钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LM2903

双路比较器

网址 www.sztdbdt.com

用芯智造·卓越品质

semiconductor device manufacturer

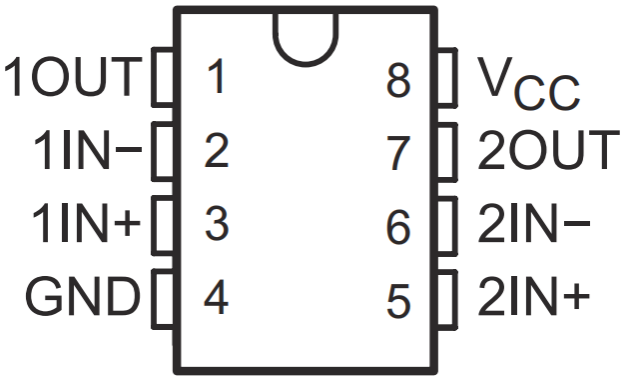
- Design
- research and development
- production
- and sales

特性

- 符合汽车应用要求
- 具有符合 AEC-Q100 标准的下列特性：
  - 器件温度等级 0：-40 ° C 至 150 ° C 的环境工作温度范围 (LM2903E-Q1)
  - 器件温度等级 1： – 40 ° C 至 125 ° C 环境工作温度范围
  - 器件 HBM ESD 分类等级 H1C
  - 器件 CDM ESD 分类等级 C4B
- 改进了 “ B ” 器件的 2kV HBM ESD
- 可用于 “ B ” 器件的 Tri-Temp 测试
- 单电源或双电源
- 独立于电源电压的 低电源电流：

每个比较器 200uA（典型值） （“ B ” 版本）

- 低输入偏置电流：3.5nA（典型值） （“ B ” 器件）
- 低输入偏置电流：0.5nA（典型值） （“ B ” 器件）
- 低输入偏移电压：±0.37mV（典型值） （“ B ” 器 件）
- 共模输入电压范围包括接地
- 差动输入电压范围等于最大额定电源电压：±36V
- 输出与 TTL、MOS 和 CMOS 兼容
- 功能安全型
  - 可提供用于功能安全系统设计的文档



D, DGK, DDF OR PW PACKAGE

应用

- 汽车
  - HEV/EV 和动力总成
  - 信息娱乐系统与仪表组 – 车身控制模块
- 工业
- 电器

说明

LM2903B-Q1 器件是业界通用 LM2903-Q1 比较器系 列的下一代版本。该下一代系列为成本敏感型应用提供了卓越的价值，其特性包括更低的失调电压、更高的电源电压能力、更低的电源电流、更低的输入偏置电流、 更低的传播延迟以及更高的 2kV ESD 性能，并提供了直接替代的便利性。

所有器件都包含两个独立的电压比较器，这些比较器可 在广泛的电压范围内运行。如果两个电源的电压差处于 2V 至 36V 范围内且 VCC 比输入共模电压至少高 1.5V，那么也可以使用双电源。输出可以连接到其他 集电极开路输出。

LM2903-Q1 和 LM2903B-Q1 符合 -40 ° C 至 +125 ° C 的 AEC-Q100 1 级温度范围。LM2903E-Q1 符合 -40 ° C 至 +150 ° C 的 0 级工作温度范围。

1.1 Pin Functions

PIN			I/O	DESCRIPTION
NAME	SOIC, VSSOP, PDIP, SO, DDF and TSSOP	DSG		
1OUT	1	1	Output	Output pin of comparator 1
1IN -	2	2	Input	Negative input pin of comparator 1
1IN+	3	3	Input	Positive input pin of comparator 1
GND	4	4	—	Ground
2IN+	5	5	Input	Positive input pin of comparator 2
2IN-	6	6	Input	Negative input pin of comparator 2
2OUT	7	7	Output	Output pin of comparator 2
V_{CC}	8	8	—	Positive Supply
Thermal Pad	—	PAD	—	Connect directly to GND pin

2 Specifications

2.1 Absolute Maximum Ratings, LM2903-Q1 and LM2903E-Q1

over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
V_{CC}	Supply voltage(2)		36	V
V_{CC}	Supply voltage, LM2903E-Q1 Only(2)		32	V
V_{ID}	Differential input voltage(3)	−36	36	V
V_I	Input voltage range (either input)	−0.3	36	V
V_O	Output voltage		36	V
I_O	Output current		20	mA
T_J	Operating virtual-junction temperature		150	°C
T_{SCG}	Duration of output short-circuit to ground		Unlimited	s

(1) Stresses beyond those listed under *Absolute Maximum Ratings* can 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 can affect device reliability.
(2) All voltage values, except differential voltages, are with respect to GND.
(3) Differential voltages are at IN+ with respect to IN−.

2.2 Absolute Maximum Ratings, LM2903B-Q1

over operating free-air temperature range (unless otherwise noted)(1)

	MIN	MAX	UNIT
Supply voltage: V_S = (V+) − (V−)	-0.3	38	V
Differential input voltage : V_{ID} (2)		±38	V
Input pins (IN+, IN−)	-0.3	38	V
Current into input pins (IN+, IN−)		-50	mA
Output pin (OUT)	-0.3	38	V
Output sink current		25	mA
Operating virtual-junction temperature		150	°C
Output short-circuit duration(3)		Unlimited	s

(1) Stresses beyond those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods can affect device reliability.
(2) Differential voltages are at IN+ with respect to IN-
(3) Short circuits from outputs to V+ can cause excessive heating and eventual destruction.

2.3 ESD Ratings, LM2903-Q1 and LM2903E-Q1

				MIN	MAX	UNIT
T_{stg}	Storage temperature range		LM2903-Q1 Only	−65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002(1)		-1000	1000	V
		Charged device model (CDM), per AEC Q100-011	All pins	-750	750	

(1) AEC Q100-002 indicates HBM stressing is done in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

2.4 ESD Ratings, LM2903B-Q1

				MIN	MAX	UNIT
T_{stg}	Storage temperature range			−65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002(1)		-2000	2000	V
		Charged device model (CDM), per AEC Q100-011	All pins	-1000	1000	

(1) AEC Q100-002 indicates HBM stressing is done in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

2.5 Recommended Operating Conditions, LM2903B-Q1

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Supply voltage: V_S = (V+) − (V−)	2	36	V
Ambient temperature, T_A, LM2903B	−40	125	°C
Input voltage range, V_{IVR}	−0.1	(V+) − 2	V

2.6 Recommended Operating Conditions, LM2903-Q1

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{CC} (non-V devices)		2	30	V
V_{CC} (V devices)		2	32	V
T_J	Junction Temperature	-40	125	°C

2.7 Recommended Operating Conditions, LM2903E-Q1

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{CC}		2	30	V
T_J	Junction Temperature	-40	150	°C

2.8 Thermal Information

THERMAL METRIC[1]		LM2903x-Q1					UNIT
		D (SOIC)	DGK (VSSOP)	PW (TSSOP)	DSG (WSON)	DDF (SOT-23)	
		8 PINS	8 PINS	8 PINS	8 PINS	8 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	154.1	176.5	182.9	102.1	197.9	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	96.5	85.5	87.1	126.0	119.2	
$R_{\theta JB}$	Junction-to-board thermal resistance	97.7	112.4	123.2	68.6	115.4	
ψ_{JT}	Junction-to-top characterization parameter	45.7	17.3	16.7	15.9	19.4	
ψ_{JB}	Junction-to-board characterization parameter	96.9	110.1	120.4	68.4	113.7	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	-	-	-	43.9	-	

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.

2.9 Electrical Characteristics LM2903B - Q1

V_S = 5V, V_{CM} = (V－) ; T_A = 25°C (unless otherwise noted).

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage, DGK package only	Input offset voltage, DGK package only	V_S = 5 to 36V	－3.5	±0.37	3.5	mV
V_{IO}	Input offset voltage, DGK package only	Input offset voltage, DGK package only	V_S = 5 to 36V, T_A = －40°C to +125°C	－5		5	mV
V_{IO}	Input offset voltage		V_S = 5 to 36V	－2.5	±0.37	2.5	mV
			V_S = 5 to 36V, T_A = －40°C to +125°C	－4		4	mV
I_B	Input bias current			-25	－3.5		nA
			T_A = －40°C to +125°C	-50			nA
I_{OS}	Input offset current			－10	±0.5	10	nA
			T_A = －40°C to +125°C	－25		25	nA
V_{CM}	Common mode range(1)		V_S = 3 to 36V	(V－)		(V+) － 1.5	V
			V_S = 3 to 36V, T_A = －40°C to +125°C	(V－)		(V+) － 2.0	V
A_{VD}	Large signal differential voltage amplification		V_S = 15V, V_O = 1.4V to 11.4V; R_L ⩾ 15k to (V+)	50	200		V/mV
V_{OL}	Low level output Voltage {swing from (V－)}		I_{SINK} ⩽ 4mA, V_{ID} = -1V		110	400	mV
			I_{SINK} ⩽ 4mA, V_{ID} = -1V T_A = －40°C to +125°C			550	mV
I_{OH-LKG}	High-level output leakage current		(V+) = V_O = 5V; V_{ID} = 1V		0.1	20	nA
			(V+) = V_O = 36V; V_{ID} = 1V		0.3	50	nA
I_{OL}	Low level output current		V_{OL} = 1.5V; V_{ID} = -1V; V_S = 5V	6	21		mA
I_Q	Quiescent current (all comparators)		V_S = 5V, no load		400	600	µA
			V_S = 36V, no load, T_A = －40°C to +125°C		550	800	µA

(1) The voltage at any input should not be allowed to go negative by more than 0.3V. The upper end of the input voltage range is V_{CC} － 1.5V for one input, and the other input can exceed the V_{CC} level; the comparator provides a proper output state. Either or both inputs can go to 36V without damage.

2.10 Switching Characteristics LM2903B - Q1

V_S = 5V, V_{O_PULLUP} = 5V, V_{CM} = V_S/2, C_L = 15pF, R_L = 5.1kOhm, T_A = 25°C (unless otherwise noted).

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{response}$	Propagation delay time, high-to-low; TTL input signal (1)	TTL input with V_{ref} = 1.4V		300		ns
$t_{response}$	Propagation delay time, high-to-low; Small scale input signal (1)	Input overdrive = 5mV, Input step = 100mV		1000		ns

(1) High-to-low and low-to-high refers to the transition at the input.

2.11 LM2903B-Q1 "T", "R" and "H" Temperature Test Options

The following table describes the production temperature testing for the LM2903B-Q1 "H", "R" and "T" options. Specifications are the same as the LM2903B-Q1 above.

Test	LM2903B-Q1	LM2903BR-Q1	LM2903BH-Q1	LM2903BT-Q1
Probe (Wafer)	-	25°C	125°C	-40°C and 125°C
Final (Packaged)	25°C	25°C	25°C	25°C

2.12 Electrical Characteristics, LM2903-Q1 and LM2903E-Q1

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

PARAMETER		TEST CONDITIONS		T_A (1)	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 1.4V, V_{IC} = $V_{IC(min)}$, V_{CC} = 5V to MAX(2)	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 = 1.4V		25°C		5	50	nA
				Full range			200	
I_{IB}	Input bias current	V_O = 1.4V		25°C		−25	−250	nA
				Full range			−500	
V_{ICR}	Common-mode input voltage range(3)			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} = 15V, V_O = 1.4V to 11.4V, R_L ⩾ 15kΩ to V_{CC}		25°C	25	100		V/mV
I_{OH}	High-level output current	V_{OH} = 5V	V_{ID} = 1V	25°C		0.1	50	nA
		V_{OH} = V_{CC} MAX(2)		Full range			1	μA
V_{OL}	Low-level output voltage	I_{OL} = 4mA,	V_{ID} = −1V	25°C		150	400	mV
				Full range			700	
I_{OL}	Low-level output current	V_{OL} = 1.5V,	V_{ID} = −1V	25°C	6			mA
I_{CC}	Supply current	R_L = ∞	V_{CC} = 5V	25°C		0.8	1	mA
			V_{CC} = MAX(2)	Full range			2.5	

(1) Full range (MIN or MAX) for LM2903-Q1 is −40°C to 125°C and −40°C to 150°C for the LM2903E-Q1 . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
(2) V_{CC} MAX = 30V for non-V devices and 32V for V-suffix devices.
(3) The voltage at either input or common-mode can not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is VCC+ − 1.5V for the inverting input (−), and the non-inverting input (+) can exceed the VCC level; the comparator provides a proper output state. Either or both inputs can go to 30V (32V for V-suffix devices) without damage.

2.13 Switching Characteristics, LM2903-Q1 and LM2903E-Q1

V_{CC} = 5V, T_A = 25°C

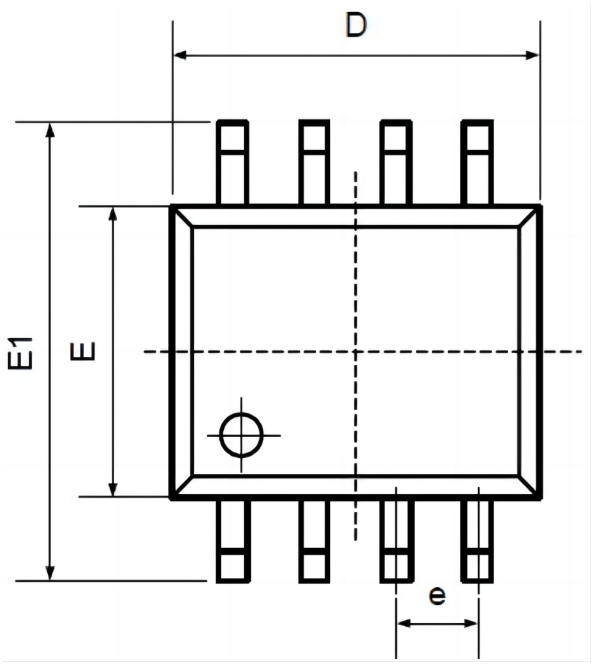
PARAMETER	TEST CONDITIONS		TYP	UNIT
Response time	R_L connected to 5V through 5.1kΩ,	100m input step with 5mV overdrive	1.3	μs
	C_L = 15pF(1) (2)	TTL-level input step	0.3	

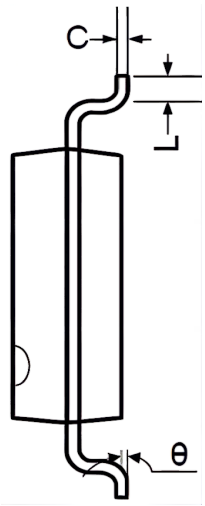
(1) C_L includes probe and jig capacitance.
(2) The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.

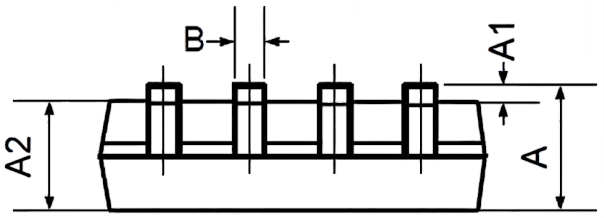
ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park
LM2903AVQDRQ1-TUDI	SOP8	Tape,Reel,2500	2903AVQ
LM2903AVQPWRQ1-TUDI	TSSOP8	Tape,Reel,2500	2903AVQ
LM2903QDGKRQ1-TUDI	MSOP8	Tape,Reel,2500	KACQ
LM2903QDRG4Q1-TUDI	SOP8	Tape,Reel,2500	2903Q1
LM2903QDRQ1-TUDI	SOP8	Tape,Reel,2500	2903Q1
LM2903QPWRQ1-TUDI	TSSOP8	Tape,Reel,2500	2903Q1
LM2903VQDRQ1-TUDI	SOP8	Tape,Reel,2500	2903VQ1
LM2903VQPWRQ1-TUDI	TSSOP8	Tape,Reel,2500	2903VQ

Package SOP8

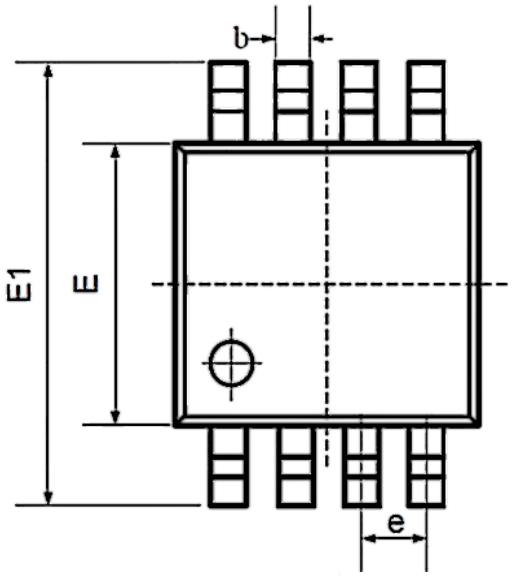


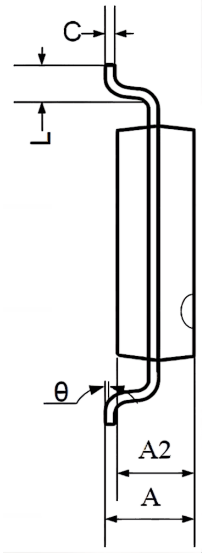


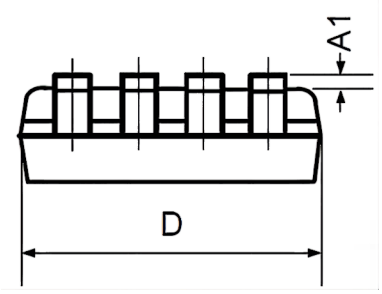


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Package MSOP8

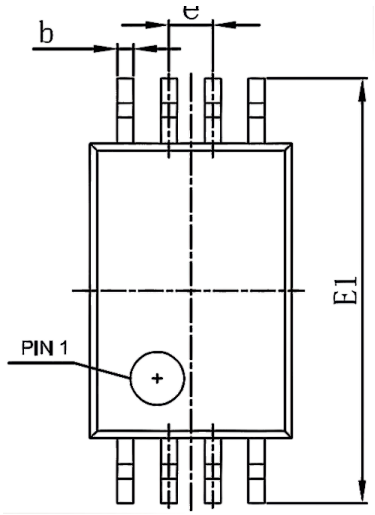


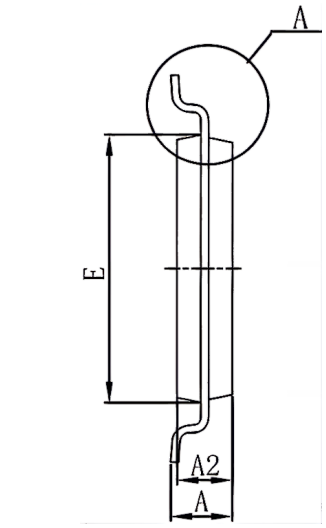


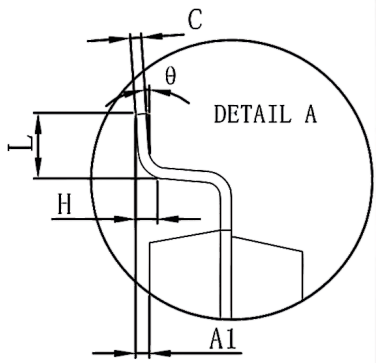


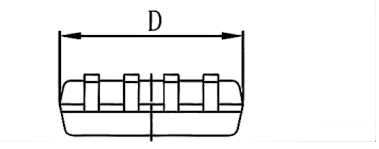
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

Package TSSOP8









Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
C	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°		1°	

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