GT431/GT432
Precision Programmable Reference

1 Features

- Reference voltage tolerance 0.4% at 25°C
- Programmable output voltage to 36V
- Low dynamic output impedance 0.2Ω
- Sink current capability of 0.15mA to 100mA
- Equivalent full-range temperature coefficient of 50ppm/°C typical
-Temperature compensated for operation over full rated operating temperature range
- Low output noise voltage
- Fast turn on response
- Operation from -40°C to 125°C
- Lead-Free packages: SOT23

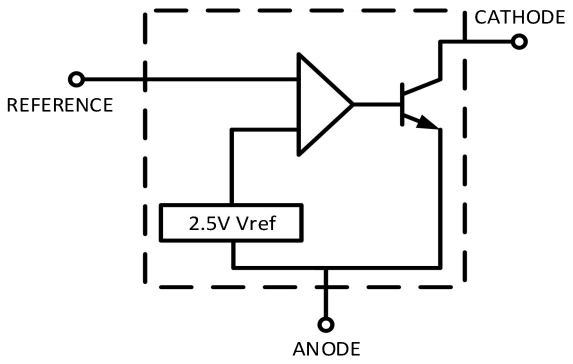
2 Application

- Adjustable voltage and current referencing
- Power supply
- Zener replacement
- Voltage monitoring
- Comparator with integrated reference
- As precision voltage reference

3 Description

The GT431 and GT432 device are three-terminal adjustable shunt regulators, with a guaranteed thermal stability over applicable temperature ranges. The output voltage can be set to any value between VREF (approximately 2.5V) and 36V with two external resistors. These devices provide a very sharp turn-on characteristic, making these devices excellent replacement for Zener diodes in many applications. Both the GT431 and GT432 devices are offered in two grades, with initial tolerances (at 25°C) of 0.4%.

Circuit Diagram



4 Revision History

Revision	Date	Note
Rev. A0. 1	2025. 04. 28	Original Version

The latest datasheet version should be checked on the GTIC official website, as the company does not actively inform customers about updates to the datasheet.

5 Device Summary, Pin and Packages

Table. 5-1. Device Summary(1)

Serial Name	Part Name	Package	Body Size (Nom)	Marking(2)	MSL(3)	Package Qty
GT431	GT431S3	SOT23(3)	2.90mm×1.30mm×1.10mm	GT431 XXXX	3	Tape and Reel,3000
GT432	GT432S3	SOT23(3)	2.90mm×1.30mm×1.10mm	GT432 XXXX	3	Tape and Reel,3000

(1) For all available packages, please contact product sales.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4) "XXXXX" in Marking will be appeared as the batch code.

5 Device Summary, Pin and Packages(Continued)

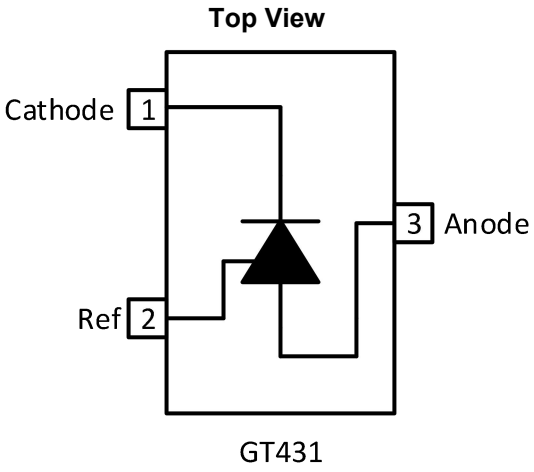


Fig.5-1. GT431: SOT23(3) Package

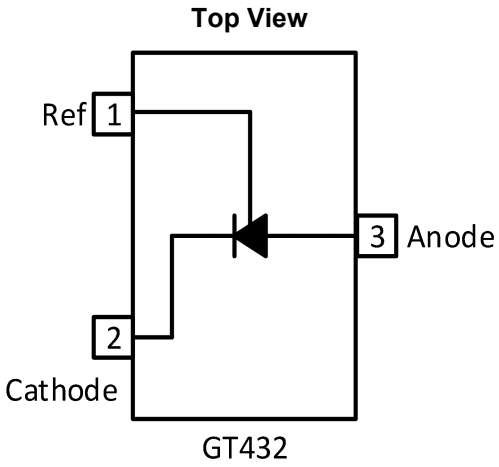


Fig.5-2. GT432: SOT23(3) Package

Table. 5-2. Pin Definition

Pin			I/O	Description
Name	GT431	GT432		
Cathode	1	2	I	Shunt Current/Voltage input
Ref	2	1	O	Threshold relative to common anode
Anode	3	3	-	Common pin, normally connected to ground

* It is suggested to leave the unconnected pins floating.

6 Voltage, Temperature, ESD and Thermal ratings

6.1 Absolute Maximum Ratings(1) (2)

Parameters	Symbol	Min.	Max.	Unit
Cathode Voltage	V_{KA}	-0.3	37	V
Cathode Current Range(Continuous)	I_{KA}	-100	+155	mA
Reference Input Current Range	I_{REF}	-0.05	+10	mA
Operating temperature	T_{opr}	-40	+125	°C
Power Dissipation	P_D	370		mW
Storage temperature	T_{stg}	-55	150	°C

(1) Stresses beyond 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 indicate under Recommended Operating Conditions is not implied.Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltages are with respect to the GND pin.

6.2 ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic discharge	Human-Body Model (HBM)	2500	V
		Charged-Device Model (CDM)	400	V

6.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameters	Min.	Max.	Unit
VKA	Cathode Voltage	VREF	36	V
IKA	Cathode Current Range(Continuous)	0.15	100	mA
TA	Operating Ambient Temperature Range	-40	+125	°C

6.4 Thermal Information

THERMAL METRIC		GT431/GT432	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	185.6	°C/W
$R_{\theta JC}$(top)	Junction-to-case(top) thermal resistance	104.3	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	54.5	°C/W
ψ_{JT}	Junction-to-top characterization parameter	31.0	°C/W
ψ_{JB}	Junction-to-board characterization parameter	54.5	°C/W
R_{JC}(bot)	Junction-to-case(bottom) thermal resistance	N/A	°C/W

7 Electrical Specifications

Over recommended operating conditions, FULL=–40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)

Parameters	Symbol	Conditions		Min.	Typ.	Max.	Unit
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}, I_{KA}=10mA$	0.4%	2.490	2.500	2.510	V
Deviation of reference Input Voltage Over temperature	ΔV_{REF}	$V_{KA}=V_{REF}$, $I_{KA}=10mA$	-40°C to 85°C	-	4	10	mV
			-40°C to 125°C		4	15	
Ratio of Change in Reference Input Voltage to the Change In Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	$I_{KA}=10mA$	ΔV_{KA}=10V to V_{REF}	-	-1.0	-2.7	mV/V
			ΔV_{KA}=36V to 10V	-	-0.5	-2.0	
Reference Input Current	I_{REF}	$I_{KA}=10mA$, R1=10kΩ, R2=∞		-	0.7	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T_A$	$I_{KA}=10mA$, R1=10kΩ, R2=∞ T_A=full Temperature		-	0.4	1.2	μA
Minimum cathode current for regulation	$I_{KA}(min)$	$V_{KA}=V_{REF}$		-	0.15	0.3	mA
Off-state cathode Current	$I_{KA}(OFF)$	V_{KA}=36V, V_{REF}=0V		-	0.1	0.5	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to100mA f≤1.0KHz		-	0.2	0.5	Ω

8 Typical Characteristics

(Over recommended operating conditions,FULL=–40°C to +125°C, Typical values are at TA=+25°C,unless otherwise noted)

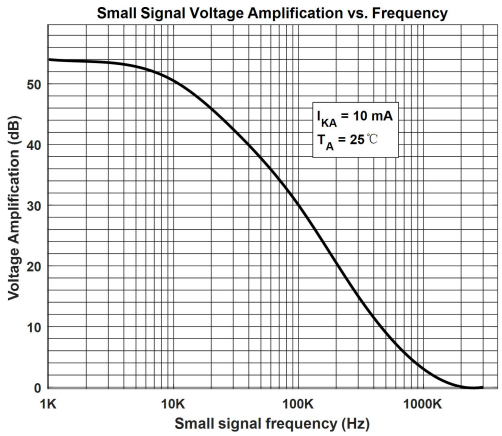


Fig.8-1. Small signal frequency response

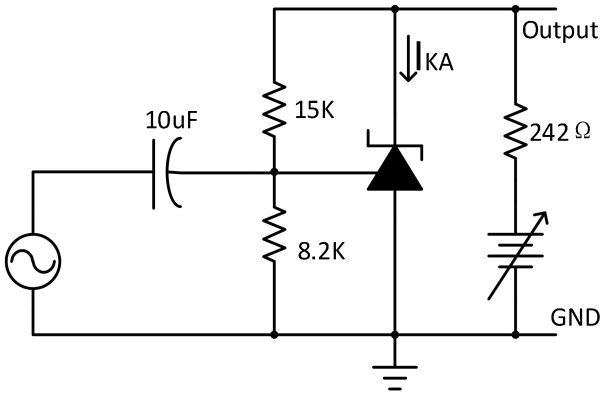


Fig.8-2. Small signal frequency response test circuit

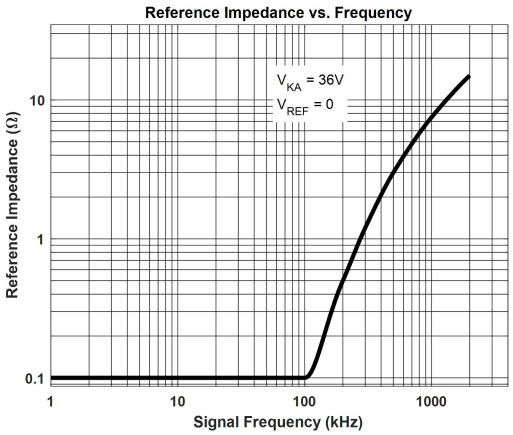


Fig.8-3. Reference impedance

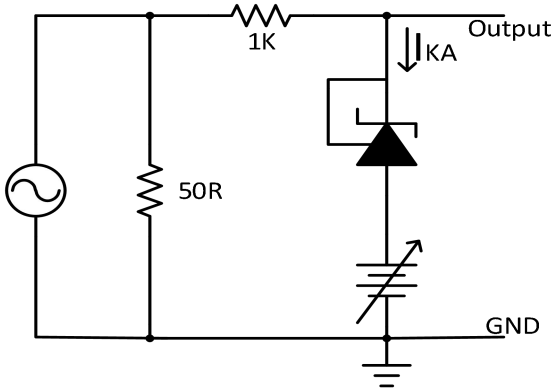


Fig.8-4. Reference impedance test circuit

8 Typical Characteristics(Continued)

(Over recommended operating conditions,FULL=–40°C to +125°C, Typical values are at TA=+25°C,unless otherwise noted)

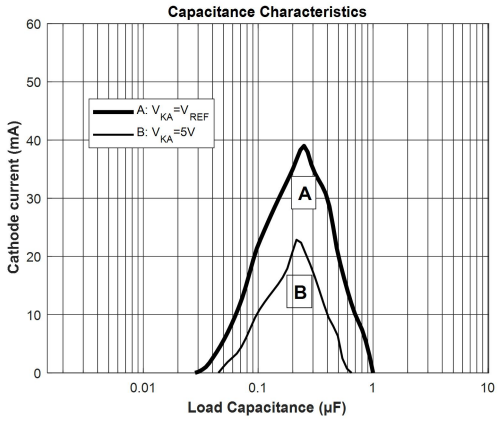


Fig.8-5. Capacitance characteristics

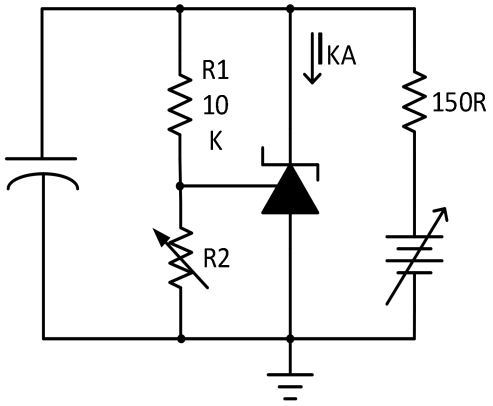


Fig.8-6. Capacitance characteristics test circuit

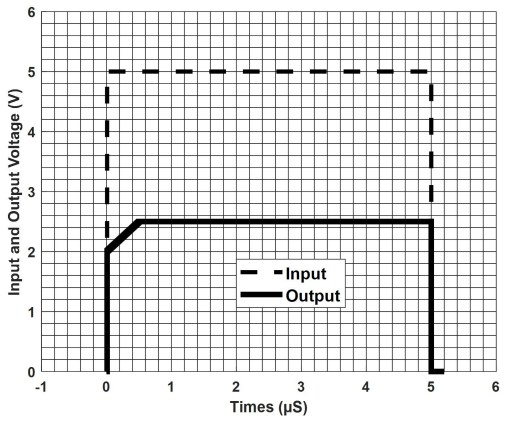


Fig.8-7. Power-on and power-off response

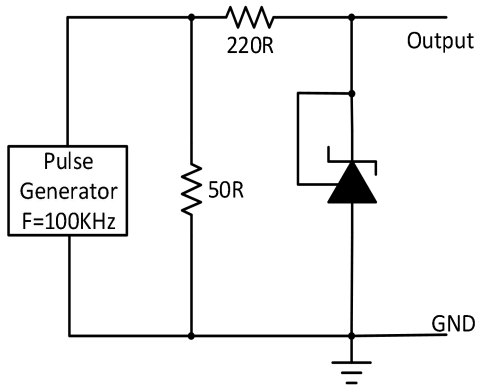


Fig.8-8. Power-on and power-off response test circuit

9 Detailed Description

9.1 Overview

This standard component has been widely adopted in various applications, from power supplies to signal paths. It integrates crucial elements, such as a precision voltage reference and an operational amplifier, which are essential analog building blocks. When combined with its key components, the GT431 family can be set up as a standalone voltage reference, error amplifier, voltage clamp, or comparator with an integrated reference.

9.2 Feature Description

The GT431 can operate with cathode voltages adjustable within a range of 2.5V to 36V. It is optimized for end-equipment applications in industrial, automotive, telecommunications, and computing systems. When used as a shunt regulator or error amplifier, a minimum cathode current greater than 0.3 mA (Imin(max)) must be ensured. In these configurations, the feedback between the cathode and reference pins allows the replication of the internal reference voltage. The operating temperature range of the GT431 device is from -40°C to 125°C.

10 Application Note

The GT431 consists of an internal reference and an amplifier that sinks current based on the difference between the reference pin and a virtual internal pin. This sink current is generated by an internal Darlington pair, as shown in the schematic diagram in the previous text. The Darlington pair is used to enable the device to sink a current of up to 100 mA.

When there is sufficient voltage headroom (≥ 2.5V) and cathode current (IKA), the GT431 will forcefully control the voltage of the reference pin at 2.5V. However, the reference pin cannot be left floating because it requires IREF ≥ 4μA. This is because the reference pin will be driven into an npn transistor, which needs a base current to operate properly.

When feedback is applied from the cathode pin and the reference pin, the GT431 will act as a Zener diode, regulating the output voltage to a constant value according to the current supplied to the cathode. This is due to the internal amplifier and the reference entering the appropriate operating region. In open-loop, servo, or error amplification implementations, in order to keep the device in the suitable linear region, a current of the same magnitude as that required in the feedback situation must be applied to it, so that the GT431 has sufficient gain.

Unlike many linear voltage regulators, the GT431 achieves stability through internal compensation and does not require an output capacitor between the cathode and the anode. However, if an output capacitor needs to be used for this device.

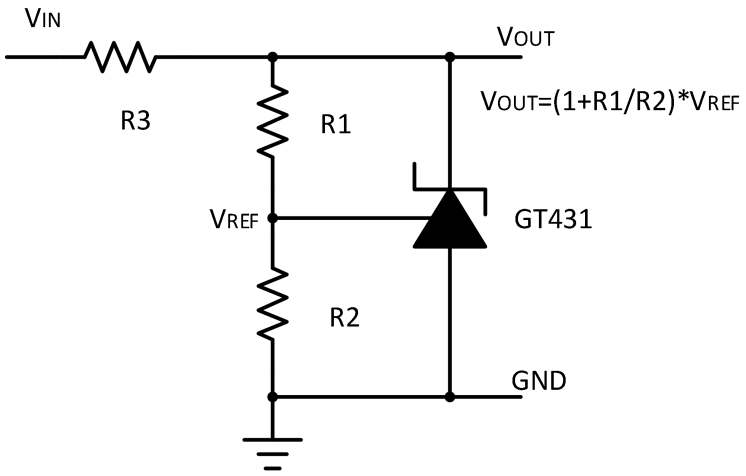


Fig.10-1. Shunt Regulator

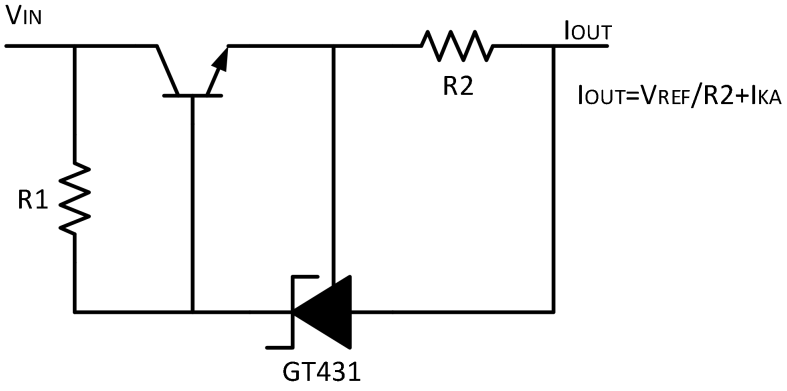


Fig.10-2. Current Source or Current Limit

10 Application Note(Continued)

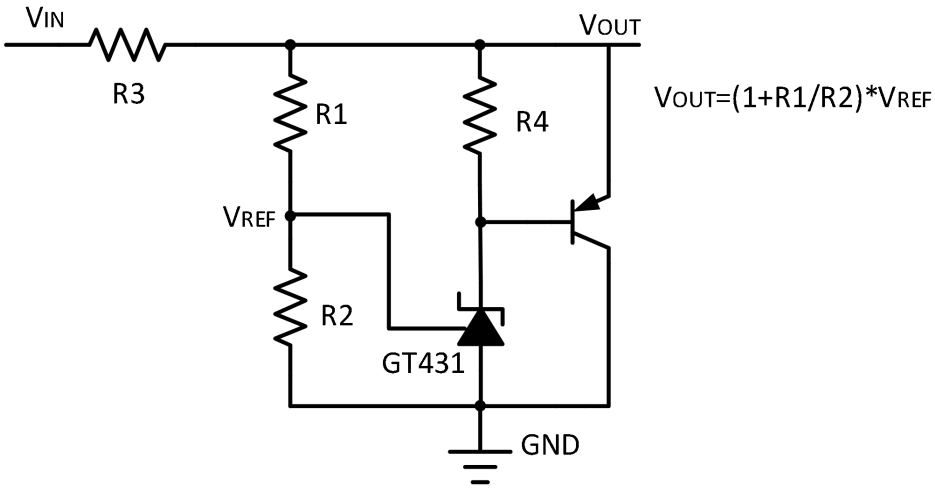


Fig.10-3. High Current Shunt Regulator

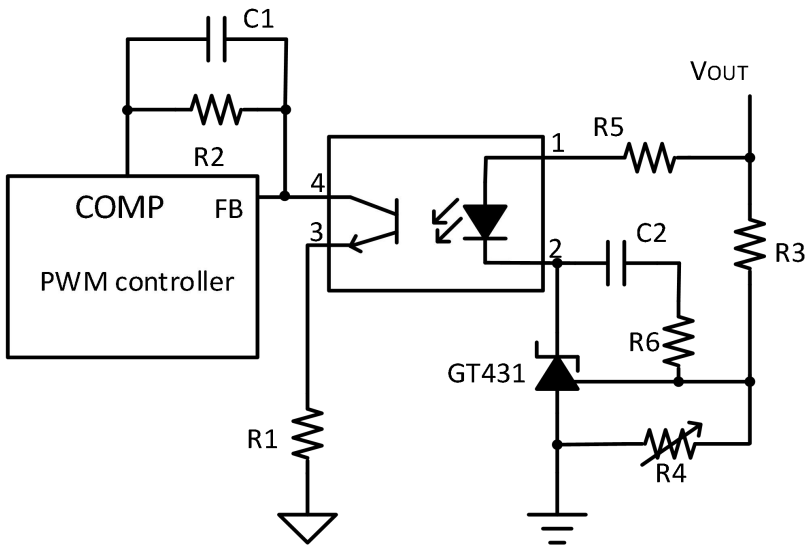
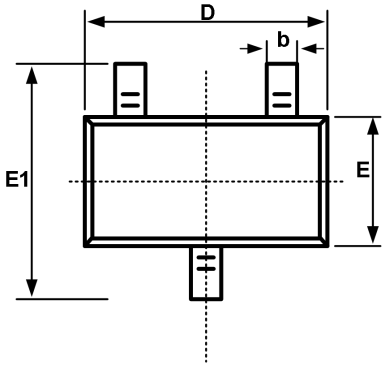
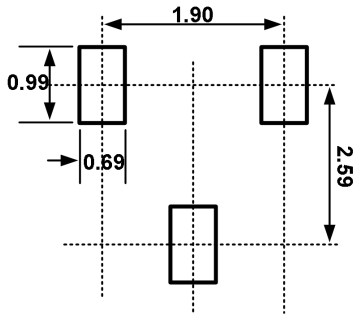


Fig.10-4. PWM Converter with Reference

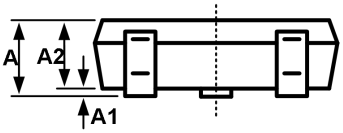
11 Package Outline Dimension

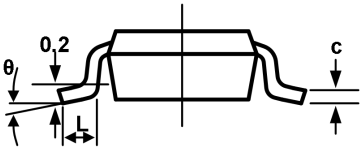
SOT23-3





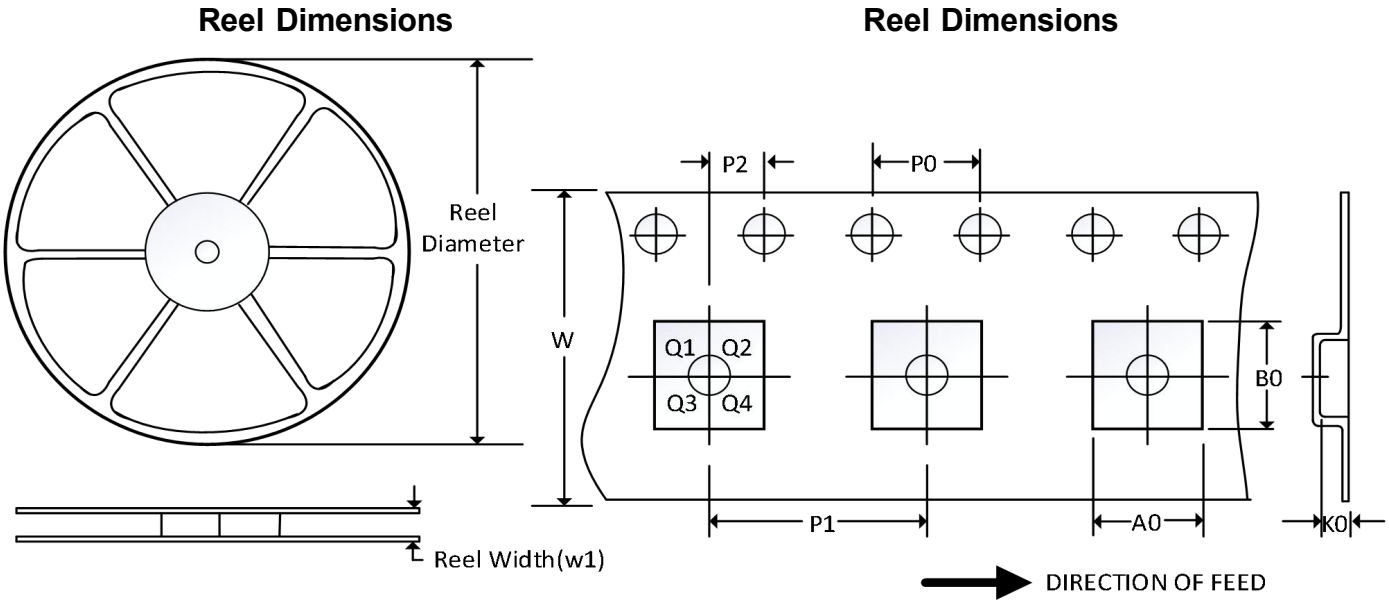
Recommended Land Pattern (Unit: mm)





Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
L	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

12 Tape and Reel Information



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 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23-3	7''	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.