

# High Peak Power Surface Mount Limiter 2 - 18 GHz



MADL-011121

Rev. V1

## Features

- Operating Frequency: 2 - 18 GHz
- Insertion Loss: 2 dB @ 18 GHz
- Peak Power Operation:  
60 dBm @ 2 GHz, 4 GHz, and 13.5 GHz
- Flat Leakage Power:  
43 dBm @ Input Power of 60 dBm
- Lead Free 8.8 x 5.0 x 1.8 mm Package
- Passive Device, No DC Bias Required
- Internal DC Blocks and Return

## Applications

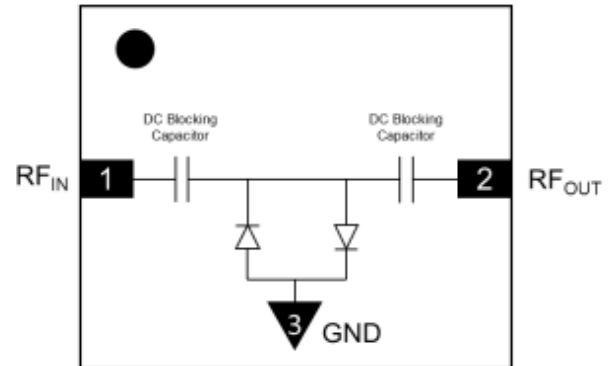
- Receiver Protector
- Ship and Airborne Radar

## Description

The MADL-011121 is a lead-free wide band surface mount limiter that integrates multiple limiter stages and blocking capacitors in a compact laminate package. This device provides superior low and high signal performance from 2 to 18 GHz without DC Bias

The MADL-011121 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<sup>1</sup>

Pin #	Function
1	RF Input
2	RF Output
3 (Paddle) <sup>2</sup>	RF and DC Ground

1. MACOM recommends connecting unused package pins to ground.
2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

## Ordering Information

Part Number	Package
MADL-011121	waffle pack
MADL-011121-000SMB	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	dB	—	0.4	0.8
	12 GHz			1.0	1.8
	18 GHz			2.0	3.0
Return Loss	2 GHz	dB	—	21	—
	10 GHz			23	
	18 GHz			19	
Input P1dB	2 - 18 GHz	dBm		25	
IIP3	-10 dBm per Tone, 10 MHz Spacing	dBm	—	30	—
IIP2	-10 dBm per Tone, 10 MHz Spacing	dBm	—	50	—
Peak Power Handling <sup>3</sup>	13.5 GHz	dBm	—	59.5	—
CW Power Handling <sup>3</sup>	12 - 18 GHz	dBm	—	37	—
Flat Leakage Power	1 $\mu\text{s}$ , 1% Duty Cycle, 13.5 GHz @ +60 dBm	dBm	—	43	—
Spike Leakage Power	1 $\mu\text{s}$ , 1% Duty Cycle, 13.5 GHz @ +60 dBm	dBm	—	44	—
Spike Leakage Time	1 $\mu\text{s}$ , 1% Duty Cycle, 13.5 GHz @ +58 dBm	ns	—	100	—
1 dB Recovery Time	1 $\mu\text{s}$ , 1% Duty Cycle, 13.5 GHz @ +57 dBm	ns	—	420	—
3 dB Recovery Time				190	

3. Both source and load VSWR < 1.2:1

### Absolute Maximum Ratings<sup>4,5</sup>

Parameter	Absolute Maximum
Peak Incident Power @ +85°C, 1 $\mu\text{s}$ pulse, 1% duty, 13.5 GHz	58 dBm
CW Incident Power @ +85°C	37 dBm
Junction Temperature <sup>6</sup>	+175°C
DC Voltage	45 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

### Maximum Survivability Ratings<sup>4,5</sup>

Parameter	Maximum Survivability
Peak Incident Power @ +85°C, 1 $\mu\text{s}$ pulse, 1% duty, 13.5 GHz	60 dBm
CW Incident Power @ +85°C	39 dBm
Junction Temperature	+250°C
DC Voltage	45 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- Operating at nominal conditions with  $T_J \leq +175^\circ\text{C}$  will ensure  $\text{MTTF} > 1 \times 10^6$  hours.

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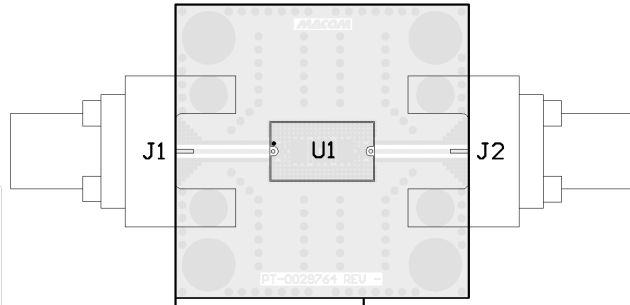
DC-0033442

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## PCB Layout



## Handling Procedures

Please observe the following precautions to avoid damage:

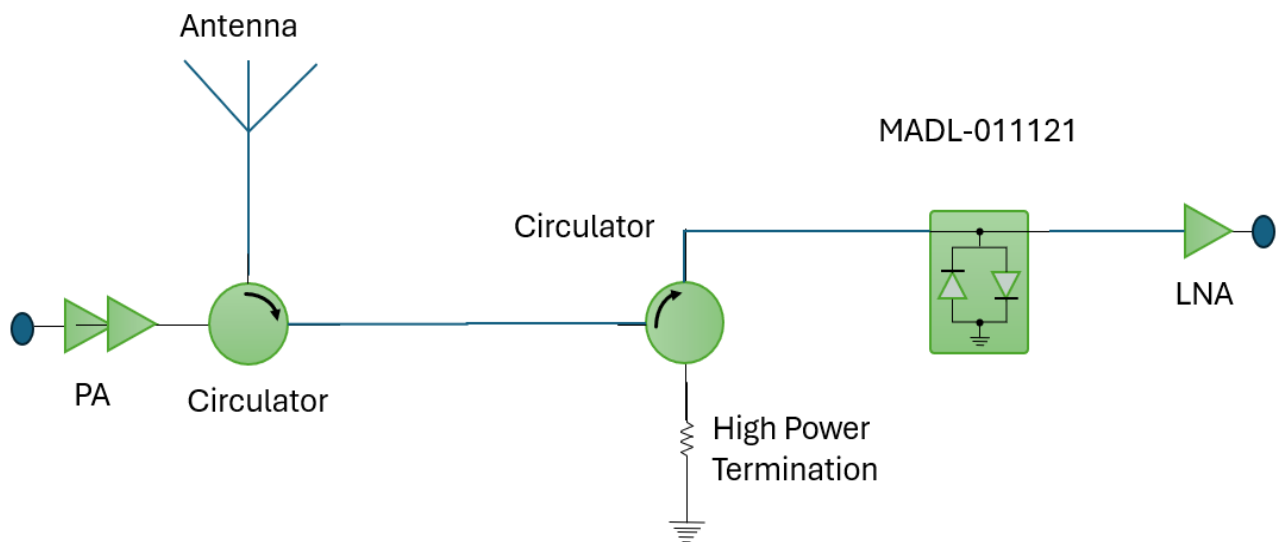
## Static Sensitivity

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.

## Parts List

Part	Value	Case Style
MADL-011121	U1	8.8 x 5 mm 2LD
1092-03A-6	J1, J2	SW Connector
PT-0034684	SMB	

## Application Schematic



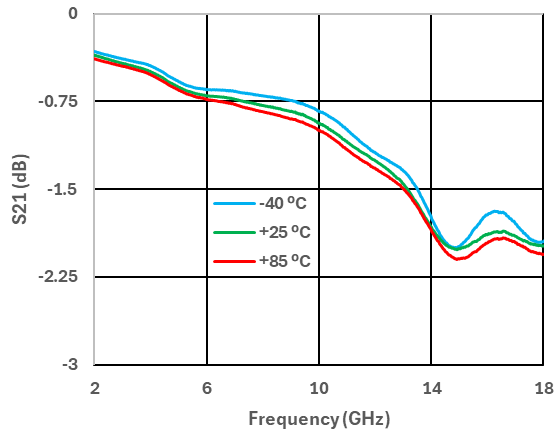
# High Peak Power Surface Mount Limiter 2 - 18 GHz



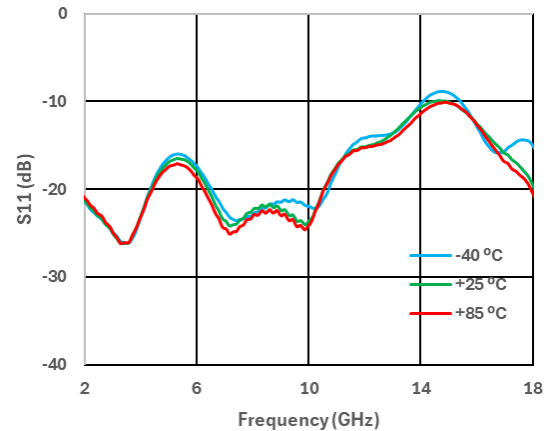
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## Typical Performance Curves

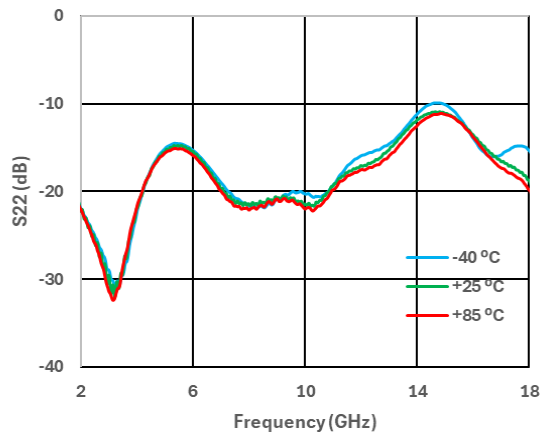
**Insertion Loss**



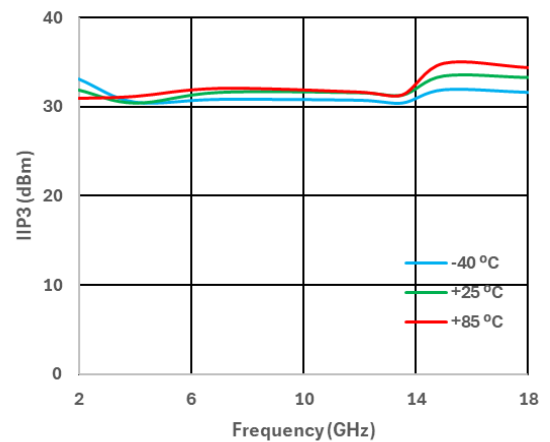
**Input Return Loss**



**Output Return Loss**



**IP3**



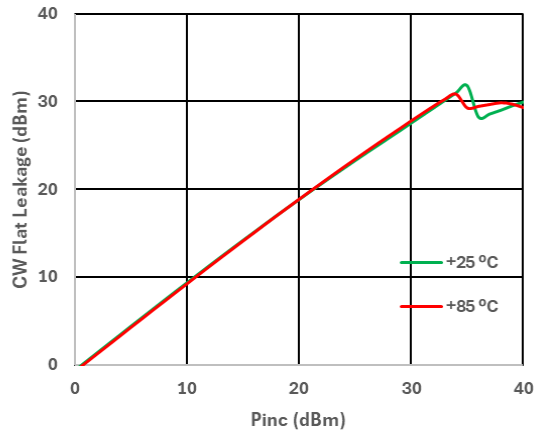
# High Peak Power Surface Mount Limiter 2 - 18 GHz



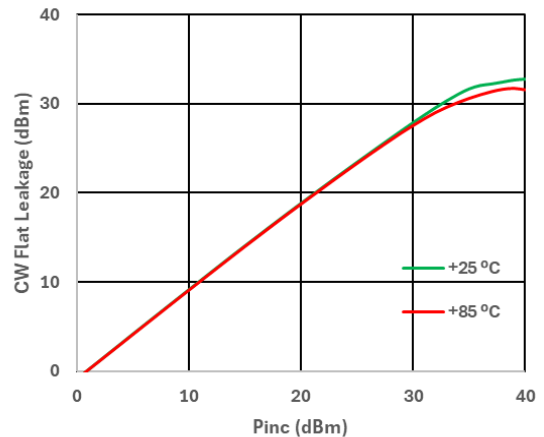
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## Typical Performance Curves:

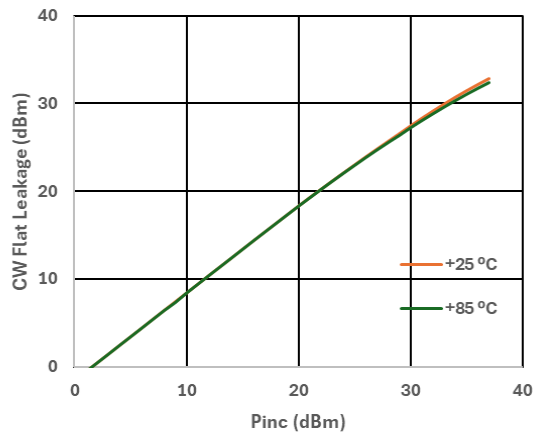
**Flat Leakage CW Power @ 2 GHz**



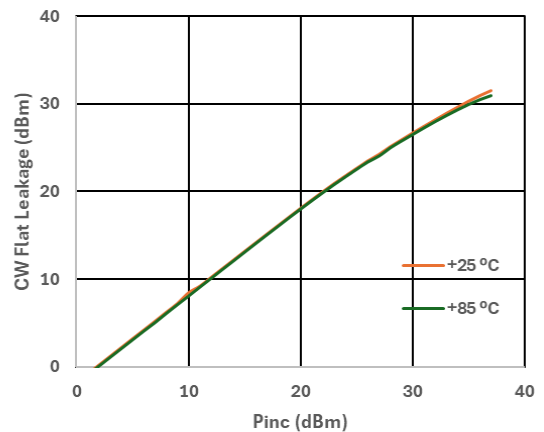
**Flat Leakage CW Power @ 4 GHz**



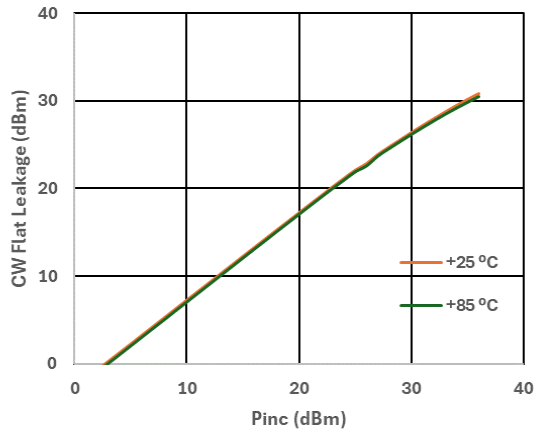
**Flat Leakage CW Power @ 8 GHz**



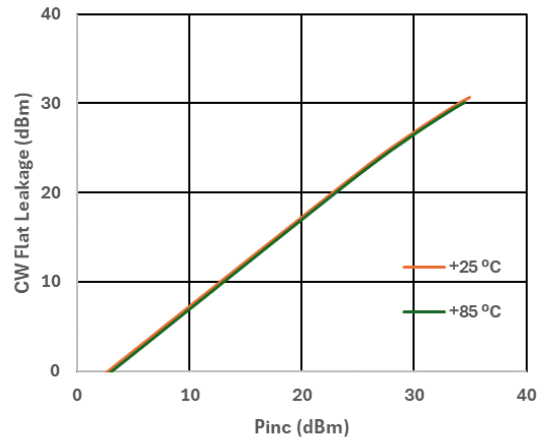
**Flat Leakage CW Power @ 12 GHz**



**Flat Leakage CW Power @ 15 GHz**



**Flat Leakage CW Power @ 18 GHz**



# High Peak Power Surface Mount Limiter 2 - 18 GHz

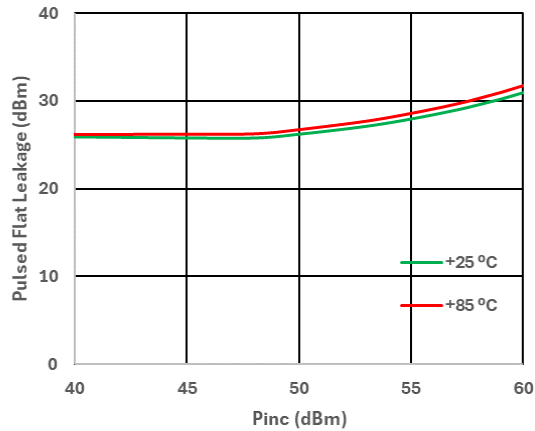


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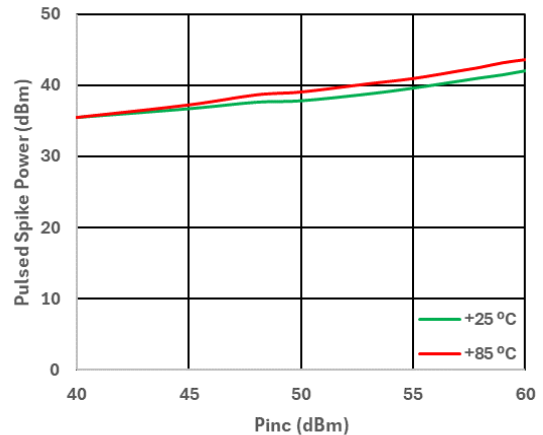
Rev. V1

## Typical Performance Curves: 1uS Pulse Width, 1% Duty Cycle

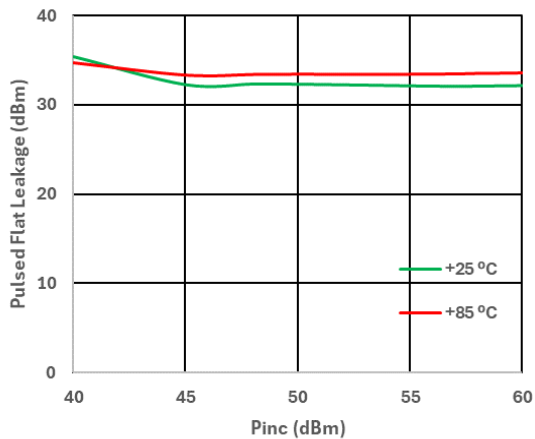
**Pulsed Flat Leakage Power @ 2 GHz**



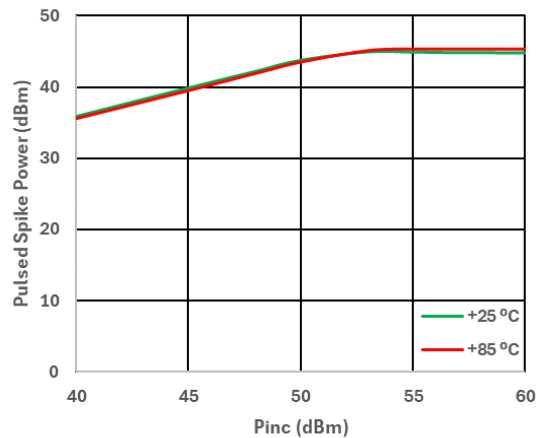
**Pulsed Spike Power @ 2 GHz**



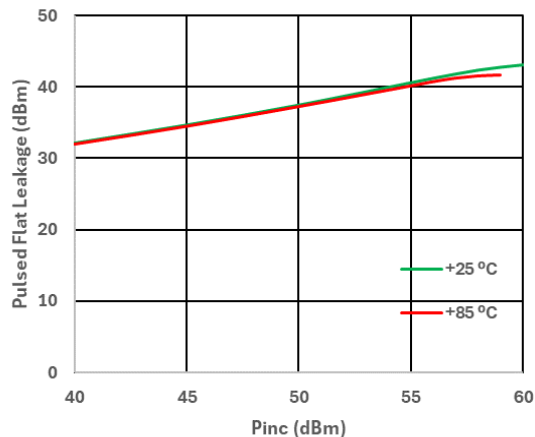
**Pulsed Flat Leakage Power @ 4 GHz**



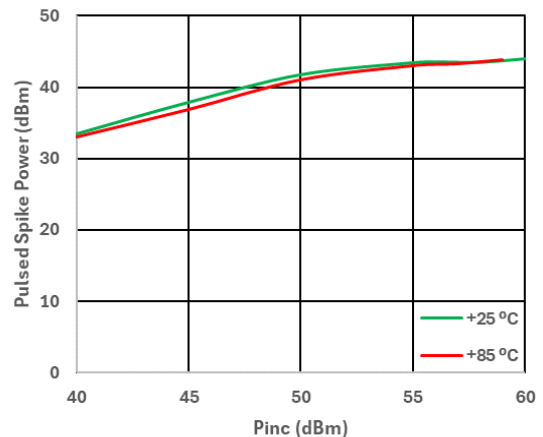
**Pulsed Spike Power @ 4 GHz**



**Pulsed Flat Leakage Power @ 13.5 GHz**



**Pulsed Spike Power @ 13.5 GHz**



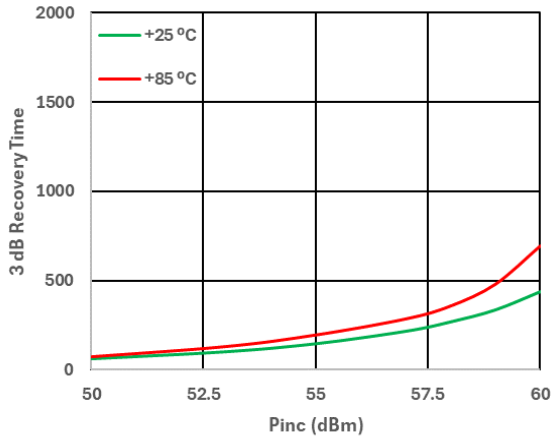
# High Peak Power Surface Mount Limiter 2 - 18 GHz



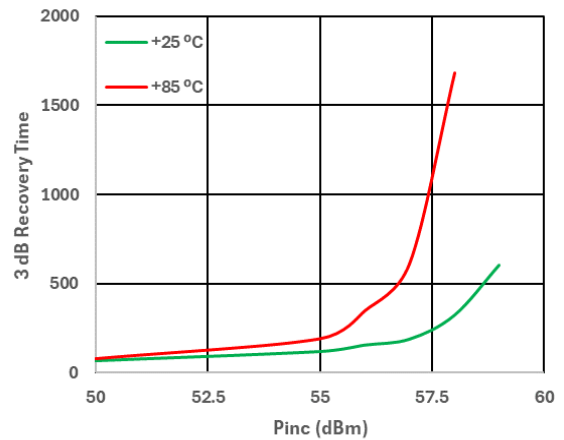
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## Typical Performance Curves: 1uS Pulse Width, 1% Duty Cycle

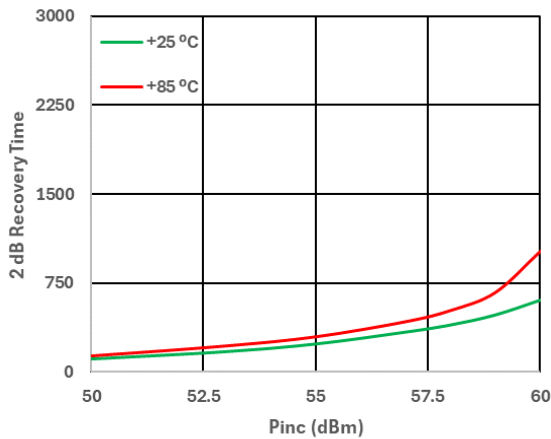
3 dB Recovery Time, 4 GHz



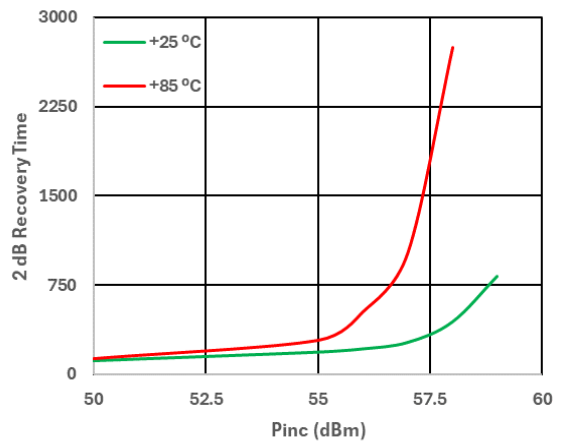
3 dB Recovery Time, 13.5 GHz



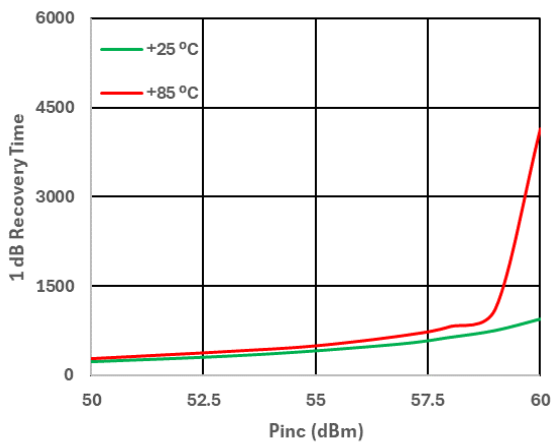
2 dB Recovery Time, 4 GHz



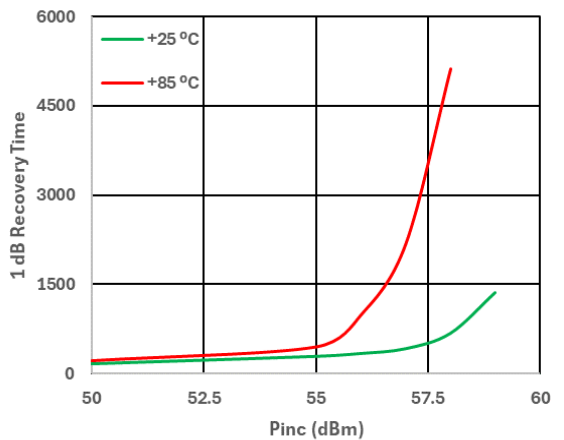
2 dB Recovery Time, 13.5 GHz



1 dB Recovery Time, 4 GHz



1 dB Recovery Time, 13.5 GHz



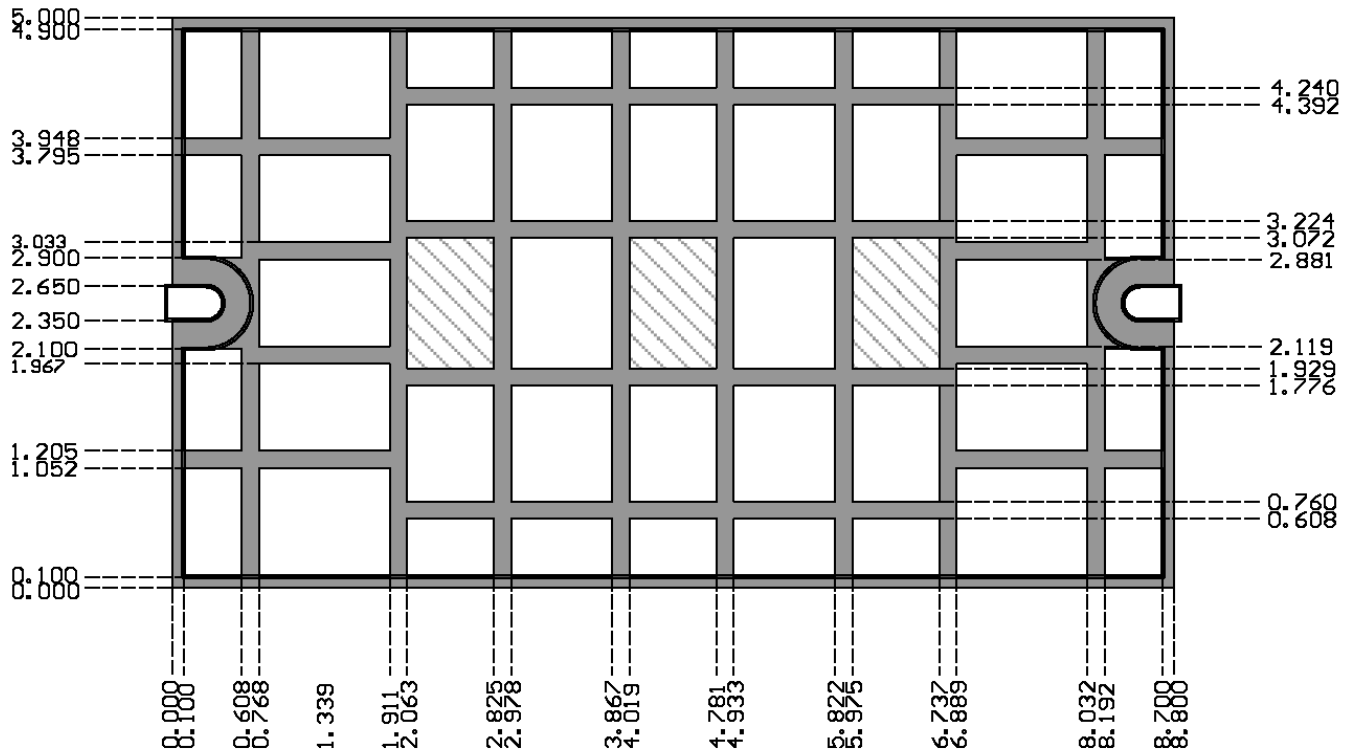
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## Recommended Solder Mask Pattern on SMB to prevent Voiding (units in mm)



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.



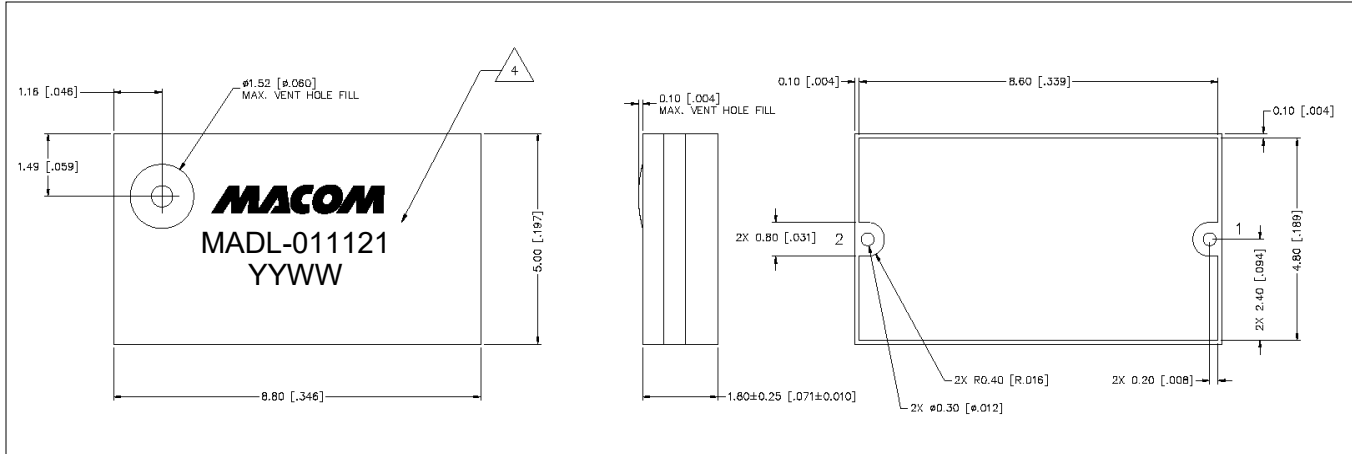
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## Outline Drawing: Lead-Free 8.8 x 5.0 x 1.8 mm 2-Lead Package<sup>†</sup>



<sup>†</sup> 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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