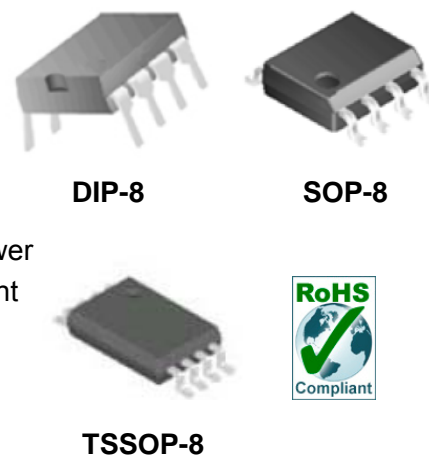


## Low Power Low Offset Voltage Dual Comparator

### General Description

- The TCI LM393 series consist of two independent precision voltage comparators with a typical offset voltage of 1.0mV and high gain. They are specially designed to operate from a single power supply over a wide range of voltages. Operation from split power is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.
- The LM393 series is available in standard DIP-8, SOP-8 and TSSOP-8 packages. LM393A is available in standard DIP-8 and SOP-8



### Features

- Wide Supply Voltage Range:  
Single Supply: 2V to 36 V  
Dual Supplies:  $\pm 1.0V$  to  $\pm 18V$
- Low Supply Current Drain: 0.6mA
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current:  $\pm 5.0nA$  (Typical)
- Low Input Offset Voltage: 1.0mV (Typical)
- Input Common Mode Voltage Range Include Ground
- Differential Input Voltage Range Equals to the Power Supply Voltage
- Low Output Saturation Voltage: 200mV at 4mA
- Open Collector Output
- RoHS Compliance

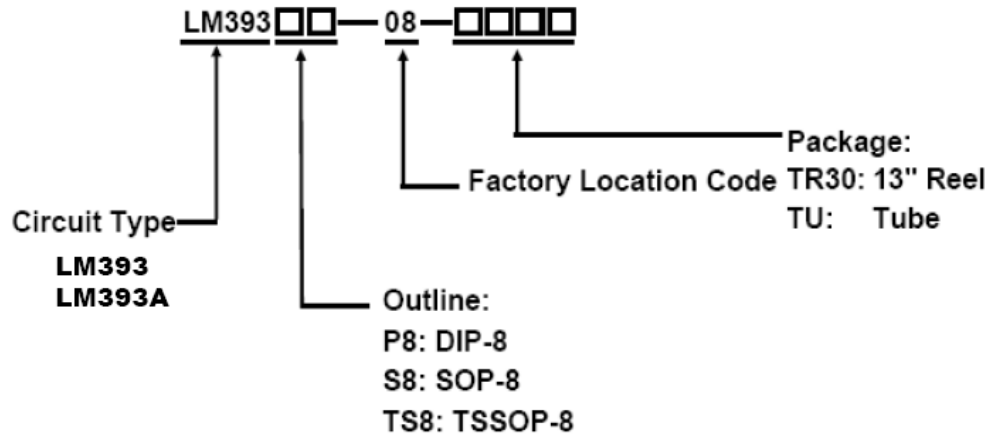
### Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply
- DC-DC Module
- PC Motherboard
- Communication Equipment

# Low Power Low Offset Voltage Dual Comparator

## LM393 Series

### Ordering Information



### Marking Information

Outline	Temperature Range	PN	Marking Code	Package Type
DIP-8	-40 to 85°C	LM393P8	AS393P-E1	Tube
		LM393AP8	AS393AP-E1	Tube
SOP-8	-40 to 85°C	LM393S8	AS393M-E1	Tube
		LM393AS8	AS393AM-E1	Tape & Reel
TSSOP-8	-40 to 85°C	LM393TS8	EG3C	Tube Tape & Reel

### Packing Information

#### Tube Package

Package Type	Units/Tube	Tubes/Inner Box	Units/Inner Box	Inner Boxes /Outer Box
DIP-8	50	40	2000	5
SOP-8	100	100	10000	5
TSSOP-8	100	100	10000	5

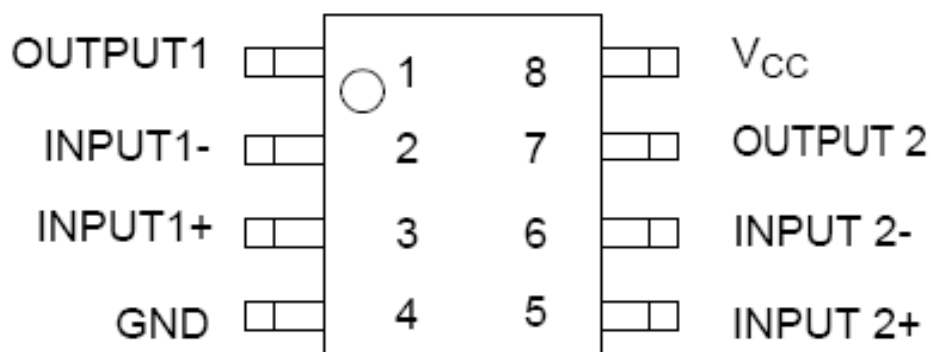
#### Tape & Reel Package

Package Type	Units/Reel	Reels/Inner Box	Units/Inner Box	Inner Boxes /Outer Box
SOP-8	4000	2	8000	8
TSSOP-8	3000	2	6000	8

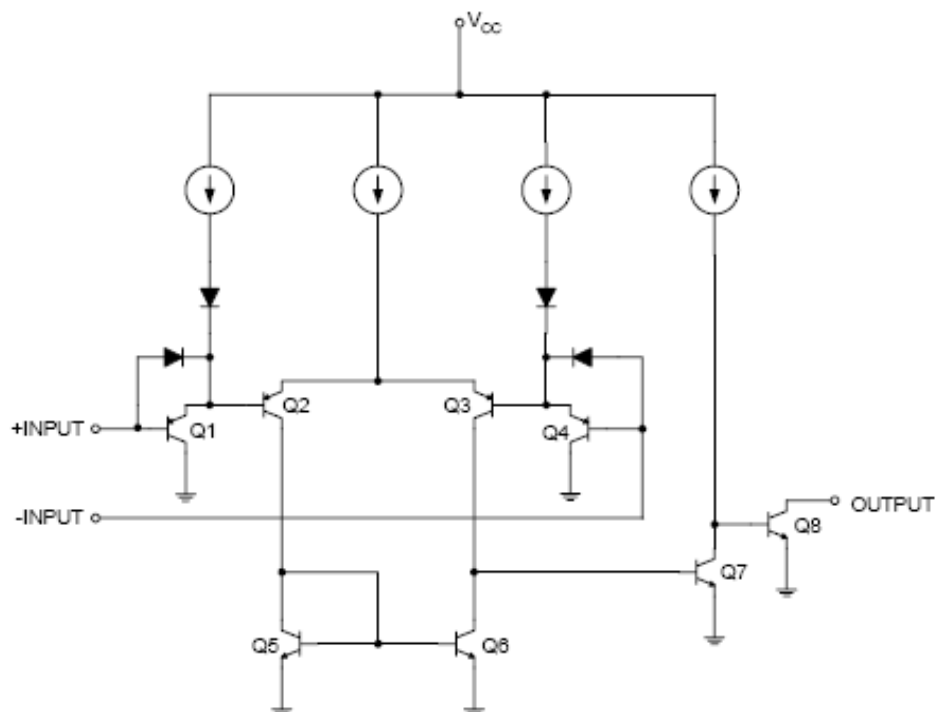
# Low Power Low Offset Voltage Dual Comparator

## LM393 Series

### Pin Configuration (Top View)



### Functional Block Diagram



# Low Power Low Offset Voltage Dual Comparator

## LM393 Series

### Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V <sub>CC</sub>	Supply Voltage		40	V
V <sub>ID</sub>	Differential Input Voltage		40	V
V <sub>IN</sub>	Input Voltage		-0.3 to 40	V
I <sub>IN</sub>	Input Current (V <sub>IN</sub> < -0.3V) (Note 2)		50	mA
	Output Short-Circuit Current to Ground		Continuous	
P <sub>D</sub>	Power Dissipation (T <sub>A</sub> = 25° C)	DIP-8	780	mW
		SOP-8	660	
		TSSOP-8	570	
T <sub>J</sub>	Operating Junction Temperature		150	° C
T <sub>STG</sub>	Storage Temperature Range		-65 to +150	° C
T <sub>LEAD</sub>	Lead Temperature (Soldering, 10 seconds)		260	° C

- Note:** 1. Stresses greater than 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 Ratings” for extended periods may affect device reliability.
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 PNP parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V<sub>+</sub> 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<sub>DC</sub> (at 25°C)

### Recommended Operating Conditions

Symbol	Description	Ratings		Unit
		Min.	Max.	
V <sub>CC</sub>	Supply Voltage	2	36	V
T <sub>A</sub>	Ambient Operating Temperature Range	-40	85	° C

# Low Power Low Offset Voltage Dual Comparator

## LM393 Series

### Electrical Characteristics

Limits in standard typeface are for  $T_A=25^{\circ}\text{C}$ , bold typeface applies over  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  (Note 3),  $V_{CC}=5\text{V}$ ,  $\text{GND}=0\text{V}$ , unless otherwise specified.

Description		Min.	Typ.	Max.	Unit	Conditions
Input Offset Voltage	LM393	-	1.0	5.0	mV	Vo=1.4V, Rs=0 Ω Vcc=5V to 30V
		-	-	7.0		
	LM393A	-	1.0	3.0		
		-	-	5.0		
Input Bias Current		-	25	250	nA	Iin+ or Iin- with output in Linear Range, VCM=0V
		-	-	400		
Input Offset Current		-	5.0	50	nA	Iin+ - Iin-, VCM=0V
		-	-	200		
Input Common Mode Voltage Range (Note 4)		0	-	VCC-1.5	V	VCC=30V
Supply Current		-	0.6	1.0	mA	VCC=5V, RL=∞
		-	-	2.0		
		-	0.7	1.7		VCC=30V, RL=∞
		-	-	3.0		
Voltage Gain		50	200	-	V/mV	VCC=15V, RL≥15KΩ, Vo=1V to 11V
Large Signal Response Time		-	200	-	nS	VIN=TTL, Logic Swing, VREF=1.4V, VRL=5V, RL=5.1K
Response Time		-	1.3	-	μS	VRL=5V, RL=5.1K
Output Sink Current		6.0	16	-	mA	VIN+=0V, VIN-=1V, Vo=1.5V
Output Leakage Current		-	0.1	-	nA	VIN+=1V, VIN-=0V, Vo=5V
		-	-	1.0	μA	VIN+=1V, VIN-=0V, Vo=30V
Saturation Voltage		-	200	400	mV	VIN+=0V, VIN-=1V, ISINK≤4mA
		-	-	500		

**Note:** 3. These specifications are limited to  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ . Limits over temperature are guaranteed by design, but not tested in production.

# Low Power Low Offset Voltage Dual Comparator

## LM393 Series

4. 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 +18V without damages, independent of the magnitude of the  $V_{CC}$ .

### Typical Characteristics Curves

Fig.1- Supply Voltage vs. Supply Current

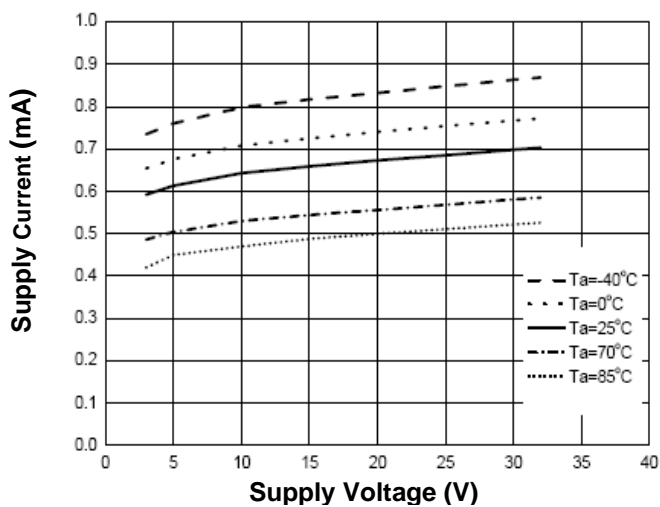


Fig.2- Supply Voltage vs. Input Bias Current

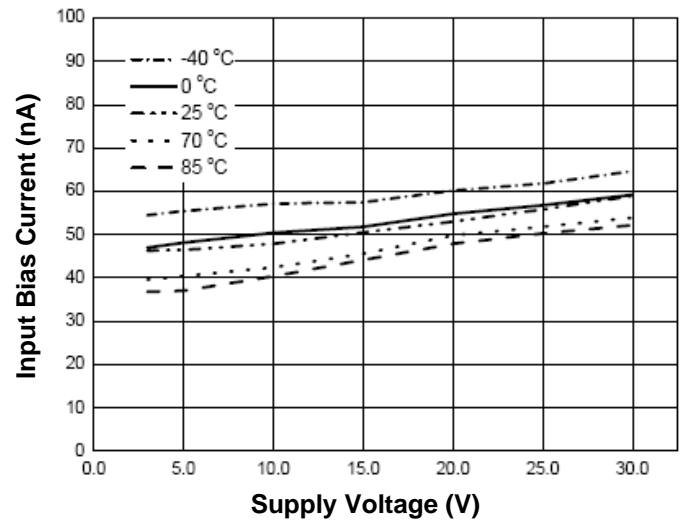


Fig.3- Output Sink Current vs. Saturation Voltage

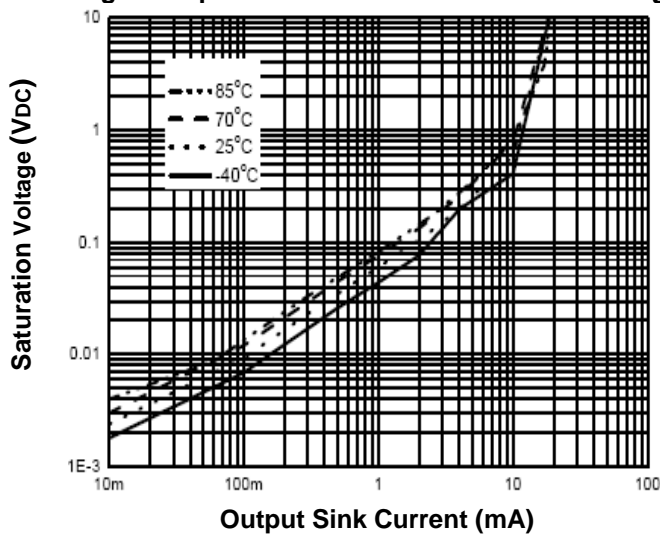
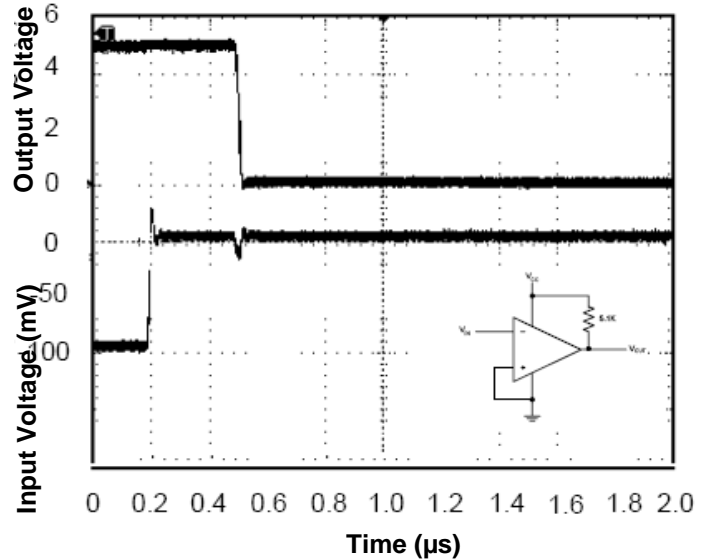
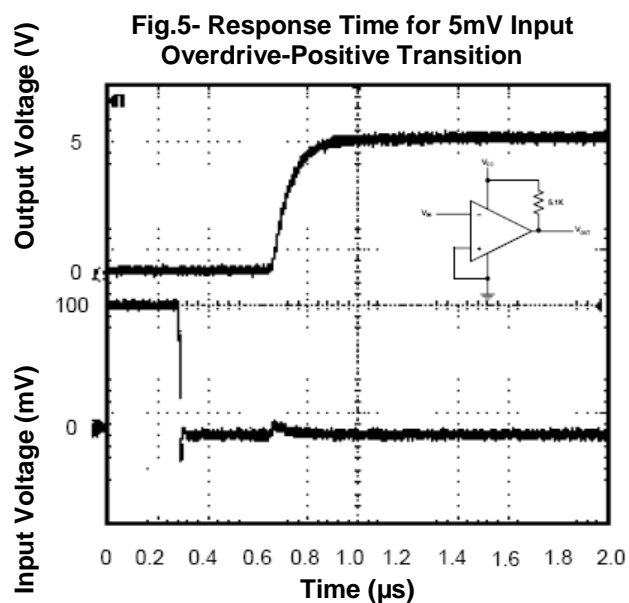


Fig.4- Response Time for 5mV Input Overdrive-Negative Transition



# Low Power Low Offset Voltage Dual Comparator

## LM393 Series



### Typical Applications

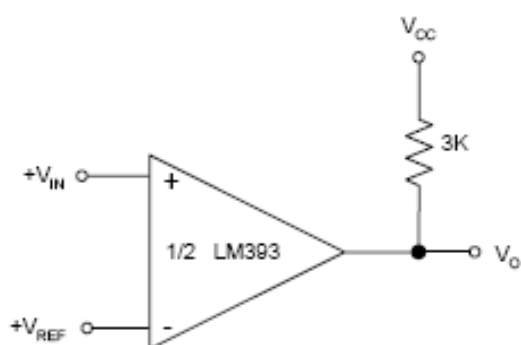


Fig.6-Basic Comparator

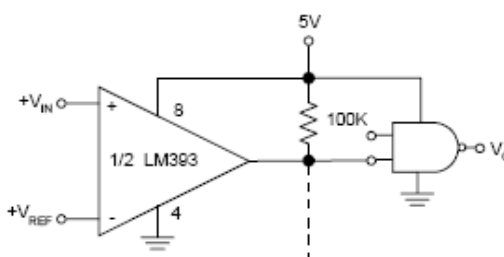
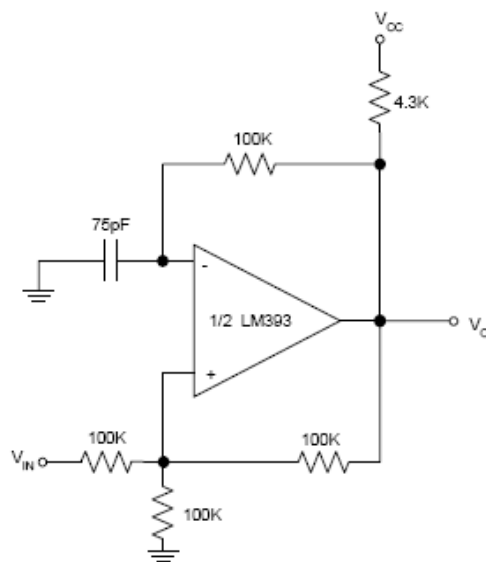


Fig.7-Driving CMOS

## LM393 Series



### Fig.9-Squarewave Oscillator

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# Low Power Low Offset Voltage Dual Comparator

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## LM393 Series

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