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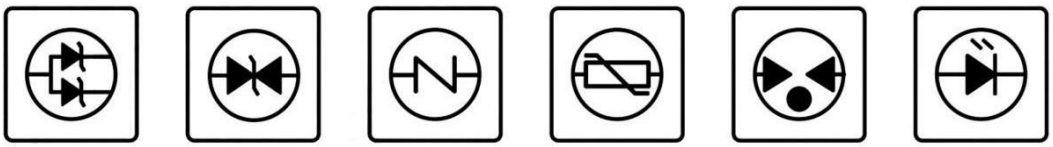
SEMICONDUCTOR



TS331ILT(MS)

Product specification

GENERAL DESCRIPTION

The TS331ILT(MS) is a single comparator version that is an open drain output comparator for maximum flexibility. It can operate in the voltage range of 2.1V to 5.5V, and each channel has 50 at low output μ Low power consumption of A (TYPE). The TS331ILT(MS) are themost cost-effective solutions for applications where low voltage operation, low power and space saving are the primary specifications in circuit design for portable consumer products.
The TS331ILT(MS) (MS) areavailable in Green SOT-23-5 packages. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- Supply Range: +2.1V to +5.5V
- Low Supply Current
- 50μA (TYP) per channel at VS = 5V and output low
- Input Common-Mode Voltage Range Includes Ground
- Low Output Saturation Voltage 100mV Typical
- Open-Drain Output for Maximum Flexibility
- SPECIFIED UP TO +125°C
- Micro SIZE PACKAGES: SOT23-5

APPLICATIONS

- Hysteresis Comparators
- Oscillators
- Window Comparators
- Industrial Equipment
- Test and Measurement

Reference News

PACKAGE OUTLINE	Marking
	
SOT-23-5	TS331ILT(MS)

SIMPLIFIED SCHEMATIC

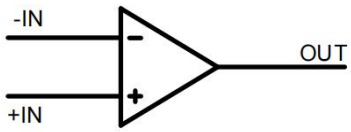


Figure 1. Simplified Schematic

Absolute Maximum Ratings(1)

		MIN	MAX	UNIT
Voltage	Supply, V_s=(V+) - (V-)		7	V
	Input pin (IN+, IN-) (2)	(V-) - 0.3	(V+) + 0.3	V
	Signal output pin (3)	(V-) - 0.3	(V+) + 0.3	V
Current	Signal Input pin (IN+, IN-) (2)	-10	10	mA
	Signal output pin (3)	-55	55	mA
Temperature	Operating Range	-40	85	°C
	Storage	-65	150	°C
	Junction		150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±55mA or less.

(3) Short-circuit from output to VCC can cause excessive heating and eventual destruction.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins (1)	±2000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins (2)	±1000	V

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

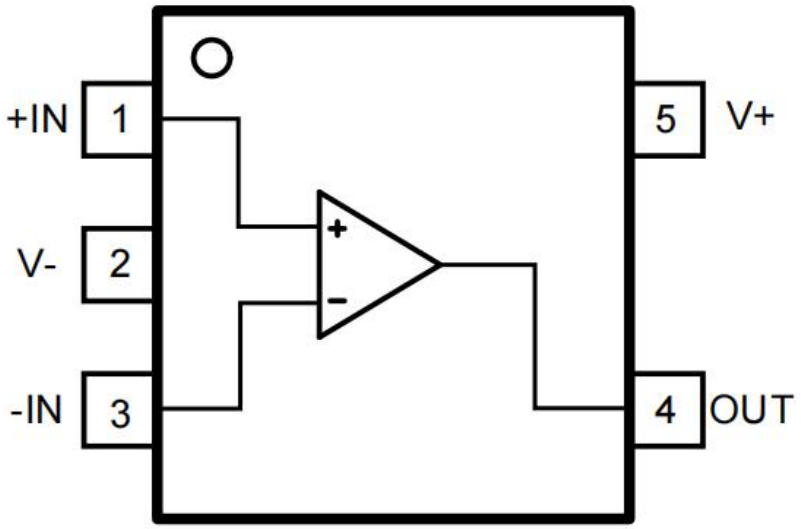
		MIN	MAX	UNIT
Supply voltage， Vs= (V+) - (V-)	Single-supply	2.1	5.5	V
	Dual-supply	±0.9	±2.75	V

PACKAGE/ORDER INFORMATION

MODEL	OPERATING TEMPERATURE RANGE	PACKAE DESCRIPTION	QTY
TS331ILT(MS)	-40°C~85°C	SO-T23-5	3000

Pin Configuration and Functions (Top View)

TS331ILT(MS)



SOT-23-5

Pin Description

Pin Name	Pin Number	I/O	Description
	SOT23-5		
+IN	1	I	Noninverting input
V-	2	-	Negative(lowest) power supply
-IN	3	I	Inverting input
OUT	4	O	Output
V+	5	-	Positive (highest) power supply

ELECTRICAL CHARACTERISTICS(V_S = 5.0V)

At T_A = 25°C, V_{CM} = V_S/2, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
POWER SUPPLY					
Operating Voltage Range		2.1		5.5	V
Quiescent Current/per channel (Output High)			29		μA
Quiescent Current/per channel (Output Low)			50		μA
Power Supply Rejection Ratio	V_S = 2.1V to 5.5V, V_{CM} = V_S/2		70		dB
INPUT					
Input offset voltage		-4	±0.8	4	mV
Input Offset Voltage Drift			0.8		μV/°C
Common-Mode Voltage Range		(V-)-0.1		4.5	V
Common-mode Rejection Ratio	V_{CM} = -0.1V to 4.5V		70		dB
Input Bias Current			2		pA
Input Offset Current			1		pA
OUTPUT					
Saturation Voltage	I_O≤4mA		100		mV
Output Pull-up Voltage Range				5.6	V
Output Current(sinking)	V_O≤1.5V		50		mA
SWITCHING					
Propagation Delay H To L	R_{PU}=5.1KΩ, Overdrive =10mV		460		ns
	R_{PU}=5.1KΩ, Overdrive =100mV		400		
Propagation Delay L To H	R_{PU}=5.1KΩ, Overdrive =10mV		950		
	R_{PU}=5.1KΩ, Overdrive =100mV		850		
Fall Time	R_{PU}=5.1KΩ, Overdrive =100mV		36		ns

ELECTRICAL CHARACTERISTICS(V_S = 2.7V)

At T_A = 25°C, V_{CM} = V_S/2, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
POWER SUPPLY					
Operating Voltage Range		2.1		5.5	V
Quiescent Current/per channel (Output High)			17		μA
Quiescent Current/per channel (Output Low)			30		μA
Power Supply Rejection Ratio	V_S = 2.1V to 5.5V, V_{CM} = V_S/2		70		dB
INPUT					
Input offset voltage		-4	±0.8	4	mV
Input Offset Voltage Drift			0.8		μV/°C
Common-Mode Voltage Range		(V-)-0.1		2.2	V
Common-mode Rejection Ratio	V_{CM} = -0.1V to 2.2V		70		dB
Input Bias Current			2		pA
Input Offset Current			1		pA
OUTPUT					
Saturation Voltage	I_O≤4mA		82		mV
Output Pull-up Voltage Range				5.6	V
Output Current(sinking)	V_O≤1.5V		20		mA
SWITCHING					
Propagation Delay H To L	R_{PU}=5.1KΩ, Overdrive =10mV		420		ns
	R_{PU}=5.1KΩ, Overdrive =100mV		380		
Propagation Delay L To H	R_{PU}=5.1KΩ, Overdrive =10mV		900		
	R_{PU}=5.1KΩ, Overdrive =100mV		880		
Fall Time	R_{PU}=5.1KΩ, Overdrive =100mV		36		ns

ELECTRICAL CHARACTERISTICS(V_S = 2.1V)

At T_A = 25°C, V_{CM} = V_S/2, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
POWER SUPPLY					
Operating Voltage Range		2.1		5.5	V
Quiescent Current/per channel (Output High)			15		μA
Quiescent Current/per channel (Output Low)			26		μA
Power Supply Rejection Ratio	V_S = 2.1V to 5.5V, V_{CM} = V_S/2		70		dB
INPUT					
Input offset voltage		-4	±0.8	4	mV
Input Offset Voltage Drift			0.8		μV/°C
Common-Mode Voltage Range		(V-)-0.1		1.3	V
Common-mode Rejection Ratio	V_{CM} = -0.1V to 1.3V		70		dB
Input Bias Current			2		pA
Input Offset Current			1		pA
OUTPUT					
Saturation Voltage	I_O≤4mA		96		mV
Output Pull-up Voltage Range				5.6	V
Output Current(sinking)	V_O≤1.5V		7		mA
SWITCHING					
Propagation Delay H To L	R_{PU}=5.1KΩ, Overdrive =10mV		480		ns
	R_{PU}=5.1KΩ, Overdrive =100mV		430		
Propagation Delay L To H	R_{PU}=5.1KΩ, Overdrive =10mV		820		
	R_{PU}=5.1KΩ, Overdrive =100mV		800		
Fall Time	R_{PU}=5.1KΩ, Overdrive =100mV		38		ns

TYPICAL CHARACTERISTICS

At T_A = 25°C, V_S = +5V, V_{CM} = V_S/2, unless otherwise noted.

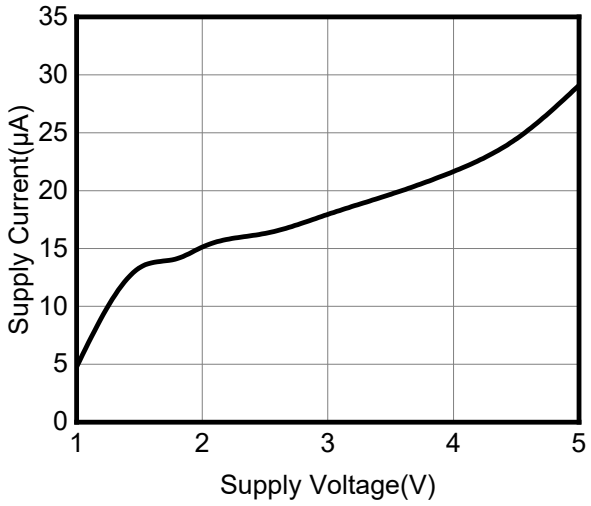


Figure 2. Supply Current vs Supply Voltage Output High

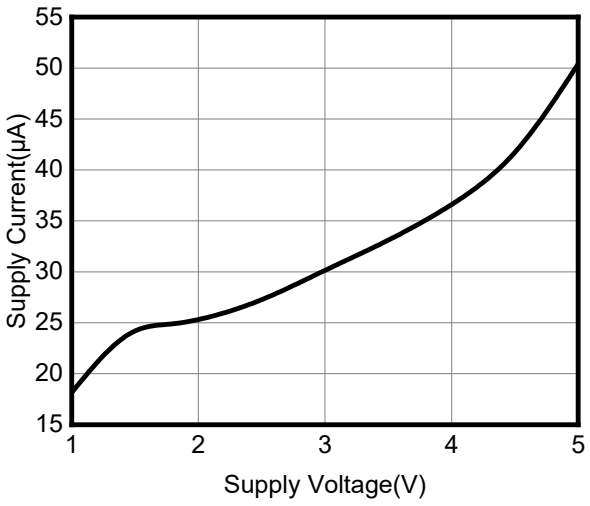


Figure 3. Supply Current vs Supply Voltage Output Low

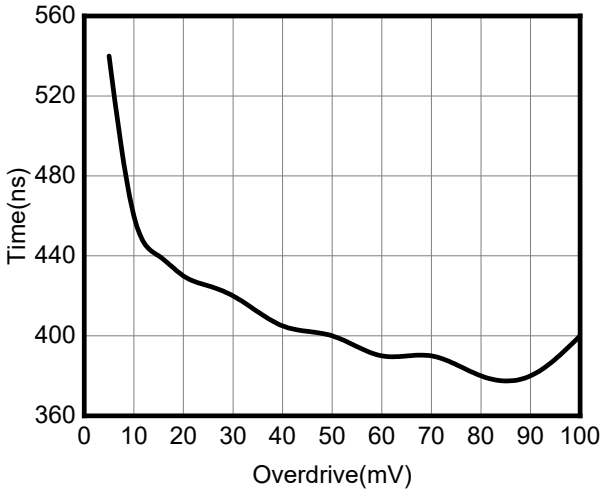


Figure 4. Response Time vs Input Overdrives Negative Transition(V_{CC}=5V)

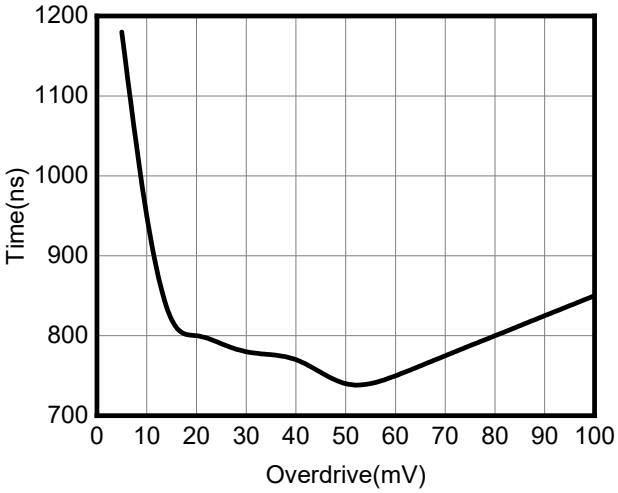


Figure 5. Response Time vs Input Overdrives Positive Transition(V_{CC}=5V)

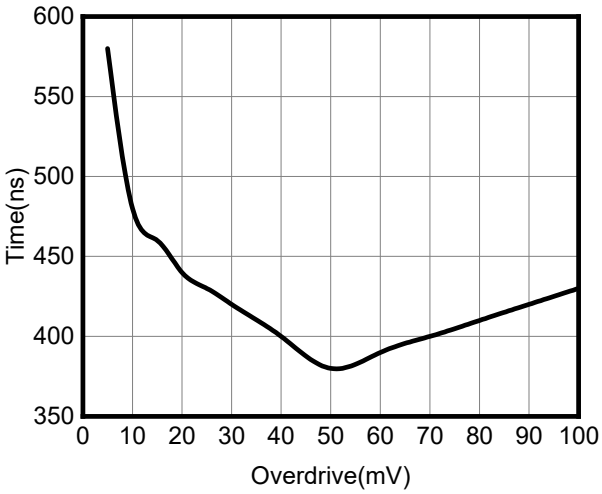


Figure 6. Response Time vs Input Overdrives Negative Transition(V_{CC}=2.1V)

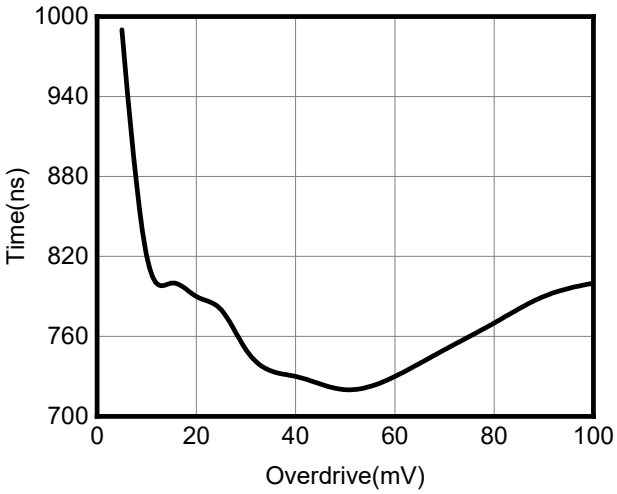


Figure 7. Response Time vs Input Overdrives Positive Transition(V_{CC}=2.1V)

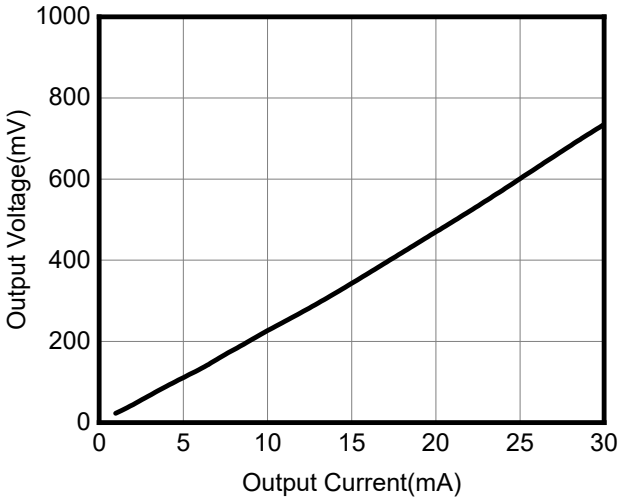


Figure 8. Output Voltage vs Output Current

DETAILED DESCRIPTION

Overview

The TS331ILT(MS) family of comparators can operate up to 5.5V on the supply pin.
This standard device has proven ubiquity and versatility across a wide range of applications.

This is due to its low power and high speed. The opendrain output allows the user to configure the output's logic low voltage (V_{OL}) and can be utilized to enable the comparator to be used in AND functionality.

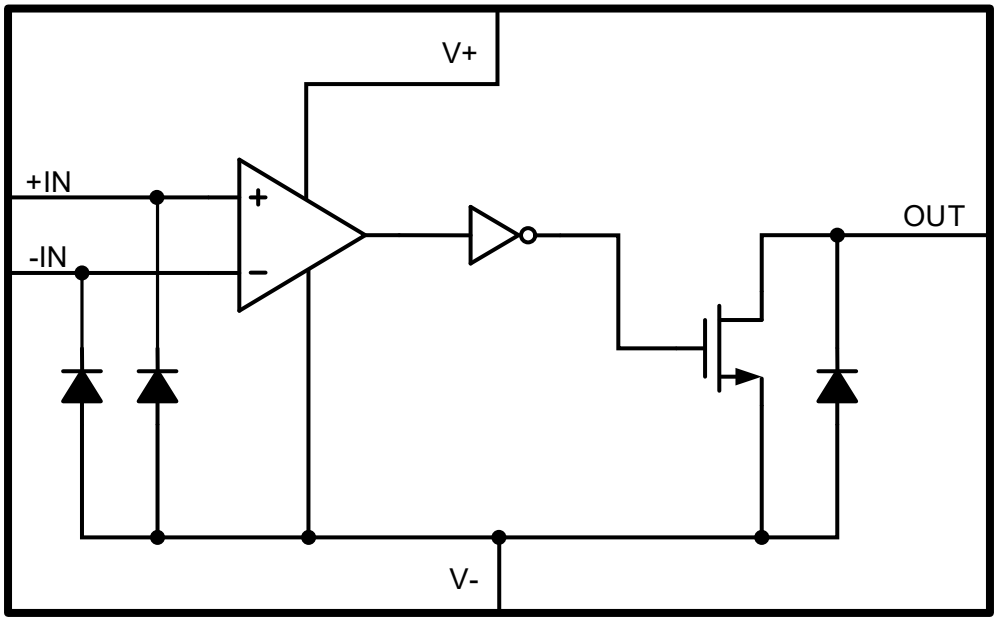


Figure 9. Functional Block Diagram

APPLICATION and IMPLEMENTATION

Application Information

TS331ILT(MS) will typically be used to compare a single signal to a reference or two signals against each other. Many users take advantage of the open drain output (logic high with pull-up) to drive the comparison logic output to a logic voltage level to an MCU or logic device.

Typical Application

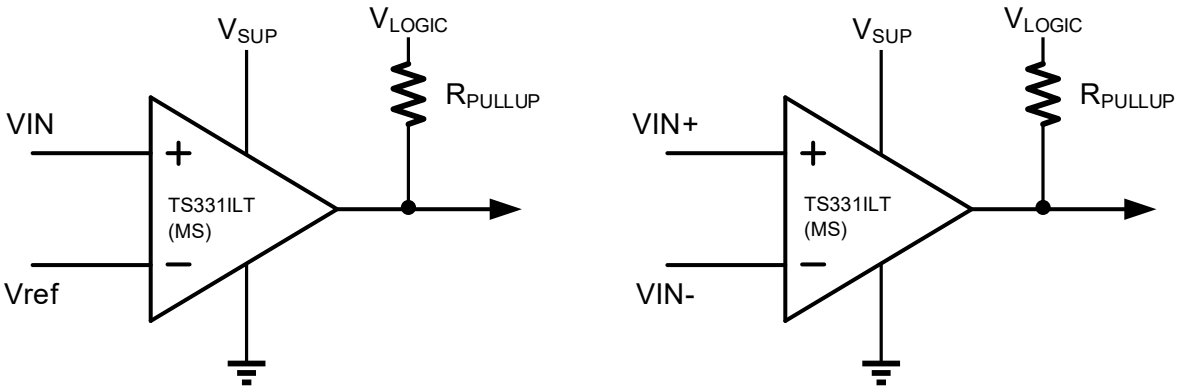


Figure 10. Typical Application Schematic

Power Supply Recommendations

For fast response and comparison applications with noisy or AC inputs, it is recommended to use a bypass capacitor on the supply pin to reject any variation on the supply voltage. This variation causes temporary fluctuations in the comparator's input common mode range and create an inaccurate comparison.

Layout

Layout Guidelines

For accurate comparator applications without hysteresis it is important maintain a stable power supply with minimized noise and glitches, which can affect the high-level input common mode voltage range. In order to achieve this, it is best to add a bypass capacitor between the supply voltage and ground. This should be implemented on the positive power supply and negative supply (if available). If a negative supply is not being used, do not put a capacitor between the IC's GND pin and system ground.

Layout Example

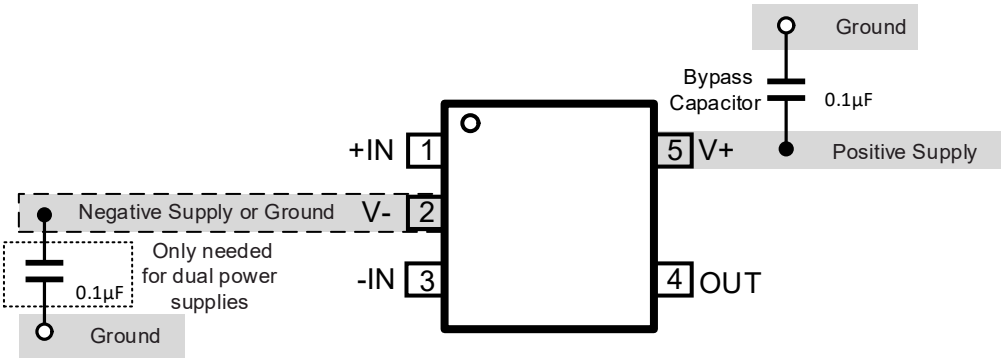
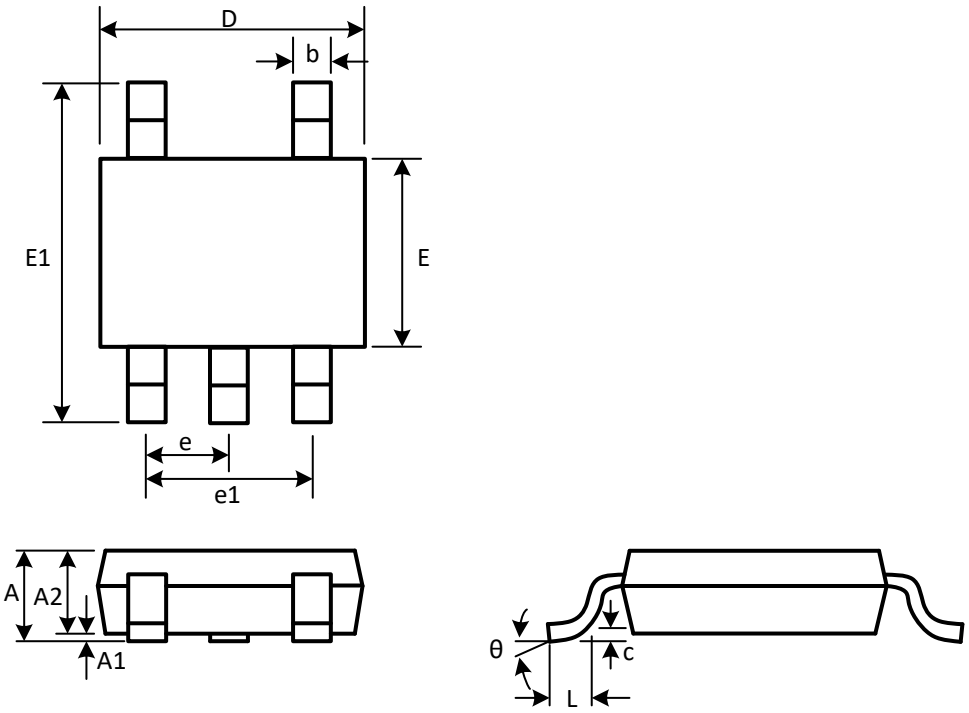


Figure 11. TS331ILT(MS) Layout Example

PACKAGE DESCRIPTION

SOT-23-5



(Unit: mm)

Symbol	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
e	0.950(BSC)	
e1	1.800	2.000
E	1.500	1.700
E1	2.650	2.950
L	0.300	0.600
θ	0°	8°

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