FUJITSU

BATTERY BACKUP IC

MB3780A

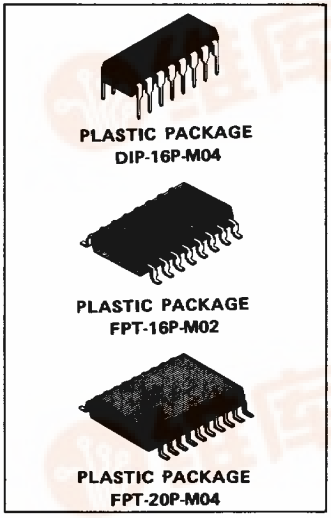
August 1989
Edition 1.0

BATTERY BACKUP IC

The Fujitsu MB3780A monolithic battery backup IC is fabricated with a bipolar linear IC technology, and is suitable for power supply of SRAM, ROM and Logic ICs.

The MB3780A generats a reset signal when power supply's ON/OFF or abnormal power supply. The MB3780A provides switching function for back up between modes such as primary bateery which is non-chargeable and secondary battery which is chargeable. All necessary functions for battery backup are available on a chip. The MB3780A is available in 16-pin Dual In-Line, space saving Flat package, or 20-pin shrink small outline which is suitable for memory card.

- Input circuit power consumption when unloaded: 1.0 mA typical
- Output drive current: 200 mA maximum (can be incleased with an external transistor)
- Input/output differential voltage: 230 mV typical
- Input loss voltage detection value: 4.2V ± 2.5%
- Onchip power-on reset circuit
- Low voltage detection value by primary battery: 2.65V, 2.37V
- Onchip secondary battery
- Output current at backup: 500 μA maximum
- Leak current at backup: 0.5 μA or less



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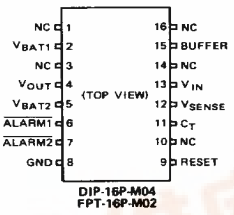
ABSOLUTE MAXIMUM RATINGS (See Note) (T_A = 25°C)

Ratings	Symbol	Value	Unit
Input Voltage	V_{IN}	−0.3 to 7	V
Battery Voltage	V_{BAT}	−0.3 to 7	V
Output Reset Voltage	V_{RESET}	7	V
Output Alarm Voltage	V_{ALARM}	7	V
Output Current	I_{OUT}	250	mA
Output Buffer Current	I_{BUF}	55	mA
Power Dissipation	P_D	*900	mW
		**540	mW
		***450	mW
Operating Temperature	T_{OP}	−30 to 85	°C
Storage Temperature	T_{STG}	−55 to 125	°C

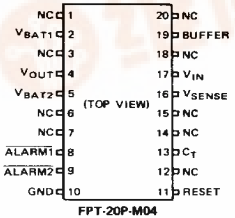
NOTE: * $T_A \leqq 25°C$ DIP-16P-M04
** $T_A \leqq 25°C$ FPT-16P-M02
*** $T_A \leqq 25°C$ FPT-20P-M04

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.

PIN ASSIGNMENT



DIP-16P-M04
FPT-16P-M02



FPT-20P-M04

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

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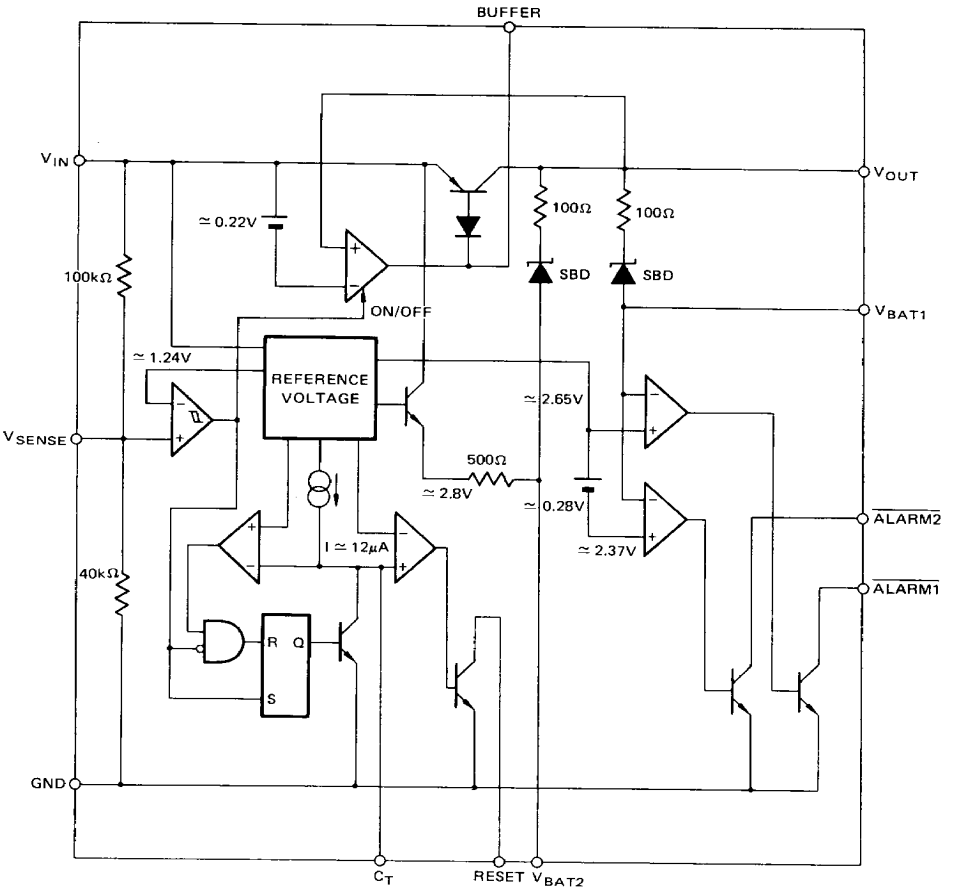
Fig. 1 – MB3780A EQUIVALENT CIRCUIT



RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Input Voltage	V_{IN}		5.0	6.0	V
Output Reset Current	I_{RESET}			3	mA
Output Alarm Current	I_{ALARM}			3	mA
Secondary Battery Charging Current	I_{CHARGE}	−3			mA
Output Current	I_{OUT}			200	mA
Output Buffer Current	I_{BUF}			50	mA
Backup Current	I_{BU}			500	μA
Operating Temperature	T_{op}	−30		85	* °C
		−30		70	** °C

NOTE: * DIP-16P-M04
** FPT-16P-M02, FPT-20P-M04

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ELECTRICAL CHARACTERISTICS

(V_{IN} = 5V, T_A = 25°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Whole Device						
Input Current	I_{IN1}	I_{OUT} = 0mA		1.0	1.5	mA
	I_{IN2}	I_{OUT} = 200mA		225	250	mA
	I_{IN3}	V_{IN} = 4.0V		1.0	1.5	mA
Backup System						
Input/Output Defferential Voltage	DV_1	I_{OUT} = 0mA	0.18	0.21	0.24	V
	DV_2	I_{OUT} = 200mA	0.19	0.22	0.25	V
Output Delay Time	tr_O	C_O = 0.01μF, C_T = 0		2.0	10	μs
Output Buffer Current	I_{BUF}	V_O = 4.7V, V_{BUF} = 4.0V	50			mA
Buffer Leak Current	I_{OHB}	V_{IN} = 0V, V_{BUF} = 4.5V			100	nA
Power Supply Monitoring System						
Input Loss Voltage	V_{INL}	V_{IN} ↘	4.10	4.20	4.30	V
	V_{INH}	V_{IN} ↗	4.20	4.30	4.40	V
Hysteresis Width of Input Loss Voltage	DV_{IN}	$V_{INH}-V_{INL}$	50	100	150	mV
Output Reset Voltage	V_{RESET}	I_{RESET} = 3mA		0.15	0.4	V
Output Reset Leak Current	I_{OHR}	V_{IN} = 4.0V, V_{RESET} = 6V		0	100	nA
Reset Pulse Width	t_{PO}	C_T = 0.01μF	0.5	1.0	1.5	ms
Input Pulse Width	t_{PI}	C_T = 0.01μF, V_{IN} ⊓	5			μs
Reset Output Rising Time	tr_R	C_T = 0.01μF R_L = 5.1kΩ, C_L = 100pF		2.0	3.0	μs
Reset Output Falling Time	tf_R			0.1	0.5	μs
Reset Output Propagation Delay Time	tpd_R	C_T = 0.01μF		2.0	10	μs

ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = 5V, T_A = 25°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Primary Battery Monitoring System						
Low Voltage Detection (Primary)	V_{BATL1}	V_{BAT1} ↘	2.55	2.65	2.75	V
	V_{BATH1}	V_{BAT1} ↗	2.59	2.69	2.79	V
Hysteresis Width of Low Voltage Detection (Primary)	DV_{BAT1}	$V_{BATH1}-V_{BATL1}$	20	40	60	mV
Low Voltage Detection (Secondary)	V_{BATL2}	V_{BAT1} ↘	2.27	2.37	2.47	V
	V_{BATH2}	V_{BAT1} ↗	2.31	2.41	2.51	V
Hysteresis Width of Low Voltage Detection (Secondary)	DV_{VAT2}	$V_{BATH2}-V_{VATL2}$	20	40	60	mV
Differential Detected Low Voltage	DV_{BAT}	$V_{VATL1}-V_{BATL2}$	0.26	0.28	0.30	V
Input Current	I_{VATA}	V_{BAT} = 3V, V_{IN} = 5V	−100		500	nA
	I_{VATB}	V_{BAT} = 3V, V_{IN} = 0V	−100		500	nA
Output Differential Voltage	DV_{B1}	I_{BAT1} = 100μA		0.30	0.35	V
Alarm Output Voltage	V_{ALARM1}	I_{ALARM1} = 3mA		0.15	0.4	V
	V_{ALARM2}	I_{ALARM2} = 3mA		0.15	0.4	V
Alarm Output Leak Current	I_{OHA1}	V_{ALARM1} = 6V		0	100	nA
	I_{OHA2}	V_{ALARM2} = 6V		0	100	nA
Alarm Output Rising Time	tr_A	R_L = 5.1kΩ, C_L = 100pF		2.0	3.0	μs
Alarm Output Falling Time	tf_A			0.1	0.5	μs
Alarm Output Propagation Delay Time	tpd_A	50mV over drive		2.0	10	μs
Secondary Battery Monitoring System						
Output Voltage	V_{CHG}	I_{CHG} = −10μA	2.65	2.80	2.95	V
Charging Current	I_{CHGL}	V_{CHG} = 2.0V	0.6	1.6	3.0	mA
	I_{CHGH}	V_{CHG} = 3.3V	−1	0	1	μA
Defferential Output Voltage	DV_{B2}	I_{BAT2} = 100μA		0.30	0.35	V

NOTE: R_L and C_L are output logic of load resistance and capacitor.

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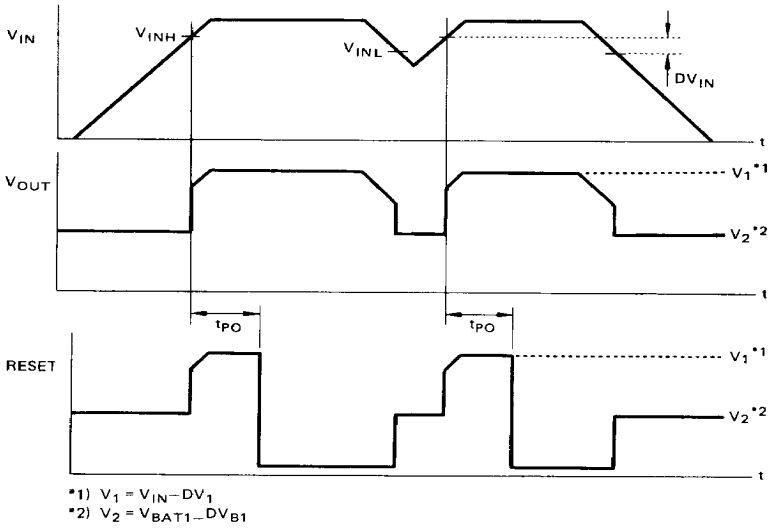
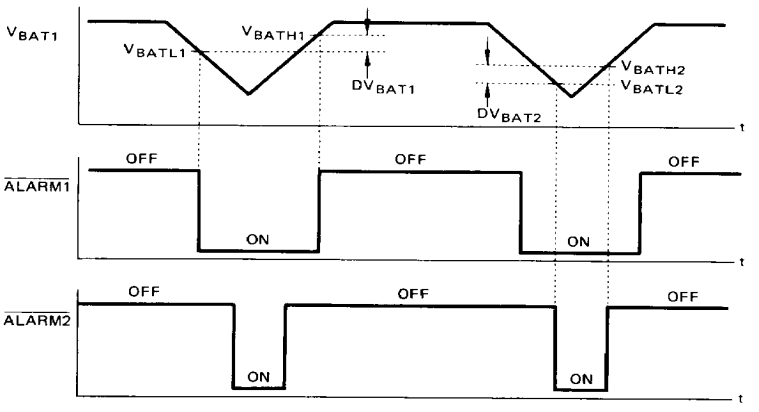
FUNCTION EXPLANATION

Fig. 2 – MB3780A INPUT ON/OFF OPERATION



*1) $V_1 = V_{IN} - DV_1$
*2) $V_2 = V_{BAT1} - DV_{B1}$

Fig. 3 – MB3780A ALARM OPERATION



Condition: $V_{IN} \geqq V_{INH}$

TIMMING DIAGRAM

Fig. 4 — MB3780A RISING/FALLING TIME OF RESET AND ALARM

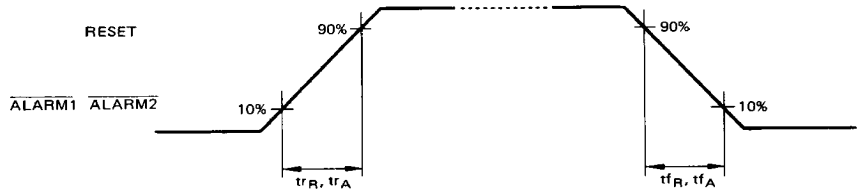
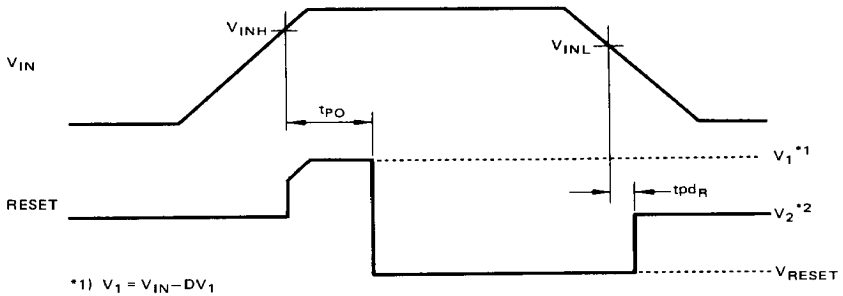
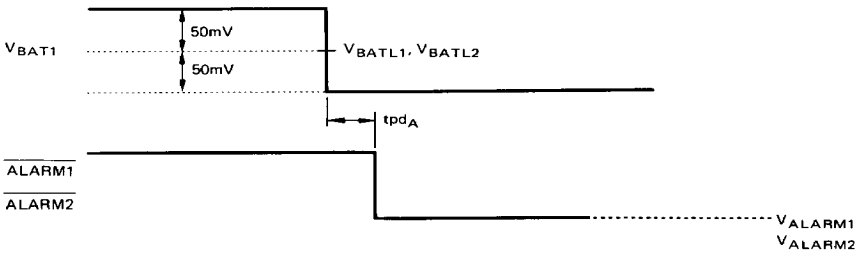


Fig. 5 — MB3780A RESET PULSE WIDTH, OUTPUT RESET PROPAGATION DELAY TIME



*1) $V_1 = V_{IN} - DV_1$
*2) $V_2 = V_{BAT1} - DV_{B1}$

Fig. 6 — MB3780A OUTPUT ALARM PROPAGATION DELAY TIME



TIMING DIAGRAM (continued)

Fig. 7 — MB3780A INPUT PULSE WIDTH

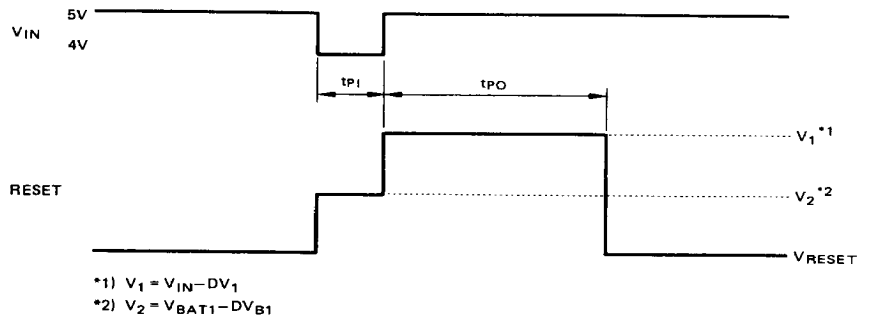
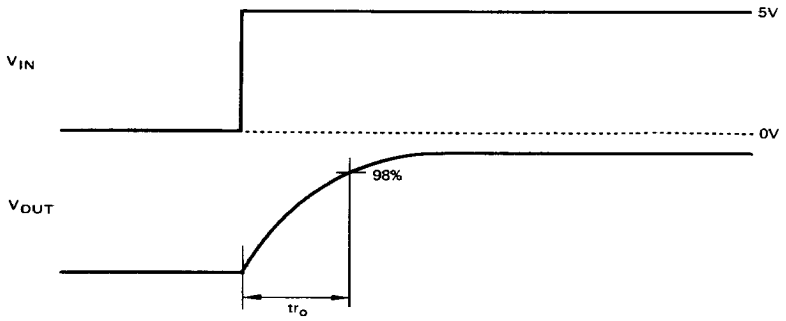
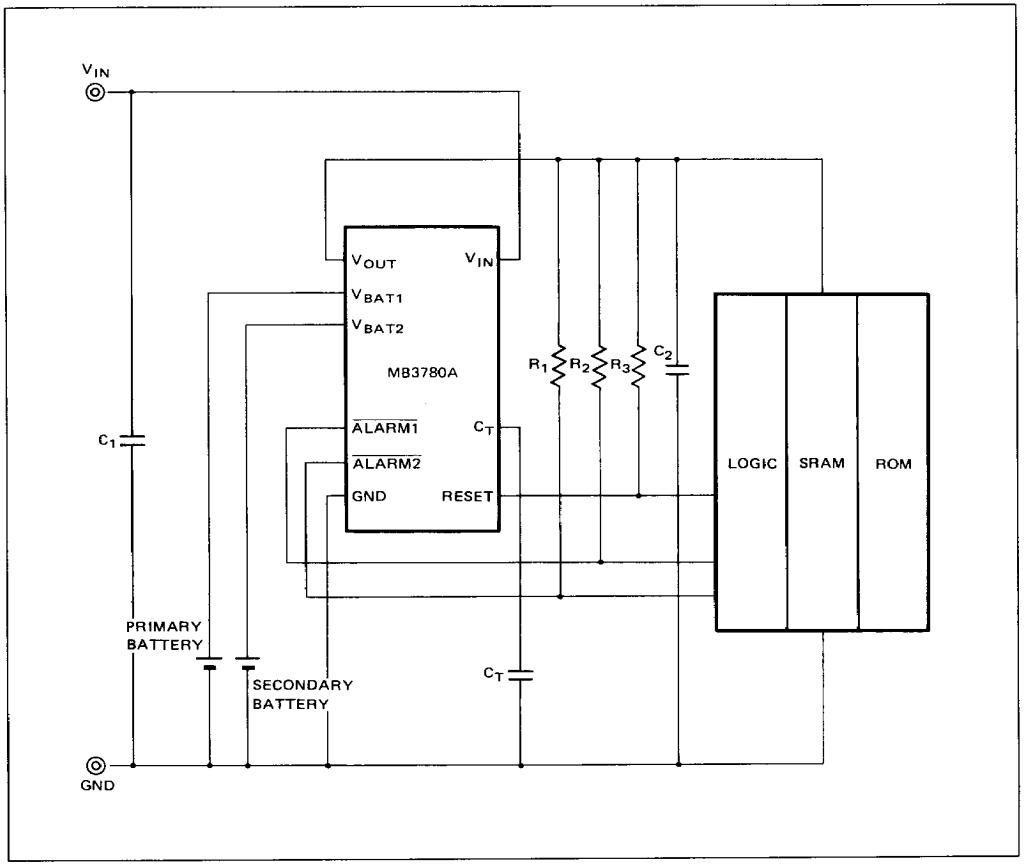


Fig. 8 — MB3780A OUTPUT VOLTAGE PROPAGATION DELAY TIME



APPLICATION EXAMPLE



NOTE: The value of C_1 and C_2 should be more than 0.022μF.

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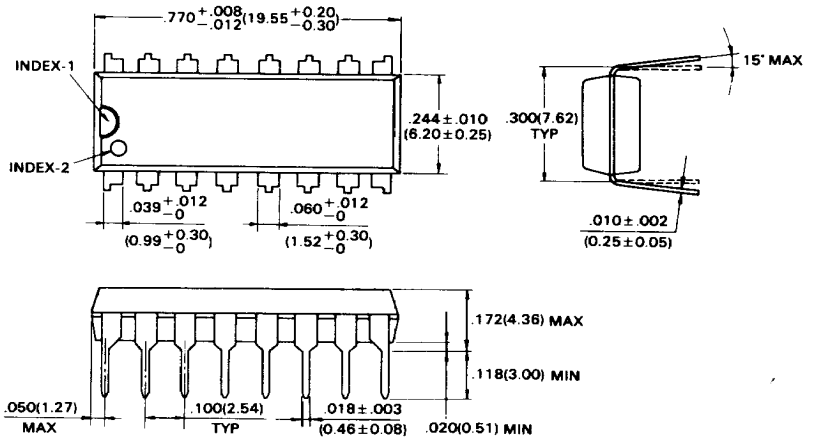
PACKAGE DIMENSIONS

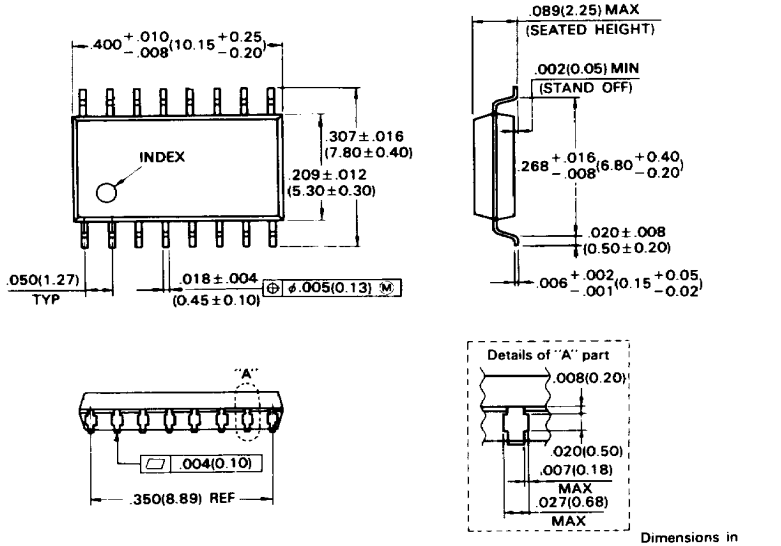
16-LEAD PLASTIC DUAL IN-LINE PACKAGE
(Case No. : DIP-16P-M04)



Dimensions in
inches (millimeters)

PACKAGE DIMENSIONS (continued)

16-LEAD PLASTIC FLAT PACKAGE
(Case No. : FPT-16P-M02)



Dimensions in inches (millimeters)

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PACKAGE DIMENSIONS (continued)