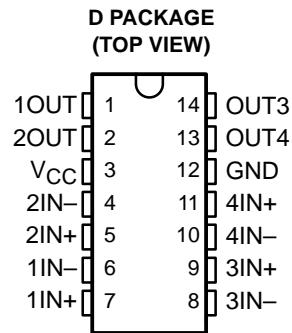


- **Controlled Baseline**
  - One Assembly/Test Site, One Fabrication Site
- **Extended Temperature Performance of –40°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **Single Supply or Dual Supplies**
- **Wide Range of Supply Voltage . . . 2 V to 36 V**
- **Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ**
- **Low Input Bias Current . . . 25 nA Typ**
- **Low Input Offset Current . . . 5 nA Typ**
- **Low Input Offset Voltage . . . 2 mV Typ**
- **Common-Mode Input Voltage Range Includes Ground**
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . . ±36 V**
- **Low Output Saturation Voltage**
- **Output Compatible With TTL, MOS, and CMOS**

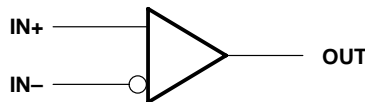
† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.



## description

This device consists of four independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2 V to 36 V, and  $V_{CC}$  is at least 1.5 V more positive than the input common-mode voltage. Current drain is independent of the supply voltage. The outputs can be connected to other open-collector outputs to achieve wired-AND relationships.

## symbol (each comparator)



## ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE‡                 | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|--------------------------|-----------------------|------------------|
| –40°C to 125°C | SOP – D    Tape and reel | LM239AQDREP§          | LM239AEP         |

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

§ This package is only available taped and reeled with standard quantities of 2500 pieces per reel.

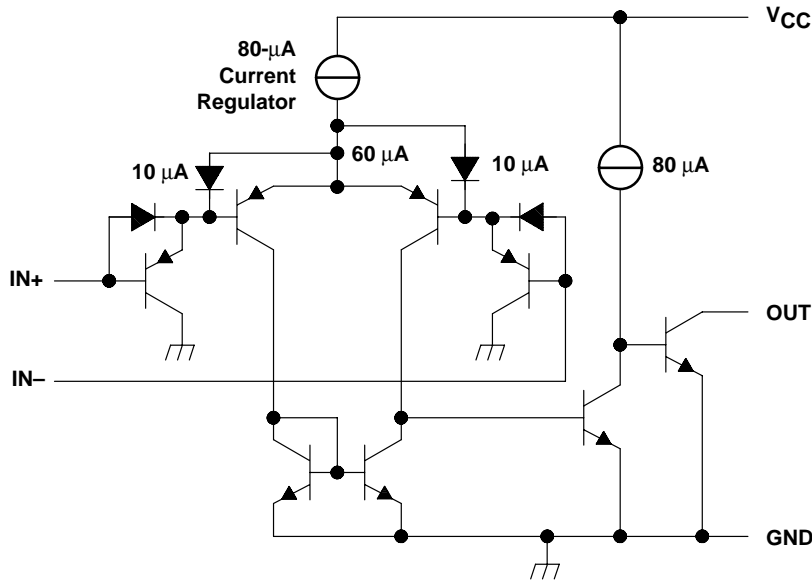


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

# LM239A-EP QUAD DIFFERENTIAL COMPARATOR

SCLS496 – MAY 2003

## schematic (each comparator)



All current values shown are nominal.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

|                                                              |                |
|--------------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                        | 36 V           |
| Differential input voltage, $V_{ID}$ (see Note 2)            | $\pm 36$ V     |
| Input voltage range, $V_I$ (either input)                    | -0.3 V to 36 V |
| Output voltage, $V_O$                                        | 36 V           |
| Output current, $I_O$                                        | 20 mA          |
| Duration of output short circuit to ground (see Note 3)      | Unlimited      |
| Package thermal impedance, $\theta_{JA}$ (see Note 4)        | 86°C/W         |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C          |
| Maximum operating junction temperature, $T_J$                | 136°C          |
| Storage temperature range, $T_{stg}$ (see Note 5)            | -65°C to 150°C |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to network ground.
  2. Differential voltages are at IN+ with respect to IN-.
  3. Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.
  4. The package thermal impedance is calculated in accordance with JESD 51-7.
  5. Long term high-temperature storage and/or extended use at maximum recommended operating conditions may result in a reduction of overall device life. See [http://www.ti.com/ep\\_quality](http://www.ti.com/ep_quality) for additional information on enhanced plastic packaging.

**electrical characteristics at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)**

| PARAMETER |                                                 | TEST CONDITIONS†                                                                                                  |  | $T_A$ ‡                | MIN        | TYP  | MAX          | UNIT |               |
|-----------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--|------------------------|------------|------|--------------|------|---------------|
| $V_{IO}$  | Input offset voltage                            | $V_{CC} = 5\text{ V to }30\text{ V}$ , $V_{IC} = V_{ICR(\text{min})}$ ,<br>$V_O = 1.4\text{ V}$                   |  | 25°C                   |            | 1    | 2.5          | mV   |               |
|           |                                                 |                                                                                                                   |  | Full range             |            |      | 5.5          |      |               |
| $I_{IO}$  | Input offset current                            | $V_O = 1.4\text{ V}$                                                                                              |  | 25°C                   |            | 5    | 50           | nA   |               |
|           |                                                 |                                                                                                                   |  | Full range             |            |      | 150          |      |               |
| $I_{IB}$  | Input bias current                              | $V_O = 1.4\text{ V}$                                                                                              |  | 25°C                   |            | -25  | -250         | nA   |               |
|           |                                                 |                                                                                                                   |  | Full range             |            |      | -400         |      |               |
| $V_{ICR}$ | Common-mode input-voltage range                 |                                                                                                                   |  | 25°C                   |            | 0 to | $V_{CC}-1.5$ | V    |               |
|           |                                                 |                                                                                                                   |  | Full range             |            | 0 to | $V_{CC}-2$   |      |               |
| $AVD$     | Large-signal differential-voltage amplification | $V_{CC} = 15\text{ V}$ , $V_O = 1.4\text{ V to }11.4\text{ V}$ ,<br>$R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$ |  | 25°C                   |            | 50   | 200          | V/mV |               |
| $I_{OH}$  | High-level output current                       | $V_{ID} = 1\text{ V}$                                                                                             |  | $V_{OH} = 5\text{ V}$  | 25°C       |      | 0.1          | 50   | nA            |
|           |                                                 |                                                                                                                   |  | $V_{OH} = 30\text{ V}$ | Full range |      |              | 1    | $\mu\text{A}$ |
| $V_{OL}$  | Low-level output voltage                        | $V_{ID} = -1\text{ V}$ ,<br>$I_{OL} = 4\text{ mA}$                                                                |  | 25°C                   |            | 150  | 400          | mV   |               |
|           |                                                 |                                                                                                                   |  | Full range             |            |      | 700          |      |               |
| $I_{OL}$  | Low-level output current                        | $V_{ID} = -1\text{ V}$ ,<br>$V_{OL} = 1.5\text{ V}$                                                               |  | 25°C                   |            | 6    | 16           | mA   |               |
| $I_{CC}$  | Supply current (four comparators)               | $V_O = 2.5\text{ V}$ ,<br>No load                                                                                 |  | 25°C                   |            | 0.8  | 2            | mA   |               |

† All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

‡ Full range (MIN to MAX) for LM239AQ is  $-40^\circ\text{C}$  to  $125^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

**switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

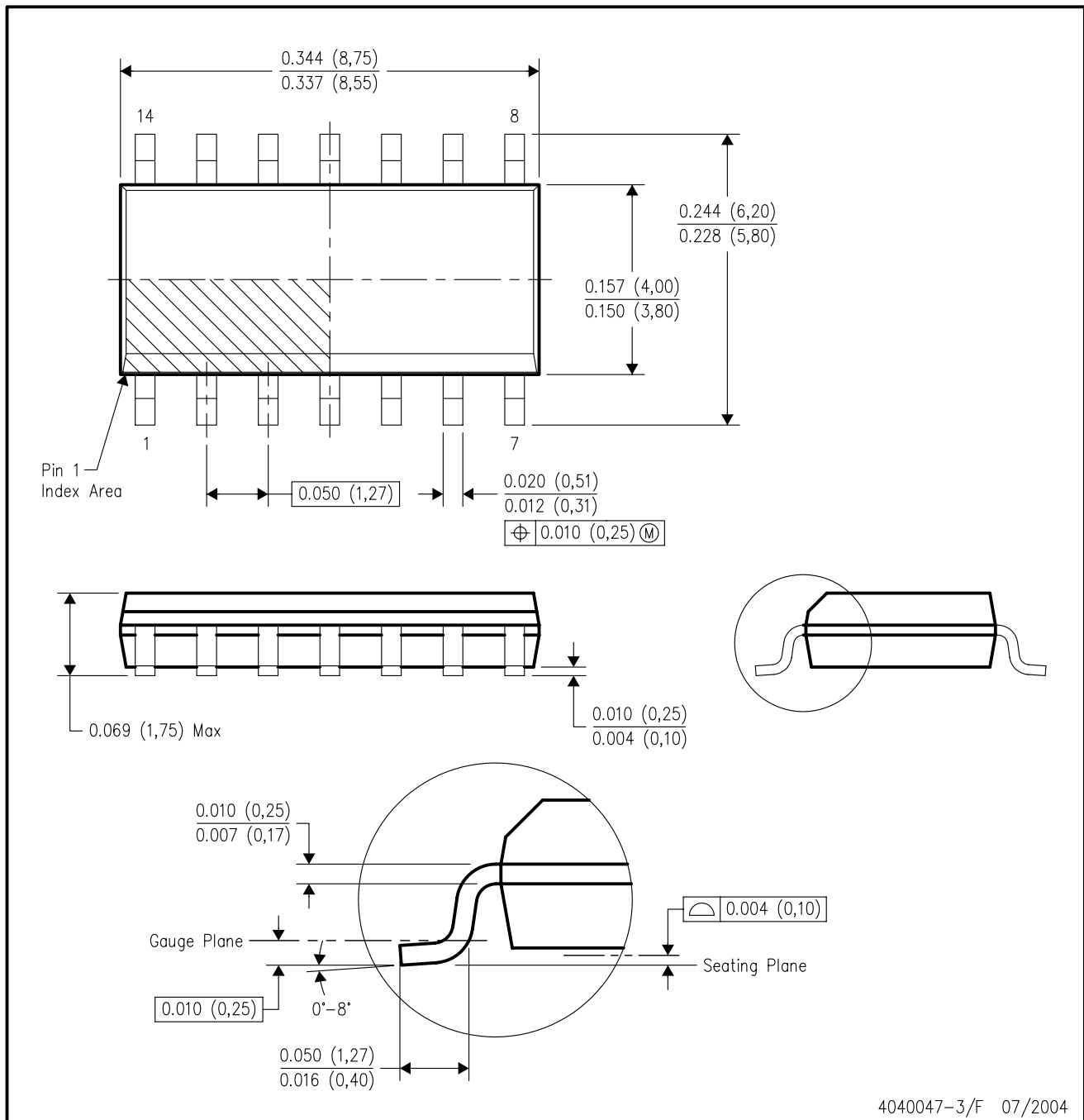
| PARAMETER     | TEST CONDITIONS                                                                       |                                       | MIN | TYP | MAX | UNIT          |
|---------------|---------------------------------------------------------------------------------------|---------------------------------------|-----|-----|-----|---------------|
| Response time | $R_L$ connected to 5 V through 5.1 k $\Omega$ ,<br>$C_L = 15\text{ pF}$ §, See Note 5 | 100-mV input step with 5-mV overdrive |     | 1.3 |     | $\mu\text{s}$ |
|               |                                                                                       | TTL-level input step                  |     | 0.3 |     |               |

§  $C_L$  includes probe and jig capacitance.

NOTE 5: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AB.

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