

# RS421V/RS422V Precision Programmable Reference

## 1 FEATURES

- **Reference Voltage Tolerance at 25°C 0.5%**
- **Programmable Output Voltage to 12 V**
- **Low Dynamic Output Impedance 0.03 Ω**
- **Sink Current Capability of 0.05mA to 100mA**
- **Equivalent Full-Range Temperature Coefficient of 25ppm/°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 RS421V and RS422V device is 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 1.24V) and 12V 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.

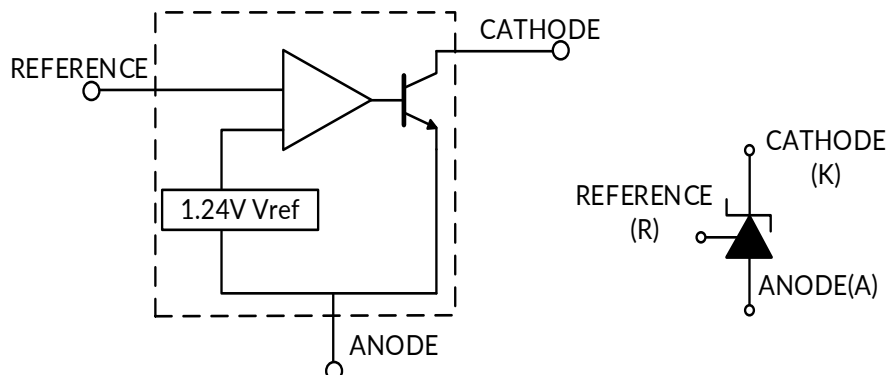
The RS421V and RS422V device is offered in two grades, with initial tolerances (at 25°C) of 0.5%.

**Device Information (1)**

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS421V	SOT23	1.30mm×2.92mm
RS422V	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



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## 5 REVISION HISTORY

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

<b>Version</b>	<b>Change Date</b>	<b>Change Item</b>
A.0	2024/09/20	Preliminary version completed
A.1	2025/02/19	Initial version completed

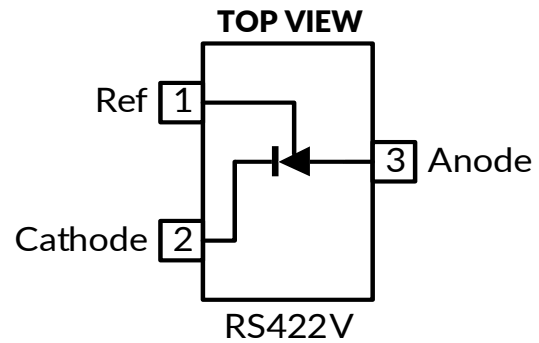
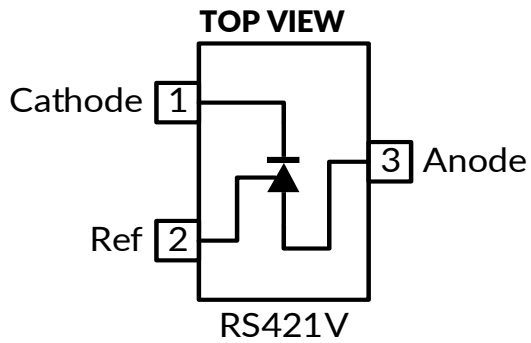
**6 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

<b>PRODUCT</b>	<b>ORDERING NUMBER</b>	<b>VOLTAGE TOLERANCE</b>	<b>PACKAGE LEAD</b>	<b>PACKAGE MARKING <sup>(2)</sup></b>	<b>MSL<sup>(3)</sup></b>	<b>PACKAGE OPTION</b>
RS421V	RS421VXSF3	0.5%	SOT23	421V	MSL3	Tape and Reel, 3000
RS422V	RS422VXSF3	0.5%	SOT23	422V	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) Runic classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with Runic if your end application is quite critical to the preconditioning setting or if you have special requirement.

## 7 PIN CONFIGURATION AND FUNCTIONS



### Pin Description

NAME	PIN		DESCRIPTION
	RS421V	RS422V	
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) <sup>(1)(2)</sup>

CHARACTERISTICS		SYMBOL	MIN	MAX	UNIT
Cathode Voltage		$V_{KA}$	-0.3	14	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 <sup>(3)</sup>	SOT23	$\theta_{JA}$		295	°C/W
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), JEDEC EIA/ JESD22-A114	±2000	V
		Charge Device Model (CDM)	±1000	V



#### 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		$V_{KA}$	$V_{REF}$	12	V
Cathode Current Range (Continuous)		$I_{KA}$	0.05	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<sub>A</sub>= +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN <sup>(1)</sup>	TYP <sup>(2)</sup>	MAX <sup>(1)</sup>	UNIT	
Reference Input Voltage	V <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =10mA	0.5%	1.234	1.24	1.246	V
Deviation of reference Input Voltage Over temperature	ΔV <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =10mA T <sub>A</sub> = -40°C ~ +125°C	-	5	15	mV	
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	ΔV <sub>REF</sub> /ΔV <sub>KA</sub>	I <sub>KA</sub> =10mA, ΔV <sub>KA</sub> =12V~V <sub>REF</sub>	-	-1.7	-2.5	mV/V	
Reference Input Current	I <sub>REF</sub>	I <sub>KA</sub> =10mA, R1=10kΩ, R2=∞	-	0.15	0.4	μA	
Deviation of Reference Input Current Over Full Temperature Range	ΔI <sub>REF</sub> /ΔT <sub>A</sub>	I <sub>KA</sub> =10mA, R1=10kΩ, R2=∞ T <sub>A</sub> = -40°C ~ +125°C	-	0.1	0.4	μA	
Minimum Cathode Current for Regulation	I <sub>KA</sub> (min)	V <sub>KA</sub> =V <sub>REF</sub>	-	40	50	μA	
Off-state Cathode Current	I <sub>KA</sub> (OFF)	V <sub>KA</sub> =14V, V <sub>REF</sub> =0V	-	0.05	2.5	μA	
Dynamic Impedance	Z <sub>KA</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =1mA to 100mA f≤1.0KHz	-	0.03	0.1	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

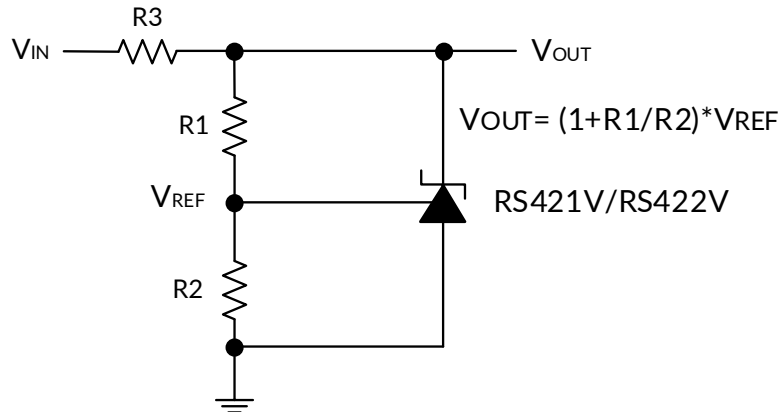


Figure 1. Shunt Regulator

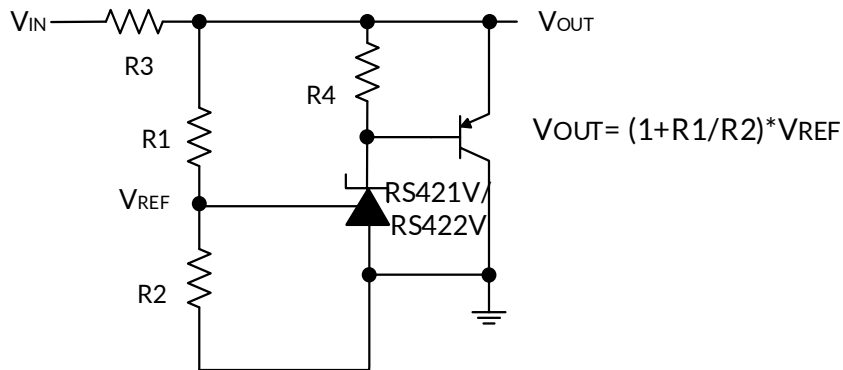


Figure 2. High Current Shunt Regulator

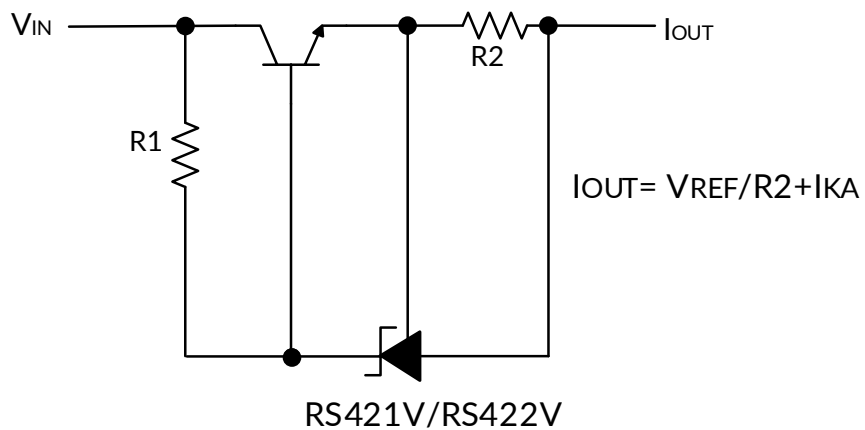
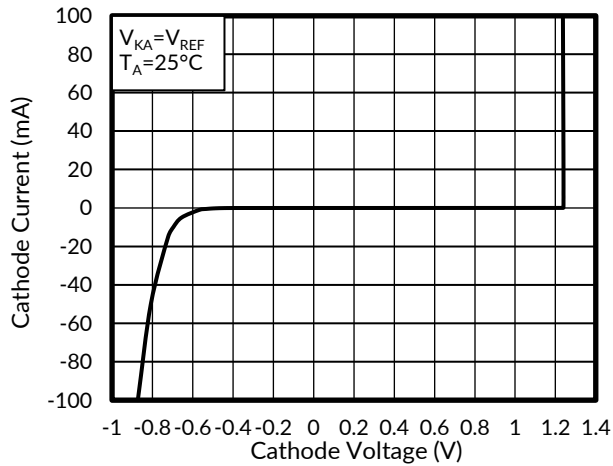


Figure 3. Current Source or Current Limit

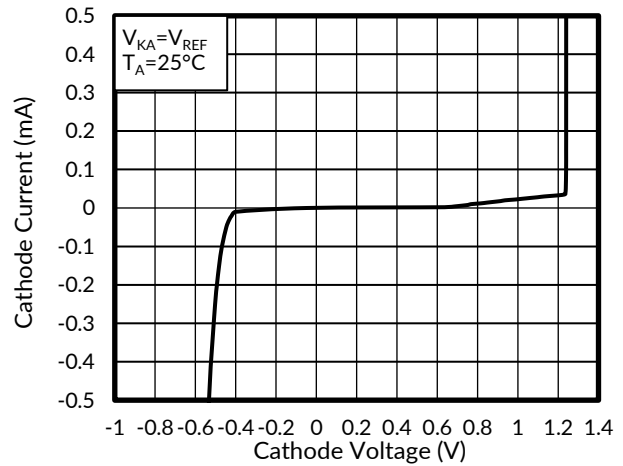


## 8.6 Typical Performance Characteristics

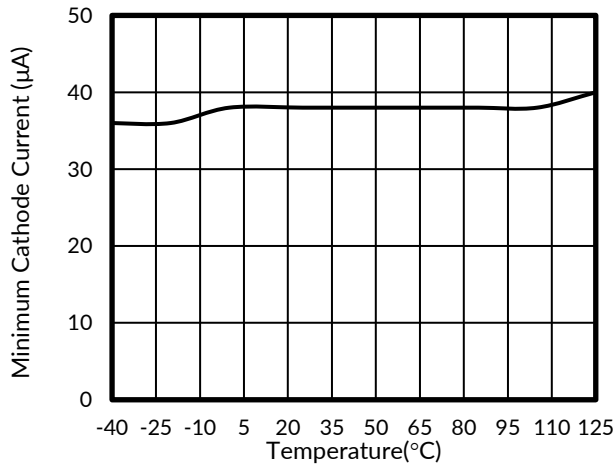
NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.



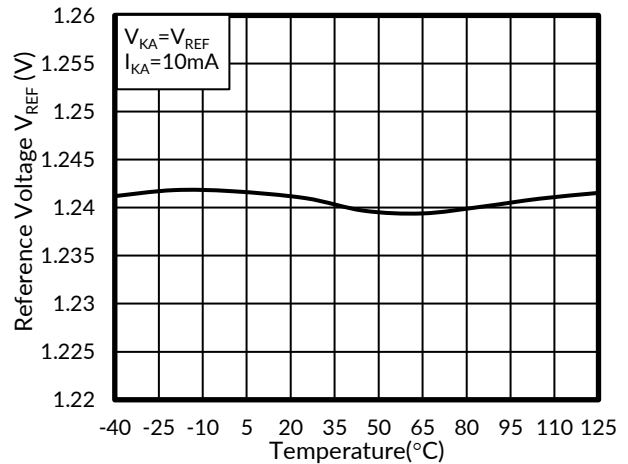
**Figure 4. Cathode Current vs Cathode Voltage**



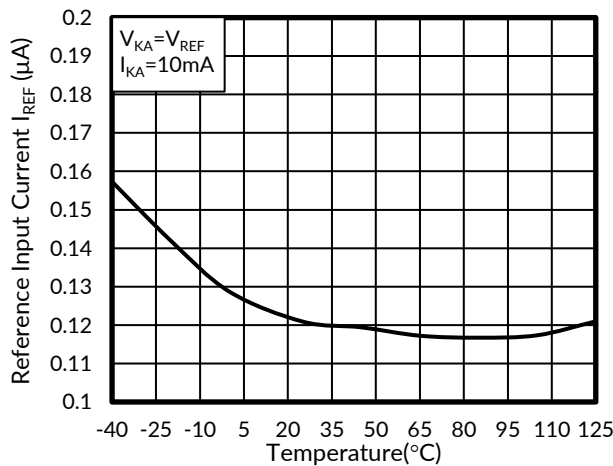
**Figure 5. Cathode Current vs Cathode Voltage**



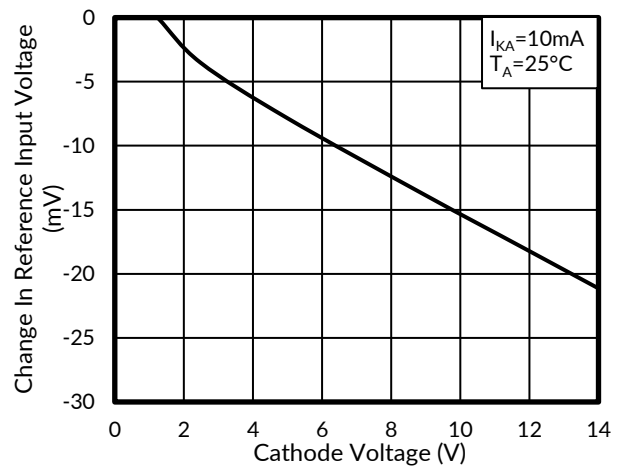
**Figure 6. Minimum Cathode Current vs Ambient Temperature**



**Figure 7. Reference Voltage vs Ambient Temperature**



**Figure 8. Reference Input Current vs Ambient Temperature**



**Figure 9. Change in Reference Input Voltage vs Cathode voltage**

### 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.

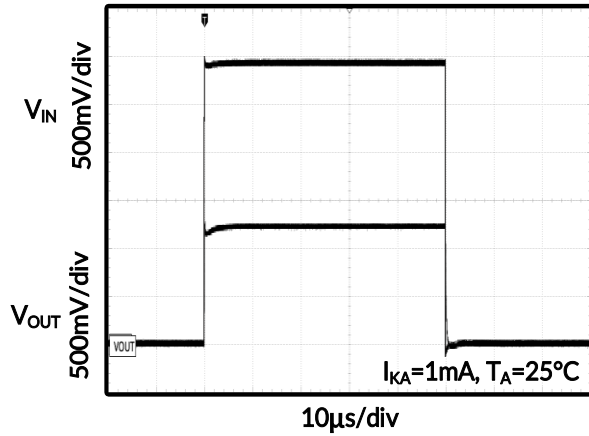


Figure 10. Pulse Response

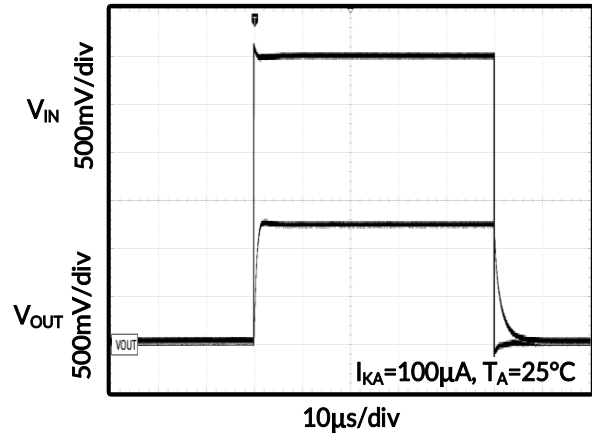


Figure 11. Pulse Response

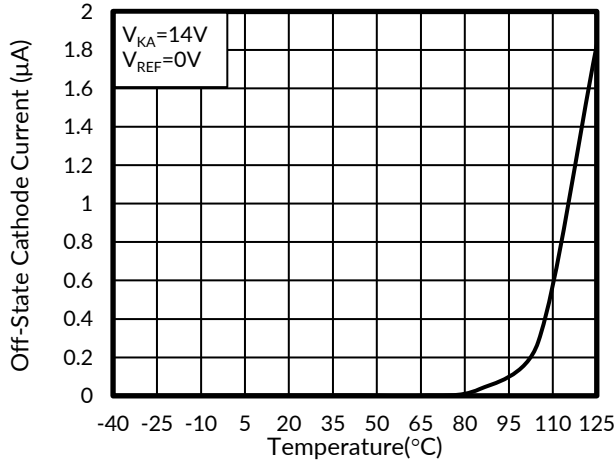
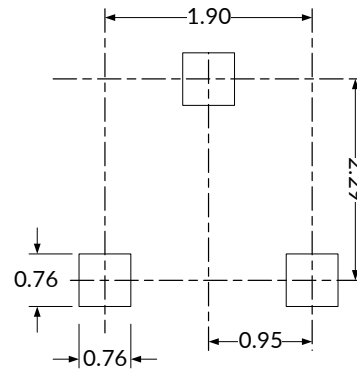
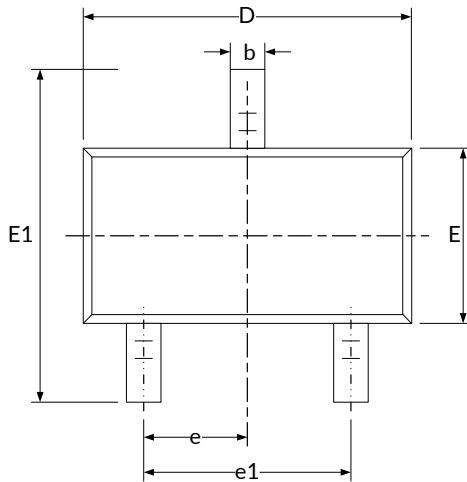
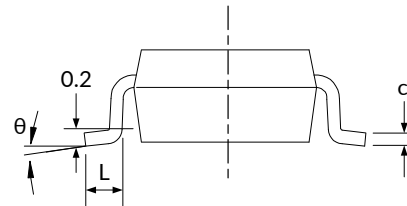
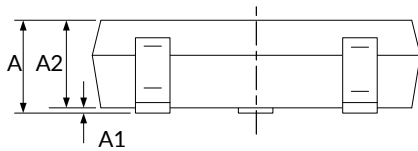


Figure 12. Off-State Cathode Current vs Ambient Temperature

## 9 PACKAGE OUTLINE DIMENSIONS

### SOT23<sup>(3)</sup>


**RECOMMENDED LAND PATTERN (Unit: mm)**


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

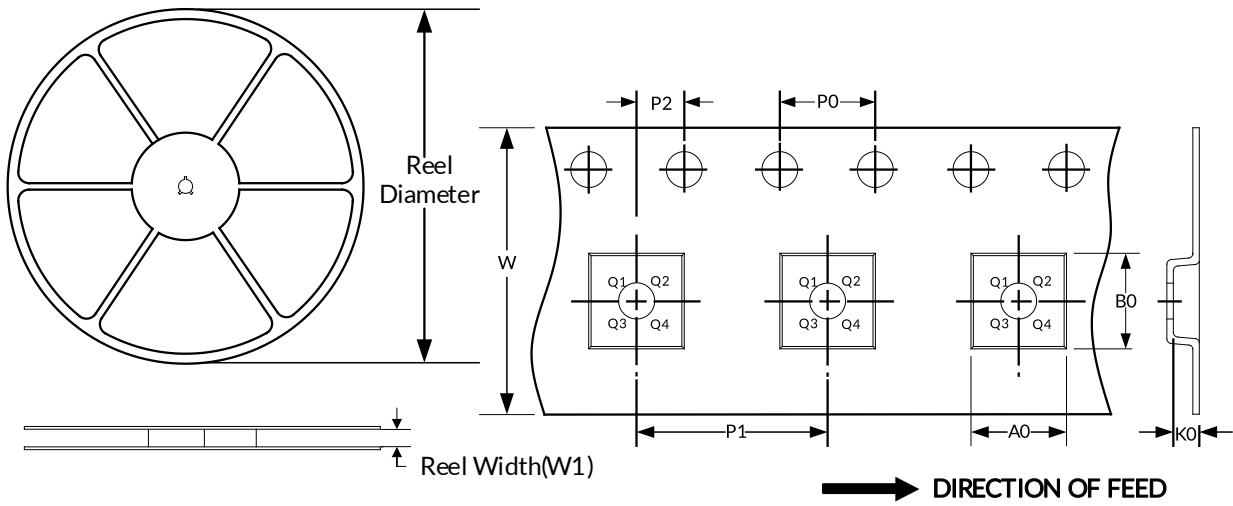
**NOTE:**

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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