LOW-POWER LOW OFFSET VOLTAGE DUAL COMPARATORS

1.Description

The LM393 consists of two independent precision voltage comparators with a typical offset voltage of 1.0mV and high gain.It is specifically designed to operate from a single power supply over a wide range of voltages(2V to 36V).Operation from split power supplies is also possible(±1V to±18V),and the low supply current drain is independent of the magnitude of the supply voltage.

The LM393 series is compatible with industry-standard 393 pinouts.

The device is available in the standard SOP-8,TSSOP-8 and MSOP-8 package.

2.Application

- Battery chargers
- Cordless telephones
- Switching power supplies
- DC-DC modules
- PC motherboards
- Communication equipment

3.Features

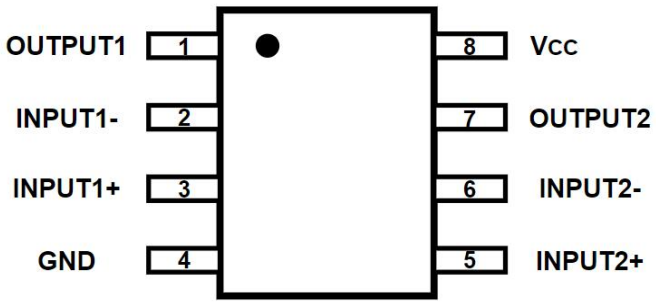
- Wide Supply Voltage Range
  - Single Supply: 2 V to 36 V
  - Dual Supplies: ±1.0 V to ±18 V
- Low Supply Current Drain: 0.6 mA (typical)
- Low Input Bias Current: 25 nA (typical)
- Low Input Offset Current: ±5.0 nA (typical)
- Low Input Offset Voltage: 1.0 mV (typical);
- Input Common-Mode Voltage Range Includes Ground
- Differential Input Voltage Range Equals the Power Supply Voltage
- Low Output Saturation Voltage: 200mV at 4mA
- Open-Collector Output
- Totally Lead-Free & Fully RoHS Compliant
- Halogen- and Antimony-free "Green" Device

4.Order information

Mode	Package	Ordering Number	Packing Option
LM393	SOP-8	LM393YSOP8G/TR	Tape and Reel,2500
	TSSOP-8	LM393YTSSOP8G/TR	Tape and Reel,3000
	MSOP-8	LM393YMSOP8G/TR	Tape and Reel,3000

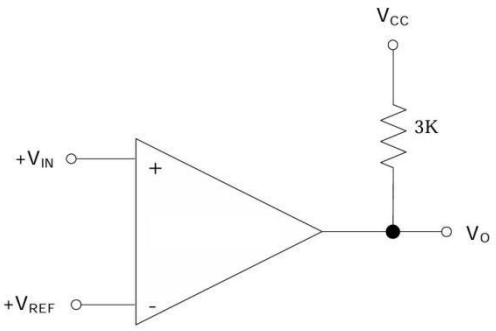
5.Pin Assignments

Top View

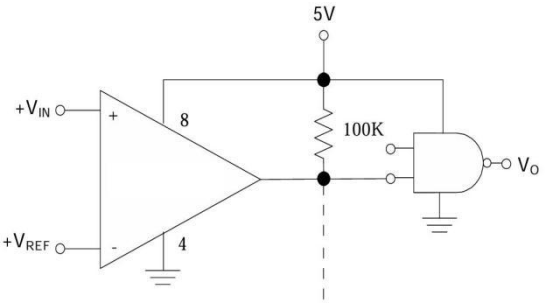


SOP-8/TSSOP-8/MSOP-8

6.Typical Applications Circuit



Basic Comparator



Driving CMOS

7.Absolute Maximum Ratings

Symbol	Parameter	Rating		Unit
V_{CC}	Supply Voltage	40		V
V_{ID}	Differential Input Voltage	40		V
V_{IN}	Input Voltage	-0.3 to 40		V
I_{IN}	Input Current (V_{IN} < -0.3V) (Note 2)	50		mA
-	Output Short-Circuit Current to Ground	Continuous		-
P_D	Power Dissipation(T_A=+25°C)	SOP-8	660	mW
		TSSOP-8	570	
		MSOP-8	450	
T_J	Operating Junction Temperature	+150		°C
T_{STG}	Storage Temperature	-65 to+150		°C
T_{LEAD}	Lead Temperature(Soldering,10 Seconds)	+260		°C

Note：

1.Stresses beyond these ratings may cause permanent damage. Functional operation is not implied under these conditions.

2. 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 -0.3 VDC (at +25°C).

8.Recommend Operating Conditions

Symbol	Parameters	Min	Max	Unit
V_{CC}	Supply Voltage	2	36	V
T_A	Operating Temperature Range	-40	85	°C

9.Electrical Specifications

(Limits in standard typeface are for T_A = +25°C, bold typeface applies over T_A = -40°C to +85°C (Note 1), V_{CC} = 5V, GND = 0V, unless otherwise specified)

Parameter	Conditions		Min	Typ	Max	Unit
Input Offset Voltage	V_O=1.4V,R_S=0Ω,V_{CC}=5 to 30V		—	1.0	5.0	mV
			—	**—**	**7**	
Input Bias Current	I_{IN+} or I_{IN-} with output in linear range,V_{CM}=0V		—	25	250	nA
			—	**—**	**400**	
Input Offset Current	I_{IN+}-I_{IN-},V_{CM}=0V		—	5.0	50	nA
			—	**—**	**200**	
Input Common Mode Voltage Range(Note 2)	V_{CC}=30V		0	—	V_{CC}-1.5	V
Supply Current	R_L=∞	V_{CC}=5V	—	0.4	1.0	mA
			—	**—**	**2**	
		V_{CC}=30V	—	0.7	1.7	
			—	**—**	**3**	
Voltage Gain	V_{CC}=15V,R_L≥15kΩ,V_O=1V to 11V		50	200	—	V/mV
Large Signal Response Time	V_{IN}=TTL Logic Swing, V_{REF}=1.4V, V_{RL}=5V, R_L=5.1k		—	200	—	ns
Response Time	V_{RL}=5V,R_L=5.1k		—	1.3	—	μs
Output Sink Current	V_{IN-}=1V, V_{IN+}=0V, V_O=1.5V		6.0	16	—	mA
Output Leakage Current	V_{IN-}=0V, VI_{N+}=1V, V_O=5V		—	0.1	—	nA
	V_{IN-}=0V, VI_{N+}=1V, V_O=30V		—	—	1	μA
Saturation Voltage	V_{IN-}=1V, V_{IN+}=0, I_{SINK} ≤ 4mA		—	200	400	mV
			—	**—**	**500**	
Thermal Resistance(Junction to Case)	SOP-8		—	9	—	°C/W
	TSSOP-8		—	15	—	
	MSOP-8		—	24	—	
Thermal Resistance(Junction to Ambient)	SOP-8		—	108	—	
	TSSOP-8		—	179	—	
	MSOP-8		—	151	—	

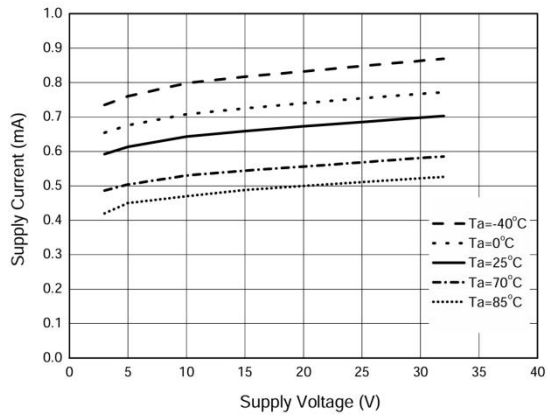
Notes:

1. These specifications are limited to -40°C ≤ T_A ≤ +85°C. Limits over temperature are guaranteed by design, but not tested in production.

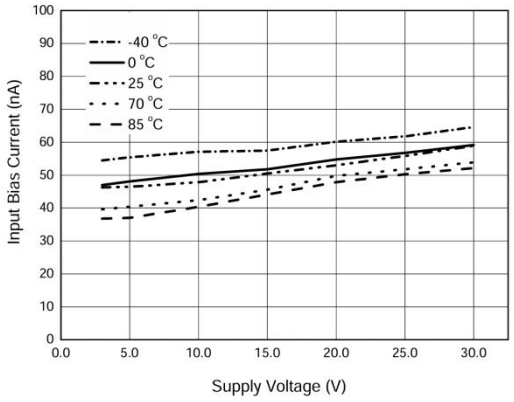
2. The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at +25°C). The upper end of the common-mode voltage range is V_{CC}-1.5V (at +25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the V_{CC}.

10.Typical Characteristics

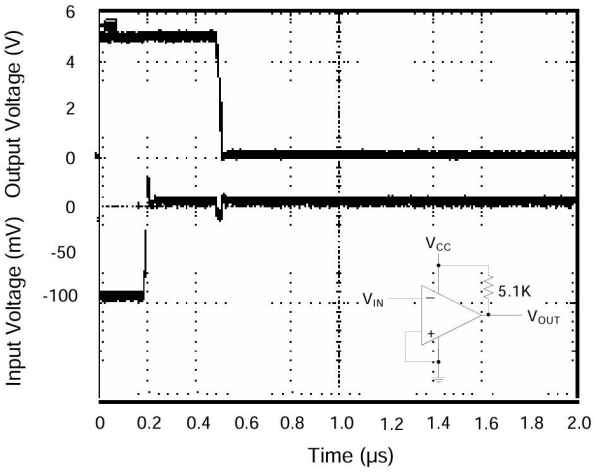
Supply Voltage vs. Supply Current



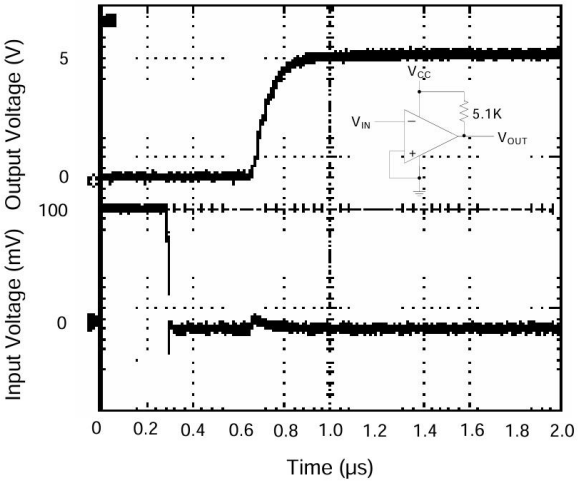
Supply Voltage vs. Input Bias Current



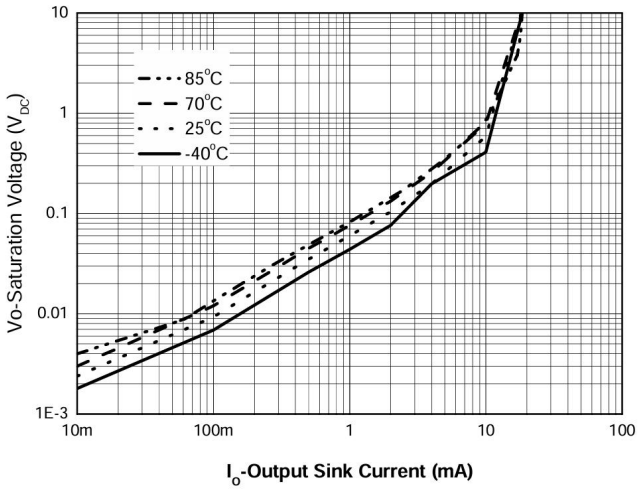
Response Time for 5mV Input Overdrive– Negative Transition



Response Time for 5mV Input Overdrive – Positive Transition

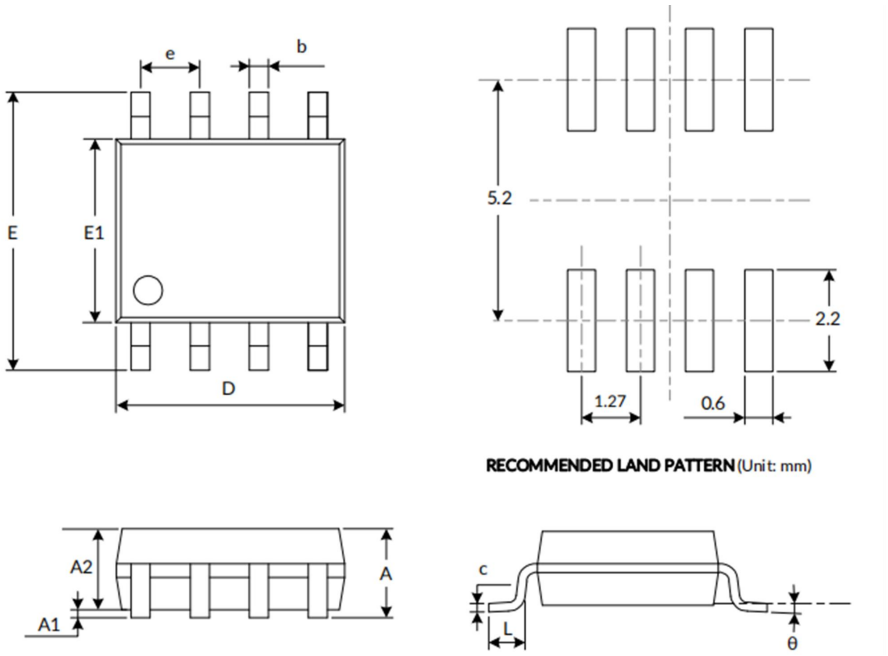


Output Sink Current vs. Saturation Voltage



11.Package Outline Dimensions

(1) Package Type:SOP-8

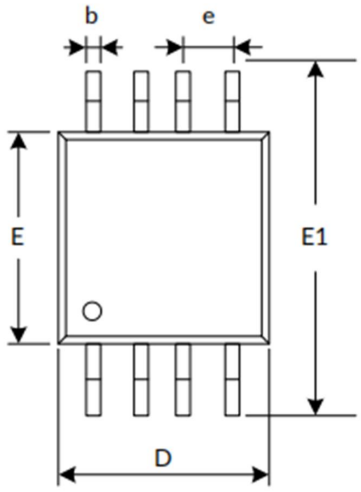


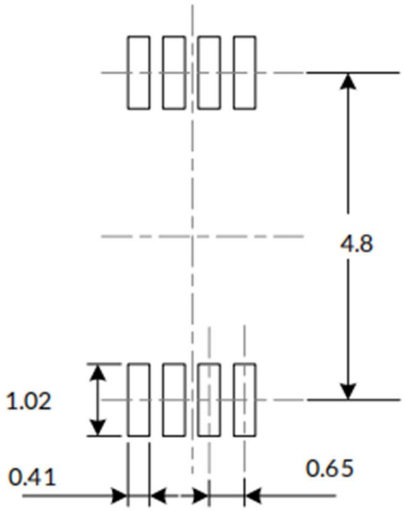
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D (1)	4.800	5.000	0.189	0.197
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTE:

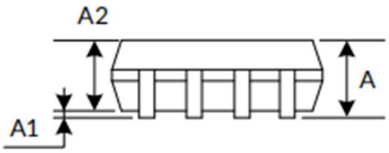
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

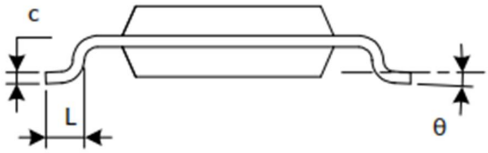
(2) Package Type:MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)



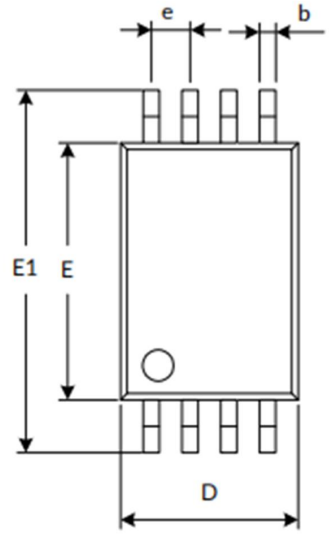


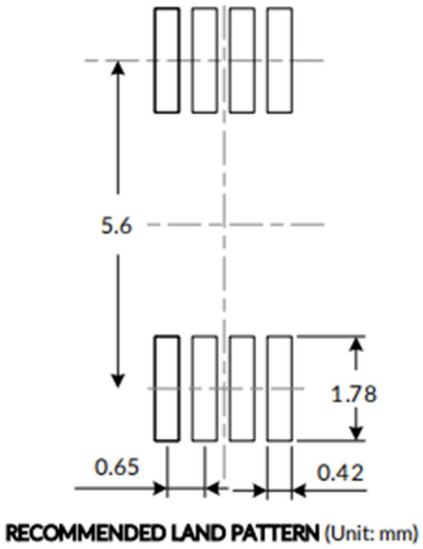
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D (1)	2.900	3.100	0.114	0.122
e	0.650(BSC) (2)		0.026(BSC) (2)	
E (1)	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

NOTE:

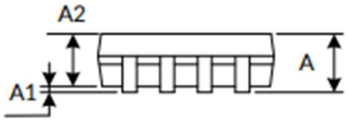
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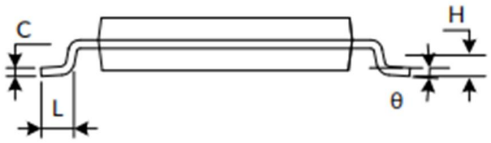
(3) Package Type:TSSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	-	1.200	-	0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D (1)	2.900	3.100	0.114	0.122
E (1)	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC) (2)		0.026(BSC) (2)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

12.Important Notice And Disclaimer

- We reserves the right to change the instruction manual without prior notice.
- Any semiconductor product has a certain possibility of failure or malfunction under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design and overall manufacturing to avoid potential failure risks that may cause personal injury or property damage.
- The improvement of product quality is endless, our company will be dedicated to provide customers with better products.