PIN Diode \( \pi \) Quad Attenuator

**Features**
- 4 PIN diodes in a SOT-25 Plastic Package
- Externally Selectable Bias and RF Matching Network
- 5 - 3000 MHz Useable Frequency Band
- 45 dBm IIP3 @ 1 GHz (50 \( \Omega \))
- 2.8 dB Loss @ 1 GHz (50 \( \Omega \))
- 36 dB Attenuation @ 1 GHz (50 \( \Omega \))
- Lead-Free
- RoHS*

**Description and Applications**
The MADP-007167-12250T is a wideband, moderate insertion loss, high IP3, PIN diode quad diode in a low-cost, surface mount SOT-25 package. Four PIN Diodes in one package reduce circuit parasitics and improve circuit density.

These PIN diode attenuators perform well where variable RF amplitude control is required in 50 \( \Omega \) and 75 \( \Omega \) circuit applications.

Wideband attenuation range, frequency flatness, and input IP3 make these devices suitable for better power level control in RF amplifiers.

**Pin Configuration**

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF Input</td>
</tr>
<tr>
<td>2</td>
<td>Series Bias</td>
</tr>
<tr>
<td>3</td>
<td>RF Output</td>
</tr>
<tr>
<td>4</td>
<td>Shunt 1 Bias</td>
</tr>
<tr>
<td>5</td>
<td>Shunt 2 Bias</td>
</tr>
</tbody>
</table>

2. RF input and RF output are functionally symmetrical.

**Ordering Information**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADP-007167-12250T</td>
<td>3000 piece reel</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.

PIN Diode $\pi$ Quad Attenuator

Electrical Specifications @ +25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Unit</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Current ($I_R$)</td>
<td>$V_R = 200 \text{ V}$</td>
<td>mA</td>
<td>—</td>
<td>10</td>
</tr>
<tr>
<td>Capacitance ($C_T$)</td>
<td>$F = 1 \text{ MHz}, V = 50 \text{ V}$</td>
<td>pF</td>
<td>.20</td>
<td>.30</td>
</tr>
<tr>
<td>Resistance ($R_S$)</td>
<td>$F = 100 \text{ MHz}, I = 1 \text{ mA}$</td>
<td>Ω</td>
<td>85</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>$F = 100 \text{ MHz}, I = 10 \text{ mA}$</td>
<td></td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>$F = 100 \text{ MHz}, I = 100 \text{ mA}$</td>
<td></td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>Minority Carrier Lifetime ($T_L$)</td>
<td>$I_F = 10 \text{ mA}$</td>
<td>ms</td>
<td>2.7</td>
<td>—</td>
</tr>
<tr>
<td>I Region Width</td>
<td>—</td>
<td>mm</td>
<td>175</td>
<td>—</td>
</tr>
</tbody>
</table>

Typical 50 Ω SOT-25 RF Performance: Freq. = 50 - 3000 MHz, $T_A = +25°C$ using Wide Band RF Circuit Design (Values Shown include Through Loss Calibrated Out of RF Test Circuit)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss</td>
<td>13 mA / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F = 1 \text{ GHz}$</td>
<td>dB</td>
<td>-2.8</td>
</tr>
<tr>
<td>Return Loss</td>
<td>13 mA / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F = 1 \text{ GHz}$</td>
<td>dB</td>
<td>-15</td>
</tr>
<tr>
<td>Attenuation</td>
<td>0 mA / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F = 1 \text{ GHz}$</td>
<td>dB</td>
<td>-36</td>
</tr>
<tr>
<td>Input IP3</td>
<td>0 V / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F1 = 1010 \text{ MHz}, F2 = 1020 \text{ MHz}$</td>
<td>dBm</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>+ 10 V / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F1 = 1010 \text{ MHz}, F2 = 1020 \text{ MHz}$</td>
<td>dBm</td>
<td>43.5</td>
</tr>
<tr>
<td></td>
<td>0 V / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F1 = 110 \text{ MHz}, F2 = 120 \text{ MHz}$</td>
<td>dBm</td>
<td>43.5</td>
</tr>
<tr>
<td></td>
<td>+ 10 V / Series Diode and 3.7 V Shunt 1 and 2 Bias, $F1 = 110 \text{ MHz}, F2 = 120 \text{ MHz}$</td>
<td>dBm</td>
<td>39</td>
</tr>
<tr>
<td>Settling Time</td>
<td>Within 1 dB of Final Attenuation Value, $F = 1 \text{ GHz}$</td>
<td>µs</td>
<td>10</td>
</tr>
<tr>
<td>RF C.W. Incident Power</td>
<td>0 - 20 V Series Diode Bias and 3.7 V Shunt 1 and 2 Bias</td>
<td>dBm</td>
<td>+ 20</td>
</tr>
</tbody>
</table>
Absoloto Maximum Ratings @ +25°C³

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-65°C to +125°C</td>
</tr>
<tr>
<td>Storage Temperature (0 mW Dissipated Power)</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>+175°C</td>
</tr>
<tr>
<td>DC Voltage @ Temperature Extremes</td>
<td>1V -200 V I</td>
</tr>
<tr>
<td>DC Current per diode</td>
<td>200 mA</td>
</tr>
<tr>
<td>Mounting Temperature</td>
<td>+235°C for 10 seconds</td>
</tr>
</tbody>
</table>

³ Exceeding these limits may cause permanent damage.

Typical Diode Performance Curves

**Series Resistance**

![Graph showing Series Resistance vs Bias Current](Image)

**Total Capacitance**

![Graph showing Total Capacitance vs Reverse Voltage](Image)
Typical Attenuator Performance

**Attenuation**

![Graph showing Attenuation vs. Frequency at different voltages.]

**Attenuation Flatness**

![Graph showing Attenuation Flatness vs. Frequency at different voltages.]

**Input IP3**

![Graph showing Input IP3 vs. Voltage at different frequencies.]

**Return Loss**

![Graph showing Return Loss vs. Frequency at different voltages.]

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SOT-25 (Case Style 1225)

<table>
<thead>
<tr>
<th>Dim</th>
<th>Inches</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>A</td>
<td>.1103</td>
<td>.1181</td>
</tr>
<tr>
<td>B</td>
<td>.1023</td>
<td>.1181</td>
</tr>
<tr>
<td>C</td>
<td>.0355</td>
<td>.0512</td>
</tr>
<tr>
<td>D</td>
<td>.0591</td>
<td>.0669</td>
</tr>
<tr>
<td>E</td>
<td>.0374 REF.</td>
<td>0.95 REF.</td>
</tr>
<tr>
<td>F</td>
<td>.0138</td>
<td>.0197</td>
</tr>
<tr>
<td>G</td>
<td>.0031</td>
<td>.0079</td>
</tr>
<tr>
<td>H</td>
<td>.0002</td>
<td>.0059</td>
</tr>
<tr>
<td>J</td>
<td>.0138</td>
<td>.0216</td>
</tr>
</tbody>
</table>
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