MLM2060-300 & MLM2060-301

PIN Diode Limiter
2 - 6 GHz

Features
- Surface Mount Limiter in 8 mm x 5 mm x 2.5 mm Package
- Incorporates PIN Limiter Diodes, DC Blocks and DC Return
- Higher Peak Power Handling than Plastic: 100 W Peak Power
- Lower Insertion Loss: 0.85 dB
- Lower Flat Leakage Power: 19 dB
- RoHS* Compliant

Description
The MLM2060-300 and MLM2060-301 Series of surface mount silicon PIN diode limiters is manufactured using a proven hybrid manufacturing process incorporating PIN diodes and passive devices integrated within a ceramic substrate. This low profile, compact surface mount component offers superior low and high signal performance to comparable MMIC devices in QFN packages. The limiter modules are designed to optimize small signal insertion loss, noise figure and high signal flat leakage performance in a compact surface mount package.

The MLM2060-300 has shunt PIN limiter diodes and a shunt coil with no DC blocks, whereas the MLM2060-301 incorporates shunt PIN limiters diodes, a shunt coil, and DC blocks for versatility of design preference. Using PIN diodes with lower thermal resistance (<40 °C/W), RF CW incident power levels of +6 dBm and RF peak incident power levels of 50 dBm @ 1 μs RF pulse width, 0.001 duty cycle are very achievable in broadband limiter applications. The lower PIN diode series resistance, (<1.5 Ω), coupled with the smaller minority carrier lifetime, (<20 ns), provides lower flat leakage power (<20 dBm) and lower spike leakage energy (<0.1 Ergs) for superior LNA protection.

These MLM2060-300 and MLM2060-301 Limiter Series are ideal for 2 to 6 GHz Radar, IED, and WiMax applications, requiring high volume, surface mount, solder re-flow manufacturing. These products are durable, reliable, and capable of meeting all military, commercial, and industrial environments. The devices are fully RoHS compliant and are available in tube or tape & reel.

### Absolute Maximum Ratings $^{1,2}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF CW Incident Power @ +85°C, Source &amp; Load VSWR &lt;1.2:1</td>
<td>35 dBm</td>
</tr>
<tr>
<td>RF Peak Incident Power @ +85°C, Source &amp; Load VSWR &lt;1.2:1, RF Pulse Width = 1 μs, 0.1% Duty Cycle</td>
<td>50 dBm</td>
</tr>
<tr>
<td>Insertion Loss Rate of Change with Operating Temperature</td>
<td>$\pm 0.0025$ dB / °C $</td>
</tr>
<tr>
<td>Junction Temperature</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>
<tr>
<td>Assembly Temperature</td>
<td>260°C for 10 seconds</td>
</tr>
</tbody>
</table>

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
**Handling Procedures**
Please observe the following precautions to avoid damage:

**Static and Moisture 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 Class 0 (HBM) devices.

**Environmental Capabilities**
This limiter is capable of meeting the environmental requirements of MIL-STD-750, MIL-STD-202 and MIL-STD-883.

**Assembly Instructions**
The MLM2060-300 & MLM2060-301 limiter diodes may be placed onto circuit boards with pick and place manufacturing equipment from tube or tape-reel dispensing. The devices are attached to the circuit board using conventional solder re-flow or wave soldering procedures with RoHS type or Sn63/Pb37 type solders.

**Typical Performance Curves**

**Gain**

**Insertion Loss**

**Input Return Loss**

**Output Return Loss**
 Typical Performance Curves

**MLM2060-300 RF CW Incident Performance**
*Output Power vs. Input Power*

![Graph showing output power vs. input power for MLM2060-300 RF CW Incident Performance.](image)

**MLM2060-301 RF Peak Incident Performance**
*Output Power vs. Input Power*

![Graph showing output power vs. input power for MLM2060-301 RF Peak Incident Performance.](image)
Table 1: Time-Temperature Profile for Sn 60 / Pb 40 or RoHS Type Solders

<table>
<thead>
<tr>
<th>Profile Feature</th>
<th>Sn-Pb Eutectic Assembly</th>
<th>Pb-Free Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average ramp-up rate (TL to TP)</td>
<td>3°C/second maximum</td>
<td>3°C/second maximum</td>
</tr>
<tr>
<td>Preheat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Temperature Minimum (TSMIN)</td>
<td>100°C</td>
<td>150°C</td>
</tr>
<tr>
<td>- Temperature Maximum (TSMAX)</td>
<td>150°C</td>
<td>200°C</td>
</tr>
<tr>
<td>- Time (Minimum to maximum) (ts)</td>
<td>60-120 seconds</td>
<td>60-180 seconds</td>
</tr>
<tr>
<td>TSMAX to TL - Ramp-up Rate</td>
<td>—</td>
<td>3°C/second maximum</td>
</tr>
<tr>
<td>Time Maintained above:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Temperature (TL)</td>
<td>183°C</td>
<td>217°C</td>
</tr>
<tr>
<td>- Time (tL)</td>
<td>60-150 seconds</td>
<td>60-180 seconds</td>
</tr>
<tr>
<td>Peak Temperature (TP)</td>
<td>225 +0 / -5°C</td>
<td>245 +0 / -5°C</td>
</tr>
<tr>
<td>Time within 5°C of actual Peak Temperature (TP)</td>
<td>10-30 seconds</td>
<td>20-40 seconds</td>
</tr>
<tr>
<td>Ramp-down Rate</td>
<td>6°C/second maximum</td>
<td>6°C/second maximum</td>
</tr>
<tr>
<td>Time 25°C to Peak Temperature</td>
<td>6 minutes maximum</td>
<td>8 minutes maximum</td>
</tr>
</tbody>
</table>

Graph1: Solder Re-Flow Time-Temperature Function
The hatched metal area on circuit side of device is RF, DC and thermal grounded.
Dimensions are in inches (mm)
Substrate Material: 20 mil thick Alumina Nitride (ALN)
RF Cover: Black Ceramic
Top Side and Backside Metallization: 100 µ IN. typical plated over Ti-Pd.
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Outline Drawing, Case Style 301 (CS301)

The hatched metal area on circuit side of device is RF, DC and thermal grounded.
Dimensions are in inches (mm)
Substrate Material: 20 mil thick Alumina Nitride (ALN)
RF Cover: Black Ceramic
Top Side and Backside Metallization: 100 µ IN. typical plated over Ti-Pd.
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