Low Power Low Offset Voltage Single Comparators

Features

- Wide Supply Voltage Range
  Single Supply: 2.0V to 36V
  Dual Supplies: ±1.0V to ±18V
- Low Supply Current at Vcc=5V: 0.4mA
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current: 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

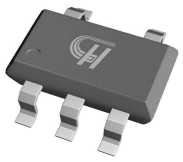
General Description

The LM331 consist of single 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 wide range of voltage. Operation from split power supply is also possible and the low power supply current drain is independent of the megnitude of the power supply voltage.

The LM331 is available in the standard SOT23-5 package.

Applications

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



SOT23-5

Figure 1. Package Type of LM331

Low Power Low Offset Voltage Single Comparators

Pin Configuration

SOT23-5

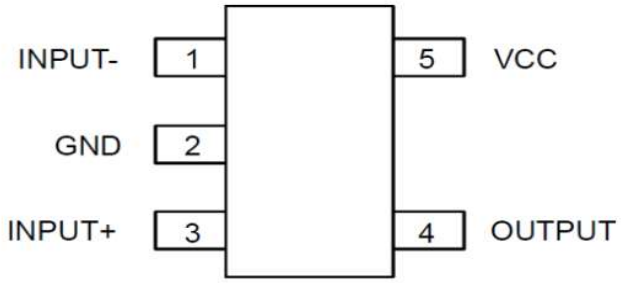
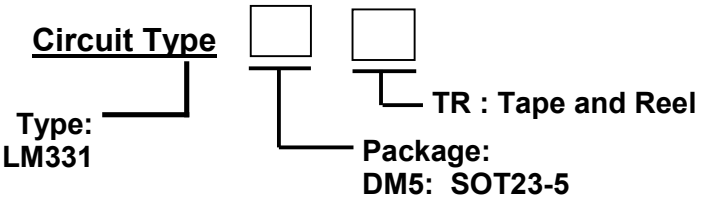


Figure 2. Pin Configuration of LM331 (Top View)

Pin Function Table

SOT23-5	Name	Function Description
1	INPUT-	Inverting Inputs
2	GND	Negative Power Supply
3	INPUT+	Non-inverting Inputs
4	OUTPUT	Outputs
5	VCC	Positive Power Supply

Ordering Information



Ordering Code note b

Part Number	Marking ID	Temperature Range	Package	Package Type
LM331DM5TR	331XX	-40'C to +85'C	SOT23-5	3000pcs/TR

note a. marking information: XX, the 1ST X is date code-Year(A=2010, B=2011,...)

the 2nd X is date code-month(A=Jan, B=Feb,...L=Dec). for example: S5BBA (2011,January)

Low Power Low Offset Voltage Single Comparators

Functional Block Diagram

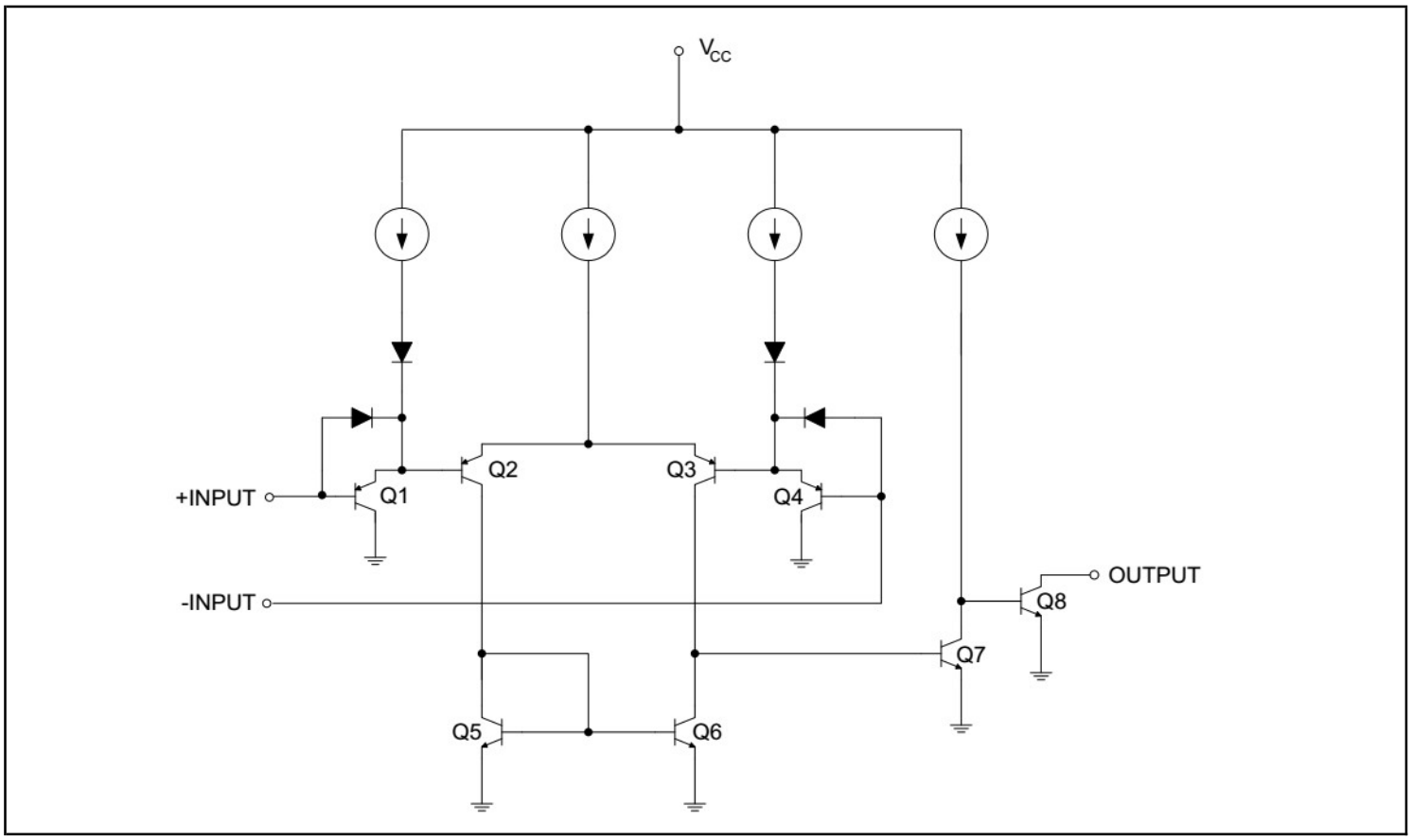
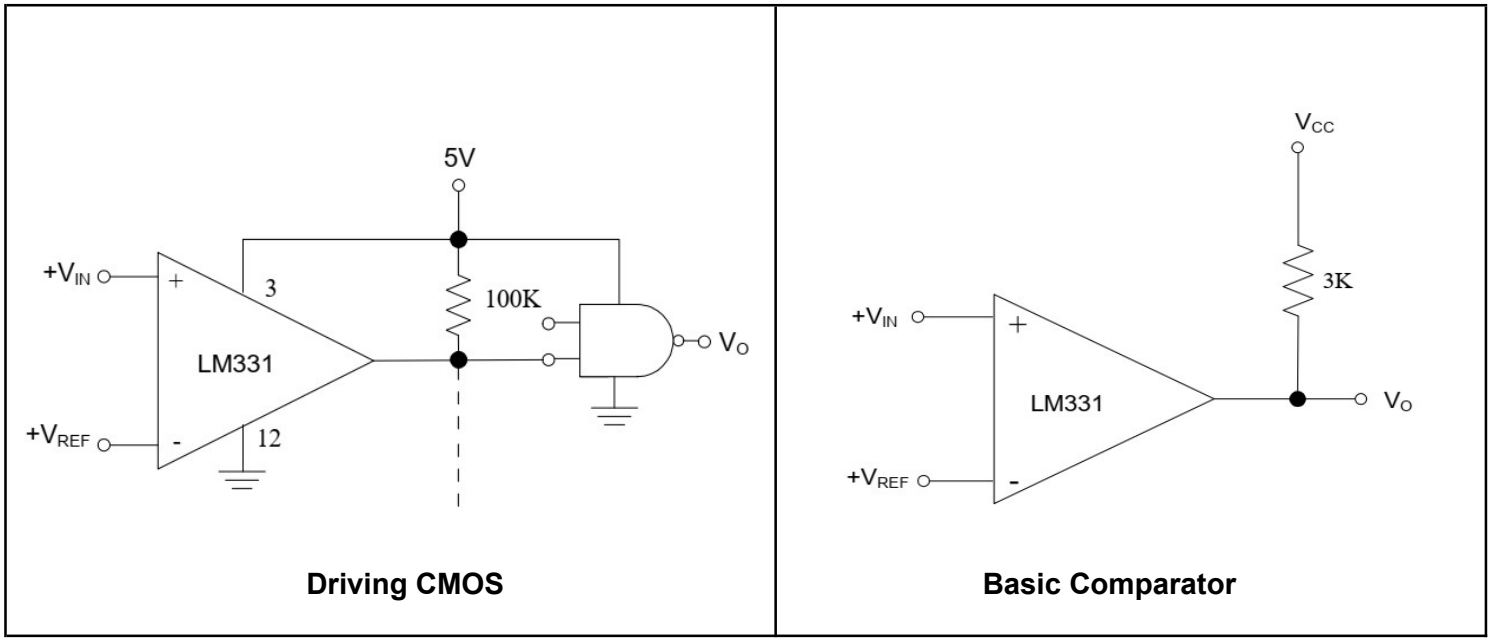


Figure 3. Functional Block Diagram of LM331

Typical Application Circuit



Driving CMOS | **Basic Comparator**

Figure 4. Typical Application Circuit of LM331

Low Power Low Offset Voltage Single Comparators

Absolute Maximum Ratings Note 1

Parameter		Symbol	Value	Unit
Supply Voltage		V_{CC}	40	V
Difference Input Voltage		V_{ID}	±40	V
Input Voltage Range		V_{IN}	-0.3 to 40	V
Input Current (V_{IN}<-0.3V)		I_{IN}	50	mA
Output Voltage		V_{out}	40	V
Output Short-Circuit to Ground		-	Continuous	-
Power Dissipation @T_A=+25'C	SOT23-5	P_D	620	mW
Storage Temperature Range		T_{STG}	-65 to 150	'C
Operating Junction Temperature		T_J	+150	'C
Lead Temperature (Soldering, 10s)		T_{LEAD}	+260	'C
ESD Class(Human Body Model)		HMB	2000	V
ESD Class(Machine Model)		MM	200	

Note 1: Stresses above those listed under"Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	2	36	V
Operating Junction Temperature Range	T_A	-40	+125	'C

Low Power Low Offset Voltage Single Comparators

Electrical Characteristics:

(Limits in standard typeface are for TA=25 `C, bold tyeface applies over TA=-40'C to +85'C[note2] VCC=5V, GND=0V, unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Type	Max	Unit
Input Offset Voltage	VOS	VOut=1.4V, VCC=5V to 30V	-	1.0	5.0	mV
			-	-	7	
Input Bias Current	IB	IIN+ or IIN- with output in linear Range, VCM=0V	-	25	250	nA
			-	-	400	
Input Offset Current	IOS	IIN+ - IIN-, VCM = 0V	-	5.0	50	nA
			-	-	200	
Input Common Mode Voltage Range[note3]	VCM	VCC=30V	0	-	VCC-1.5	V
Supply Current	IO	VCC=5V, RL = ∞	-	0.4	1.0	mA
			-	-	2.0	
		VCC=30V, RL = ∞	-	0.7	1.7	
			-	-	3.0	
Voltage Gain	GV	RL>=15KΩ, VCC=15V, VOut=1V to 11V	50	200	-	V/mV
Large Signal Response Time	Tr	VIN=TTL Logic Swing, VREF=1.4V, VRL=5V, RL=5.1KΩ	-	200	-	ns
Response Time	TRS	VRL=5V, RL=5.1KΩ	-	1.3	-	us
Output Sink Current	ISINK	VIN- =1V, VIN+=0, VO=1.5V	6.0	16	-	mA
Output Leakage Current	ILeakage	VIN- =0V, VIN+=1V, VO=5V	-	0.1	-	nA
		VIN- =0V, VIN+=1V, VO=30V	-	-	1.0	uA
Saturation Voltage	VSAT	VIN- =1V, VIN+=0, ISINK<=4mA	-	200	400	mV
			-	-	500	
Thermal Resistance (Junction to Case)	θJC	SOT23-5	-	32	-	'C/W
Thermal Resistance (Junction to Ambient)	θJA	SOT23-5	-	195	-	'C/W

note 2. These specifications are limited to -40°C<=TA<=85°C. Limits over temperature are guaranteed by design, but not tested in production

3. 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 VCC-1.5V (at 25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the VCC

Low Power Low Offset Voltage Single Comparators

Performance Characteristics (Unless Otherwise Specified.)

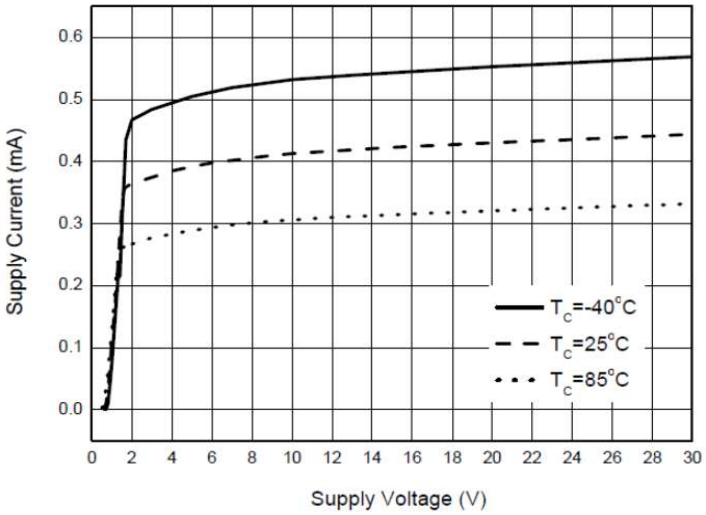


Figure. 5 Supply Current vs. Supply Voltage

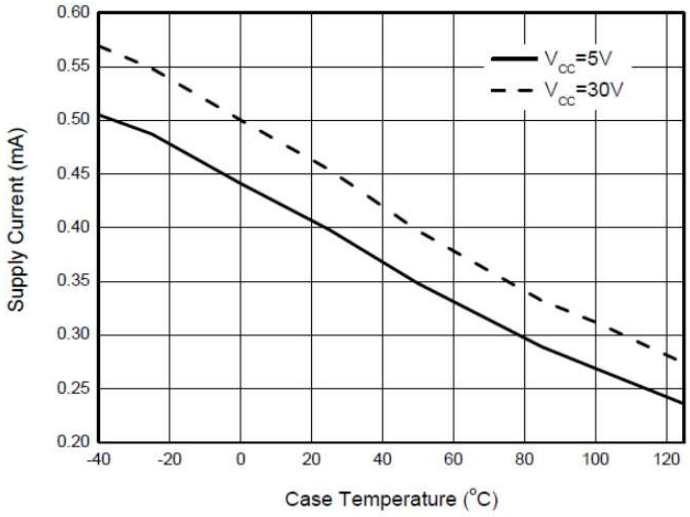


Figure. 6 Supply Current vs. Case Temperature

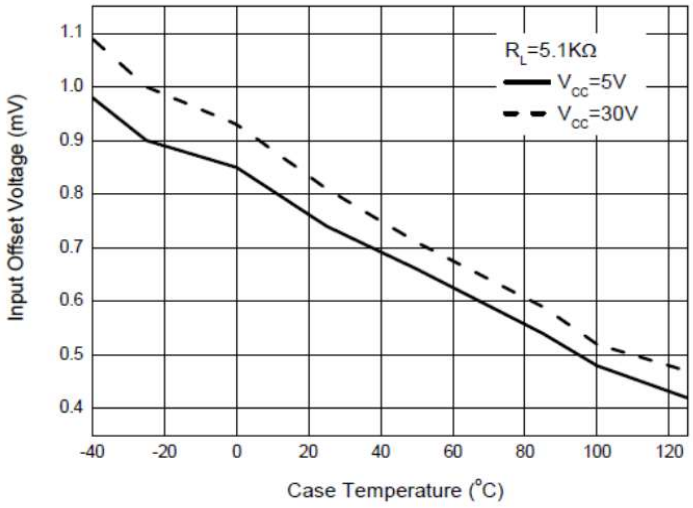


Figure.7 Input Offset Voltage vs. Case Temperature

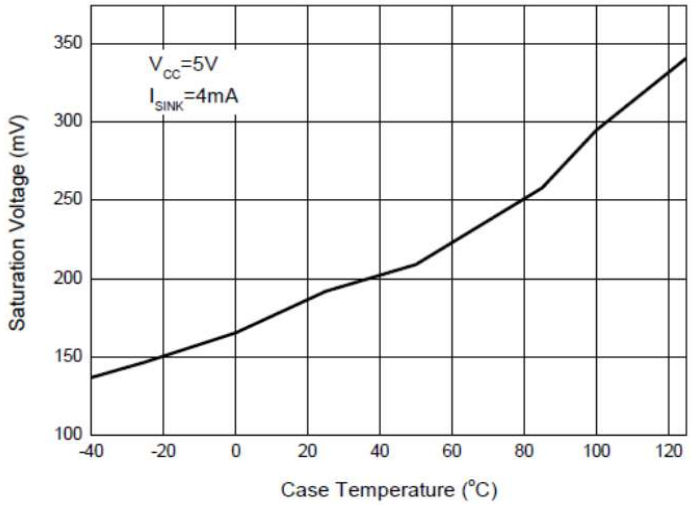


Figure. 8 Saturation Voltage vs. Case Temperature

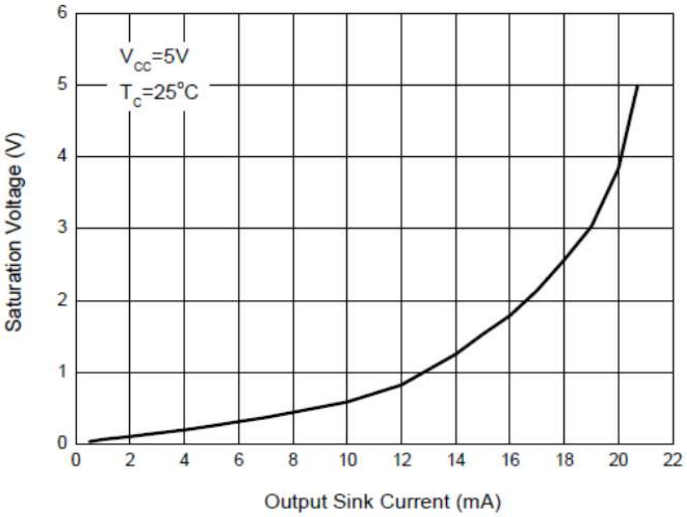


Figure. 9 Saturation Voltage vs. Output Sink Current

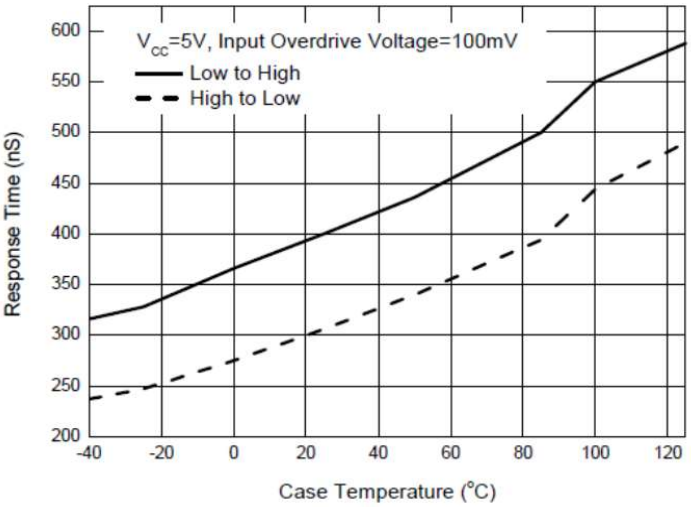


Figure. 10 Response Time vs. Case Temperature

Low Power Low Offset Voltage Single Comparators

Performance Characteristics (con.)

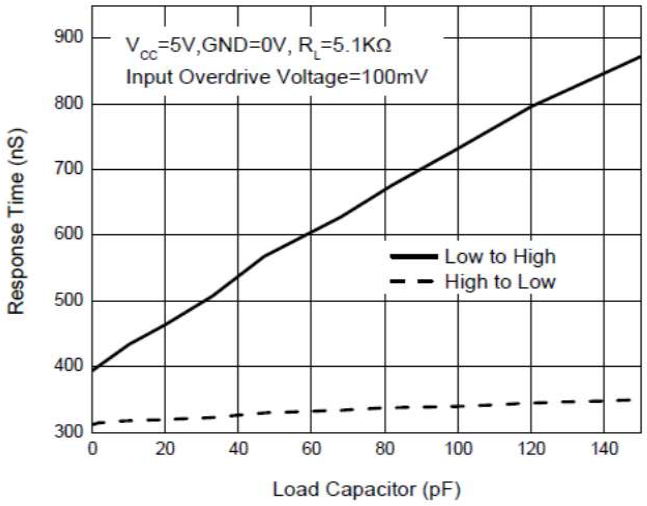


Figure. 11 Response Time vs. Load Capacitor

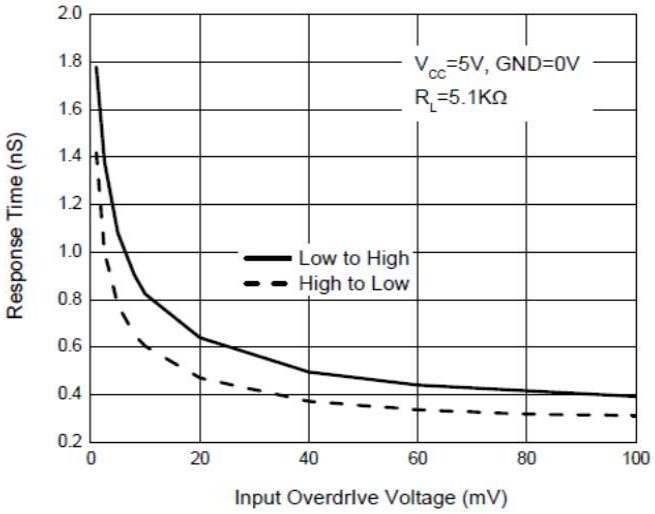


Figure. 12 Response Time vs. Input Overdrive Voltage

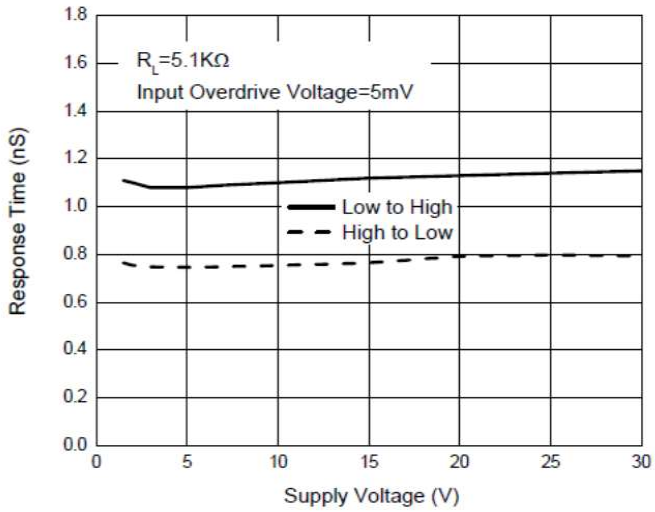


Figure. 13 Response Time vs. Supply Voltage

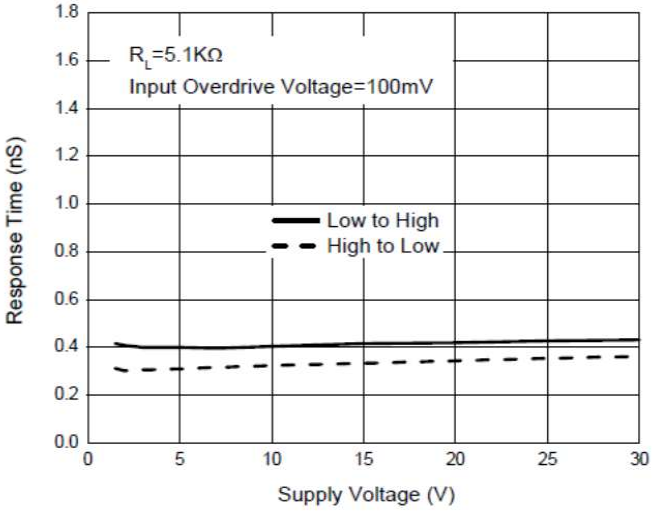


Figure. 14 Response Time vs. Supply Voltage

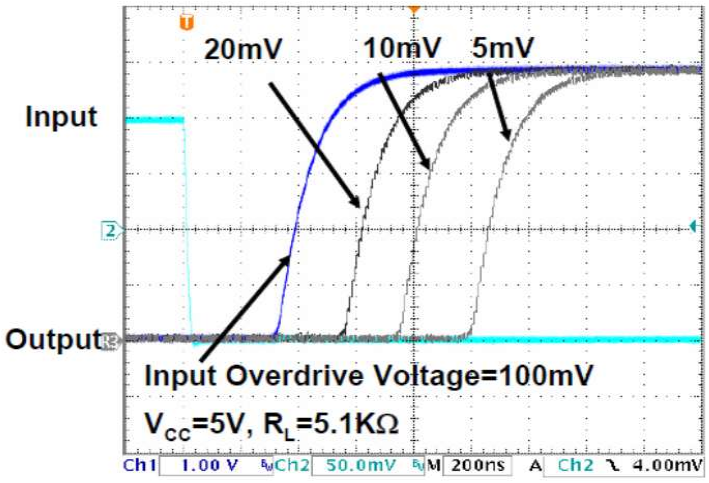


Figure. 15 Response Time for Positive Transition

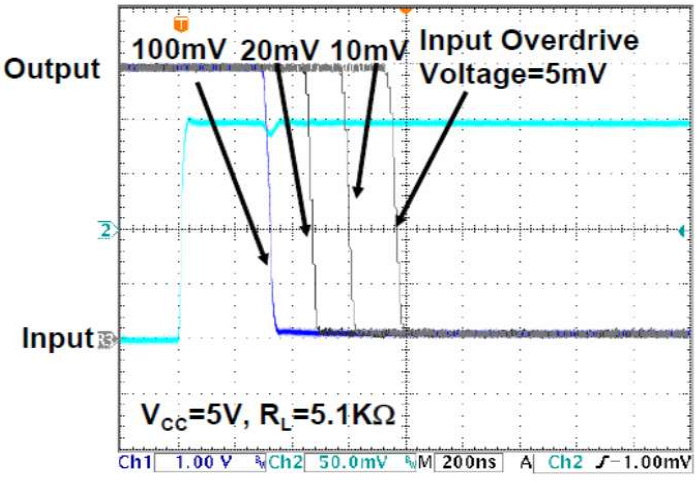


Figure. 16 Response Time for Negative Transition

Low Power Low Offset Voltage Single Comparators

Performance Characteristics (con.)

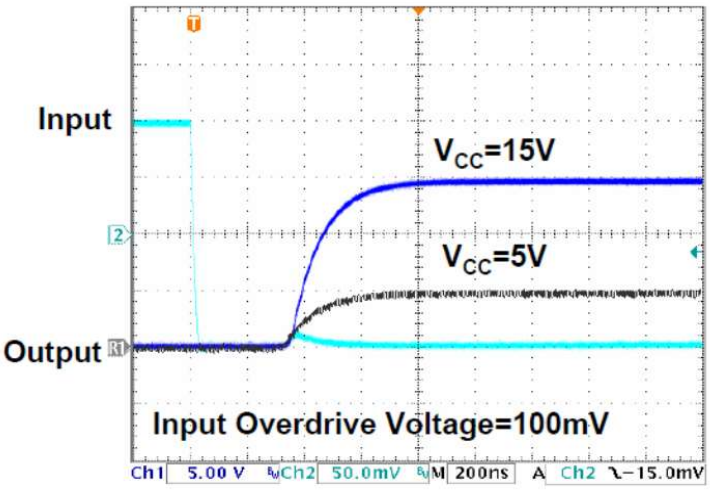


Figure. 17 Response Time for Positive Transition

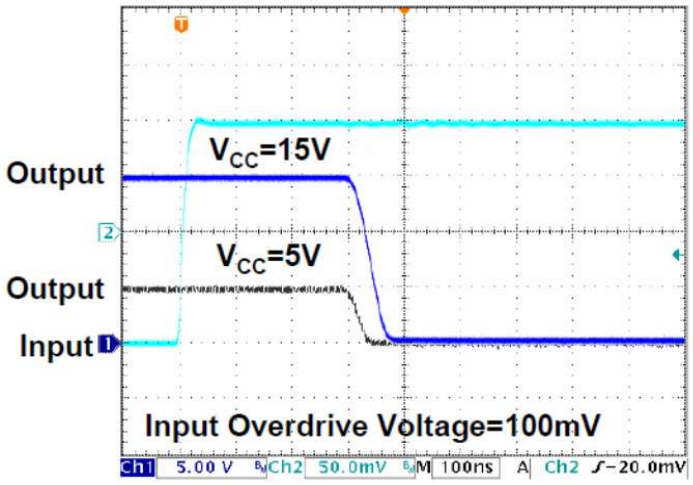


Figure. 18 Response Time for Negative Transition

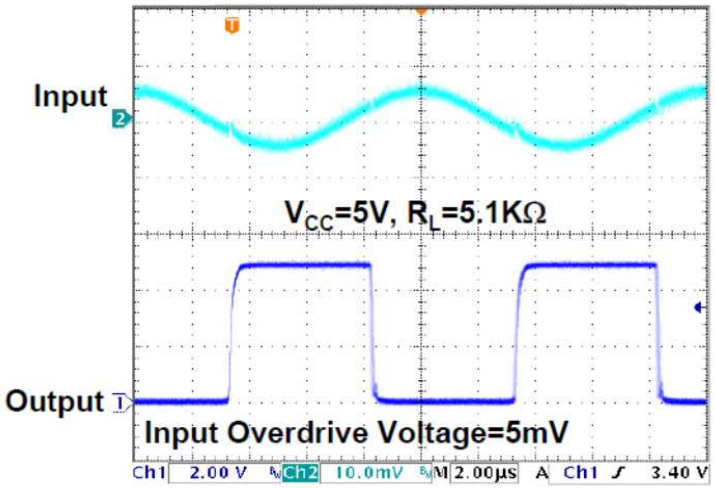


Figure. 19 100kHz Response

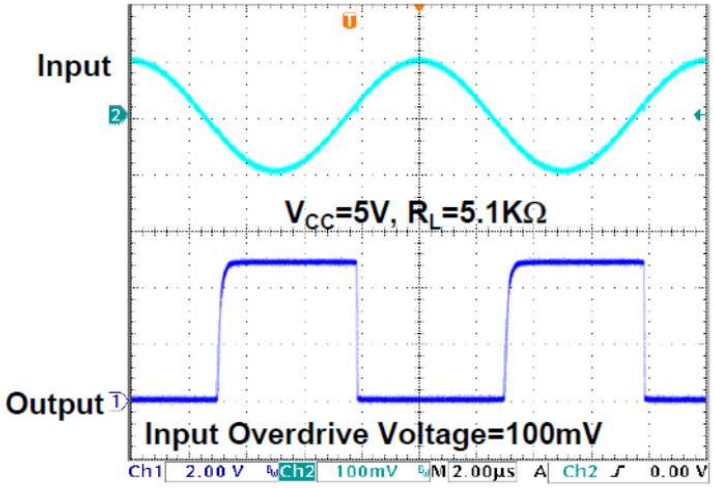


Figure. 20 100kHz Response

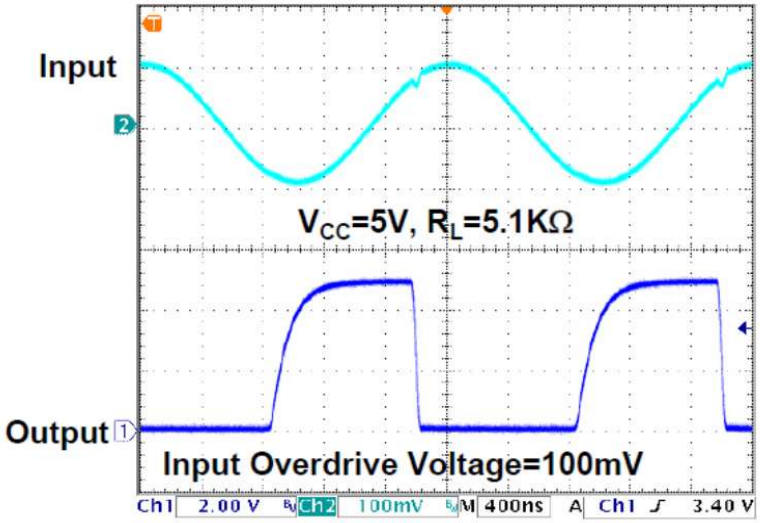


Figure. 21 500kHz Response

Low Power Low Offset Voltage Single Comparators

Typical Application Circuit

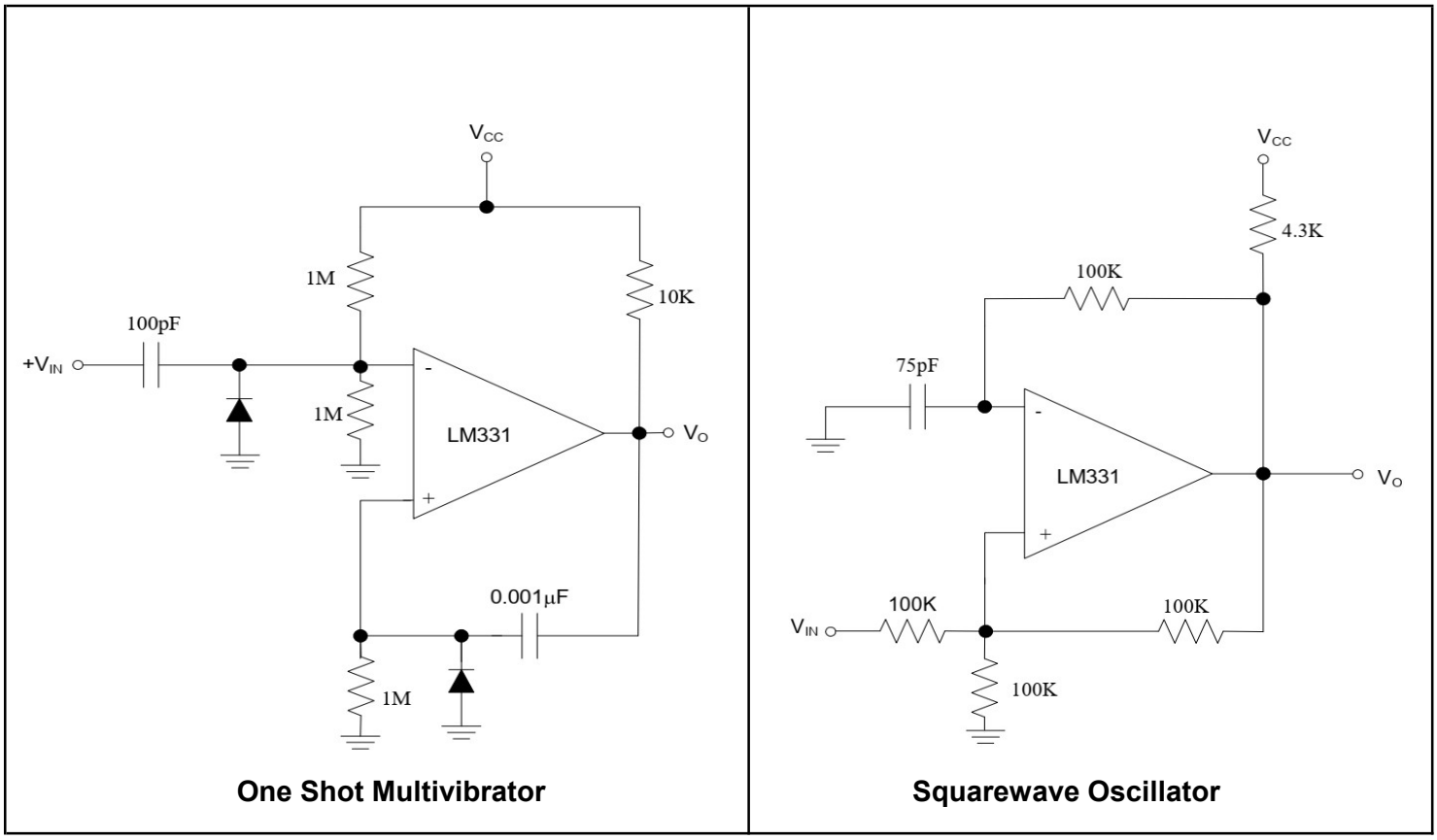


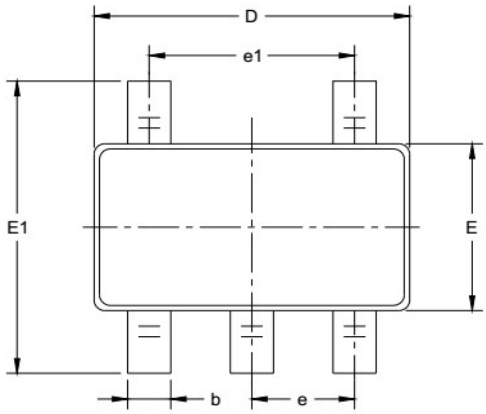
Figure 22. Typical Application Circuit of LM331

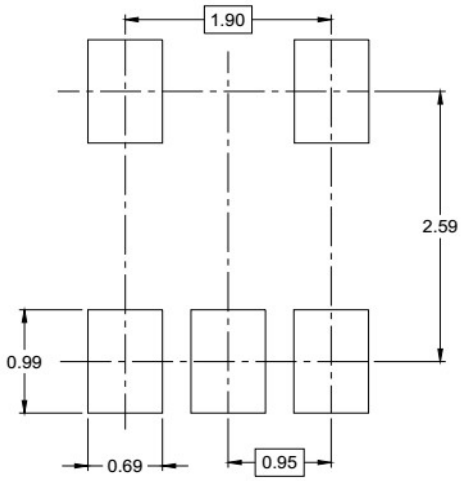
Low Power Low Offset Voltage Single Comparators

Mechanical Dimensions

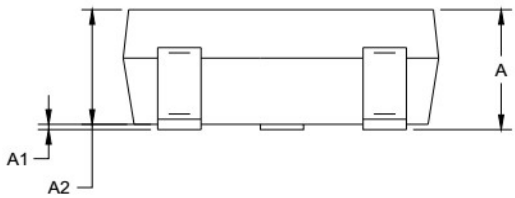
DM5 : SOT23-5

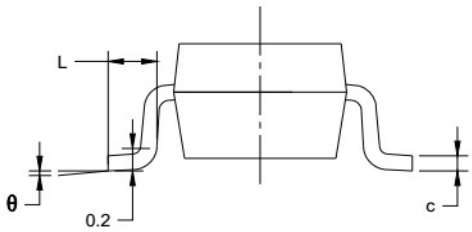
Unit: mm (inch)





RECOMMENDED LAND PATTERN (Unit: mm)





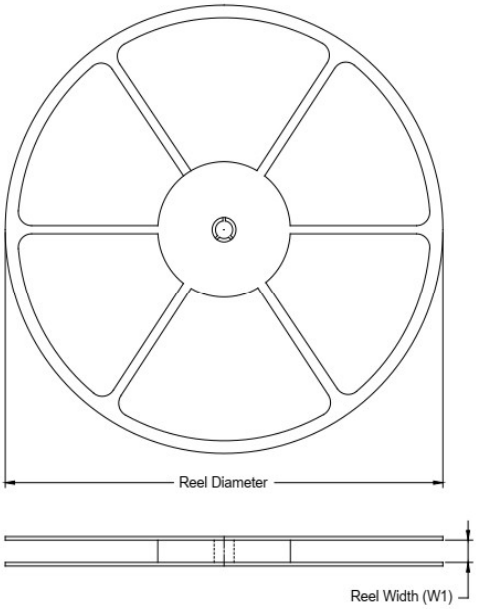
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

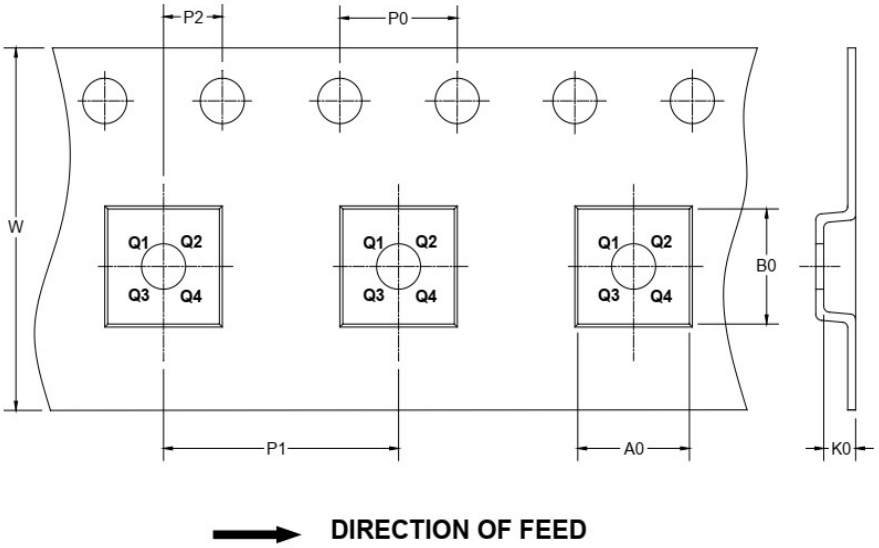
Low Power Low Offset Voltage Single Comparators

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

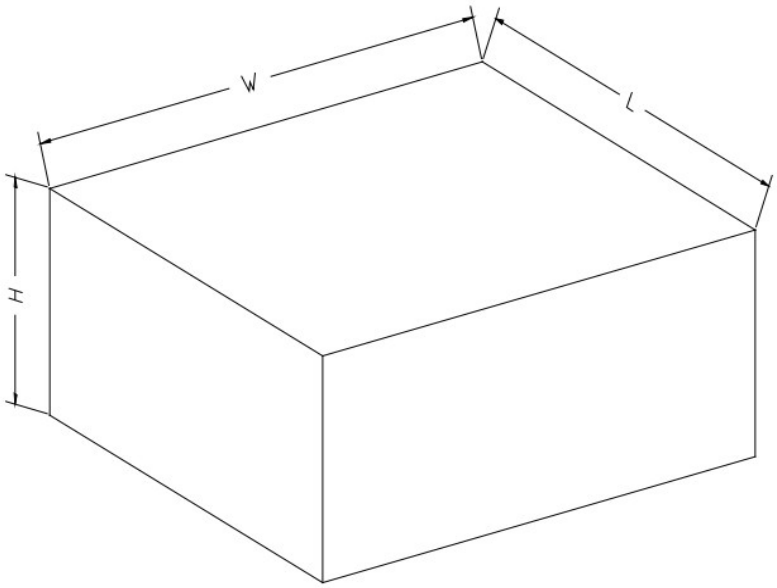


NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23-5	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18