

ASSP

# VOLTAGE DETECTOR

## MB3761

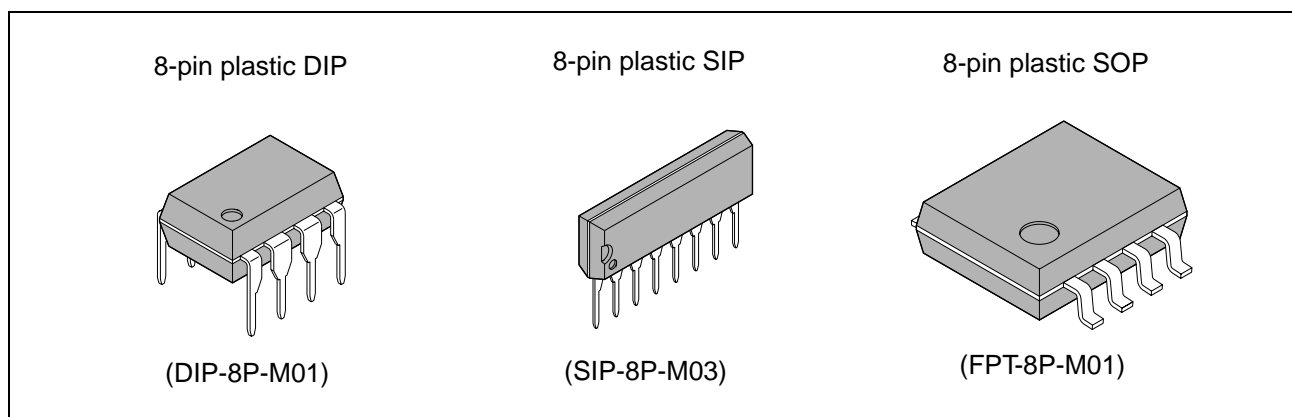
### DESCRIPTION

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  $\mu$ A 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

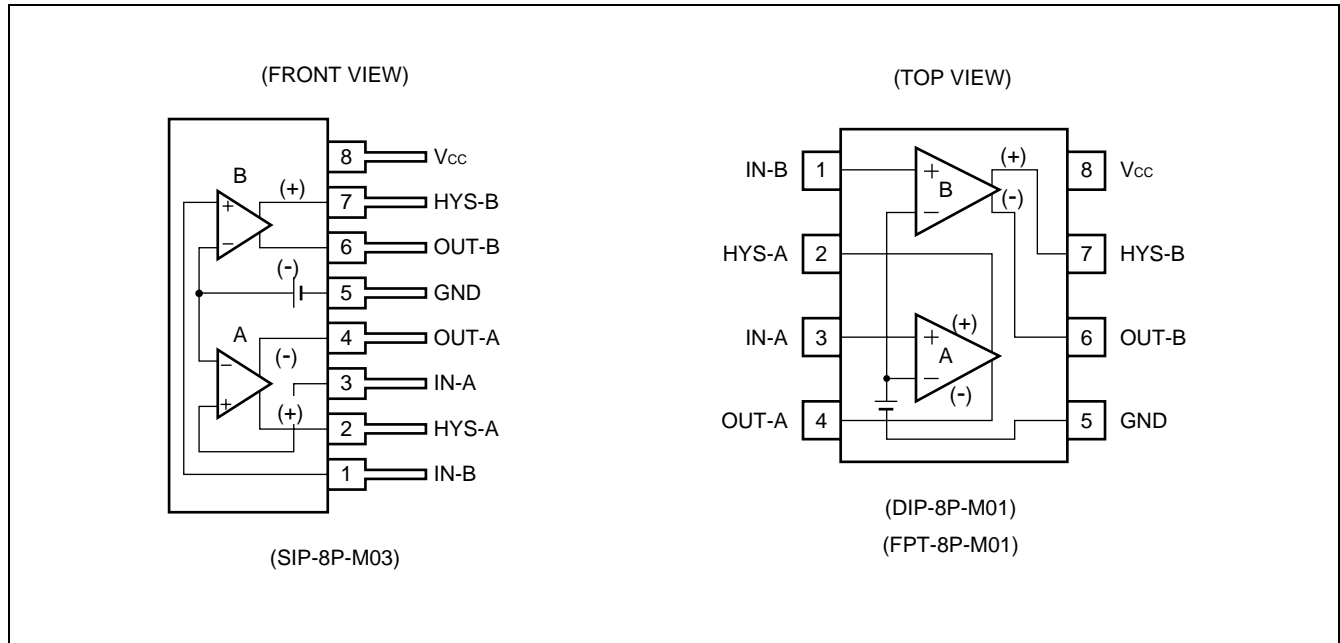


Note : This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.



# MB3761

## ■ PIN ASSIGNMENT



## ■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min	Max	
Power Supply Voltage	V <sub>CC</sub>	—	41	V
Output Voltage	V <sub>O</sub>	—	41	V
Output Current	I <sub>O</sub>	—	50	mA
Input Voltage	V <sub>IN</sub>	- 0.3	+ 6.5	V
Power Dissipation	P <sub>D</sub>	—	350 (T <sub>A</sub> ≤ +70°C)	mW
Storage Temperature	T <sub>STG</sub>	- 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 <sub>CC</sub>	2.5	40	V
Operating Temperature	T <sub>A</sub>	- 20	+ 75	°C
Output Current at pin 4	I <sub>O4</sub>	—	4.5	mA
Output Current at pin 6	I <sub>O6</sub>	—	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.

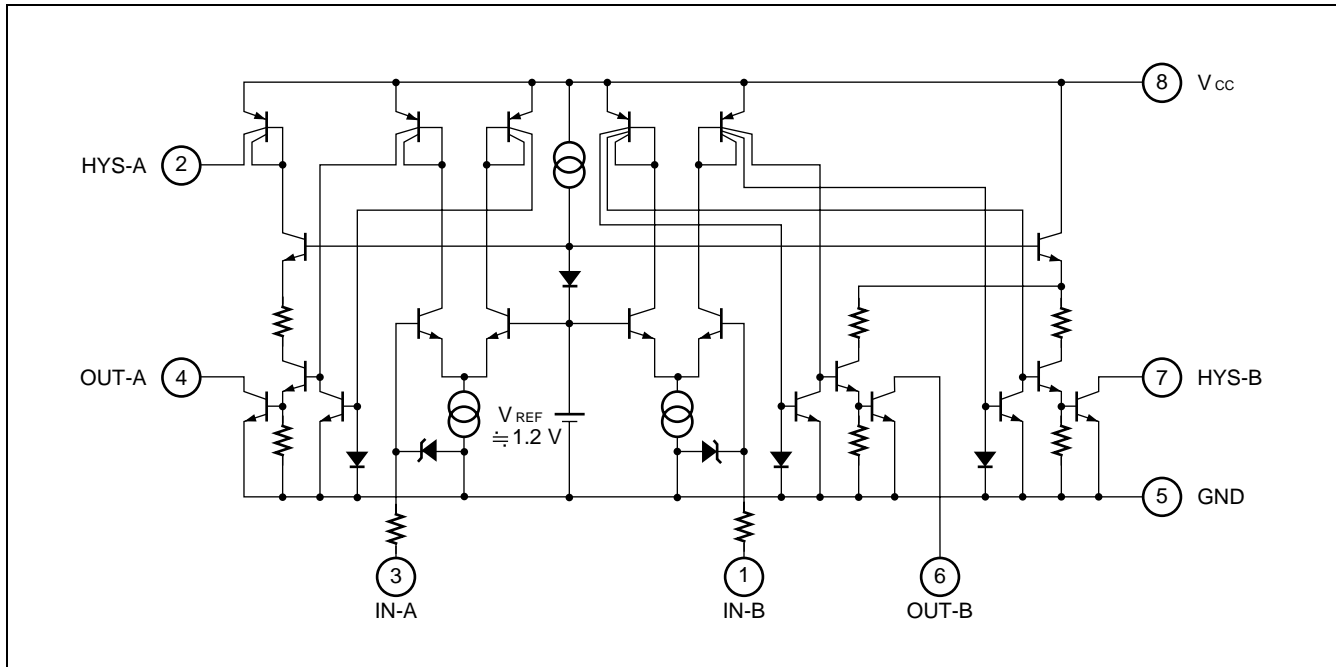
No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

## ■ ELECTRICAL CHARACTERISTICS

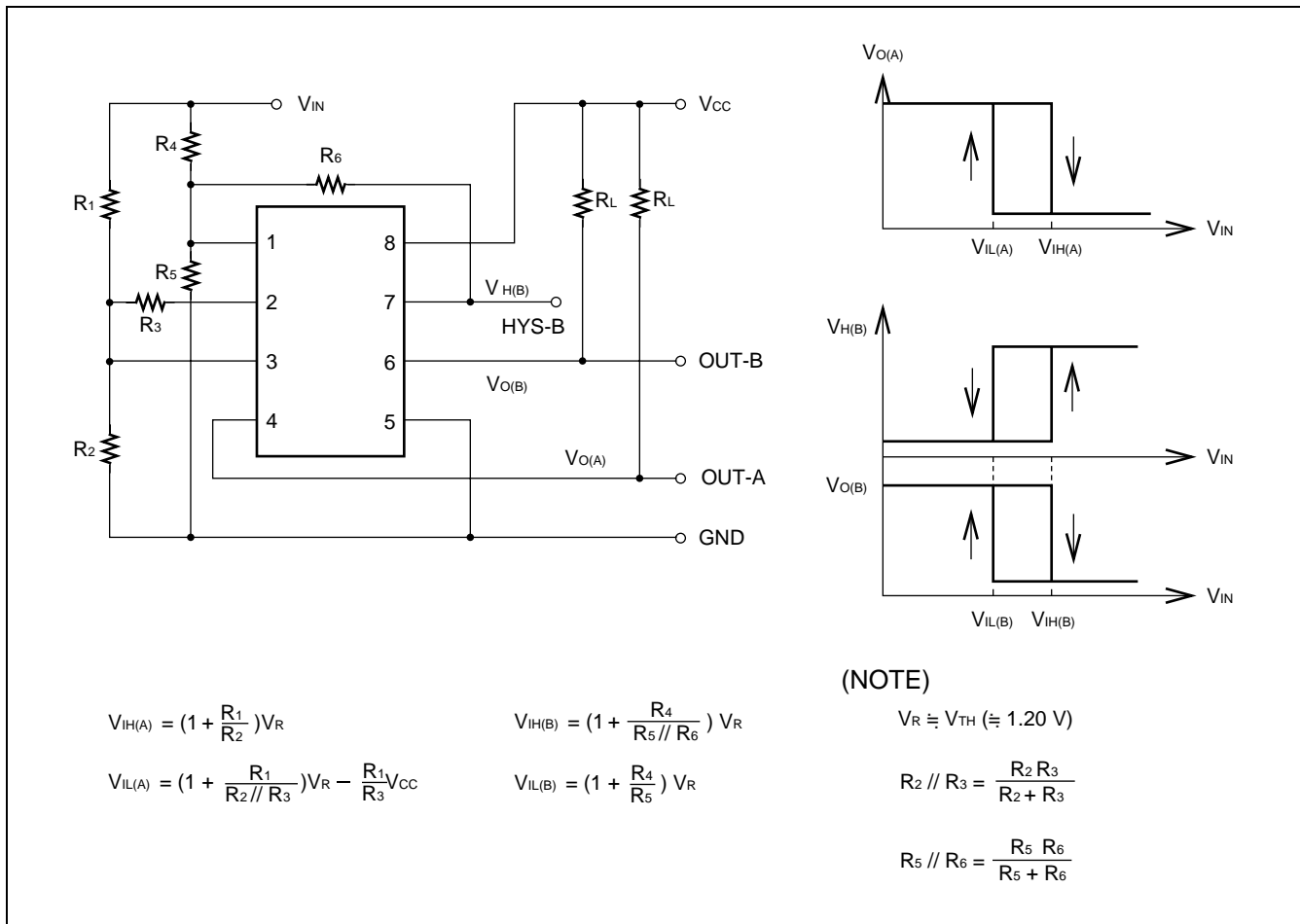
( $T_A=+25^{\circ}\text{C}$ ,  $V_{CC}=5\text{ V}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Power Supply Voltage	ICCL	$V_{CC}=40\text{ V}$ , $V_{IL}=1.0\text{ V}$	-	250	400	$\mu\text{A}$
	ICCH	$V_{CC}=40\text{ V}$ , $V_{IH}=1.5\text{ V}$	-	400	600	$\mu\text{A}$
Threshold Voltage	$V_{TH}$	$I_O=2\text{ mA}$ , $V_O=1\text{ V}$	1.15	1.20	1.25	V
Deviation of Threshold Voltage	$\Delta V_{TH1}$	$2.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$	-	3	12	mV
	$\Delta V_{TH2}$	$4.5\text{ V} \leq V_{CC} \leq 40\text{ V}$	-	10	40	mV
Offset Voltage between Outputs	$V_{OOSA}$	$I_{OA}=4.5\text{ mA}$ , $V_{OA}=2\text{ V}$ , $I_{HA}=20\text{ }\mu\text{A}$ , $V_{HA}=3\text{ V}$	-	2.0	-	mV
	$V_{OSSB}$	$I_{OB}=3\text{ mA}$ , $V_{OB}=2\text{ V}$ , $I_{HB}=3\text{ mA}$ , $V_{HB}=2\text{ V}$	-	2.0	-	mV
Temperature Coefficient of Threshold Voltage	$\alpha$	$-20^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$	-	$\pm 0.05$	-	$\text{mV}/^{\circ}\text{C}$
Difference Voltage on Threshold Voltage between Channel	$\Delta V_{THAB}$		-10	-	-10	mV
Input Current	$I_{IL}$	$V_{IL}=1.0\text{ V}$	-	5		nA
	$I_{IH}$	$V_{IH}=1.5\text{ V}$	-	100	500	nA
Output Leakage Current	$I_{OH}$	$V_O=40\text{ V}$ , $V_{IL}=1.0\text{ V}$	-	-	1	$\mu\text{A}$
Hysteresis Output Leakage Current	$I_{HLA}$	$V_{CC}=40\text{ V}$ , $V_{HA}=0\text{ V}$ , $V_{IL}=1.0\text{ V}$	-	-	0.1	$\mu\text{A}$
	$I_{HHB}$	$V_{HB}=40\text{ V}$ , $V_{IH}=1.5\text{ V}$	-	-	1	$\mu\text{A}$
Output Sink Current	$I_{OLA}$	$V_O=1.0\text{ V}$ , $V_{IH}=1.5\text{ V}$	6	12	-	mA
	$I_{OLB}$	$V_O=1.0\text{ V}$ , $V_{IH}=1.5\text{ V}$	4	10	-	mA
Hysteresis Current	$I_{HHA}$	$V_H=0\text{ V}$ , $V_{IH}=1.5\text{ V}$	40	80	-	$\mu\text{A}$
	$I_{HLB}$	$V_H=1.0\text{ V}$ , $V_{IL}=1.0\text{ V}$	4	10	-	mA
Output Saturation Voltage	$V_{OLA}$	$I_O=4.5\text{ mA}$ , $V_{IH}=1.5\text{ V}$	-	120	400	mV
	$V_{OLB}$	$I_O=3.0\text{ mA}$ , $V_{IH}=1.5\text{ V}$	-	120	400	mV
Hysteresis Saturation	$V_{HHA}$	$I_H=20\text{ }\mu\text{A}$ , $V_{IH}=1.5\text{ V}$	-	50	200	mV
	$V_{HLB}$	$I_H=3.0\text{ mA}$ , $V_{IL}=1.0\text{ V}$	-	120	400	mV
Output Delay Time	$t_{PHL}$	$R_L=5\text{ k}\Omega$	-	2	-	$\mu\text{s}$
	$t_{PLH}$	$R_L=5\text{ k}\Omega$	-	3	-	$\mu\text{s}$

## EQUIVALENT CIRCUIT

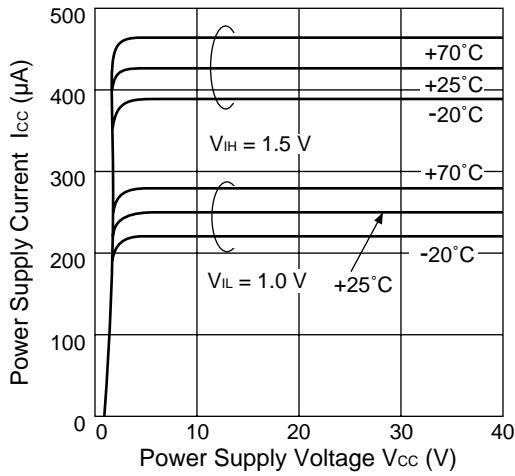


## OPERATIONAL DEFINITIONS

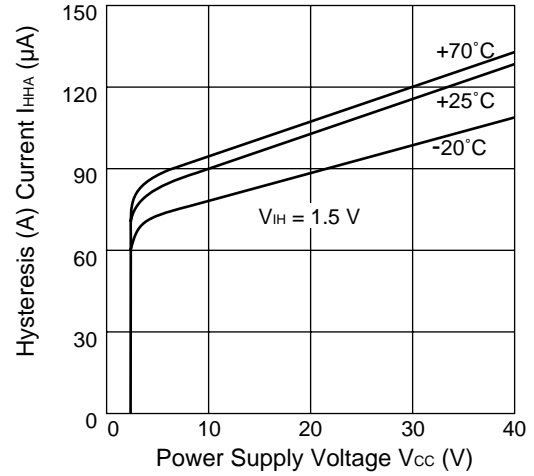


## TYPICAL PERFORMANCE CHARACTERISTICS

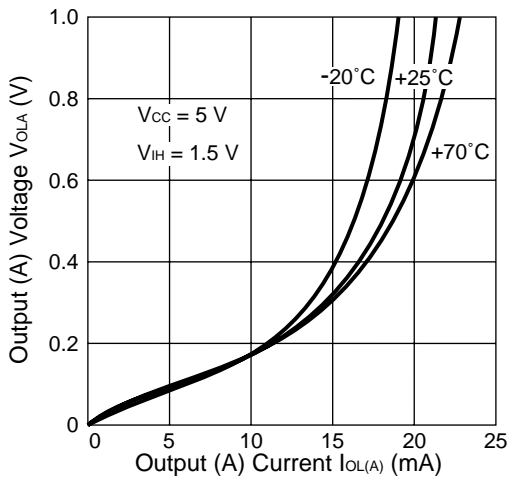
Power Supply Current vs. Power Supply Voltage



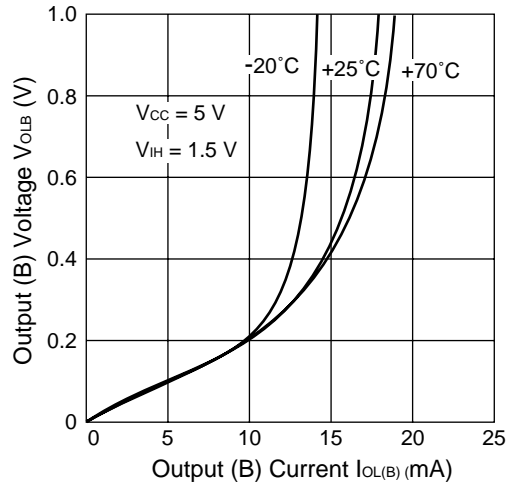
Hysteresis (A) Current vs. Power Supply Voltage



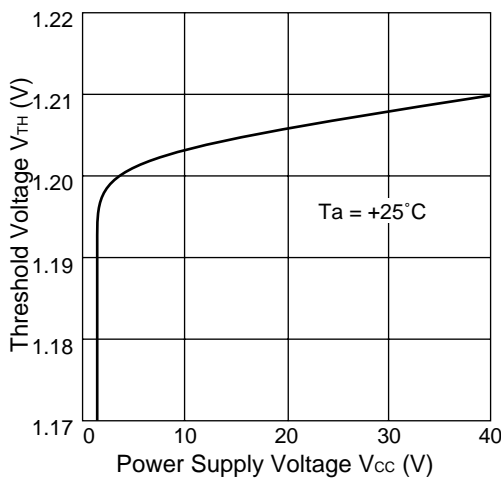
Output (A) Voltage vs. Output (A) Current



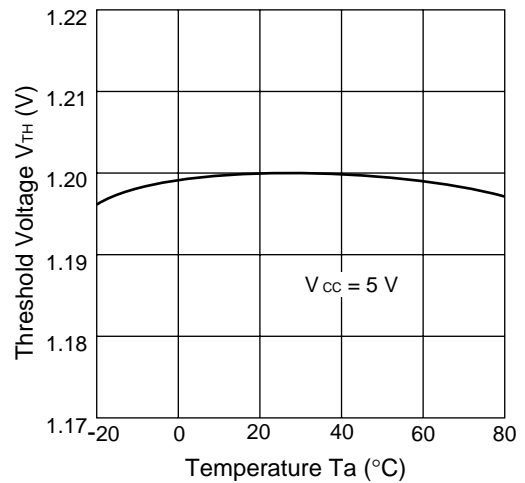
Output (B) Voltage vs. Output (B) Current



Threshold Voltage vs. Power Supply Voltage

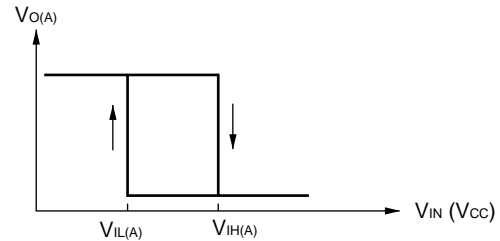
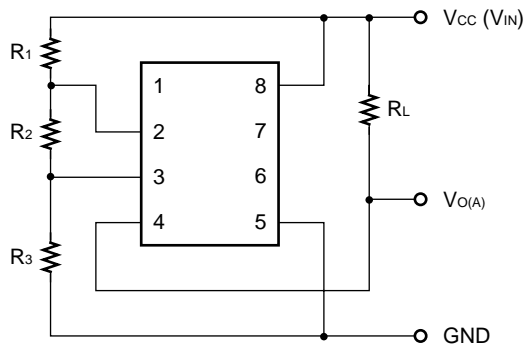


Threshold Voltage vs. Temperature



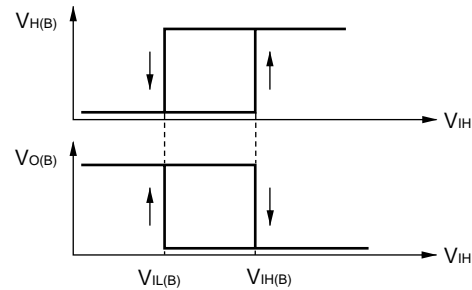
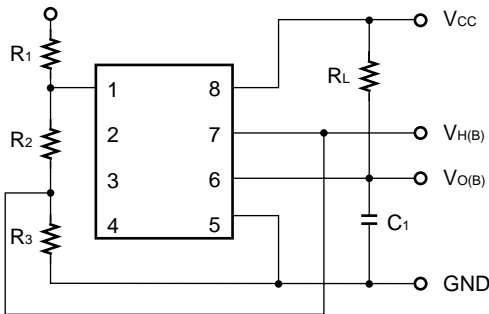
## APPLICATION EXAMPLES

### 1. Addition of Hysteresis



$$V_{IH(A)} \cong \left(1 + \frac{R_1 + R_2}{R_3}\right) V_R$$

$$V_{IL(A)} \cong \left(1 + \frac{R_2}{R_3}\right) V_R$$

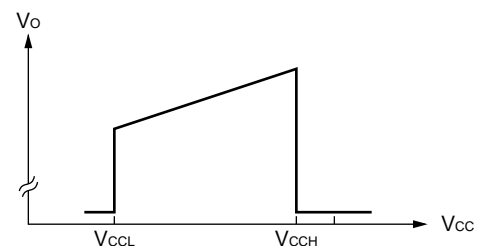
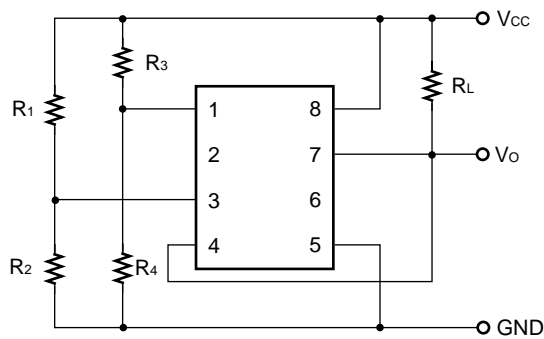


$$V_{IH(B)} \cong \left(1 + \frac{R_1}{R_2}\right) V_R$$

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

Note : All calculations occur with the output voltage at 0. The hysteresis values are adjusted for load condition and saturation voltage.

### 2. Voltage Detection for Alarm



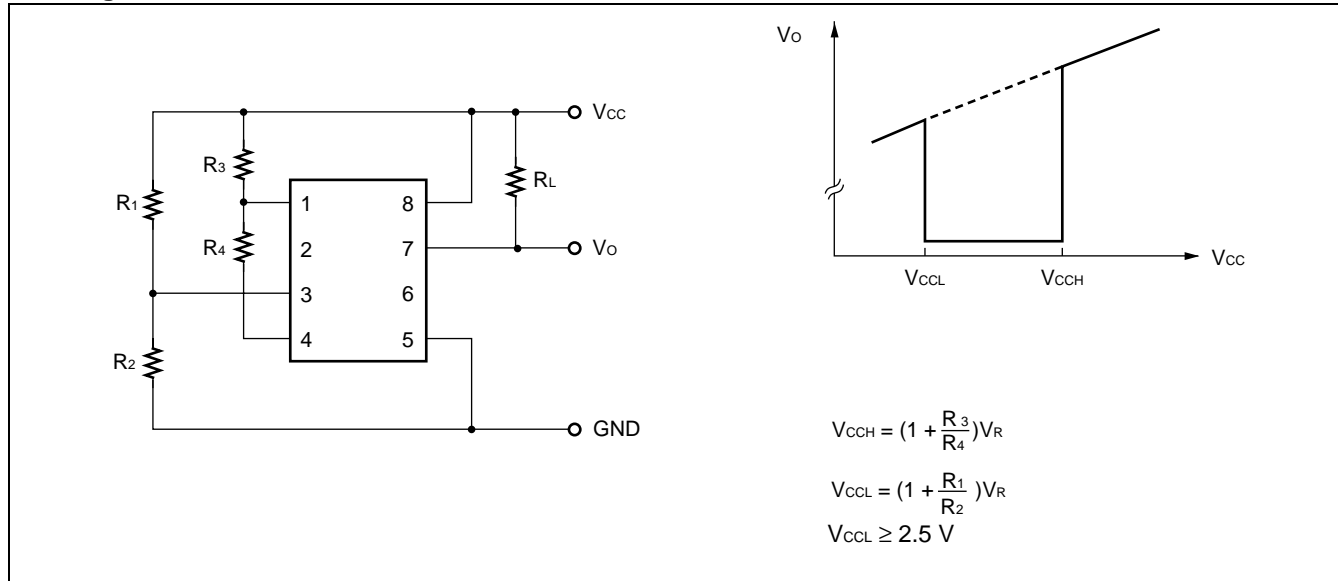
$$V_{CCCH} = \left(1 + \frac{R_1}{R_2}\right) V_R$$

$$V_{CCCL} = \left(1 + \frac{R_3}{R_4}\right) V_R$$

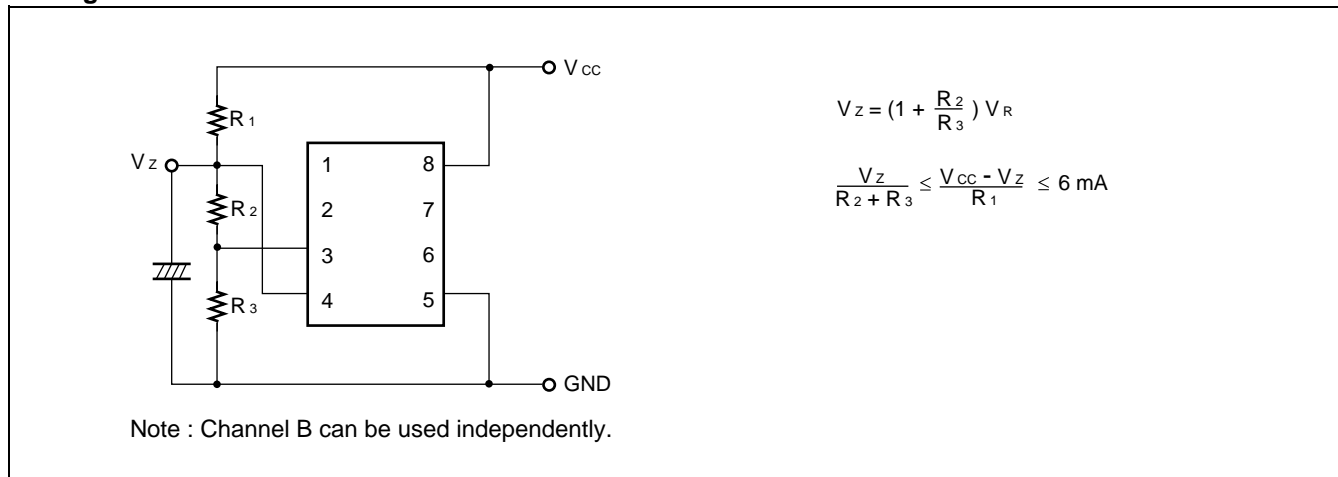
$$V_{CCCL} \geq 2.5 \text{ V}$$

For hysteresis, a positive feedback from pin 2 or 7 is required.

### 3. Voltage Detection for Alarm

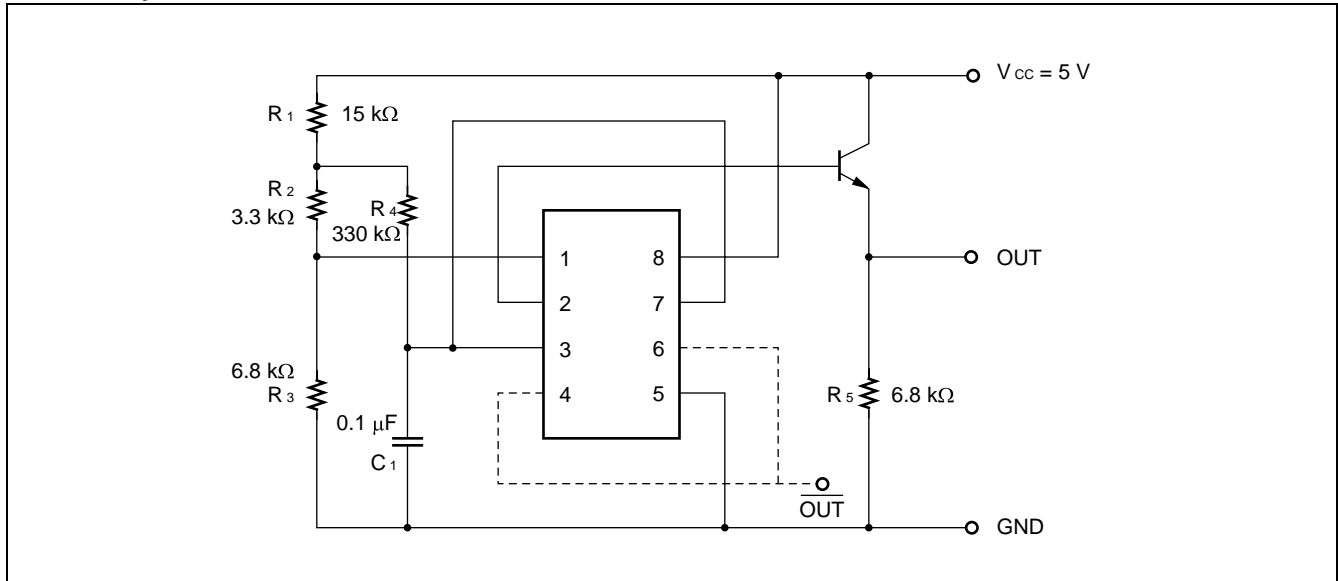


### 4. Programmable Zener

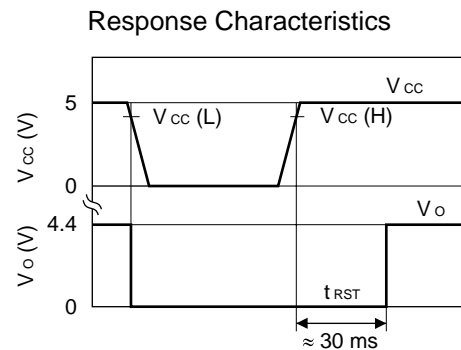
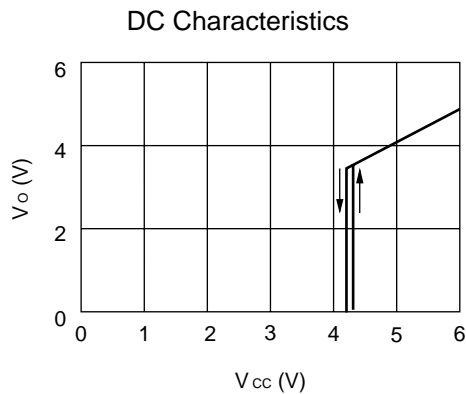




## 5. Recovery Reset Circuit



## ■ TYPICAL CHARACTERISTICS



- Voltage Threshold Levels ( $V_{CC(L)}$  and  $V_{CC(H)}$ ) and Hysteresis Width can be changed by the resistors ( $R_1$  through  $R_4$ ).

$$V_{CC(L)} = \frac{R_1 + R_2 + R_3}{R_3} V_{TH}$$

$$V_{CC(H)} = V_{CC(L)} + \frac{R_1 (R_2 + R_3)}{R_3 R_4} V_{TH}$$

- 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

## ■ 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.

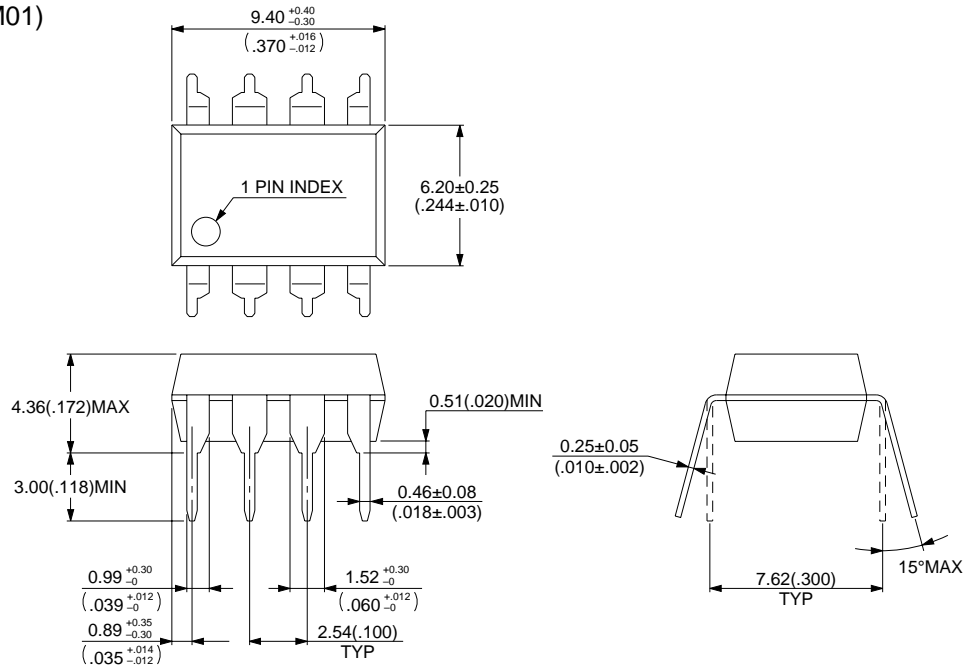
## ■ ORDERING INFORMATION

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)



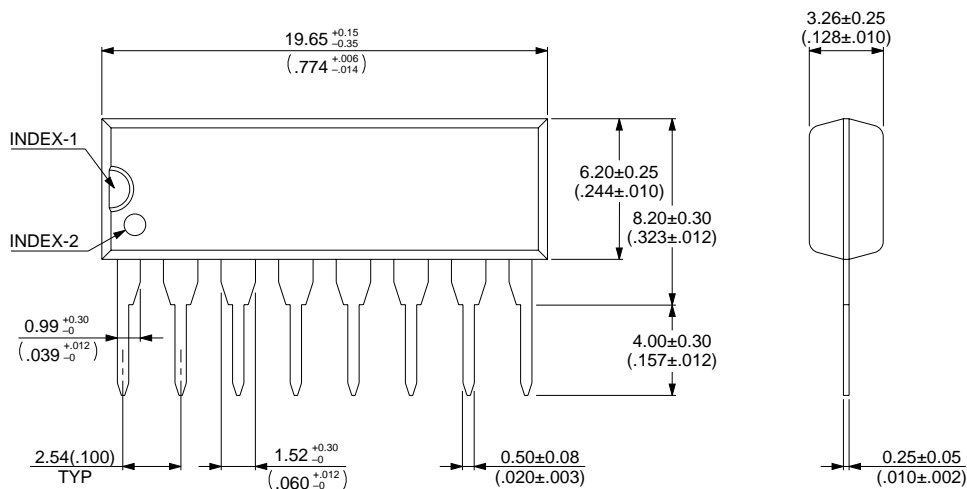
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Dimensions in mm (inches) .

Note : The values in parentheses are reference values.

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



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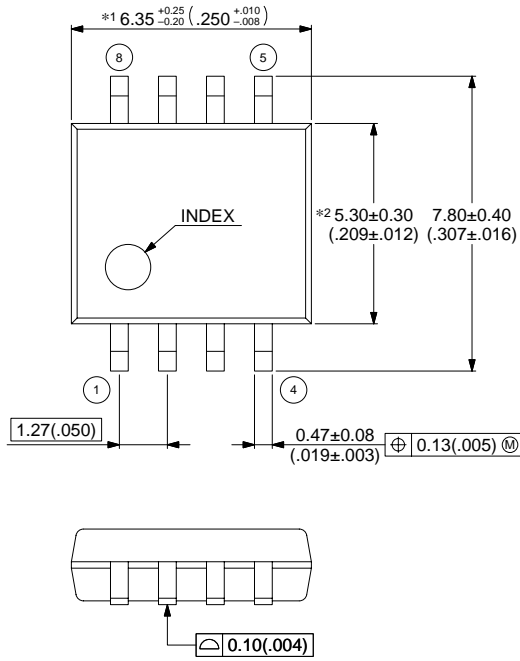
Dimensions in mm (inches) .

Note : The values in parentheses are reference values.

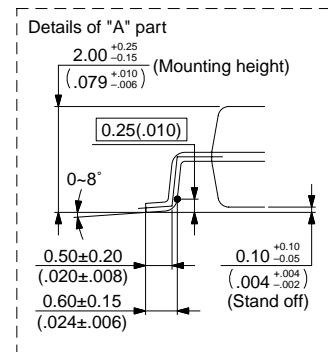
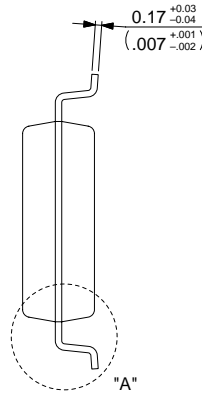
(Continued)

# 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.



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

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