High Power Reflective SPDT PIN Diode Switch
6 - 18 GHz

Features
- Low Loss: 0.6 dB @ 12 GHz
- High Isolation: 44 dB @ 12 GHz
- Up to 14 W CW Power Handling, +85°C
- Switching Speed: <115 ns
- Integrated DC Blocks and RF Bias Networks
- Optional Bias Resistors
- Die with G-S RF Pads and DC Bias Pads
- RoHS* Compliant

Applications
- Point-to-Point, Radar, Radiometers, Test & Instrumentation Equipment and High Frequency Applications

Description
The MASW-011108-DIE is a high power symmetrical SPDT PIN diode switch. This broadband, reflective, high linearity, switch was developed for 6 - 18 GHz applications that require up to 14 W of power handling while maintaining low insertion loss and high isolation.

The SPDT MMIC utilizes MACOM’s proven AlGaAs PIN diode technology. The switch is fully passivated with silicon nitride and has an added polymer layer for scratch protection. The protective coating prevents damage to the junctions and the anode air-bridges during handling and assembly. The die has backside metallization to facilitate an epoxy die attach process.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASW-011108-DIE</td>
<td>Gel Pack</td>
</tr>
</tbody>
</table>

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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1. The die backside must be connected to RF, DC and thermal ground.
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MASW-011108-DIE
Rev. V1

Electrical Specifications: \( T_A = +25°C, V_F^2 = 5\, V, V_R^3 = -15\, V, Z_0 = 50\, \Omega \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Loss (RF_COMMON to RF_x ON state)</td>
<td>6 GHz, 8 GHz, 12 GHz, 14 GHz, 18 GHz</td>
<td>dB</td>
<td>0.80</td>
<td>0.95</td>
<td>1.25</td>
</tr>
<tr>
<td>Isolation (RF_COMMON to RF_x OFF state)</td>
<td>6 GHz, 8 GHz, 12 GHz, 14 GHz, 18 GHz</td>
<td>dB</td>
<td>35</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>Return Loss (RF_COMMON)</td>
<td>6 GHz, 8 GHz, 12 GHz, 14 GHz, 18 GHz</td>
<td>dB</td>
<td>12</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>Return Loss (RF_1, RF_2 ON state)</td>
<td>6 GHz, 8 GHz, 12 GHz, 14 GHz, 18 GHz</td>
<td>dB</td>
<td>12</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>CW Power Handling (ON state)</td>
<td>6.2 GHz, +85°C @ ( V_R = -15, V ) 6.2 GHz, +85°C @ ( V_R = -33, V )</td>
<td>dBm / W</td>
<td>39 / 8</td>
<td>41.5 / 14</td>
<td>—</td>
</tr>
<tr>
<td>Switching Speed ( T_{ON} / T_{OFF} ) ( T_{RISE} / T_{FALL} )</td>
<td>50% DC to 90% RF / 50% DC to 10% RF 10% to 90% RF / 90% to 10% RF</td>
<td>ns</td>
<td>115 / 25</td>
<td>75 / 16</td>
<td>—</td>
</tr>
<tr>
<td>Reverse Bias Current</td>
<td>( V_R = -15, V )</td>
<td>nA</td>
<td>25</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

2. Forward bias current (\( I_F \)) is set to 10 mA @ 5 V with internal bias resistors \( R_{B1} = R_{B2} = 98\, \text{Ohm} \)
3. Reverse bias voltage (\( V_R \)) should be determined based on working conditions. For example, -33 V @ 41.5 dBm input power. For lower power applications, a less negative voltage can be used. R. Caverly and G. Hiller, “Establishing the Minimum Reverse Bias for a PIN Diode in a High Power Switch,” IEEE Transactions on Microwave Theory and Techniques, Vol.38, No.12, December 1990.
4. Isolation defined with 1 port in low loss state.

Absolute Maximum Ratings\(^5,6\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Bias Voltage</td>
<td>-50 V</td>
</tr>
<tr>
<td>Forward Bias Current</td>
<td>25 mA</td>
</tr>
<tr>
<td>CW Incident Power</td>
<td>42 dBm @ +85°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
</tbody>
</table>

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.

Truth Table

<table>
<thead>
<tr>
<th>RF_COMMON Path</th>
<th>Bias 1</th>
<th>Bias 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF1 Insertion Loss</td>
<td>-15 V</td>
<td>5 V</td>
</tr>
<tr>
<td>RF2 Isolation</td>
<td>5 V</td>
<td>-15 V</td>
</tr>
<tr>
<td>RF2 Insertion Loss</td>
<td>5 V</td>
<td>-15 V</td>
</tr>
<tr>
<td>RF1 Isolation</td>
<td>5 V</td>
<td>-15 V</td>
</tr>
</tbody>
</table>

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM class 1A devices.
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Typical Performance Curves of a Die including Bond Wires (probed on a test PCB)
Reverse Bias Voltage = -15 V

Insertion Loss over Forward Bias Voltage

Insertion Loss over Temp

RF-C to RF1/2 Return Loss

RF1/2 Return Loss

Isolation over Forward Bias Voltage

Isolation over Temp

For further information and support please visit: https://www.macom.com/support
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Die Outline Drawing†

Notes:

- Unless otherwise specified all dimensions shown as μm with a tolerance of +/- 5 μm
- Die thickness is 100 +/- 10 μm
- Bond Pad/backside metallization: Gold

<table>
<thead>
<tr>
<th>Bond Pad Dimensions (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pad</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1, 2, 9</td>
</tr>
<tr>
<td>3, 8</td>
</tr>
<tr>
<td>4, 5, 6, 7</td>
</tr>
<tr>
<td>10, 11</td>
</tr>
<tr>
<td>12, 13</td>
</tr>
</tbody>
</table>
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