

ASSP

BIPOLAR

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

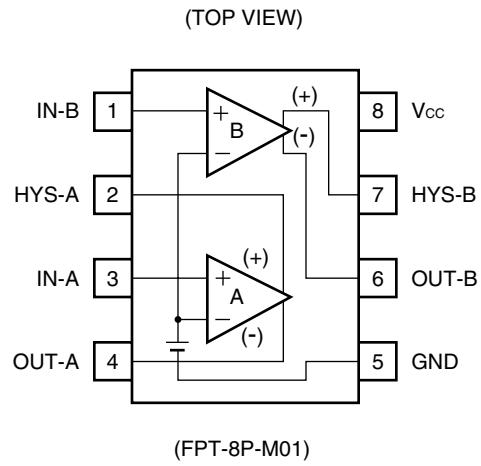
- Wide power supply voltage range: 2.5 V to 40 V
- Low power and small voltage dependency supply current: 250 μ A Typ
- Built-in stable low voltage generator: 1.20 V Typ
- Easy-to-add hysteresis characteristics.
- One type of package (SOP-8pin : 1 type)

■ APPLICATIONS

- Industrial Equipment
- Arcade Amusement etc.

MB3761

■ PIN ASSIGNMENT



■ 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 ≤ +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 Ambient 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.

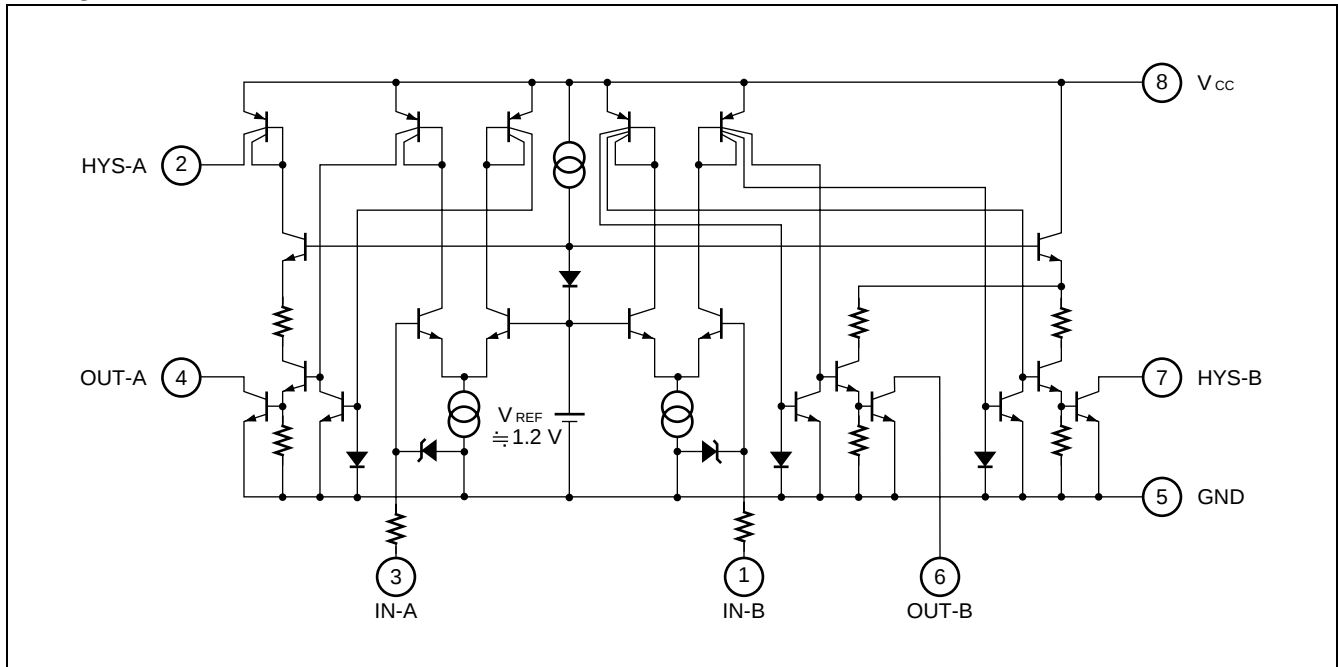
No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

■ ELECTRICAL CHARACTERISTICS

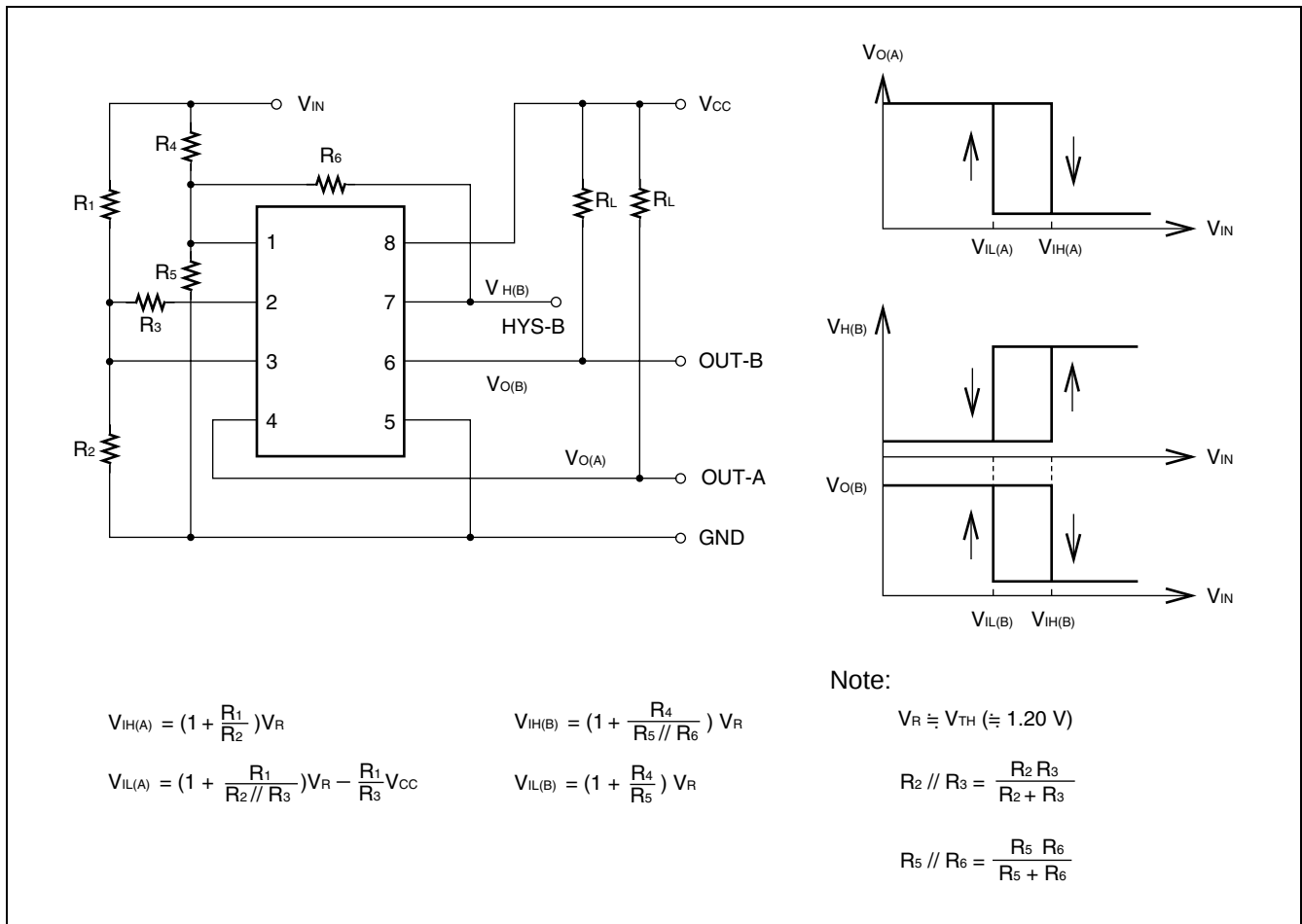
(TA=+25°C, VCC=5 V)

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Power Supply Voltage	ICCL	VCC= 40 V, VIL= 1.0 V	-	250	400	μA
	ICCH	VCC= 40 V, VIH= 1.5 V	-	400	600	μA
Threshold Voltage	VTH	Io = 2 mA, Vo= 1 V	1.15	1.20	1.25	V
Deviation of Threshold Voltage	ΔVTH1	2.5 V ≤ VCC ≤ 5.5 V	-	3	12	mV
	ΔVTH2	4.5 V ≤ VCC ≤ 40 V	-	10	40	mV
Offset Voltage between Outputs	VOOSA	IOA= 4.5 mA, VOA= 2 V, IHA= 20 μA, VHA= 3 V	-	2.0	-	mV
	VOSSB	IOB= 3 mA, VOB= 2 V, IHB= 3 mA, VHB= 2 V	-	2.0	-	mV
Temperature Coefficient of Threshold Voltage	α	-20°C ≤ TA ≤ +70°C	-	±0.05	-	mV/°C
Difference Voltage on Threshold Voltage between Channel	ΔVTHAB	-	-10	-	+10	mV
Input Current	IIL	VIL= 1.0 V	-	5		nA
	IIH	VIH= 1.5 V	-	100	500	nA
Output Leakage Current	IOH	Vo= 40 V, VIL= 1.0 V	-	-	1	μA
Hysteresis Output Leakage Current	IHLA	VCC= 40 V, VHA= 0 V, VIL= 1.0 V	-	-	0.1	μA
	IHHB	VHB= 40 V, VIH= 1.5 V	-	-	1	μA
Output Sink Current	IOLA	Vo= 1.0 V, VIH= 1.5 V	6	12	-	mA
	IOLB	Vo= 1.0 V, VIH= 1.5 V	4	10	-	mA
Hysteresis Current	IHHA	VH= 0 V, VIH= 1.5 V	40	80	-	μA
	IHLB	VH= 1.0 V, VIL= 1.0 V	4	10	-	mA
Output Saturation Voltage	VOLA	Io= 4.5 mA, VIH= 1.5 V	-	120	400	mV
	VOLB	Io= 3.0 mA, VIH= 1.5 V	-	120	400	mV
Hysteresis Saturation	VHHA	IH= 20 μA, VIH= 1.5 V	-	50	200	mV
	VHLB	IH= 3.0 mA, VIL= 1.0 V	-	120	400	mV
Output Delay Time	tPHL	RL= 5 kΩ	-	2	-	μs
	tPLH	RL= 5 kΩ	-	3	-	μs

■ EQUIVALENT CIRCUIT

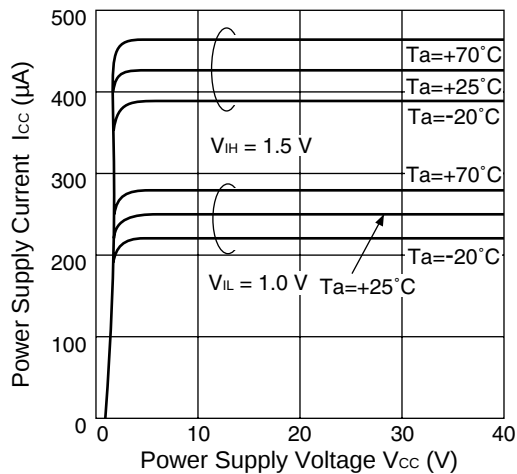


■ OPERATIONAL DEFINITIONS

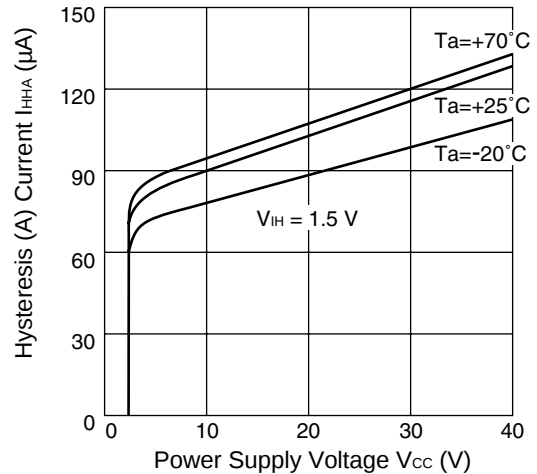


■ TYPICAL PERFORMANCE CHARACTERISTICS

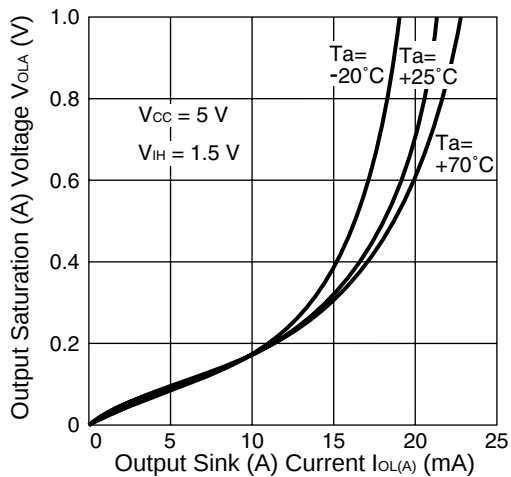
Power Supply Current vs. Power Supply Voltage



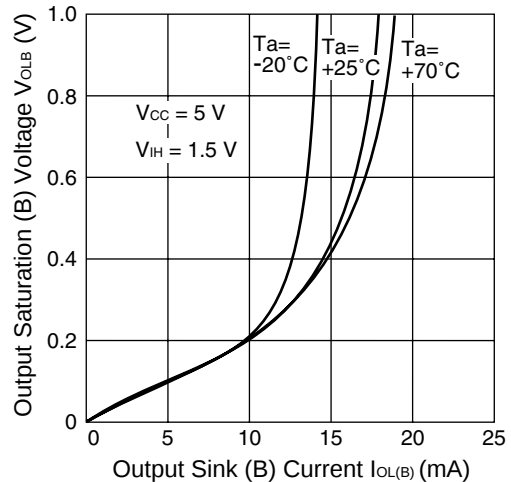
Hysteresis (A) Current vs. Power Supply Voltage



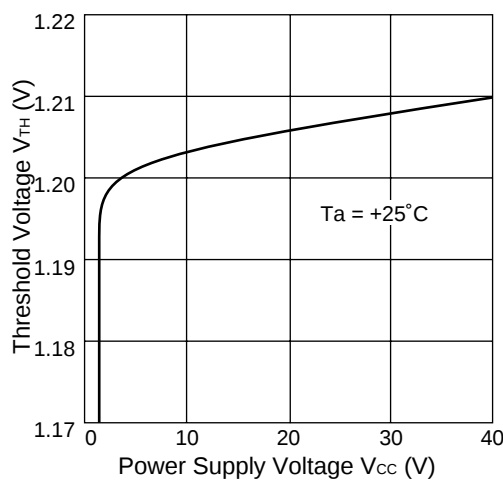
Output Saturation (A) Voltage vs. Output Sink (A) Current



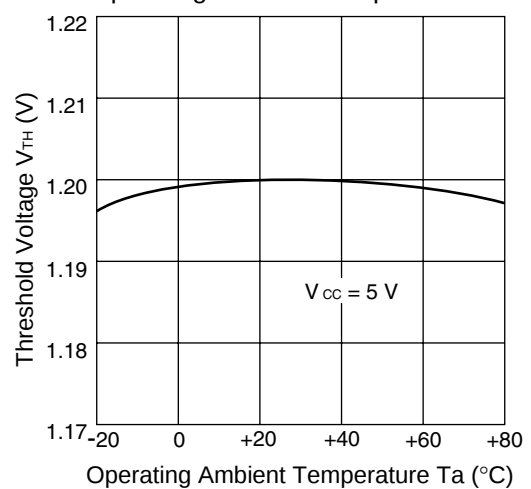
Output Saturation (B) Voltage vs. Output Sink (B) Current



Threshold Voltage vs. Power Supply Voltage

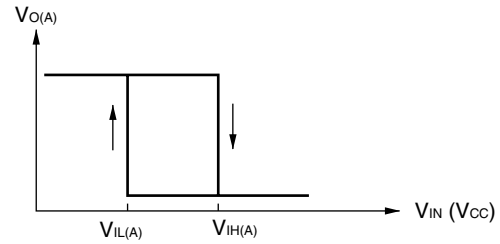
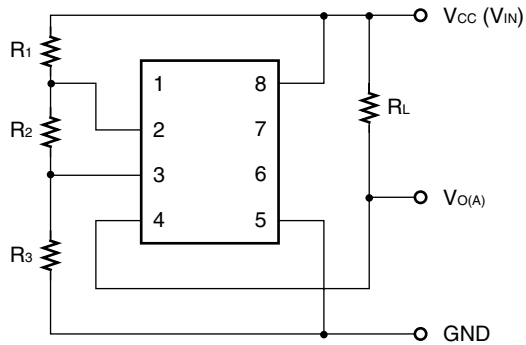


Threshold Voltage vs. Operating Ambient Temperature



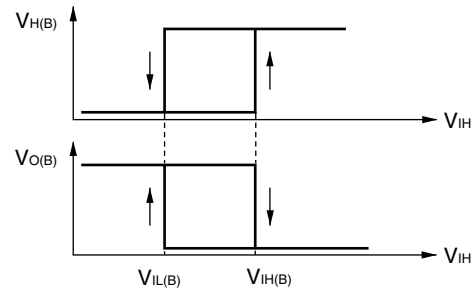
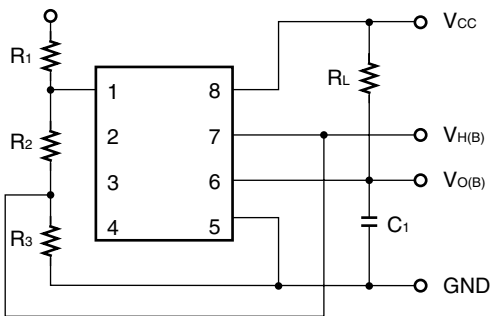
APPLICATION EXAMPLES

1. Addition of Hysteresis



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

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

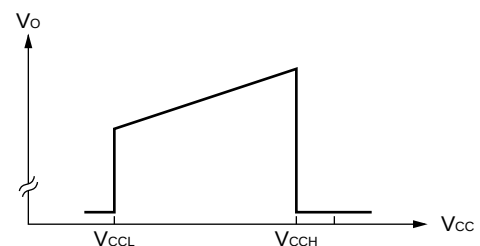
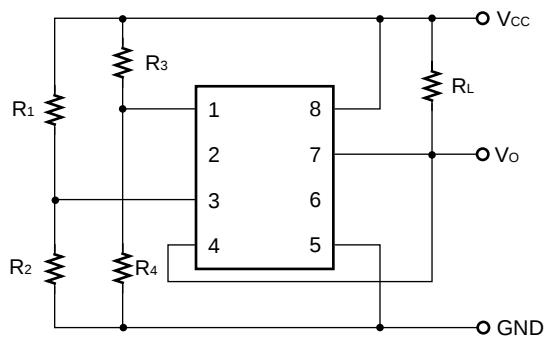


$$V_{IH(B)} \approx (1 + \frac{R_1}{R_2}) V_R$$

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

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

2. Voltage Detection for Alarm



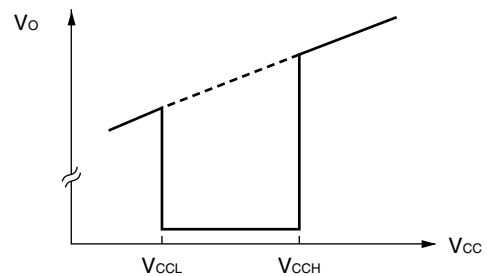
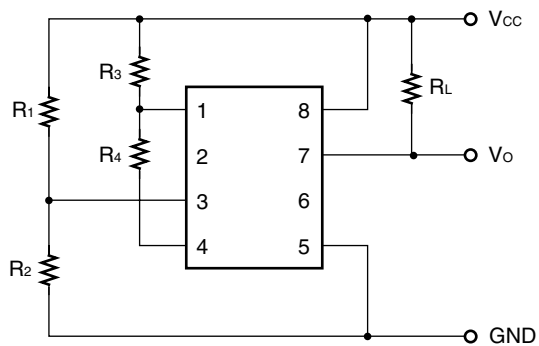
$$V_{CCH} = (1 + \frac{R_1}{R_2}) V_R$$

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

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

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

3. Voltage Detection for Alarm

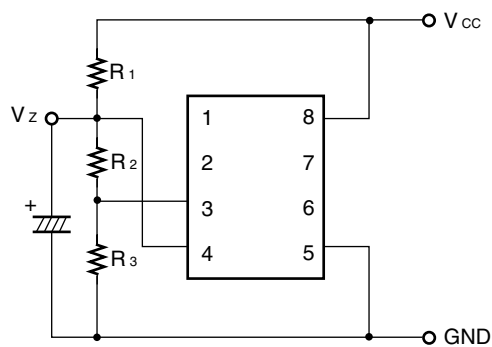


$$V_{CCH} = (1 + \frac{R_3}{R_4}) V_R$$

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

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

4. Programmable Zener

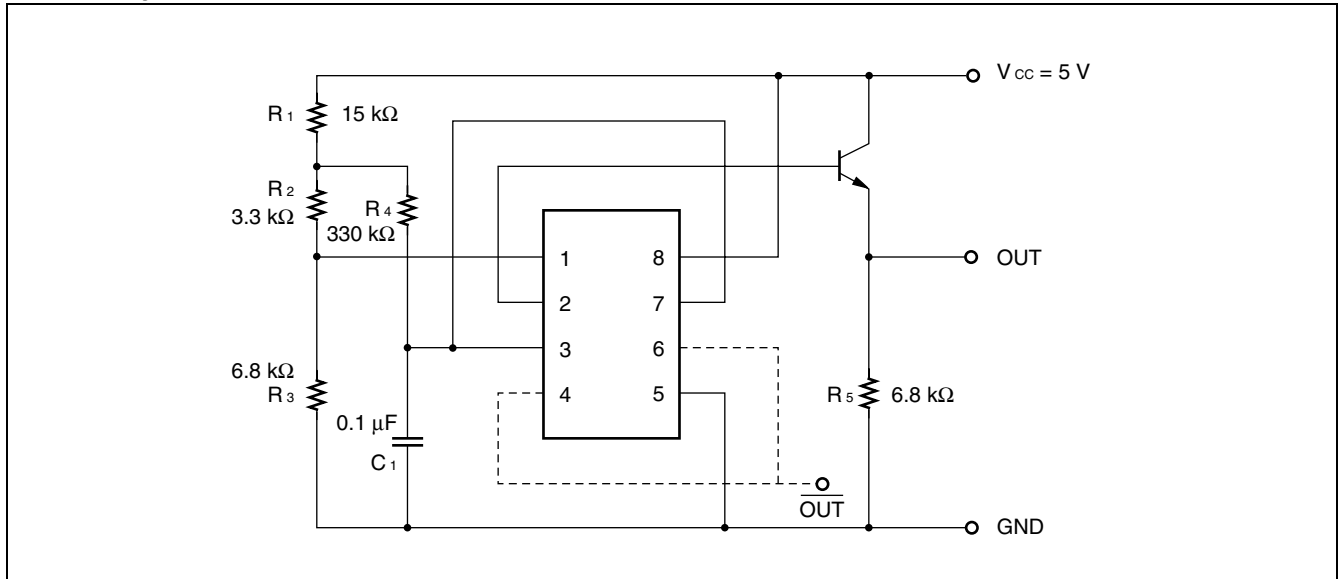


$$V_Z = (1 + \frac{R_2}{R_3}) V_R$$

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

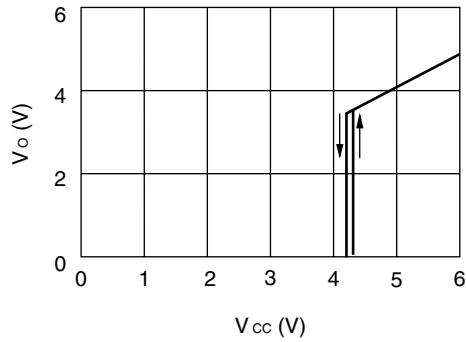
Note : Channel B can be used independently.

5. Recovery Reset Circuit

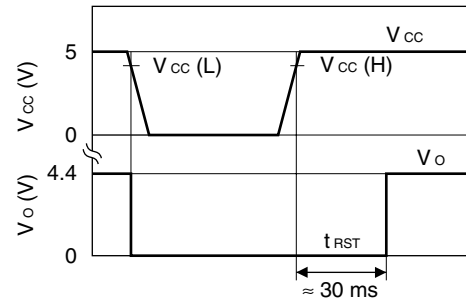


■ TYPICAL CHARACTERISTICS

DC Characteristics



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

■ 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

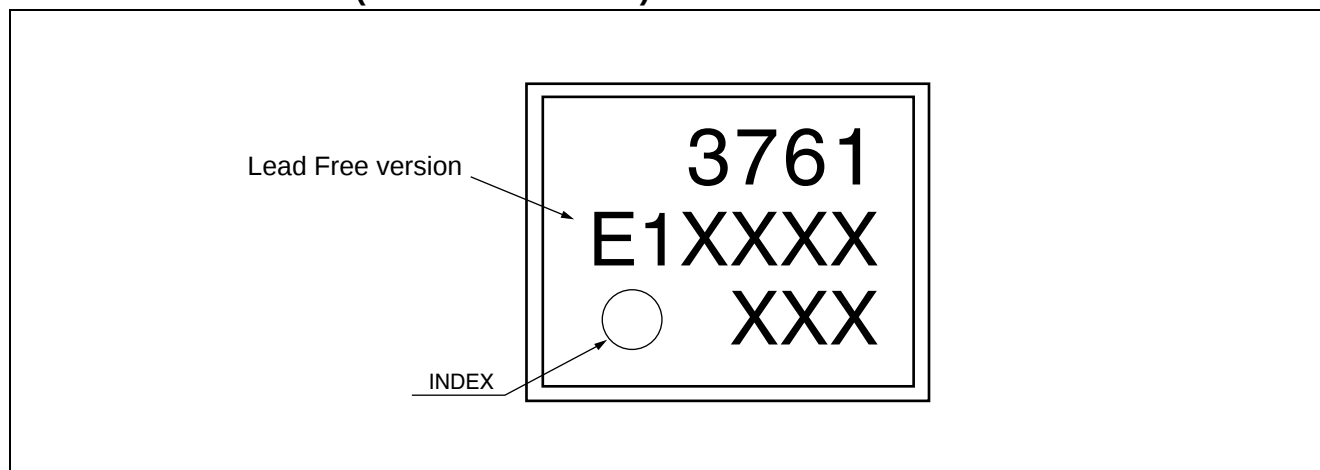
Part number	Package	Remarks
MB3761PF-□□□	8-pin plastic SOP (FPT-8P-M01)	Conventional version
MB3761PF-□□□E1	8-pin plastic SOP (FPT-8P-M01)	Lead Free version

■ RoHS Compliance Information of Lead (Pb) Free version

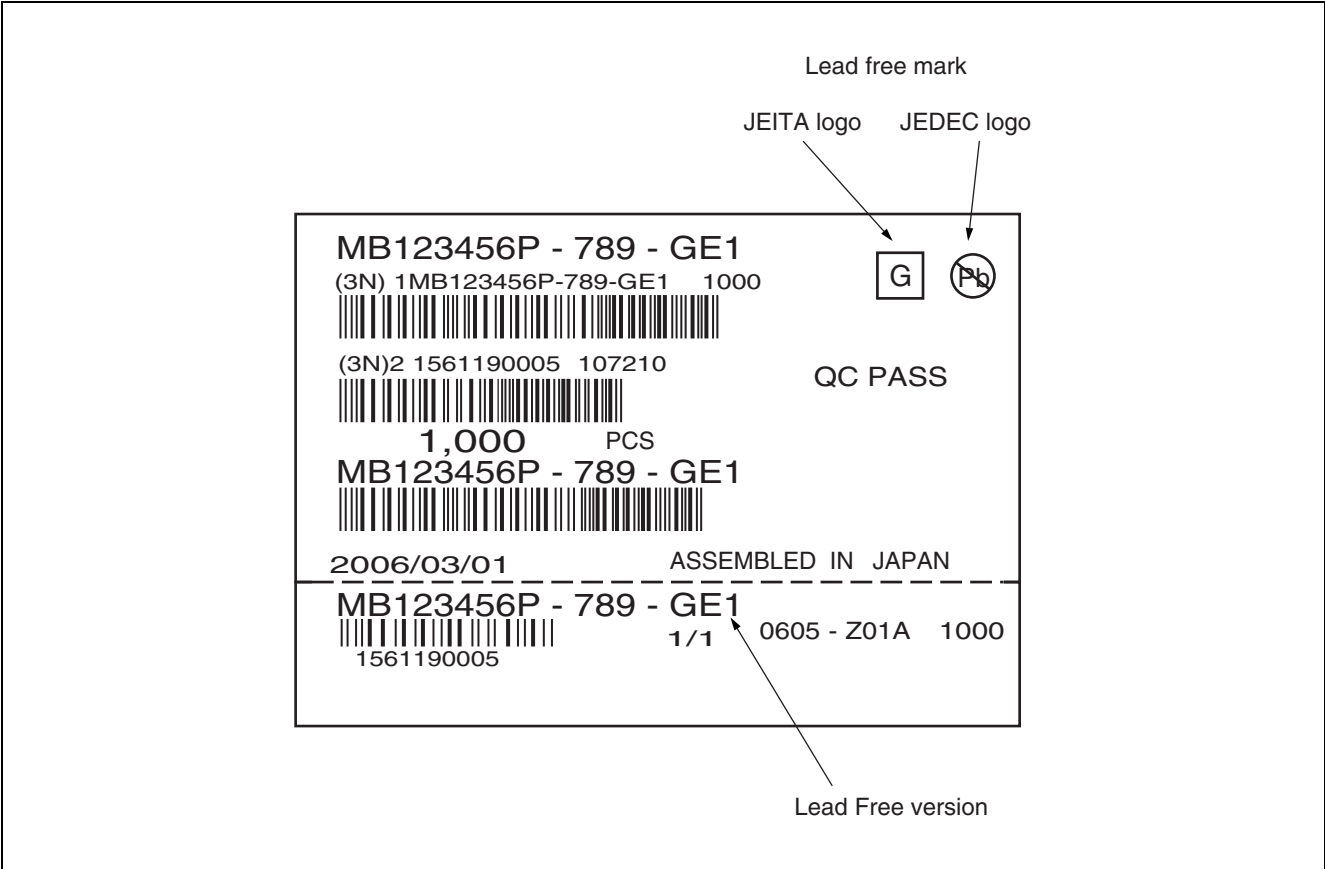
The LSI products of Fujitsu with “E1” are compliant with RoHS Directive , and has observed the standard of lead, cadmium, mercury, Hexavalent chromium, polybrominated biphenyls (PBB) , and polybrominated diphenyl ethers (PBDE) .

The product that conforms to this standard is added “E1” at the end of the part number.

■ MARKING FORMAT (Lead Free version)



■ LABELING SAMPLE (Lead free version)

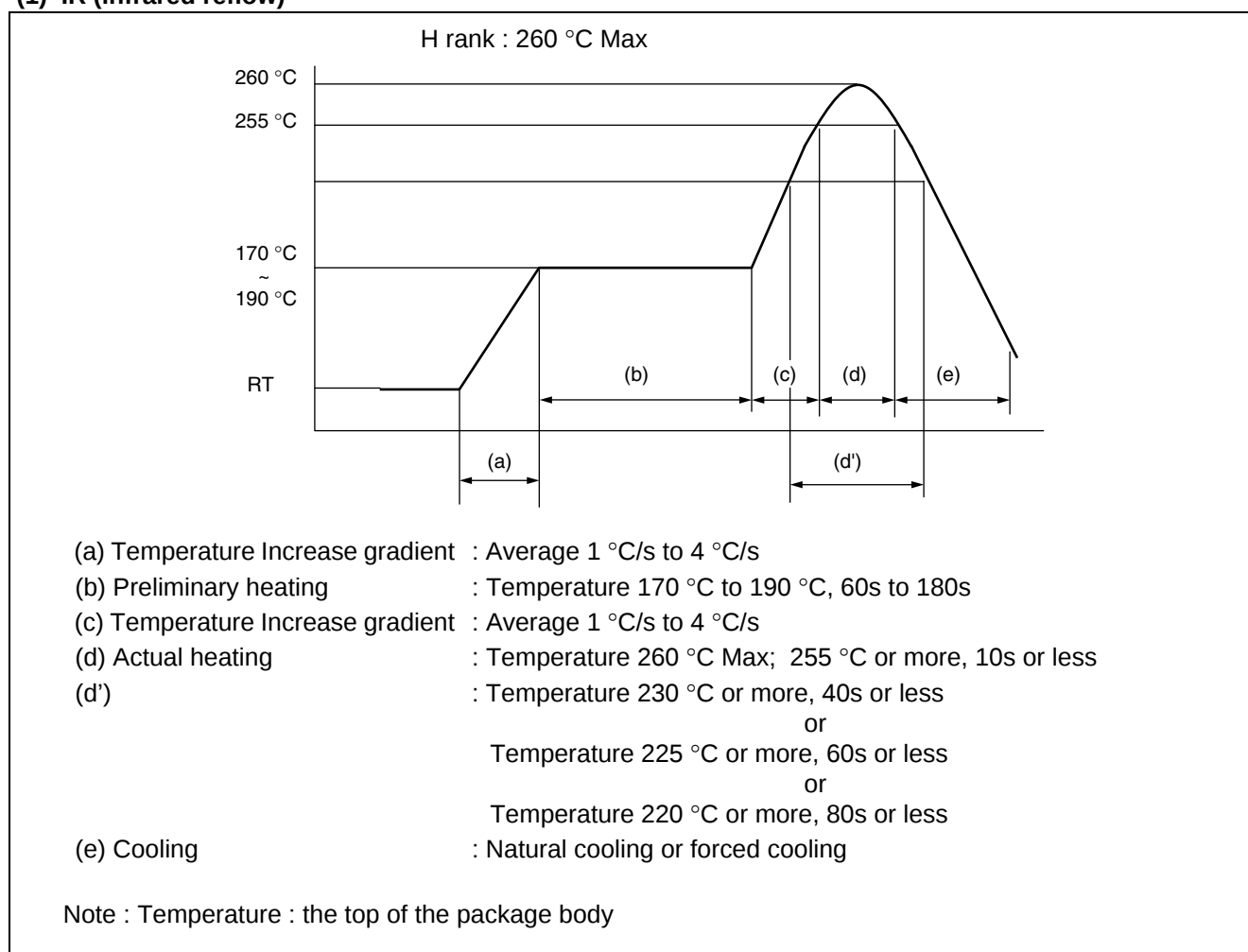


■ MB3761PF-□□□E1 RECOMMENDED CONDITIONS OF MOISTURE SENSITIVITY LEVEL

Item	Condition	
Mounting Method	IR (infrared reflow) , Manual soldering (partial heating method)	
Mounting times	2 times	
Storage period	Before opening	Please use it within two years after Manufacture.
	From opening to the 2nd reflow	Less than 8 days
	When the storage period after opening was exceeded	Please processes within 8 days after baking (125 °C, 24H)
Storage conditions	5 °C to 30 °C, 70%RH or less (the lowest possible humidity)	

[Temperature Profile for FJ Standard IR Reflow]

(1) IR (infrared reflow)

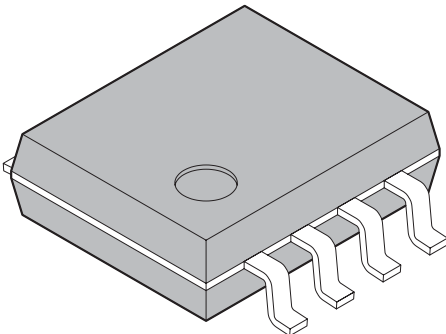


(2) Manual soldering (partial heating method)

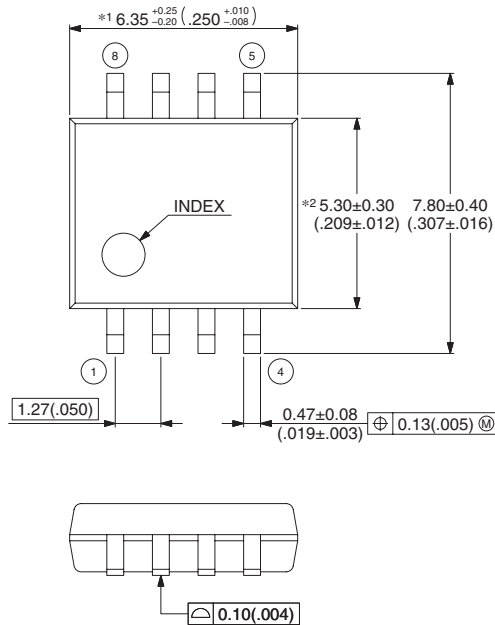
Conditions : Temperature 400 °C Max

Times : 5 s max/pin

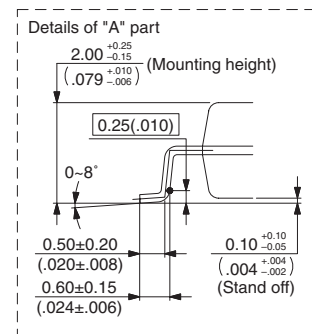
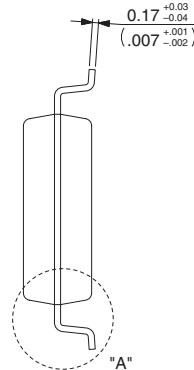
■ PACKAGE DIMENSION

8-pin plastic SOP  (FPT-8P-M01)	Lead pitch	1.27 mm
	Package width × package length	5.3 × 6.35 mm
	Lead shape	Gullwing
	Sealing method	Plastic mold
	Mounting height	2.25 mm MAX
	Weight	0.10 g
	Code (Reference)	P-SOP8-5.3×6.35-1.27

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.



FUJITSU LIMITED

All Rights Reserved.

The contents of this document are subject to change without notice. Customers are advised to consult with FUJITSU sales representatives before ordering.

The information, such as descriptions of function and application circuit examples, in this document are presented solely for the purpose of reference to show examples of operations and uses of Fujitsu semiconductor device; Fujitsu does not warrant proper operation of the device with respect to use based on such information. When you develop equipment incorporating the device based on such information, you must assume any responsibility arising out of such use of the information. Fujitsu assumes no liability for any damages whatsoever arising out of the use of the information.

Any information in this document, including descriptions of function and schematic diagrams, shall not be construed as license of the use or exercise of any intellectual property right, such as patent right or copyright, or any other right of Fujitsu or any third party or does Fujitsu warrant non-infringement of any third-party's intellectual property right or other right by using such information. Fujitsu assumes no liability for any infringement of the intellectual property rights or other rights of third parties which would result from the use of information contained herein.

The products described in this document are designed, developed and manufactured as contemplated for general use, including without limitation, ordinary industrial use, general office use, personal use, and household use, but are not designed, developed and manufactured as contemplated (1) for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could have a serious effect to the public, and could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2) for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite).

Please note that Fujitsu will not be liable against you and/or any third party for any claims or damages arising in connection with above-mentioned uses of the products.

Any semiconductor devices have an inherent chance of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

If any products described in this document represent goods or technologies subject to certain restrictions on export under the Foreign Exchange and Foreign Trade Law of Japan, the prior authorization by Japanese government will be required for export of those products from Japan.

Edited Business Promotion Dept.