

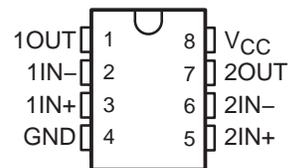
# LM2903-Q1 DUAL DIFFERENTIAL COMPARATORS

SLCS141C – MAY 2003 – REVISED JUNE 2004

- 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)
- Single Supply or Dual Supplies
- Low Supply-Current Drain Independent of Supply Voltage . . . 0.4 mA Typ Per Comparator
- 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 . . .  $\pm 36$  V
- Low Output Saturation Voltage
- Output Compatible With TTL, MOS, and CMOS

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

D OR PW PACKAGE  
(TOP VIEW)



## description/ordering information

This device consists of two independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies 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.

The LM2903Q is tested from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  and is manufactured to demanding automotive requirements.

## ORDERING INFORMATION

$T_A$	$V_{IOmax}$ AT $25^{\circ}\text{C}$	MAX $V_{CC}$	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
$-40^{\circ}\text{C}$ to $125^{\circ}\text{C}$	7 mV	30 V	SOIC (D)	Tape and reel	LM2903QDRQ1	2903Q1
	7 mV	30 V	TSSOP (PW)	Tape and reel	LM2903QPWRQ1	2903Q1
	7 mV	32 V	SOIC (D)	Tape and reel	LM2903VQDRQ1	2903VQ1
	7 mV	32 V	TSSOP (PW)	Tape and reel	LM2903VQPWRQ1	2903VQ1
	2 mV	32 V	SOIC (D)	Tape and reel	LM2903AVQDRQ1	2903AVQ
	2 mV	32 V	TSSOP (PW)	Tape and reel	LM2903AVQPWRQ1	2903AVQ

‡ 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).

## symbol (each comparator)



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**TEXAS  
INSTRUMENTS**

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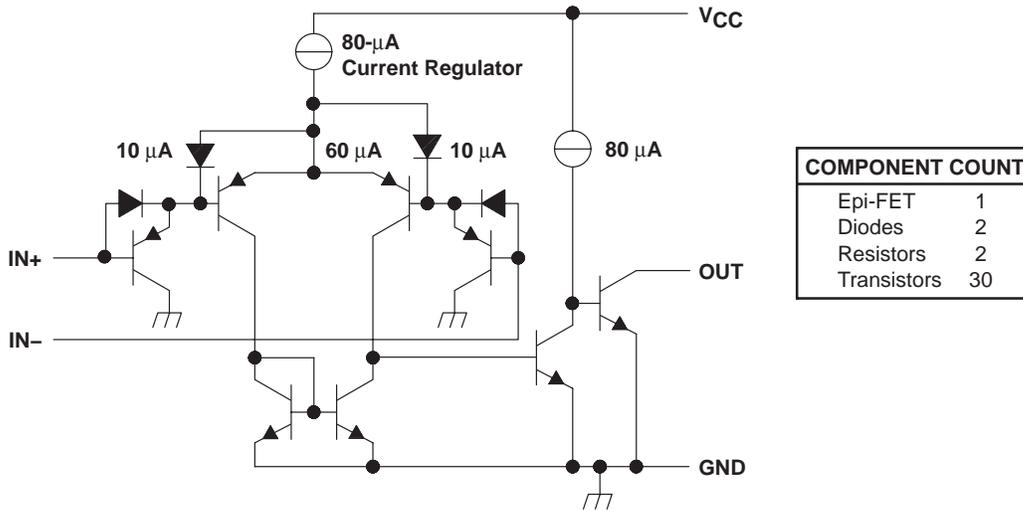
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# LM2903-Q1

## DUAL DIFFERENTIAL COMPARATORS

SLCS141C – MAY 2003 – REVISED JUNE 2004

### schematic (each comparator)



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): D package	97°C/W
PW package	149°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or PW package	260°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:
- All voltage values, except differential voltages, are with respect to GND.
  - Differential voltages are at IN+ with respect to IN-.
  - Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.
  - The package thermal impedance is calculated in accordance with JESD 51-7.

# LM2903-Q1

## DUAL DIFFERENTIAL COMPARATORS

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### 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	$V_O = 1.4\text{ V}$ , $V_{IC} = V_{IC(min)}$ , $V_{CC} = 5\text{ V to MAX}‡$	Non-A devices	25°C		2	7	mV
			Full range			15	
		A-suffix devices	25°C		1	2	
			Full range			4	
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$		25°C		5	50	nA
			Full range			200	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		25°C		-25	-250	nA
			Full range			-500	
$V_{ICR}$ 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	$V_{CC} = 15\text{ V}$ , $V_O = 1.4\text{ V to }11.4\text{ V}$ , $R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$		25°C		25	100	V/mV
$I_{OH}$ High-level output current	$V_{OH} = 5\text{ V}$	$V_{ID} = 1\text{ V}$	25°C		0.1	50	nA
	$V_{OH} = V_{CC}\text{ MAX}‡$		Full range			1	$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$I_{OL} = 4\text{ mA}$ ,	$V_{ID} = -1\text{ V}$	25°C		150	400	mV
			Full range			700	
$I_{OL}$ Low-level output current	$V_{OL} = 1.5\text{ V}$ ,	$V_{ID} = -1\text{ V}$	25°C		6		mA
$I_{CC}$ Supply current	$R_L = \infty$		25°C		0.8	1	mA
			Full range			2.5	

† Full range (MIN or MAX) for LM2903Q is  $-40^\circ\text{C}$  to  $125^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

‡  $V_{CC}\text{ MAX} = 30\text{ V}$  for non-V devices and  $32\text{ V}$  for V-suffix devices.

§ The voltage at either input or common-mode should not be allowed to go negative by more than  $0.3\text{ V}$ . The upper end of the common-mode voltage range is  $V_{CC+} - 1.5\text{ V}$ , but either or both inputs can go to  $30\text{ V}$  ( $32\text{ V}$  for V-suffix devices) without damage.

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

PARAMETER	TEST CONDITIONS		TYP	UNIT
Response time	$R_L$ connected to $5\text{ V}$ through $5.1\text{ k}\Omega$ , $C_L = 15\text{ pF}$ ¶, 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  $1.4\text{ V}$ .

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
LM2903AVQDRQ1	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
LM2903AVQPWRQ1	ACTIVE	TSSOP	PW	8	2000	None	CU NIPDAU	Level-1-250C-UNLIM
LM2903QDRQ1	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
LM2903QPWRQ1	ACTIVE	TSSOP	PW	8	2000	None	CU NIPDAU	Level-1-250C-UNLIM
LM2903VQDRQ1	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
LM2903VQPWRQ1	ACTIVE	TSSOP	PW	8	2000	None	CU NIPDAU	Level-1-250C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> 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).

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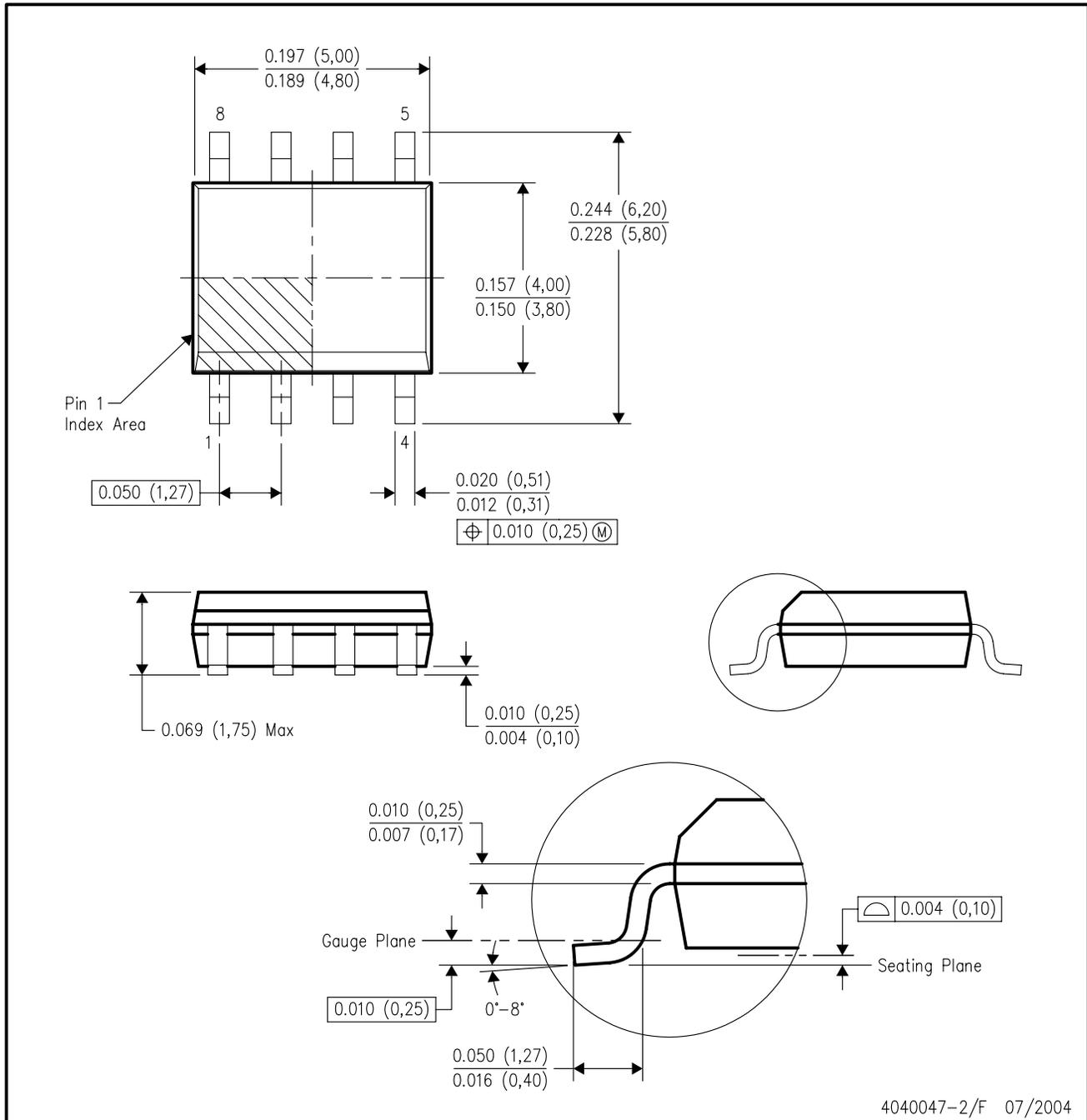
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

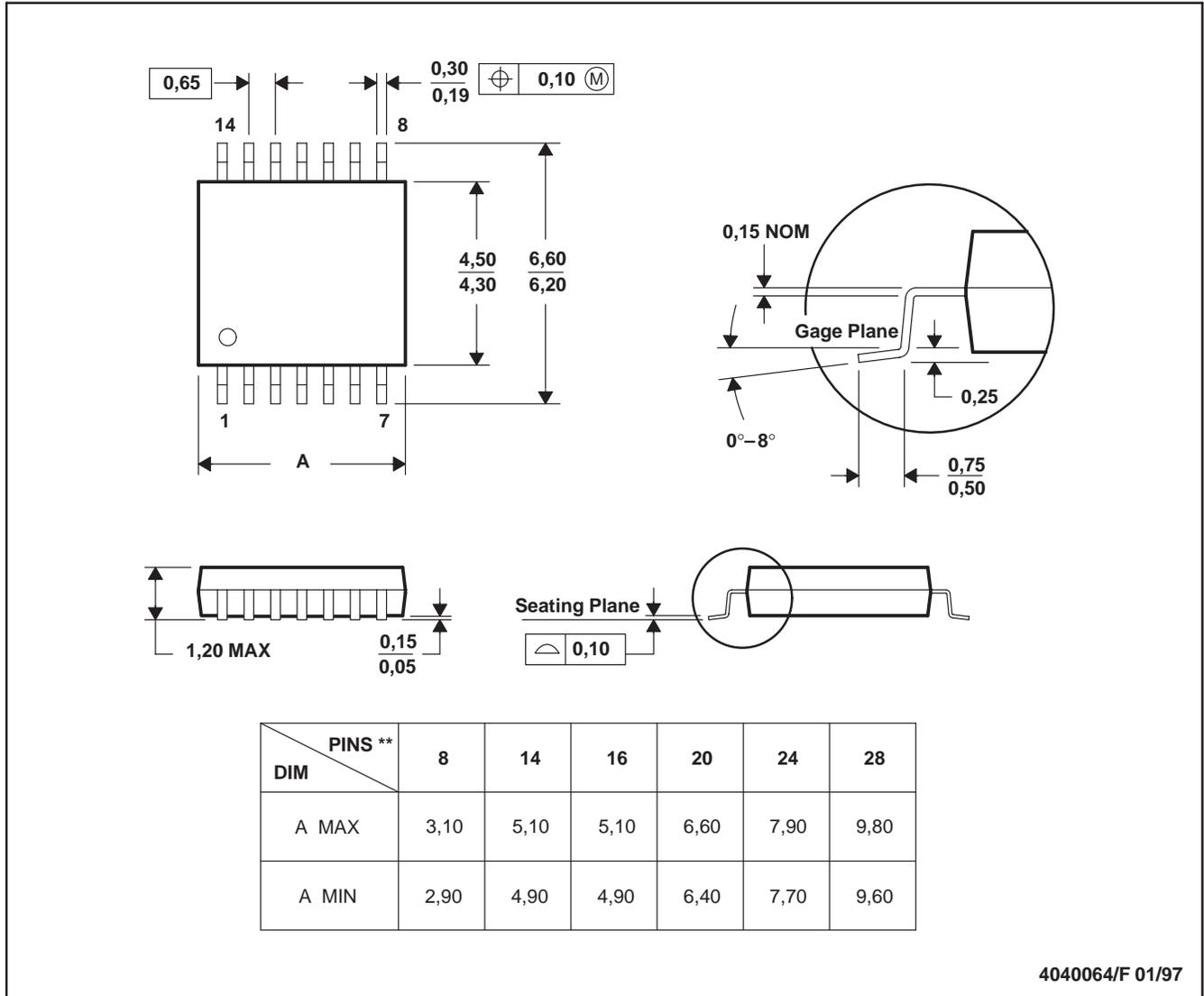


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AA.

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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