

DATA SHEET

# SMP1321 Series: Low Capacitance, Plastic Packaged PIN Diodes

## Applications

- High-performance wireless switches

## Features

- Capacitance: 0.18 pF typical @ 30 V
- Series resistance: 1.05  $\Omega$  typical @ 10 mA
- 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 10 GHz. The low capacitance of these diodes (0.25 pF maximum at 30 V), combined with a low resistance (2.0  $\Omega$  maximum at 10 mA), makes the SMP1321 series particularly suited for 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 small footprint SC-79, a low inductance SOT-23, a miniature SOD-882, and an SOD-323.

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

**Table 1. SMP1321 Series Packaging and Marking**

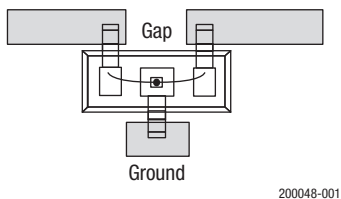
|  |   |  |   |                                    |                                     |
|--|---|--|---|------------------------------------|-------------------------------------|
|  |   |  |   |                                    |                                     |
| Common Anode                                   | Series Pair                                     | Low Inductance                                 | Single  | Single                             | Single                              |
| SOT-23   | SOT-23  | SOT-23   | SC-79<br>Green™                                 | SOD-882<br>Green™                  | SOD-323<br>Green™                   |
| <b>SMP1321-003LF</b><br>Green™<br>Marking: RM9 | <b>◆SMP1321-005LF</b><br>Green™<br>Marking: RM2 | <b>SMP1321-007LF</b><br>Green™<br>Marking: RMB | <b>SMP1321-079LF</b><br>Marking: Cathode and C6 | <b>SMP1321-040LF</b><br>Marking: C | <b>SMP1321-011LF</b><br>Marking: RM |
| $L_s = 1.5 \text{ nH}$                         | $L_s = 1.5 \text{ nH}$                          | $L_s = 0.4 \text{ nH}$                         | $L_s = 0.7 \text{ nH}$                          | $L_s = 0.45 \text{ nH}$            | $L_s = 1.5 \text{ nH}$              |

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.

**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**

Package dimensions are shown in Figures 6 to 12 (even numbers), and tape and reel dimensions are provided in Figures 7 to 13 (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 (Per Junction)<sup>1</sup>**

| Parameter  | Symbol    | Minimum | Maximum | Units |
|--|-----------|---------|---------|-------|
| Reverse voltage  | $V_R$     |         | 100     | V     |
| Power dissipation @ 25 °C lead temperature                   | $P_D$     |         | 400     | mW    |
| Storage temperature  | $T_{STG}$ | -65     | +150    | °C    |
| Operating temperature  | $T_A$     | -65     | +150    | °C    |
| Electrostatic discharge:<br>Human Body Model (HBM), Class 1A | ESD       |         | 500     | V     |

<sup>1</sup> 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. SMP1321 Series Electrical Specifications (Per Junction)<sup>1</sup>**  
( $T_A = +25\text{ °C}$ , Unless Otherwise Noted)

| Parameter                | Symbol   | Test Condition  | Min | Typical      | Max  | Units                |
|--------------------------|----------|---|-----|--------------|------|----------------------|
| Reverse current          | $I_R$    | $V_R = 100\text{ V}$  |     |              | 10   | $\mu\text{A}$        |
| Capacitance <sup>2</sup> | $C_T$    | $F = 1\text{ MHz}, V = 30\text{ V}$                             |     | 0.18         | 0.25 | $\text{pF}$          |
| Resistance               | $R_S$    | $F = 100\text{ MHz}$<br>$I = 1\text{ mA}$<br>$I = 10\text{ mA}$ |     | 3.00<br>1.05 | 2.00 | $\Omega$<br>$\Omega$ |
| Forward voltage          | $V_F$    | $I_F = 10\text{ mA}$  |     | 0.85         |      | V                    |
| Carrier lifetime         | $\tau_I$ | $I_F = 10\text{ mA}$  |     | 0.4          |      | $\mu\text{s}$        |
| I region width           |          |   |     | 12           |      | $\mu\text{m}$        |

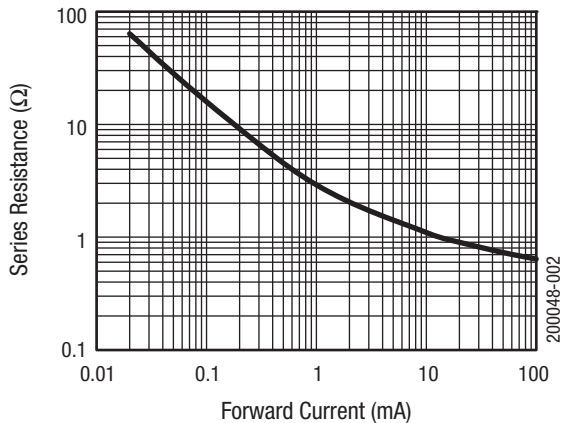
<sup>1</sup> Performance is guaranteed only under the conditions listed in this table.

<sup>2</sup>  $C_T$  is 0.4 pF maximum for the SMP1321-007.

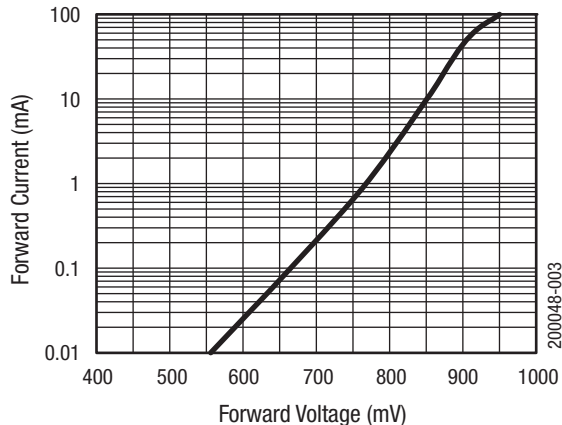
**Table 4. Resistance vs Temperature @ 500 MHz (Per Junction)**

| $I_F$<br>(mA) | $R_S @ -55\text{ °C}$<br>( $\Omega$ ) | $R_S @ -15\text{ °C}$<br>( $\Omega$ ) | $R_S @ +25\text{ °C}$<br>( $\Omega$ ) | $R_S @ +65\text{ °C}$<br>( $\Omega$ ) | $R_S @ +100\text{ °C}$<br>( $\Omega$ ) |
|---------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|--|
| 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                                  |

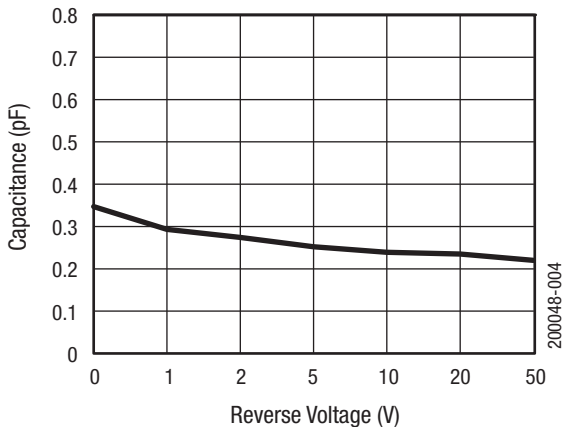
**Typical Performance Characteristics (Per Junction)**



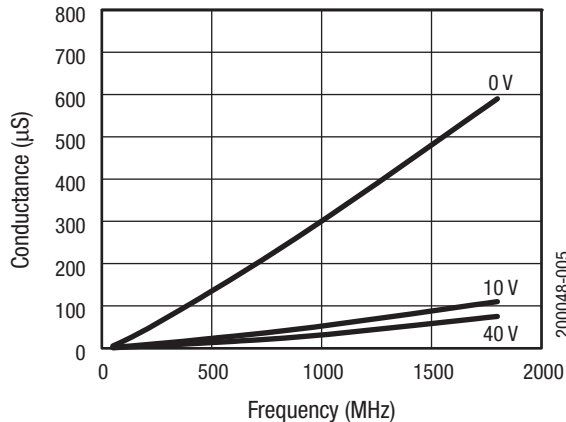
**Figure 2. Series Resistance vs Current @ 100 MHz**



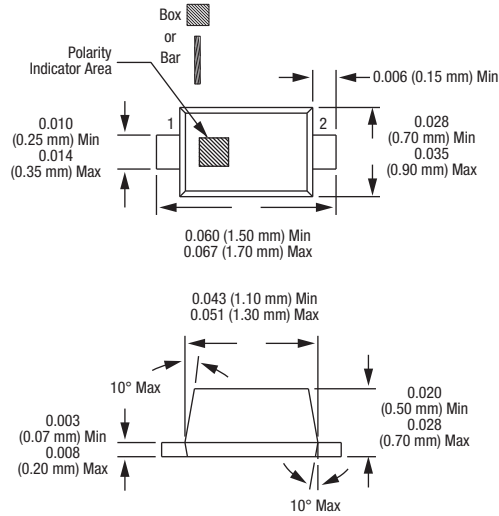
**Figure 3. Forward Current vs Voltage**



**Figure 4. Capacitance vs Reverse Voltage (1 MHz to 1 GHz)**

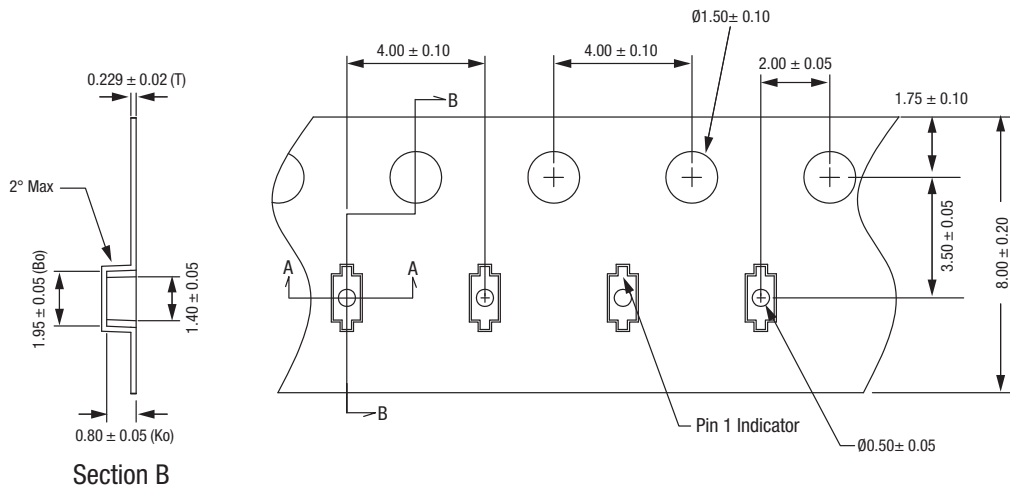


**Figure 5. Conductance vs Frequency and Reverse Voltage**



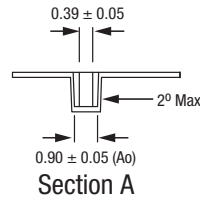
Dimensions are in inches (millimeters shown in parentheses) 200048-006

Figure 6. SC-79 Package Dimension Drawing



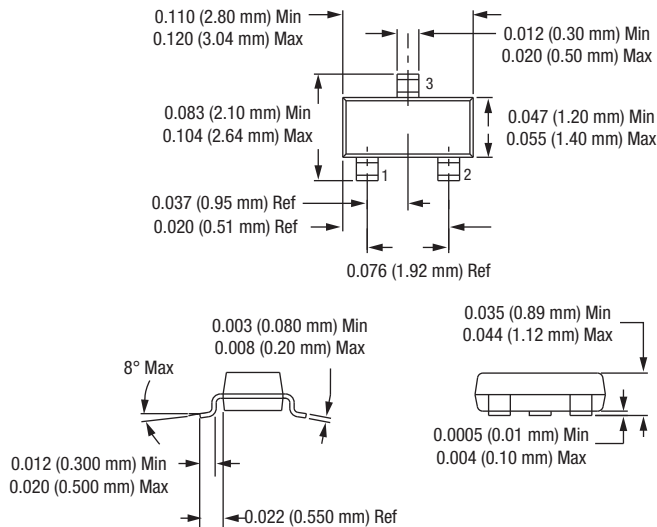
Notes:

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.
5. All measurements are in millimeters.



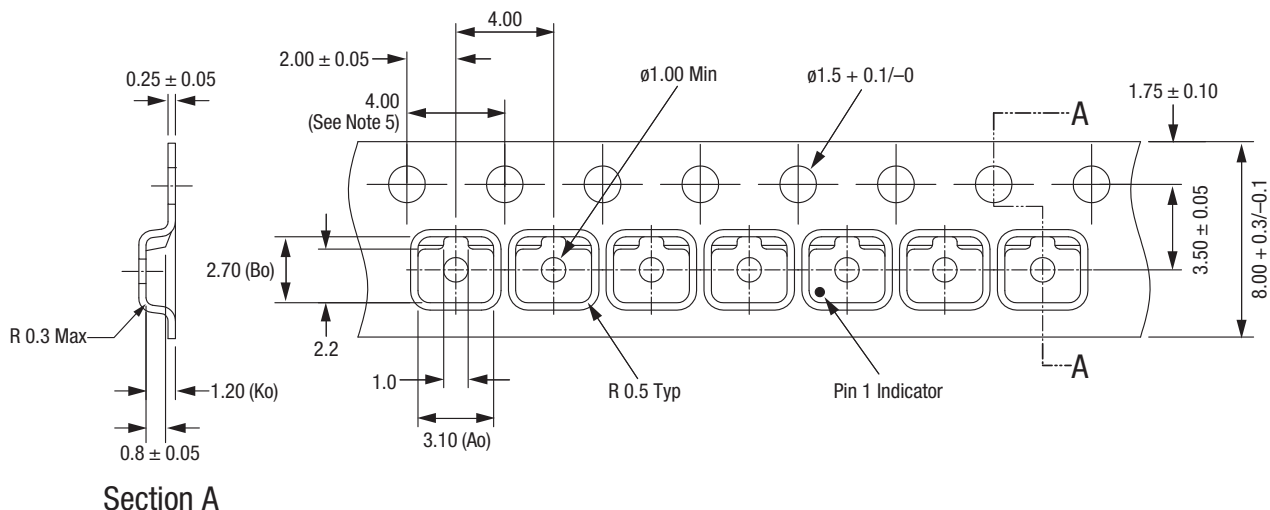
200048-007

Figure 7. SC-79 Tape and Reel Dimensions



Dimensions are in inches (millimeters shown in parentheses) 200048-008

Figure 8. SOT-23 Package Dimension Drawing



Section A

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:  
 Ao = 3.3  
 Bo = 2.9  
 Ko = 1.22

200048-009

Figure 9. SOT-23 Tape and Reel Dimensions







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