

Product Specification

XBLW LM239

Quadruple Comparator

WEB | www.xinboleic.com

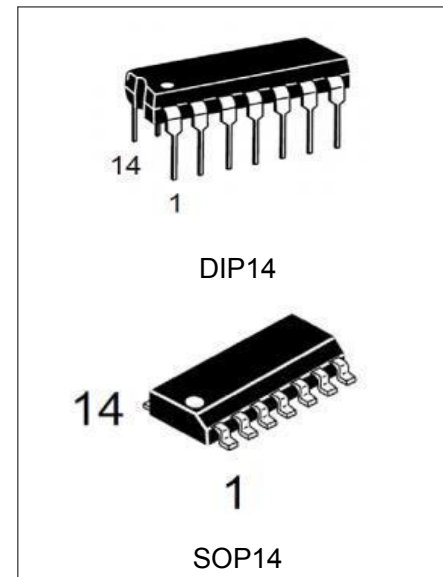


Description

The LM239 is a four-comparator integrated circuit designed for level detection and low level detection in consumer and industrial electronics. Adopt DIP14, SOP14 package form.

Features

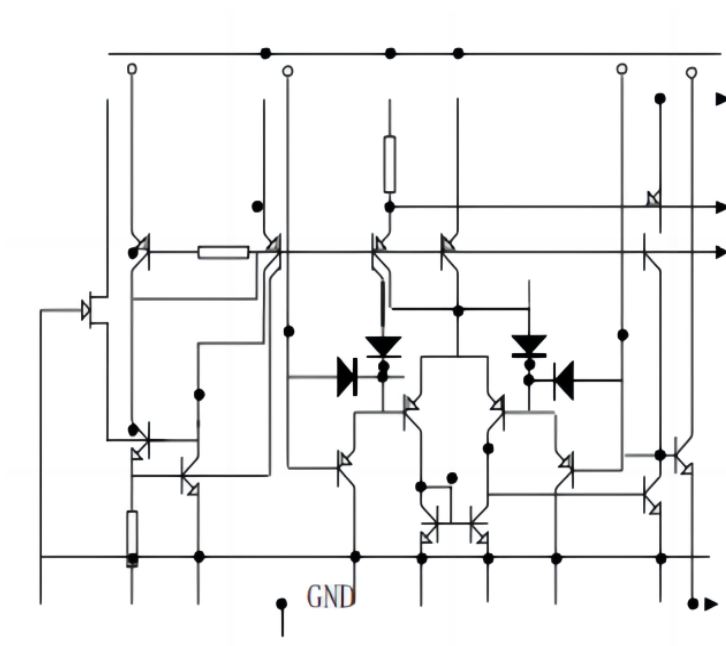
- Single or dual power supply operation
- Low input bias current: 25nA (typical)
- Low input offset current: $\pm 5.0\text{nA}$ (typical)
- Output saturation voltage: 130mV
- Compatible with TTL and CMOS



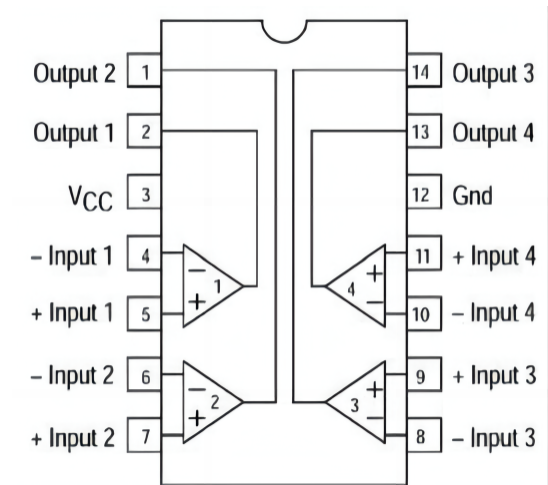
Ordering Information

| Product Model | Package Type | Marking | Packing | Packing Qty |
|---------------|--------------|---------|---------|--------------|
| XBLW LM239N | DIP-14 | LM239N | Tube | 1000Pcs/Box |
| XBLW LM239DTR | SOP-14 | LM239 | Tape | 2500Pcs/Reel |
| | | | | |
| | | | | |

Internal circuit diagram



Pin arrangement diagram



Pin end function symbol

| Export end serial number | Function | Symbol | Export end serial number | Function | Symbol |
|--------------------------|-------------------|---------|--------------------------|------------------|---------|
| 1 | Output 2 | OUT2 | 8 | Inverting input3 | IN3 (-) |
| 2 | Output 1 | OUT1 | 9 | Positive input3 | IN3 (+) |
| 3 | Power source | Vcc | 10 | Inverting input4 | IN4 (-) |
| 4 | Inverting input 1 | IN1 (-) | 11 | Positive input4 | IN4 (+) |
| 5 | Positive input 1 | IN1 (+) | 12 | Earthing | GND |
| 6 | Inverting input2 | IN2 (-) | 13 | Output 4 | OUT4 |
| 7 | Positive input2 | IN2 (+) | 14 | Output 3 | OUT3 |

Limit parameter (absolute maximum rating, Tamb=25°C if no other provisions are made)

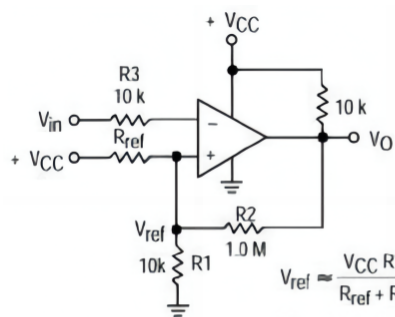
| Parameter | Symbol | Number value | Single bit |
|----------------------------------|--------|----------------|------------|
| Supply voltage | Vcc | 36 or ± 18 | V |
| Input differential voltage range | VIDR | 36 | V |
| Input common-mode voltage range | VICMR | -0.3~Vcc | V |
| Output current | ISC | 50 | mA |
| Power consumption (*) | PD | 1.0 | W |
| Operating ambient temperature | Tamb | -20~+85 | °C |
| Storage temperature | Tstg | -65~150 | °C |

Note (*): When used above 25 °C, power consumption is reduced by 8mW for every 1 °C increase.

**Electrical characteristics (if not otherwise specified, $V_{CC}=5V$,
 $T_{amb}=25^{\circ}C$)**

| Peculiarity | Test condition | Symbol | Norm value | | | Single bit |
|---------------------------------|--|------------|------------|-----------|--------------|------------|
| | | | MIN | TYP | MAX | |
| Input offset voltage | | V_{IO} | | ± 2.0 | ± 5.0 | mV |
| | $0^{\circ}C \leq T_a \leq 70^{\circ}C$ | | | | ± 9.0 | |
| Input offset current | | I_{IO} | | ± 5.0 | ± 50 | nA |
| | $0^{\circ}C \leq T_a \leq 70^{\circ}C$ | | | | ± 150 | |
| Input bias current | | I_{IB} | | 25 | 250 | nA |
| | $0^{\circ}C \leq T_a \leq 70^{\circ}C$ | | | | 400 | |
| Input common-mode voltage range | | V_{ICR} | 0 | | $V_{CC}-1.5$ | V |
| | $0^{\circ}C \leq T_a \leq 70^{\circ}C$ | | 0 | | $V_{CC}-2.0$ | |
| Supply current | $R_L = \infty$ | I_{CC} | | 0.8 | 2.0 | mA |
| | $R_L = \infty, V_{CC} = 30V$ | | | 1.0 | 2.5 | |
| Voltage gain | $R_L > 15K, V_{CC} = 15V$ | G_V | 50 | 200 | | V/mV |
| Large signal response time | $V_{IN} = \text{TTL Logical swing}, V_{REF} = 1.4V, V_{RL} = 5.0V, R_L = 5.1K$ | t_{RES} | | 300 | | ns |
| Response time | $V_{RL} = 5.0V, R_L = 5.1K$ | t_{RES} | | 1.3 | | ns |
| Input differential voltage | | V_{ID} | | | V_{CC} | V |
| Output dip 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 |
| | $V_{IN} (-) > 1.0V, V_{IN} (+) = 0V, I_{SINK} < 4.0mA, 0^{\circ}C \leq T_a \leq 70^{\circ}C$ | | | | 700 | |
| Output leakage current | $V_{IN} (+) > 1.0V, V_{IN} (-) = 0V, V_o = 5.0V$ | I_{OL} | | 0.1 | | nA |
| | $V_{IN} (+) > 1.0V, V_{IN} (-) = 0V, V_o = 30V, 0^{\circ}C \leq T_a \leq 70^{\circ}C$ | | | | 1000 | |

Application drawing

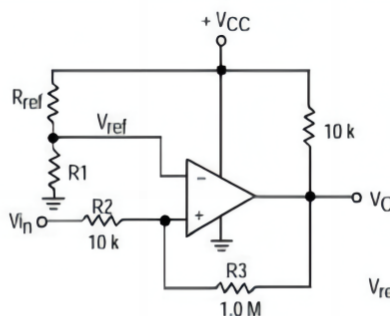


$$V_{ref} \approx \frac{V_{CC} R1}{R_{ref} + R1}$$

$$R3 \approx R1 // R_{ref} // R2$$

$$V_H = \frac{R1 // R_{ref}}{R1 // R_{ref} + R2} [V_{O(max)} - V_{O(min)}]$$

$$R2 \gg R_{ref} // R1$$



$$V_{ref} = \frac{V_{CC} R1}{R_{ref} + R1}$$

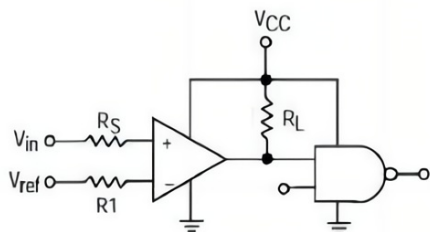
$$R2 \approx R1 // R_{ref}$$

Amount of Hysteresis V_H

$$V_H = \frac{R2}{R2 + R3} [V_{O(max)} - V_{O(min)}]$$

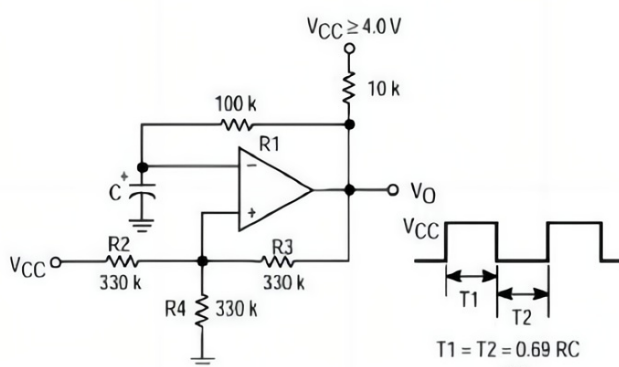
Inverse comparator with hysteresis

Positive phase comparator with lag



R_S = Source Resistance
 $R1 \approx R_S$

| Logic | Device | V _{CC} (V) | R _L (kΩ) |
|-------|-------------|---------------------|---------------------|
| CMOS | 1/4 MC14001 | +15 | 100 |
| TTL | 1/4 MC7400 | +5.0 | 10 |



$$T1 = T2 = 0.69 RC$$

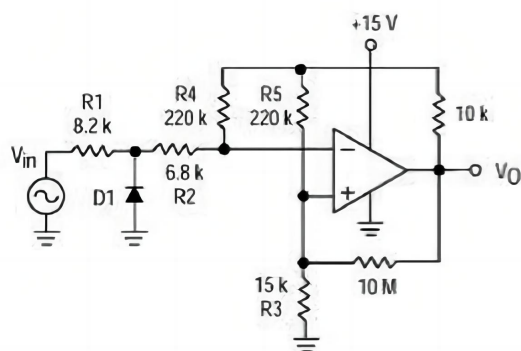
$$f = \frac{7.2}{C(\mu F)}$$

$$R2 = R3 = R4$$

$$R1 \approx R2 // R3 // R4$$

Logical driver

Square wave oscillator

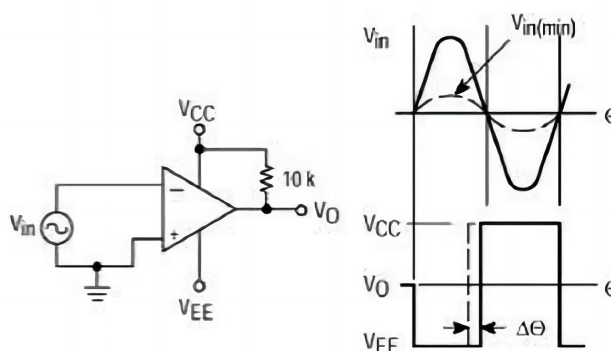


D1 prevents input from going negative by more than 0.6 V.

$$R1 + R2 = R3$$

$$R3 \leq \frac{R5}{10} \text{ for small error in zero crossing}$$

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

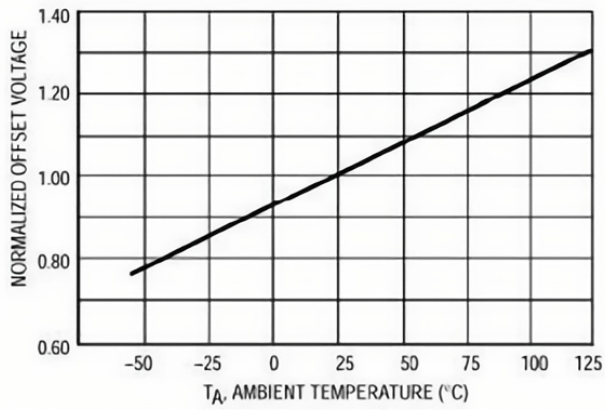


Zero-crossing detector (single-supply application)

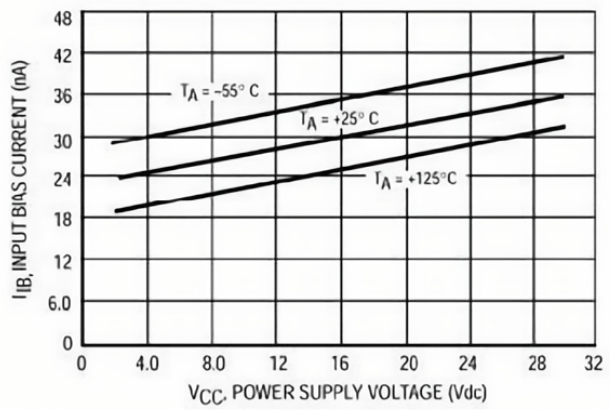
Zero-crossing detector (dual power supply application)

Characteristic Curve

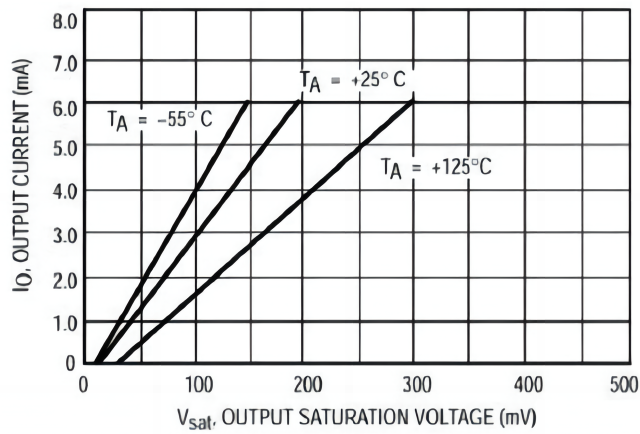
Normal input offset voltage



Input bias current

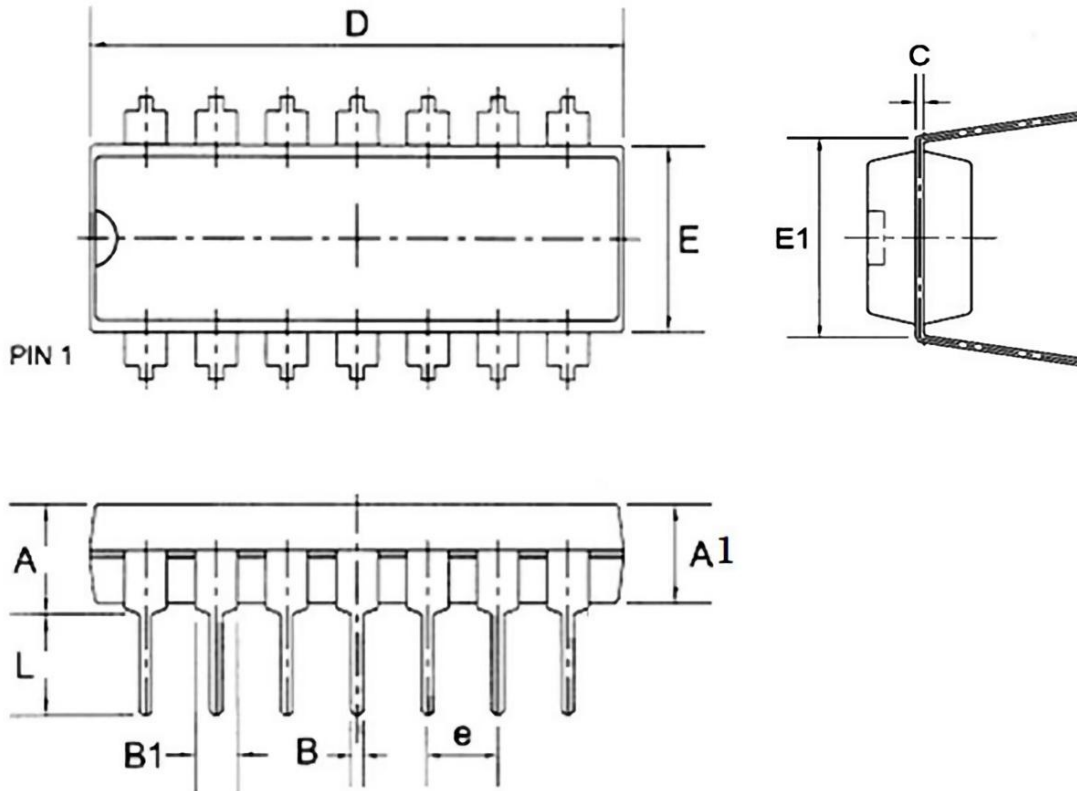


Output trap current and output saturation voltage



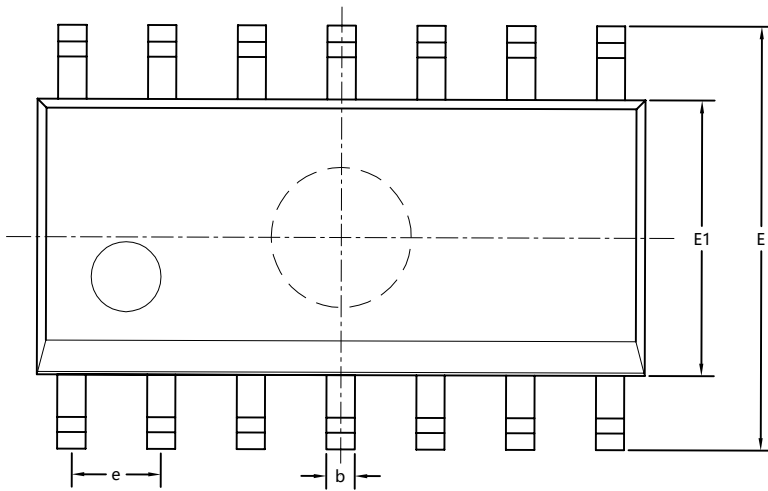
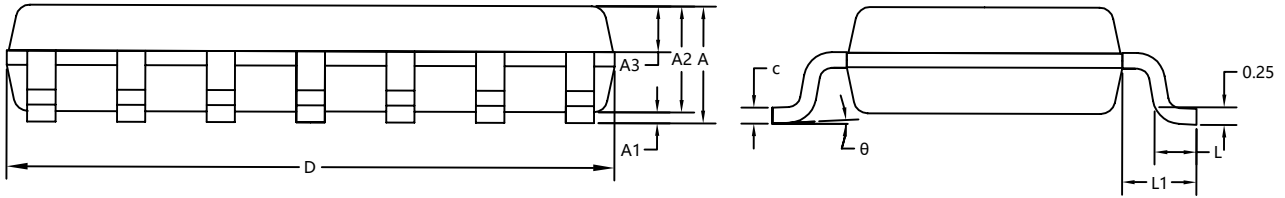
Packaging information:

DIP14



| Symbol | Dimensions in Millimeters | | |
|--------|---------------------------|-------|-------|
| | Min | Nom | Max |
| A | -- | -- | 4.31 |
| A1 | 3.15 | 3.30 | 3.65 |
| B | -- | 0.46 | -- |
| B1 | -- | 1.60 | -- |
| C | -- | 0.25 | -- |
| D | 19.00 | 19.30 | 19.60 |
| E | 6.20 | 6.40 | 6.60 |
| E1 | -- | 7.60 | -- |
| e | -- | 2.54 | -- |
| L | 3.00 | 3.35 | 3.60 |

SOP14



| SYMBOL | MILLIMETER | | |
|----------|------------|------|------|
| | MIN | NOM | MAX |
| A | 1.50 | 1.60 | 1.70 |
| A1 | 0.10 | 0.15 | 0.25 |
| A2 | 1.40 | 1.45 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.35 | 0.40 | 0.45 |
| c | 0.15 | 0.20 | 0.25 |
| D | 8.50 | 8.60 | 8.70 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.85 | 3.90 | 3.95 |
| e | 1.27BSC | | |
| L | 0.50 | 0.60 | 0.70 |
| L1 | 1.05REF | | |
| θ | 0° | 4° | 8° |

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