKER
110000060	EE	SOLENOID, LEDEX #124911-030
110000061	00	SWITCH, SPST CUTLER HAMMER 7561K74
110000062	00	RELAY, W107DIP-1
110000063	00	SWITCH, 8-POS AMP435166-5
110000064	00	SWITCH, 3PDT 15A/CONTACT
110000065	01	SWITCH, MINI TOGGLE MOMENTARY
110000066	01	SWITCH, MINI TOGGLE MAINTAINING
110000067	02	SWITCH SELECTOR
110000068	01	SWITCH SELECTOR (POWER)
110000069	01	SWITCH, TOGGLE, MOMENTARY
110000070	01	SWITCH, TOGGLE, MAINTAIN
110000071	00	SWITCH, MICRO #311SM701-T
110000072	00	SWITCH, PRESS 10" FAIRCHILD #PSF100A-10C
110000073	00	SWITCH, PRESS 20" FAIRCHILD #PSF100A-20C
110000074	00	SWITCH, MOM ACT 101 SN11
110000075	00	SWITCH, OAK 390 DP TCW POS
110000076	00	SWITCH LOW TORQUE 1-NO, CHERRY #E51-51T
110000077	00	SWITCH . 251 SIM RLR, MICRO#311SM4-T
110000078	00	SWITCH FLEX LEAF W/RLR, MICRO#111SM2-T
110000079	00	SWITCH OPT 2-CHAN, HEI#0S562A-060LW

PART NUMBER	REV	DESCRIPTION
110000080	00	RELAY TP DR 1435-IC-12D GUARDIAN
110000081	00	SWITCH ON/OFF 101/A
110000082	00	SWITCH SELECT 101/A
110000083	00	SWITCH TOP/FORM 101/A
110000084	00	SWITCH OVERRIDE 101/A
110000085	00	SWITCH LINIT (REED)
110000086	00	SWITCH & INDICATOR FORWARD
110000087	00	SWITCH & INDICATOR LOAD
110000088	00	SWITCH & INDICATOR ON LINE
110000089	00	SWITCH & INDICATOR REVERSE
110000090	00	SWITCH REWIND
110000091	00	SWITCH RESET
110000092	00	SWITCH MICRO 15MI-T/J55
110000093	00	SWITCH PAPER OUT
110000094	00	SWITCH & INDICATOR POWER
110000095	00	SWITCH LOAD RUN
110000096	00	SWITCH TOGGLE UCC ASR 33
110000097	00	RELAY UCC ASR 33
110000098	00	RELAY AC 25A 120V M600L
110000099	00	SWITCH PB SPDT POWER
110000100	00	SWITCH PB SPDT RESET
110000101	00	SWITCH PB SPST STOP
110000102	00	RELAY TIME DELAY CDS 114
110000103	00	RELAY GEN PURP CDS 114
110000104	00	SWITCH MICRO CDS 114
110000105	00	RELAY POWER DIST CDS 114
110000106	00	SWITCH MICRO 2310
110000107	00	SWITCH MERCURY 2310
110000108	00	SWITCH 2310
110000109	00	SWITCH MOMENTRY 2310
110000110	00	SWITCH 2310
110000111	00	SWITCH RIBBON REVERSE
110000112	00	SWITCH PAPER OUT UPPER
110000113	00	SWITCH PAPER OUT LOWER
110000114	00	SWITCH MOM PUSH CHEAT INTLK
110000115	00	000000000000000 RELAY DBL POLE. 10 SEC DELAY
110000116	00	SWITCH TOGGLE 3 POSITION TDTO2DD93
110000117	00	SWITCH REWIND REDACTRON 15006701
110000118	00	SWITCH C&K 52 PDDLE HNDL U33 CRT DSPL

REV. 02

PART NUMBER	REV	DESCRIPTION
111000000	00	DEVICE CONN CARD READER
111000001	00	CONN 9 CONTACT PLUG DEC 9P
111000002	00	CONN 9 CONTACT SOCKET DEC 9S SZ 20
111000003	00	CONN 25 CONTACT PLUG DBC 25P SZ 20
111000004	00	CONN 25 CONTACT SOCKET DBC 25S SZ 20
111000005	00	CONN 50 CONTACT PLUG DDC 50P SZ 20
111000006	00	CONN 50 CONTACT SOCKET DDC 50S SZ 20
111000007	00	CONN 19 CONTACT PLUG 2DE19P
111000008	00	CONN 19 CONTACT SOCKET 2DE19S
111000009	00	CONN 52 CONTACT PLUG 2DB52P
111000010	00	CONN 52 CONTACT SOCKET 2DB5ES
111000011	00	CONN 100 CONTACT PLUG 2DD100P
111000012	00	CONN 100 CONTACT SOCKET 2DD100S
111000019	00	CONN JUNCTION SHELL DE 24657
111000020	00	CONN JUNCTION SHELL DB24659
111000021	00	CONN JUNCTION SHELL DD24661
111000022	00	CONN SCREW LOCK ASSY FEMALE D204018-2
111000023	00	CONN SCREW LOCK MALE D20419-16
111000024	00	CONN SCREW LOCK MALE 20419-21
111000025	00	CONN SCREW LOCK MALE 20420-15
111000026	00	CONN A/C OUTLET PS 1369
111000027	00	CONN CABLE 20 DUAL POS AMP 86148-1
111000029	00	CONN CONTACT COMP LD 4-330808-9
111000030	00	CONN DIP SOCKET 16 PIN 041-001 112N
111000031	00	TERM POST 025SQ . 287 AMP 86144-4
111000032	00	CONN FASTON RECEPTACLE SERIES 250
111000033	00	TERM RCPT 250 22-18 AWG AMP 42628-2
111000034	00	TERM RCPT 250 16-14 AWG AMP 42332-4
111000035	00	TERM R TNG #10STUD 16-14 AMP 2-31903-2
111000036	00	TERM R TNG #10STUD 22-16 AMP 2-31889-3
111000037	00	TERM R TNG #6STUD 22-16 AMP 2-32403-1
111000038	00	TERM RCPT 187 22-18 AWG AMP 60972-3
111000039	00	CONN WINCHESTER ELEC 109-8340
111000040	00	CONN CABLE 22 DUAL POS AMP 86148-2
111000041	00	CONN RCPT 50 DUAL POSN AMP 86018-2
111000042	00	TERM TAB 250 . 097STUD 90 AMP 41204
111000043	00	CONN 36 CONT FOR DISK
111000044	00	TERM TAB 250 . 130STUD 90 AMP 42117-2
111000045	00	TERM TAB 250 . 130STUD DFS AMP 42506-2
111000046	00	CONN T&B 18RA-6F
111000047	00	CONN WIRE SPLICE T&B ZRBR
111000050	00	CONN HI-CLAMP PPC-11
111000051	00	CONN FASTENER CB4-2 1/8 DIA BUTTON
111000052	00	CONN 6 PIN AM
111000053	00	CONN DISK FROM 111-000-043 LG
111000054	00	CONN DISK FROM 111-000-043 SM
111000055	00	CONN T&B RBB-25
111000056	00	CONN T&B RCC
111000057	00	TERM TAB 250 130STUD 1PR AMP 41480
111000058	00	CONN AMP 85969-2 CRP 24-20 AWG
111000059	00	CONN AMP 1-480435-0
111000062	00	CONN SOLDER SLEEVE D142-51
111000063	00	CONN HAYCO DC-201 BLACK
111000064	00	CONN HAYCO DC-201 AMBER ORANGE
111000065	00	CONN HAYCO T-1018 TIN PLATE TAB
111000069	00	CONN STYLE A 5353867
111000070	00	CONN STYLE B 5353868
111000071	00	CONN TERMINAL CONTACT 66341-2
111000072	00	CONN 6 CIRCUIT FASTON P/18 480003-5
111000073	00	CONN CONTACT PC 125CF 50
111000074	00	CONN CONTACT TERMINAL 60413-1
111000075	00	TERM POST 025SQ . 210 AMP 86144-8
111000076	00	CONN TERMINAL BUSH GREEN DC-87-3-2
111000077	00	CONN TERMINAL BUSH CRG DC-87-3-2
111000078	00	CONN TERMINAL TAB BRASS T-202-55
111000079	00	CONN 26 POSITION 583679-1
111000080	00	CONN MOLEX 1490 RECEPTACLE
111000081	00	TERM FEM . 093 14 TO 20 GA MOLEX 1189
111000082	00	CONN MOLEX 1490 PLUG
111000083	00	TERM MALE . 093 14 TO 20 GA MOLEX 1190
111000084	00	CONN AMPHENOL MIN RAC 17 17-300-01
111000085	00	CONN AMPHENOL RT ANGLE PIN 17-1208-02
111000086	00	CONN AMPHENOL RT ANGLE PIN 17-1209-02
111000087	00	CONN COMPONENT LEAD SOCKET 380635-1
111000088	00	CONN EPO GROUND TAB 5271288
111000091	00	CONN PWR RECEPT. MS3102 A24-25
111000093	00	CONN BLOCK SKT 75 CONT AMP 201311-1
111000094	00	CONN BLOCK 29 POSN AMP 202477-4
111000095	00	CONN CONT SKT 18-16 AWG AMP 66101-1
111000096	00	CONN CONT SKT 10-8 AWG AMP 66257-2
111000097	00	CONN SKT RG/U CA AMP 329013
111000098	01	CONN POLORIZING KEY (USED/079)
111000099	00	CONN MINI BRASS RIVIT . 116X3/16
111000100	00	CONN 24 PIN (PART # 111000040)
111000101	00	CONN CABLE 40 DUAL POSN AMP 1-86148-1
111000102	00	CONN PLUG RECP P&S TURNLOCK
111000103	00	CONN ASSY DIGITRONICS PTR 2540
111000104	00	CONN CRIMP LUG T&B RC1157
111000107	00	CONN MOLEX STD NYLON P/N 126-P-1
111000108	00	CONN MOLEX STD NYLON P/N 1261-R
111000109	00	CONN MRAC 42PJ
111000110	00	CONN PIN CONTACT 8114

PART NUMBER	REV	DESCRIPTION
111000111	00	TERM R TNG #10STUD 12-10 AMP 2-35109-1
111000112	00	CONN PCB 28 DUAL POSITION
111000113	00	CONN CABLE 20 POSN AMP 86402-1
111000114	00	CONN 12 POSITION AMP 86402-4
111000115	00	CONN CONTACT TWIN LEAF AMP 583616
111000116	00	CONN KEY AMP 583274
111000117	00	CONN PC EDGE 50 DUAL POS AMP1-583717-9
111000118	00	CONN CINCH 252-15-30-160
111000119	00	CONN PC EDGE 10 DUAL POS AMP 583717-1
111000120	00	CONN FERRULE COAX 328664
111000121	00	CONN RETENTION SPRING COAX 243332-1
111000122	00	CONN ALIGN BSHG RED AMP 329051
111000123	00	CONN SPR RTNG AMP 583691-3
111000124	00	CONN RECEPTACLE MOLEX 1292-R2
111000125	00	CONN PIN FEMALE MOLEX 02091133
111000126	00	CONN PLUG MALE MOLEX 1292-P1
111000127	00	TERM MALE . 093 18 TC 22 GA MOLEX 1380
111000128	00	CONN RIVET FLAT HD AK41H
111000129	00	CONN RECEPTACLE MOLEX 1261R-2
111000131	00	CONN PIN MOLEX 02092132
111000132	00	CONN RF PNL RECEPTOR 83-798-1050
111000133	00	CONN JACKSCREW FEMALE 200875
111000134	00	CONN 9 PIN W/MOUNTING TABS
111000135	00	TERM FEM . 093 18 TO 22 GA MOLEX 1381
111000136	00	CONN PLUG 2 PIN
111000137	00	CONN RECEPTACLE 2 PIN
111000138	00	CONN 22 PIN
111000139	00	TERM SLTD TNG FLG #6 16-14A#2-320861-1
111000140	00	TERM R TNG #6STUD 16-14 AMP 2-32442-1
111000141	00	TERM R TNG #8STUD 22-16 AMP 2-31886-2
111000142	00	CONN MALE A/C PLUG 15AMP 125V
111000143	00	CONN DAISY CHAIN . 025 SQ POST 5"SP
111000144	00	TERM R TNG #2STUD 22-16 AMP 2-320440-1
111000145	00	CONN FEMALE SOCKET CONTACT
111000146	00	CONN MALE PIN CONTACT
111000147	00	CONN 13 POS SINGLE ROW MOD IV
111000148	00	CONN KEY AMP 86286-1
111000149	00	CONN HOUSING, TWIN LEAF . 100CTRS
111000150	00	CONN AMP 225-21031-101 OR EQUIV
111000151	00	CONN CINCH 251-18-30-160
111000152	00	CONN AMP 57-30360
111000153	EE	CONN FLAG FASTON TERM
111000154	00	CONN OUTPUT ELCO 00-8016-038-000-707
111000155	EE	CONN BERG #75307-002
111000156	00	CONN JACK SCREW AMP #202490-2
111000157	00	CONN FLANGED INLET AH 5278 NEMA 5-15P
111000158	00	CONN WIRE MOLD ASSY 10P AMCO PM60-10
111000159	00	CONN RUBBER BOOTH AH 7511
111000160	00	CONN 3VH30-1JN3 DEVICE 1055B
111000161	EE	CONN WIRE MOLD ASSY 6 POS
111000162	00	CONN PIN CONTACT 14 AWG AMP 61118-5
111000163	00	CONN PIN CONTACT 26 AWG AMP 60910-5
111000164	00	CONN SOCKET AC ARROW HART #5278
111000165	00	CONN SOCKET AMP 61117-5
111000166	00	CONN CONT SKT 30-22 AWG AMP 60909-
111000167	00	CONN 6 SKT MATE-N-LOK AMP 1-480273-0
111000168	00	CONN 12 SKT MATE-N-LOK AMP 1-480275-0
111000169	00	CONN 12 PIN MATE-N-LOK AMP 1-480275-0
111000170	00	CONN PLUG MOLEX 12CKT 1360P
111000171	00	CONN RCPT MOLEX 12CKT 1360R-1
111000172	00	CONN VIKING 3VH30 1JN3
111000174	00	CONN MOLEX 5 PIN WAFERCON
111000175	00	CONN MOLEX 5 PIN
111000176	00	CONN BASELESS CRTG LAMP AMP 61528-1
111000177	00	TERM TAB 250 . 130STD 2PR AMP 41481
111000178	00	CONN USM POP RIVET AD42S
111000179	00	CONN PC EDGE 25 DUAL POS AMP1-583717-1
111000180	00	CONN WIRE MOLD ASSY
111000182	00	CONN WIRE MOLD ASSY MODIFIER
111000183	00	CONN TEST PROBE FEM #53061
111000134	00	CONN TEST PROBE MALE #20357
111000185	00	CONN 50 DUAL POS
111000186	00	CONN AMP FSTON 187 SERIES TAB 61947-1
111000187	00	CONN AMP FSTON 187 SERIES TAB 61951-1
111000188	00	CONN AMP FSTON "187" RECP AMP 61697-1
111000189	00	CONN HOUSING MALE 9 PIN
111000190	00	CONN HOUSING FEMALE 9 PIN
111000191	00	CONN FASTON CLIP-FLAG TYPE
111000192	00	CONN BARRIER STRIP & TERMINAL
111000193	00	CONN SPADE LUG #10-12
111000194	00	CONN WAFER 9 PIN MOLEX 0918-5094
111000195	00	CONN AMP FSTON 110 TAB 42971-1
111000196	00	CONN AMP FSTON 187 TAB 61761-1
111000197	00	CONN 40 PIN W STRAIN RELIEF #3417-3000
111000198	00	CONN 40 PIN PCB HEADER #3432-1002
111000199	00	CONN POLARIZING KEY
111000200	00	CONN VIKING 3VH35 CND-12
111000201	00	TERM R TNG #4STUD 22-16 AMP 31878
111000202	00	TERM R TNG #10STUD 8AWG AMP 52265-2
111000203	00	TERM RCPT 250 14-10AWG AMP 41450
111000204	00	CONN HSG 250 TERM RCPT AMP 1-480416-0
111000205	00	TERM RCPT 187 22-18AWG MAP 60972-2

PART NUMBER	REV	DESCRIPTION
111000206	00	TERM RCPT 110 22-18AWG AMP 61048-2
111000207	00	TERM TAB 187 130STUD ANLR AMP 61761-2
111000208	00	TERM TAB 110 136STUD STR AMP 60858-1
111000209	00	TERM POST 025SQ . 165 AMP 87022-9
111000210	00	SPLICE COAX TO AWG AMP #330592
111000211	00	CONN BRASS RIVET TIN PLATED
111000212	00	CONN PNL RCPT TYPE UHF AMPHENOL 83-1R
111000213	00	TERM RCPT 28-22 AWG BERG 47712
111000214	00	CONN HSG 4 PIN BERG 65039-033
111000215	01	CONN 3VH50/1JV5 VIKING
111000216	00	TERM R TNG #8STUD 16-14 AMP 30927
111000217	00	CONN RECEPTACLE MOLEX # 1261-R2
111000218	00	CONN PLUG MOLEX # 1261-P
111000219	00	CONN 9 PIN MOLEX #1840-9-2
111000220	00	CONN 12 PIN MOLEX #1840-12-2
111000221	00	CONN QUICK DISC TAB ETC #3531
111000222	00	CONN QUICK DISC TAB ETC #3523
111000223	00	CONN 25 PIN DUAL POSN #PJDH-25S
111000224	00	CONN POLARIZING KEY #109-8597
111000225	00	TERM R TNG #10STUD 6AWG BUR YAEUSC-L1
111000226	00	TERM RCPT 250 14-10AWG BUR PQ10R258B
111000227	00	CONN 29 PIN WINCHESTER #SRE29PD4J
111000228	00	CONN MR 4PIN HDR(TIN) AMP #9-350255-1
111000229	00	CONN MR 4SKT HSG AMP #1-350240-9
111000230	00	CONN MR 6PIN HDR(TIN) AMP #9-350258-1
111000231	00	CONN MR 6SKT HSG AMP #1-350241-9
111000232	00	CONN MR 9PIN HDR(GOLD) AMP#9-350261-2
111000233	00	CONN MR 9SKT HSG AMP #1-350242-9
111000234	00	CONN MR 12PIN HDR (TIN) AMP #9-350264-1
111000235	00	CONN MR 12SKT HSG AMP #1-350243-9
111000236	00	CONN MR SKT CON 26-18 TIN AMP 350037-1
111000237	00	CONN MR SKT CON 26-18 GLD AMP 350037-2
111000238	00	CONN HOUSING AMP 1-480305-0
111000239	00	PIN AMP 61118-1
111000240	00	CON PIN MALE 20-14 MOLEX #20-09-2101
111000241	00	CON PIN FEMALE 20-14 MOLEX #20-09-1101
111000242	00	CONN 60 PIN AMP 582459-1
111000243	00	CONN PIN MALE 22-18 MOLEX #02-09-2116
111000244	00	CON PIN FEMALE 22-18 MOLEX #02-09-1116
111000245	00	CON PLUG FOR . 093 TERM, MOLEX TYPE 1619
111000246	00	CON RCPT FOR . 093 TERM, MOLEX TYPE 1619
111000247	00	CONTACT, CONN. AMP #66135-2
111000248	00	SHIELD, CONN. AMP #200532-1
111000249	00	JACKSCREW AMP #582360-3
111000250	00	CONNECTOR, DUAL, 36 PIN 600-061-18SL
111000251	00	CONNECTOR 582388-9 AMP
111000252	00	CONTRACT, CONN. 66088-3 AMP
111000253	00	CONTRACT, CONN. 66150-3 AMP
111000254	00	CONNECTOR WINCHESTER #MRAC50PJTDHS
111000255	00	CONNECTOR CINCH #251-25-30-160
111000256	00	CONNECTOR 57-30240
111000257	00	CONN CARD CAGE-TERMINAL
111000258	00	CONN CARD CAGE 15 PIN
111000259	00	CONN MR 15 PIN HDR (TIN) AMP #9-350267-1
111000260	00	CONN MR 15SKT HSG AMP #1-35024409
111000261	00	CONN PIN . 025SQ, WW, . 660LG #75401-015
111000262	00	CONN CANNON 19S SK-19-21C-1/2
111000263	00	CONN PC QUICK-CONNECT . 187 TAB FEMALE
111000264	00	TERM R TNG #6STUD 18-22 AMP 2-34144-1
111000265	00	TERM R TNG #6STUD 10-12 AMP 2-34168-1
111000266	00	CONN RIVET
111000267	00	CONN FEMALE MOLEX 1189T PIN
111000268	00	CONN MALE MOLEX 1380T
111000269	00	CONN MALE MOLEX 1120T PIN
111000270	00	CONN FEMALE PIN MOLEX 1381T
111000271	00	CONN USM POP RIVET #AD44H
111000272	00	TERM POST . 025SQ UMINSUL. AMP #87022-4
111000273	00	TERM AMP 250 FASTON ADT 61765-2
111000274	00	CONN KEY, POLARIZING FOR AMPMODU TYPE
111000275	00	CONN CONTRACT, LOCK CLIP -. 025POST
111000276	00	CONN HOUSING, LOCK CLIP, 2 ROW 6 POS
111000277	00	CONN HOUSING, LOCK CLIP, 2 ROW 20 PCS
111000278	00	CONN PLDG 20A 250V HUBBELL 2421
111000279	00	CONN AMP PINS (BRIGHT TIN DIP)
111000280	00	CONN RCPT 2-PIN MOLEX #03-09-1021
111000281	00	CONN SCREW LOCK PNL RECEPTACLE
111000282	00	CONN SCREW LOCK CA PLUG
111000283	00	CONN MATE-N-LOCK 8 PIN HDR, #350212-1
111000284	00	CONN MATE-N-LOCK 8 PIN, AMP #1-480283-0
111000285	00	CONN 20-14 TIN PIN, AMP #60619-1
111000286	00	CONN POST INSUL POD AMP #1-480306-1
111000287	00	CONN FLAG INSUL SPT AMP #60290-2
111000288	00	CONN WINCHESTER HW50D2-111-2B
111000289	00	TERM MALE-MOLEX 1854-02-06-2132
111000290	00	TERM RECEP, 2 CKT MOLEX 1625-2R1
111000291	00	CONN ADPTR 1/4" PUSHON TAB-1:2
111000292	EE	CONN HOUSING, LOCK CLIP 12 POS
111000293	00	CONN 11 POS 22 PIN, EDGE CARD
111000294	00	CONN 4 PIN M. R. HDR (GOLD)
111000295	00	CONN 15 PIN M. R. HDR (GOLD)
111000296	00	CONN 20-14 GOLD PIN TP DR AMP
111000297	00	CONN M-N-L 8 PIN HDR GLD AMP#350212-2
111000298	00	CONN HSG 50 DUAL POS, AMP #1-583717-7
111000299	00	CONN 50 POS. 4 SURF DISK 3426-0000 3M
111000300	00	CONN 25 POS. 4 SURF DISK 3415-0000 3M
111000301	00	CONN 34 POS. 4 SURF DISK 3M P/N 3402
111000302	00	CONN 34 POS. 4 SURF DISK 3M 3424
111000303	00	TERM . 250 INLINE FEM N2/4-2/10
111000304	00	TERM INSUL-CONNECT 18-20 GA WIRE
111000305	00	CONN AMP FASTON 45 250SER SGL42822-2
111000306	00	CONN AMP FASTON 45 250SER DBL 41477
111000307	00	CONN CONT TWINLEAF AMP
111000308	00	CONN 22PIN W/FRAME, VIKING#OVH22/1JN3
111000309	00	CONN FASTON 14-20AWG NON-INSUL42452-2
111000310	00	CONN 18 CONT SINGLE ROW
111000311	00	CONN 18 CONT DUAL POS
111000312	00	CONN 18 CONT DUAL POS HSG
111000313	00	CONN OUTPUT J2 M600L
111000314	00	CONN CONT MALE PIN 22-26AWG
111000315	00	CONN CONT FEM SKT PIN 22-26AWG
111000316	00	CONN 250 FASTON 10-20AWG TERM
111000317	EE	CONN 75 POS M SER CDC DISK ADPT
111000318	00	CONN W/FRM CINCH 251-22-30-160
111000319	00	CONN PLUG 30A 250V HUBBELL 45215
111000320	EE	CONN 50 POS M SERIES CDC DISK ADPT
111000321	00	CONN CONTACT 15 AMP 1332
111000322	00	CONN PWR POLE MDL 15AMP 600V 1315
111000323	00	CONN MOLEX RCPTCLE W/O EARS
111000324	00	CONN WAFERCON 3 PINS MOLEX
111000325	00	CONN TWIST LOCK 20A 125V HUBBELL 2615
111000326	00	CONN TWIST LOCK 30A 125V HUBBELL 2315
111000327	00	CONN ASSY DIGITRONICS BC7611-2 22 PINS

PART NUMBER	REV	DESCRIPTION
113000002	00	FUSE 10A 250V LITTELFUSE 3AB #314010
113000003	00	FB 2-POLE, 3AG MTG, LITTELFUSE #357002
113000004	00	FUSE 1/2A 250V LITTELFUSE 8AG #361.500
113000005	00	FUSE 3/4A 250V LITTELFUSE 8AG #361.750
113000008	00	FUSE CLIP, EARLESS, BUSS #5680-05
113000009	00	FUSE 2A 250V LITTELFUSE 8AG #361002
113000010	00	FUSE 3A 125V LITTELFUSE 3AG #313003
113000011	00	FUSE 2A 125V LITTELFUSE 3AG #313002
113000012	00	FUSE 1/2A 125V LITTELFUSE 3AG #313.500
113000013	00	FUSE 3/8A 250V BUSS MDL FUSETRON
113000014	00	FUSE 1A 250V BUSS AGX FAST ACTING
113000015	00	FUSE 4A 250V LITTELFUSE 3AG #312004
113000016	00	CB 15A 50V 1-POLE TI #51MC2-29-15
113000017	00	FUSE 15A 32V LITTELFUSE 1AG #301015
113000018	00	FUSEHOLDER PNL MTD, R-A TERM, LF #342004
113000019	00	FUSE 15A 250V LITTELFUSE 3AB #314015
113000020	00	FUSE 30A 600V BUSS KTK LIMITRON
113000021	00	FUSE BLOCK 3-POLE 250V BUSS #2809
113000022	00	FUSE 5A 32V LITTELFUSE 1AG #301005
113000023	00	FUSE 10A 32V LITTELFUSE 1AG #301010
113000025	00	FUSEHOLDER PNL MTD, STR TERM, LF #342012
113000026	00	FUSE 30A 125V LITTELFUSE 3AB #31430
113000027	00	FUSEHOLDER PNL MTD, H-V KNOB, LF #34027
113000028	00	PICOFUSE AX LEAD 3/4A 125V LF #275.750
113000029	00	FUSE 2 1/2A 32V BUSS AGW GLASS TUBE
113000030	00	FUSE 1/4A 250V BUSS AGX FAST ACTING
113000032	00	FUSE 15A 32V BUSS MDL FUSETRON
113000033	00	FUSE 5A 250V LITTELFUSE 3AB #314005
113000034	00	FUSE 1A 32V BUSS AGA GLASS TUBE
113000035	00	FUSE 3A 32V BUSS AGA GLASS TUBE
113000036	00	FUSE 6A 32V BUSS AGA GLASS TUBE
113000037	00	FUSE 8A 250V LITTELFUSE 3AB #314008
113000038	00	FUSEHOLDER PNL MTD, STR TERM, LF #342038
113000040	00	FUSE 15A 32V BUSS AGC FAST ACTING
113000041	00	FUSE 2A 250V LITTELFUSE 3AG #312002
113000042	00	PICOFUSE AX LD, 1 1/2A 125V, LF #26501.5
113000043	00	FUSE 5A 32V BUSS MDL FUSETRON
113000044	00	FUSE 3A 32V LITTELFUSE 1AG #301003
113000045	00	FUSE 4A 32V BUSS AGW FAST ACTING
113000046	00	CB 20A 65V 2P, AIRPAX #UPG-11-1-6-1-203
113000047	00	FUSE 5A 125V LITTELFUSE 3AG #313005
113000048	00	FUSEHOLDER IN LINE FOR 3AG
113000049	00	FUSEHOLDER, MODIFIED, INLINE FOR 3AG
113000050	00	FUSE 1/4A 250V LITTELFUSE 3AG #313.250
113000051	00	FUSE .125A BUSS MDL SLD BLD
113000052	00	FUSE 4A 32V LITTLEFUSE 3AG#311004
113000053	00	FUSE 5A 32V LITTLEFUSE 3AG#311005
113000054	00	FUSE 10A 32V LITTLEFUSE 3AG#311010
113000055	00	CB 8A 50/60HZ 250V AIRPAX
113000056	00	FUSE 1A SLO BLO 3AG
113000057	00	FUSE 1A 250V LITTLEFUSE 3AG#312001
113000058	00	FUSE 1/8A 3AG 2310
113000059	00	FUSE 8A 3AG 2310
113000060	00	FUSE 15A 3AG 2310
113000061	00	FUSE 1/2A 250V 3AG LITTLEFUSE

PART NUMBER	REV	DESCRIPTION
114000001	00	HUDSON 28V BULBS 21870
114000002	00	HUDSON BULB 2176
114000004	00	INDICATOR CARTRIDGE CML
114000005	00	INDICATOR CARTRIDGE CML 64 0272
114000006	00	INDICATOR CARTRIDGE 6V CML 240272 GR W
114000007	00	INDICATOR CARTRIDGE 115V CML 240321 RE
114000008	00	LAMP TUNGSOL #561
114000009	00	BULB-PLT LAMP CML 84-0421
114000011	00	LAMP INCANDESCENT AMBER 14V
114000012	00	LAMP INCANDESCENT RED 14V
114000013	00	INDICATOR RDOUT DIG SP-331 1.5D16.33"
114000014	00	INDICATOR RDOUT DIG SP-332 2DIG. 33 IN
114000015	00	INDICATOR RDOUT DIG SP-333 3DIG. 33 IN
114000016	00	INDICATOR RDOUT DIG SP-353 3DIG. 55 IN
114000017	00	INDICATOR RDOUT DIG SP-354 2.5D. 55IN
114000018	00	LAMP GE 379
114000019	00	INDICATOR FILE PROJECT
114000020	00	BULB LIGHT BULB
114000021	00	LAMP INCAND GV .20A
114000022	00	LAMP GE 1638

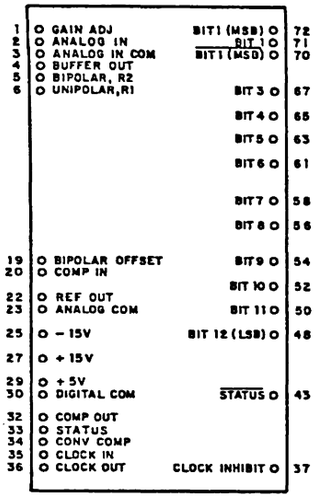
PART NUMBER	REV	DESCRIPTION
[illegible]	00	FAN AXIAL-PAMOTOR 8500
[illegible]	00	FAN AXIAL-ROTRON/CYCLONICS
[illegible]	00	BLOWER AMDC B-350-25 25-351 SPECIAL BLA
[illegible]	00	FAN ROTRON SARGENT 115V 5L HL
[illegible]	01	MOTOR HEAD LOAD
[illegible]	00	FAN, SKIPPER
[illegible]	00	MOTOR DRIVE 50HZ
[illegible]	00	MOTOR DRIVE 50HZ DISC 8000
[illegible]	01	MOTOR CAPSTAN OUTLINE DWG
[illegible]	02	MOTOR REEL OUTLINE DWG
[illegible]	00	MOTOR UNMODIFIED 3ML2M GRANGER
[illegible]	03	MOTOR SHADED POLE TYPEM 1/15
[illegible]	00	BLOWER ADPT SPST
[illegible]	00	MOTOR FILTER (350 CFM)
[illegible]	00	MOTOR SCREEN OUTLET (350 CFM)
[illegible]	00	MOTOR AIR DUCT (350 CFM)
[illegible]	00	MOTOR ALUM GRILL
[illegible]	00	BLOWER (350 CFM)
115000021	00	FAN SKIPPER ROTON #SKIA-1
115000022	00	FAN ADAPTER AIR DUCT
115000023	00	FAN 105 CFM HOWARD #3-90-8011-115V
115000024	00	BLOWER LAMB #115721-0
115000025	00	MOTOR 1 3 HP GE #5KCP19PG235T
115000026	00	BLOWER AUXILLARY WITH SS GRILL
115000027	00	BLOWER AUX W/SS GRILL 230V
115000028	EE	MOTOR HYSTERESIS SYNCH SPEC
115000029	00	FAN, VENTURI 115V, 50/60HZ ROTRON CT3A2
115000030	00	GUARD, FINGER ROTRON 20132-2
115000031	EE	BLOWER SPECIFICATION CABINET
115000032	00	MOTOR MAIN 101/A
115000033	00	MOTOR DRIVE 101/A
115000034	00	MOTOR 1.6A 60HZ UP ASR 33
115000035	00	BLOWER WIND JAMMER
115000036	00	FAN COOLING 117V 60HZ
115000037	00	MOTOR ASSY BLOWER M600L
115000038	00	MOTOR ASSY SP-8 M600L
115000039	00	MOTOR BRUSH DRIV CDS 114
115000040	00	MOTOR DRUM 2310
115000041	00	MOTOR RIBBON 2310
115000042	00	FAN 2310
115000043	00	MOTOR 115V 60/50HZ
115000044	00	MOTOR 230V 60/50HZ
115000045	00	MOTOR DRIVE 900RPM 115 VACCT381-2
115000046	00	BLOWER G/P SPEC CAB 230V 50HZ
115000047	00	MOTOR ASSY CC7073-6 DIGITRONICS
115000048	00	MOTOR SPINDLE ASSY DIABLO 15536-02

NUMERICAL INDEX
CIRCUIT MODULES

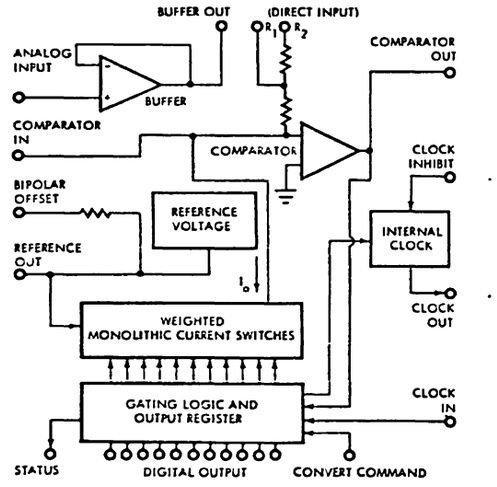
116000001

A/D Converter

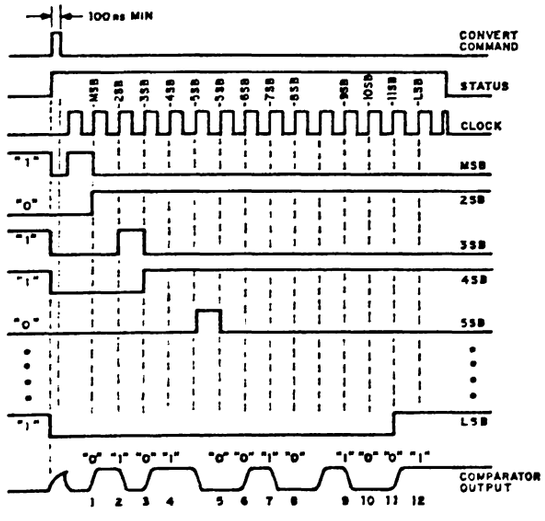
Pin Configuration
Top View



Block Diagram



Timing Diagram



Pin Designations

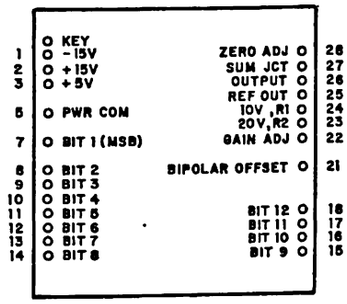
Pin No.		Pin No.	
1	Gain Adj.	72	Bit 1 (MSB)
2	Analog In	71	Bit 2
3	Analog In Com	70	Bit 1 (MSB)
4	Buffer Out	69	No pin
5	Bipolar, R2	68	No pin
6	Unipolar, R1	67	Bit 3
7	No pin	66	No pin
8	No pin	65	Bit 4
9	No pin	64	No pin
10	No pin	63	Bit 5
11	No pin	62	No pin
12	No pin	61	Bit 6
13	No pin	60	No pin
14	No pin	59	No pin
15	No pin	58	Bit 7
16	No pin	57	No pin
17	No pin	56	Bit 8
18	No pin	55	No pin
19	Bipolar Offset	54	Bit 9
20	Comp In	53	No pin
21	No pin	52	Bit 10
22	Ref Out	51	No pin
23	Analog Com	50	Bit 11
24	No pin	49	No pin
25	-15V	48	Bit 12 (LSB)
26	No pin	47	No pin
27	+15V	46	No pin
28	No pin	45	No pin
29	+5V	44	No pin
30	Digital Com	43	STATUS
31	No pin	42	No pin
32	Comp Out	41	No pin
33	Status	40	No pin
34	Conv Comm	39	No pin
35	Clock In	38	No pin
36	Clock Out	37	Clock Inhibit

The 116000001 circuit module is a 12-bit binary analog-to-digital converter.

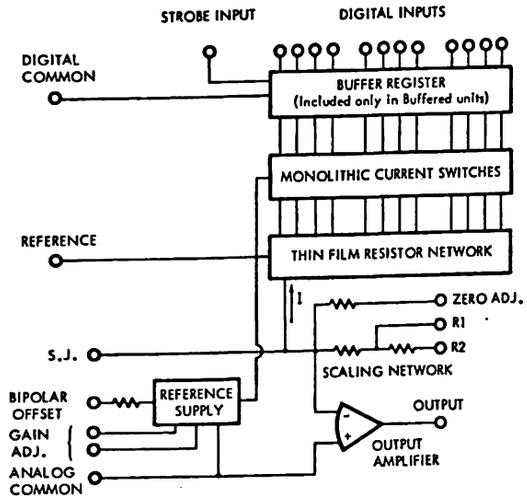
116000002

Pin Configuration

Top View



Block Diagram



D/A Converter

Pin Designations

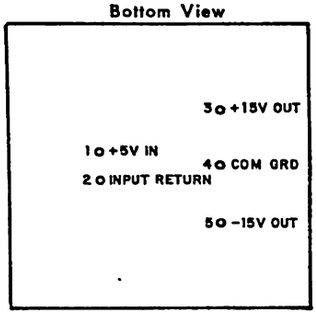
Pin No.	
K	Key
1	-15V
2	+15V
3	+5V
4	No pin
5	Pwr Com
6	No pin
7	Bit 1 (MSB)
8	Bit 2
9	Bit 3
10	Bit 4
11	Bit 5
12	Bit 6
13	Bit 7
14	Bit 8
15	Bit 9
16	Bit 10
17	Bit 11
18	Bit 12
19	No pin
20	No pin
21	Bipolar Offset
22	Gain Adj
23	20V
24	10V
25	Ref
26	Output
27	Sum JCT
28	Zero Adj

The 116000002 circuit module is a 12-bit binary digital-to-analog converter with an externally programmable output amplifier.

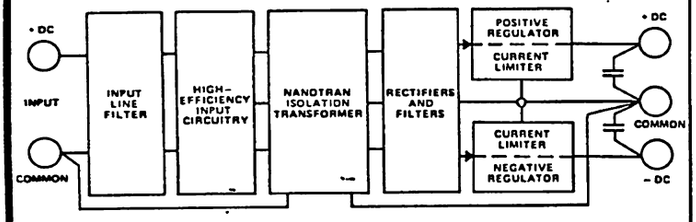
116000003

Power Supply DC/DC

Pin Configuration
Bottom View



Block Diagram



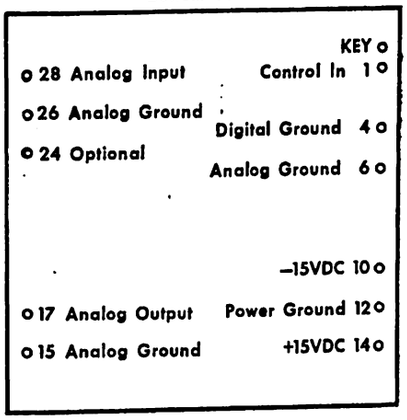
Pin Designations

Pin No.	
1	+5VDC Input
2	Input Return
3	+15VDC Output
4	Common Grd
5	-15VDC Output

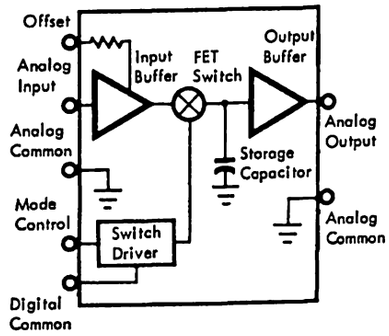
116000004

Sample and Hold

Pin Configuration
Bottom View



Block Diagram



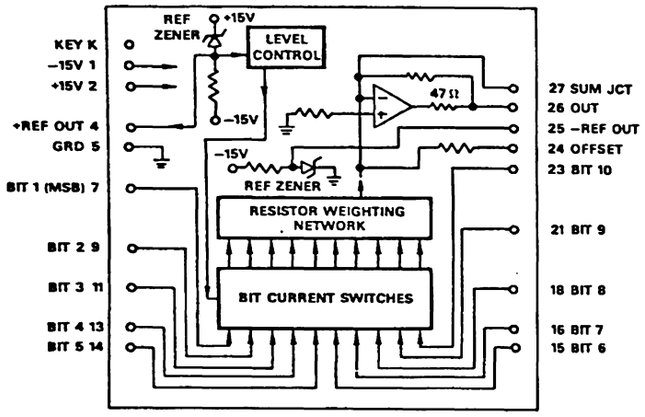
Pin Designations

Pin No.	
K	Key
1	Control In
2	No pin
3	No pin
4	Digital Ground
5	No pin
6	Analog Ground
7	No pin
8	No pin
9	No pin
10	-15VDC
11	No pin
12	Power Ground
13	No pin
14	+15VDC
15	Analog Ground
16	No pin
17	Analog Output
18	No pin
19	No pin
20	No pin
21	No pin
22	No pin
23	No pin
24	Offset (Grd)
25	No pin
26	Analog Ground
27	No pin
28	Analog Input

The 116000004 circuit module is a fast sample-and-hold device with low droop rate and overall accuracy compatible with 12-bit A/D conversion systems operating to 1/2LSB accuracy. This module accepts ±10 volt data, a TTL/DTL and C/MOS compatible control signal, and requires ±15Vdc power.

116000006

Pin Configuration & Block Diagram
Top View



D/A Converter

Pin Designations

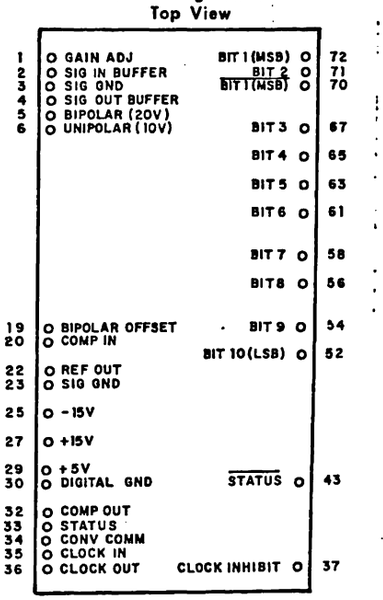
Pin No.	
1	-15V
2	+15V
3	No pin
4	+Ref Out
5	Grd
6	No pin
7	Bit 1 (MSB)
8	No pin
9	Bit 2
10	No pin
11	Bit 3
12	No pin
13	Bit 4
14	Bit 5
15	Bit 6
16	Bit 7
17	No pin
18	Bit 8
19	No pin
20	No pin
21	Bit 9
22	No pin
23	Bit 10
24	Offset
25	-Ref Out
26	Out
27	Sum JCT
28	No pin

The 116000006 circuit module is a 10-bit binary, unipolar digital-to-analog converter with a built-in I. C. output amplifier.

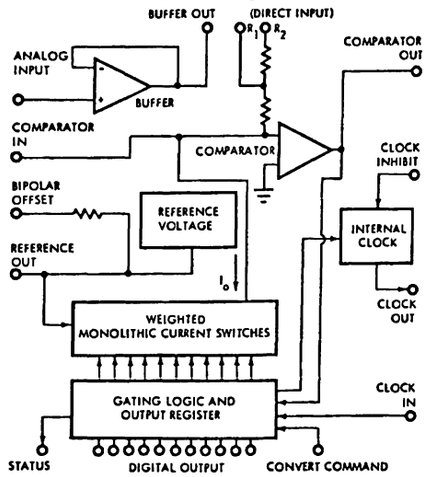
116000007

A/D Converter

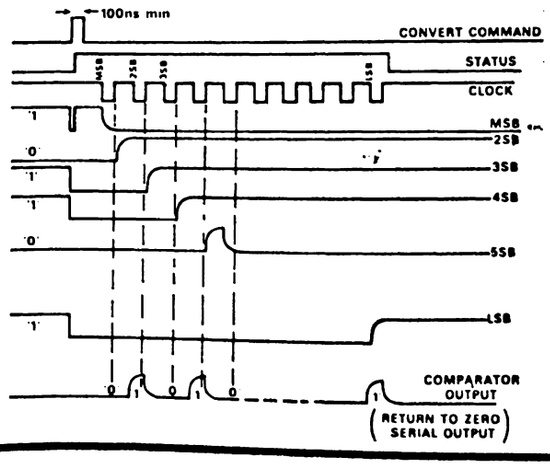
Pin Configuration
Top View



Block Diagram



Timing Diagram



Pin Designations

Pin No.		Pin No.	
1	Gain Adj.	72	Bit 1 (MSB)
2	Sig. In Buffer	71	Bit 2
3	Sig. Grd	70	Bit 1 (MSB)
4	Sig. Out Buffer	69	No pin
5	Bipolar (20V)	68	No pin
6	Unipolar (10V)	67	Bit 3
7	No pin	66	No pin
8	No pin	65	Bit 4
9	No pin	64	No pin
10	No pin	63	Bit 5
11	No pin	62	No pin
12	No pin	61	Bit 6
13	No pin	60	No pin
14	No pin	59	No pin
15	No pin	58	Bit 7
16	No pin	57	No pin
17	No pin	56	Bit 8
18	No pin	55	No pin
19	Bipolar Offset	54	Bit 9
20	Comp. In	53	No pin
21	No pin	52	Bit 10 (LSB)
22	Ref. Out	51	No pin
23	Sig. Grd	50	No pin connection
24	No pin	49	No pin
25	-15V	48	No pin connection
26	No pin	47	No pin
27	+15V	46	No pin
28	No pin	45	No pin
29	+5V	44	No pin
30	Digital Grd	43	STATUS
31	No pin	42	No pin
32	Comp. Out	41	No pin
33	Status	40	No pin
34	Conv. Comm.	39	No pin
35	Clock In	38	No pin
36	Clock Out	37	Clock Inhibit

The 116000007 circuit module is a 10-bit binary analog-to-digital converter capable of $\pm$1/2LSB.

PART NUMBER	REV	DESCRIPTION
121000001	00	CRYSTAL 14.08 KC
121000002	00	CRYSTAL 16.00 KC
121000003	00	CRYSTAL 10 MC
121000004	00	CRYSTAL 20 MC
121000005	00	CRYSTAL 19.20 KC
121000006	00	CRYSTAL 8.8 KC
121000007	00	CRYSTAL 230.4 KC
121000008	00	CRYSTAL 153.6 KC
121000009	00	CRYSTAL 65.536 KC
121000010	00	CRYSTAL 307.2 KC
121000011	00	CRYSTAL 38.4 KC
121000012	00	CRYSTAL 76.8 KC
121000013	00	CRYSTAL 192.0 KC
121000014	00	CRYSTAL 13.33 MC
121000015	00	CRYSTAL 40 KC
121000016	00	CRYSTAL 204.8 KC
121000017	00	CRYSTAL 25.6 KC
121000018	00	CRYSTAL 10.752 KC
121000019	00	CRYSTAL 1228.800 KHZ VR6 E-5
121000020	00	CRYSTAL 11.5 MHC
121000021	00	CRYSTAL 100 KC
121000023	00	CRYSTAL 614.4 KC
121000024	00	CRYSTAL XTA2.1.54 MHZ
121000025	00	CRYSTAL 11.004 MHZ
121000026	00	CRYSTAL 50 MHZ
121000027	00	CRYSTAL 15.36 MHZ
121000028	00	CRYSTAL 160.000 KHZ
121000029	00	CRYSTAL 8.33 MHZ
121000030	00	CRYSTAL 6.912 MHZ