

## 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 at  $V_{CC}=5V$ : 0.4mA
- I Low Input Bias Current: 25nA (Typ)
- I Low Input Offset Current: 5nA (Typ)
- I Low Input Offset Voltage:  $\pm 1mV$  (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:  
GS331 Available in SOT23-5 Package

## General Description

The GS331 consists of a single precision voltage comparator with a typical input offset voltage of 1.0mV and high voltage gain. It is 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 GS331 is available in standard SOT-23-5 package.

## Applications

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

## Pin Configuration

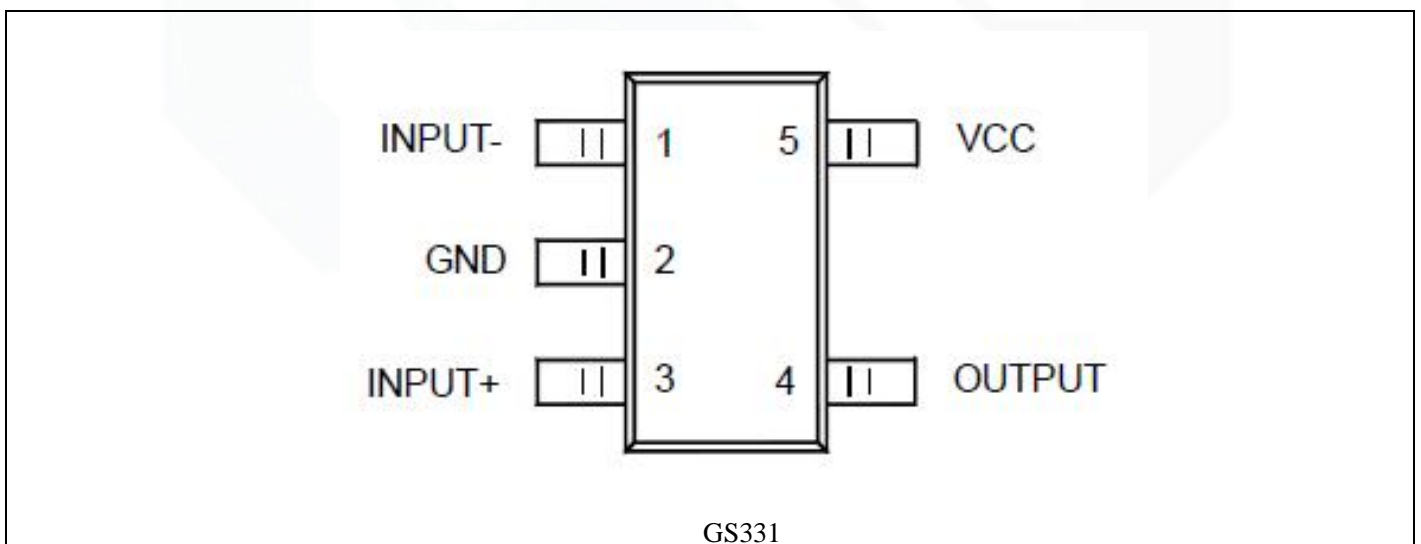


Figure 1. Pin Assignment Diagram

## Functional Block Diagram

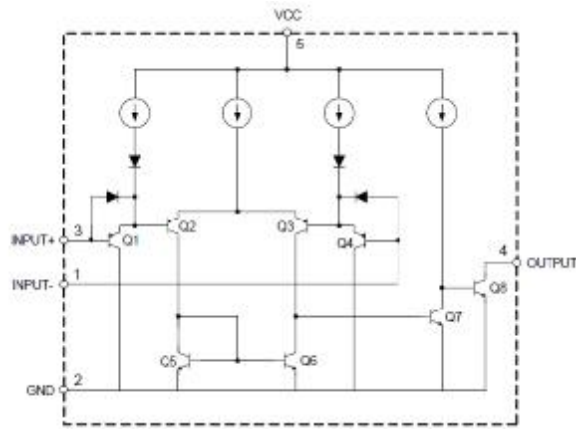


Figure 2. Functional Block Diagram of GS331

## 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
GS331	Single	GS331-TR	SOT23-5	Tape and Reel,3000	331

## Recommended Operating Conditions

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

## Electrical Characteristics

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Input Offset Voltage	$V_{OS}$	$V_{OUT}=1.4V$ , $V_{CC}=5$ to $30V$		1	5	mV	
					7.0		
Input Bias Current	$I_B$	$I_{IN+}$ or $I_{IN-}$ with output in linear range, $V_{CM}=0V$		25	250	nA	
					400		
Input Offset Current	$I_{IO}$	$I_{IN+}-I_{IN-}$ , $V_{CM}=0V$		5	50	nA	
					200		
Input Common Mode Voltage Range (Note 4)		$V_{CC}=30V$	0		$V_{CC}-1.5$	V	
Supply Current	$I_{CC}$	$R_L=\infty$	$V_{CC}=5V$		0.4	1.0	mA
						2.0	
				$V_{CC}=30V$	0.5	1.7	
					3.0		
Voltage Gain	$G_V$	$V_{CC}=15V$ , $R_L \geq 15k\Omega$ , $V_{OUT}=1$ to $11V$	50	200		V/mV	
Large Signal Response Time		$V_{IN}$ =TTL Logic Swing, $R_L=5.1k\Omega$		200		ns	
Response Time		$R_L=5.1k\Omega$		1.3		$\mu s$	
Output Sink Current	$I_{SINK}$	$V_{IN-}=1V$ , $V_{IN+}=0V$ , $V_{OUT}=1.5V$	6.0	16		mA	
Output Leakage Current	$I_{LEAK}$	$V_{IN-}=0V$ , $V_{IN+}=1V$ , $V_{OUT}=5V$		0.1		nA	
		$V_{IN-}=0V$ , $V_{IN+}=1V$ , $V_{OUT}=30V$			1	$\mu A$	
Saturation Voltage	$V_{SAT}$	$V_{IN-}=1V$ , $V_{IN+}=0V$ , $I_{SINK} \leq 4mA$		200	400	mV	
					500		

Note 3: These specifications are limited to  $-40^{\circ}C \leq T_A \leq 85^{\circ}C$ . 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  $25^{\circ}C$ ). The upper end of the common mode voltage range is  $V_{CC}-1.5V$  (at  $25^{\circ}C$ ), but either or both inputs can go to 18V without damages, independent of the magnitude of the VCC.

## Typical Performance characteristics

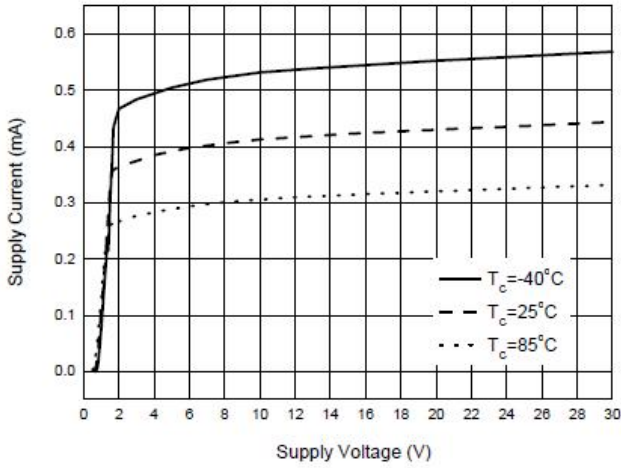


Figure 4. Supply Current vs. Supply Voltage

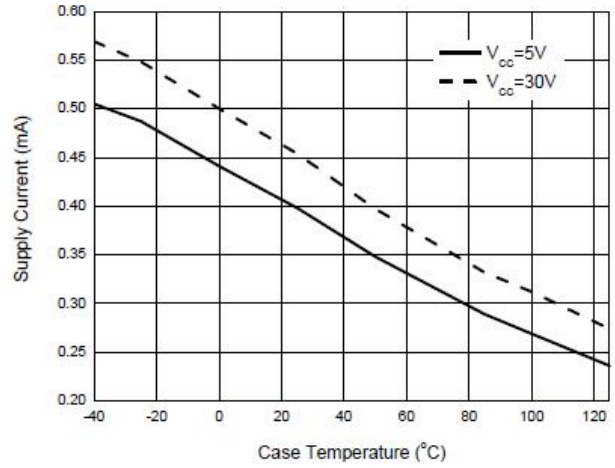


Figure 5. Supply Current vs. Case Temperature

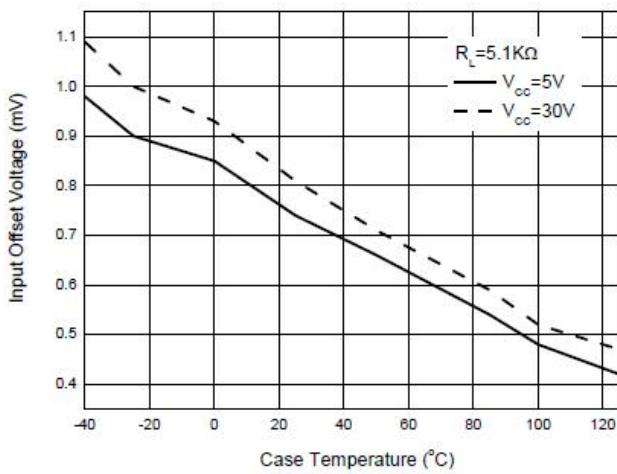


Figure 6. Input Offset Voltage vs. Case Temperature

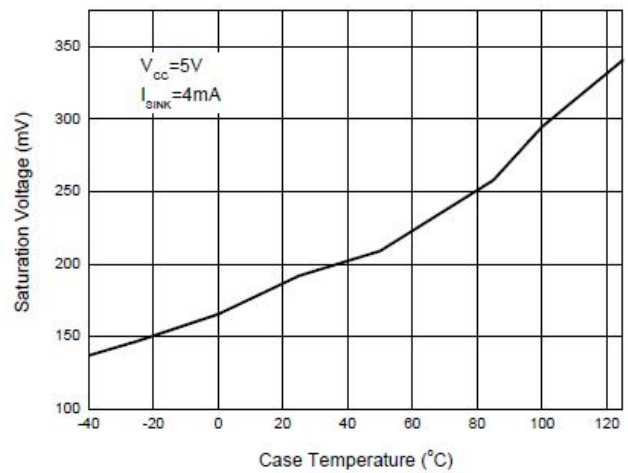


Figure 7. Saturation Voltage vs. Case Temperature

Typical Performance Characteristics (Continued)

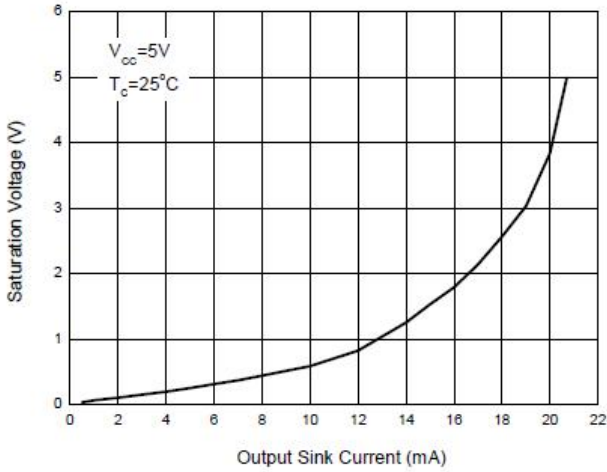


Figure 8. Saturation Voltage vs. Output Sink Current

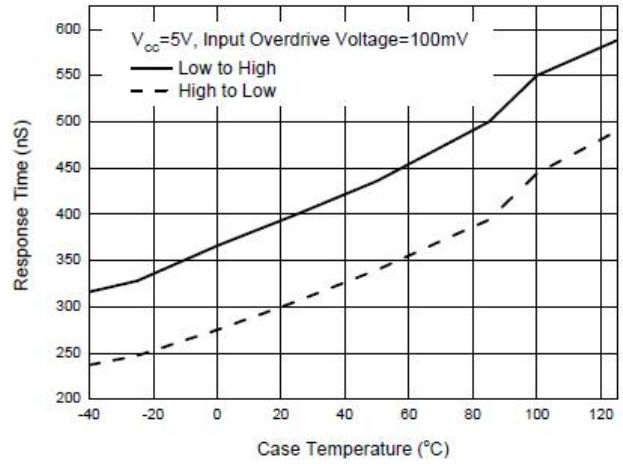


Figure 9. Response Time vs. Case Temperature

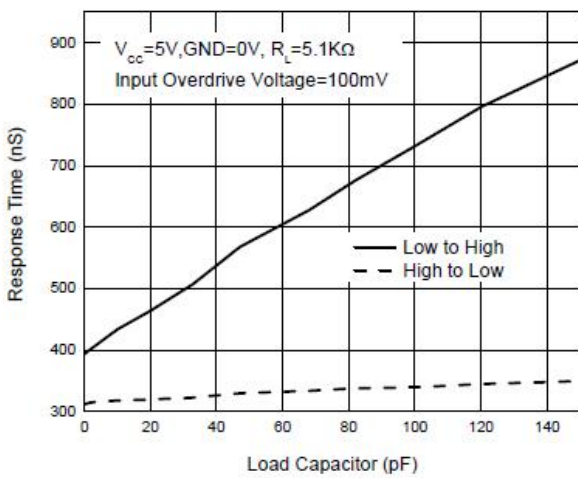


Figure 10. Response Time vs. Load Capacitor

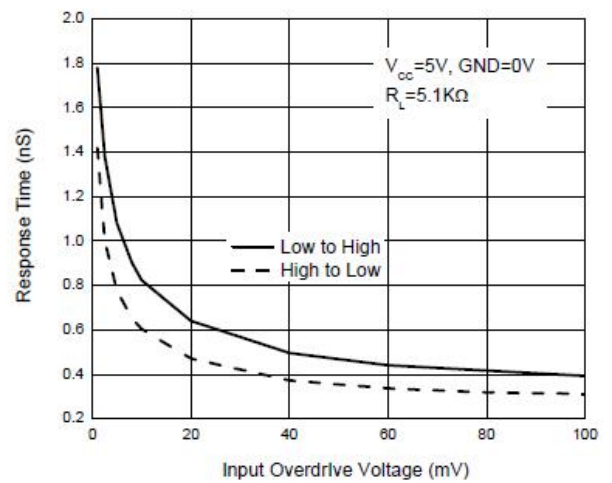


Figure 11. Response Time vs. Input Overdrive Voltage

Typical Performance Characteristics (Continued)

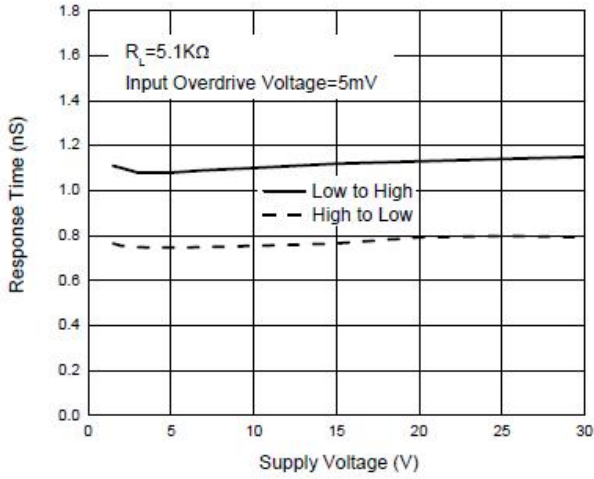


Figure 12. Response Time vs. Supply Voltage

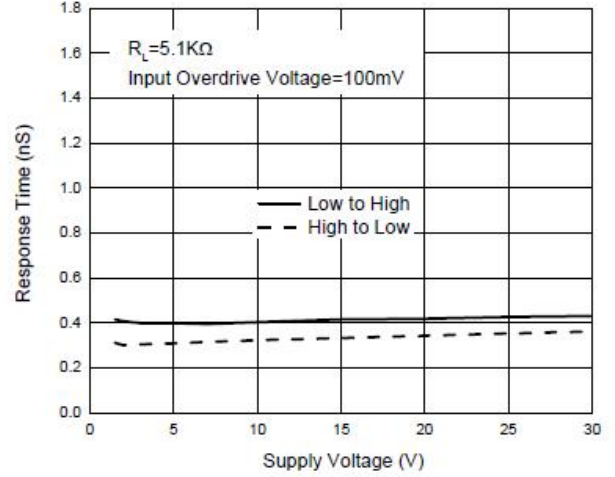


Figure 13. Response Time vs. Supply Voltage

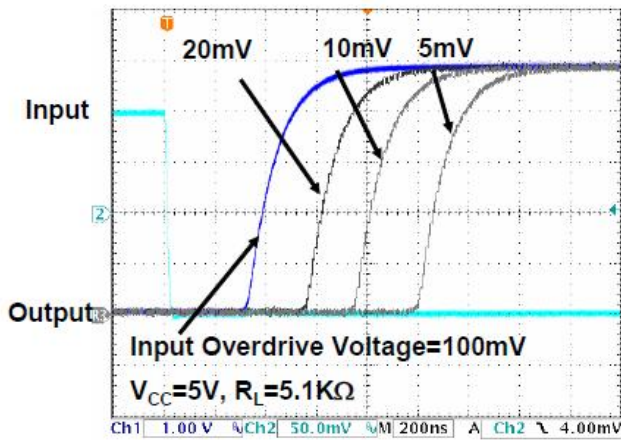


Figure 14. Response Time for Positive Transition

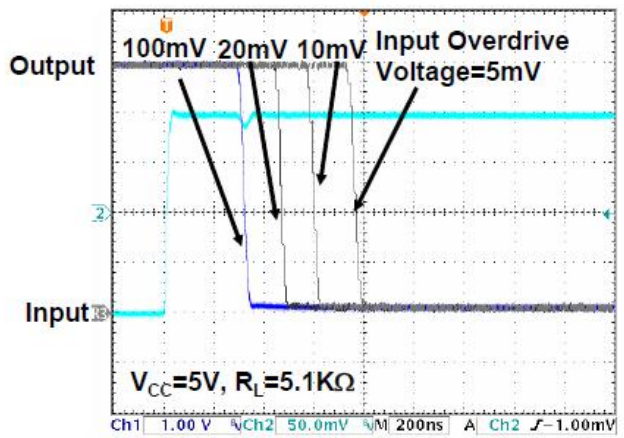


Figure 15. Response Time for Negative Transition

Typical Performance Characteristics (Continued)

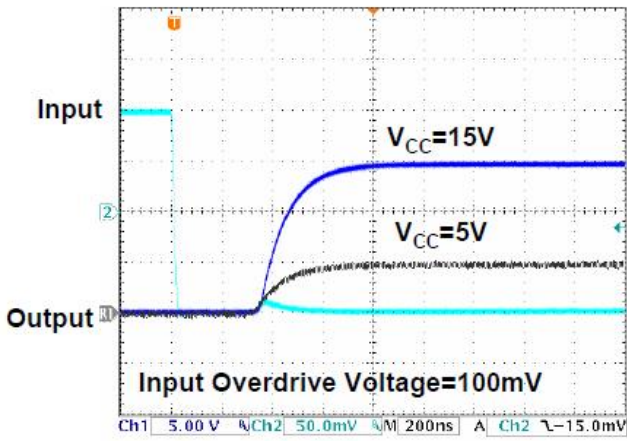


Figure 16. Response Time for Positive Transition

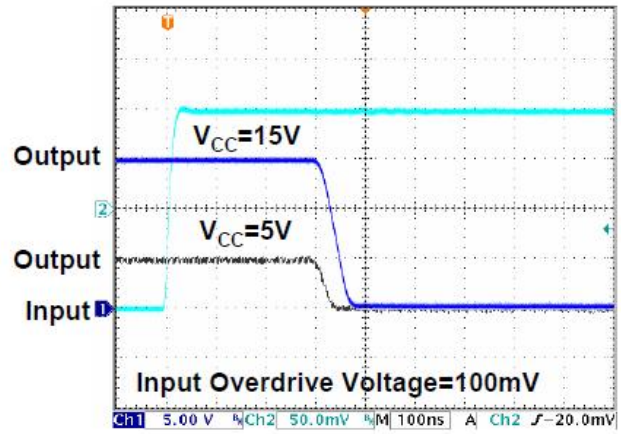


Figure 17. Response Time for Negative Transition

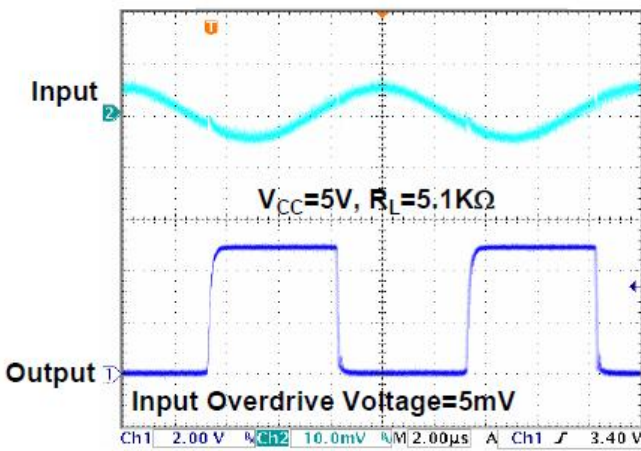


Figure 18. 100kHz Response

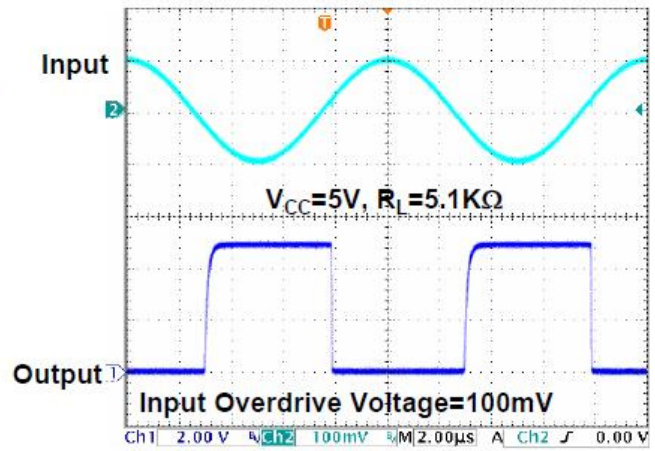


Figure 19. 100kHz Response

Typical Performance Characteristics (Continued)

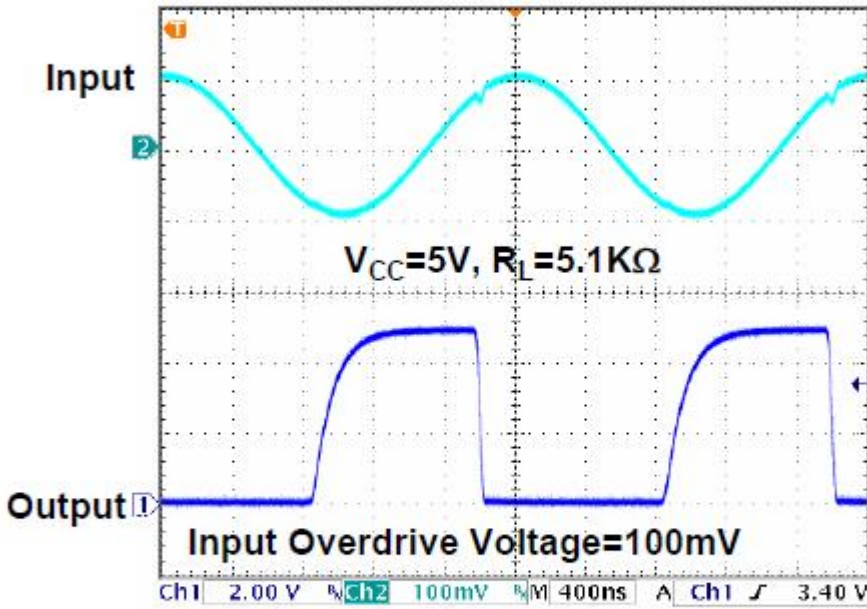


Figure 20. 500kHz Response



Typical Applications

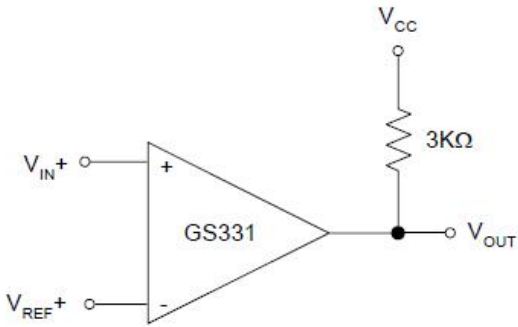


Figure 21. Basic Comparator

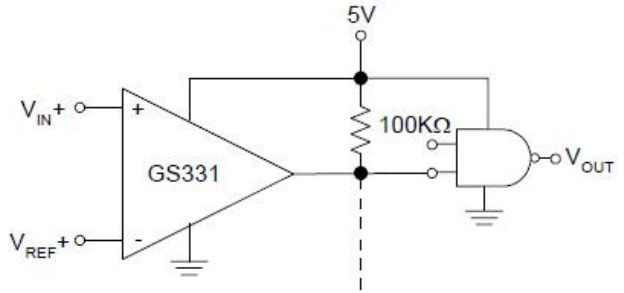


Figure 22. Driving CMOS

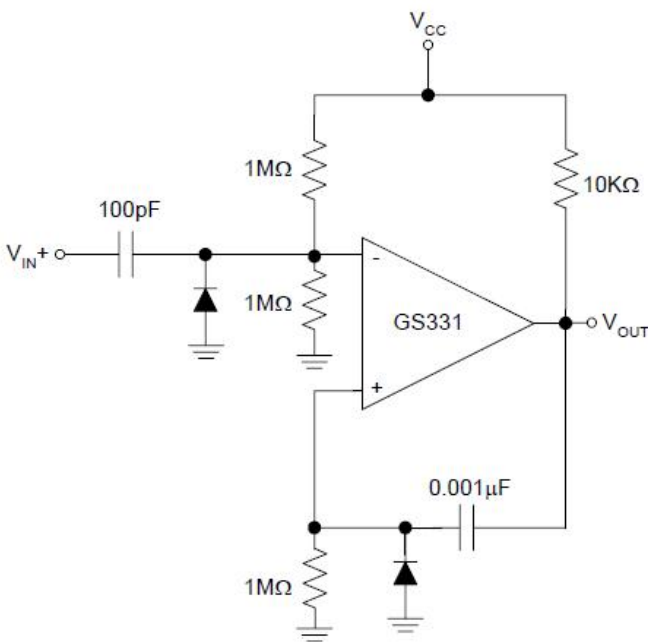


Figure 23. One Shot Multivibrator

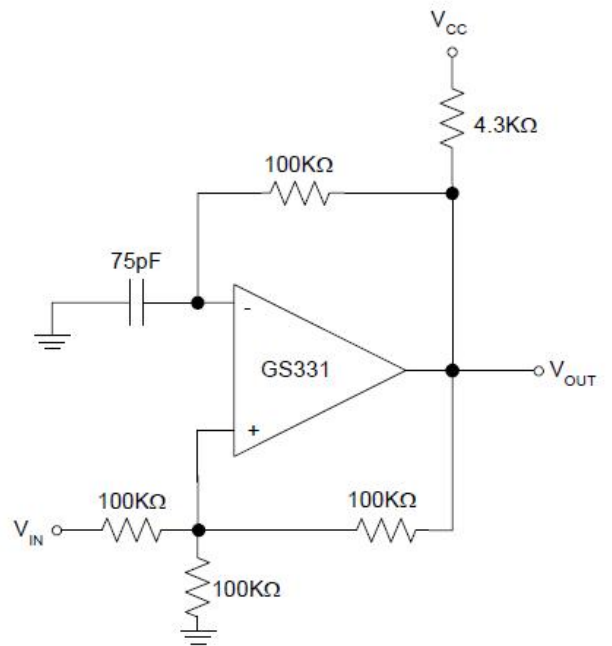
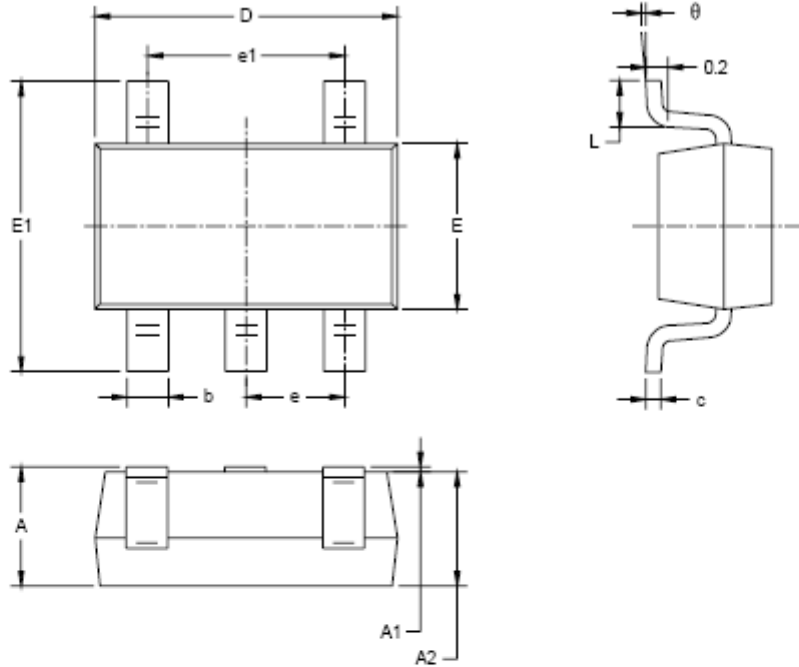


Figure 24. Squarewave Oscillator

Package Information

SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.118
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

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