

## Features

- I Wide Supply Voltage Range
- I Single Supply: 2.0V to 36V
- I Dual Supplies:  $\pm 1.0V$  to  $\pm 18V$
- I Low Supply Current Drain: 0.6mA
- I Low Input Bias Current: 25nA (Typ)
- I Low Input Offset Current: 5.0nA (Typ)
- I Low Input Offset Voltage:  $\pm 1.0mV$  (Typ)
- I Input Common Mode Voltage Range Includes Ground
- I Differential Input Voltage Range Equals to the Power Supply Voltage
- I Low Output Saturation Voltage: 200mV at 4mA
- I Open Collector Output
- I Small Package:  
GS393/393A Available in SOP-8 and DIP-8 Packages

## General Description

The GS393/393A consist of two independent precision voltage comparators with a typical offset voltage of 1.0mV and high gain. They are specifically designed to operate from a single power supply over wide range of voltages. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. The GS393/393A series are compatible with industry standard 393. GS393A has more stringent input offset voltage than GS393.

## Applications

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

## Pin Configuration

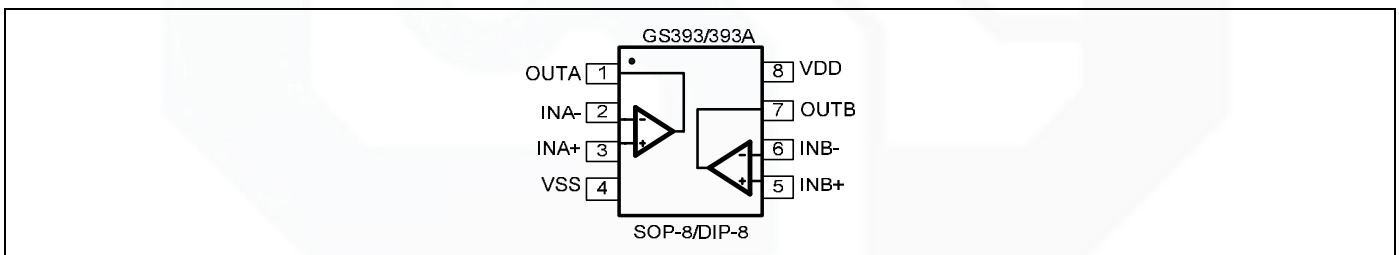


Figure 1. Pin Assignment Diagram

## Functional Block Diagram

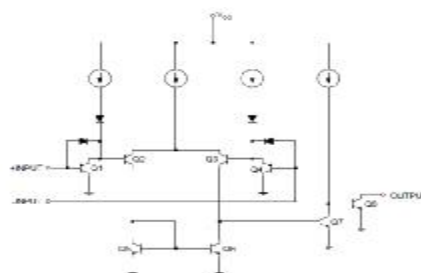


Figure 2. Functional Block Diagram of GS393/393A (Each comparator)

## Absolute Maximum Ratings

Condition	Symbol	Max
Power Supply Voltage	V <sub>CC</sub>	±20V or 40V
Differential input voltage	V <sub>I(DIFF)</sub>	40V
Input Voltage	V <sub>I</sub>	-0.3V~40V
Operating Junction Temperature	T <sub>J</sub>	150°C
Storage Temperature Range	T <sub>stg</sub>	-65°C ~+150°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.

Note 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<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 -0.3 VDC at 25°C).

## Package/Ordering Information

MODEL	CHANNEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
GS393	Dual	GS393-SR	SOP-8	Tape and Reel,4000	GS393
		GS393-DR	DIP-8	20Tube(1000pcs)	GS393
GS393A	Dual	GS393A-SR	SOP-8	Tape and Reel,4000	GS393
		GS393A-DR	DIP-8	20Tube(1000pcs)	GS393

## Recommended Operating Conditions

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

## Electrical Characteristics

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

Parameter	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	$V_O=1.4\text{V}$ , $R_S=0\Omega$ , $V_{CC}=5\text{V to }30\text{V}$	GS393	1.0	5.0	mV
			7		
		GS393A	1.0	3.0	
			5		
Input Bias Current	$I_{IN+}$ or $I_{IN-}$ with output in Linear Range, $V_{CM}=0\text{V}$		25	250	nA
				<b>400</b>	
Input Offset Current	$I_{IN+}-I_{IN-}$ , $V_{CM}=0\text{V}$		5.0	50	nA
				<b>200</b>	
Input Common Mode Voltage Range (Note 4)	$V_{CC}=30\text{V}$	0		$V_{CC}-1.5$	V
Supply Current	$R_L=\infty$	$V_{CC}=5\text{V}$	0.6	1.0	mA
			2		
		$V_{CC}=30\text{V}$	0.7	1.7	
			3		
Voltage Gain	$V_{CC}=15\text{V}$ , $R_L\geq 15\text{k}\Omega$ , $V_O=1\text{V to }11\text{V}$	50	200		V/mV
Large Signal Response Time	$V_{IN}=\text{TTL Logic Swing}$ , $V_{REF}=1.4\text{V}$ , $V_{RL}=5\text{V}$ , $R_L=5.1\text{k}$		200		ns
Response Time	$V_{RL}=5\text{V}$ , $R_L=5.1\text{k}$		1.3		$\mu\text{s}$
Output Sink Current	$V_{IN}=1\text{V}$ , $V_{IN+}=0$ , $V_O=1.5\text{V}$	6.0	16		mA
Output Leakage Current	$V_{IN}=0\text{V}$ , $V_{IN+}=1\text{V}$ , $V_O=5\text{V}$		0.1		nA
	$V_{IN}=0\text{V}$ , $V_{IN+}=1\text{V}$ , $V_O=30\text{V}$			<b>1</b>	$\mu\text{A}$
Saturation Voltage	$V_{IN}=1\text{V}$ , $V_{IN+}=0$ , $I_{SINK}\leq 4\text{mA}$		200	400	mV
				<b>500</b>	
Thermal Resistance (Junction to Case)	DIP-8		93		$^\circ\text{C/W}$
	SOIC-8		138		

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

Note 4: The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at  $25\text{ }^\circ\text{C}$ ). The upper end of the common-mode voltage range is  $V_{CC}-1.5\text{V}$  (at  $25\text{ }^\circ\text{C}$ ), but either or both inputs can go to +36V without damages, independent of the magnitude of the VCC.

Typical Performance characteristics

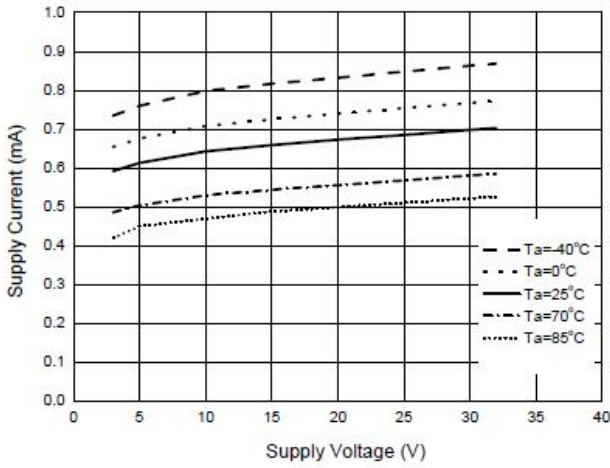


Figure 3. Supply Voltage vs. Supply Current

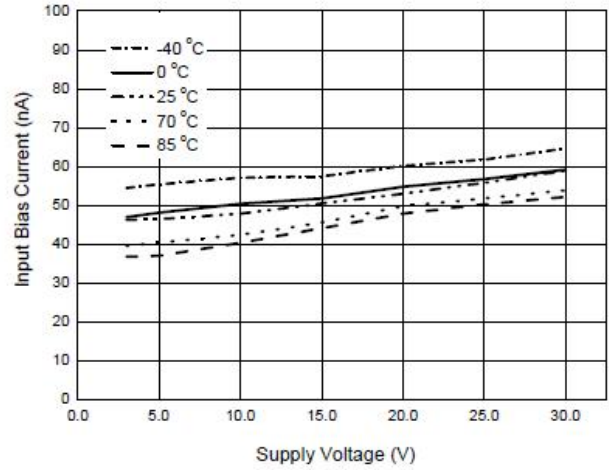


Figure 4. Supply Voltage vs. Input Bias Current

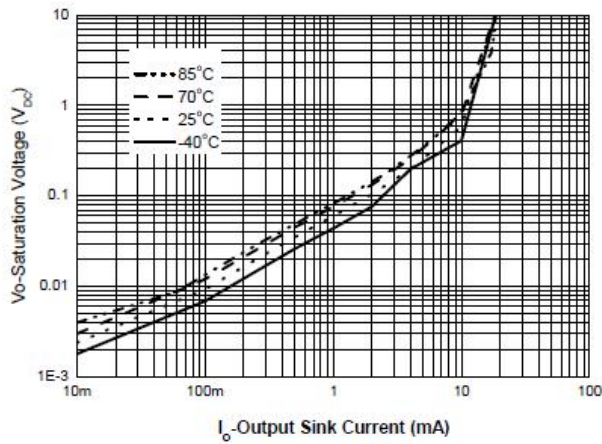


Figure 5. Output Sink Current vs. Saturation Voltage

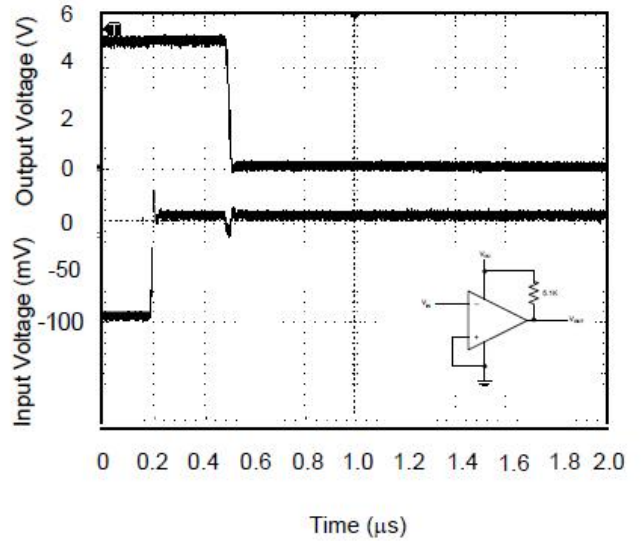


Figure 6. Response Time for 5mV Input Overdrive - Negative Transition

Typical Performance characteristics

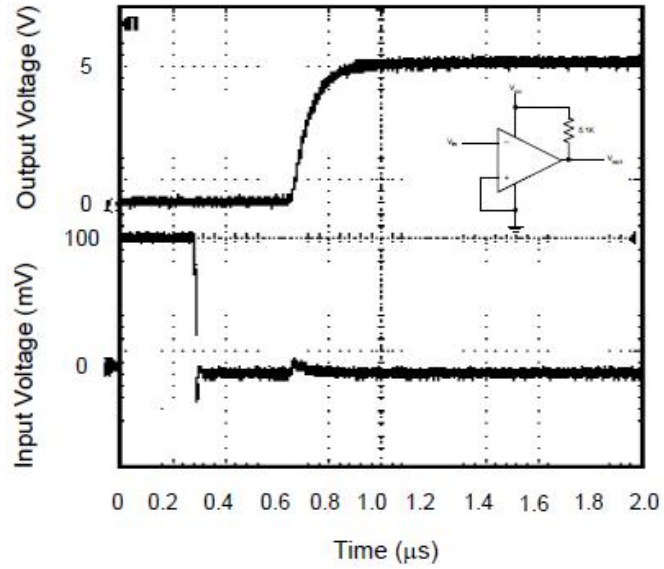


Figure 7. Response Time for 5mV Input Overdrive  
- Positive Transition

**Typical Applications**

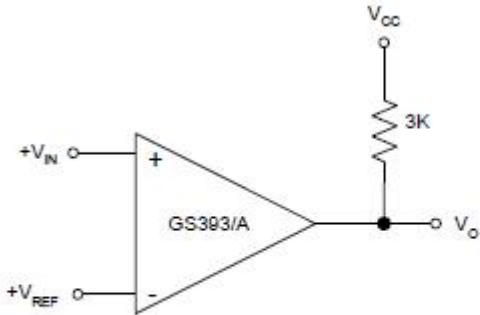


Figure 8. Basic Comparator

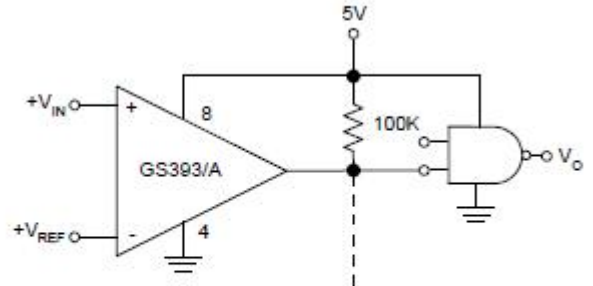


Figure 9. Driving CMOS

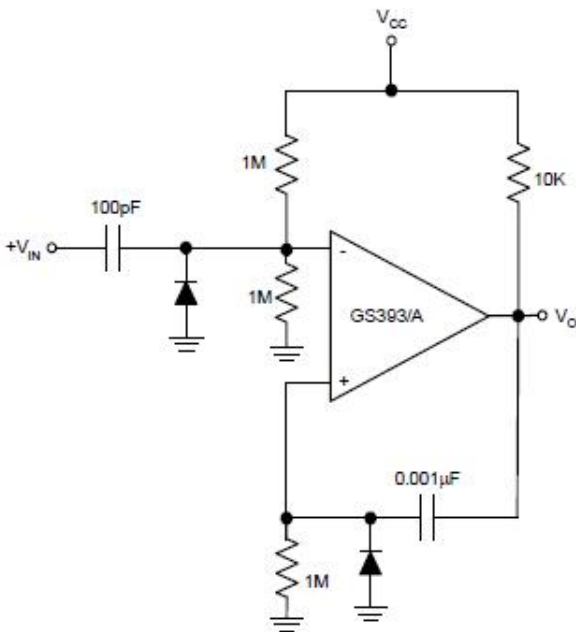


Figure 10. One Shot Multivibrator

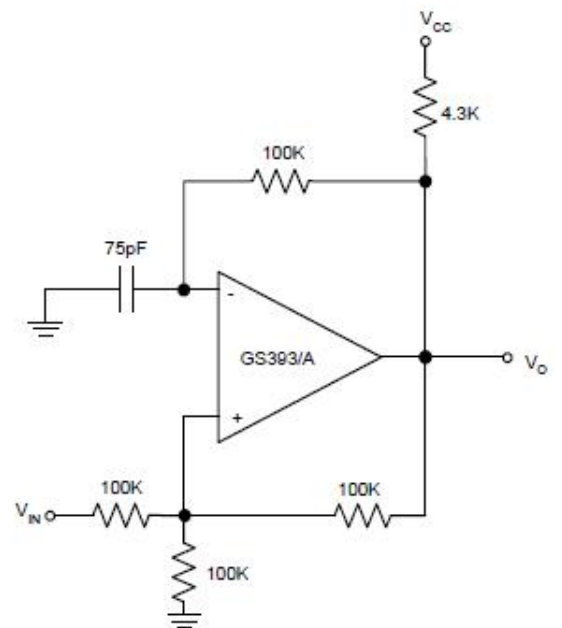
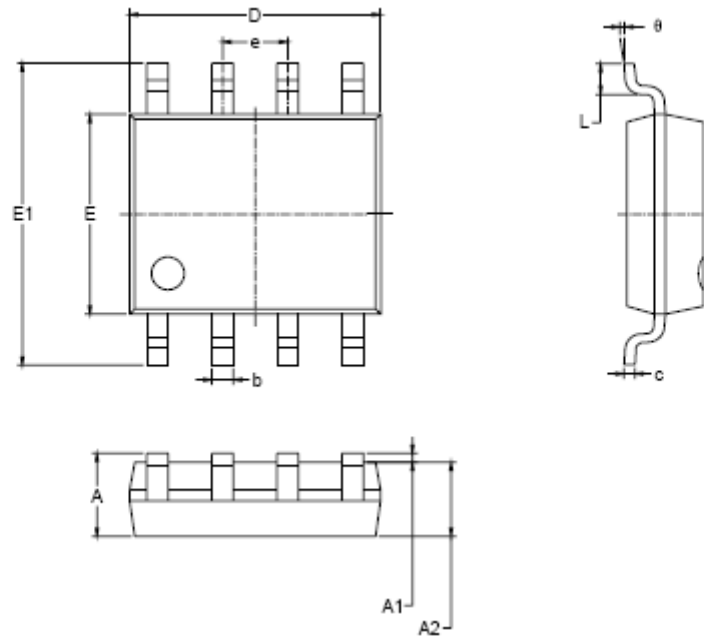


Figure 11. Squarewave Oscillator



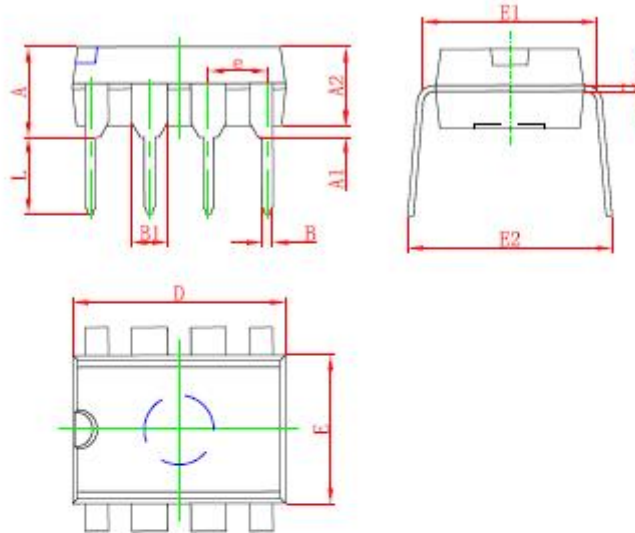
Package Information

SOP-8



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	0.170	0.250	0.008	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
theta	0°	8°	0°	8°

DIP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.380	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100 (BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354