

# Surface Mount Mixer and Detector Schottky Diodes

## Applications

- Sensitive RF and microwave detector circuits
- Sampling and mixer circuits
- High-volume wireless
- WiFi and mobile
- Low-noise receivers in high-sensitivity ID tags
- Radio designs

## Features

- Tight parameter distribution
- Available as singles, pairs, and dual pairs
- 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

These low-cost, surface mountable, plastic packaged silicon mixer Schottky diodes are designed for RF and microwave mixers and detectors. They include low barrier diodes and zero-bias detectors that combine Skyworks advanced semiconductor technology with low-cost packaging techniques. All diodes are 100 percent DC tested and deliver tight parameter distribution, which minimizes performance variability.

These diodes are available in SOD-882, SC-70, SC-79, SC-88, SOD-323, SOT-23, SOT-143, and Molded Interconnect System (MIS) packages. Wiring configurations include singles, common cathode, series pairs, unconnected pairs, and dual series pairs. They may be used at frequencies up to 24 GHz.

Table 1 describes the various packages and marking of the mixer and detector Schottky diodes.

**Table 1. Schottky Diode Packaging and Marking**

Single	Single	Single	Common Cathode	Series Pair
SC-79 Green™	SOD-323 Green™	SOT-23	SOT-23	SOT-23
				<b>SMS1546-005LF</b> Green™ Marking: XG2
		<b>SMS7621-001</b> Marking: SH1		◆ <b>SMS7621-005</b> Marking: SH2
◆ <b>SMS7621-079LF</b> Marking: Cathode		<b>SMS7621-001LF</b> Green™ Marking: XH1		◆ <b>SMS7621-005LF</b> Green™ Marking: XH2
		<b>SMS7630-001</b> Marking: SD1		<b>SMS7630-005</b> Marking: SD2
◆ <b>SMS7630-079LF</b> Marking: Anode	<b>SMS7630-011LF</b> Marking: XD	<b>SMS7630-001LF</b> Green™ Marking: XD1		<b>SMS7630-005LF</b> Green™ Marking: XD2
$L_S = 0.7 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$		$L_S = 1.5 \text{ nH}$
			SC-70	SC-70
			<b>SMS7621-074</b> Marking: SH3	<b>SMS7621-075</b> Marking: SH2
			<b>SMS7621-074LF</b> Green™ Marking: XH3	<b>SMS7621-075LF</b> Green™ Marking: XH2
			$L_S = 1.4 \text{ nH}$	$L_S = 1.4 \text{ nH}$

Reverse Series Pair	Unconnected Pair	Reverse Unconnected Pair	Unconnected Pair	Dual Series Pair	Single
SOT-23	SOT-143	SOT-143	MIS Green™	SC-88 Green™	SOD-882 Green™
◆ <b>SMS7621-006</b> Marking: SH8	<b>SMS7621-015</b> Marking: SH7		<b>SMS7621-517</b> Marking: H Pb-Free		
◆ <b>SMS7621-006LF</b> Green™ Marking: XH8	<b>SMS7621-015LF</b> Marking: XH7			<b>SMS7621-081LF</b> Marking: XHQ	<b>SMS7621-040LF</b> Marking: E
◆ <b>SMS7630-006</b> Marking: SD8		◆ <b>SMS7630-020</b> Marking: SD0	<b>SMS7630-517</b> Marking: D Pb-Free		
◆ <b>SMS7630-006LF</b> Green™ Marking: XD8		◆ <b>SMS7630-020LF</b> Marking: XD0			<b>SMS7630-040LF</b> Marking: P
$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 1.5 \text{ nH}$	$L_S = 0.6 \text{ nH}$	$L_S = 1.8 \text{ nH}$	$L_S = 0.45 \text{ nH}$



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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## Electrical and Mechanical Specifications

The absolute maximum ratings of the mixer and detector Schottky diodes are provided in Table 2. Electrical specifications are provided in Tables 3 and 4. The associated SPICE model parameters are provided in Table 5. A typical detector schematic diagram is shown in Figure 1.

A pinout and equivalent circuit diagram for the dual series pair Schottky diode (SMS7621-081LF) is shown in Figure 2. Typical performance characteristics are illustrated in Figures 3 and 4. Package dimensions are shown in Figures 5 to 19 (odd numbers), and tape and reel dimensions are provided in Figures 6 to 20 (even numbers).

Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The mixer and detector Schottky diodes are rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C for 5 seconds. They 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.

## Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed.

**Table 2. Surface Mount Mixer and Detector Diodes Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Maximum	Units
Reverse voltage	$V_R$		Rated $V_B$	V
Forward current, steady state	$I_F$		50	mA
Power dissipation	$P_D$		75	mW
Storage temperature	$T_{STG}$	-65	+150	°C
Operating temperature	$T_A$	-65	+150	°C
Junction temperature	$T_J$		+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.

**Table 3. Surface Mount Mixer and Detector Diodes Electrical Specifications (Note 1)**  
( $T_A = +25$  °C Per Junction, Unless Otherwise Noted)

Part Number	Barrier	Minimum $V_B$ @ 10 $\mu$ A (V)	Typical $C_T$ @ 0 V (pF)	$V_F$ @ 1 mA (mV)	Maximum Pair Configuration $\Delta V_F$ @ 1 mA (mV)	Maximum $R_T$ (Note 2) ( $\Omega$ )
SMS1546 series	Low	2	0.50	200 to 270	10	8 @ 10 mA
SMS7621 series	Low	2	0.25	260 to 320	10	18 @ 5 mA

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

**Note 2:**  $R_T$  is the slope resistance.

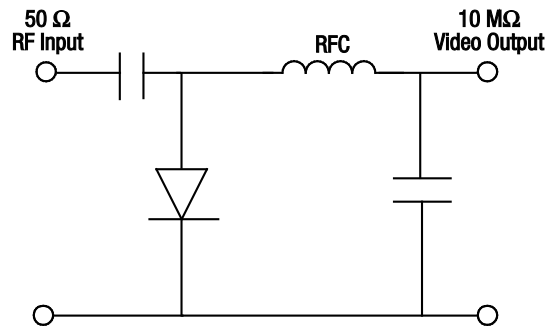
**Table 4. Surface Mount Mixer and Detector Diodes Electrical Specifications (Note 1)**  
 (TA = +25 °C Per Junction, Unless Otherwise Noted)

Part Number	Minimum V <sub>B</sub> @ 100 $\mu$ A (V)	Typical C <sub>T</sub> @ 0.15 V (pF)	V <sub>F</sub> @ 0.1 mA (mV)	V <sub>F</sub> @ 1 mA (mV)	Maximum Pair Configuration $\Delta$ V <sub>F</sub> @ 1 mA (mV)	Typical R <sub>v</sub> ( $\Omega$ )
SMS7630 series	1	0.3	60 to 120	135 to 240	10	5000

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

**Table 5. SPICE Model Parameters (Per Junction)**

Parameter	Units	SMS1546 Series	SMS7621 Series	SMS7630 Series
I <sub>s</sub>	A	3E-7	4E-8	5E-6
R <sub>s</sub>	$\Omega$	4	12	20
N	–	1.04	1.05	1.05
T <sub>T</sub>	sec	1E-11	1E-11	1E-11
C <sub>J0</sub>	pF	0.38	0.1	0.14
M	–	0.36	0.35	0.40
E <sub>g</sub>	eV	0.69	0.69	0.69
X <sub>TI</sub>	–	2	2	2
F <sub>c</sub>	–	0.5	0.5	0.5
B <sub>v</sub>	V	3	3	2
I <sub>bv</sub>	A	1E-5	1E-5	1E-4
V <sub>J</sub>	V	0.51	0.51	0.34



**Figure 1. Typical Detector Circuit**

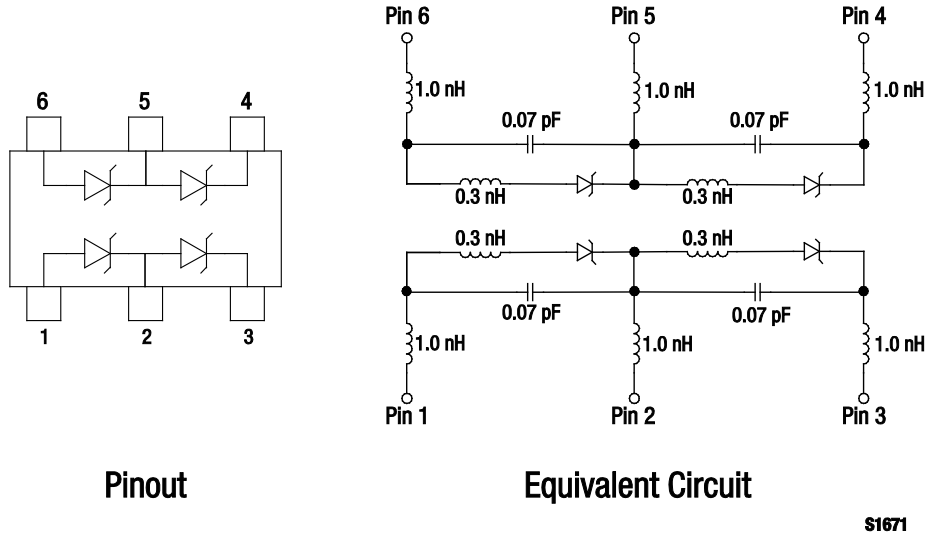


Figure 2. SMS7621-081LF Dual Series Pair Pinout and Equivalent Circuit

**Typical Performance Characteristics**

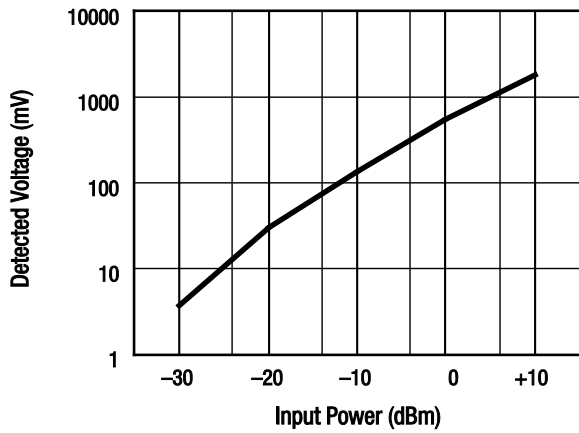


Figure 3. Typical Detector Characteristics @ 1.8 GHz

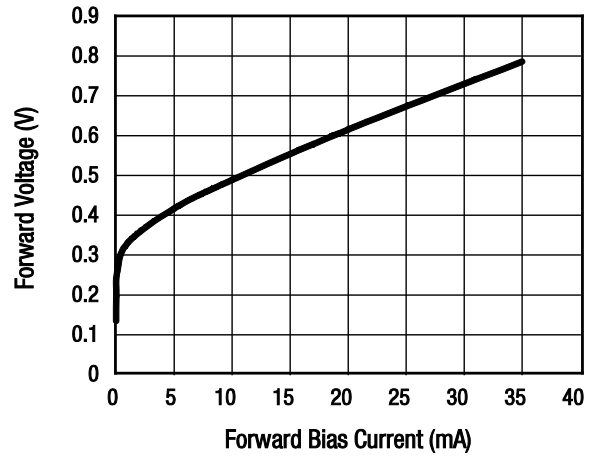
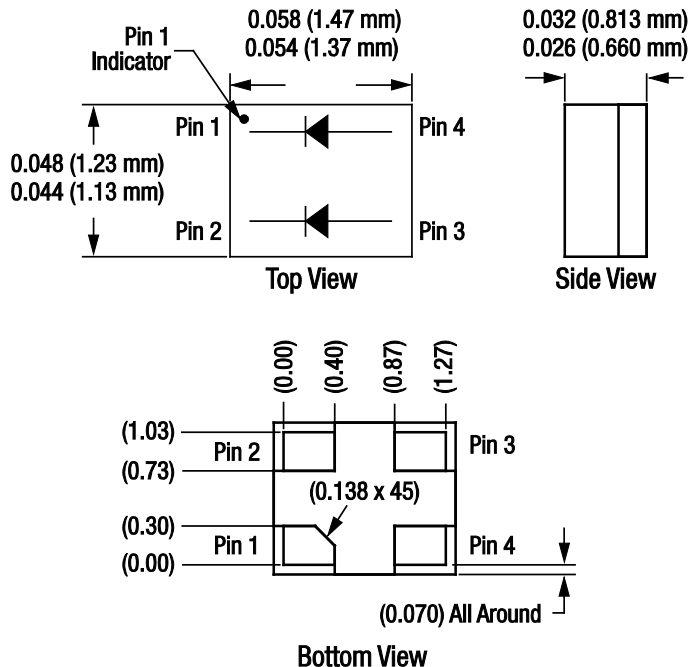


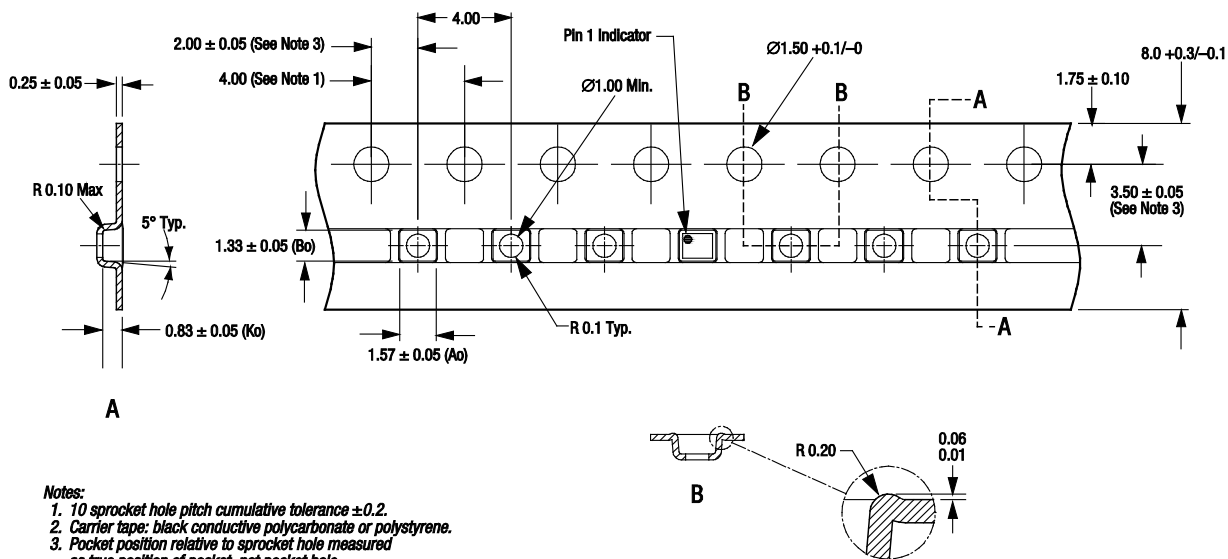
Figure 4. SMS7621-081LF Forward Voltage vs Forward Bias Current



Dimensions are in inches (millimeters shown in parentheses)

S1833

Figure 5. MIS Package Dimension Drawing



Notes:

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
2. Carrier tape: black conductive polycarbonate or polystyrene.
3. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
4. ESD-surface resistivity is  $\leq 1 \times 10^8$  Ohms/square per EIA, JEDEC TNR Specification.
5. Cover tape material: transparent conductive PSA with 5.4 mm width.
6. All measurements are in millimeters.

S2928

Figure 6. MIS Tape and Reel Dimensions

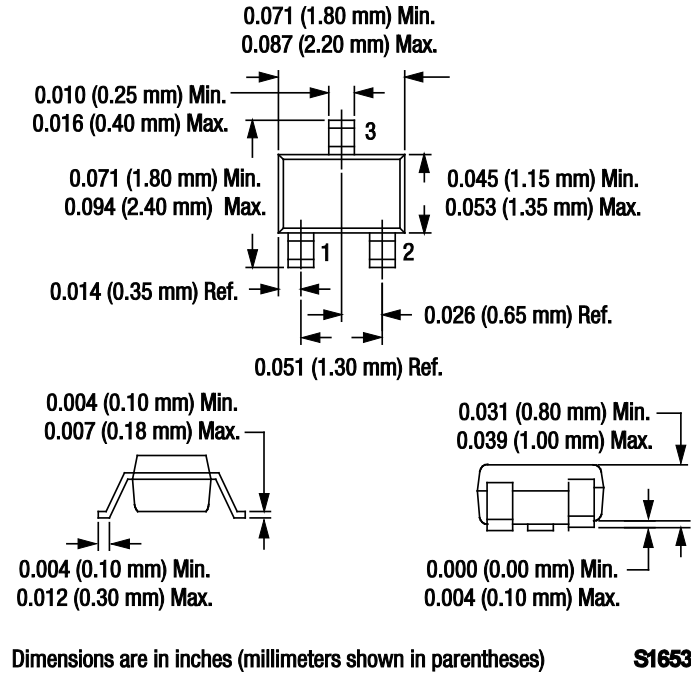
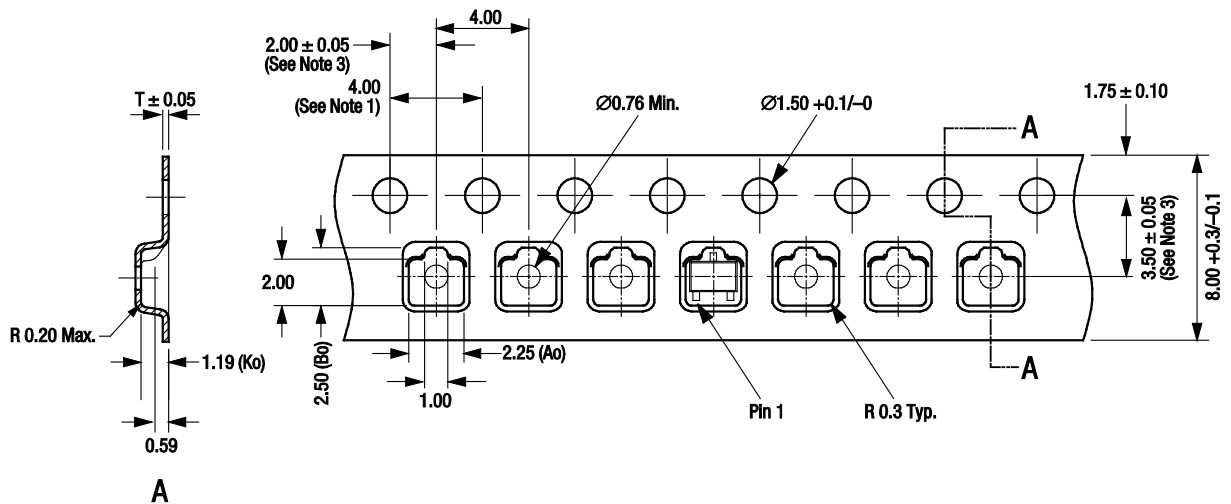


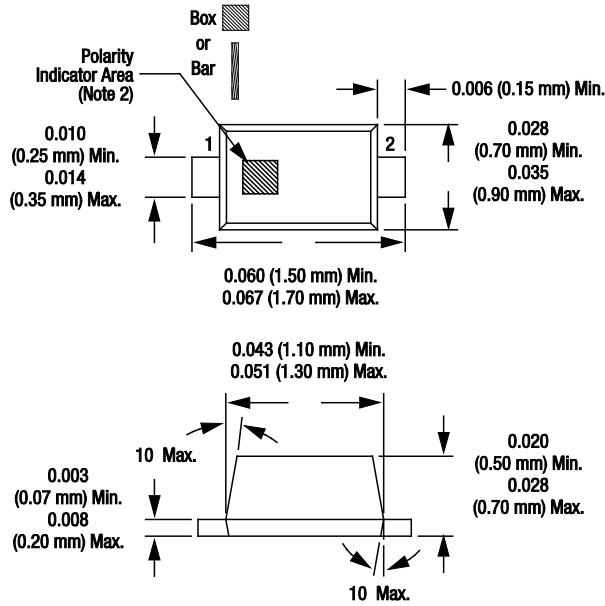
Figure 7. SC-70 Package Dimension Drawing



- Notes:
1. Sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
  2. Carrier tape: black conductive polystyrene.
  3. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
  4. Cover tape material: transparent conductive PSA with 9.2 mm width.
  5. All measurements are in millimeters.

**S1685c**

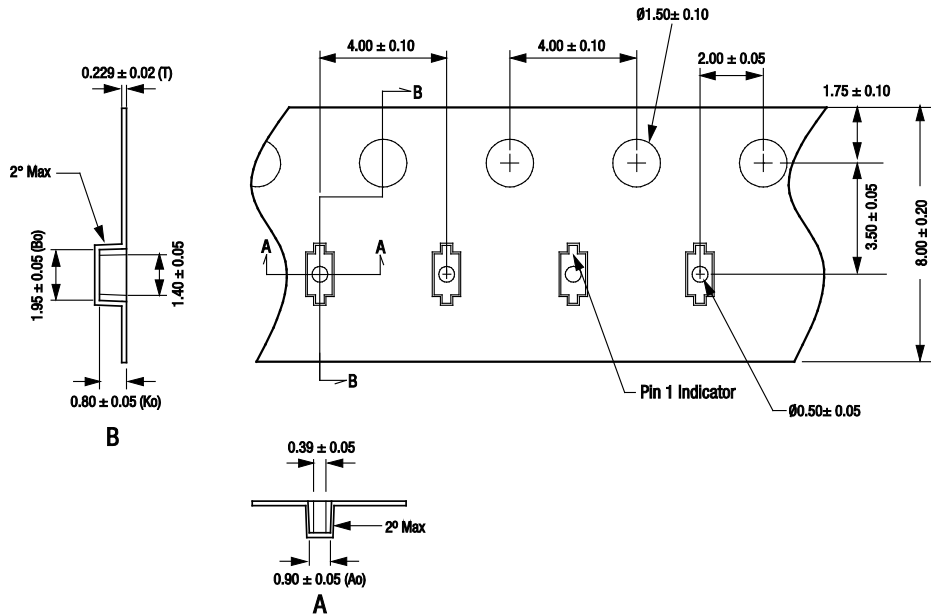
Figure 8. SC-70 Tape and Reel Dimensions



- Notes:  
 1. Dimensions are in inches (millimeters shown in parentheses).  
 2. Cathode indicator for SMS7621-079LF  
 Anode indicator for SMS7630-079LF

S1652a

Figure 9. SC-79 Package Dimension Drawing



- 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. ESD-surface resistivity is  $\leq 1 \times 10^8$  Ohms/square per EIA, JEDEC TNR Specification.  
 4. All measurements are in millimeters.

S2029

Figure 10. SC-79 Tape and Reel Dimensions



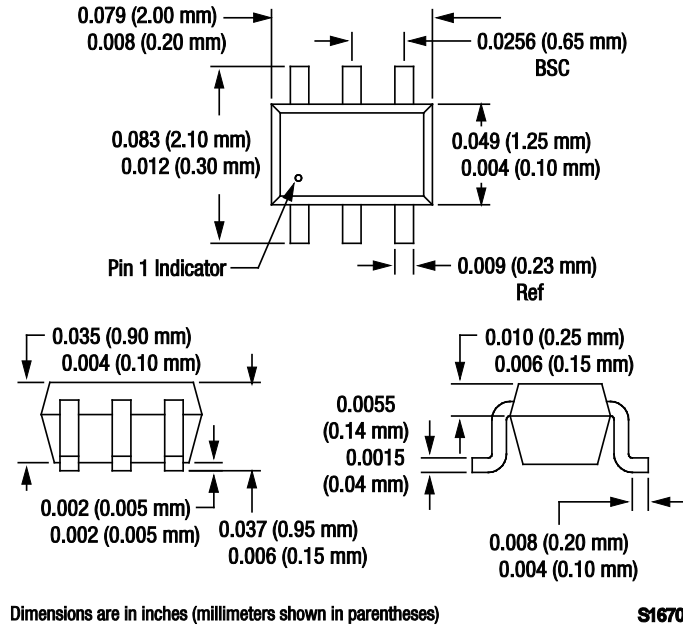


Figure 11. SC-88 Package Dimension Drawing

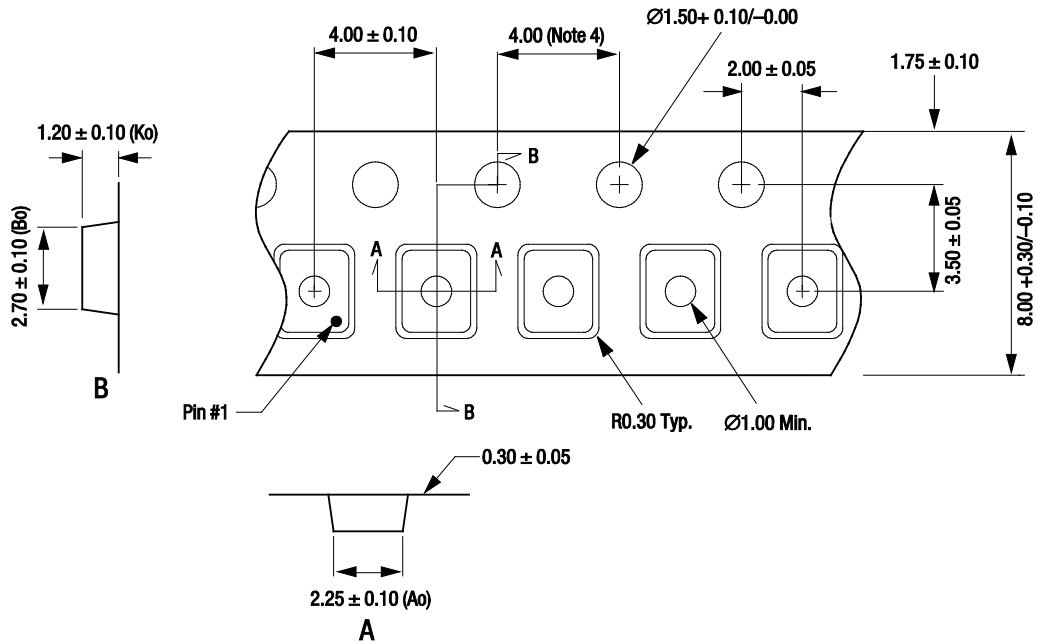


Figure 12. SC-88 Tape and Reel Dimensions

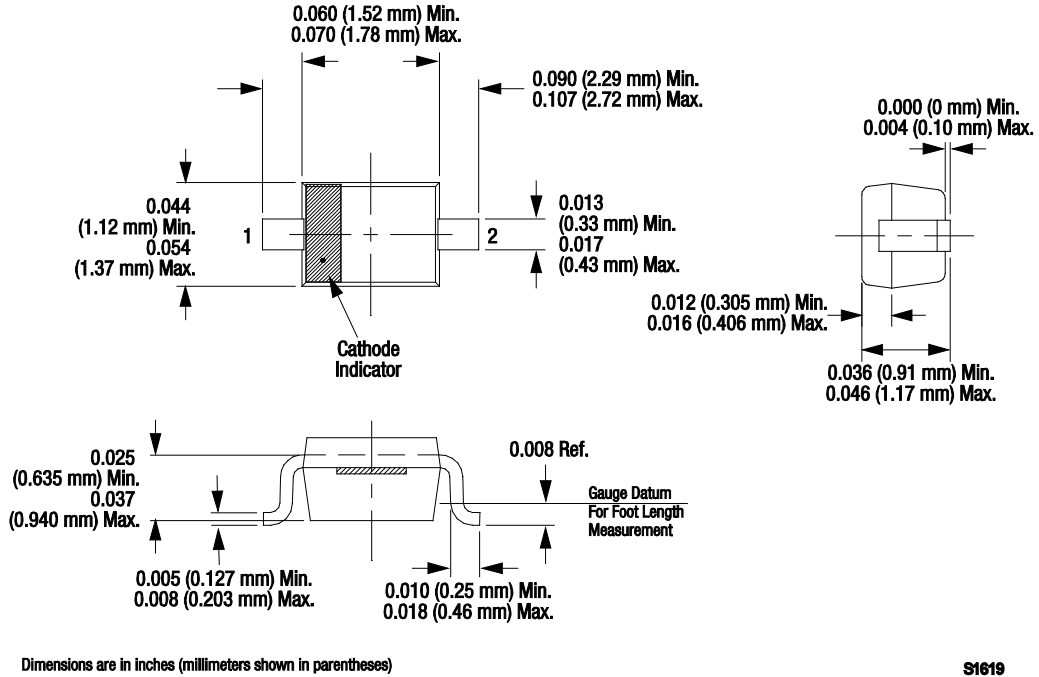
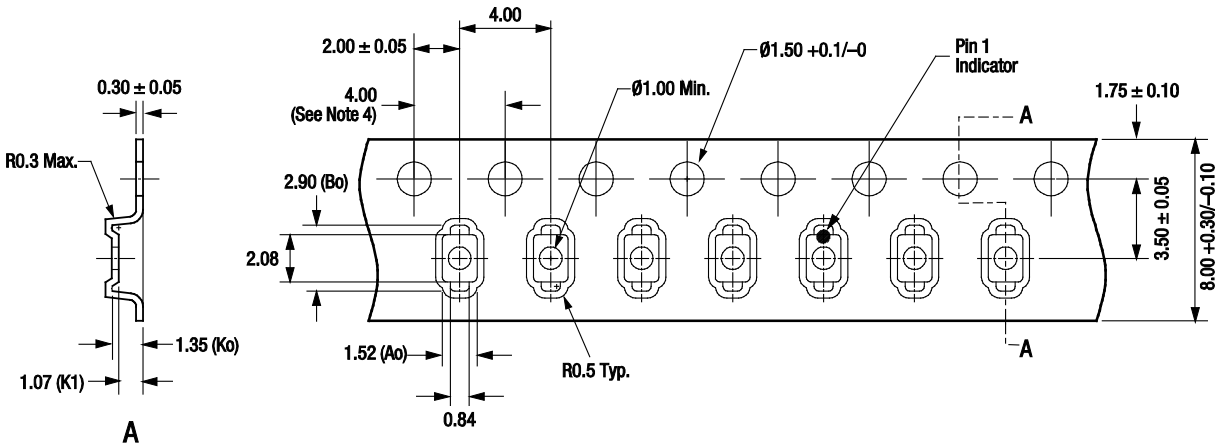


Figure 13. SOD-323 Package Dimension Drawing



- Notes:
1. Carrier tape: black conductive polystyrene.
  2. Cover tape: transparent conductive PSA.
  3. Cover tape size: 5.4 mm width.
  4. 10 sprocket hole pitch cumulative tolerance:  $\pm 0.20$  mm.
  5. All measurements are in millimeters.

S2910

Figure 14. SOD-323 Tape and Reel Dimensions

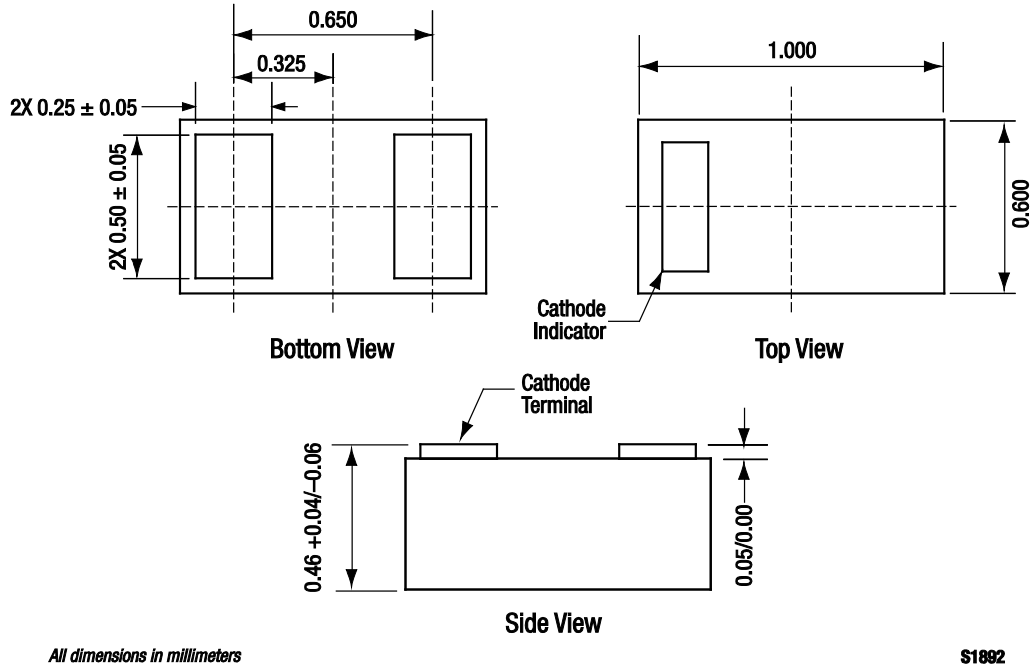


Figure 15. SOD-882 Package Dimension Drawing

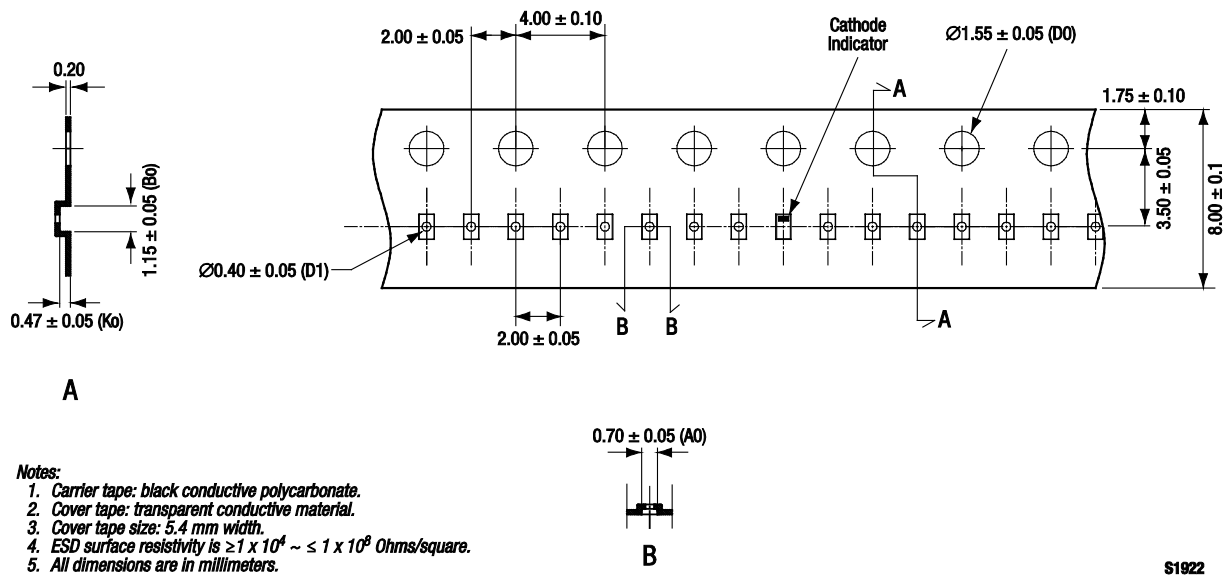


Figure 16. SOD-882 Tape and Reel Dimensions

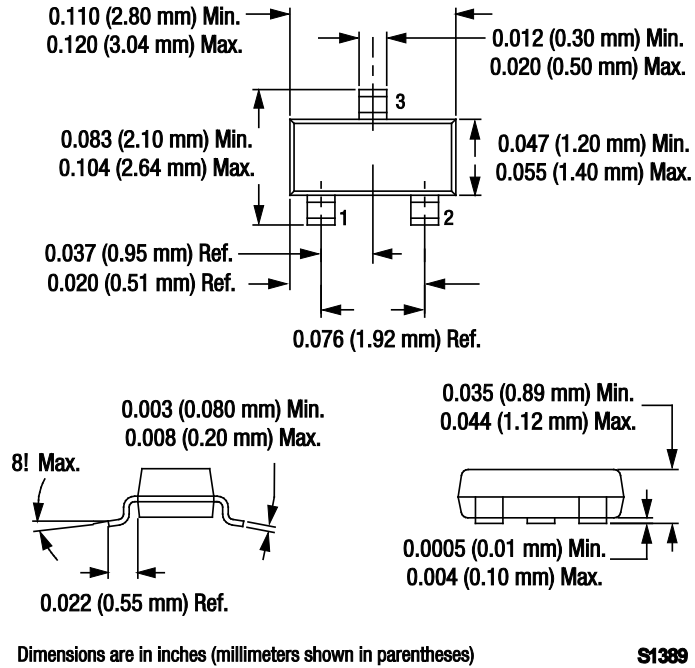
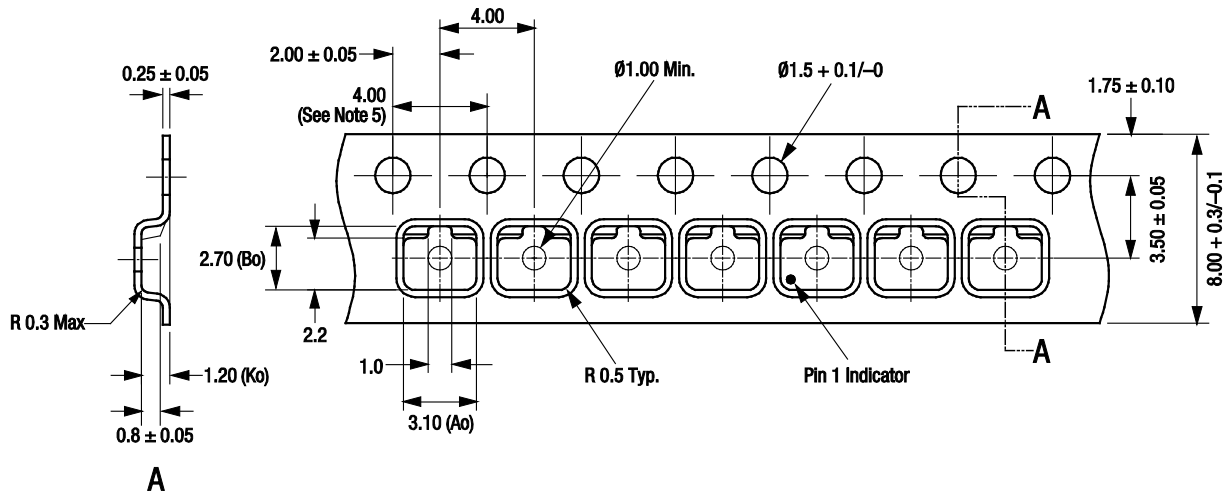


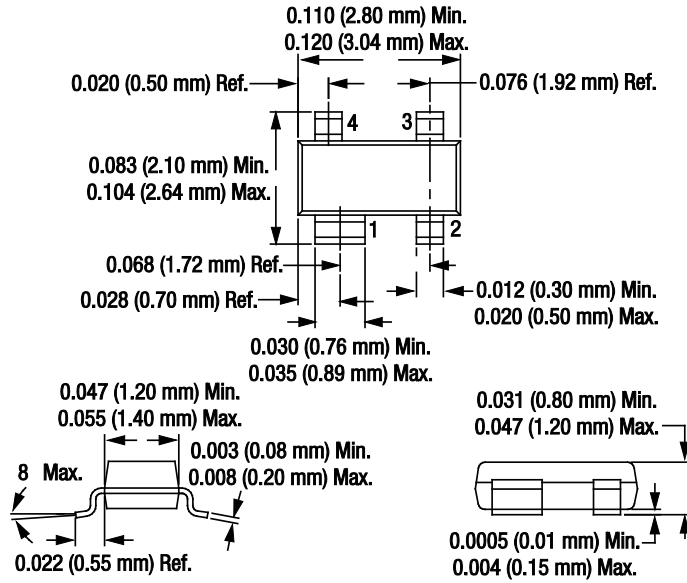
Figure 17. SOT-23 Package Dimension Drawing



- Notes:
1. Carrier tape: black conductive polycarbonate.
  2. Cover tape material: transparent conductive PSA.
  3. Cover tape size: 5.40 mm width.
  4. Tolerance ±0.10 mm.
  5. Ten sprocket hole pitch cumulative tolerance: ±0.2 mm.
  5. All measurements are in millimeters.

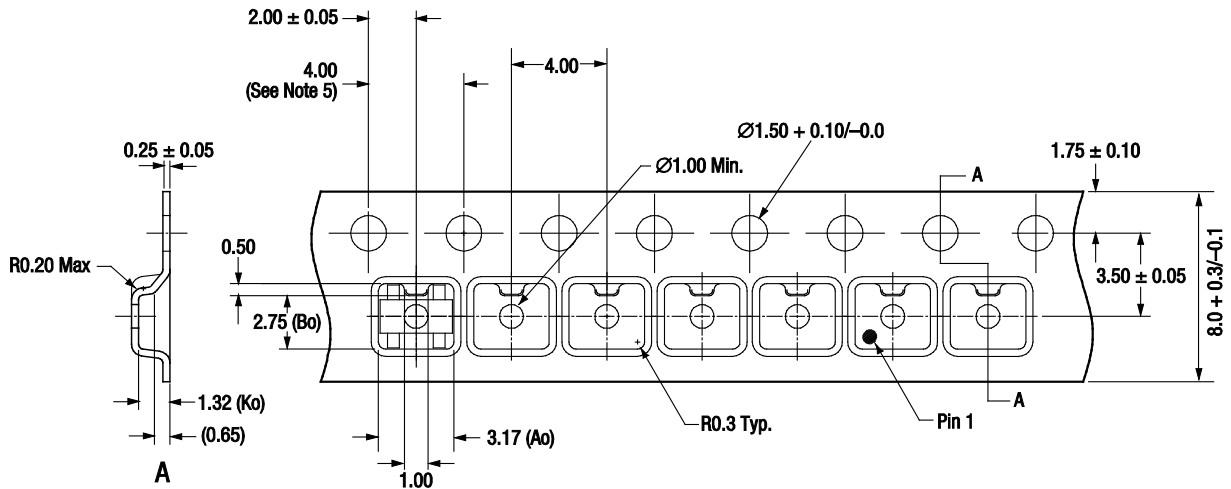
S1684b

Figure 18. SOT-23 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses) **S1651**

**Figure 19. SOT-143 Package Dimension Drawing**



**Notes:**

1. Carrier tape: black conductive polycarbonate.
2. Cover tape material: transparent conductive PSA.
3. Cover tape size: 5.4 mm width.
4. Tolerance:  $.XX = \pm 0.10$
5. Ten sprocket hole pitch cumulative tolerance:  $\pm 0.2$  mm.
6. All measurements are in millimeters.

**S2515a**

**Figure 20. SOT-143 Tape and Reel Dimensions**

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