钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LM2903

低功耗低失调电压双路比较器

网址 www.sztdbdt.com

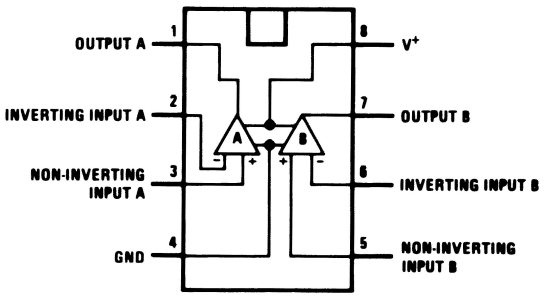
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

特性

- 宽电源
  - 电压范围：2.0V 至 36V
  - 单电源或双电源：±1.0V 至 ±18V
- 极低的电源电流消耗 (0.4mA) - 与电源电压无关
- 低输入偏置电流：25nA
- 低输入失调电流：±5nA
- 最大失调电压：±3mV
- 输入共模电压范围包括接地
- 差分输入电压范围等于电源电压
- 低输出饱和电压：250mV（电流为 4mA）
- 输出电压与 TTL、DTL、ECL、MOS 和 CMOS 逻 辑系统兼容
- 采用 8 凸点（12 密耳）DSBGA 封装
- 请参阅 AN-1112 (SNVA009) 中的 DSBGA 注意事 项
- 优势
  - 高精度比较器
  - Vos 温漂更低
  - 消除了对双电源的需求
  - 允许接近接地检测
  - 与所有形式的逻辑兼容
  - 具有适用于电池供电的功耗



P and D Package
8-Pin CDIP,PDIP,SOIC

应用

- 电池供电类 应用
- 工业 应用

说明

LM193-N 系列由两个独立的精密电压比较器组成，两 个比较器的失调电压规格低至 2.0mV（最大值），这 些比较器专为在宽电压范围内由单个电源供电而设计。 也可以由分离式电源供电，并且低电源电流消耗与电源 电压的大小无关。这些比较器还具有独特的特性：即使 由单电源电压供电，输入共模电压范围也包括接地。

应用领域包括限制比较器、简单模数转换器；脉冲、方 波和时间延迟发生器；各种 VCO；MOS 时钟计时器；多谐振荡器和高压数字逻辑门。LM193-N 系列可以直接连接 TTL 和 CMOS。由正负电源供电时，LM19-N 系列将直接连接 MOS 逻辑，其低功耗相对于标准比较器具有明显的优势。

LM393 和 LM2903 器件采用 TI 创新的具有 8 个（12 密耳）大凸点的薄 DSBGA 封装。

Pin Functions

PIN			I/O	DESCRIPTION
NAME	NO.			
	PDIP/SOIC/ TO-99	DSBGA		
OUTA	1	A1	O	Output, Channel A
-INA	2	B1	I	Inverting Input, Channel A
+INA	3	C1	I	Noninverting Input, Channel A
GND	4	C2	P	Ground
+INB	5	C3	I	Noninverting Input, Channel B
-INB	6	B3	I	Inverting Input, Channel B
OUTB	7	A3	O	Output, Channel B
V+	8	A2	P	Positive power supply

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)(2)(3)

			MIN	MAX	UNIT
Differential Input Voltage (4)				36	V
Input Voltage			−0.3	36	V
Input Current (V_{IN}<−0.3 V) (5)				50	mA
Power Dissipation (6)	PDIP			780	mW
	TO-99			660	mW
	SOIC			510	mW
	DSBGA			568	mW
Output Short-Circuit to Ground (7)				Continuous	
Lead Temperature (Soldering, 10 seconds)				260	°C
Soldering Information	PDIP Package Soldering (10 seconds)			260	°C
	SOIC Package	Vapor Phase (60 seconds)		215	°C
		Infrared (15 seconds)		220	°C
Storage temperature, T_{stg}			-65	150	°C

(1) *Absolute Maximum Ratings* indicate limits beyond which damage may occur. *Recommended Operating Conditions* indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and test conditions, see the Electrical Characteristics.
(2) Refer to RETS193AX for LM193AH military specifications and to RETS193X for LM193H military specifications.
(3) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
(4) Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than −0.3V (or 0.3V below the magnitude of the negative power supply, if used).
(5) This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V^+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than −0.3V.
(6) For operating at high temperatures, the LM393 and LM2903 must be derated based on a 125°C maximum junction temperature and a thermal resistance of 170°C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient. The LM193/LM193A/LM293 must be derated based on a 150°C maximum junction temperature. The low bias dissipation and the "ON-OFF" characteristic of the outputs keeps the chip dissipation very small (P_D≤100 mW), provided the output transistors are allowed to saturate.
(7) Short circuits from the output to V^+ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 20 mA independent of the magnitude of V^+.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±1300	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

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

	MIN	NOM	MAX	UNIT
Supply Voltage (V+) - Single Supply	2.0		36	V
Supply Voltage (V+) - Dual Supply	±1.0		±18	V
Operating Input Voltage on (VIN pin)	0		(V+) -1.5V	V
Operating junction temperature, T_J : LM193/LM193A	-55		125	°C
Operating junction temperature, T_J : LM2903	-40		85	°C
Operating junction temperature, T_J : LM293	-25		85	°C
Operating junction temperature, T_J : LM393	0		70	°C

6.4 Thermal Information

THERMAL METRIC(1)		LMx93 TO-99 8 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	170	°C/W

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

6.5 Electrical Characteristics: LM193A V^+= 5 V, T_A = 25°C

Unless otherwise stated.

PARAMETER	TEST CONDITIONS		LM193A MIN	LM193A TYP	LM193A MAX	UNIT
Input Offset Voltage	See (1).			1.0	2.0	mV
Input Bias Current	$I_{IN}(+)$ or $I_{IN}(-)$ with Output In Linear Range, V_{CM} = 0 V (2)			25	100	nA
Input Offset Current	$I_{IN}(+)-I_{IN}(-)$ V_{CM} = 0 V			3.0	25	nA
Input Common Mode Voltage Range	V+ = 30 V (3)		0		$V^+-1.5$	V
Supply Current	$R_L=\infty$	V^+=5 V		0.4	1	mA
		V^+=36 V		1	2.5	mA
Voltage Gain	R_L≥15 kΩ, V^+=15 V V_O = 1 V to 11 V		50	200		V/mV
Large Signal Response Time	V_{IN}=TTL Logic Swing, V_{REF}=1.4 V V_{RL}=5V, R_L=5.1 kΩ			300		ns
Response Time	V_{RL}=5V, R_L=5.1 kΩ (4)			1.3		µs
Output Sink Current	$V_{IN}(-)$=1V, $V_{IN}(+)$=0, V_O≈1.5 V		6.0	16		mA
Saturation Voltage	$V_{IN}(-)$=1V, $V_{IN}(+)$=0, I_{SINK}≤4 mA			250	400	mV
Output Leakage Current	$V_{IN}(-)$=0, $V_{IN}(+)$=1V, V_O=5 V			0.1		nA

(1) At output switch point, V_O≈1.4V, R_S= 0 Ω with V^+ from 5V to 30V; and over the full input common-mode range (0V to $V^+-1.5$V), at 25°C.
(2) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
(3) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V^+-1.5$ V at 25°C, but either or both inputs can go to 36 V without damage, independent of the magnitude of V^+.
(4) The response time specified is for a 100 mV input step with 5 mV overdrive. For larger overdrive signals 300 ns can be obtained, see *LMx93 and LM193A Typical Characteristics* .

6.6 Electrical Characteristics: LM193A (V+ = 5 V)(1)

PARAMETER	TEST CONDITIONS	LM193A MIN	LM193A TYP	LM193A MAX	UNIT
Input Offset Voltage	See (2)			4.0	mV
Input Offset Current	$I_{IN(+)}-I_{IN(-)}$, V_{CM}=0 V			100	nA
Input Bias Current	$I_{IN}(+)$ or $I_{IN}(-)$ with Output in Linear Range, V_{CM}=0 V (3)			300	nA
Input Common Mode Voltage Range	V^+=30 V (4)	0		$V^+-2.0$	V
Saturation Voltage	$V_{IN}(-)$=1V, $V_{IN}(+)$=0, I_{SINK}≤4 mA			700	mV
Output Leakage Current	$V_{IN}(-)$=0, $V_{IN(+)}$=1V, V_O=30 V			1.0	µA
Differential Input Voltage	Keep All V_{IN}'s≥0 V (or V^-, if Used), (5)			36	V

(1) These specifications are limited to −55°C≤T_A≤+125°C, for the LM193/LM193A. With the LM293 all temperature specifications are limited to −25°C≤T_A≤+85°C and the LM393 temperature specifications are limited to 0°C≤T_A≤+70°C. The LM2903 is limited to −40°C≤T_A≤+85°C.
(2) At output switch point, V_O≈1.4V, R_S= 0 Ω with V^+ from 5V to 30V; and over the full input common-mode range (0V to $V^+-1.5$V), at 25°C.
(3) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
(4) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V^+-1.5$ V at 25°C, but either or both inputs can go to 36 V without damage, independent of the magnitude of V^+.
(5) Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than −0.3V (or 0.3V below the magnitude of the negative power supply, if used).

6.7 Electrical Characteristics: LMx93 and LM2903 V^+= 5 V, T_A = 25°C

Unless otherwise stated.

PARAMETER	TEST CONDITIONS		LM193-N			LM293-N, LM393-N			LM2903-N			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	See (1)			1.0	5.0		1.0	5.0		2.0	7.0	mV
Input Bias Current	$I_{IN}(+)$ or $I_{IN}(-)$ with Output In Linear Range, V_{CM} = 0 V (2)			25	100		25	250		25	250	nA
Input Offset Current	$I_{IN}(+)-I_{IN}(-)$ V_{CM} = 0 V			3.0	25		5.0	50		5.0	50	nA
Input Common Mode Voltage Range	V+ = 30 V (3)		0		V+−1.5	0		V+−1.5	0		V+−1.5	V
Supply Current	R_L=∞	V^+=5 V		0.4	1		0.4	1		0.4	1.0	mA
		V^+=36 V		1	2.5		1	2.5		1	2.5	mA
Voltage Gain	R_L≥15 kΩ, V^+=15 V V_O = 1 V to 11 V		50	200		50	200		25	100		V/mV
Large Signal Response Time	V_{IN}=TTL Logic Swing, V_{REF}=1.4 V V_{RL}=5 V, R_L=5.1 kΩ			300			300			300		ns
Response Time	V_{RL}=5 V, R_L=5.1 kΩ (4)			1.3			1.3			1.5		µs
Output Sink Current	$V_{IN}(-)$=1 V, $V_{IN}(+)$=0, V_O≤1.5 V		6.0	16		6.0	16		6.0	16		mA
Saturation Voltage	$V_{IN}(-)$=1 V, $V_{IN}(+)$=0, I_{SINK}≤4 mA			250	400		250	400		250	400	mV
Output Leakage Current	$V_{IN}(-)$=0, $V_{IN}(+)$=1V, V_O=5 V			0.1			0.1			0.1		nA

(1) At output switch point, V_O≈1.4V, R_S= 0 Ω with V^+ from 5V to 30V; and over the full input common-mode range (0V to V^+−1.5V), at 25°C.
(2) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
(3) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+−1.5 V at 25°C, but either or both inputs can go to 36 V without damage, independent of the magnitude of V^+.
(4) The response time specified is for a 100 mV input step with 5 mV overdrive. For larger overdrive signals 300 ns can be obtained, see *LMx93 and LM193A Typical Characteristics* .

6.8 Electrical Characteristics: LMx93 and LM2903 (V+ = 5 V)(1)

PARAMETER	TEST CONDITIONS	LM193-N			LM293-N, LM393-N			LM290-N			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	See (2)			9			9		9	15	mV
Input Offset Current	$I_{IN(+)}-I_{IN(-)}$, V_{CM}=0 V			100			150		50	200	nA
Input Bias Current	$I_{IN}(+)$ or $I_{IN}(-)$ with Output in Linear Range, V_{CM}=0 V (3)			300			400		200	500	nA
Input Common Mode Voltage Range	V^+=30V (4)	0		$V^+-2.0$	0		$V^+-2.0$	0		$V^+-2.0$	V
Saturation Voltage	$V_{IN}(-)$=1V, $V_{IN}(+)$=0, I_{SINK}≤4 mA			700			700		400	700	mV
Output Leakage Current	$V_{IN}(-)$=0, $V_{IN(+)}$=1V, V_O=30 V			1.0			1.0			1.0	μA
Differential Input Voltage	Keep All V_{IN}'s≥0 V (or V^-, if Used), (5)			36			36			36	V

(1) These specifications are limited to −55°C≤T_A≤+125°C, for the LM193/LM193A. With the LM293 all temperature specifications are limited to −25°C≤T_A≤+85°C and the LM393 temperature specifications are limited to 0°C≤T_A≤+70°C. The LM2903 is limited to −40°C≤T_A≤+85°C.

(2) At output switch point, V_O≈1.4V, R_S= 0 Ω with V^+ from 5V to 30V; and over the full input common-mode range (0V to V^+−1.5V), at 25°C.

(3) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.

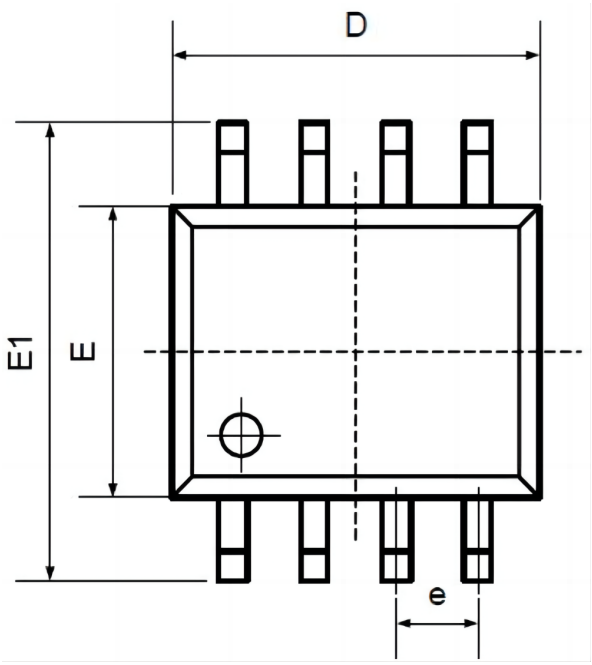
(4) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+−1.5 V at 25°C, but either or both inputs can go to 36 V without damage, independent of the magnitude of V^+.

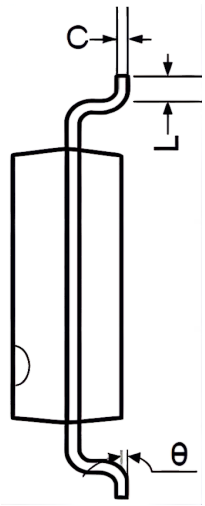
(5) Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than −0.3V (or 0.3V below the magnitude of the negative power supply, if used).

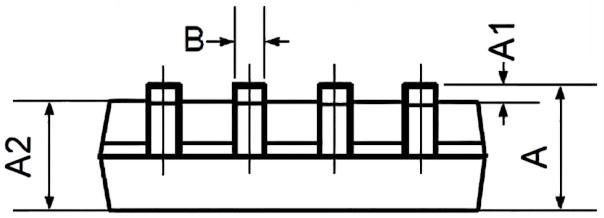
ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park
LM2903MX/NOPB-TUDI	SOP8	Tape,Reel,2500	LM2903M
LM2903N/NOPB-TUDI	DIP8	Tube,50,A box of 2000	LM2903N
LM393MX/NOPB-TUDI	SOP8	Tape,Reel,2500	LM393M
LM393N/NOPB-TUDI	DIP8	Tube,50,A box of 2000	LM393N

Package SOP8

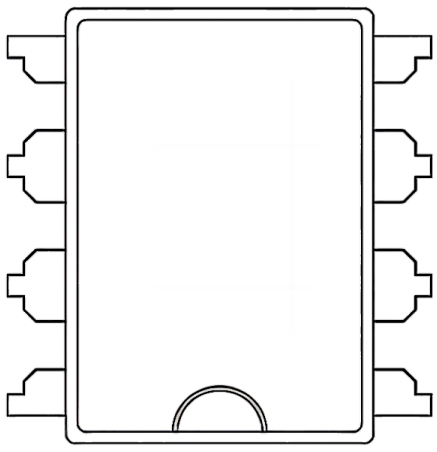


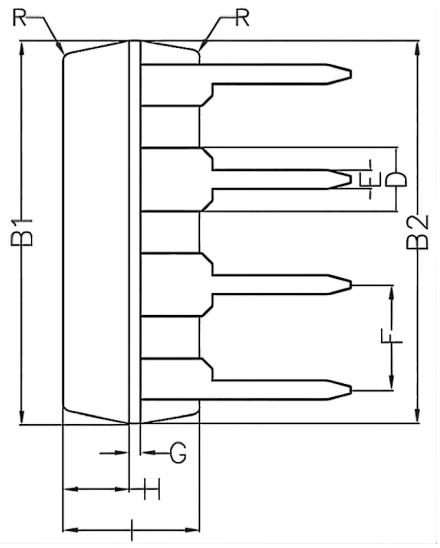


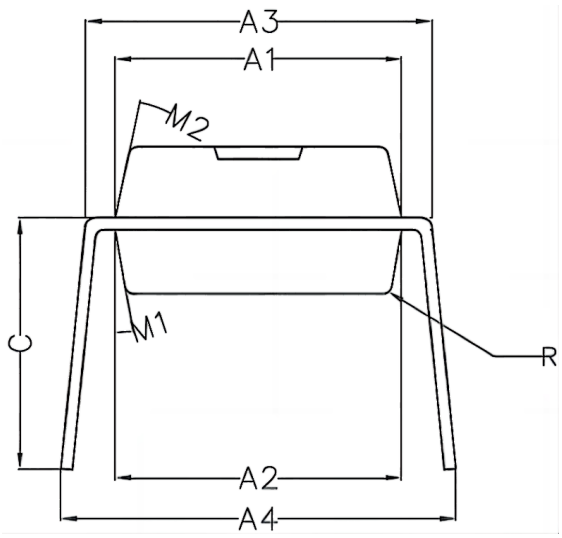


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

Package DIP8







Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
工	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°

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