

High Peak Power Surface Mount Limiter 2 - 20 GHz



MADL-011100

Rev. V2

Features

- Operating Frequency: 2 - 20 GHz
- Peak Power Operation: 58 dBm @ 13 GHz
- Insertion Loss: 1 dB @ 12 GHz
- Flat Leakage Power: 28 dBm @ 58 dBm
- Lead Free 8.8 x 5 x 1.8 mm package
- Passive Device, No DC Bias Required
- Internal DC Blocks and Return
- RoHS* Compliant

Applications

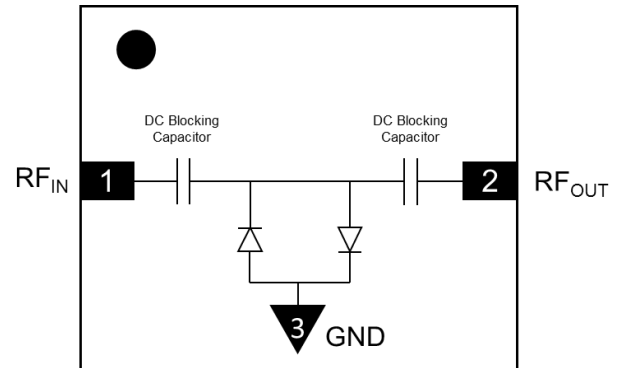
- Receiver Protection
- Ship and Airborne Radar

Description

The MADL-011100 is a lead-free wide band surface mount limiter that integrates multiple limiter stages and blocking capacitors into a compact laminate package. This device provides superior low and high signal performance from 2 to 20 GHz without DC bias.

The MADL-011100 is ideally suitable for high peak power receiver-protector microwave circuit applications where higher performance surface mount limiter assemblies are required.

Functional Schematic



Pin Configuration

Pin #	Function
1	RF Input
2	RF Output
3 (Paddle) ¹	Ground

1. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MADL-011100	Parts in Waffle Pack
MADL-011100-SMB	Sample Board

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

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Electrical Specifications: $T_A = +25^\circ\text{C}$, $Z_0 = 50 \Omega$, $P_{in} = -10 \text{ dBm}$ (unless otherwise specified)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	2 GHz 12 GHz 18 GHz	dB	—	0.4 1.0 1.7	0.7 1.4 2.1
Return Loss	2 - 18 GHz	dB	—	15	—
P1dB	13 GHz	dBm	—	26	—
IIP3	-10 dBm per Tone, 10 MHz Spacing, F1 = 13.000 GHz F2 = 13.010 GHz	dBm	—	24	—
IIP2	-10 dBm per Tone, 10 MHz Spacing, F1 = 13.000 GHz F2 = 13.010 GHz	dBm	—	62	—
Peak Power Handling ²	1 μs PW, 1% Duty Cycle, 3 GHz 5 GHz 13 GHz 15 GHz	dBm	—	58 58 58 54	—
CW Power Handling ³	5 GHz	dBm	—	38	—
Flat Leakage Power	1 μs PW, 1% Duty Cycle, 13 GHz @ +58 dBm	dBm	—	28	—
Spike Leakage Power	1 μs PW, 1% Duty Cycle, 13 GHz @ +58 dBm	dBm	—	33	—
Spike Leakage Time	58 dBm Incident Power 1 μs RF Pulse Width, 1% Duty Cycle 13 GHz	ns	—	25	—
Spike Leakage Energy	55 dBm Incident Power 1 μs RF Pulse Width, 1% Duty Cycle 13 GHz	ergs	—	0.5	—
1 dB Recovery Time 3 dB Recovery Time	55 dBm Incident Power 1 μs RF Pulse Width, 1% Duty Cycle 5 GHz	ns	—	270 130	—

2. Both Source and Load VSWR < 1.2:1

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Recommended Operating Conditions³

Parameter	Recommended Operation Value
Peak Incident Power @ +85°C, 1 μs pulse, 1% duty 3 GHz 5 GHz 13 GHz	57 dBm 57 dBm 57 dBm
CW Incident Power @ +85°C	36 dBm
DC Voltage	40 V
Junction Temperature ²	175°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

3. Operating at nominal conditions with $T_J \leq +175^\circ\text{C}$ will ensure MTTF > 1×10^6 hours.

Absolute Maximum Ratings^{4,5}

Parameter	Absolute Maximum Value
Peak Incident Power @ +85°C, 1 μs pulse, 1% duty 3 GHz 5 GHz 13 GHz	58 dBm 58 dBm 58 dBm
CW Incident Power @ +85°C	37 dBm
DC Voltage ⁶	45 V
Junction Temperature ⁷	175°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

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. Maximum DC voltage applied externally to RF input and RF output DC blocking capacitors.

7. Operating at nominal conditions with $T_J \leq +175^\circ\text{C}$ will ensure MTTF > 1×10^6 hours.

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 devices.

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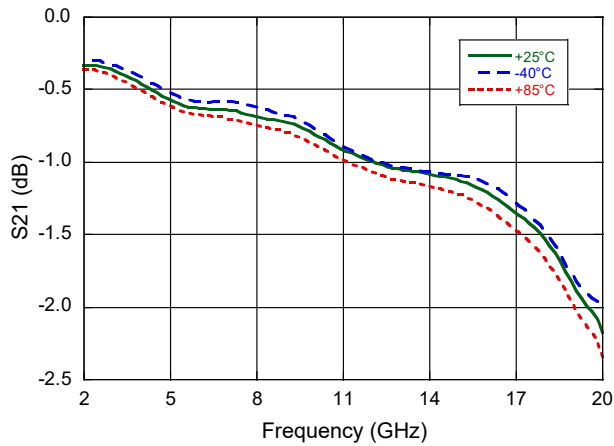


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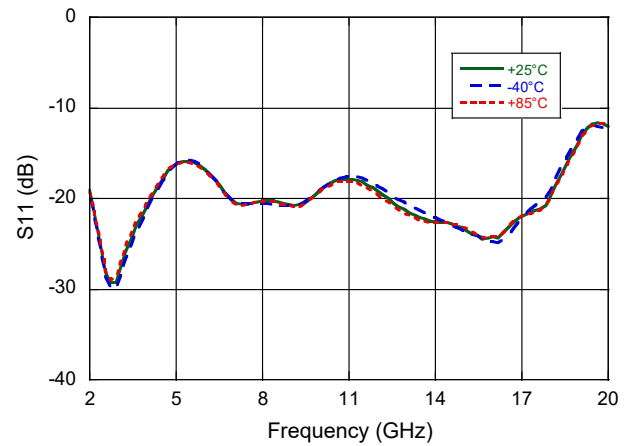
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Typical Performance Curves: Freq. = 2 - 20 GHz, $Z_0 = 50 \Omega$

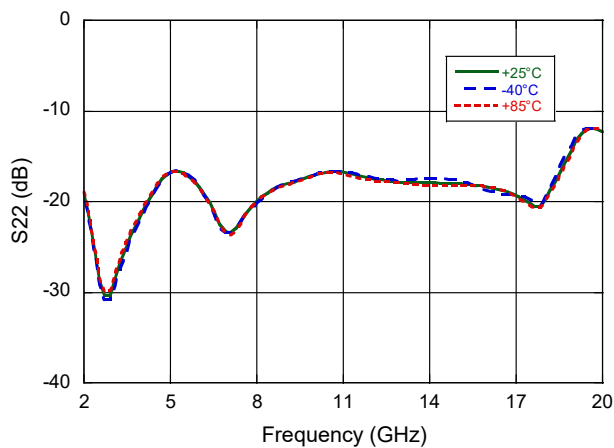
Insertion Loss



Input Return Loss



Output Return Loss



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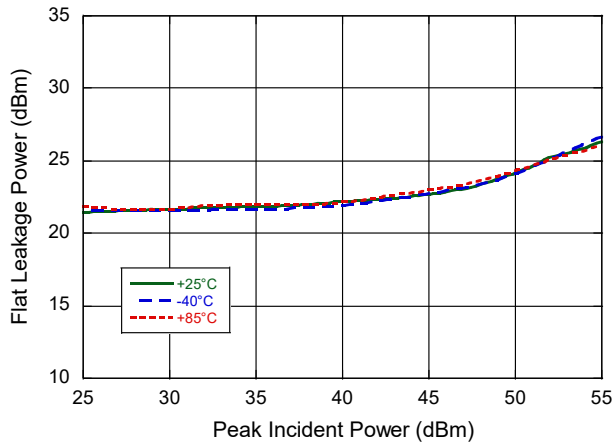


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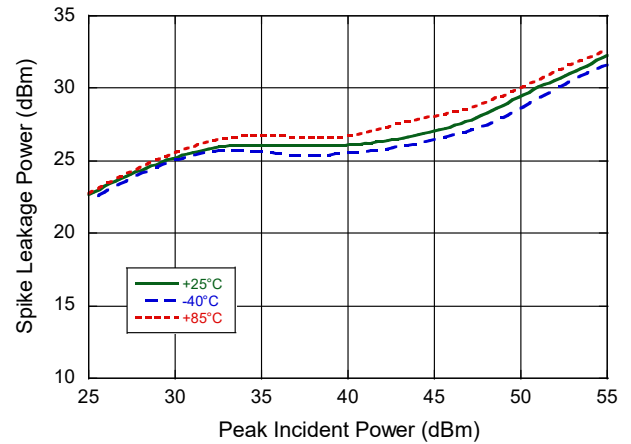
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Typical Performance Curves: 1 μ s Pulse Width, 1% Duty Cycle

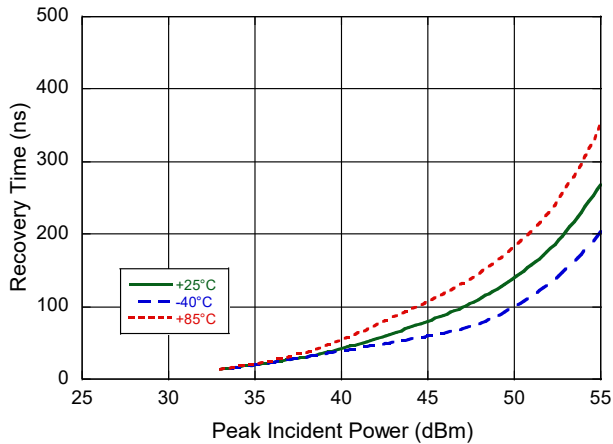
Flat Leakage Power @ 5 GHz



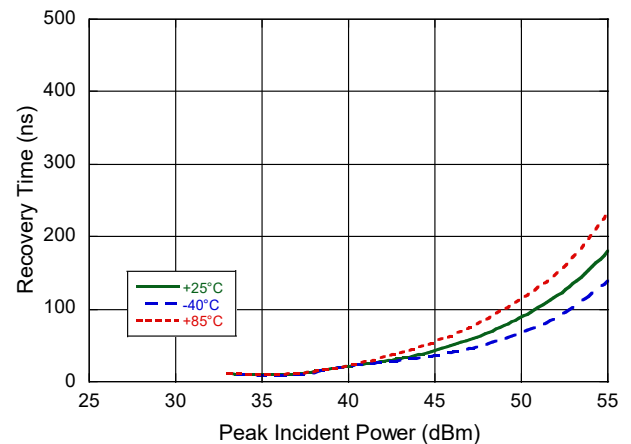
Spike Leakage Power @ 5 GHz



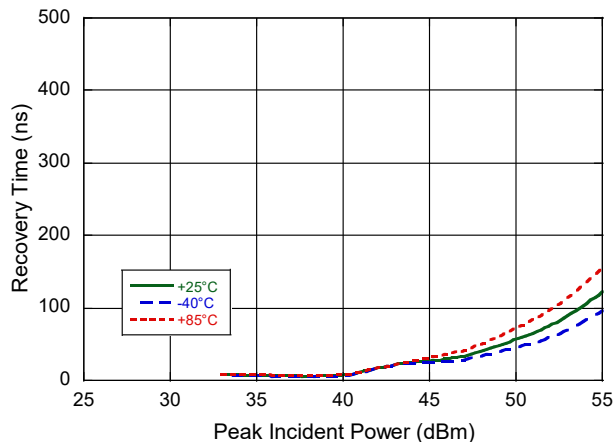
Recovery Time @ 5 GHz, 1 dB



Recovery Time @ 5 GHz, 2 dB



Recovery Time @ 5 GHz, 3 dB



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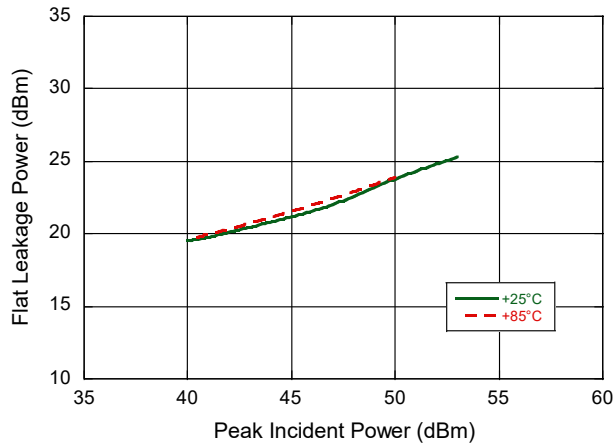


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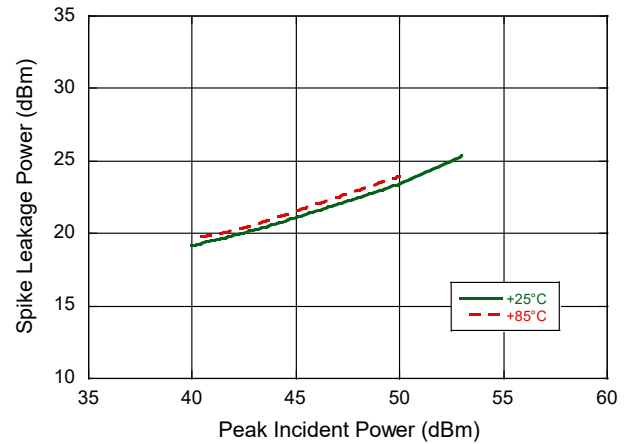
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Typical Performance Curves: $Z_0 = 50 \Omega$

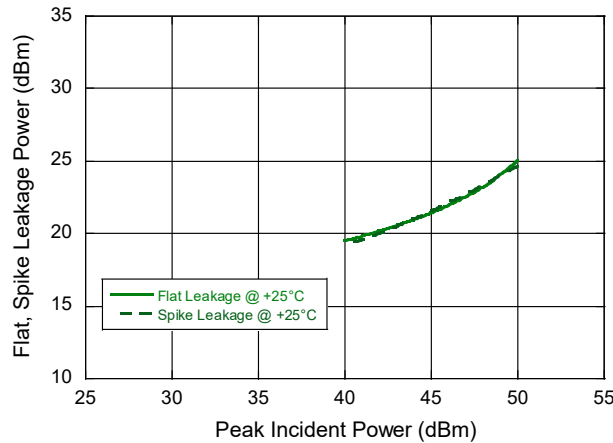
**Flat Leakage Power @ 1 GHz,
1 μ s RF Pulse Width, 1% Duty Cycle**



**Spike Leakage Power @ 1 GHz,
1 μ s RF Pulse Width, 1% Duty Cycle**



**Flat & Spike Leakage Power @ 1 GHz,
10 μ s RF Pulse Width, 2% Duty Cycle**



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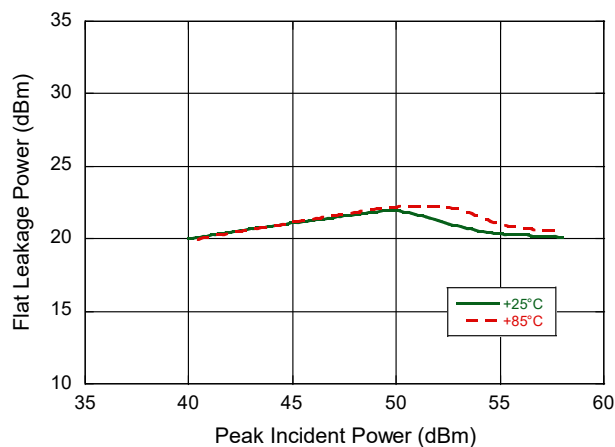


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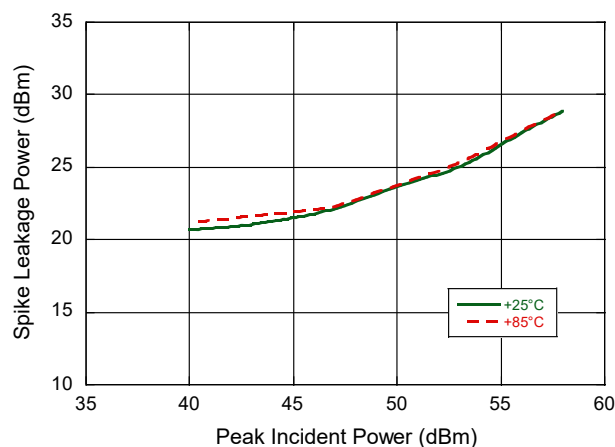
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Typical Performance Curves: $Z_0 = 50 \Omega$

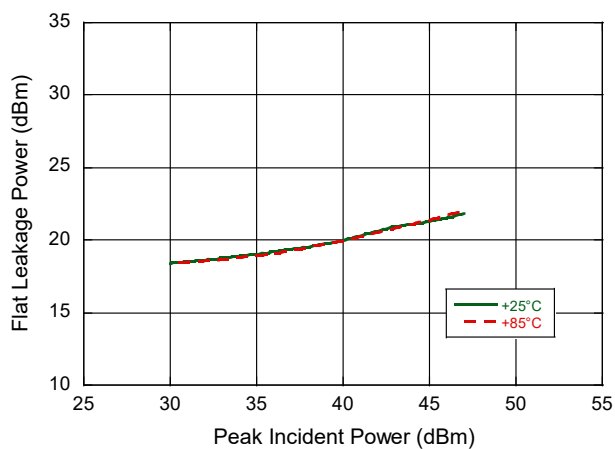
**Flat Leakage Power @ 3 GHz,
1 μ s RF Pulse Width, 1% Duty Cycle**



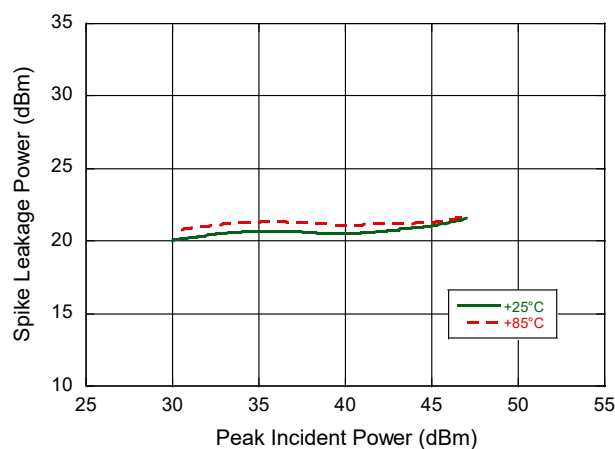
**Spike Leakage Power @ 3 GHz,
1 μ s RF Pulse Width, 1% Duty Cycle**



**Flat Leakage Power @ 3 GHz,
10 μ s RF Pulse Width, 2% Duty Cycle**



**Spike Leakage Power @ 3 GHz,
10 μ s RF Pulse Width, 2% Duty Cycle**



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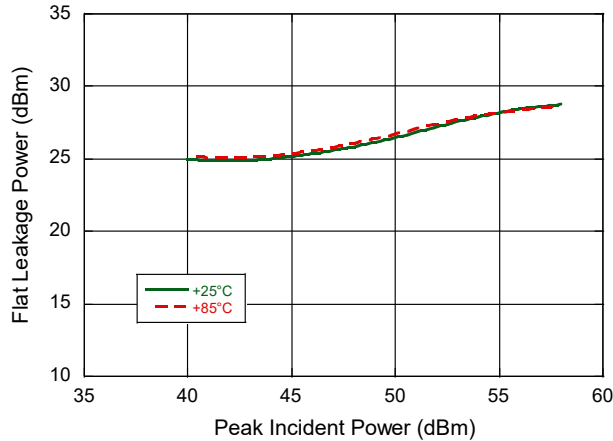


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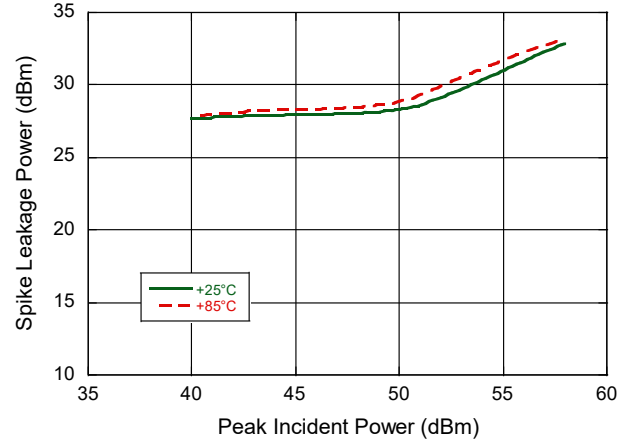
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Typical Performance Curves: 1 μ s RF Pulse Width, 1% Duty Cycle

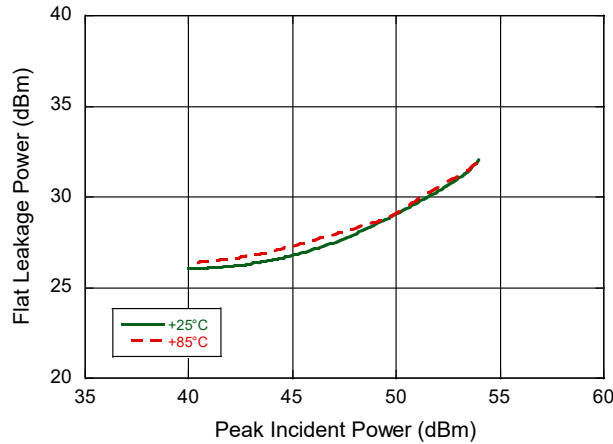
Flat Leakage Power @ 13 GHz



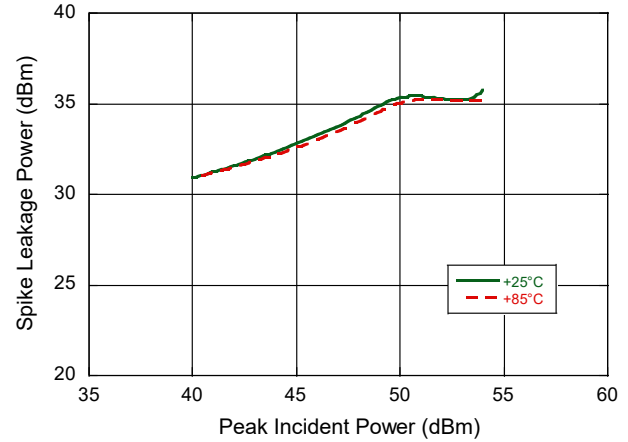
Spike Leakage Power @ 13 GHz



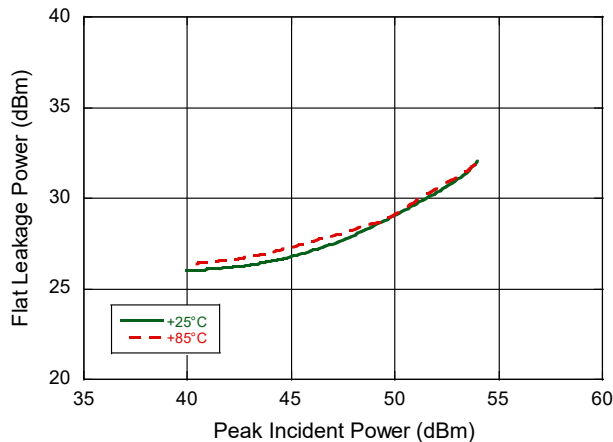
Flat Leakage Power @ 15 GHz



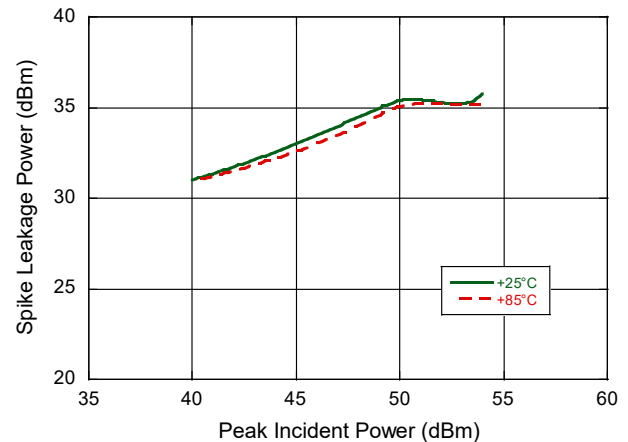
Spike Leakage Power @ 15 GHz



Flat Leakage Power @ 18 GHz



Spike Leakage Power @ 18 GHz



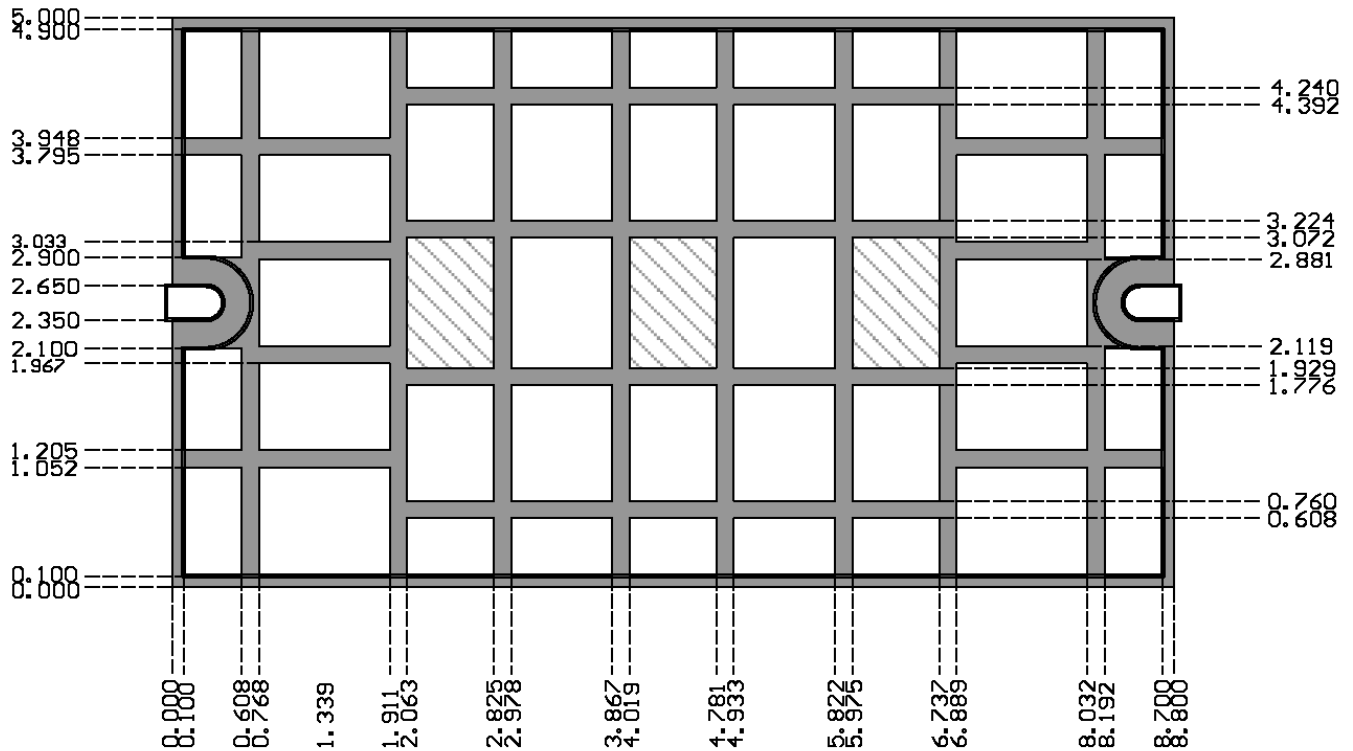
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Recommended Solder Mask Pattern on SMB to Prevent Voiding (units in mm)



Diode Locations: Minimize solder voiding

Recommended Attachment

A High density solid Cu via farm or Solid Cu heat Slug is recommended under the attach pad for optimum thermal heat dissipation. Solder voiding under the package should be minimized and no voiding should be present under the diode locations.

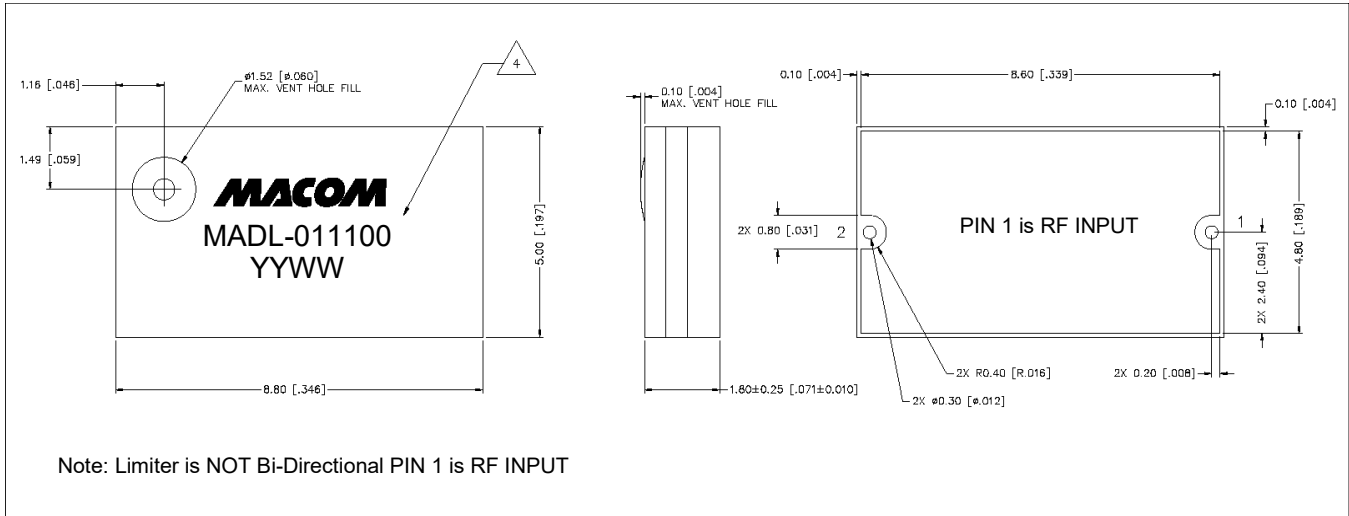
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Outline Drawing: Lead-Free 8.8 mm x 5 mm x 1.8 mm 2-Lead Package[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level (MSL) 3 requirements.
Plating is Au over Pd over Ni over Cu

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