MADL-011015

250 W Peak Power Limiter
2 - 4 GHz

Rev. V2

Features
- 54 dBm Peak Power Handling @ +85°C
- 50 dBm CW Power Handling @ +85°C
- 0.6 dB Insertion Loss (2.7 - 3.5 GHz)
- 15 dB Return Loss (2.7 - 3.5 GHz)
- 15 dBm Flat Leakage Power
- Lead-Free 10.1 x 6.2 x 3.2 mm³ Package
- RoHS* Compliant
- Hermetic Seal

Description
The MADL-011015 is a lead-free surface mount, high power limiter which integrates the equivalent of 17 PIN, Schottky, limiter diodes, capacitors, inductors, and resistors in a compact ceramic package. This device provides superior low and high signal performance from 2 - 4 GHz without DC bias.

The MADL-011015 is ideally suitable for higher peak and CW power receiver-protector microwave circuits applications where higher performance surface mount limiter assemblies are required.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADL-011015-001</td>
<td>Bulk</td>
</tr>
<tr>
<td>MADL-011015-001SMB</td>
<td>Sample test board</td>
</tr>
</tbody>
</table>

1. Hermetic Seal provides fine leak rate < 5x10⁻⁸ atm·cc/s.

### 250 W Peak Power Limiter

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### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Incident Power @ +85°C 1 ms pulse, 10% duty</td>
<td>54 dBm</td>
</tr>
<tr>
<td>Peak Incident Power @ +85°C 100 µs pulse, 10% duty</td>
<td>56 dBm</td>
</tr>
<tr>
<td>CW Incident Power @ +85°C</td>
<td>50 dBm</td>
</tr>
<tr>
<td>Junction Temperature (T&lt;sub&gt;J&lt;/sub&gt;)</td>
<td>175°C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-65°C to +125°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to +150°C</td>
</tr>
</tbody>
</table>

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

6. Operating at nominal conditions with T<sub>J</sub> ≤ +175°C will ensure MTTF > 1 x 10<sup>6</sup> hours.

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### Electrical Specifications: T<sub>A</sub> = +25°C, Z<sub>0</sub> = 50 Ω (unless otherwise defined)

<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</td>
<td>-10 dBm, 2.0 GHz</td>
<td>dB</td>
<td>0.4</td>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>-10 dBm, 3.5 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-10 dBm, 4.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return Loss</td>
<td>-10 dBm, 2.0 GHz</td>
<td>dB</td>
<td>25</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>-10 dBm, 3.5 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-10 dBm, 4.0 GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P&lt;sub&gt;1&lt;/sub&gt;dB Input Compression Power</td>
<td>3.5 GHz</td>
<td>dBm</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW Incident Power&lt;sup&gt;3&lt;/sup&gt;</td>
<td>3.5 GHz</td>
<td>dBm</td>
<td>51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Incident Power&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1 ms pulse, 10% duty cycle, 3.5 GHz</td>
<td>dBm</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat Leakage Power</td>
<td>+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz</td>
<td>dBm</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spike Leakage Power</td>
<td>+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz</td>
<td>dBm</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spike Leakage Energy</td>
<td>+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz</td>
<td>ergs</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spike Leakage Time (3 dB below Peak Spike Power)</td>
<td>+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz</td>
<td>ns</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery Time (1 dB of Insertion Loss)</td>
<td>+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz</td>
<td>µs</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input 3rd Order Intermodulation Products (IIP3)</td>
<td>-10 dBm, F1 = 3.500 GHz, F2 = 3.510 GHz</td>
<td>dBm</td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Incident power ratings defined with 1.2:1 maximum source VSWR and 1.2:1 maximum load VSWR.
Typical Performance Curves

**Insertion Loss vs. Frequency**

-2.0  -1.5  -1.0  -0.5  0.0  0.5  1.0  1.5  2.0  2.5  3.0  3.5  4.0  4.5

**S21 (dB)**

-1.2  -1.0  -0.7  -0.5  -0.2  0.0

**Frequency (GHz)**

1.5  2.0  2.5  3.0  3.5  4.0  4.5

**Input Return Loss vs. Frequency**

-24  -18  -12  -6  0  6  12  18  24

**S11 (dB)**

-40°C  +25°C  +85°C

**Frequency (GHz)**

1.5  2.0  2.5  3.0  3.5  4.0  4.5

**Pulsed Flat Leakage Power vs. PIN**

(1 ms Pulse, 10% Duty Cycle, 3.5 GHz)

Output Power (dBm)

-20  -10  0  10  20

**Input Power (dBm)**

10  20  30  40  50  60

**CW Flat Leakage Power vs. PIN @ 3.5 GHz**

Output Power (dBm)

-20  -10  0  10  20

**Input Power (dBm)**

10  20  30  40  50  60

**Pulsed Spike Leakage Power vs. PIN**

(1 ms Pulse, 10% Duty Cycle, 3.5 GHz)

Output Power (dBm)

10  20  30  40

**Input Power (dBm)**

40  45  50  55  60

**Pulsed 1 dB Recovery Time vs. PIN**

(1 ms Pulse, 10% Duty Cycle, 3.5 GHz)

1 dB Recovery Time (ns)

0  1000  2000  3000  4000

**Input Power (dBm)**

40  45  50  55  60

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SMB Parts List

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Connector</td>
<td>2</td>
<td>Johnson 142-0761-861</td>
</tr>
<tr>
<td>Limiter</td>
<td>1</td>
<td>MADL-011015</td>
</tr>
</tbody>
</table>

Handling Procedures
Please observe the following precautions to avoid damage:

**Static Sensitivity**
These 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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**Lead-Free 10.1 x 6.2 x 3.2 mm³ 2-Lead package†**

Plating is Au over Ni over Cu.

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Application Section

Transmit-Receive Block Diagram using the S Band MADL-011015 Limiter

Ant

Circulator

PA

Circulator

50 Ω High Power Load

MADL-011015 Limiter

LNA
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