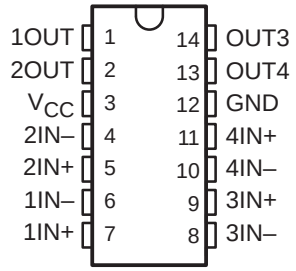
- **Qualification in Accordance With AEC-Q100†**
- **Qualified for Automotive Applications**
- **Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval**
- **ESD Protection Exceeds 1000 V Per MIL-STD-883, Method 3015; Exceeds 100 V Using Machine Model (C = 200 pF, R = 0); Exceeds 2000 V Charged Device Model**
- **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**

† Contact factory for details. Q100 qualification data available on request.

D PACKAGE
(TOP VIEW)



description/ordering information

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.

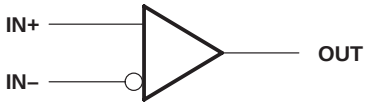
ORDERING INFORMATION

T_A	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	SOP – D	Tape and reel	LM239AQDRQ1§	LM239AQ1

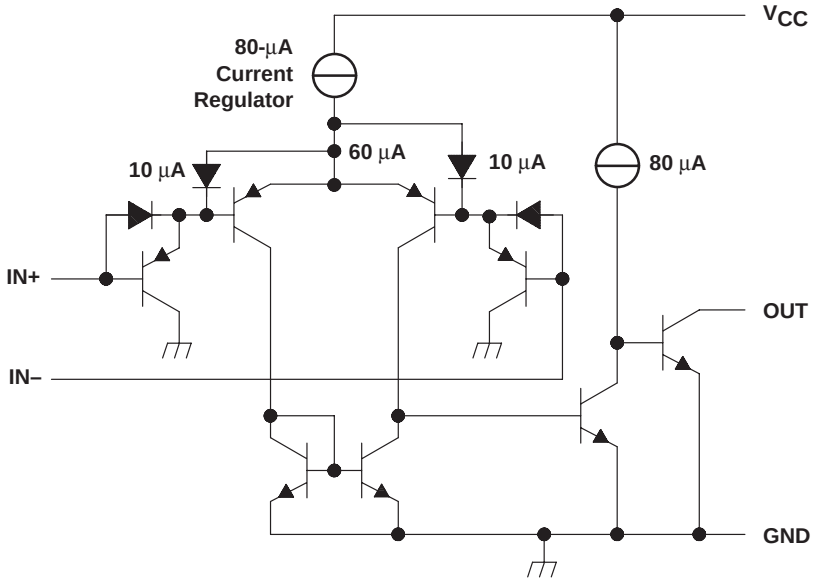
‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

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

symbol (each comparator)



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)	±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, θ_{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}	–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.

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

PARAMETER		TEST CONDITIONS†		T_A‡	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_{CC} = 5 V to 30 V, $V_{IC} = V_{ICR}$(min), V_O = 1.4 V		25°C		1	2.5	mV
				Full range			5.5	
I_{IO}	Input offset current	V_O = 1.4 V		25°C		5	50	nA
				Full range			150	
I_{IB}	Input bias current	V_O = 1.4 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			
A_{VD}	Large-signal differential-voltage amplification	V_{CC} = 15 V, V_O = 1.4 V to 11.4 V, $R_L \geq 15\ k\Omega$ to V_{CC}		25°C	50	200		V/mV
I_{OH}	High-level output current	V_{ID}= 1 V	V_{OH} = 5 V	25°C		0.1	50	nA
			V_{OH} = 30 V	Full range			1	µA
V_{OL}	Low-level output voltage	V_{ID} = –1 V,	I_{OL} = 4 mA	25°C		150	400	mV
				Full range			700	
I_{OL}	Low-level output current	V_{ID} = –1 V,	V_{OL} = 1.5 V	25°C	6	16		mA
I_{CC}	Supply current (four comparators)	V_O = 2.5 V,	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°C to 125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Response time	R_L connected to 5 V through 5.1 kΩ, C_L = 15 pF§, See Note 5	100-mV input step with 5-mV overdrive		1.3		µs
		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.

PACKAGING INFORMATION

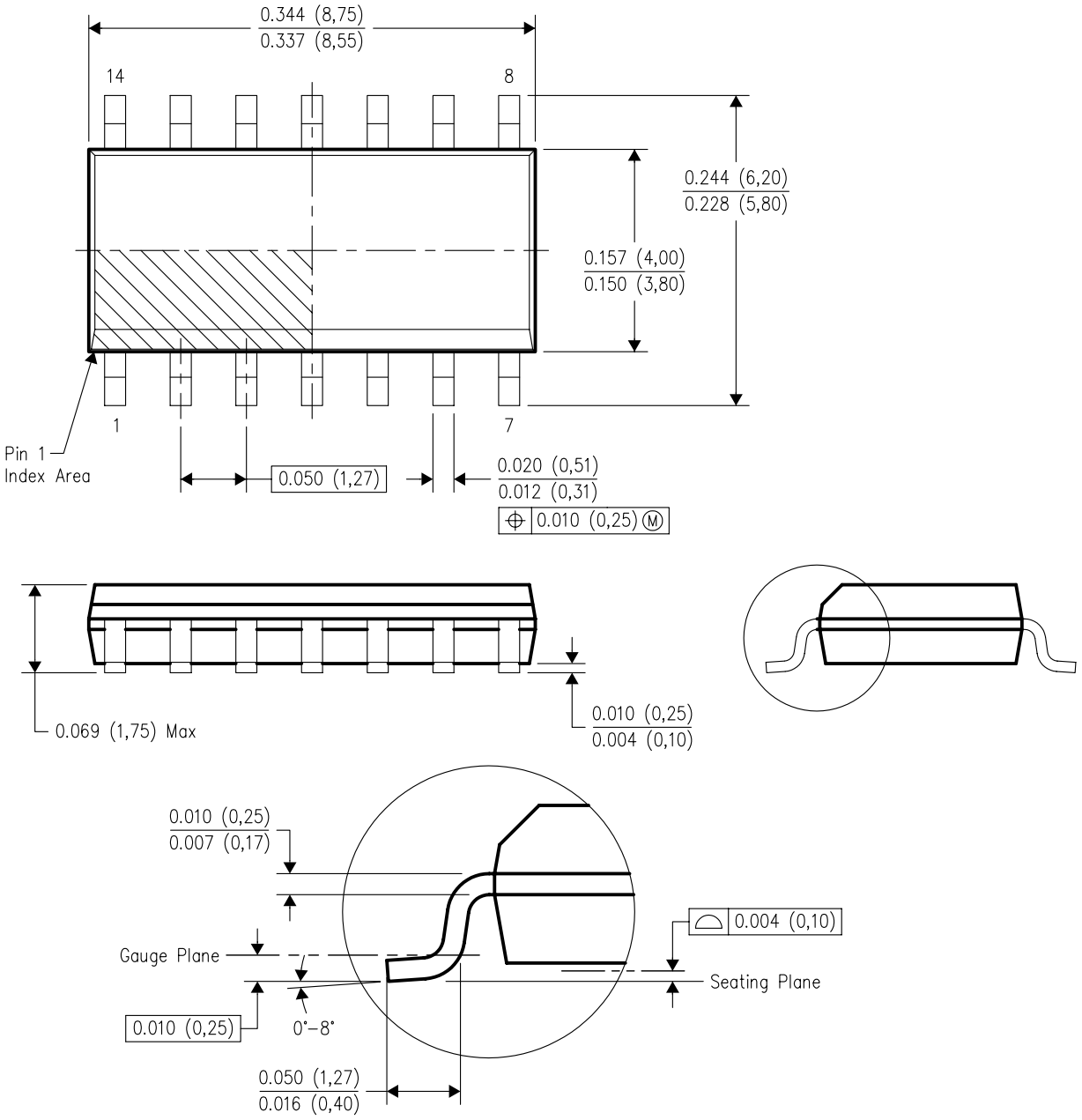
Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
LM239AQDRQ1	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDECindustry standard classifications, and peak solder temperature.

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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