

Features

- Wide Supply Voltage Range
- Single Supply: 2.0V to 36V
- 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 Includes Ground
- Differential Input Voltage Range Equals to the Power Supply Voltage
- Low Output Saturation Voltage: 200mV at 4mA
- Open Collector Output
- 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

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

Pin Configuration

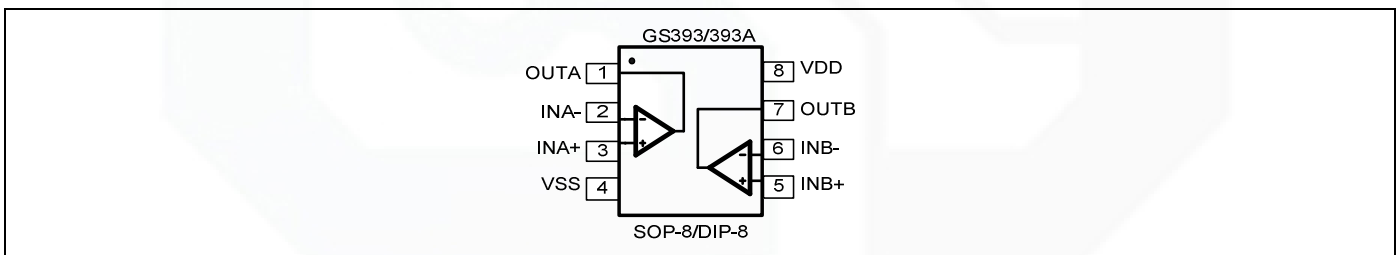


Figure 1. Pin Assignment Diagram

Functional Block Diagram

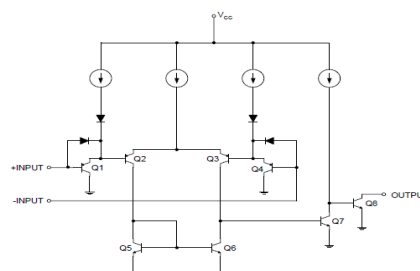


Figure 2. Functional Block Diagram of GS393/393A (Each comparator)

Absolute Maximum Ratings

| Condition | Symbol | Max |
|-----------------------------|----------------------|---------------|
| Power Supply Voltage | V _{CC} | ±20V or 40V |
| Differential input voltage | V _{I(DIFF)} | 40V |
| Input Voltage | V _I | -0.3V~40V |
| Operating Temperature Range | T _{opr} | -25°C ~+125°C |
| Storage Temperature Range | T _{stg} | -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₊ 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_{CC} | 2 | 36 | V |
| Operating Temperature Range | T_A | -40 | 85 | $^{\circ}\text{C}$ |

Electrical Characteristics

Limits in standard typeface are for $T_A=25^{\circ}\text{C}$, bold typeface applies over $T_A=-40^{\circ}\text{C}$ to 85°C (Note 3), $V_{CC}=5\text{V}$, $\text{GND}=0\text{V}$, 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 30V | 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 |
| | | | | | 400 | |
| Input Offset Current | $I_{IN+}-I_{IN-}$, $V_{CM}=0\text{V}$ | | | 5.0 | 50 | nA |
| | | | | | 200 | |
| 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 11V | | 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 | | μs |
| 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 |
| | $V_{IN}=0\text{V}$, $V_{IN+}=1\text{V}$, $V_O=30\text{V}$ | | | | 1 | μA |
| Saturation Voltage | $V_{IN}=1\text{V}$, $V_{IN+}=0$, $I_{SINK} \leq 4\text{mA}$ | | | 200 | 400 | mV |
| | | | | | 500 | |
| Thermal Resistance (Junction to Case) | DIP-8 | | | 93 | | $^{\circ}\text{C/W}$ |
| | SOIC-8 | | | 138 | | |

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.

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°C). The upper end of the common-mode voltage range is $V_{CC}-1.5\text{V}$ (at 25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the VCC.

Typical Performance characteristics

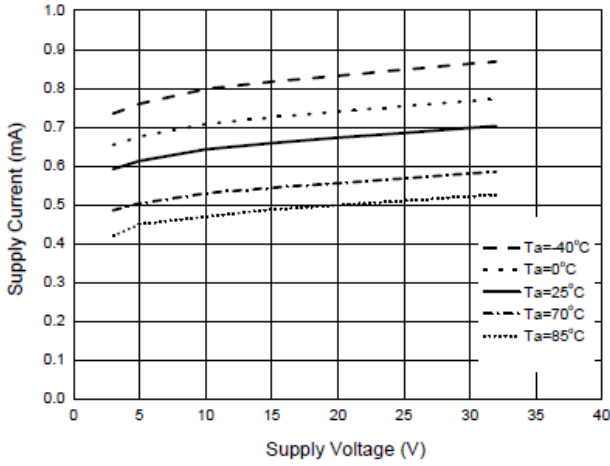


Figure 3. Supply Voltage vs. Supply Current

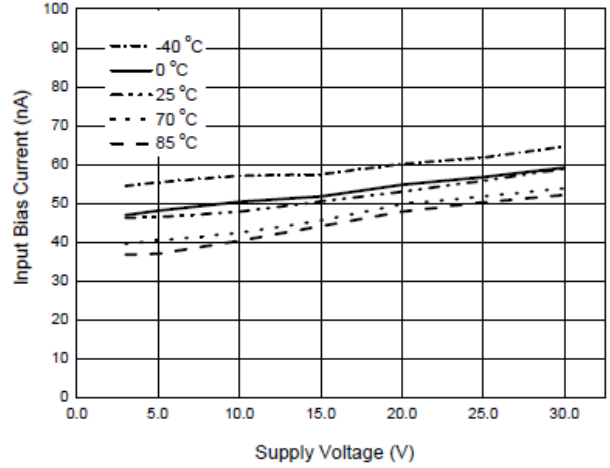


Figure 4. Supply Voltage vs. Input Bias Current

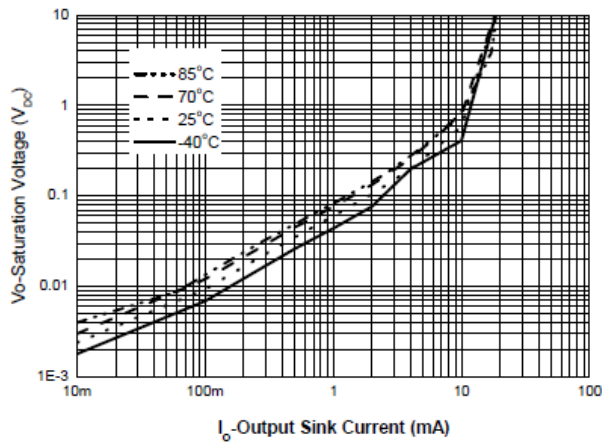


Figure 5. Output Sink Current vs. Saturation Voltage

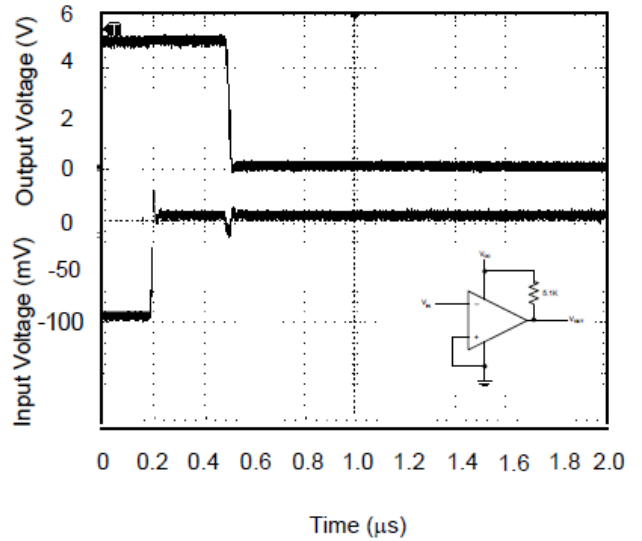


Figure 6. Response Time for 5mV Input Overdrive - Negative Transition

Typical Performance characteristics

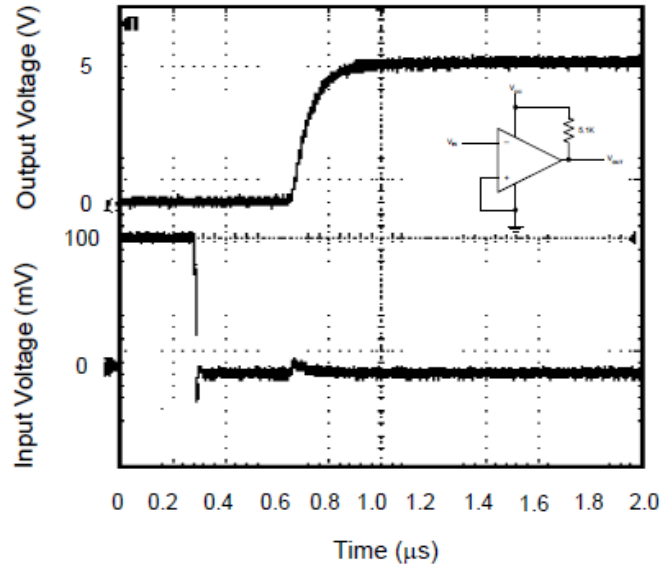


Figure 7. Response Time for 5mV Input Overdrive
- Positive Transition

Typical Applications

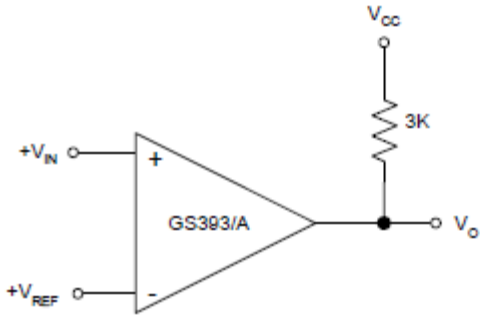


Figure 8. Basic Comparator

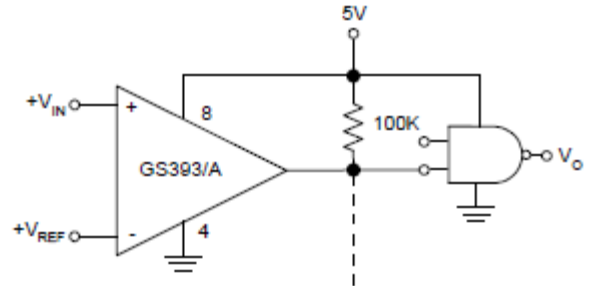


Figure 9. Driving CMOS

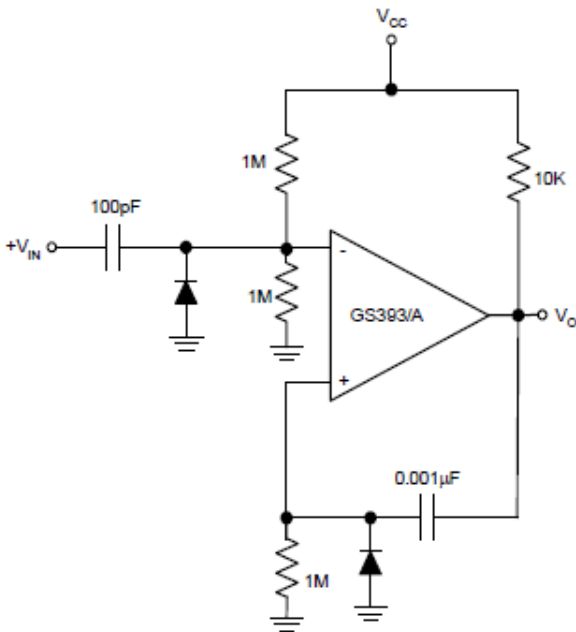


Figure 10. One Shot Multivibrator

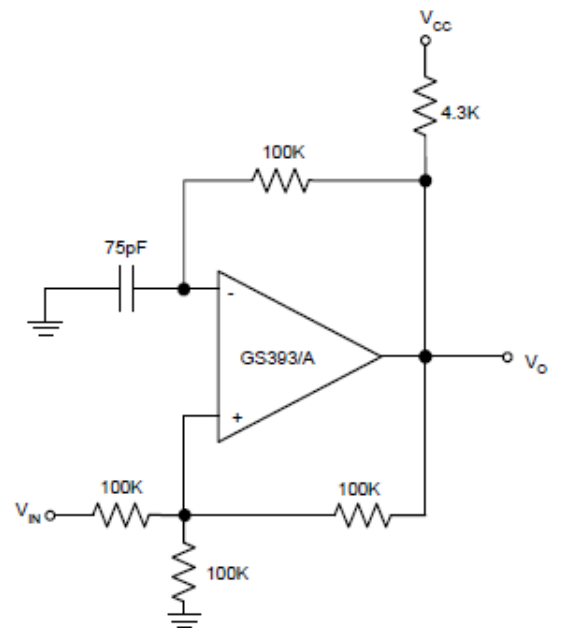
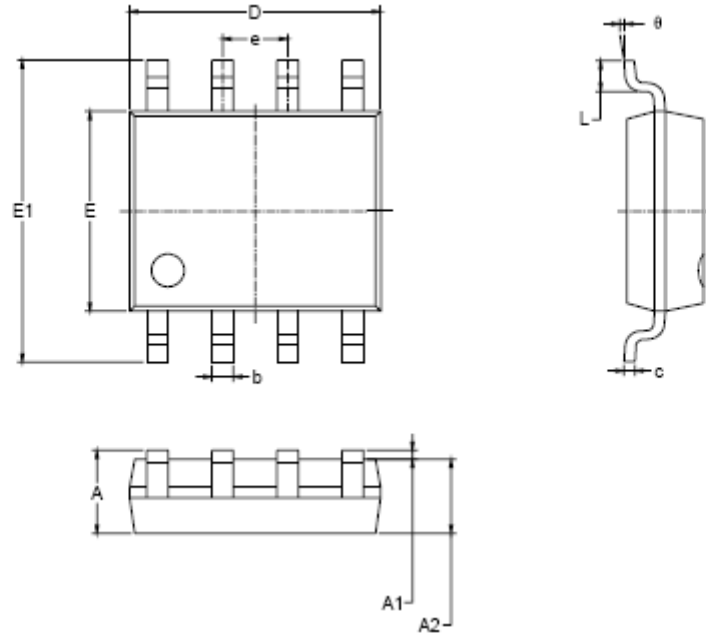
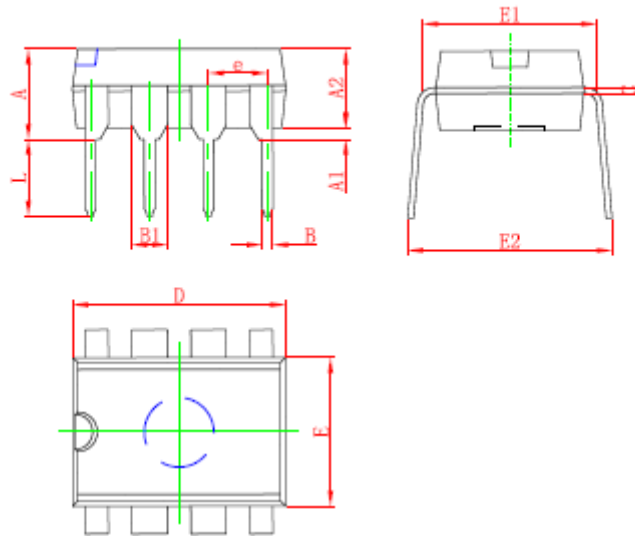


Figure 11. Squarewave Oscillator

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 | 0.006 | 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 |
| θ | 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 | 8.000 | 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 |

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