

DATA SHEET

SMP1307 Series: Very Low Distortion Attenuator Plastic Packaged PIN Diodes

Applications

- Very low distortion Pi and TEE attenuators
- Cable TV AGC
- High-volume wireless systems

Features

- Low distortion design
- Frequency range from 5 MHz to > 2 GHz
- 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 SMP1307 series of plastic packaged, surface mountable, low capacitance (0.3 pF) silicon PIN diodes is designed for attenuator applications from 5 MHz to beyond 2 GHz.

The thick 175 μm I region width of these PIN diodes makes them very attractive for use in very low distortion Pi and TEE attenuators commonly found in TV distribution applications. The 1.5 μs carrier lifetime of these diodes results in resistance of 100 Ω maximum at 1 mA and 10 Ω maximum at 10 mA.

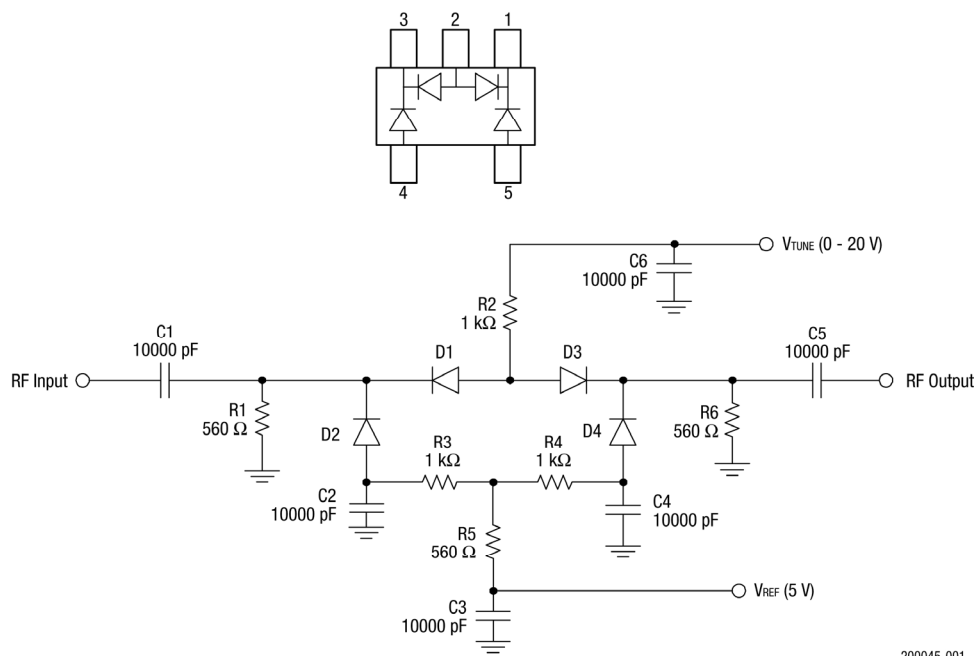
The SMP1307 series is available in a selection of plastic packages, as a single diode in the small footprint SOD-323 package, and in a variety of configurations in the SOT-23 package. Also available in an SOT-5 package (SMP1307-027LF) is a diode array designed for four-diode Pi attenuator circuits. Table 1 describes the various packages and marking of the SMP1307 series.

Table 1. SMP1307 Series Packaging and Marking

| | | | | | |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| Common Anode | Common Cathode | Series Pair | Reverse Series Pair | Single | PI |
| SOT-23 | SOT-23 | SOT-23 | SOT-23 | SOD-323 Green™ | SOT-5 |
| SMP1307-003LF Green™ Marking: RJ9 | SMP1307-004LF Marking: RJ3 | SMP1307-005LF Green™ Marking: RJ2 | SMP1307-006LF Green™ Marking: RJ8 | SMP1307-011LF Marking: RJ | SMP1307-027LF Green™ Marking: RJM |
| Ls = 1.5 nH | Ls = 1.5 nH | Ls = 1.5 nH | Ls = 1.5 nH | Ls = 1.5 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.



200045-001

Figure 1. SMP1307-027LF Application Circuit

SMP1307-027LF Four-Diode Pi Attenuator

The SMP1307-027LF uses four PIN diode junctions in a five-lead SOT package. It is configured for ease of insertion in the Pi attenuator circuit commonly used for broadband TV distribution systems, covering a frequency range from 5 MHz to over 1 GHz.

A broadband attenuator was designed using the SMP1307-027LF that shows good performance up to 2 GHz. The attenuator was evaluated with a 50 Ω source and load impedance. Figure 1 shows an application circuit for this device (the typical performance of the SMP1307-027LF is shown in Figure 2).

Electrical and Mechanical Specifications

The absolute maximum ratings of the SMP1307 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 SMP1307 series are illustrated in Figures 2 to 6. Package dimensions are shown in Figures 7 to 11 (odd numbers), and tape and reel dimensions are provided in Figures 8 to 12 (even 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 SMP1307 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. SMP1307 Series Absolute Maximum Ratings¹

| Parameter | Symbol | Minimum | Maximum | Units |
|--|-----------|---------|---------|-------|
| Reverse voltage | V_R | | 200 | 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 |

¹ 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.

ESD HANDLING: 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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.

Table 3. SMP1307 Series Electrical Specifications¹
($T_A = +25$ °C, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|--------------------------|--------|--|-----|---------|----------------|----------------------------------|
| Reverse current | I_R | $V_R = 200$ V | | | 10 | μ A |
| Capacitance ² | C_T | $f = 1$ MHz, $V = 30$ V | | | 0.3 | pF |
| Resistance | R_S | $f = 100$ MHz $I = 1$ mA $I = 10$ mA $I = 100$ mA | | 75 | 100 15 3 | Ω Ω Ω |
| Forward voltage | V_F | $I_F = 10$ mA | 0.7 | 0.85 | 1 | V |
| Carrier lifetime | T_I | $I_F = 10$ mA | | 1.5 | | μ s |
| I region width | | | | 175 | | μ m |

¹ Performance is guaranteed only under the conditions listed in this table.

² The SMP1307-027LF maximum capacitance is 0.45 pF.

Table 4. Resistance vs Temperature @ 100 MHz

| I_F (mA) | R_S @ -55 °C (Ω) | R_S @ -15 °C (Ω) | R_S @ +25 °C (Ω) | R_S @ +65 °C (Ω) | R_S @ +100 °C (Ω) |
|------------|--------------------|--------------------|--------------------|--------------------|---------------------|
| 0.02 | 2386 | 2360 | 2546 | 2520 | 2440 |
| 0.10 | 560 | 598 | 632 | 633 | 639 |
| 0.3 | 203 | 219 | 236 | 239 | 242 |
| 1.0 | 66.1 | 71.2 | 79.3 | 83.6 | 85.4 |
| 10 | 9.1 | 10.0 | 10.9 | 12.2 | 12.9 |
| 20 | 5.6 | 6.0 | 6.6 | 7.4 | 7.8 |
| 100 | 2.2 | 2.4 | 2.6 | 3.0 | 3.2 |

Typical Performance Characteristics

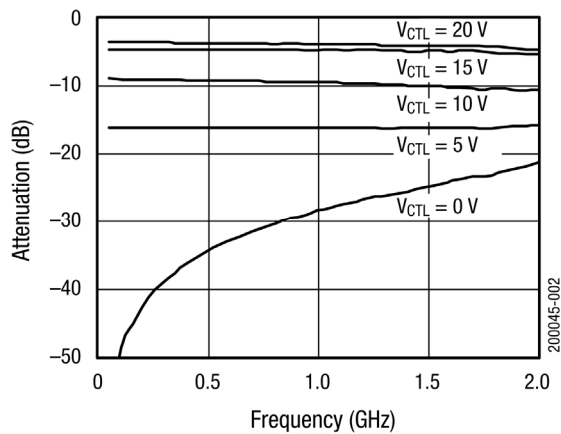


Figure 2. SMP1307-027LF Attenuation vs Frequency vs Control Voltage

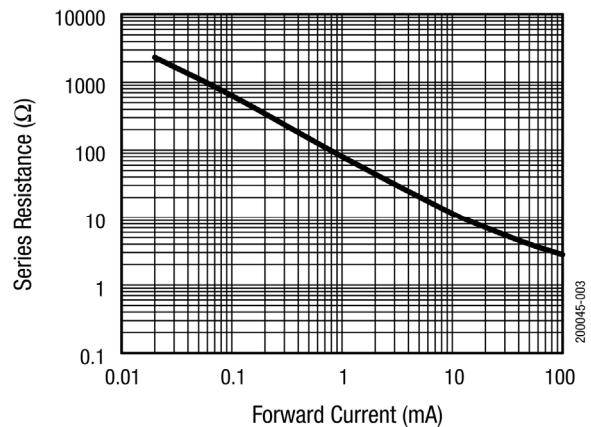


Figure 3. Series Resistance vs Current @ 100 MHz

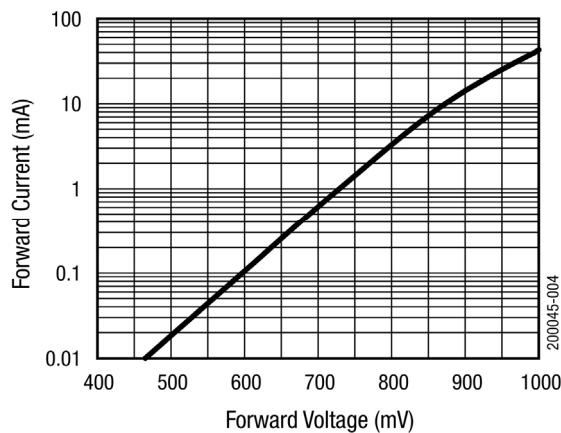


Figure 4. DC Characteristic

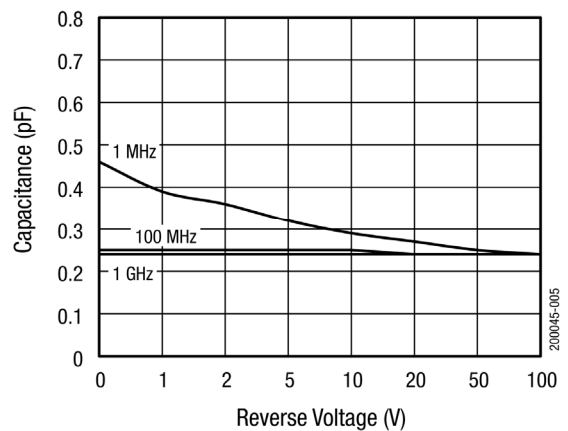


Figure 5. Capacitance vs Reverse Voltage

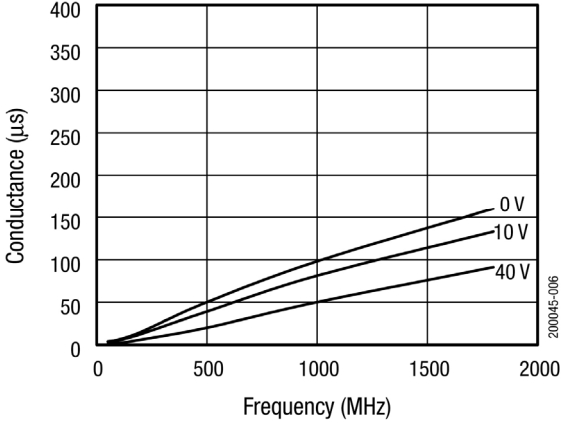
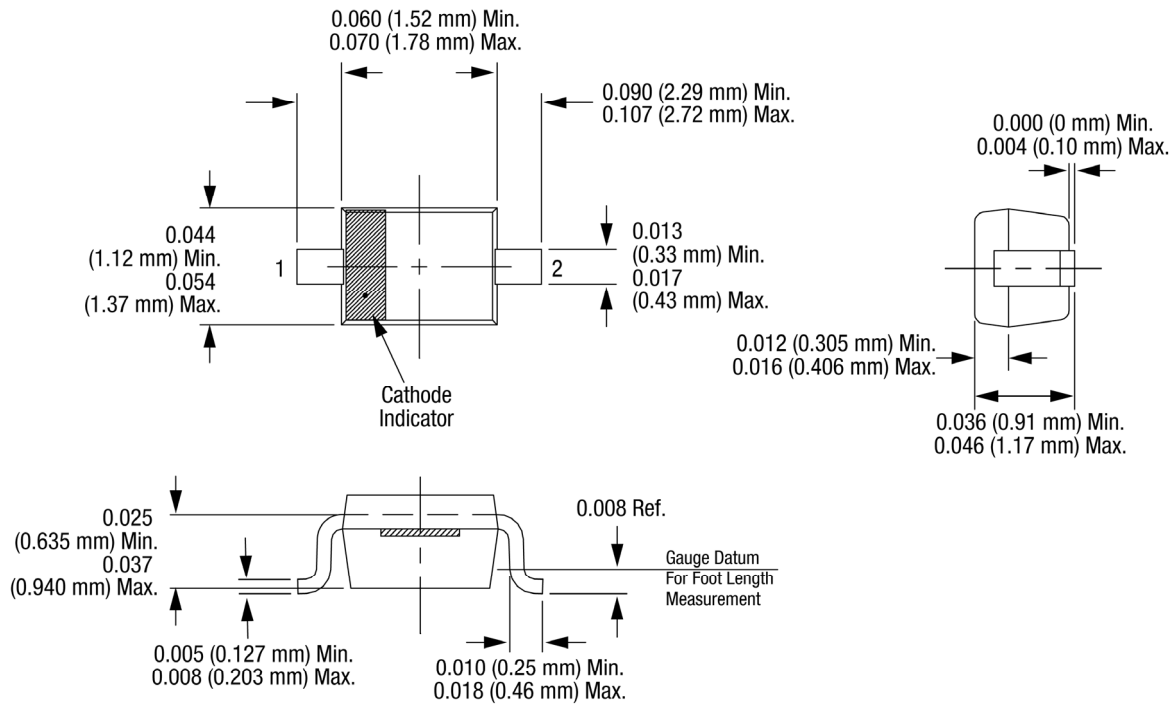


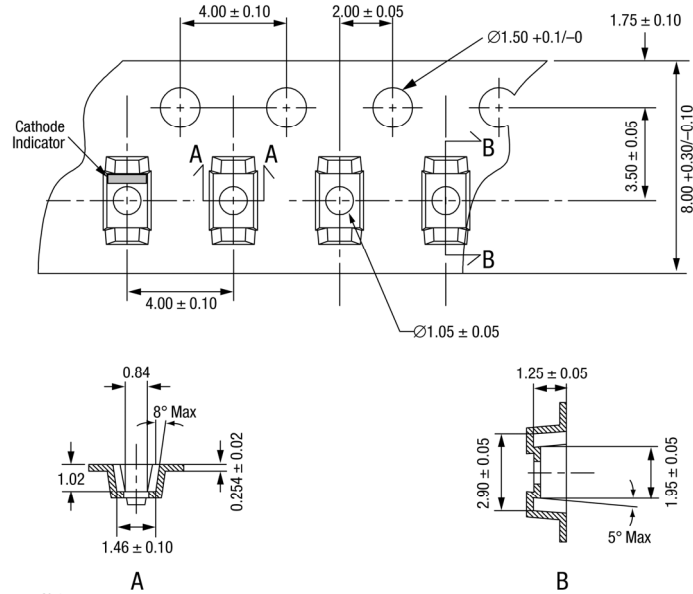
Figure 6. Conductance vs Frequency and Reverse Voltage



Dimensions are in inches (millimeters shown in parentheses)

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Figure 7. SOD-323 Package Dimension Drawing

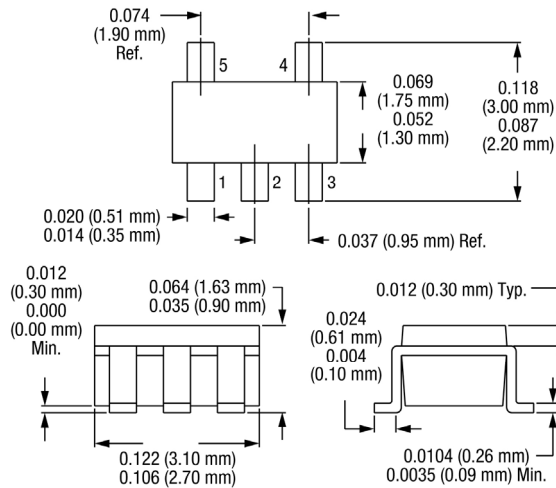


Notes:

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_o and B_o 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.

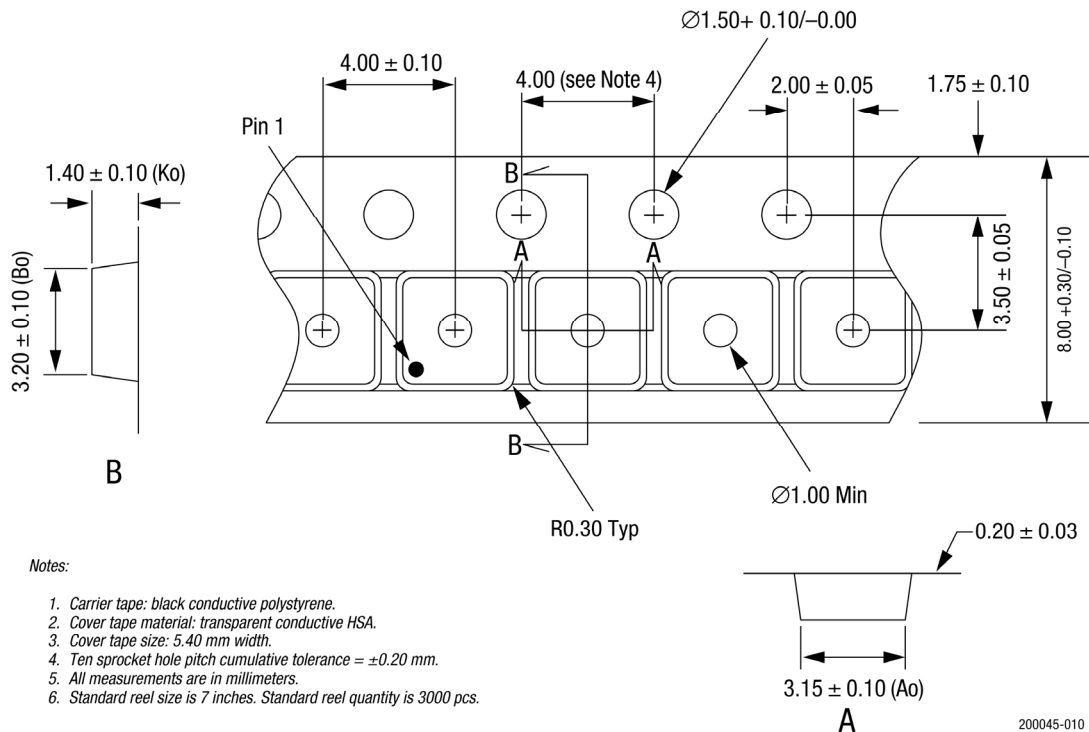
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Figure 8. SOD-323 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses) 200045-009

Figure 9. SOT-5 Package Dimension Drawing

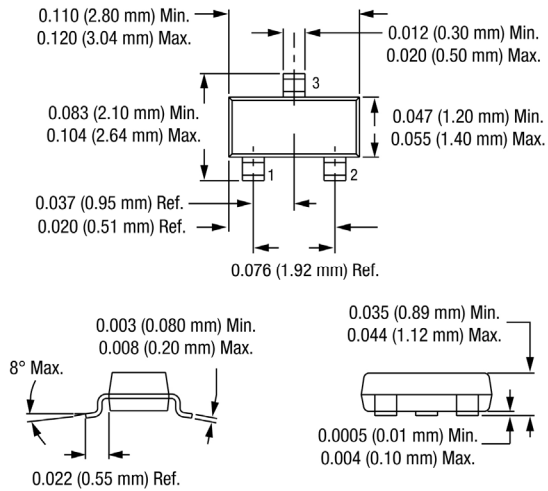


Notes:

1. Carrier tape: black conductive polystyrene.
2. Cover tape material: transparent conductive HSA.
3. Cover tape size: 5.40 mm width.
4. Ten sprocket hole pitch cumulative tolerance = ±0.20 mm.
5. All measurements are in millimeters.
6. Standard reel size is 7 inches. Standard reel quantity is 3000 pcs.

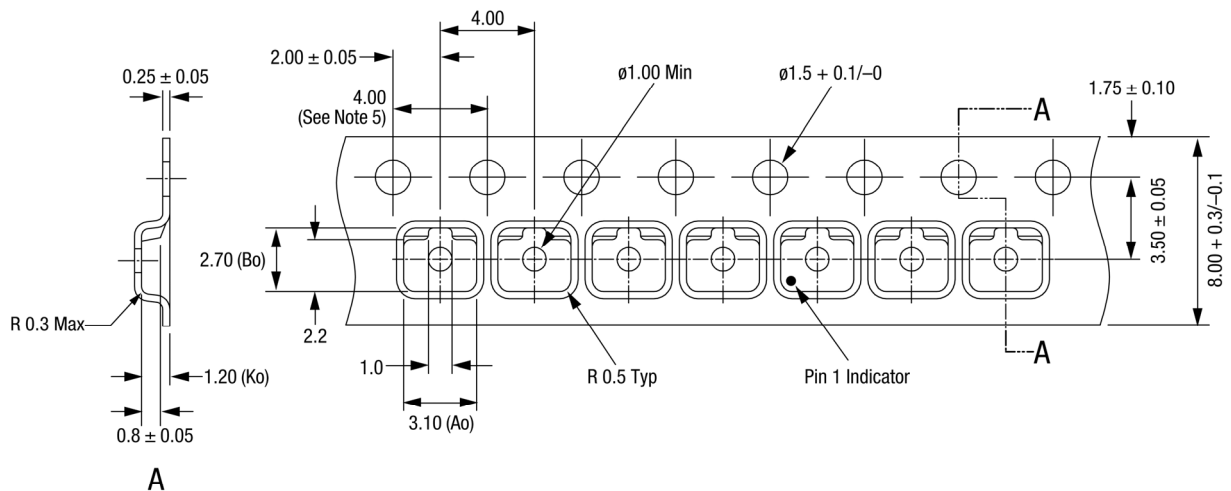
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Figure 10. SOT-5 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses) 200045-011

Figure 11. 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.
6. All measurements are in millimeters.
7. Alternative carrier tape dimensions are:
 $A_0 = 3.3$
 $B_0 = 2.9$
 $K_0 = 1.22$

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Figure 12. SOT-23 Tape and Reel Dimensions