*ASSP*

VOLTAGE DETECTOR

MB3761

■ DESCRIPTION

Designed for voltage detector applications, the Fujitsu MB3761 is a dual comparator with a built-in high precision reference voltage generator. Outputs are open-collector outputs and enable use of the OR-connection between both channels. Both channels have hysteresis control outputs. Because of a wide power supply voltage range and a low power supply current, the MB3761 is suitable for power supply monitors and battery backup systems.

■ FEATURES

- Wide power supply voltage range: 2.5 V to 40 V
- Low power and small voltage dependency supply current: 250 μA Typ
- Built-in stable low voltage generator: 1.20 V Typ
- Easy-to-add hysteresis characteristics.
- Package: 8-pin Plastic SIP Package (Suffix: -PS)
                8-pin Plastic DIP Package (Suffix: -P)
                8-pin Plastic SOP Package (Suffix: -PF)

■ PACKAGE

8-pin plastic DIP   8-pin plastic SIP   8-pin plastic SOP

(DIP-8P-M01)   (SIP-8P-M03)   (FPT-8P-M01)
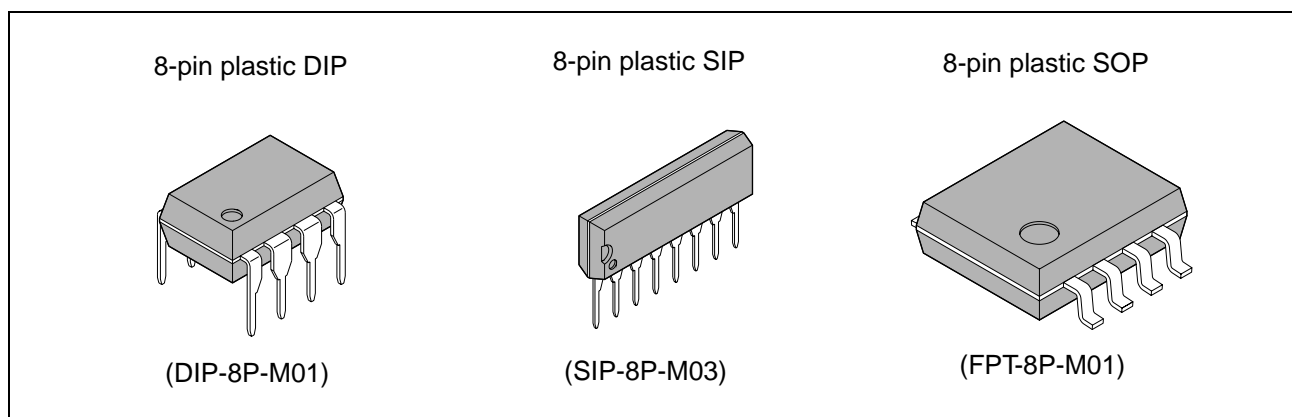
Note : This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

FUJITSU

MB3761

■ PIN ASSIGNMENT

(FRONT VIEW)

(TOP VIEW)

(SIP-8P-M03)

(DIP-8P-M01)
(FPT-8P-M01)
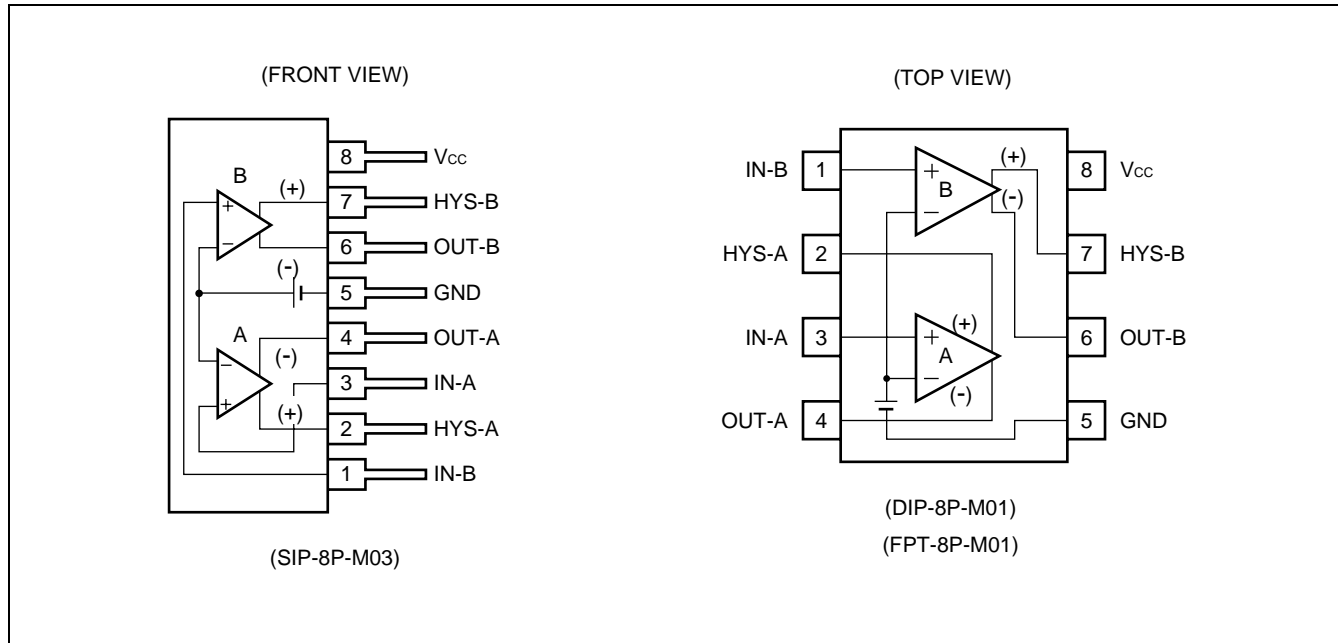
■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min	Max	
Power Supply Voltage	V_{CC}	—	41	V
Output Voltage	V_O	—	41	V
Output Current	I_O	—	50	mA
Input Voltage	V_{IN}	− 0.3	+ 6.5	V
Power Dissipation	P_D	—	350 ($T_A \leq +70°C$)	mW
Storage Temperature	T_{STG}	− 55	+ 125	°C

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value		Unit
		Min	Max	
Power Supply Voltage	V_{CC}	2.5	40	V
Operating Temperature	T_A	− 20	+ 75	°C
Output Current at pin 4	I_{O4}	—	4.5	mA
Output Current at pin 6	I_{O6}	—	3.0	mA

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.
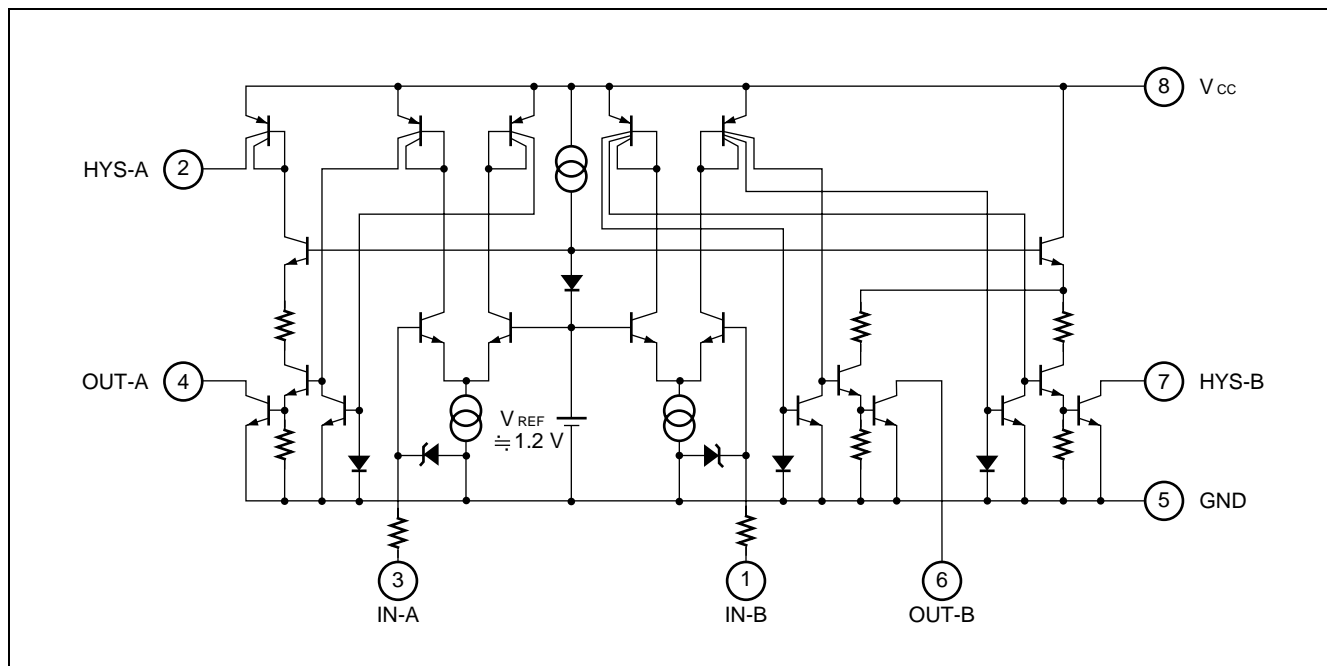
No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.
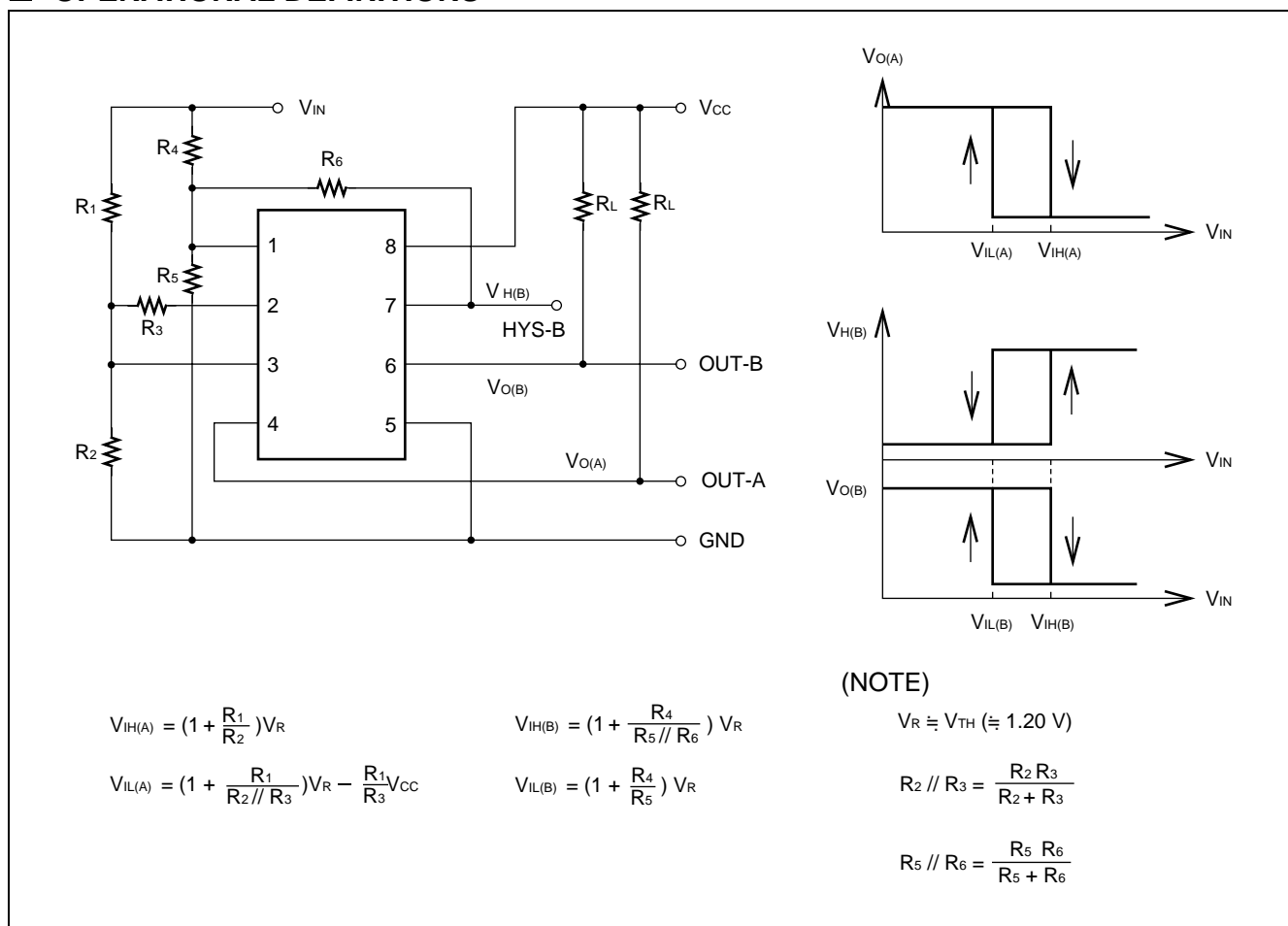
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MB3761

■ ELECTRICAL CHARACTERISTICS

(T$_A$=+25°C, V$_{CC}$=5 V)

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Power Supply Voltage	I$_{CCL}$	V$_{CC}$= 40 V, V$_{IL}$= 1.0 V	-	250	400	μA
	I$_{CCH}$	V$_{CC}$= 40 V, V$_{IH}$= 1.5 V	-	400	600	μA
Threshold Voltage	V$_{TH}$	I$_O$ = 2 mA, V$_O$= 1 V	1.15	1.20	1.25	V
Deviation of Threshold Voltage	ΔV$_{TH1}$	2.5 V ≤ V$_{CC}$ ≤ 5.5 V	-	3	12	mV
	ΔV$_{TH2}$	4.5 V ≤ V$_{CC}$ ≤ 40 V	-	10	40	mV
Offset Voltage between Outputs	V$_{OOSA}$	I$_{OA}$= 4.5 mA, V$_{OA}$= 2 V, I$_{HA}$= 20 μA, V$_{HA}$= 3 V	-	2.0	-	mV
	V$_{OSSB}$	I$_{OB}$= 3 mA, V$_{OB}$= 2 V, I$_{HB}$= 3 mA, V$_{HB}$= 2 V	-	2.0	-	mV
Temperature Coefficient of Threshold Voltage	α	-20°C ≤ T$_A$ ≤ +70°C	-	±0.05	-	mV/°C
Difference Voltage on Threshold Voltage between Channel	ΔV$_{THAB}$		-10	-	-10	mV
Input Current	I$_{IL}$	V$_{IL}$= 1.0 V	-	5		nA
	I$_{IH}$	V$_{IH}$= 1.5 V	-	100	500	nA
Output Leakage Current	I$_{OH}$	V$_O$= 40 V, V$_{IL}$= 1.0 V	-	-	1	μA
Hysteresis Output Leakage Current	I$_{HLA}$	V$_{CC}$= 40 V, V$_{HA}$= 0 V, V$_{IL}$= 1.0 V	-	-	0.1	μA
	I$_{HHB}$	V$_{HB}$= 40 V, V$_{IH}$= 1.5 V	-	-	1	μA
Output Sink Current	I$_{OLA}$	V$_O$= 1.0 V, V$_{IH}$= 1.5 V	6	12	-	mA
	I$_{OLB}$	V$_O$= 1.0 V, V$_{IH}$= 1.5 V	4	10	-	mA
Hysteresis Current	I$_{HHA}$	V$_H$= 0 V, V$_{IH}$= 1.5 V	40	80	-	μA
	I$_{HLB}$	V$_H$= 1.0 V, V$_{IL}$= 1.0 V	4	10	-	mA
Output Saturation Voltage	V$_{OLA}$	I$_O$= 4.5 mA, V$_{IH}$= 1.5 V	-	120	400	mV
	V$_{OLB}$	I$_O$= 3.0 mA, V$_{IH}$= 1.5 V	-	120	400	mV
Hysteresis Saturation	V$_{HHA}$	I$_H$= 20 μA, V$_{IH}$= 1.5 V	-	50	200	mV
	V$_{HLB}$	I$_H$= 3.0 mA, V$_{IL}$= 1.0 V	-	120	400	mV
Output Delay Time	t$_{PHL}$	R$_L$= 5 kΩ	-	2	-	μs
	t$_{PLH}$	R$_L$= 5 kΩ	-	3	-	μs

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■ EQUIVALENT CIRCUIT

HYS-A ②

OUT-A ④

③ IN-A

⑧ V CC

$V_{REF} \doteqdot 1.2\ V$

① IN-B

⑥ OUT-B

⑦ HYS-B

⑤ GND

■ OPERATIONAL DEFINITIONS

V_{IN}

R_4 R_6

R_1

R_5

R_3

R_2

1   8

2   7 $V_{H(B)}$ HYS-B

3   6 $V_{O(B)}$ OUT-B

4   5 $V_{O(A)}$ OUT-A

V_{CC}

R_L R_L

GND

$V_{O(A)}$, V_{IN} , $V_{IL(A)}$, $V_{IH(A)}$

$V_{H(B)}$, $V_{O(B)}$, V_{IN} , $V_{IL(B)}$, $V_{IH(B)}$

$$V_{IH(A)} = (1 + \frac{R_1}{R_2})V_R$$

$$V_{IL(A)} = (1 + \frac{R_1}{R_2 /\!/ R_3})V_R - \frac{R_1}{R_3}V_{CC}$$

$$V_{IH(B)} = (1 + \frac{R_4}{R_5 /\!/ R_6})\ V_R$$

$$V_{IL(B)} = (1 + \frac{R_4}{R_5})\ V_R$$

(NOTE)

$$V_R \doteqdot V_{TH}\ (\doteqdot 1.20\ V)$$

$$R_2 /\!/ R_3 = \frac{R_2\ R_3}{R_2 + R_3}$$

$$R_5 /\!/ R_6 = \frac{R_5\ R_6}{R_5 + R_6}$$

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MB3761

■ **TYPICAL PERFORMANCE CHARACTERISTICS**

Power Supply Current vs. Power Supply Voltage
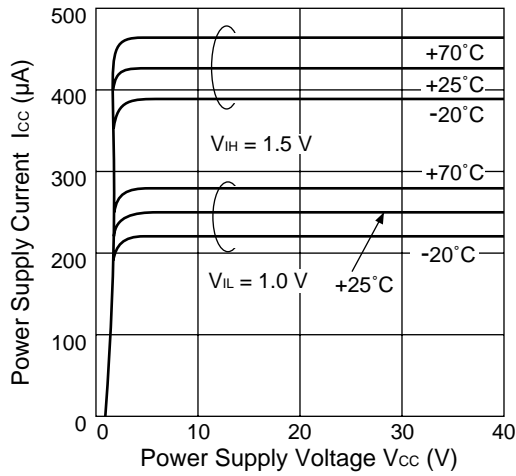
Hysteresis (A) Current vs. Power Supply Voltage
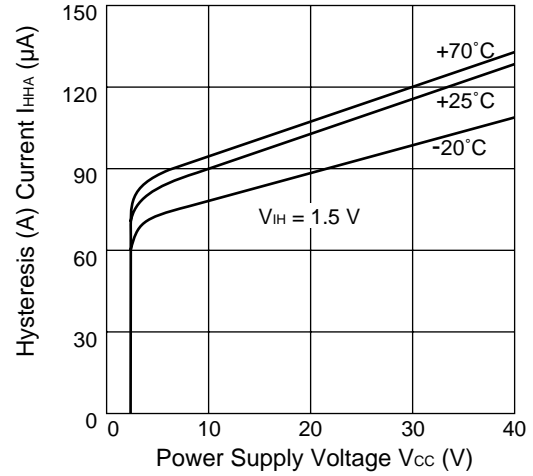
Output (A) Voltage vs. Output (A) Current
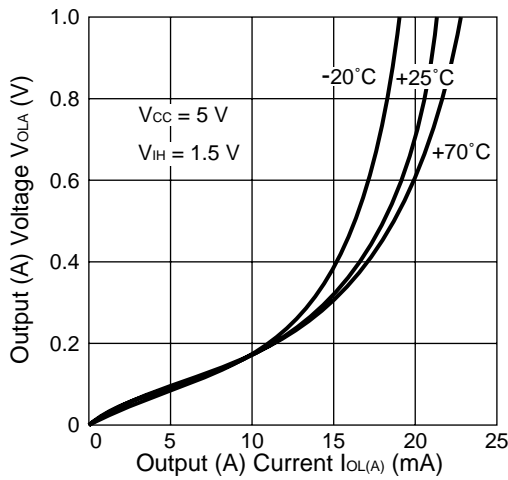
Output (B) Voltage vs. Output (B) Current
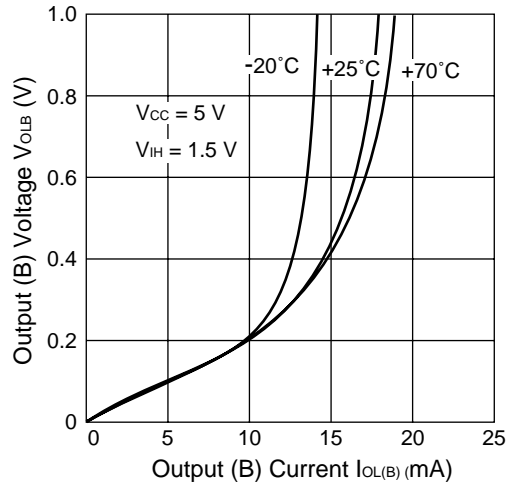
Threshold Voltage vs. Power Supply Voltage
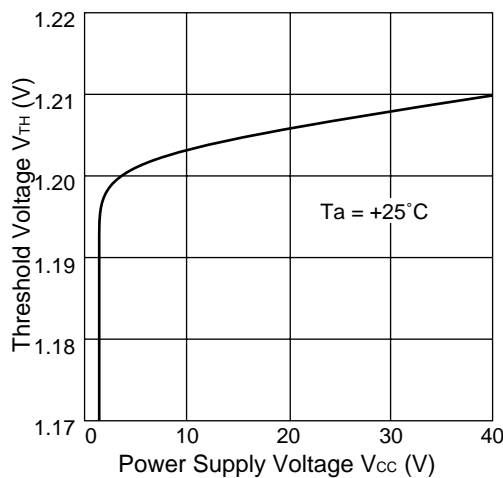
Threshold Voltage vs. Temperature

6
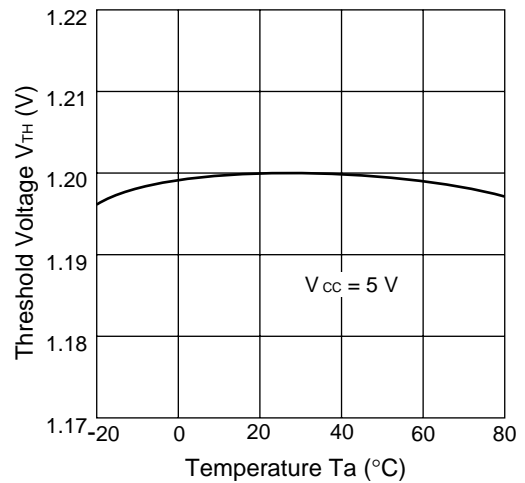
■ APPLICATION EXAMPLES

1. Addition of Hysteresis
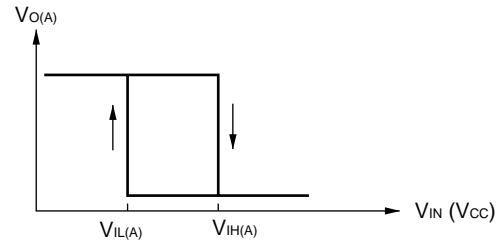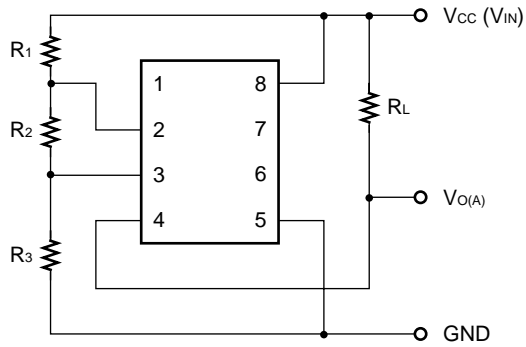
$$V_{IH(A)} \fallingdotseq (1 + \frac{R_1 + R_2}{R_3})V_R$$

$$V_{IL(A)} \fallingdotseq (1 + \frac{R_2}{R_3})V_R$$

Note : All calculations occur with the output voltage
at 0. The hysteresis values are adjusted for
load condition and saturation voltage.
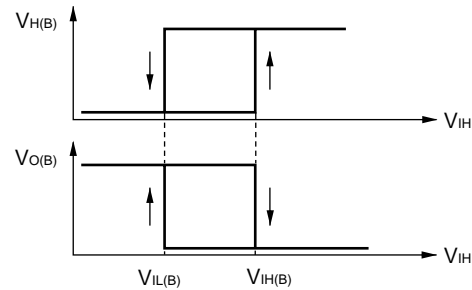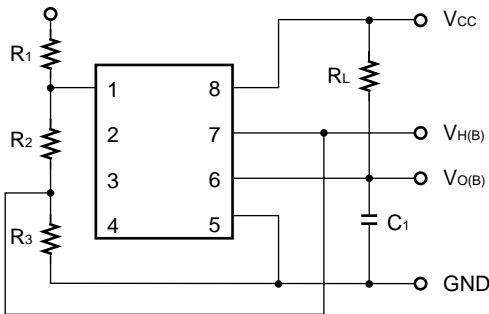
$$V_{IH(B)} \fallingdotseq (1 + \frac{R_1}{R_2})V_R$$

$$V_{IL(B)} \fallingdotseq (1 + \frac{R_1}{R_2 + R_3})V_R$$

2. Voltage Detection for Alarm

For hysteresis, a positive feedback from pin 2 or 7 is required.
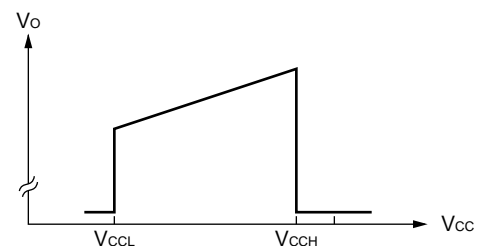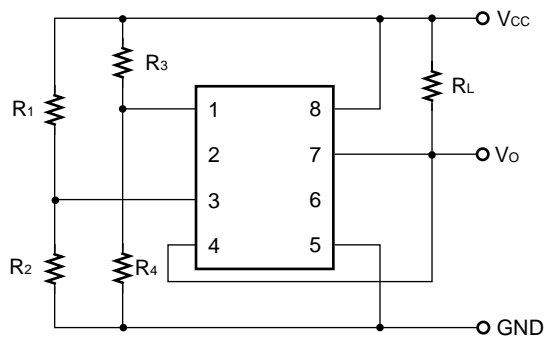
$$V_{CCH} = (1 + \frac{R_1}{R_2})V_R$$

$$V_{CCL} = (1 + \frac{R_3}{R_4})V_R$$

$$V_{CCL} \geq 2.5 \text{ V}$$

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3. Voltage Detection for Alarm

$$V_{CCH} = (1 + \frac{R_3}{R_4})V_R$$

$$V_{CCL} = (1 + \frac{R_1}{R_2})V_R$$

$$V_{CCL} \geq 2.5 \text{ V}$$

4. Programmable Zener

Note : Channel B can be used independently.

$$V_Z = (1 + \frac{R_2}{R_3}) V_R$$

$$\frac{V_Z}{R_2 + R_3} \leq \frac{V_{CC} - V_Z}{R_1} \leq 6 \text{ mA}$$

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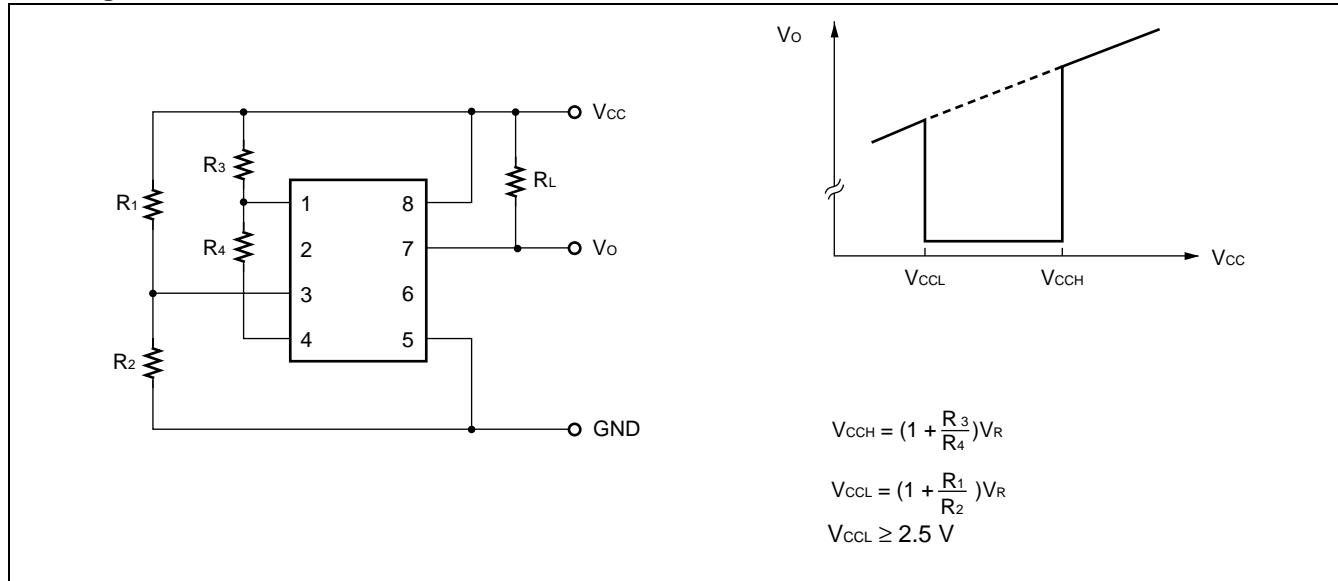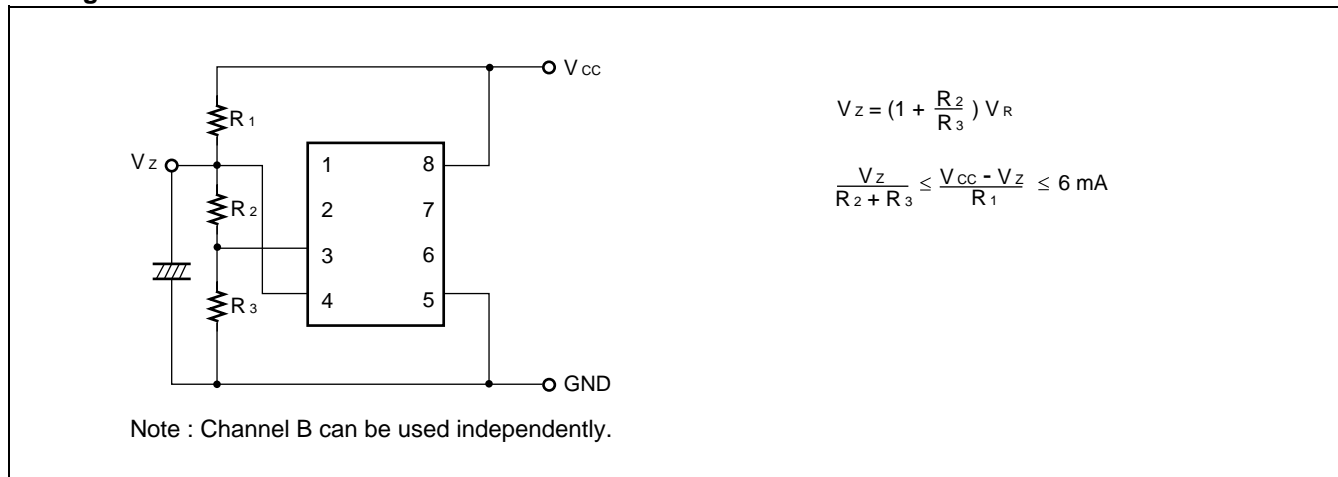
5. Recovery Reset Circuit

MB3761
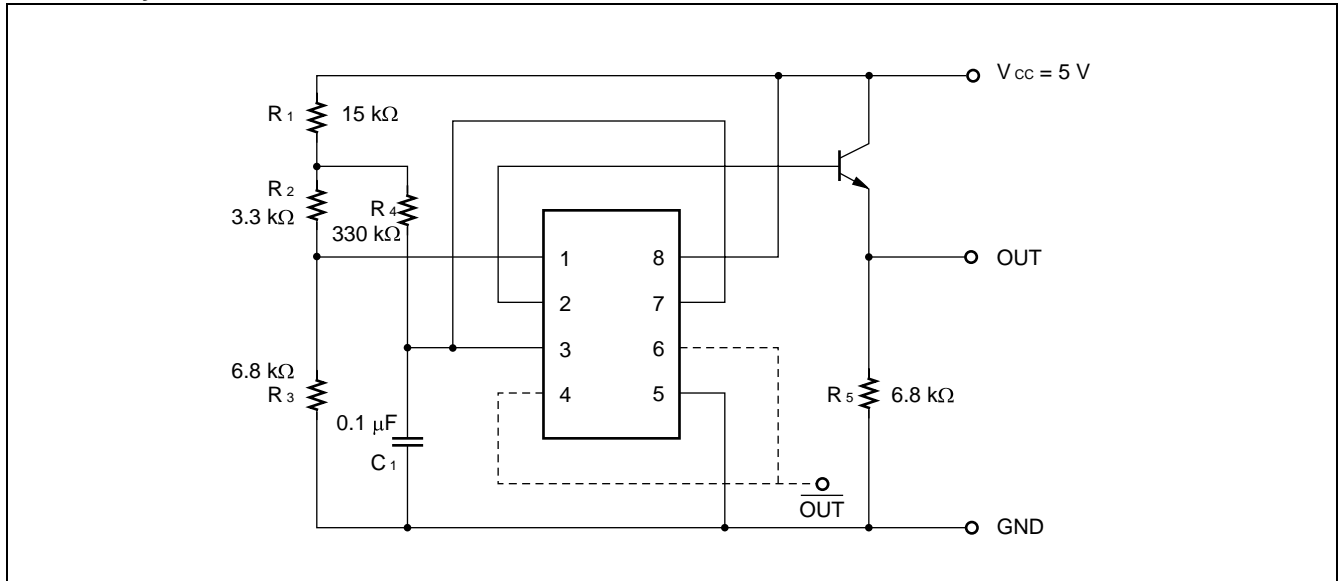
■ TYPICAL CHARACTERISTICS

DC Characteristics
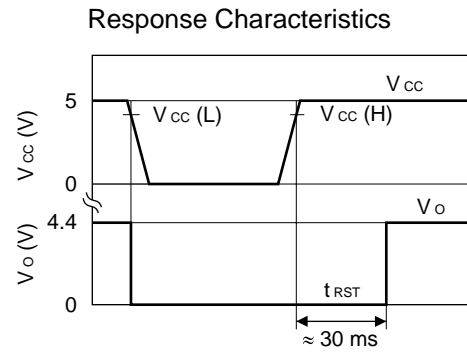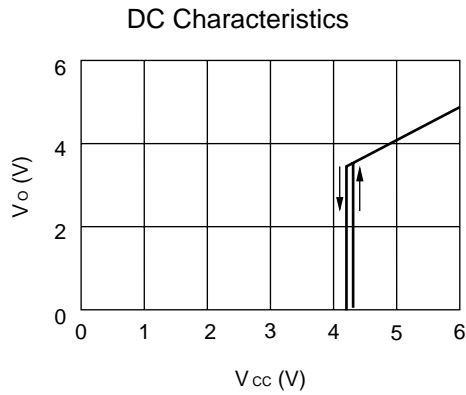
- Voltage Threshold Levels (V_{CCL} and V_{CCH}) and Hysteresis Width can be changed by the resistors (R_1 through R_4).

$$V_{CCL} = \frac{R_1 + R_2 + R_3}{R_3} V_{TH}$$

$$V_{CCH} = V_{CCL} + \frac{R_1 (R_2 + R_3)}{R_3 \; R_4} V_{TH}$$

- Power-On Reset Time is provided by the following approximate equation:

$$t_{RST} = -C_1 R_4 \cdot \ln \left\{ 1 - \frac{V_{TH}}{V_{CC}} \left(1 + \frac{R_1}{R_2 + R_3} \right) \right.$$

- The recommended value of h_{FE} of the external transistor is from 50 to 200.

- In the case of an instant power fail, the remaining charge in C_1 effects t_{RST}.

- If necessary, the reversed output is provided on HYS terminal

Response Characteristics

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■ NOTES ON USE

- Take account of common impedance when designing the earth line on a printed wiring board.

- Take measures against static electricity.
  - For semiconductors, use antistatic or conductive containers.
  - When storing or carrying a printed circuit board after chip mounting, put it in a conductive bag or container.
  - The work table, tools and measuring instruments must be grounded.
  - The worker must put on a grounding device containing 250 kΩ to 1 MΩ resistors in series.

- Do not apply a negative voltage
  - Applying a negative voltage of −0.3 V or less to an LSI may generate a parasitic transistor, resulting in malfunction.

■ ORDERING INFORMATION

Part number	Package	Remarks
MB3761M	8-pin Plastic DIP (DIP-8P-M01)	
MB3761PS	8-pin Plastic SIP (SIP-8P-M03)	
MB3761PF	8-pin Plastic SOP (FPT-8P-M01)	

MB3761

■ **PACKAGE DIMENSION**

8-pin Plastic DIP
(DIP-8P-M01)

$9.40^{+0.40}_{-0.30}$
$\left(.370^{+.016}_{-.012}\right)$

1 PIN INDEX

6.20 ± 0.25
$(.244\pm.010)$

4.36(.172)MAX

3.00(.118)MIN

$0.99^{+0.30}_{-0}$
$\left(.039^{+.012}_{-0}\right)$

$0.89^{+0.35}_{-0.30}$
$\left(.035^{+.014}_{-.012}\right)$

0.51(.020)MIN

0.46 ± 0.08
$(.018\pm.003)$

$1.52^{+0.30}_{-0}$
$\left(.060^{+.012}_{-0}\right)$

2.54(.100)
TYP

0.25 ± 0.05
$(.010\pm.002)$

7.62(.300)
TYP

15°MAX
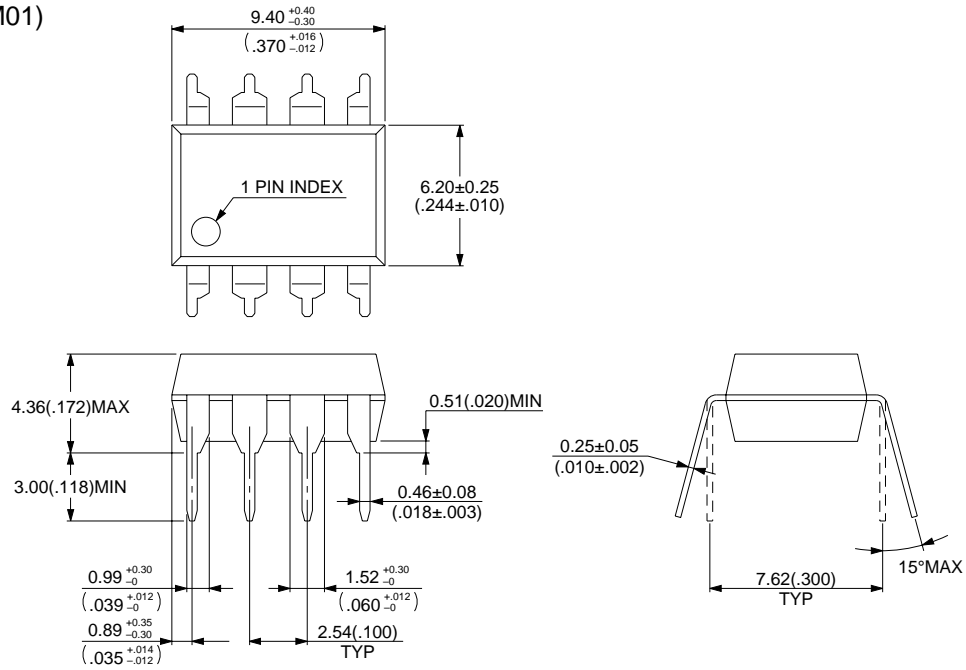
© 1994 FUJITSU LIMITED D08006S-2C-3

Dimensions in mm (inches) .
Note : The values in parentheses are reference values.

(Continued)

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8-pin Plastic SIP
(SIP-8P-M03)

$19.65 ^{+0.15}_{-0.35}$
$\left(.774 ^{+.006}_{-.014}\right)$

INDEX-1

INDEX-2

$0.99 ^{+0.30}_{-0}$
$\left(.039 ^{+.012}_{-0}\right)$

6.20±0.25
(.244±.010)

8.20±0.30
(.323±.012)

4.00±0.30
(.157±.012)

2.54(.100)
TYP

$1.52 ^{+0.30}_{-0}$
$\left(.060 ^{+.012}_{-0}\right)$

0.50±0.08
(.020±.003)

3.26±0.25
(.128±.010)

0.25±0.05
(.010±.002)
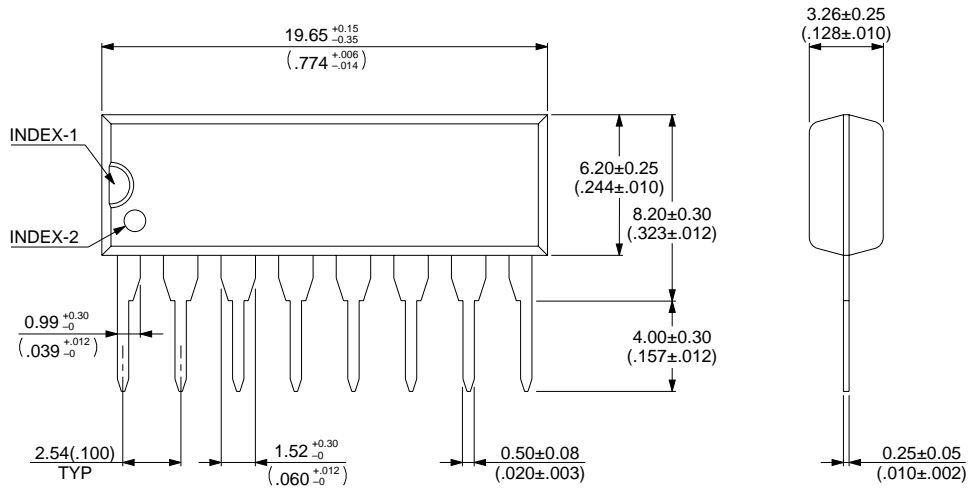
© 1994 FUJITSU LIMITED S08010S-3C-2

Dimensions in mm (inches) .
Note : The values in parentheses are reference values.

(Continued)

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MB3761

8-pin Plastic SOP
(FPT-8P-M01)
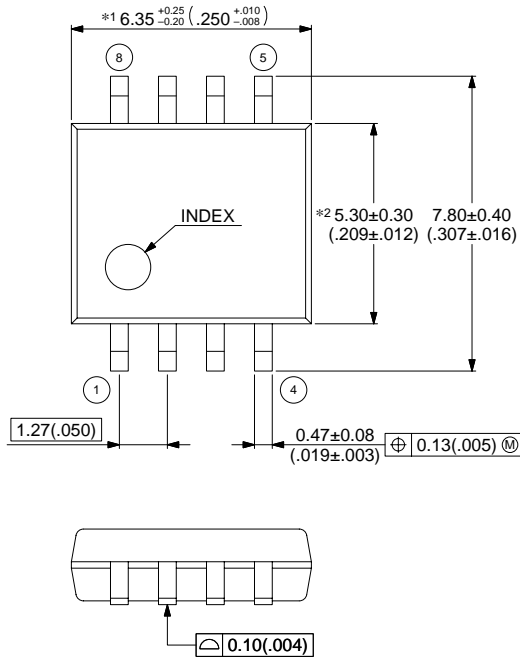
Note 1) *1 : These dimensions include resin protrusion.
Note 2) *2 : These dimensions do not include resin protrusion.
Note 3) Pins width and pins thickness include plating thickness.
Note 4) Pins width do not include tie bar cutting remainder.

*1 $6.35^{+0.25}_{-0.20}$ ($.250^{+.010}_{-.008}$)

$0.17^{+0.03}_{-0.04}$
($.007^{+.001}_{-.002}$)

INDEX

*2 5.30 ± 0.30 7.80 ± 0.40
(.209±.012) (.307±.016)

"A"

Details of "A" part

$2.00^{+0.25}_{-0.15}$
($.079^{+.010}_{-.006}$) (Mounting height)

0.25(.010)

0~8°

1.27(.050)

0.47 ± 0.08
(.019±.003)   ⊕ 0.13(.005) Ⓜ

0.50 ± 0.20
(.020±.008)

0.60 ± 0.15
(.024±.006)

$0.10^{+0.10}_{-0.05}$
($.004^{+.004}_{-.002}$)
(Stand off)

0.10(.004)

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Dimensions in mm (inches) .
Note : The values in parentheses are reference values

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