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 Ω typical @ 10 mA
- Packages rated MSL1, 260 °C per JEDEC J-STD-020

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 Ω 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

<table>
<thead>
<tr>
<th>Series Pair</th>
<th>Single</th>
<th>Single</th>
<th>Single</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT-23</td>
<td>SC-79</td>
<td>SOD-882</td>
<td>SOD-323</td>
</tr>
<tr>
<td>Green™</td>
<td>Green™</td>
<td>Green™</td>
<td>Green™</td>
</tr>
<tr>
<td>SMP1321-005LF</td>
<td>SMP1321-079LF</td>
<td>SMP1321-040LF</td>
<td>SMP1321-011LF</td>
</tr>
<tr>
<td>Marking: RM2</td>
<td>Marking: Cathode and C6</td>
<td>Marking: C</td>
<td>Marking: RM</td>
</tr>
<tr>
<td>Ls = 1.5 nH</td>
<td>Ls = 0.7 nH</td>
<td>Ls = 0.45 nH</td>
<td>Ls = 1.5 nH</td>
</tr>
</tbody>
</table>

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.

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 1 to 4.

Package Dimensions
Package dimensions are shown in Figures 5 to 11 (odd numbers), and tape and reel dimensions are provided in Figures 6 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 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) 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>V_R</td>
<td>100</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Power dissipation @ 25 °C lead temperature</td>
<td>P_D</td>
<td>400</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_STG</td>
<td>-65</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>T_A</td>
<td>-65</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>Electrostatic discharge:</td>
<td>ESD</td>
<td>500</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

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. SMP1321 Series Electrical Specifications (Per Junction) 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse current</td>
<td>I_N</td>
<td>V_R = 100 V</td>
<td>10</td>
<td>10</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Capacitance</td>
<td>C_T</td>
<td>F = 1 MHz, V = 30 V</td>
<td>0.18</td>
<td>0.25</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Resistance</td>
<td>R_S</td>
<td>F = 100 MHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I = 1 mA</td>
<td>3.00</td>
<td>3.00</td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I = 10 mA</td>
<td>1.05</td>
<td>1.05</td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Forward voltage</td>
<td>I_F</td>
<td>I_F = 10 mA</td>
<td>0.85</td>
<td>0.85</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Carrier lifetime</td>
<td>I_L</td>
<td>I_L = 10 mA</td>
<td>0.4</td>
<td>0.4</td>
<td></td>
<td>μs</td>
</tr>
<tr>
<td>I region width</td>
<td></td>
<td></td>
<td>12</td>
<td>12</td>
<td></td>
<td>μm</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>I_F (mA)</th>
<th>R_S @ -55 °C (Ω)</th>
<th>R_S @ -15 °C (Ω)</th>
<th>R_S @ +25 °C (Ω)</th>
<th>R_S @ +65 °C (Ω)</th>
<th>R_S @ +100 °C (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.02</td>
<td>47.4</td>
<td>50.0</td>
<td>56.3</td>
<td>61.5</td>
<td>65.1</td>
</tr>
<tr>
<td>0.10</td>
<td>12.0</td>
<td>12.6</td>
<td>13.9</td>
<td>15.4</td>
<td>16.4</td>
</tr>
<tr>
<td>0.3</td>
<td>5.2</td>
<td>5.4</td>
<td>5.8</td>
<td>6.4</td>
<td>6.9</td>
</tr>
<tr>
<td>0.5</td>
<td>3.6</td>
<td>3.8</td>
<td>4.1</td>
<td>4.5</td>
<td>4.8</td>
</tr>
<tr>
<td>1.0</td>
<td>2.4</td>
<td>2.5</td>
<td>2.6</td>
<td>2.8</td>
<td>3.1</td>
</tr>
<tr>
<td>10</td>
<td>1.03</td>
<td>1.04</td>
<td>1.04</td>
<td>1.07</td>
<td>1.15</td>
</tr>
<tr>
<td>20</td>
<td>0.871</td>
<td>0.888</td>
<td>0.873</td>
<td>0.889</td>
<td>0.956</td>
</tr>
<tr>
<td>100</td>
<td>0.669</td>
<td>0.659</td>
<td>0.642</td>
<td>0.645</td>
<td>0.695</td>
</tr>
</tbody>
</table>
Typical Performance Characteristics (Per Junction)

Figure 1. Series Resistance vs Current @ 100 MHz

Figure 2. Forward Current vs Voltage

Figure 3. Capacitance vs Reverse Voltage (1 MHz to 1 GHz)

Figure 4. Conductance vs Frequency and Reverse Voltage
Figure 5. SC-79 Package Dimension Drawing

Figure 6. SC-79 Tape and Reel 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. ESD-surface resistivity is \( \leq 1 \times 10^8 \) ohms/square per EIA, JEDEC TNR Specification.
5. All measurements are in millimeters.
Figure 7. SOT-23 Package Dimension Drawing

Detail 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:
   \[ Ao = 3.3 \]
   \[ Bo = 2.9 \]
   \[ Ko = 1.22 \]

Figure 8. SOT-23 Tape and Reel Dimensions
Notes:

1. All measurements are in millimeters.
3. These packages are used principally for discrete devices.
4. This dimension includes stand-off height and package body thickness, but does not include attached features, e.g., external heatsink or chip capacitors. An integral heatsting is not considered an attached feature.
5. This dimension is primarily terminal plating, but does not include small metal protrusion.

Figure 9. SOD-882 Package Dimension Drawing

Detail A

Notes:

1. Carrier tape: black conductive polycarbonate.
2. Cover tape: transparent conductive material.
3. Cover tape size: 5.4 mm width.
4. ESD surface resistivity is \( \geq 1 \times 10^6 \) \( \leq 1 \times 10^9 \) Ohms/square.
5. All dimensions are in millimeters.

Figure 10. SOD-882 Tape and Reel Dimensions
Figure 11. SOD-323 Package Dimension Drawing

Dimensions are in inches (millimeters shown in parentheses)

Figure 12. SOD-323 Tape and Reel Dimensions

Notes:
1. Carrier tape: black conductive polystyrene.
2. Core tape: transparent conductive PSA.
3. Cover tape size: 5.4 mm width.
4. 10 sprocket hole pitch cumulative tolerance: ±0.00 mm.
5. All measurements are in millimeters.