

# 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 generates 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 battery 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 increased with an external transistor)
- Input/output differential voltage: 230 mV typical
- Input loss voltage detection value: 4.2V  $\pm$  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  $\mu$ A maximum
- Leak current at backup: 0.5  $\mu$ A or less

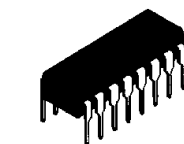
#### ABSOLUTE MAXIMUM RATINGS (See Note)

( $T_A = 25^\circ\text{C}$ )

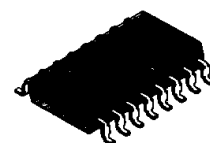
Ratings	Symbol	Value	Unit
Input Voltage	$V_{IN}$	-0.3 to 7	V
Battery Voltage	$V_{BAT}$	-0.3 to 7	V
Output Reset Voltage	$V_{RESET}$	7	V
Output Alarm Voltage	$V_{ALARM}$	7	V
Output Current	$I_{OUT}$	250	mA
Output Buffer Current	$I_{BUF}$	55	mA
Power Dissipation	$P_D$	*900	mW
		**540	mW
		***450	mW
Operating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

- NOTE:**
- \*  $T_A \leq 25^\circ\text{C}$  DIP-16P-M04
  - \*\*  $T_A \leq 25^\circ\text{C}$  FPT-16P-M02
  - \*\*\*  $T_A \leq 25^\circ\text{C}$  FPT-20P-M04

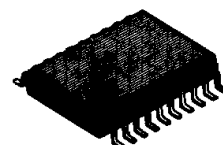
Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



PLASTIC PACKAGE  
DIP-16P-M04

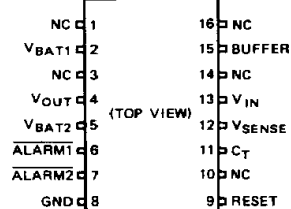


PLASTIC PACKAGE  
FPT-16P-M02

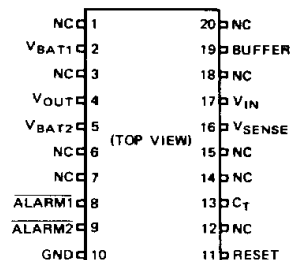


PLASTIC PACKAGE  
FPT-20P-M04

#### PIN ASSIGNMENT



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



FPT-20P-M04

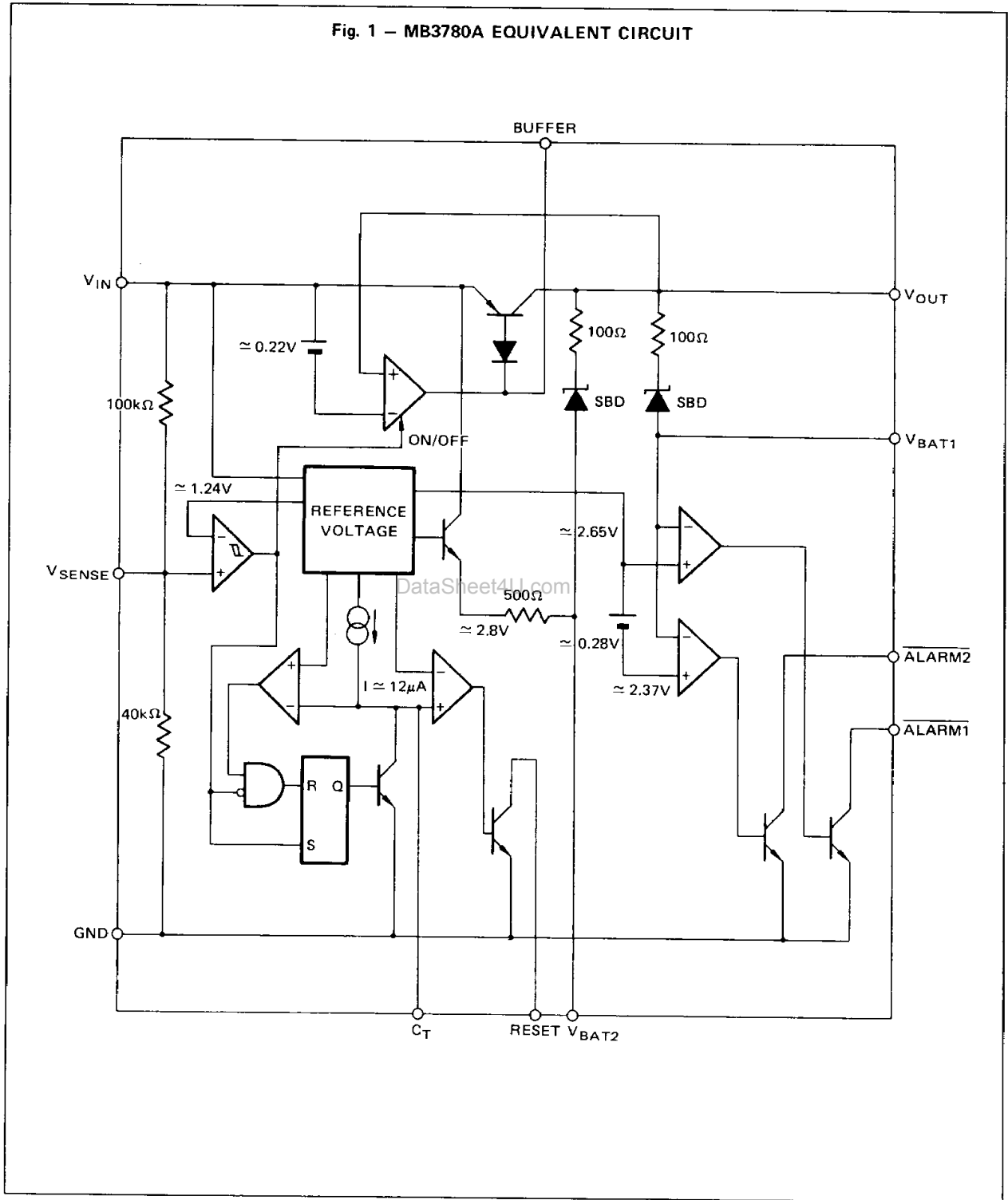
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.



**MB3780A**

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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	$\mu$ A
Operating Temperature	$T_{OP}$	-30		85	* °C
		-30		70	** °C

NOTE: \* DIP-16P-M04

\*\* FPT-16P-M02, FPT-20P-M04






FUJITSU



MB3780A

## ELECTRICAL CHARACTERISTICS

(V<sub>IN</sub> = 5V, T<sub>A</sub> = 25°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Whole Device						
Input Current	I <sub>IN1</sub>	I <sub>OUT</sub> = 0mA		1.0	1.5	mA
	I <sub>IN2</sub>	I <sub>OUT</sub> = 200mA		225	250	mA
	I <sub>IN3</sub>	V <sub>IN</sub> = 4.0V		1.0	1.5	mA
Backup System						
Input/Output Defferential Voltage	DV <sub>1</sub>	I <sub>OUT</sub> = 0mA	0.18	0.21	0.24	V
	DV <sub>2</sub>	I <sub>OUT</sub> = 200mA	0.19	0.22	0.25	V
Output Delay Time	t <sub>ro</sub>	C <sub>O</sub> = 0.01μF, C <sub>T</sub> = 0		2.0	10	μs
Output Buffer Current	I <sub>BUF</sub>	V <sub>O</sub> = 4.7V, V <sub>BUF</sub> = 4.0V	50			mA
Buffer Leak Current	I <sub>OHB</sub>	V <sub>IN</sub> = 0V, V <sub>BUF</sub> = 4.5V			100	nA
Power Supply Monitoring System						
Input Loss Voltage	V <sub>INL</sub>	V <sub>IN</sub> 	4.10	4.20	4.30	V
	V <sub>INH</sub>	V <sub>IN</sub> 	4.20	4.30	4.40	V
Hysteresis Width of Input Loss Voltage	DV <sub>IN</sub>	V <sub>INH</sub> - V <sub>INL</sub>	50	100	150	mV
Output Reset Voltage	V <sub>RESET</sub>	I <sub>RESET</sub> = 3mA		0.15	0.4	V
Output Reset Leak Current	I <sub>OHR</sub>	V <sub>IN</sub> = 4.0V, V <sub>RESET</sub> = 6V		0	100	nA
Reset Pulse Width	t <sub>PO</sub>	C <sub>T</sub> = 0.01μF	0.5	1.0	1.5	ms
Input Pulse Width	t <sub>PI</sub>	C <sub>T</sub> = 0.01μF, V <sub>IN</sub> 	5			μs
Reset Output Rising Time	t <sub>rR</sub>	C <sub>T</sub> = 0.01μF		2.0	3.0	μs
Reset Output Falling Time	t <sub>fR</sub>	R <sub>L</sub> = 5.1kΩ, C <sub>L</sub> = 100pF		0.1	0.5	μs
Reset Output Propagation Delay Time	t <sub>pdR</sub>	C <sub>T</sub> = 0.01μF		2.0	10	μs

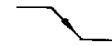

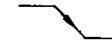
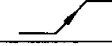
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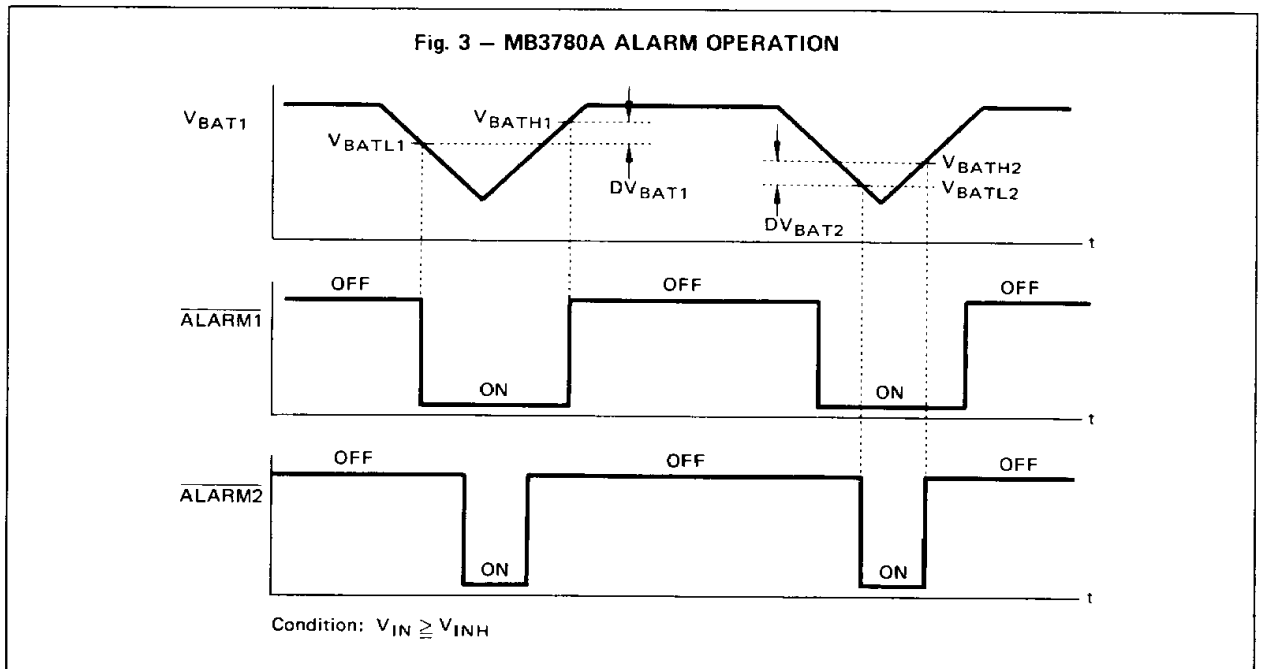
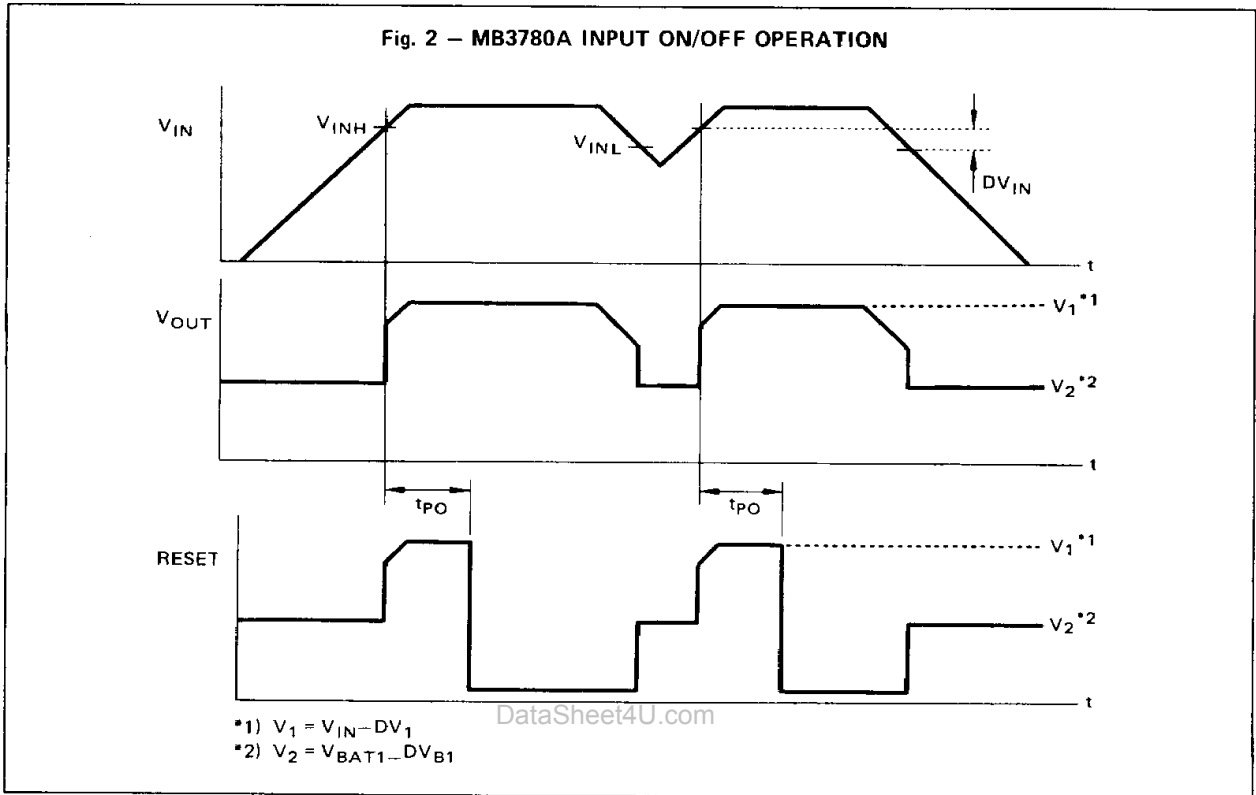
**ELECTRICAL CHARACTERISTICS (continued)**
(V<sub>IN</sub> = 5V, T<sub>A</sub> = 25°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
<b>Primary Battery Monitoring System</b>						
Low Voltage Detection (Primary)	V <sub>BATL1</sub>	V <sub>BAT1</sub> 	2.55	2.65	2.75	V
	V <sub>BATH1</sub>	V <sub>BAT1</sub> 	2.59	2.69	2.79	V
Hysteresis Width of Low Voltage Detection (Primary)	DV <sub>BAT1</sub>	V <sub>BATH1</sub> - V <sub>BATL1</sub>	20	40	60	mV
Low Voltage Detection (Secondary)	V <sub>BATL2</sub>	V <sub>BAT1</sub> 	2.27	2.37	2.47	V
	V <sub>BATH2</sub>	V <sub>BAT1</sub> 	2.31	2.41	2.51	V
Hysteresis Width of Low Voltage Detection (Secondary)	DV <sub>VAT2</sub>	V <sub>BATH2</sub> - V <sub>VATL2</sub>	20	40	60	mV
Differential Detected Low Voltage	DV <sub>BAT</sub>	V <sub>VATL1</sub> - V <sub>BATL2</sub>	0.26	0.28	0.30	V
Input Current	I <sub>VATA</sub>	V <sub>BAT</sub> = 3V, V <sub>IN</sub> = 5V	-100		500	nA
	I <sub>VATB</sub>	V <sub>BAT</sub> = 3V, V <sub>IN</sub> = 0V	-100		500	nA
Output Differential Voltage	DV <sub>B1</sub>	I <sub>BAT1</sub> = 100μA		0.30	0.35	V
Alarm Output Voltage	V <sub>ALARM1</sub>	I <sub>ALARM1</sub> = 3mA		0.15	0.4	V
	V <sub>ALARM2</sub>	I <sub>ALARM2</sub> = 3mA		0.15	0.4	V
Alarm Output Leak Current	I <sub>OHA1</sub>	V <sub>ALARM1</sub> = 6V		0	100	nA
	I <sub>OHA2</sub>	V <sub>ALARM2</sub> = 6V		0	100	nA
Alarm Output Rising Time	t <sub>rA</sub>	R <sub>L</sub> = 5.1kΩ, C <sub>L</sub> = 100pF		2.0	3.0	μs
Alarm Output Falling Time	t <sub>fA</sub>			0.1	0.5	μs
Alarm Output Propagation Delay Time	t <sub>pdA</sub>	50mV over drive		2.0	10	μs
<b>Secondary Battery Monitoring System</b>						
Output Voltage	V <sub>CHG</sub>	I <sub>CHG</sub> = -10μA	2.65	2.80	2.95	V
Charging Current	I <sub>CHGL</sub>	V <sub>CHG</sub> = 2.0V	0.6	1.6	3.0	mA
	I <sub>CHGH</sub>	V <sub>CHG</sub> = 3.3V	-1	0	1	μA
Differential Output Voltage	DV <sub>B2</sub>	I <sub>BAT2</sub> = 100μA		0.30	0.35	V

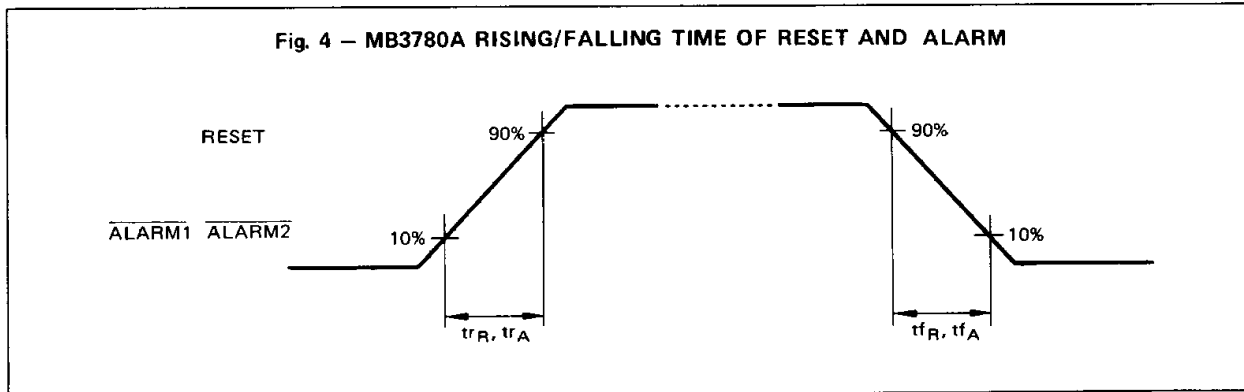
NOTE: R<sub>L</sub> and C<sub>L</sub> are output logic of load resistance and capacitor.


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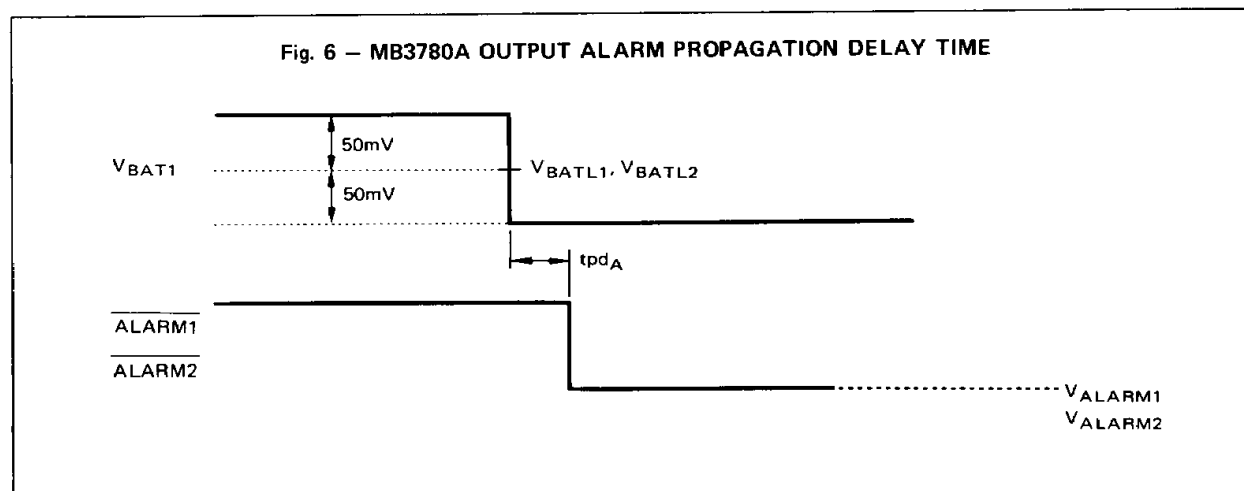
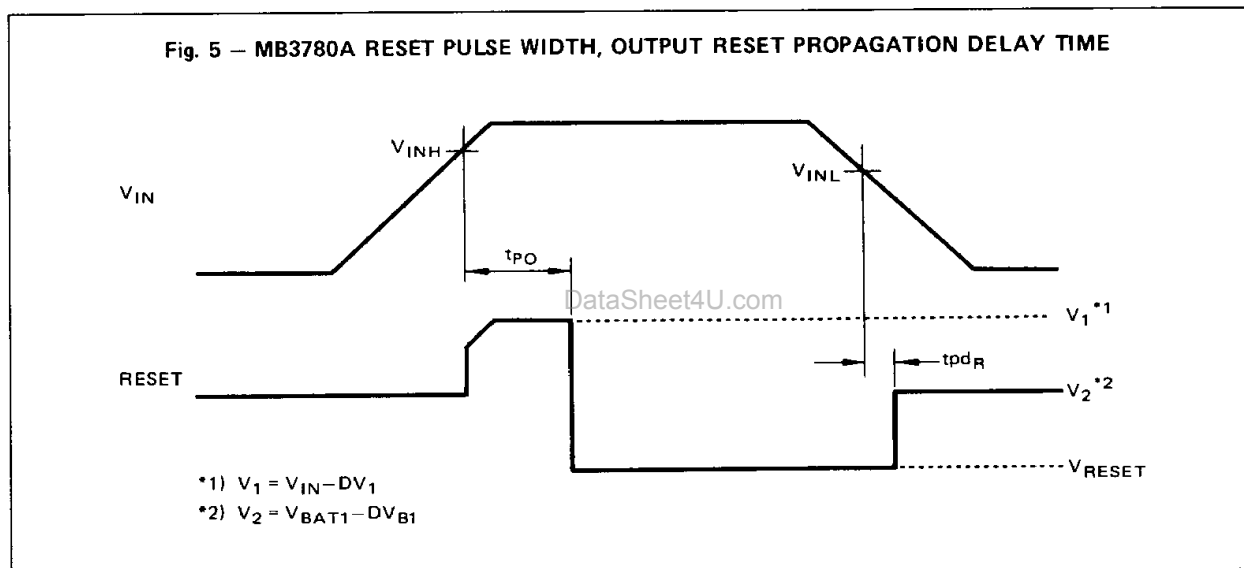
## FUNCTION EXPLANATION



## TIMMING DIAGRAM



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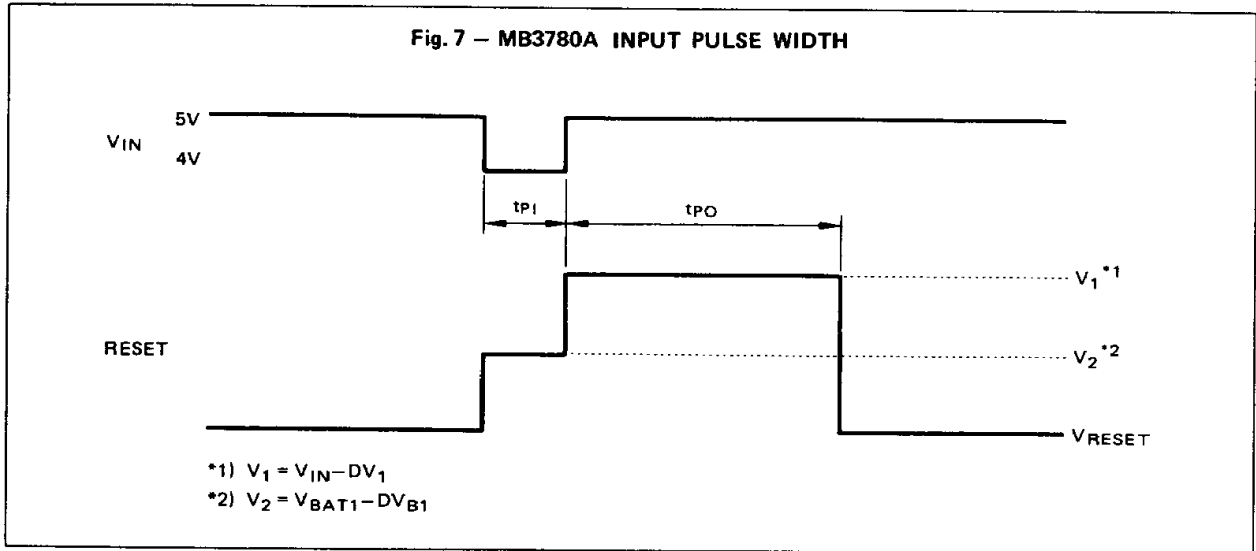




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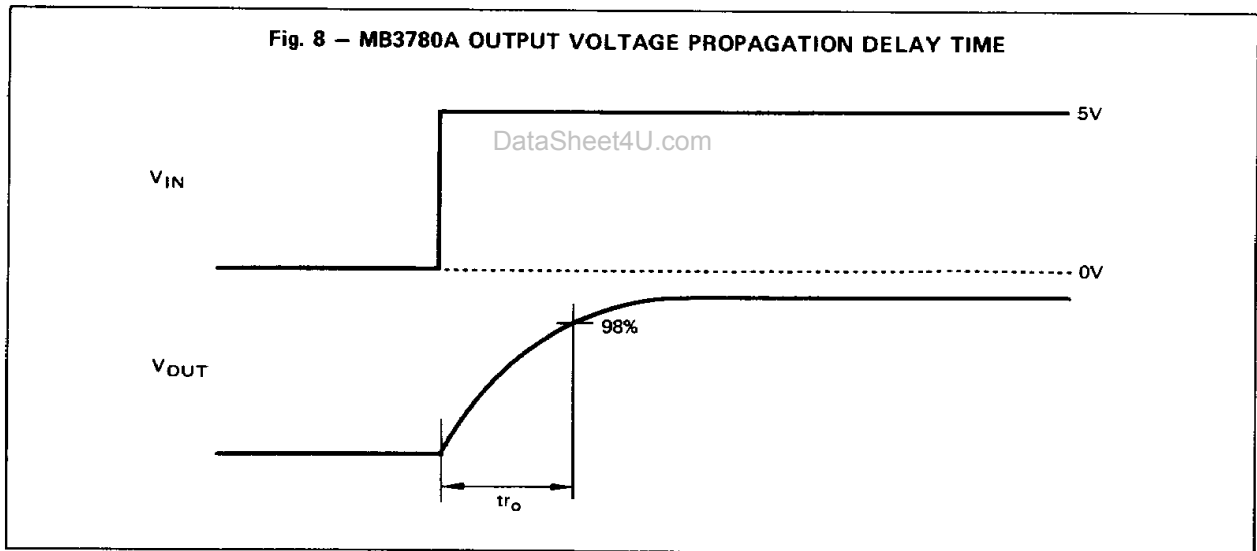
### TIMING DIAGRAM (continued)

Fig. 7 – MB3780A INPUT PULSE WIDTH

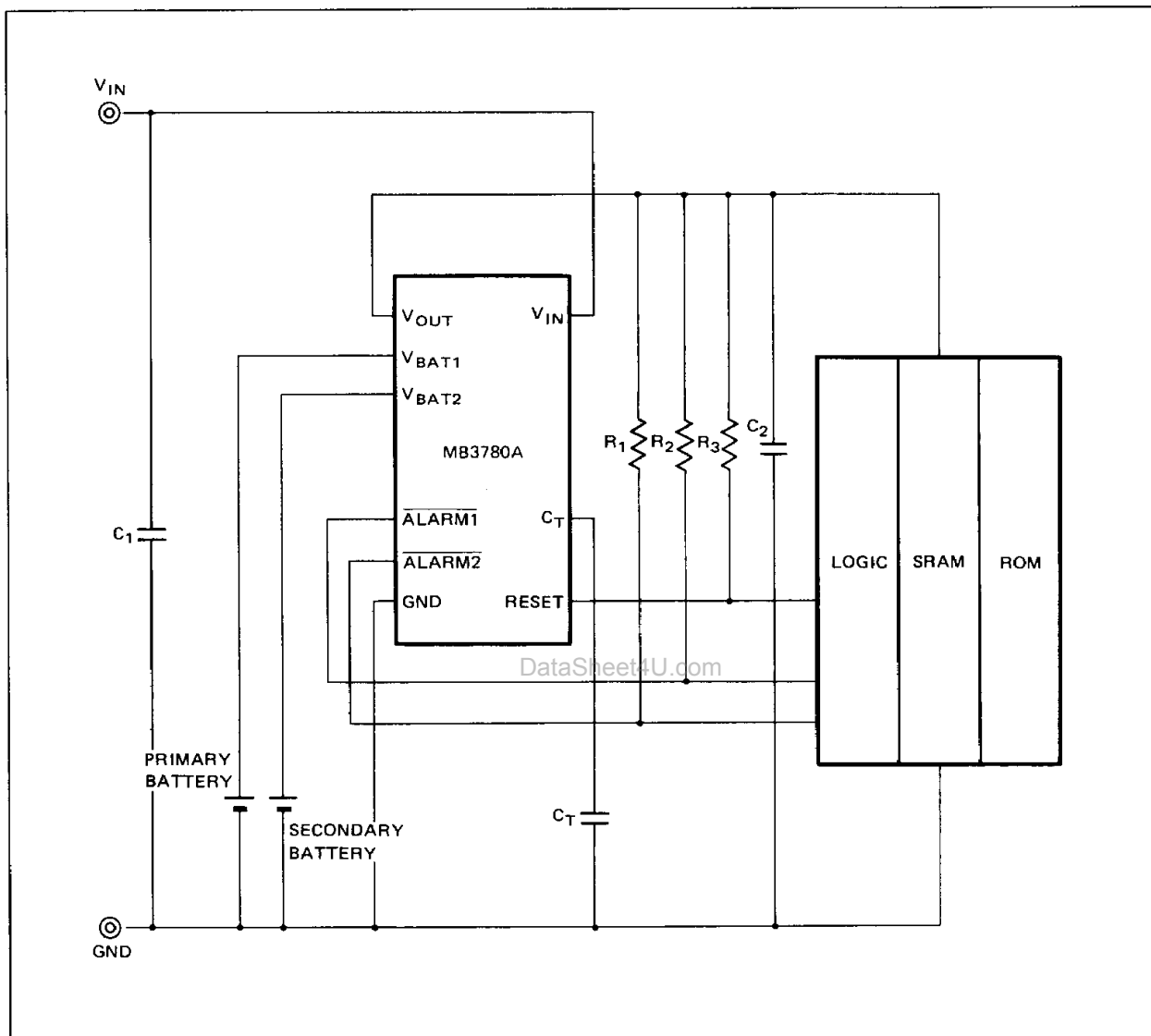


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Fig. 8 – MB3780A OUTPUT VOLTAGE PROPAGATION DELAY TIME





**APPLICATION EXAMPLE**

**NOTE:** The value of  $C_1$  and  $C_2$  should be more than  $0.022\mu\text{F}$ .

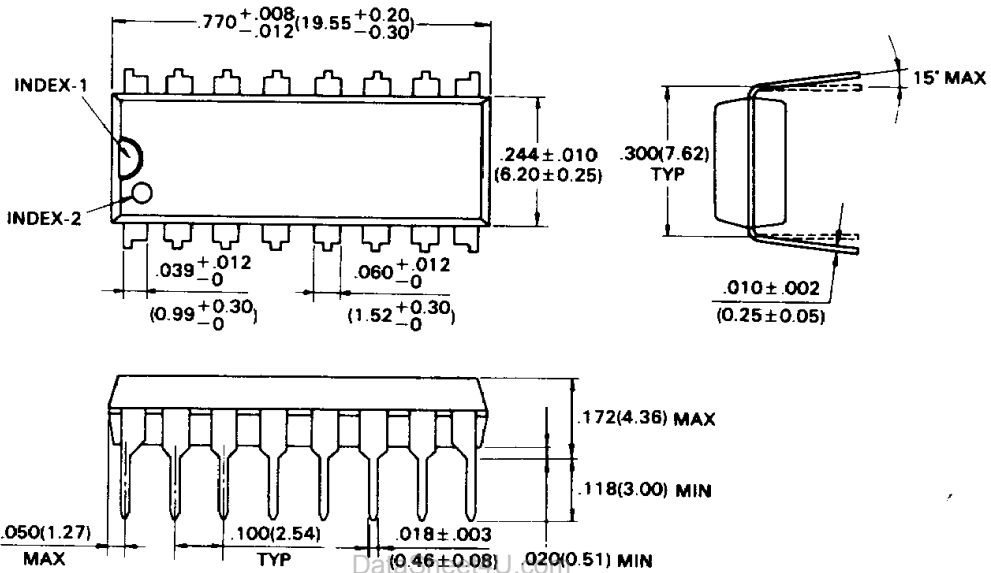


**MB3780A**

## PACKAGE DIMENSIONS

### 16-LEAD PLASTIC DUAL IN-LINE PACKAGE

(Case No. : DIP-16P-M04)

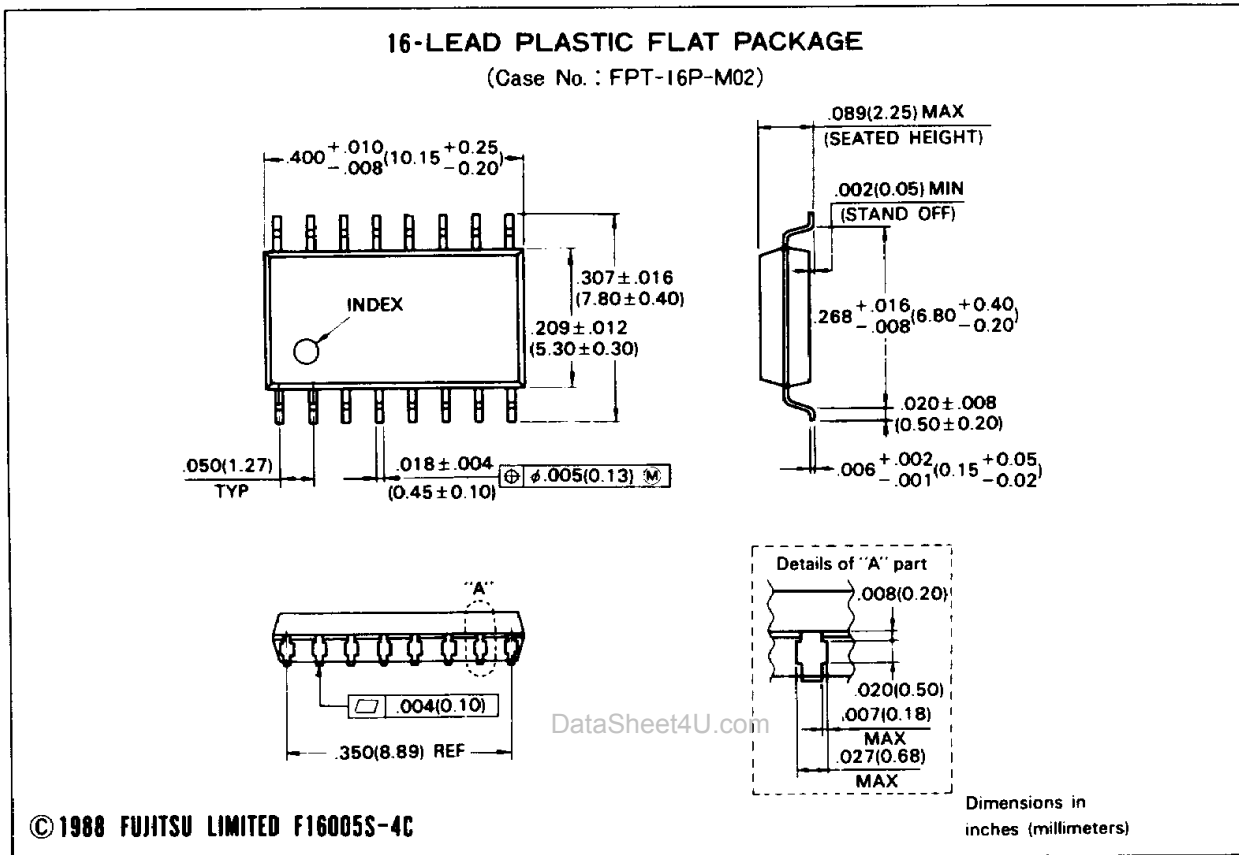


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Dimensions in inches (millimeters)

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## PACKAGE DIMENSIONS (continued)



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### PACKAGE DIMENSIONS (continued)

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