

SMP1321 Series: Low Capacitance, Plastic Packaged PIN Diodes

Applications

- High-performance wireless switches
- WLAN 802.11 a/b/g systems (SMP1321-508)

Features

- Capacitance: 0.25 pF
- Packages rated MSL1, 260 °C per JEDEC J-STD-020



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.



Description

The SMP1321 series of plastic packaged, surface mountable PIN diodes is designed for use in high volume switch applications from 10 MHz to more than 2 GHz. The low capacitance of these diodes (0.25 pF), combined with a low resistance (2.0 Ω maximum at 10 mA), makes the SMP1321 series particularly suited to high isolation, series-connected PIN diode switches in battery operated circuits.

The SMP1321 series is available in a selection of plastic packages and a variety of configurations that include a low inductance SOT-23 (0.4 nH), a small footprint SC-79, and a miniature SC-70. The SMP1321-508 has been specifically designed for WLAN 802.11 a/b/g applications.

Table 1 describes the various packages and marking of the SMP1321 series.

Table 1. SMP1321 Series Packaging and Marking

Single	Common Anode	Common Cathode	Series Pair	Low Inductance	Single	Single	Anti-Parallel
SOT-23	SOT-23	SOT-23	SOT-23	SOT-23	SOD-323 Green™	SC-79 Green™	LGA Green™
SMP1321-001 Marking: PM1	SMP1321-003 Marking: PM9	SMP1321-004 Marking: PM3	◆SMP1321-005 Marking: PM2	SMP1321-007 Marking: PMB			SMP1321-508 Pb-Free Marking: H
SMP1321-001LF Green™ Marking: RM1	SMP1321-003LF Green™ Marking: RM9	SMP1321-004LF Green™ Marking: RM3	◆SMP1321-005LF Green™ Marking: RM2	SMP1321-007LF Green™ Marking: RMB	SMP1321-011LF Marking: RM	SMP1321-079LF Marking: Cathode	
L _S = 1.5 nH	L _S = 1.5 nH	L _S = 1.5 nH	L _S = 1.5 nH	L _S = 0.4 nH	L _S = 1.5 nH	L _S = 0.7 nH	L _S = 0.6 nH
	SC-70		SC-70	SC-70			
	SMP1321-073 Marking: PM9		SMP1321-074 Marking: PM2	SMP1321-075 Marking: PMB			
	SMP1321-073LF Green™ Marking: RM9		SMP1321-074LF Green™ Marking: RM2	SMP1321-075LF Green™ Marking: RM2			
	L _S = 1.4 nH		L _S = 1.4 nH	L _S = 1.4 nH			



The Pb-free symbol or "LF" in the part number denotes a lead-free, RoHS-compliant package unless otherwise noted as Green™. Tin/lead (Sn/Pb) packaging is not recommended for new designs.



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SMP1321-007

For the -007 configuration of the SOT-23 package, the package inductance is effectively reduced to 0.4 nH compared to the 1.5 nH value of the standard configuration. This lower inductance is particularly beneficial when the diodes are used as shunt connected switches at frequencies higher than 500 MHz in which inductance is the primary limitation on maximum switch isolation.

To achieve the effective 0.4 nH, the SOT-23 package must be inserted in the microstrip circuit board with a gap in the trace, as shown in Figure 1. Because of the polarity of the diode junction, this low inductance feature is realizable only with the cathode connected to ground.

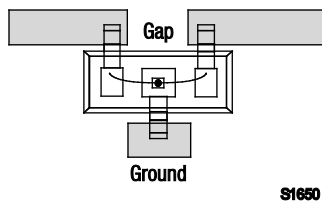


Figure 1. SOT-23 Package Trace Gap

Electrical and Mechanical Specifications

The part number and configuration for the SMP1321 series are provided in Table 1. The absolute maximum ratings of the

SMP1321 series are provided in Table 2. Electrical specifications are provided in Table 3. Resistance versus temperature measurements are provided in Table 4.

Typical performance characteristics of the SMP1321 series are illustrated in Figures 2 to 5. Package dimensions are shown in Figures 6 to 14 (even numbers), and tape and reel dimensions are provided in Figures 7 to 15 (odd numbers).

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SMP1321 series is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

Table 2. SMP1321 Series Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Reverse voltage	V_R		100	V
Power dissipation @ 25 °C lead temperature	P_D		250	mW
Storage temperature	T_{STG}	-65	+150	°C
Operating temperature	T_A	-65	+150	°C

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

CAUTION: Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times. The SMP1321 series PIN diodes are Class 1A ESD devices.

Table 3. SMP1321 Series Electrical Specifications (Note 1)
($T_A = +25\text{ °C}$, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Reverse current	I_R	$V_R = 100\text{ V}$			10	μA
Capacitance (Note 2)	C_T	$F = 1\text{ MHz}, V = 30\text{ V}$			0.25	pF
Resistance	R_S	$F = 100\text{ MHz}$ $I = 1\text{ mA}$ $I = 10\text{ mA}$		3	2	Ω Ω
Forward voltage	V_F	$I_F = 10\text{ mA}$		0.85		V
Carrier lifetime	τ_I	$I_F = 10\text{ mA}$		0.4		μs
I region width				15		μm

Note 1: Performance is guaranteed only under the conditions listed in this Table.

Note 2: C_T is 0.4 pF maximum for the SMP1321-007.

Table 4. Resistance vs Temperature @ 500 MHz

I_F (mA)	$R_S @ -55\text{ °C}$ (Ω)	$R_S @ -15\text{ °C}$ (Ω)	$R_S @ +25\text{ °C}$ (Ω)	$R_S @ +65\text{ °C}$ (Ω)	$R_S @ +100\text{ °C}$ (Ω)
0.02	47.4	50.0	56.3	61.5	65.1
0.10	12.0	12.6	13.9	15.4	16.4
0.3	5.2	5.4	5.8	6.4	6.9
0.5	3.6	3.8	4.1	4.5	4.8
1.0	2.4	2.5	2.6	2.8	3.1
10	1.03	1.04	1.04	1.07	1.15
20	0.871	0.888	0.873	0.889	0.956
100	0.669	0.659	0.642	0.645	0.695

Typical Performance Characteristics

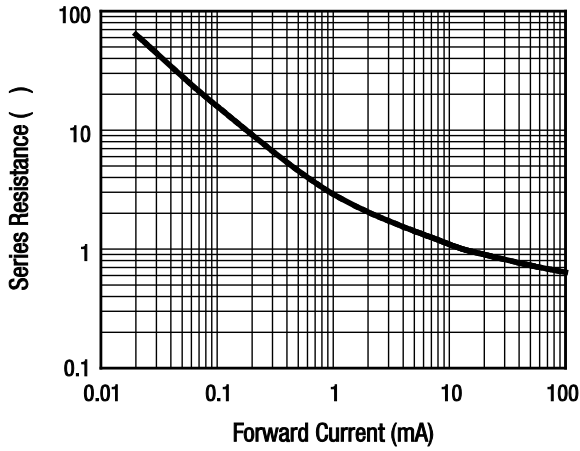


Figure 2. Series Resistance vs Current @ 100 MHz

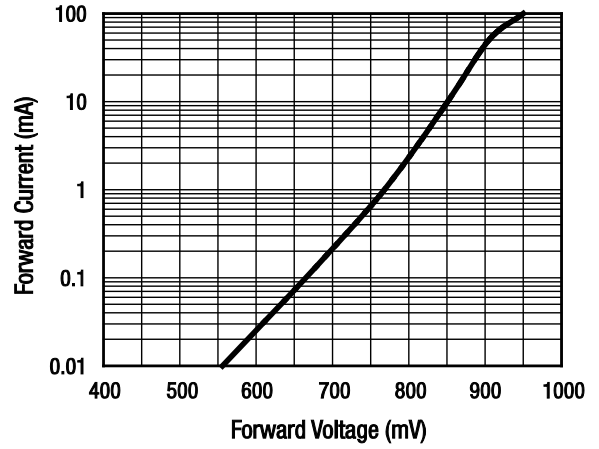


Figure 3. DC Characteristics

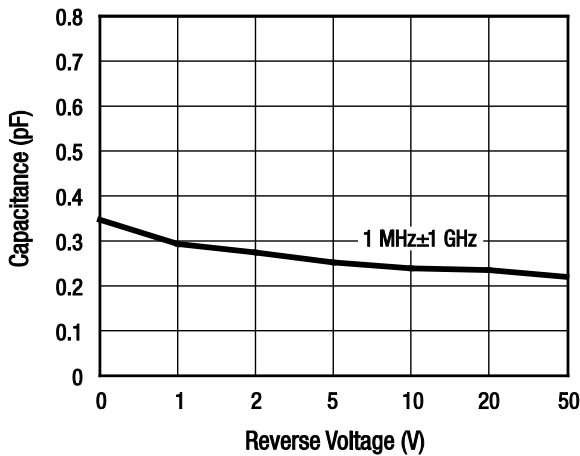


Figure 4. Capacitance vs Reverse Voltage

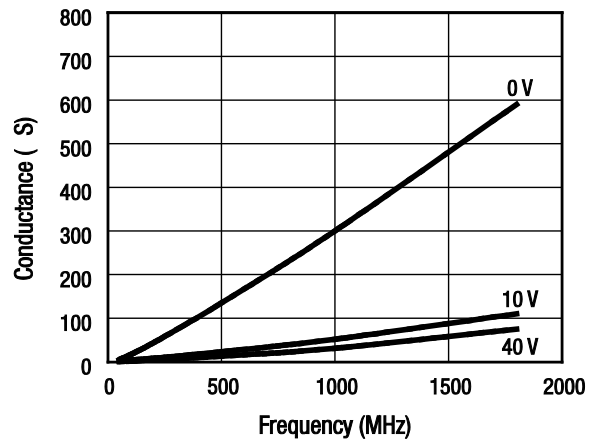
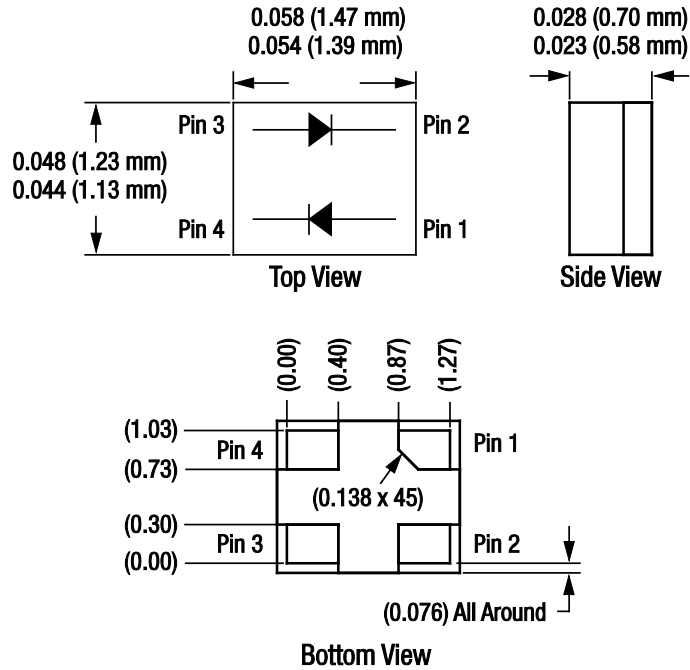


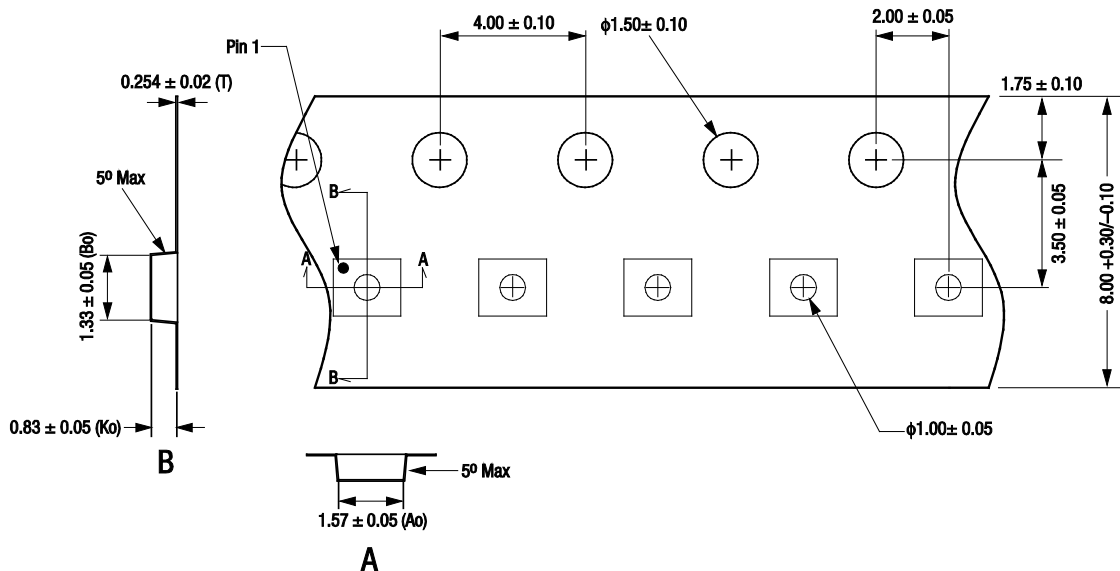
Figure 5. Conductance vs Frequency and Reverse Voltage



Dimensions are in inches (millimeters shown in parentheses)

S1659

Figure 6. LGA Package Dimensions



- Notes:
1. Carrier tape: black conductive polycarbonate or polystyrene.
 2. Cover tape material: transparent conductive PSA.
 3. Cover tape size: 5.4 mm width.
 4. All measurements are in millimeters.
 5. Standard reel size is 7 inches. Standard reel quantity is 3000 pcs.

S1682

Figure 7. LGA Tape and Reel Dimensions

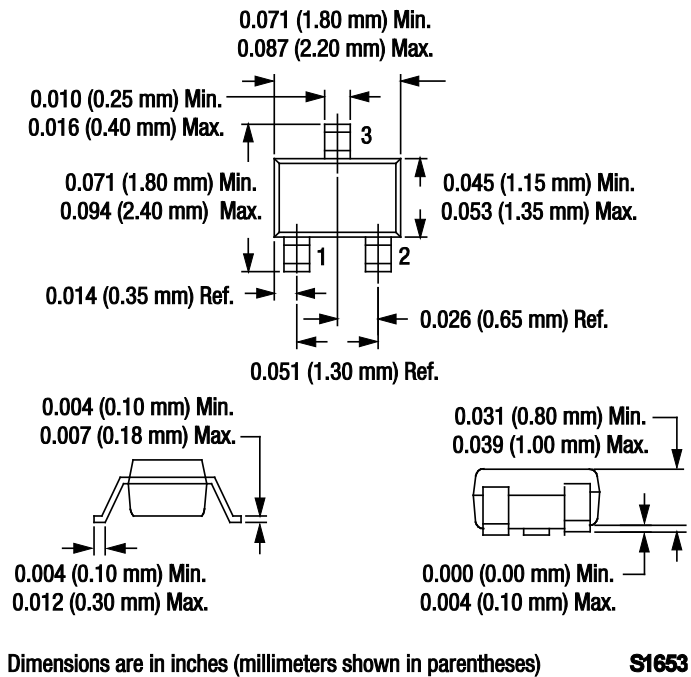
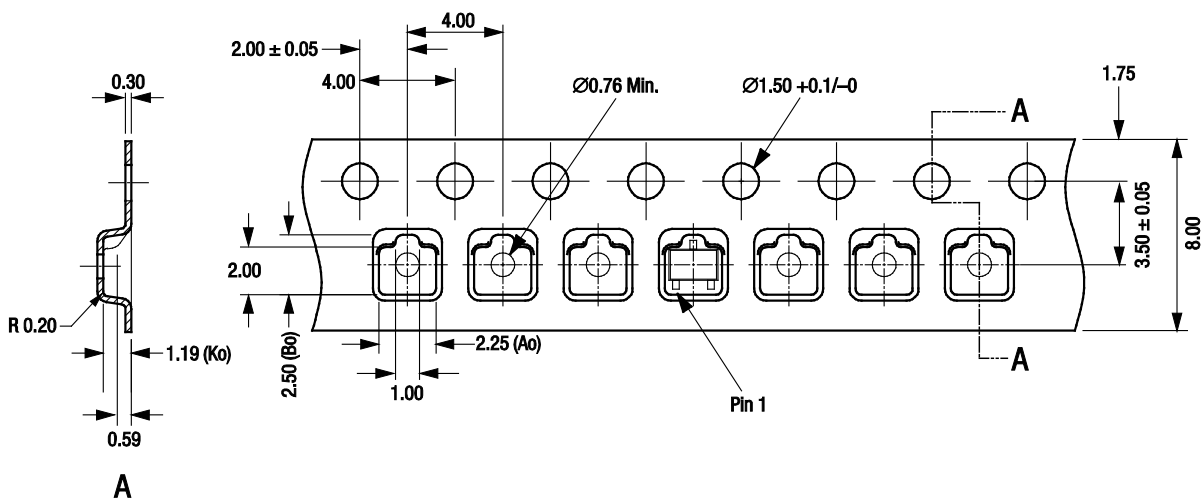


Figure 8. SC-70 Package Dimension Drawing

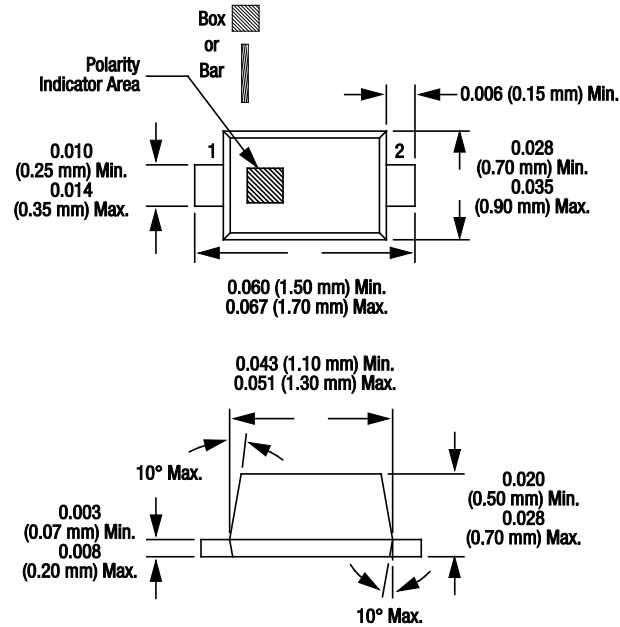


Notes:

1. Carrier tape: black conductive polystyrene bakeable material at 125 °C.
2. Cover tape material: transparent conductive PSA.
3. Cover tape size: 5.40 mm width.
4. ESD surface resistivity is $\geq 1 \times 10^4$ and approx. $\leq 1 \times 10^9$ Ohms/square per EIA, JEDEC TNR Specification.
5. All measurements are in millimeters.

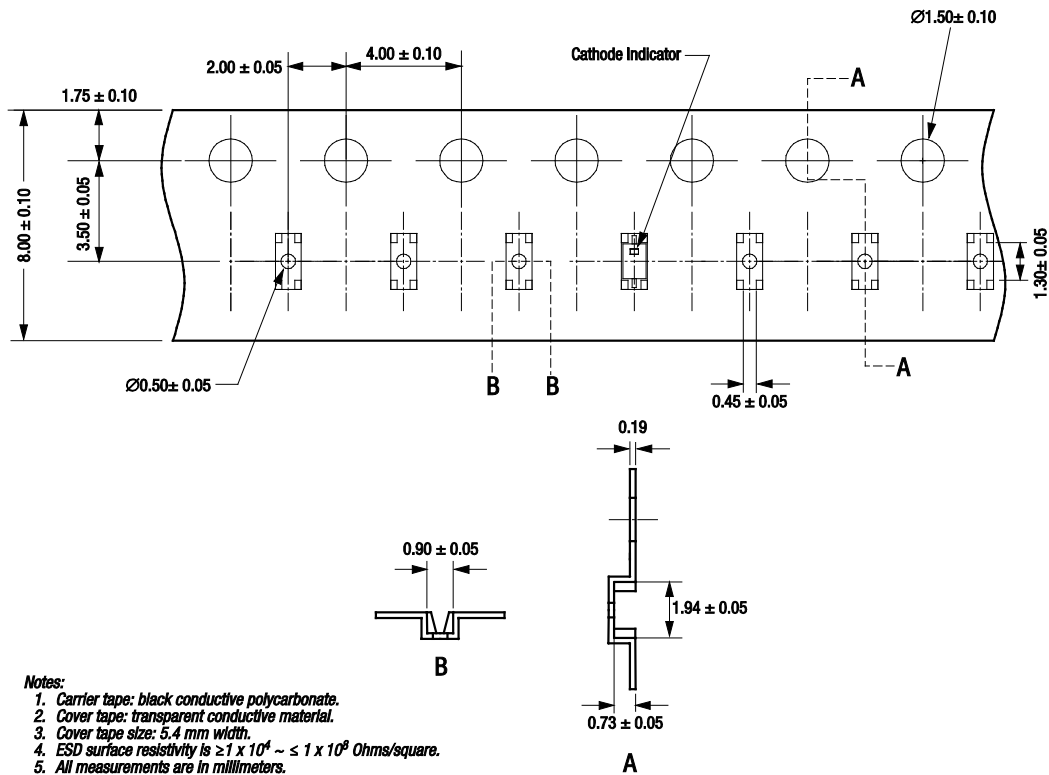
S1685b

Figure 9. SC-70 Tape and Reel Dimensions



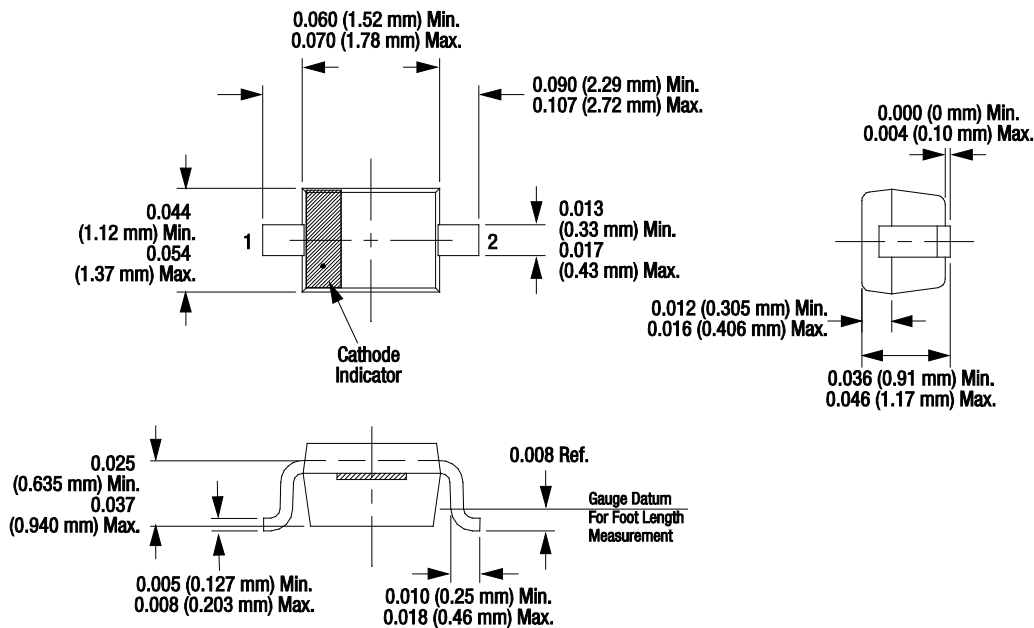
Dimensions are in inches (millimeters shown in parentheses) S1652

Figure 10. SC-79 Package Dimension Drawing



S2188

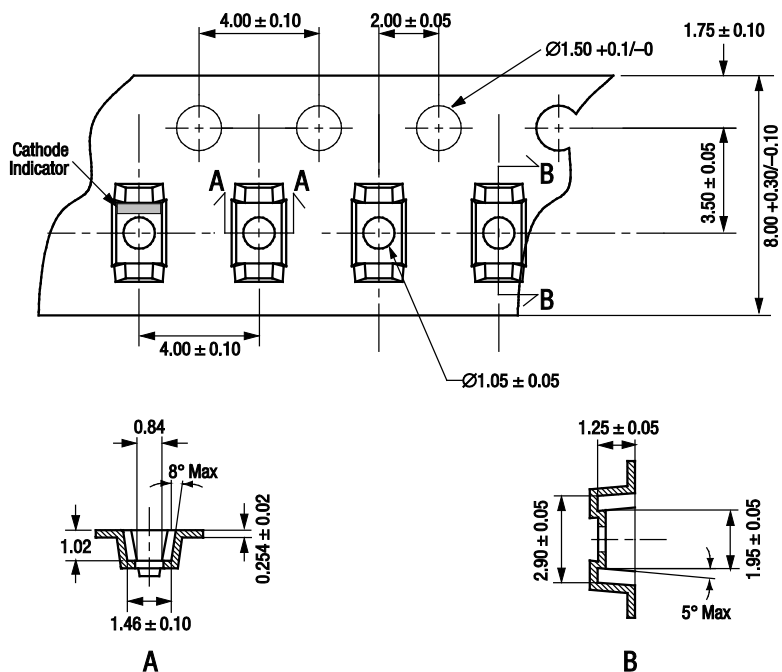
Figure 11. SC-79 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses)

S1619

Figure 12. SOD-323 Package Dimension Drawing

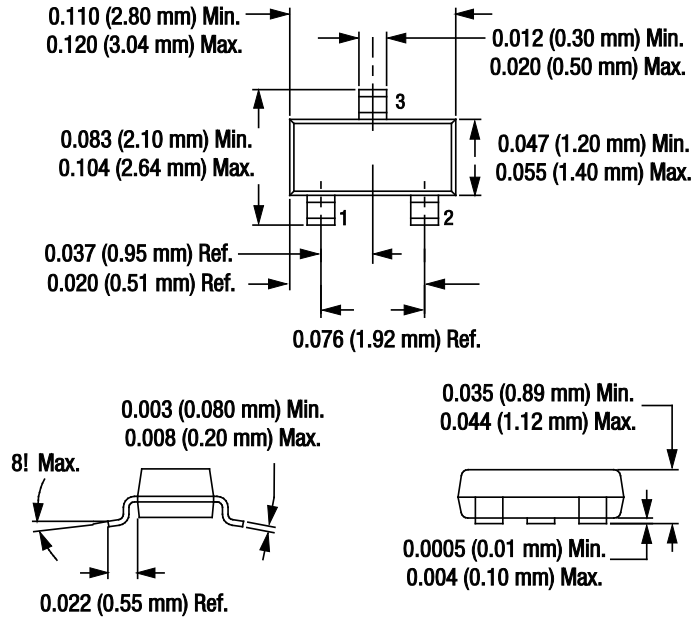


Notes:

1. Carrier tape: black conductive polycarbonate or polystyrene.
2. Cover tape: transparent conductive material.
3. Cover tape size: 5.5 mm width.
4. ESD surface resistivity is $\geq 1 \times 10^5 \sim \leq 1 \times 10^{11}$ Ohms/square.
5. 10 sprocket hole pitch cumulative tolerance: ± 0.20 mm.
6. A_0 and B_0 measured on plane 0.30 mm above bottom of the pocket.
7. All measurements are in millimeters.
8. Standard reel size is 7 inches. Standard reel quantity is 3000 pcs.

S2061

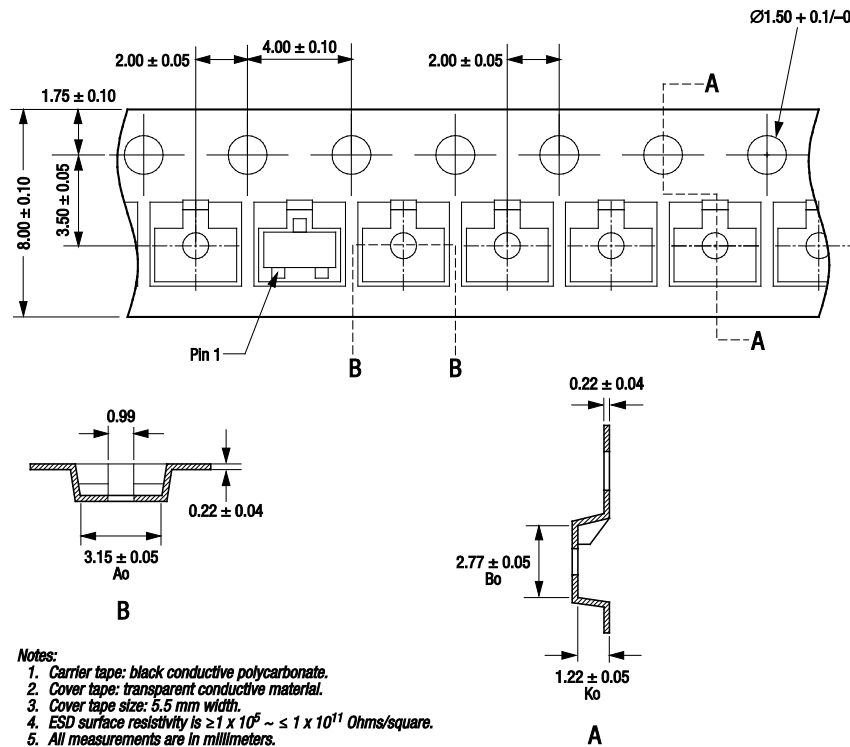
Figure 13. SOD-323 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses)

S1399

Figure 14. SOT-23 Package Dimension Drawing



- Notes:
1. Carrier tape: black conductive polycarbonate.
 2. Cover tape: transparent conductive material.
 3. Cover tape size: 5.5 mm width.
 4. ESD surface resistivity is $\geq 1 \times 10^5 \sim \leq 1 \times 10^{11}$ Ohms/square.
 5. All measurements are in millimeters.
 6. Standard reel size is 7 inches. Standard reel quantity is 3000 pcs.

S2259

Figure 15. SOT-23 Tape and Reel Dimensions

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