

Low Power Low Offset Voltage Quad Comparators

LM339

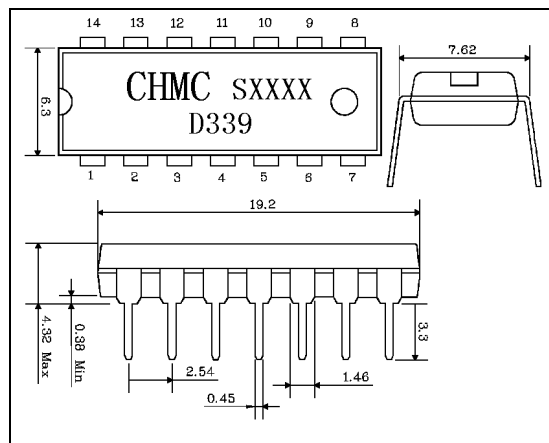
DESCRIPTION:

The LM339 consists of four independent precision voltage comparators. These were designed specifically to operate from a signal power supply over a wide range of voltage. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. The LM339 also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

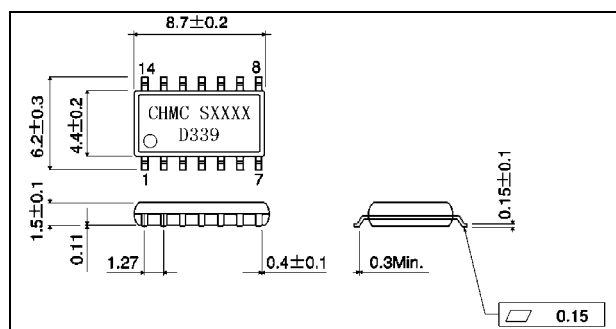
FEATURE:

- Low input biasing current: 25nA (TYP.) .
- Low input offset current: $\pm 5.0\text{nA}$ (TYP.) .
- Low output saturation voltage: 130mV.
- Output voltage compatible with TTL, CMOS.

Outline Drawing

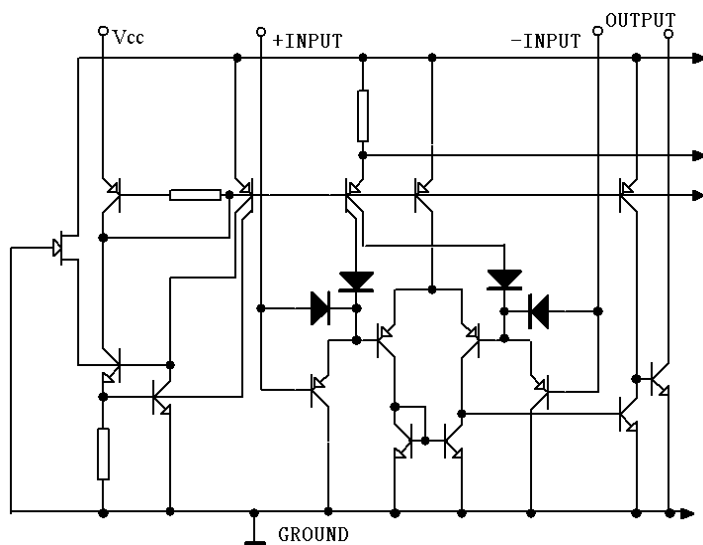


DIP14

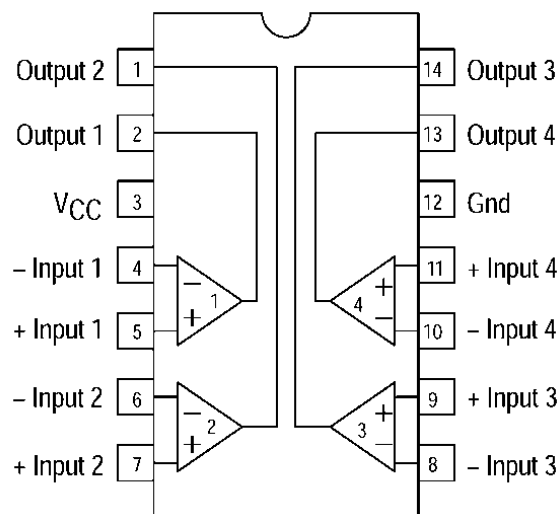


SOP14

PIN CONFIGURATION



BLOCK DIAGRAM



PIN DESCRIPTIONS

| No | Description | Symbol | No | Description | Symbol |
|----|----------------|---------|----|-------------|---------|
| 1 | Output 2 | OUT2 | 8 | -Input3 | IN3 (-) |
| 2 | Output 1 | OUT1 | 9 | +Input3 | IN3 (+) |
| 3 | Supply Voltage | Vcc | 10 | -Input4 | IN4 (-) |
| 4 | -Input1 | IN1 (-) | 11 | +Input4 | IN4 (+) |
| 5 | +Input1 | IN1 (+) | 12 | Ground | GND |
| 6 | -Input2 | IN2 (-) | 13 | Output 4 | OUT4 |
| 7 | +Input2 | IN2 (+) | 14 | Output 3 | OUT3 |

ABSOLUTE MAXIMUM RATINGS

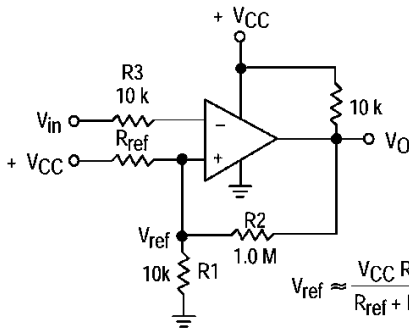
| Characteristics | Symbol | Value | Unit |
|-----------------------------|-------------------|----------------|------|
| Supply Voltage | Vcc | 36 or ± 18 | V |
| Differential Input Voltage | V _{IDR} | 36 | V |
| Input Voltage | V _{ICMR} | -0.3~Vcc | V |
| Input Current | I _{sc} | 50 | |
| Power Dissipation (*) | P _D | 1.0 | W |
| Operating Temperature Range | T _{amb} | -20~+85 | °C |
| Storage Temperature Range | T _{stg} | -65~150 | °C |

Note (*): Power dissipation reduces 8 mW/°C for using above Ta=25°C.

ELECTRICAL CHARACTERISTICS (Unless otherwise specified :Vcc=5V, Tamb=25°C)

| Characteristics | Test conditions | Symbol | Mi | Typ. | Max | Unit |
|---------------------------------|--|-------------------|-----|-----------|-----------|------|
| Input Offset Voltage | | V _{IO} | | ± 2.0 | ± 5.0 | mV |
| | 0°C ≤ Ta ≤ 70°C | | | | ± 9.0 | |
| Input Offset Current | | I _{IO} | | ± 5.0 | ± 50 | nA |
| | 0°C ≤ Ta ≤ 70°C | | | | ± 150 | |
| Input Bias Current | | I _{IB} | | 25 | 250 | nA |
| | 0°C ≤ Ta ≤ 70°C | | | | 400 | |
| Input Common-mode Voltage Range | | V _{ICR} | 0 | | Vcc-1.5 | V |
| | 0°C ≤ Ta ≤ 70°C | | 0 | | Vcc-2.0 | |
| Supply Current | R _L =∞ | I _{CC} | | 0.8 | 2.0 | mA |
| | R _L =∞, Vcc=30V | | | 1.0 | 2.5 | |
| Voltage Gain | R _L ≥ 15KΩ, Vcc=15V | G _v | 50 | 200 | | V/mV |
| Large Signal Response Time | V _{IN} =TTL Logic Swing, V _{REF} =1.4V, V _{RL} =5.0V, R _L =5.1KΩ | t _{RES} | | 300 | | ns |
| Response Time | V _{RL} =5.0V, R _L =5.1KΩ | t _{RES} | | 1.3 | | ns |
| Input Differential Voltage | | V _{ID} | | | Vcc | V |
| Output Sink Current | V _{IN} (-) ≥ 1.0V, V _{IN} (+)=0V, V _O ≤ 1.5V | I _{SINK} | 6.0 | 16 | | mA |
| output saturation voltage | V _{IN} (-) ≥ 1.0V, V _{IN} (+)=0V, I _{SINK} ≤ 4.0mA | V _{SAT} | | 130 | 400 | mV |
| | V _{IN} (-) ≥ 1.0V, V _{IN} (+)=0V, I _{SINK} ≤ | | | | 700 | |
| Output Leakage Current | V _{IN} (+) ≥ 1.0V, V _{IN} (-)=0V, V _O =5.0V | I _{OL} | | 0.1 | | nA |
| | V _{IN} (+) ≥ 1.0V, V _{IN} (-)=0V, V _O =30V 0°C ≤ Ta ≤ 70°C | | | | 1000 | |

APPLICATION CIRCUIT

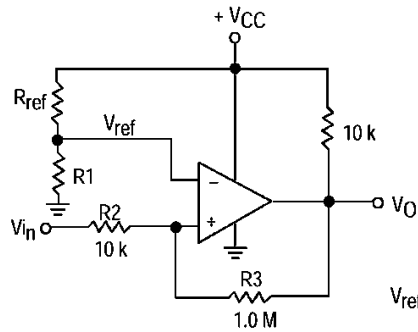


$$V_{ref} \approx \frac{V_{CC} R_1}{R_{ref} + R_1}$$

$$R_3 = R_1 // R_{ref} // R_2$$

$$V_H = \frac{R_1 // R_{ref}}{R_1 // R_{ref} + R_2} [V_{O(max)} - V_{O(min)}]$$

$$R_2 \gg R_{ref} // R_1$$

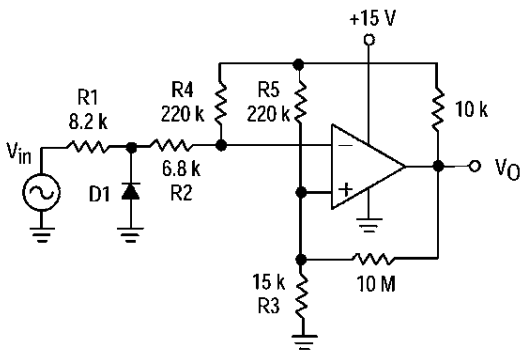


$$V_{ref} = \frac{V_{CC} R_1}{R_{ref} + R_1}$$

$$R_2 \approx R_1 // R_{ref}$$

Amount of Hysteresis V_H

$$V_H = \frac{R_2}{R_2 + R_3} [(V_{O(max)} - V_{O(min)})]$$

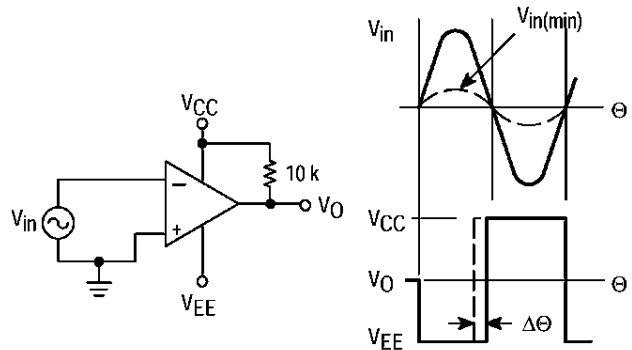


D1 prevents input from going negative by more than 0.6 V.

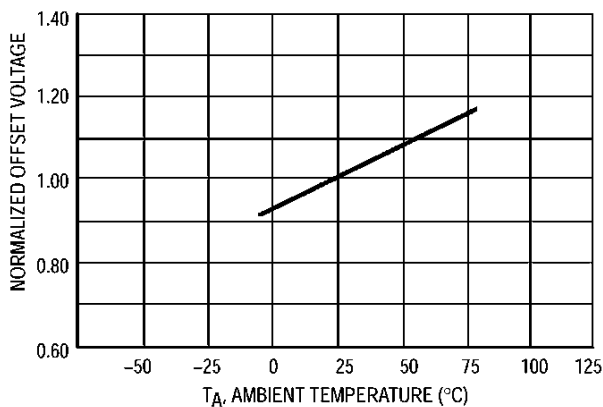
$$R_1 + R_2 = R_3$$

$$R_3 \leq \frac{R_5}{10} \text{ for small error in zero crossing}$$

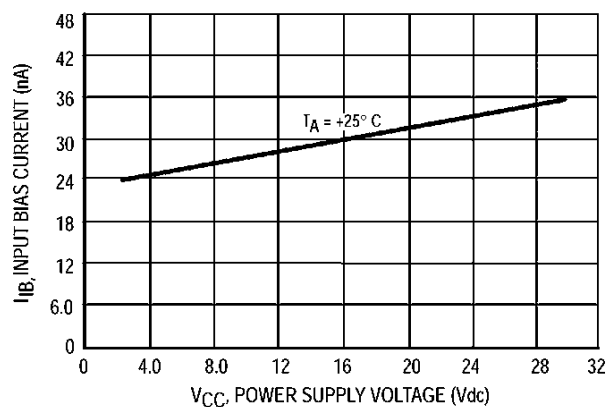
$V_{in(min)} \approx 0.4 \text{ V peak for } 1\% \text{ phase distortion } (\Delta\theta)$.



TYPICAL CHARACTERISTICS CURVES:

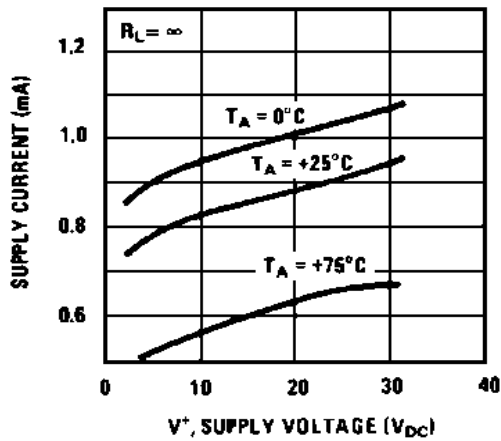


Input Offset Voltage

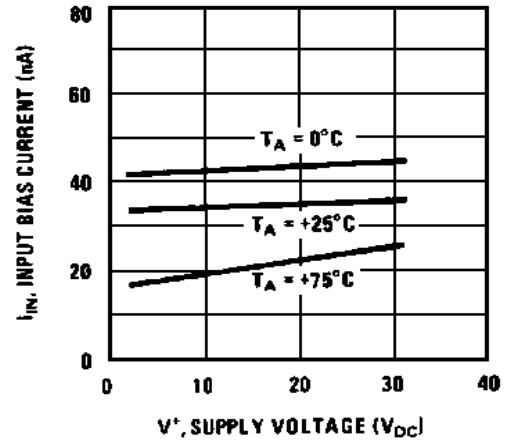


Input Bias Current

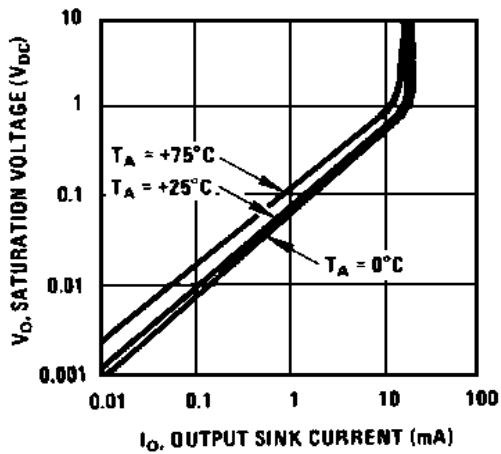
Supply Current



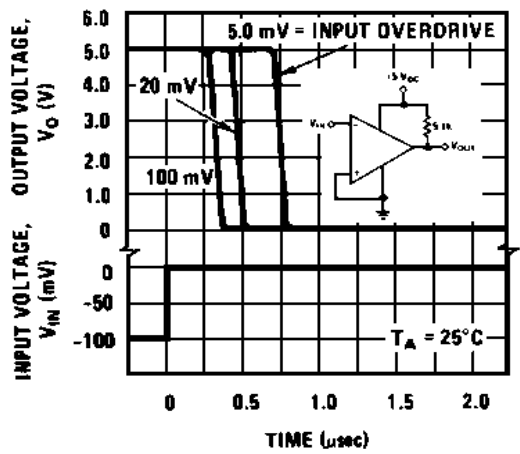
Input Current



Output Saturation Voltage



Response Time for Various Input Overdrives — Negative Transition



Response Time for Various Input Overdrives — Positive Transition

