RS431AE/ RS432AE Precision Programmable Reference

1 FEATURES

- **Reference Voltage Tolerance at 25°C 0.5% (A Grade)**
- **Programmable Output Voltage to 18 V**
- **Low Dynamic Output Impedance 0.2 Ω**
- **Sink Current Capability of 0.5mA 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 Junction Temperature from -40°C to 150°C**
- **Lead-Free Packages: SOT23**

2 APPLICATIONS

- **Adjustable Voltage and Current Referencing**
- **Power Supply**
- **Zener Replacement**
- **Voltage Monitoring**
- **Comparator with Integrated Reference**
- **As Precision Voltage Reference**

3 DESCRIPTIONS

The RS431AE and RS432AE 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 V_{REF} (approximately 2.5V) and 18V with two external resistors. These devices have provided a very sharp turn-on characteristic, making these devices excellent replacement for Zener diodes in many applications.

Both the RS431AE and RS432AE devices are offered in two grades, with initial tolerances (at 25°C) of 0.5% for A grade.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS431AE	SOT23	1.30mm×2.92mm
RS432AE	SOT23	1.30mm×2.92mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 Function Block Diagram

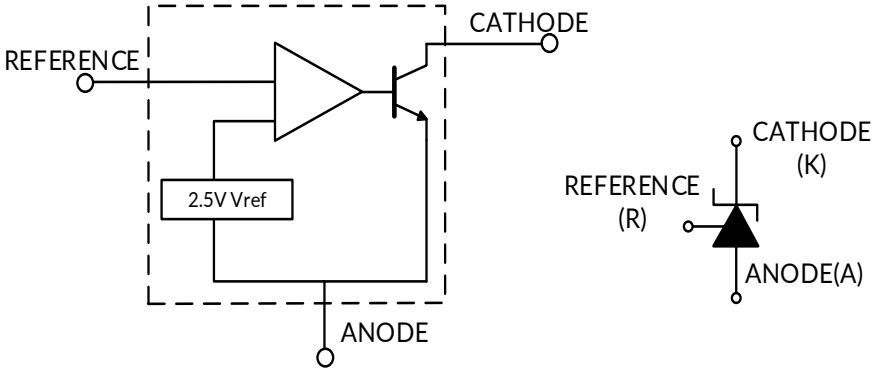


Table of Contents

5 Revision History

Note: Page numbers for previous revisions may different from page numbers in the current version.

Version	Change Date	Change Item
A.1	2023/07/05	Initial version completed
A.2	2024/04/07	Add MSL on Page 4@RevA.1

6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	VOLTAGE TOLERANCE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS431AE	RS431AEYSF3	0.5%	SOT23	431A	MSL3	Tape and Reel, 3000
RS432AE	RS432AEYSF3	0.5%	SOT23	432A	MSL3	Tape and Reel, 3000

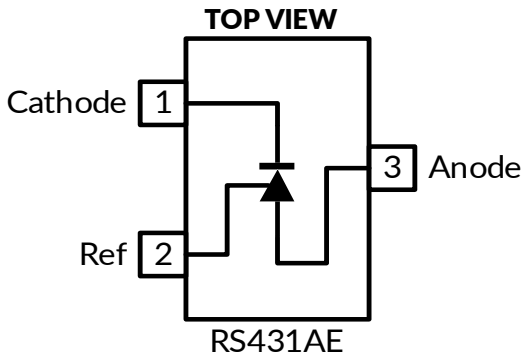
NOTE:

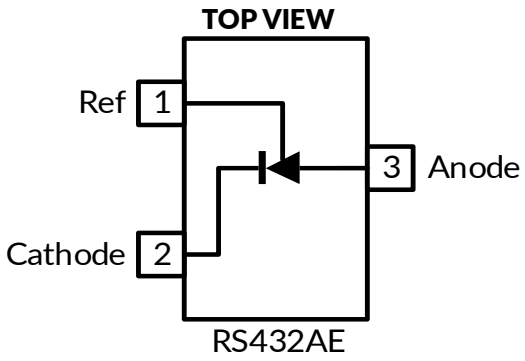
(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(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.

7 Pin configuration and Functions





Pin Description

NAME	PIN		DESCRIPTION
	RS431AE	RS432AE	
Cathode	1	2	Shunt Current/ Voltage input
Ref	2	1	Threshold relative to common anode
Anode	3	3	Common pin, normally connected to ground

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)(2)

Characteristics		Symbol	MIN	MAX	UNIT
Cathode Voltage		V_{KA}	-0.3	20	V
Cathode Current Range (Continuous)		I_{KA}	-100	155	mA
Reference Input Current Range		I_{REF}	-0.05	10	mA
Operating junction temperature		T_{opr}	-40	150	°C
Package thermal impedance (3)	SOT23	θ_{JA}		295	°C/W
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 indicated 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.
(3) The package thermal impedance is calculated in accordance with JESD-51.

8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), per ANSI/ESDA/JEDEC JS-001 (1)	±2000	V
		Charge Device Model (CDM), per ANSI/ESDA/JEDEC JS-002 (2)	±1000	V

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250 V CDM allows safe manufacturing with a standard ESD control process.

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.3 Recommended Operating Conditions

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

Characteristics	Symbol	MIN	MAX	UNIT
Cathode Voltage	V_{KA}	V_{REF}	18	V
Cathode Current Range (Continuous)	I_{KA}	0.5	100	mA
Operating Ambient Temperature Range	T_A	-40	125	°C

8.4 Electrical Characteristics

(Over recommended operating conditions, Full= -40°C to +125°C, typical values are at T_A= +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN(1)	TYP(2)	MAX(1)	UNIT
Reference Input Voltage	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA	0.5%	2.488	2.50	2.512	V
Deviation of Reference Input Voltage Over Temperature	ΔV_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA T_A= -40°C ~ +125°C		-	20	50	mV
Ratio of Change In Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	I_{KA}=10mA	$\Delta V_{KA}=V_{REF}$~18V	-	-0.1	-1.0	mV/V
Reference Input Current	I_{REF}	I_{KA}=10mA, R1=10kΩ, R2=∞		-	0.7	2.0	μA
Deviation of Reference Input Current Over Full Temperature Range	ΔI_{REF}	I_{KA}=10mA, R1=10kΩ, R2=∞ T_A= -40°C ~ +125°C		-	0.35	1	μA
Minimum Cathode Current for Regulation	$I_{KA\ (min)}$	$V_{KA}=V_{REF}$		-	0.2	0.3	mA
Off-State Cathode Current	$I_{KA\ (OFF)}$	V_{KA}=18V, V_{REF}=0V		-	0.1	0.5	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1mA to100mA f≤1.0KHz		-	0.2	0.5	Ω

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(2) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

8.5 TYPICAL APPLICATIONS CIRCUIT

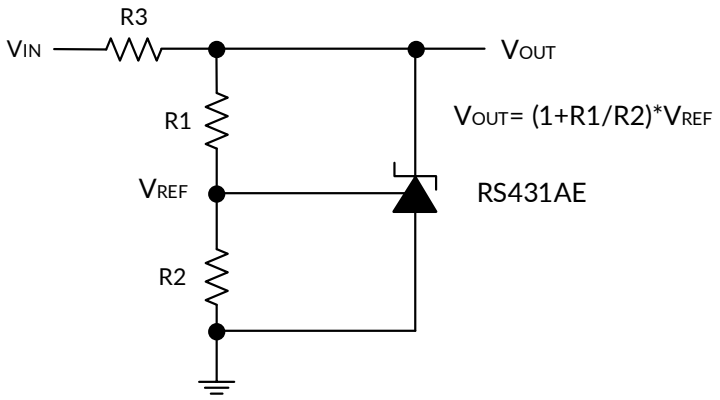


Figure 1. Shunt Regulator

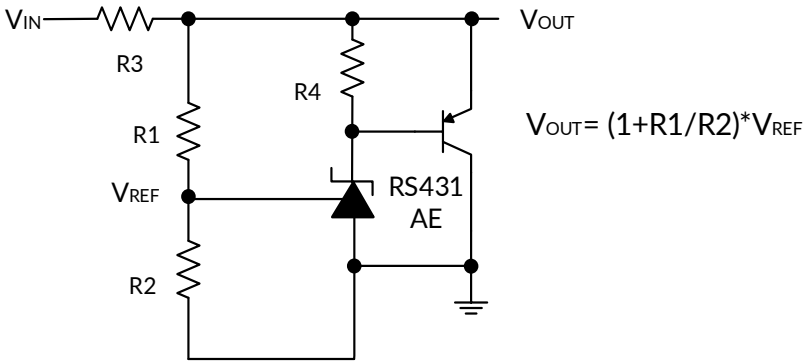


Figure 2. High Current Shunt Regulator

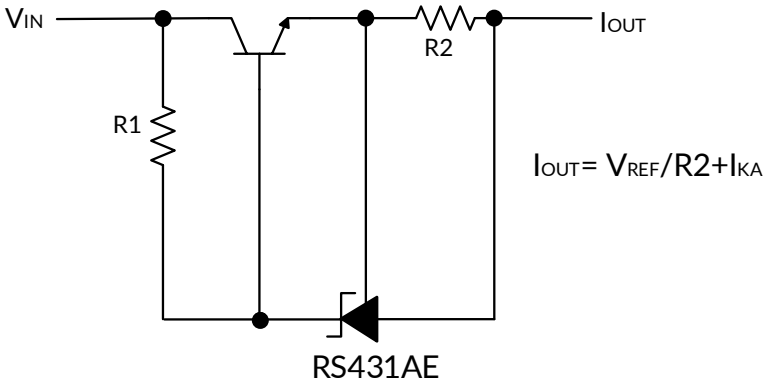


Figure 3. Current Source or Current Limit

8.6 TYPICAL PERFORMANCE CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

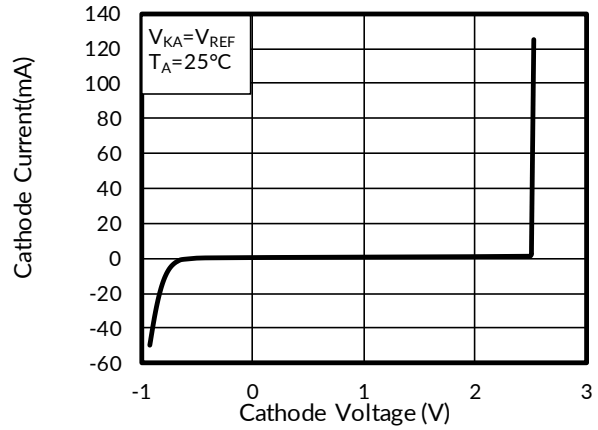


Figure 4. Cathode Current vs Cathode Voltage

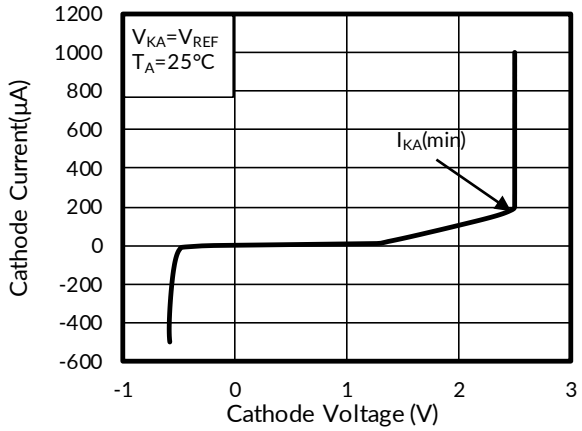


Figure 5. Cathode Current vs Cathode Voltage

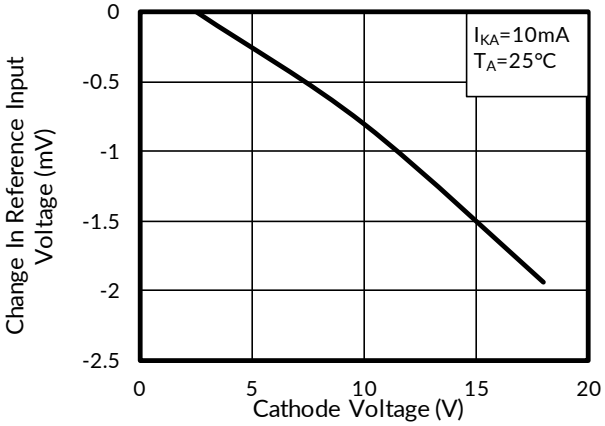


Figure 6. Change in Reference Input Voltage vs Cathode voltage

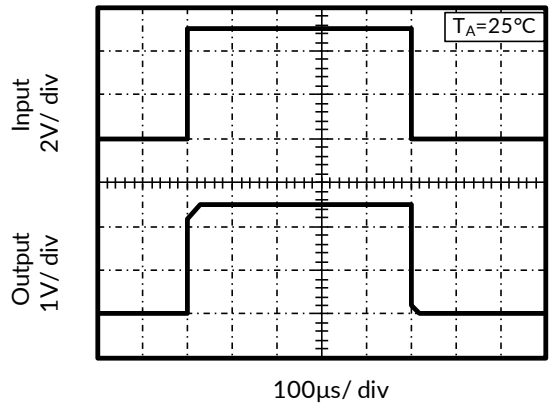


Figure 7. Pulse Response

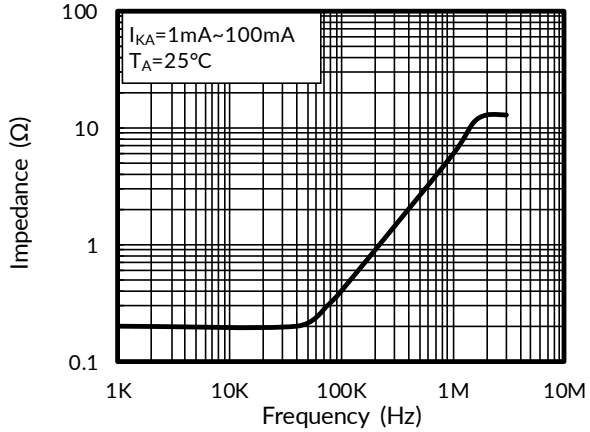


Figure 8. Dynamic Impedance vs Frequency

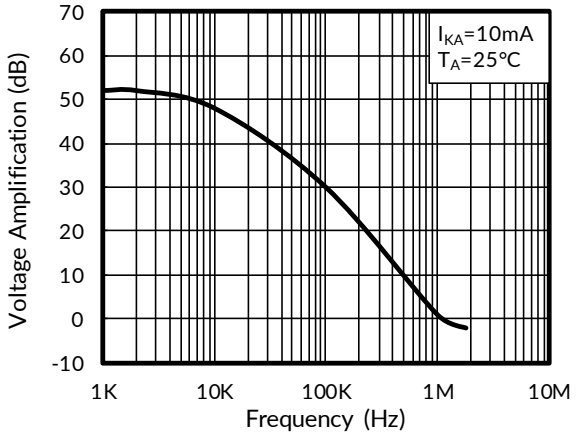


Figure 9. Small Signal Voltage Amplification vs Frequency

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

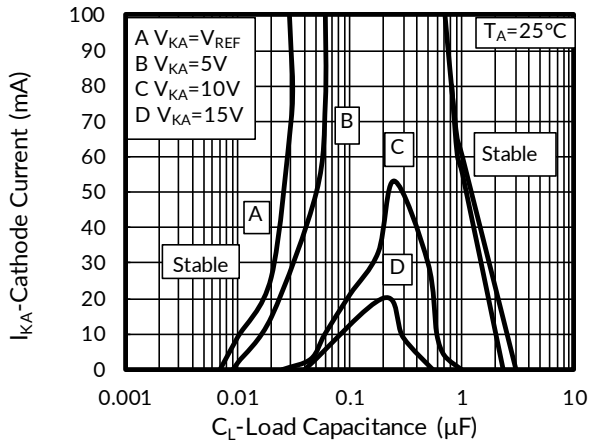


Figure 10. Cathode Current vs Load Capacitance

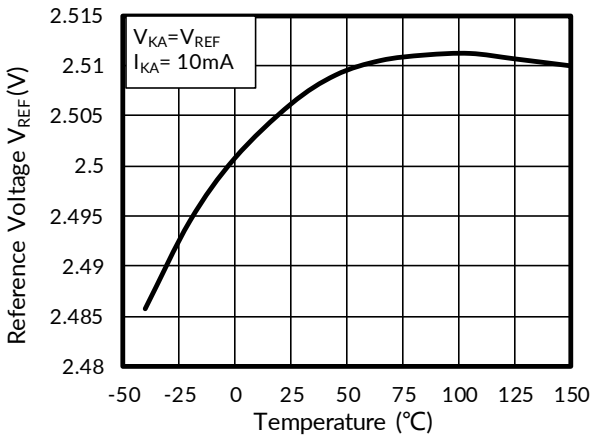


Figure 11. Reference Voltage vs Ambient Temperature

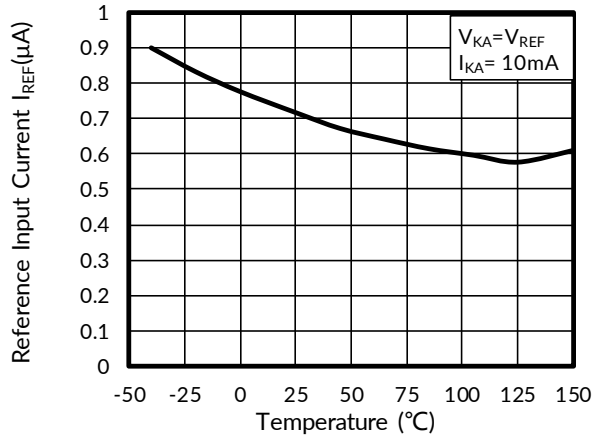
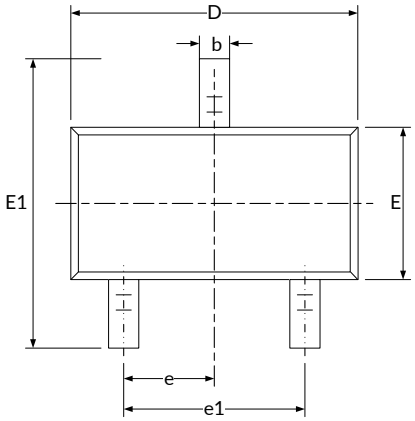
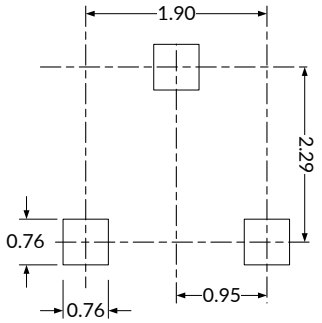


Figure 12. Reference Input Current vs Ambient Temperature

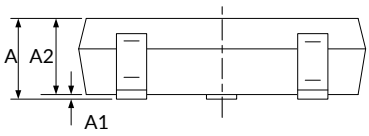
9 PACKAGE OUTLINE DIMENSIONS

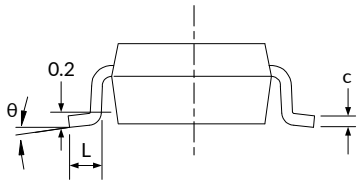
SOT23 (3)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	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 (1)	2.800	3.000	0.110	0.118
E (1)	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 (BSC) (2)		0.037 (BSC) (2)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

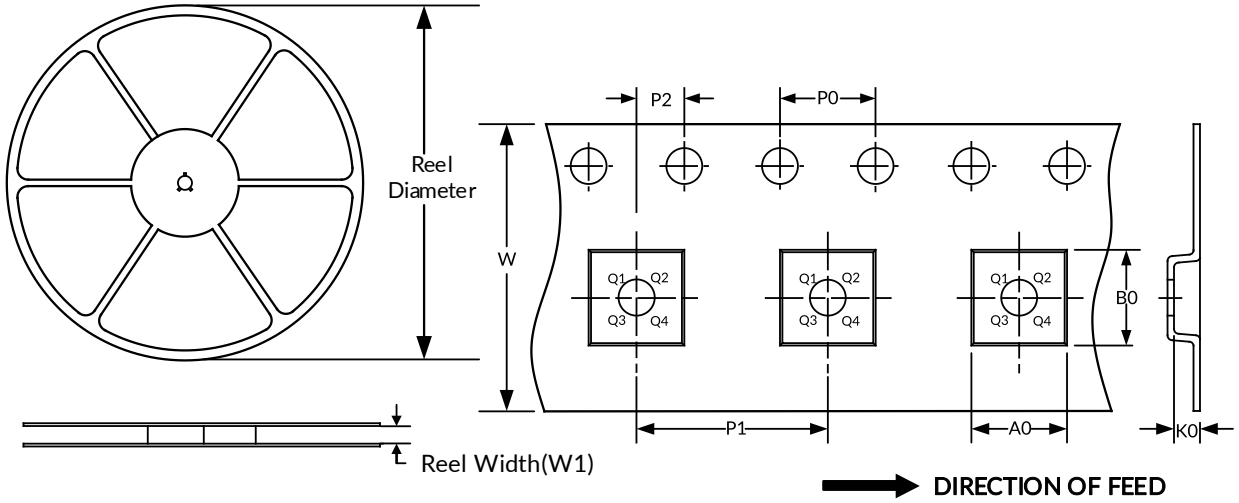
NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

10 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



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	7”	9.5	3.15	2.77	1.22	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.

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