# MIC6270

## IttyBitty® Comparator

## General Description

The MIC6270 is a precision voltage comparator with an offset voltage specification of 5mV maximum.

The MIC6270 is designed to operate from a single 2V to 36V power supply. Operation from split power supplies is also possible. Its low supply current drain is independent of the magnitude of the supply voltage.

This comparator also features an input common-mode voltage range that includes ground. Inputs are protected against reverse polarity (input voltage less than V–) and ESD.

The MIC6270 has an open-collector output that directly interfaces with TTL, CMOS, and other types of logic. Several MIC6270 outputs can be connected together for wired-OR logic. The output also features an internal pull-up current source that can be used instead of an external load in some applications.

Data sheets and support documentation can be found on Micrel's web site at www.micrel.com.

## Features

- 2V to 36V supply
- 300µA supply current independent of supply
- 25nA input bias current
- ±5nA input offset current
- ±3mV input offset voltage
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- 250mV at 4mA output saturation voltage
- Output compatible with TTL, DTL, ECL, MOS, and CMOS logic

## Applications

- Limit comparators
- A/D converters
- Pulse, square wave, time delay generators
- Wide range VCO
- MOS clock timers
- Multi-vibrators and high-voltage digital logic gates
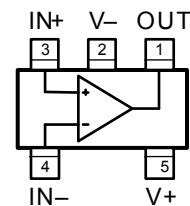
## Ordering Information

| Part Number | | Temperature Range | Package |
|---|---|---|---|
| Standard | Pb-Free | | |
| MIC6270BM5 | MIC6270YM5 | –40° to +85°C | 5-Pin SOT-23 |

## Pin Configuration
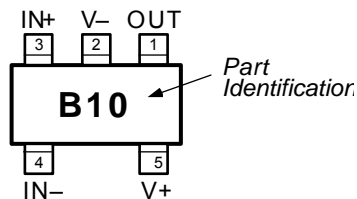


**5-Pin SOT-23 (M5)**

## Functional Configuration



**5-Pin SOT-23 (M5)**

## Pin Description

| Pin Number | Pin Name | Pin Function |
|---|---|---|
| 1 | OUT | Comparator Output |
| 2 | V– | Negative Supply:  Negative supply for split supply application or ground for single supply application. |
| 3 | IN+ | Non-inverting Input |
| 4 | IN– | Inverting Input |
| 5 | V+ | Positive Supply |

IttyBitty is a registered trademark of Micrel, Inc.

## Absolute Maximum Ratings

Supply Voltage ($V_{V+} - V_{V-}$) ............................. 36V or ±18V
Differential Input Voltage ($V_{IN+} - V_{IN-}$). ........................±36V
Input Voltage ................................................. –0.3V to +36V
Input Current ($V_{IN} < $–0.3V)...........................................50mA
Output Short-Circuit to GND, **Note 1** .................................∞
Storage Temperature ($T_s$) .........................–65°C to +150°C
Lead Temperature (soldering, 10sec.).......................260°C

## Operating Ratings[2]

Supply Voltage .................................................. 2V to +36V
Ambient Temperature ($T_A$) .........................–40°C to +85°C
Thermal Resistance
 SOT-23-5 ($\theta_{JA}$)..................................................220°C/W
 (mounted to printed circuit board)

## Electrical Characteristics
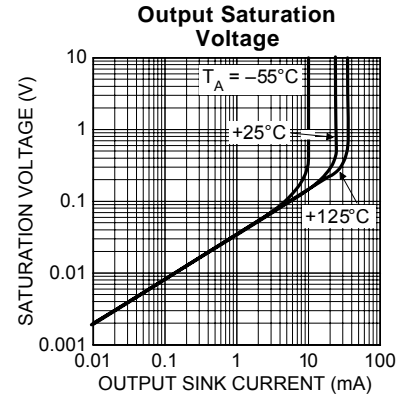
V+ = 5V; $T_A$ = 25°C, **bold** values indicate –40°C$\leq T_A \leq$ +85°C, $T_A = T_J$; unless noted.

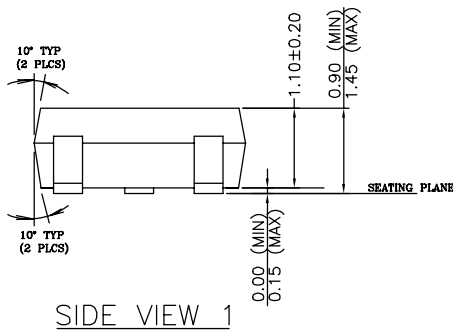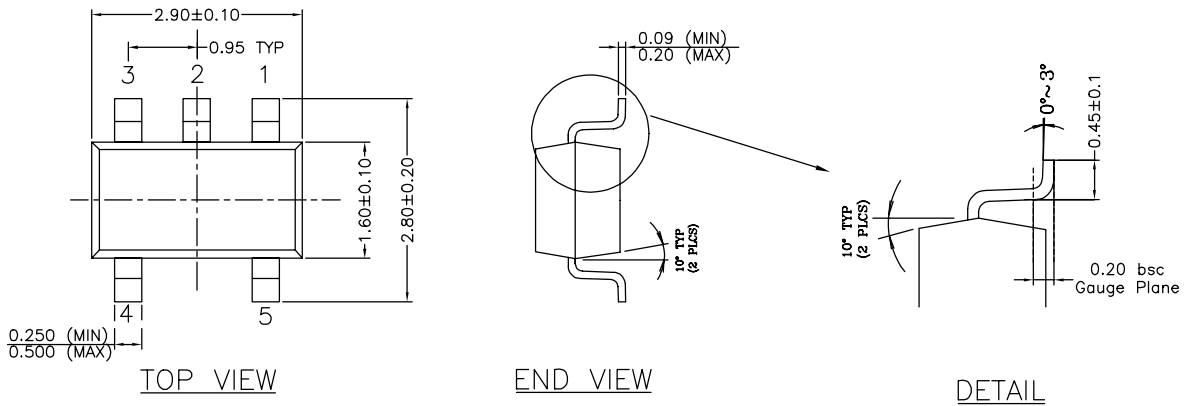| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{OS}$ | Input Offset Voltage | **Note 2** | | 2 | 5<br>**9** | mV<br>mV |
| $I_B$ | Input Bias Current | $I_{IN(+)}$ or $I_{IN(-)}$ with output in linear range, $V_{CM}$ = 0V, **Note 3** | | 25 | 250<br>**400** | nA<br>nA |
| $I_{OS}$ | Input Offset Current | $I_{IN(+} - I_{IN(-)}$, VCM = 0V | | 5 | 50<br>**150** | nA<br>nA |
| $V_{CM}$ | Input Voltage Range | V+ = 30V, **Note 4** | 0 | | V+ – 1.5<br>**V+ – 2** | V<br>V |
| $I_S$ | Supply Current | $R_L$ = ∞<br>$R_L$ = ∞, V+ = 36V | | 0.3<br>0.4 | 0.9<br>1.2 | mA<br>mA |
| | Voltage Gain | $R_L \geq$ 15kΩ, V+ = 15V<br>$V_O$ = 1V to 11V | 50 | 200 | | V/mV |
| | Large Signal Response Time | $V_{IN}$ = TTL logic swing, $V_{REF}$ = 1.4V<br>$V_{RL}$ = 5V, $R_L$ = 5.1kΩ | | 300 | | ns |
| | Response Time | $V_{RL}$ = 5V, $R_L$ = 5.1kΩ, **Note 5** | | 0.6 | | µs |
| | Output Sink Current | $V_{IN(-)}$ = 1V, $V_{IN(+)}$ = 0, $V_O \leq$ 1.5V | 10 | 20 | | mA |
| | Output Pull-Up Current | | | 15 | 50 | µA |
| | Saturation Voltage | $V_{IN(-)}$ = 1V, $V_{IN(+)}$ = 0, $I_{SINK} \leq$ 4mA | | 250 | 400<br>**700** | mV<br>mV |
| | Differential Input Voltage | $V_{IN(+)}$, $V_{IN(-)} \geq$ 0V (or V–, if used), **Note 6** | | | 36 | V |

**General Note**: Devices are ESD protected; however, handling precautions are recommended.

1. A short circuit from OUT to V+ can cause excessive heating and damage the device. The maximum short circuit output current (OUT to V–) is approximately 20mA, independent of $V_{V+}$.

2. Measured at the output switch point where $V_{OUT} \cong$ 1.4Vdc with $R_S$ = 0Ω, V+ = 5Vdc to 30Vdc, and over the full input common-mode range (0Vdc to V+ – 1.5Vdc).

3. The direction of input current is out of the device due to its PNP input.

4. The input common-mode voltage, $V_{IN+}$, or $V_{IN-}$ must not go below –0.3V. The upper end of the common-mode voltage range is V+ – 1.5V at 25°C, but either or both inputs can go to +36Vdc without damage, independent of $V_{V+}$.

5. The response time measured using a 100mV input step with 5mV overdrive. With greater overdrive, 300ns can be obtained. See "Typical Characteristics."

6. Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be below –0.3Vdc (or 0.3Vdc below $V_{V-}$).

# Typical Characteristics

**Supply Current
vs. Supply Voltage**

**Input Current
vs. Supply Voltage**

**Output Saturation
Voltage**

**Output Response Time
vs. Overdrive (Test Circuit)**

**Output Response Time
vs. Overdrive**

**Output Response Time
vs. Overdrive**
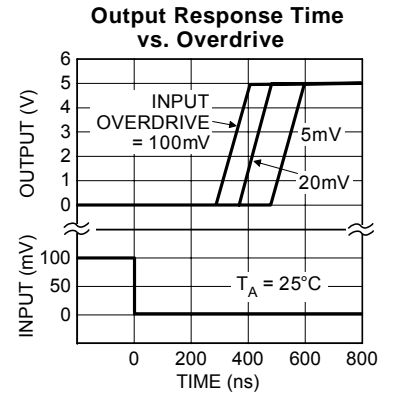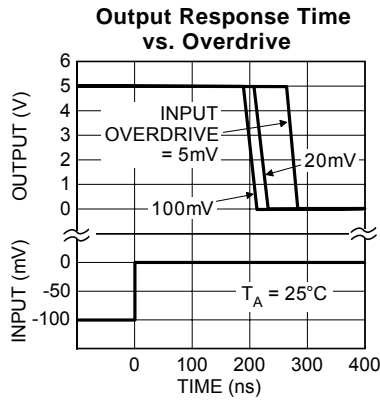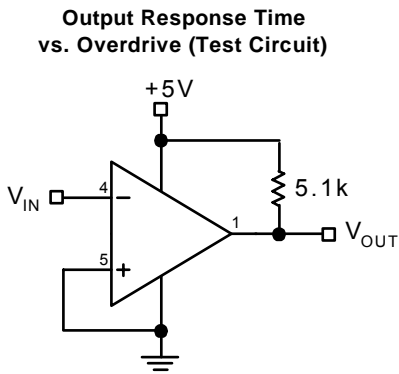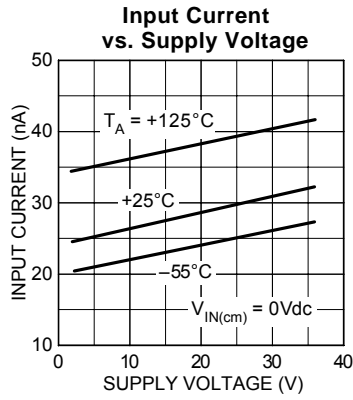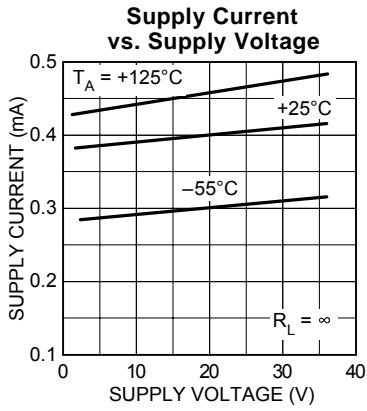
## Package Information





NOTE:
1. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & BURR.
2. PACKAGE OUTLINE INCLUSIVE OF SOLER PLATING.
3. DIMENSION AND TOLERANCE PER ANSI Y14.5M, 1982.
4. FOOT LENGTH MEASUREMENT BASED ON GAUGE PLANE METHOD.
5. DIE FACES UP FOR MOLD, AND FACES DOWN FOR TRIM/FORM.
6. ALL DIMENSIONS ARE IN MILLIMETERS.

**5-Pin SOT-23 (M5)**

The information furnished by Micrel in this data sheet is believed to be accurate and reliable. However, no responsibility is assumed by Micrel for its use. Micrel reserves the right to change circuitry and specifications at any time without notification to the customer.

Micrel Products are not designed or authorized for use as components in life support appliances, devices or systems where malfunction of a product can reasonably be expected to result in personal injury. Life support devices or systems are devices or systems that (a) are intended for surgical implant into the body or (b) support or sustain life, and whose failure to perform can be reasonably expected to result in a significant injury to the user. A Purchaser's use or sale of Micrel Products for use in life support appliances, devices or systems is a Purchaser's own risk and Purchaser agrees to fully indemnify Micrel for any damages resulting from such use or sale.

© 1998 Micrel, Incorporated.