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FUJITSU

DATA SHEET

MB3794
CAR AUDIO SYSTEM POWER SUPPLY IC

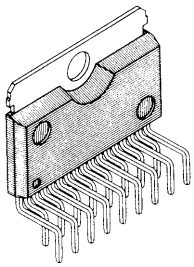
CAR AUDIO SYSTEM POWER SUPPLY IC

The MB3794 is a multi-output, multi-function power supply IC, which was developed for car audio systems, including the digital tuning system.

The IC supplies 5V to a microcomputer, 9.15V to an RF stage for tuner, and 8.4V to an FM/AM receiver and a compact cassette tape deck and shares power among them. It is easy to switch between AM, FM, CASSETTE, and common power modes

The multiplex drive method enables AM signals to be received even while the cassette tape deck is being used.

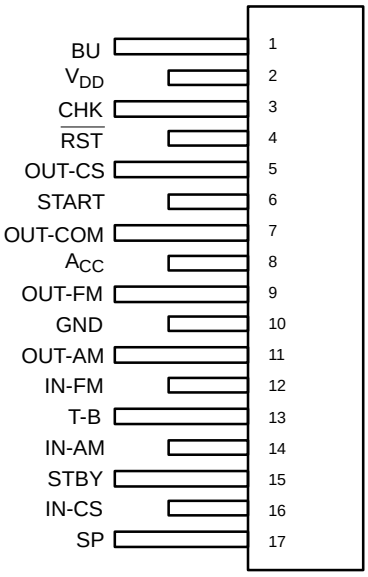
The MB3794 is a complete system power supply. The IC is mounted in a 17-pin small ZIP package to save space.



PLASTIC PACKAGE
ZIP-17P-M03

- Multiple output ports (5.0V, 9.15V, and four 8.4V)
  - Multiple function ports (four control input ports and three control output ports)
- Suitable for car components
  - Control input for constant-voltage output on/off control (except 5V output)
- TTL and CMOS-compatible control input voltage
- Low saturation voltage (0.3V typical)
- Small backup current (380 μA typical)
- Small package (ZIP 17 with radiation fin)
- Power supply surge voltage and over-current protection circuits

PIN ASSIGNMENT
(TOP VIEW)



ABSOLUTE MAXIMUM RATINGS (see Note) (GND = 0V, T_A = +25°C)

Rating	Symbol	Value	Unit
Input voltage	V_{IN}	24	V
Input surge voltage	$V_{IN\ (S)}$	50	V
Power dissipation	P_D	6.5*	W
Storage temperature	T_{STG}	–55 to +150	°C
Output current	I_O	OUT-FM 200 OUT-AM,OUT-CS 70 OUT-COM 180 T1–B 18 $\overline{V}_{DD}$ 50	mA

*See Page 11, Power Derating Characteristics

Note: Permanent device damage may occur if Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

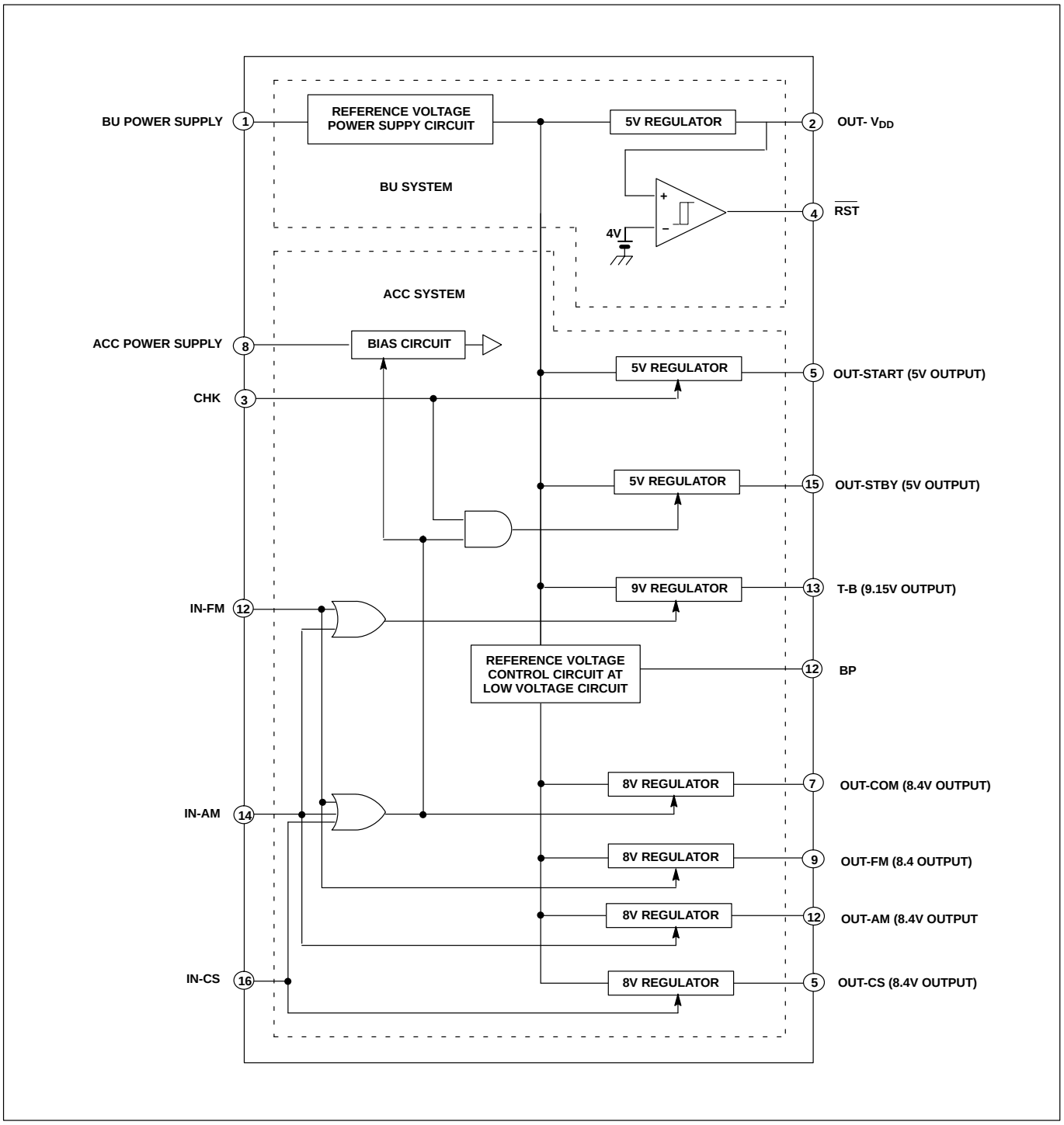


Figure 1. MB3794 Block Diagram

FUNCTIONAL EXPLANATIONS OF PINS

Terminal No.	Terminal Name	Function
8	ACC	To be connected to the main battery.
1	BU	To be connected to the backup battery.
12	IN-FM	TTL or CMOS-level control can be supplied by output selection input with a microcomputer. (Function table and sequences 1 and 3)
14	IN-AM	
16	IN-CS	
3	CHK	ACC line connection check terminal. (Sequences 3 and 4). If the level is low, all outputs are turned off. The terminal uses hysteresis to compensate for AC line noise.
9	OUT-FM	Power supply for FM tuner such as FM IF and FM DEM.
11	OUT-AM	Power supply for AM tuner.
5	OUT-CS	Power supply for a cassette tape deck, such as equalizer and amplifier. Select IN-CS for this output.
7	OUT-COM	Power supply for common system functions such as tone control and volume/balance control. Select IN-FM, IN-AM, IN-CS for this output.
13	T-B	Power supply for the varicap for the first RF stage of tuner. Select IN-FM or IN-AM for this output.
15	STBY	Control output pin for a circuit that has a standby function, and that works on the same logic as OUT-COM.
6	START	Transmits system operation start information to the microprocessor according to the CHK voltage. (Sequence 4)
2	V_{DD}	Powers the microprocessor and receives power from the BU. The supply cannot be turned on or off by control input. (Sequence 2)
4	$\overline{RST}$	If V_{DD} goes down, this output terminal resets the microprocessor. (Sequence 5)
17	BP	Improves the ripple rejection ratio when the voltage is reduced. If no improvement, connect the terminal to ACC. For the usage, see the BP TERMINAL USAGE.
10	GND	Ground

RECOMMENDED OPERATING CONDITIONS

(V_{ACC} = V_{BU}, GND = 0V)

Parameter	Symbol	Pin Name	Min.	Typ.	Max.	Unit
Input voltage	$V_{IN\ (ACC)}$	ACC	10	13.2	16	V
Backup input voltage	$V_{IN\ (S)}$	BU	7.5	13.2	16	V
Output current	I_O	T-B			10	mA
		OUT-FM			160	mA
		OUT-AM, OUT-CS			60	mA
		OUT-COM			100	mA
		START, STBY			2	mA
		V_{DD}			40	mA
Operating temperature	T_{OP}	—	-40	25	85	°C

ELECTRICAL CHARACTERISTICS

V_{ACC} = V_{BU}, GND = 0V, Tj = 25°C

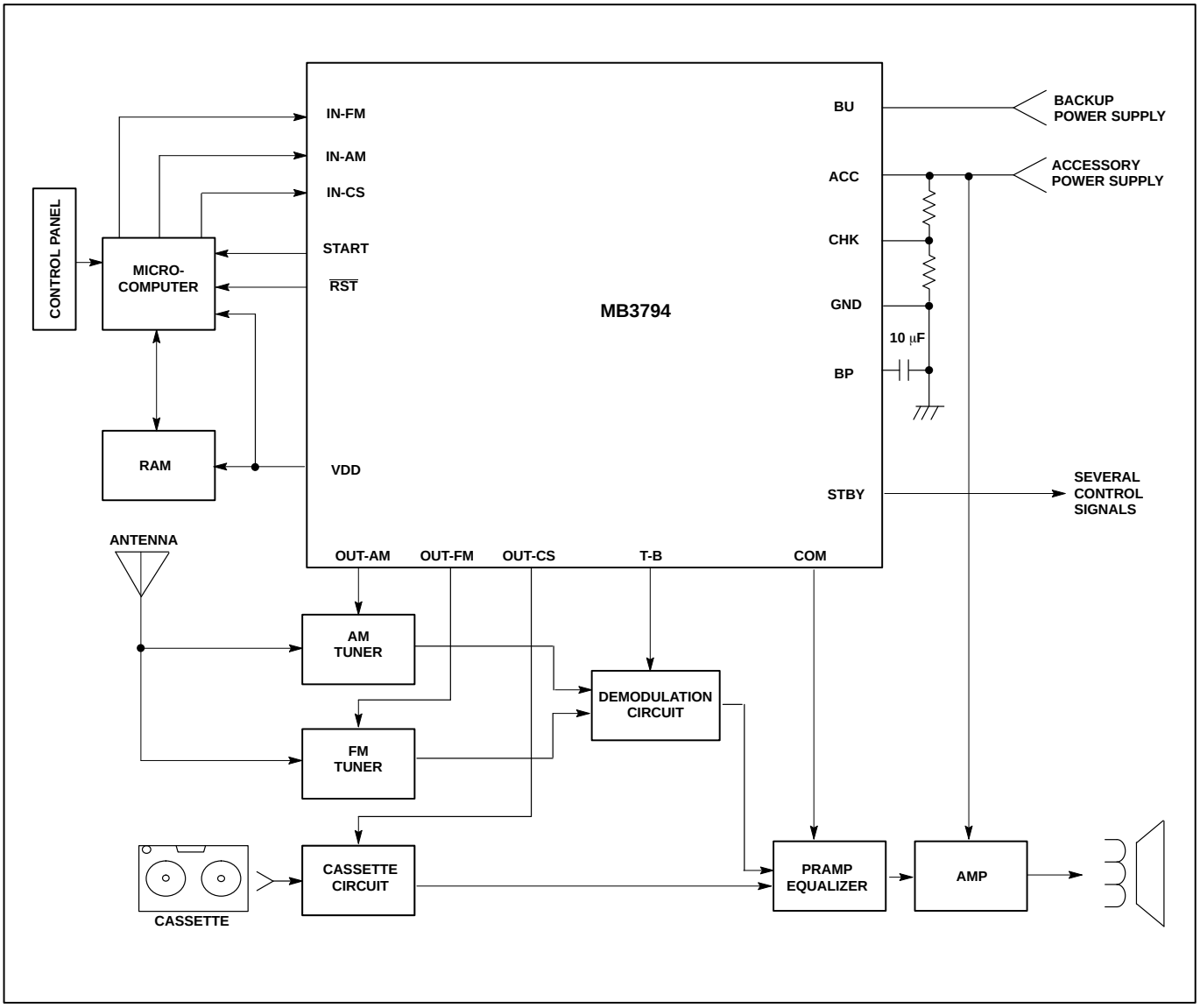
Parameter	Symbol	Condition	Pin Name	Standard			Unit
				Min	Typ	Max	
Output Voltage	V_{01}	I_O =10 mA, V_{ACC} =10V	T-B	8.7	9.15	9.6	V
	V_{02}	I_O = 50 mA, V_{ACC} = 9.5V	COM	8.0	8.4	8.8	V
		I_O = 100 mA, V_{ACC} = 9.8V		8.0	8.4	8.8	
	V_{03}	I_O = 100 mA, V_{ACC} = 9.5V	FM	8.0	8.4	8.8	V
		I_O = 150 mA, V_{ACC} = 9.8V		8.0	8.4	8.8	
	V_{04}	I_O = 50 mA, V_{ACC} = 9.5V	AM	8.0	8.4	8.8	V
	V_{05}	I_O = 50 mA, V_{ACC} = 9.5V	CS	8.0	8.4	8.8	V
	V_{06}	I_O = 2 mA, V_{ACC} = 9.5V	START	4.8	5.0	5.2	V
	V_{07}	I_O = 2 mA, V_{ACC} = 9.5V	STBY	4.8	5.0	5.2	V
	V_{08}	I_O = 30 mA , V_{ACC} = 7.5V	V_{DD}	4.8	5.0	5.2	V
Minimum 1/0 Voltage Difference	V_{D01}	I_O = 10 mA	T-B	—	0.2	0.4	V
	V_{D02}	I_O = 50 mA	COM	—	0.3	0.6	V
		I_O = 100 mA		—	0.6	0.9	
	V_{D03}	I_O = 100 mA	FM	—	0.3	0.6	V
		I_O = 150 mA		—	0.6	0.9	
	V_{D04}	I_O = 50 mA	AM	—	0.3	0.6	V
	V_{D05}	I_O = 50 mA	CS	—	0.3	0.6	V
	V_{D06}	I_O = 2 mA	START	—	2.0	2.6	V
	V_{D07}	I_O = 2 mA	STBY	—	2.0	2.6	V
	V_{D08}	I_O = 30 mA	V_{DD}	—-	0.3	0.6	V
Output Offset Voltage	ΔV_O	V_{ACC} = 10V	V_{02} to V_{05}	—	60	—	mV
Input Stability	ΔV_{IN}	I_O = 10 mA, V_{ACC} = 10 to 16V	T-B	—	10	—	mV
		I_O = 50 mA, V_{ACC} = 10 to 16V	FM	—	10	—	
		I_O = 50 mA, V_{ACC} = 10 to 16V	AM, CS	—	10	—	
		I_O = 2 mA , V_{ACC} = 10 to 16V	START, STBY	—	20	—	
		I_O = 30 mA, V_{BU} = 5.5 to 16V	V_{DD}	-	10	—	

ELECTRICAL CHARACTERISTICS, continued

V_{ACC} = V_{BU}, GND = 0V, Tj = 25°C

Parameter	Symbol	Condition	Pin Name	Standard			Unit
				Min	Typ	Max	
Load stability	ΔV_{Load}	I_O = 0 to 10 mA , V_{ACC} = 10V	T-B	—	10	—	mV
		I_O = 0 to 50 mA, V_{ACC} = 9.5V	COM	—	30	—	
		I_O = 0 to 100 mA, V_{ACC} = 9.8V		—	60	—	
		I_O = 0 to 100 mA, V_{ACC} = 9.5V	FM	—	30	—	
		I_O = 0 to 150 mA, V_{ACC} = 9.8V		—	60	—	
		I_O = 0 to 50 mA, V_{ACC} = 9.5V	AM, CS	—	30	—	
		I_O = 0 to 30 mA, V_{ACC} = 7.5V	V_{DD}	—	30	—	
Control terminal input voltage (FM, AM, CS)	V_{IH}	V_{ACC} = 9.5V	FM, AM, CS	2.0	—	V_{ACC}	V
	V_{IL}			-0.3	—	0.8	
CHK terminal input voltage	V_{IHC}	V_{ACC} = 9.5V	CHK	1.34	—	3.0	V
	V_{ILC}			–0.3	—	1.14	
Control terminal input current (FM, AM, CS)	I_{IH}	V_I = 5V, V_{ACC} = 9.5V	FM, AM, CS	—	50	70	μA
	I_{IL}	V_I = 0V, V_{ACC} = 9.5V		—	—	1	
CHK terminal input current	I_{IHC}	V_I = 1.34V, V_{ACC} = 9.5V	CHK	—	1	10	μA
	I_{ILC}	V_I = 0V, V_{ACC} = 9.5V		—	—	5	
Hysteresis width	V_{HYSC}	V_{BU} = 7.5V	CHK	—	70	—	mV
	V_{HYSR}		RST	—	200	—	
RST terminal output voltage	V_{OLR}	I_{RST} = 4.0 mA	RST	—	—	1.0	V
ACC terminal input current	I_{ACCO}	I_{DD} = 0 mA, V_{ACC} = 10V	ACC	—	3.9	—	mA
Backup input current	I_{BUO}	I_{DD} = 0 mA, V_{ACC} = 7.5V	BU	—	380	550	μA
Ripple rejection ratio	R.R.	13.2	V_{IN} = $1V_{P.P}$		60		dB
Output voltage temperature coefficient	$\Delta V/\Delta T$		V_{01} to V_{08}		0.045		%/°C

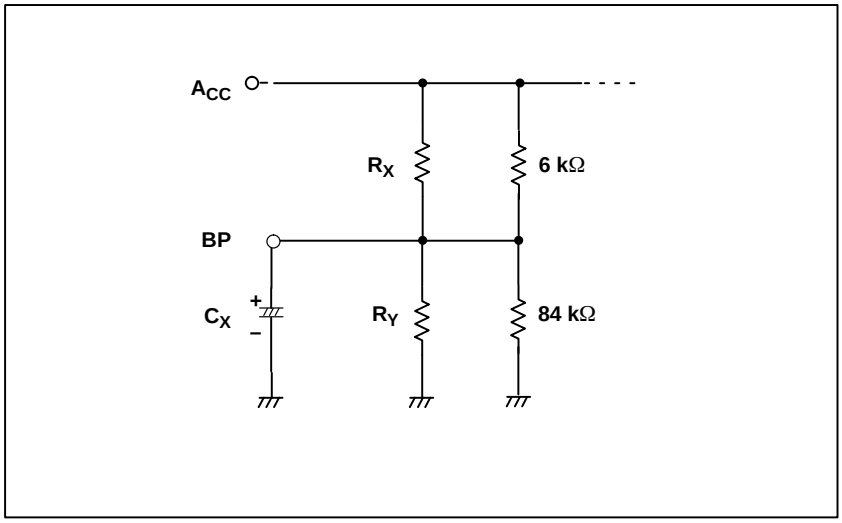
APPLICATION



BP TERMINAL USAGE

The BP terminal is usually connected to the ACC terminal. However, if the resistor (R_X or R_Y), shown in the figure below, is added the ripple rejection ratio of the 8.4V output system (V_{02} to V_{05}) can be improved when the voltage is low (nonstabilized ACC area).

The time constant (τ) is determined by C_X and the impedance (about 5.6 kΩ if $R_X = \infty$. $R_Y = \infty$) of the BP terminal ($\tau = C_X \times R$)



The output voltages when the Rx and Ry resistors are added can be calculated from the following expressions:

With $R_X \rightarrow V_O = V_{IN\ (ACC)} \times 84\ k\Omega \div (6\ k\Omega \mathbin{/\!/} R_X + 84\ k\Omega)$
With $R_Y \rightarrow V_O = V_{IN\ (ACC)} \times 84\ k\Omega \mathbin{/\!/} R_Y \div (84\ k\Omega \mathbin{/\!/} R_Y + 6\ k\Omega)$

Note: The standard value of minimum I/O voltage is based on the conditions that $R_X = 0\Omega$ and $R_Y = \infty$. The R_X value must be 40 kΩ or more because the output voltage is limited by the minimum I/O voltage difference.

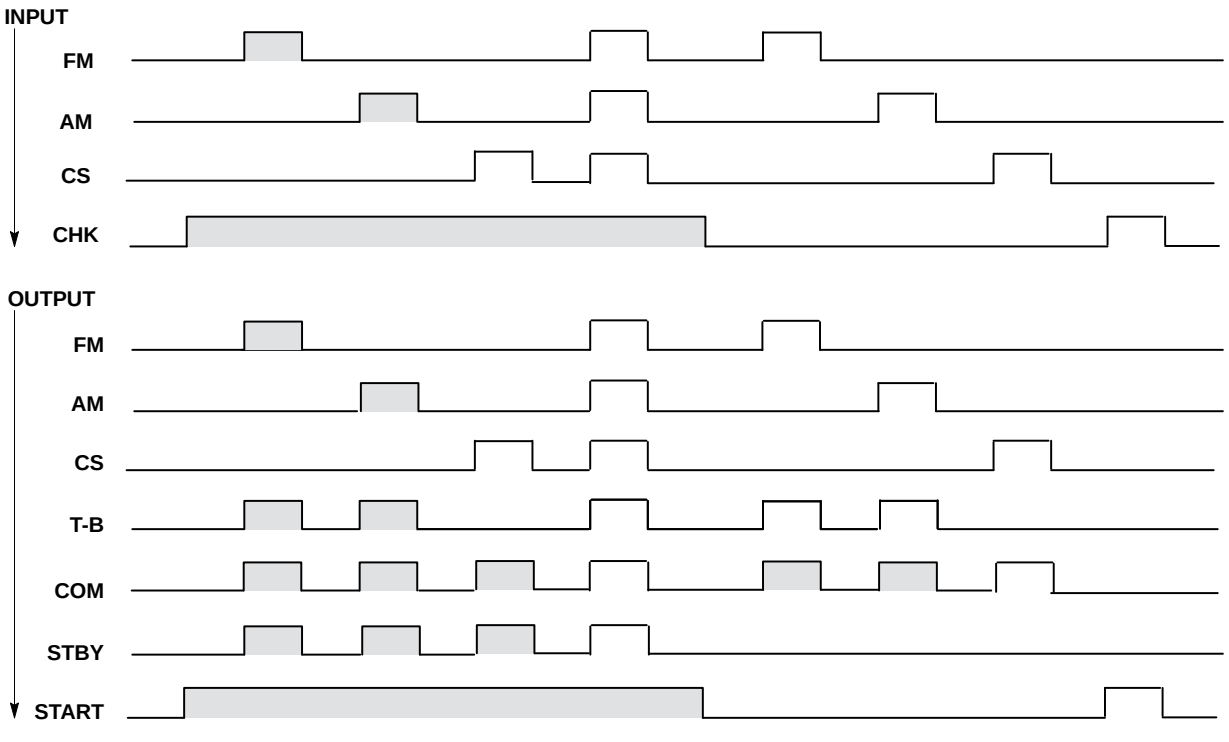
FUNCTION TABLE

CHK	Input			Output							Function
	FM	AM	CS	FM	AM	CS	T-B	COM	STBY	START	
L	L	L	L	L	L	L	L	L	L	L	All outputs off
H										H	
L	H	L	L	H	L	L	H	H	L	L	FM selection
H									H	H	
L	L	H	L	L	H	L	H	H	L	L	AM selection
H									H	H	
L	L	L	H	L	L	H	L	H	L	L	CS selection
H									H	H	
L	H	H	L	H	H	L	H	H	L	L	FM and AM selection
H									H	H	
L	H	L	H	H	L	H	H	H	L	L	FM and CS selection
H									H	H	
L	L	H	H	L	H	H	H	H	L	L	AM and CS selection
H									H	H	
L	H	H	H	H	H	H	H	H	L	L	All outputs on
H									H	H	

Note: Double selection increases heat dissipation, so power consumption and layout must be designed carefully.

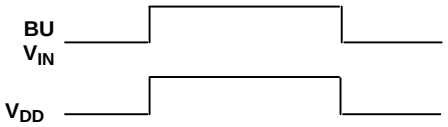
CONTROL SEQUENCE

(1) ACC System Input

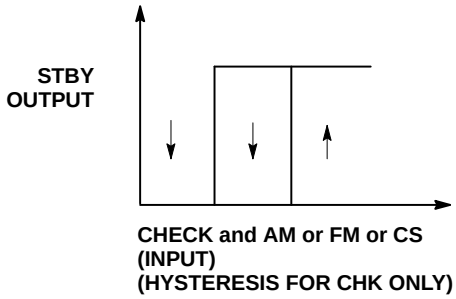


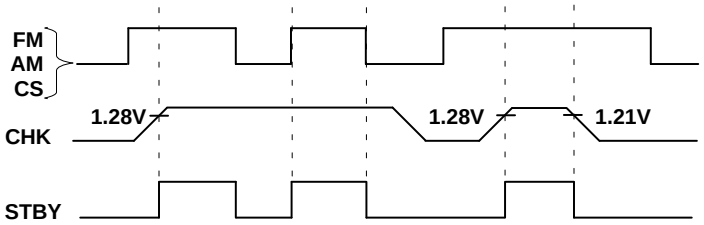
CONTROL SEQUENCE (continued)

(2) BU System I/O

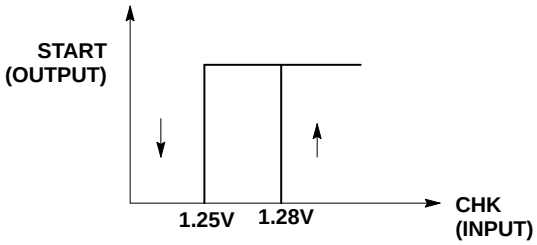


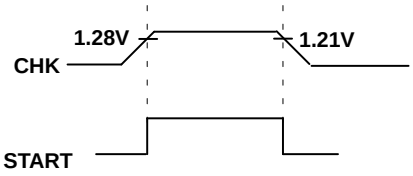
(3) Standby Output (ACC System)



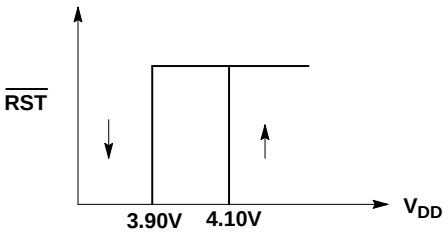


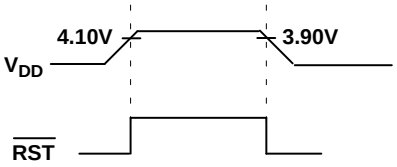
(4) Start Output (ACC System)



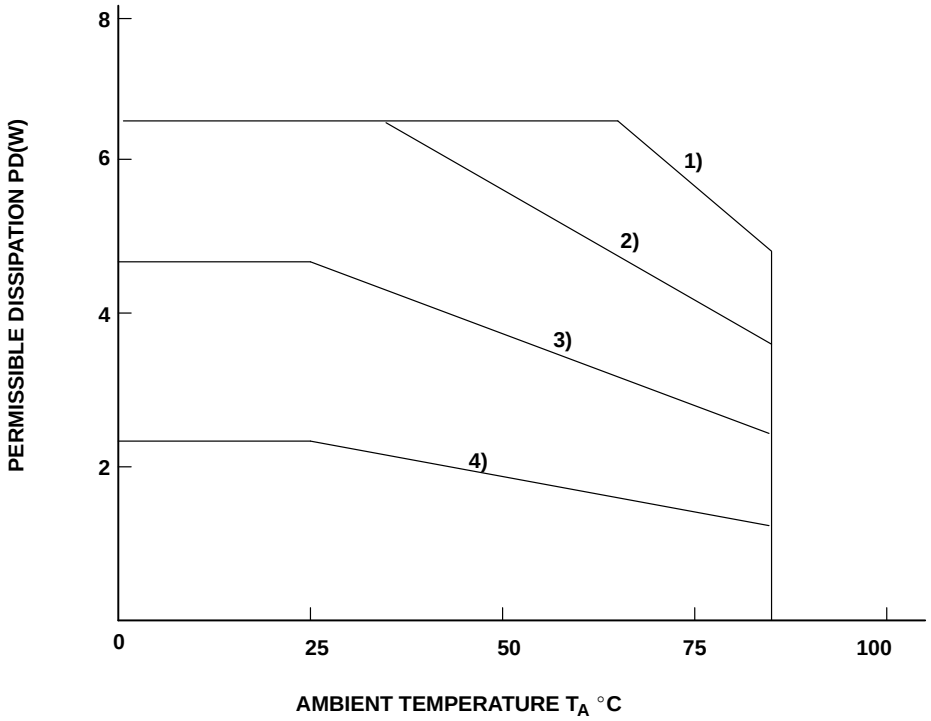


(5) Reset Output (BU System)





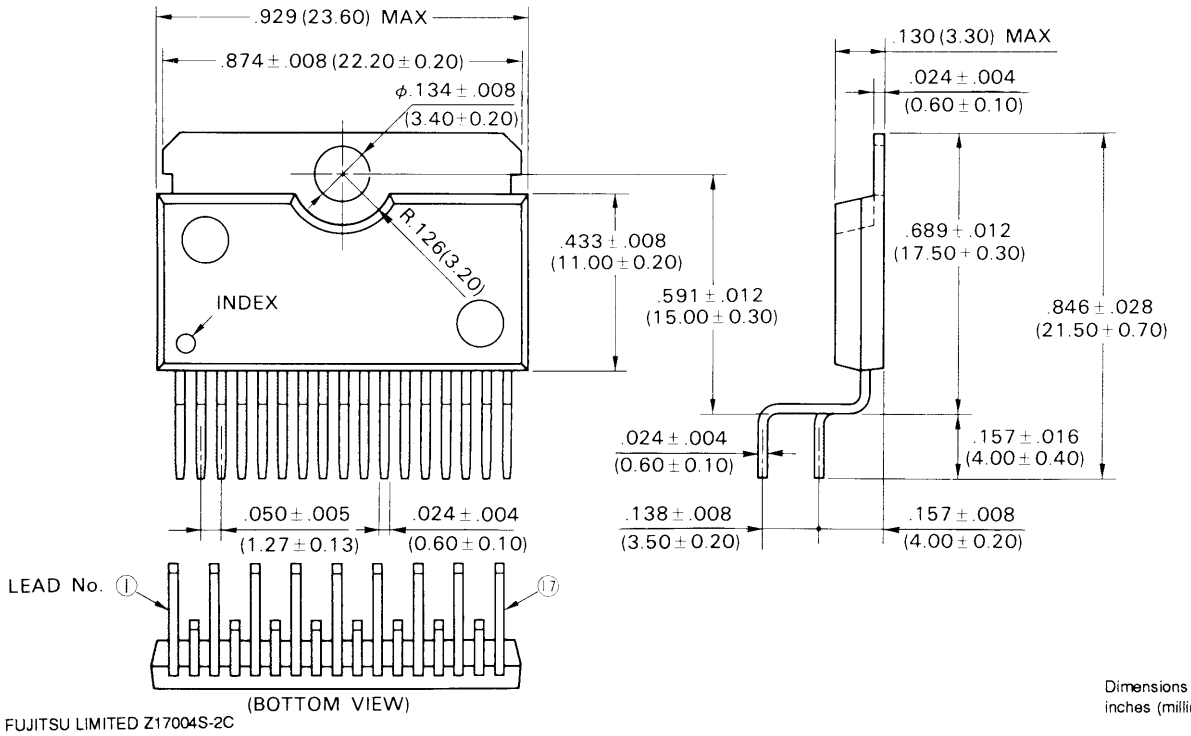
POWER DERATING CHARACTERISTICS



Conditions:
1) 50 cm^2 x 2-mm thick radiation board
2) 25 cm^2 x 2-mm thick radiation board
3) 10 cm^2 x 2-mm thick radiation board
4) No radiation board

PACKAGE DIMENSIONS

17-LEAD PLASTIC ZIG-ZAG IN-LINE PACKAGE
(CASE No.: ZIP-17P-M03)



FUJITSU LIMITED

For further information please contact:

Japan

FUJITSU LIMITED
Integrated Circuits and Semiconductor Marketing
Furukawa Sogo Bldg., 6–1, Marunouchi 2–chome
Chiyoda–ku, Tokyo 100, Japan
Tel: (03) 3216–3211
Telex: 781–2224361
FAX: (03) 3216–9771

North and South America

FUJITSU MICROELECTRONICS, INC.
Semiconductor Division
3545 North First Street
San Jose, CA 95134–1804 USA
Tel: 408 –922–9000
Telex: 910–671–4915
FAX: 408–432–9044

Europe

FUJITSU MIKROELEKTRONIK GmbH
Arabella Centre 9.OG
Lyoner Strasse 44-48
D-6000 Frankfurt 71
F.R. Germany
Tel: (069) 66320
Telex: 411963 FAX: (069) 6632122

Asia

FUJITSU MICROELECTRONICS ASIA PTE LIMITED
51 Bras Basah Road,
Plaza By The Park,
#06–04/07,
Singapore 0718
Tel: 336–1600
Telex: 55573 FAX: 336–1609

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