FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-27300-2E

ASSP

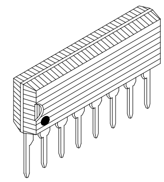
VOLTAGE DETECTOR

MB3761

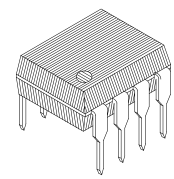
VOLTAGE DETECTOR

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.

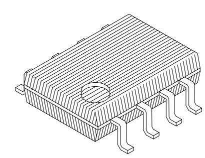
- Wide power supply voltage range: 2.5 V to 40 V
- Low power and small voltage dependency supply current: 250 µA typical.
- Built-in stable low voltage generator: 1.20 V typical.
- Easy-to-add hysteresis characteristics.
- Package: 8-pin Plastic SIP Package (Suffix: -PS)
  8-pin Plastic DIP Package (Suffix: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



PLASTIC PACKAGE
SIP-08P-M03



PLASTIC PACKAGE
DIP-08P-M01



PLASTIC PACKAGE
FPT-08P-M01

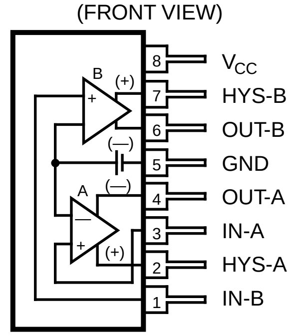
ABSOLUTE MAXIMUM RATINGS (See NOTE)

Rating	Symbol	Value	Unit
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 to +6.5	V
Power Dissipation	P_D	350 ($T_A \leq 70°C$)	mW
Storage Temperature	T_{STG}	-55 to 125	°C

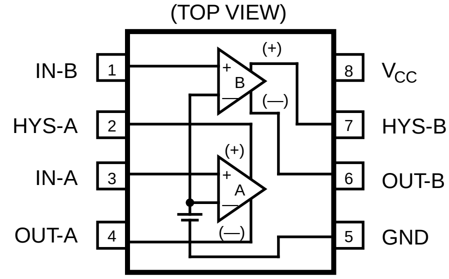
NOTE: Permanent device damage may occur if **ABSOLUTE MAXIMUM RATINGS** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PIN ASSIGNMENT

(FRONT VIEW)



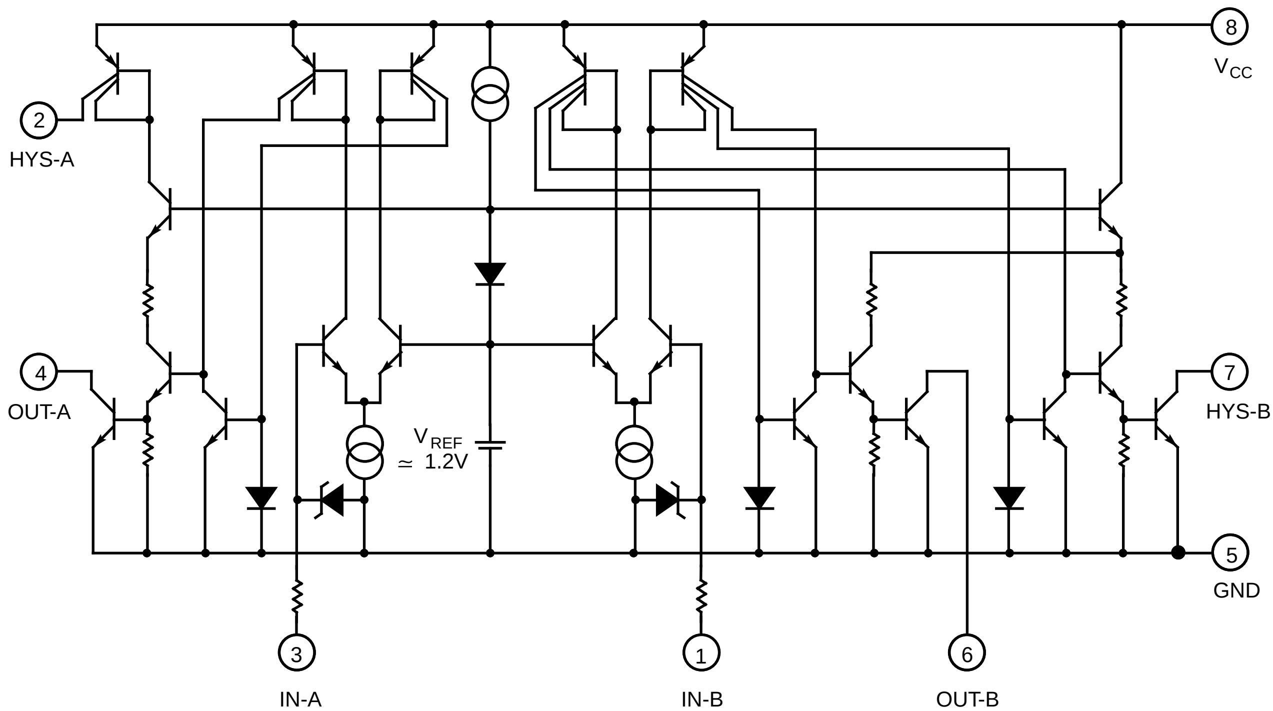
(TOP VIEW)



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

Figure 1. MB3761 Equivalent Circuit



■ RECOMMENDED OPERATING CONDITIONS

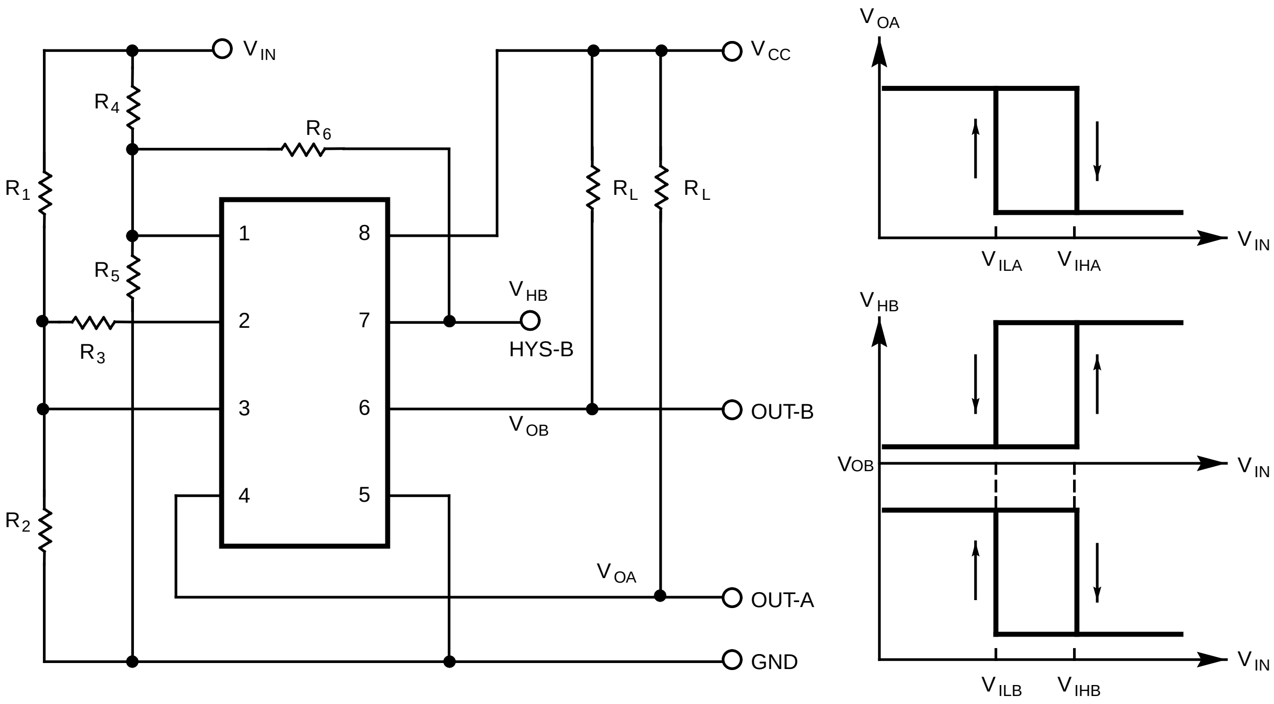
Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	2.5 to 40	V
Operating Temperature	T_A	-20 to 75	°C
Output Current at pin 4	I_{O4}	4.5	mA
Output Current at pin 6	I_{O6}	3.0	mA

■ ELECTRICAL CHARACTERISTICS

T_A=25°C, V_{CC}=5V

Parameter	Designator	Conditions	Values			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 mA, 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

Figure 2. Operational Definitions



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

$$V_{ILA} = \left(1 + \frac{R_1}{R_2 \,//\, R_3}\right)V_R - \frac{R_1}{R_3} V_{CC}$$

$$V_{IHB} = \left(1 + \frac{R_4}{R_5 \,//\, R_6}\right)V_R$$

$$V_{ILB} = \left(1 + \frac{R_4}{R_5}\right)V_R$$

NOTE)

$$V_R \simeq V_{TH} \; (\simeq 1.20V)$$

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

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

■ TYPICAL PERFORMANCE CHARACTERISTICS

Fig. 3 - Power Supply Current vs Power Supply Voltage

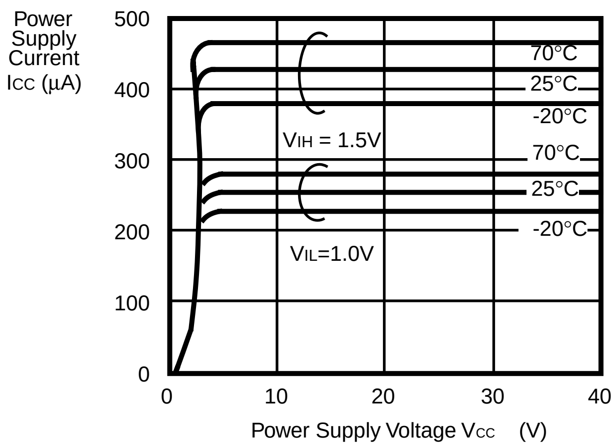


Fig. 4 - Hysteresis (A) Current vs Power Supply Voltage

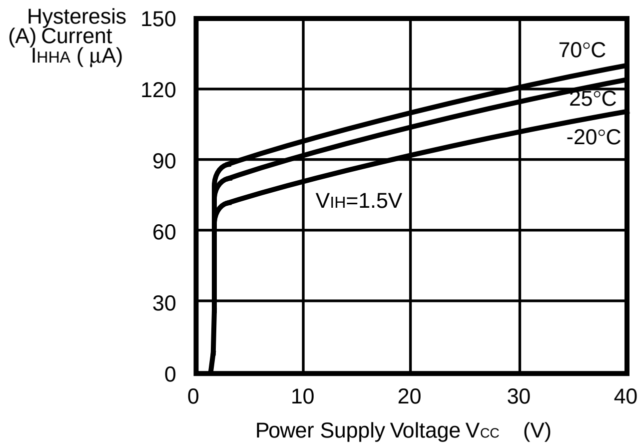


Fig. 5 - Output (A) Voltage vs. Output (A) Current

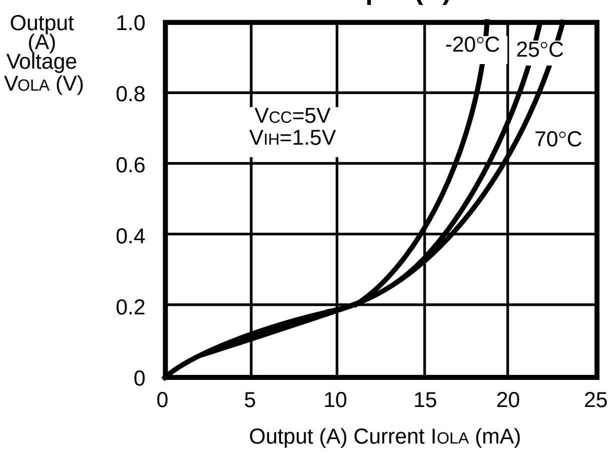


Fig. 6 - Output (B) Voltage vs. Output (B) Current

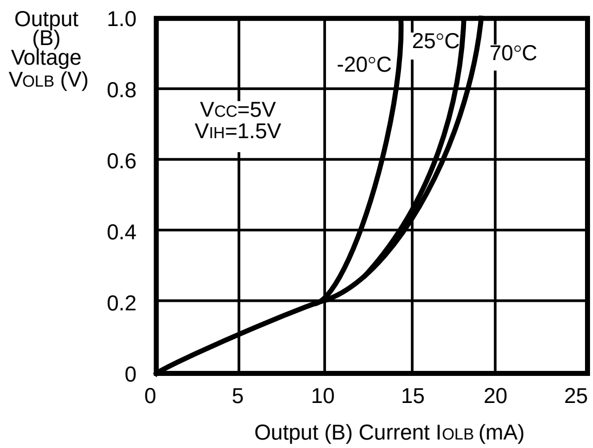


Fig. 7 - Threshold Voltage vs. Power Supply Voltage

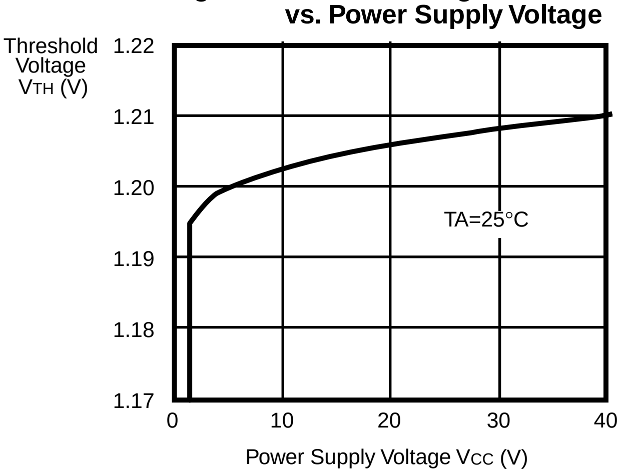
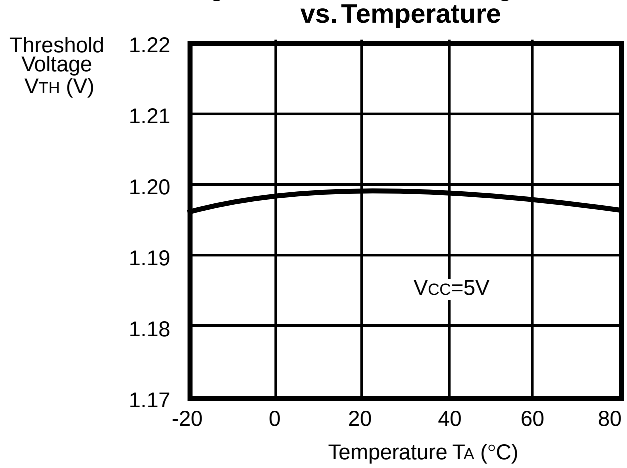


Fig. 8 - Threshold Voltage vs. Temperature



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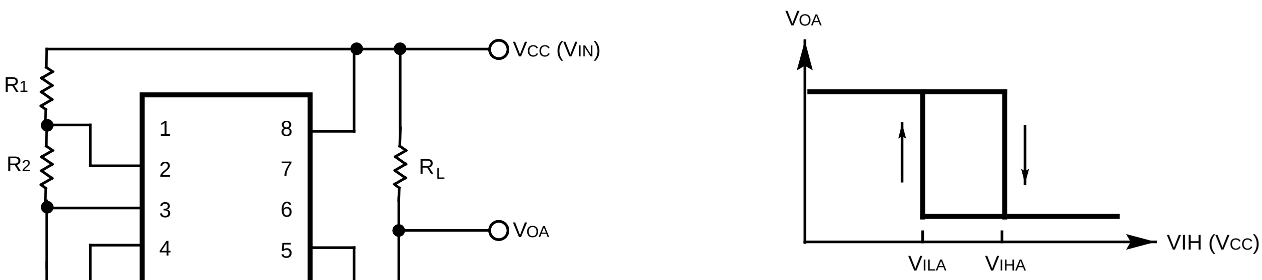
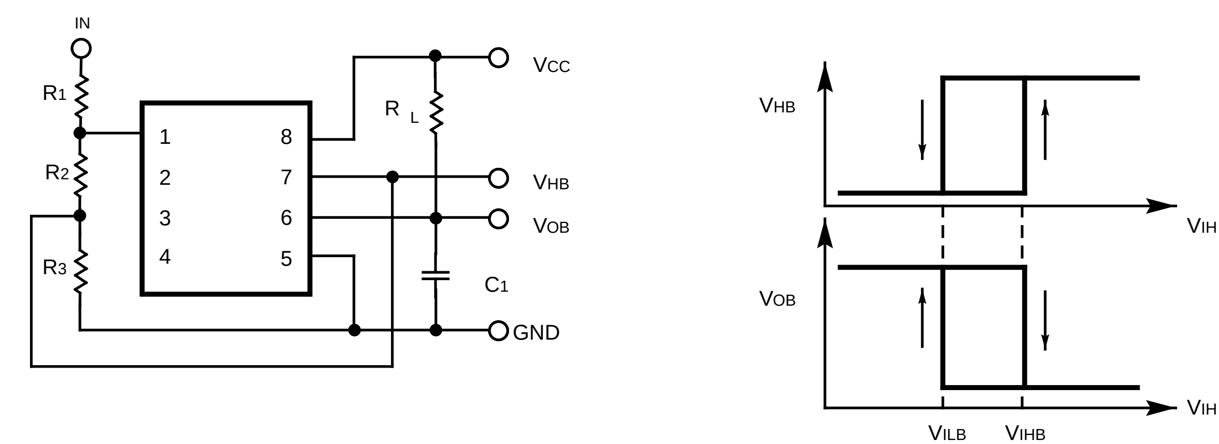
■ APPLICATION EXAMPLES

Figure 9. Addition of Hysteresis



$V_{IHA} = (1 + \frac{R_1 + R_2}{R_3}) V$ $V_{ILA} = (1 + \frac{R_2}{R_3}) V_R$

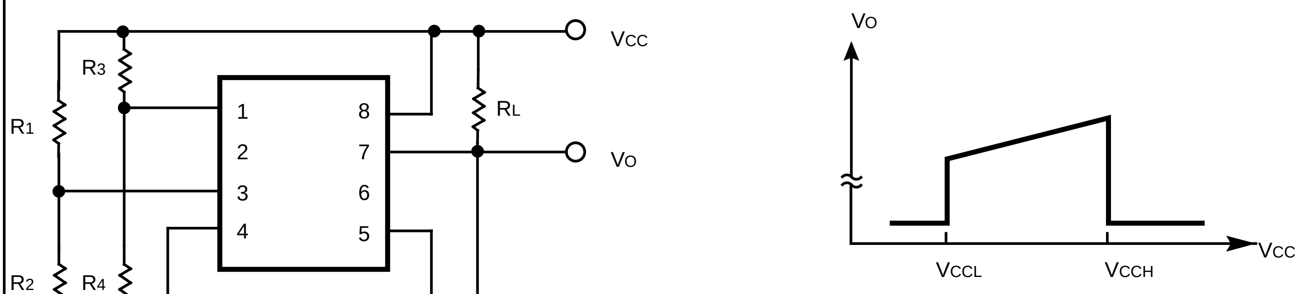


Note: All calculations occur with the output voltage at 0. The hysteresis values are adjusted for load condition and saturation voltage.

$V_{IHB} = (1 + \frac{R_1}{R_2}) V_R$ $V_{ILB} = (1 + \frac{R_1}{R_2 + R_3}) V_R$

■ APPLICATION EXAMPLES (Continued)

Figure 10. Voltage Detection for Alarm

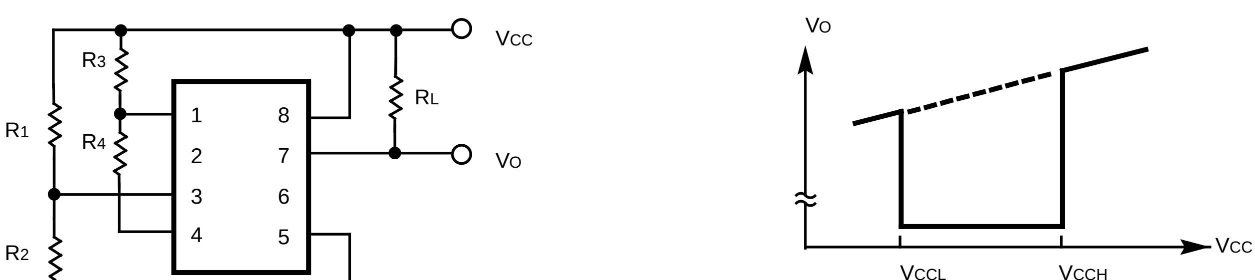


$$V_{CCH} = \left(1 + \frac{R_1}{R_2}\right) V_R \qquad V_{CCL} = \left(1 + \frac{R_3}{R_4}\right) V_R$$

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

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

Figure 11. Voltage Detection for Alarm



$$V_{CCH} = \left(1 + \frac{R_3}{R_4}\right) V_R \qquad V_{CCL} = \left(1 + \frac{R_1}{R_2}\right) V_R$$

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

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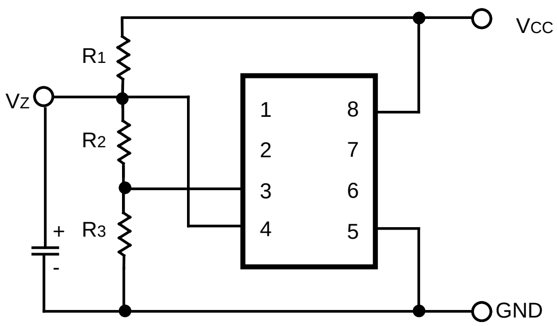
■ APPLICATION EXAMPLES (Continued)

Figure 12. Programmable Zener

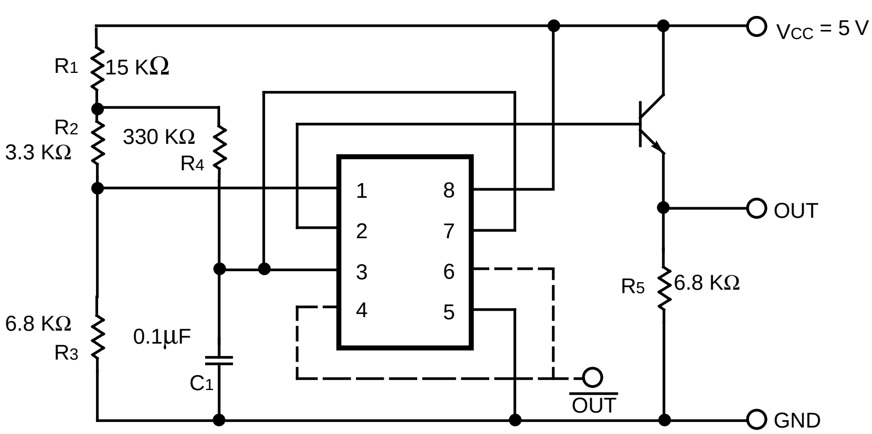


$$V_Z \simeq \left(1+\frac{R_2}{R_3}\right)V_R$$

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

Channel B can be used independently.

Figure 13. Recovery Reset Circuit



■ PACKAGE DIMENSIONS

Figure 14. DC Characteristics

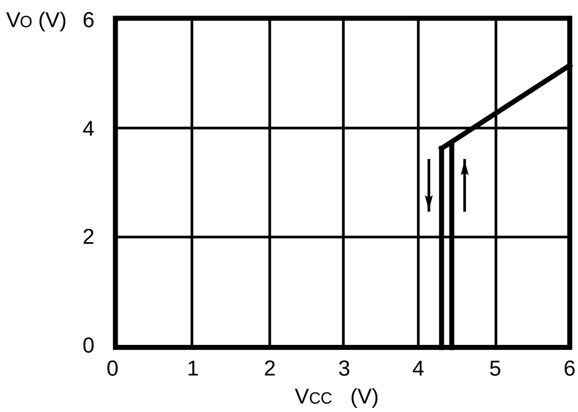
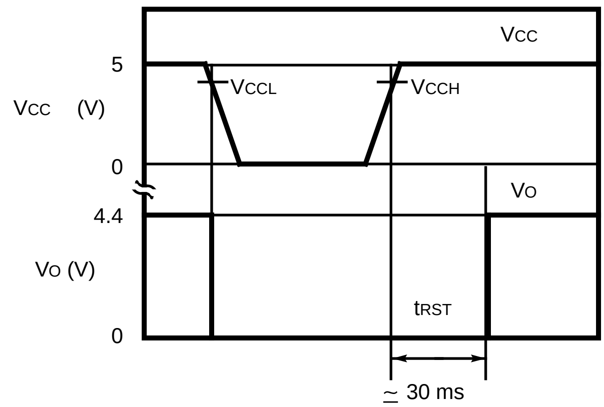


Figure 15. Response Characteristics



- 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

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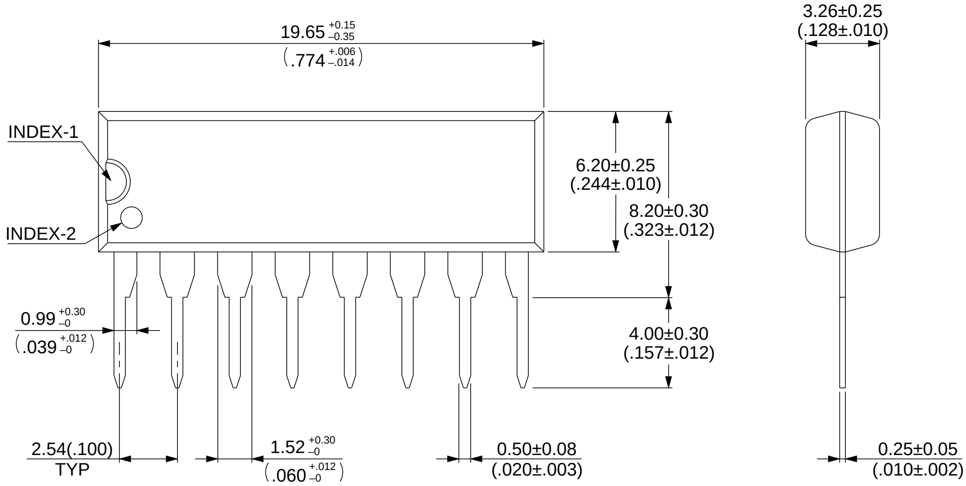
■ PACKAGE DIMENSIONS (Continued)

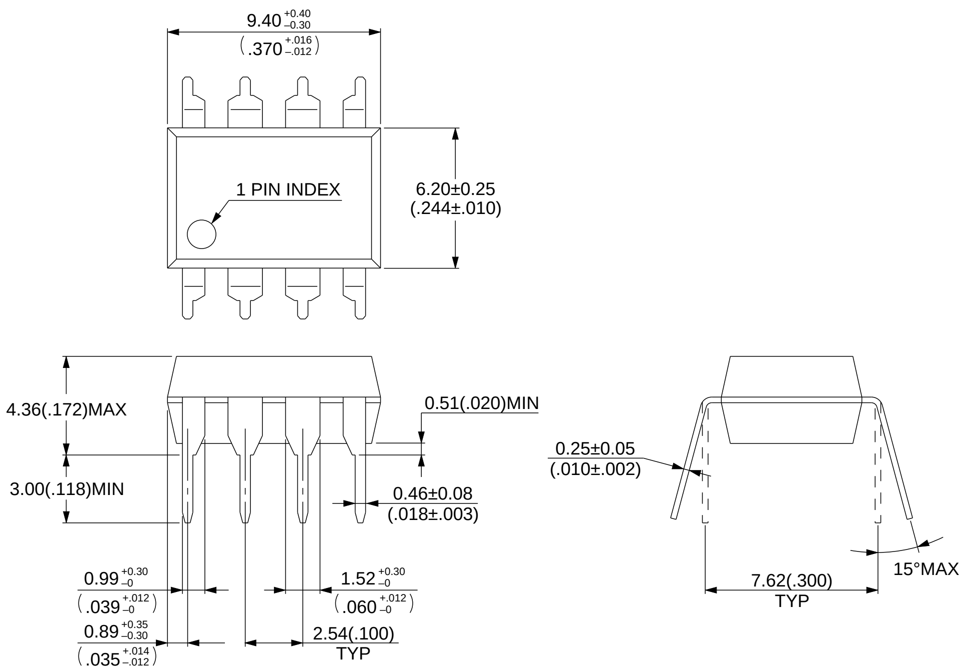
8 pin, Plastic SIP
(SIP-08P-M03)



Dimensions in mm (inches).

■ PACKAGE DIMENSIONS (Continued)

8 pin, Plastic DIP
(DIP-08P-M01)



Dimensions in mm (inches).

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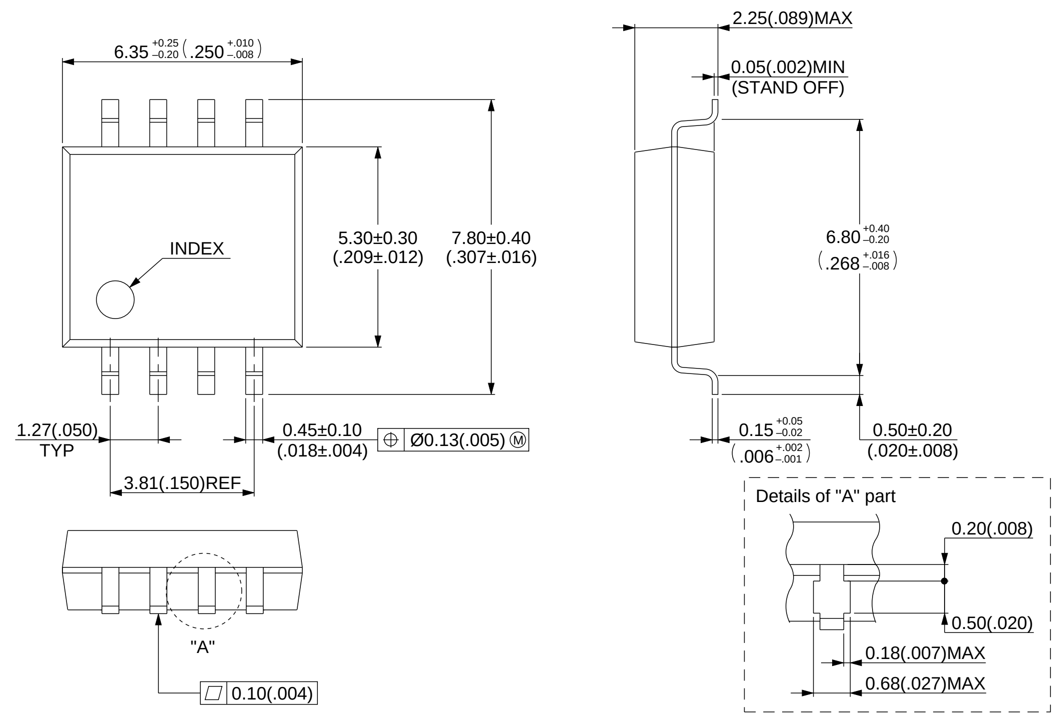
■ PACKAGE DIMENSIONS (Continued)

8 pin, Plastic SOP
(FPT-08P-M01)



Dimensions in mm(inches).

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