

## 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 mm<sup>3</sup> Package
- RoHS\* Compliant
- Hermetic Seal<sup>1</sup>

## 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.

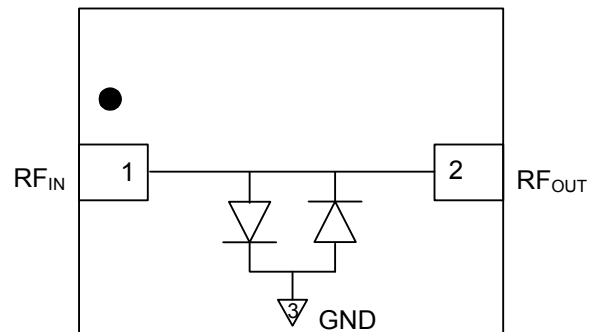
The MADL-011015 is ideally suitable for higher peak and CW power receiver-protector microwave circuits applications where higher performance surface mount limiter assemblies are required.

## Ordering Information

Part Number	Package
MADL-011015-001	Bulk
MADL-011015-001SMB	Sample test board

1. Hermetic Seal provides fine leak rate <math> < 5 \times 10^{-8} \text{ atm} \cdot \text{cc/s}</math>.

## Functional Schematic



Top view

## Pin Configuration

Pin No.	Pin Name	Description
1 (dot)	RF <sub>IN</sub>	RF Input
2	RF <sub>OUT</sub>	RF Output
3	Paddle <sup>2</sup>	Ground

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

\* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

**250 W Peak Power Limiter**  
**2 - 4 GHz**

Rev. V2

**Electrical Specifications:  $T_A = +25^\circ\text{C}$ ,  $Z_0 = 50 \Omega$  (unless otherwise defined)**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	-10 dBm, 2.0 GHz -10 dBm, 3.5 GHz -10 dBm, 4.0 GHz	dB	—	0.4 0.6 0.8	— 0.9 —
Return Loss	-10 dBm, 2.0 GHz -10 dBm, 3.5 GHz -10 dBm, 4.0 GHz	dB	—	25 15 13	—
P1dB Input Compression Power	3.5 GHz	dBm	—	14	—
CW Incident Power <sup>3</sup>	3.5 GHz	dBm	—	51	—
Peak Incident Power <sup>3</sup>	1 ms pulse, 10% duty cycle, 3.5 GHz	dBm	—	56	—
Flat Leakage Power	+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz	dBm	—	15	—
Spike Leakage Power	+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz	dBm	—	30	—
Spike Leakage Energy	+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz	ergs	—	0.3	—
Spike Leakage Time (3 dB below Peak Spike Power)	+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz	ns	—	30	—
Recovery Time (1 dB of Insertion Loss)	+56 dBm, 1 ms pulse, 10% duty cycle, 3.5 GHz	$\mu\text{s}$	—	3	—
Input 3rd Order Intermodulation Products (IIP3)	-10 dBm, F1 = 3.500 GHz, F2 = 3.510 GHz	dBm	—	25	—

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

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

Parameter	Absolute Maximum
Peak Incident Power @ +85°C 1 ms pulse, 10% duty	54 dBm
Peak Incident Power @ +85°C 100 $\mu\text{s}$ pulse, 10% duty	56 dBm
CW Incident Power @ +85°C	50 dBm
Junction Temperature <sup>6</sup> ( $T_J$ )	175°C
Operating Temperature	-65°C to +125°C
Storage Temperature	-65°C to +150°C

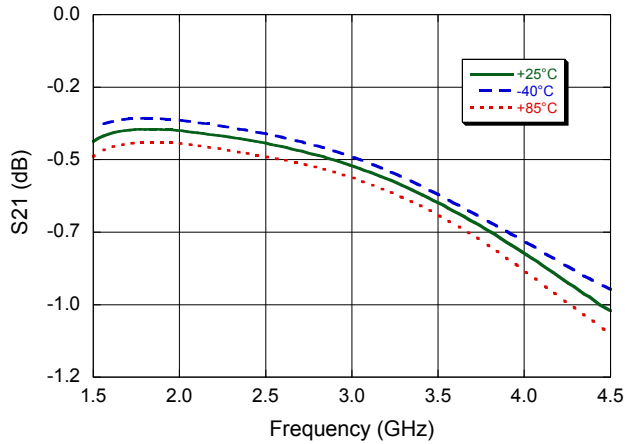
4. Exceeding any one or combination of these limits may cause permanent damage to this device.  
 5. MACOM does not recommend sustained operation near these survivability limits.  
 6. Operating at nominal conditions with  $T_J \leq +175^\circ\text{C}$  will ensure  $\text{MTTF} > 1 \times 10^6$  hours.

2

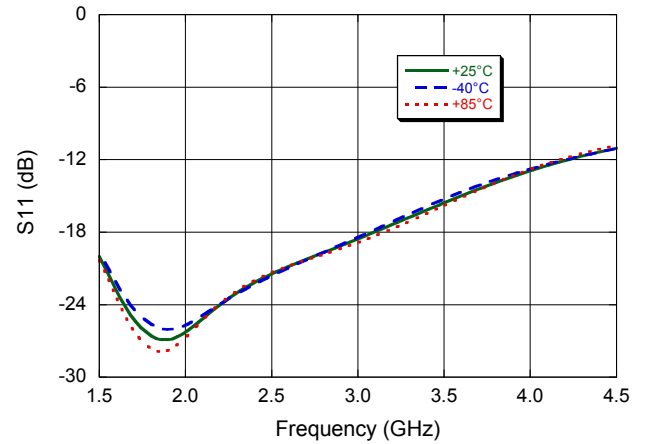
M/A-COM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

## Typical Performance Curves

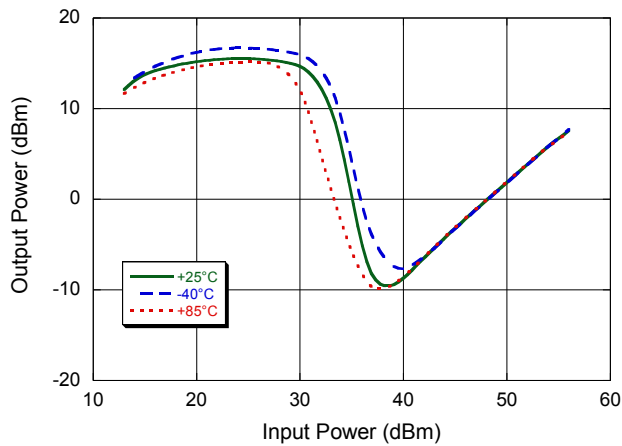
**Insertion Loss vs. Frequency**



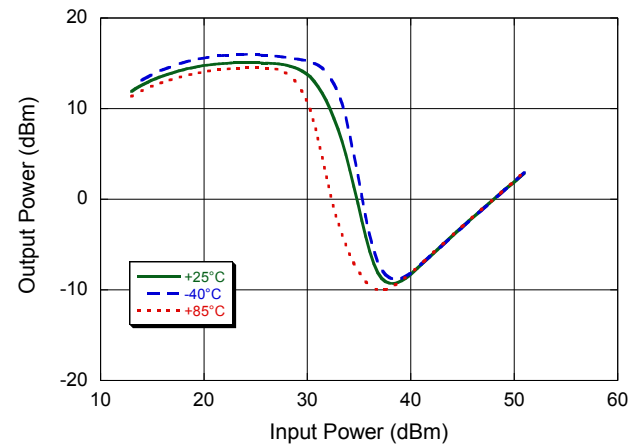
**Input Return Loss vs. Frequency**



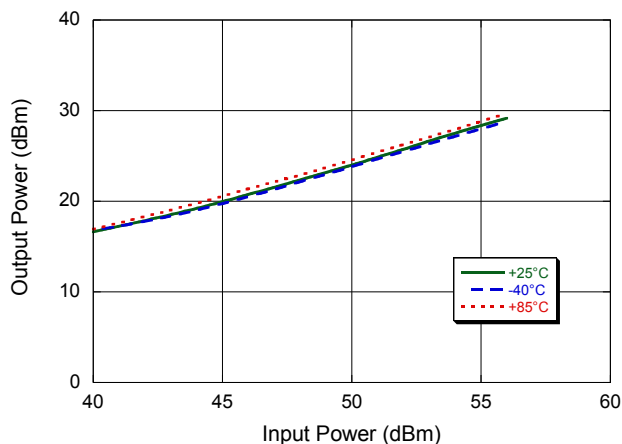
**Pulsed Flat Leakage Power vs. P<sub>IN</sub>**  
(1 ms Pulse, 10% Duty Cycle, 3.5 GHz)



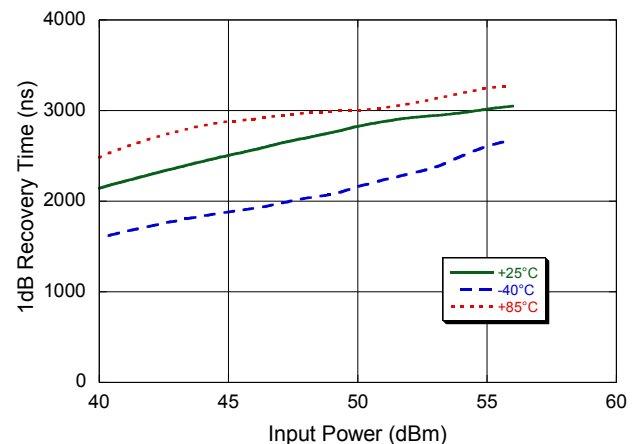
**CW Flat Leakage Power vs. P<sub>IN</sub> @ 3.5 GHz**



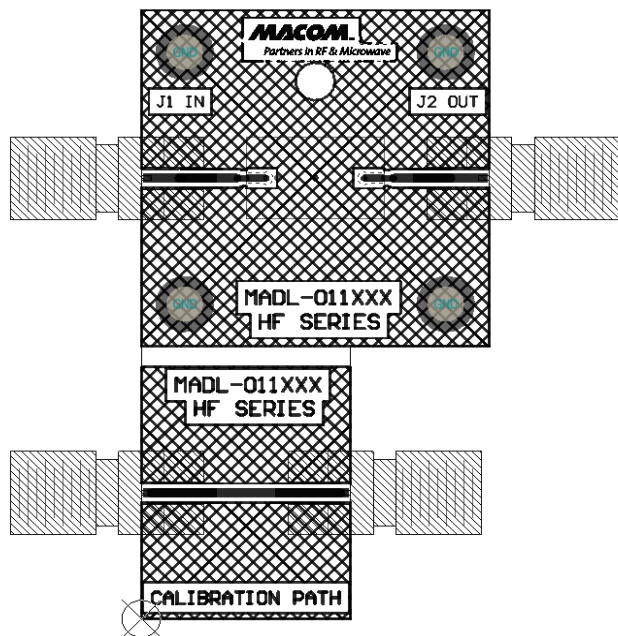
**Pulsed Spike Leakage Power vs. P<sub>IN</sub>**  
(1 ms Pulse, 10% Duty Cycle, 3.5 GHz)



**Pulsed 1 dB Recovery Time vs. P<sub>IN</sub>**  
(1 ms Pulse, 10% Duty Cycle, 3.5 GHz)



## SMB Layout



## SMB Parts List

Part	Quantity	Part Number
RF Connector	2	Johnson 142-0761-861
Limiter	1	MADL-011015

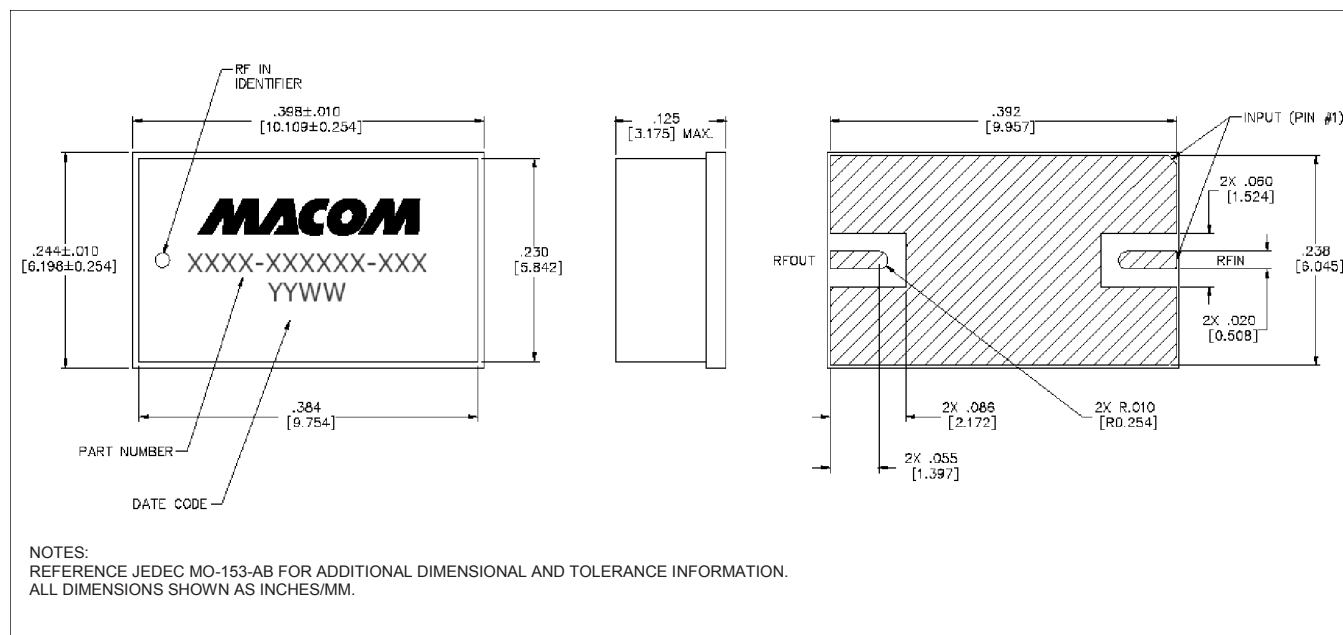
## Handling Procedures

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.

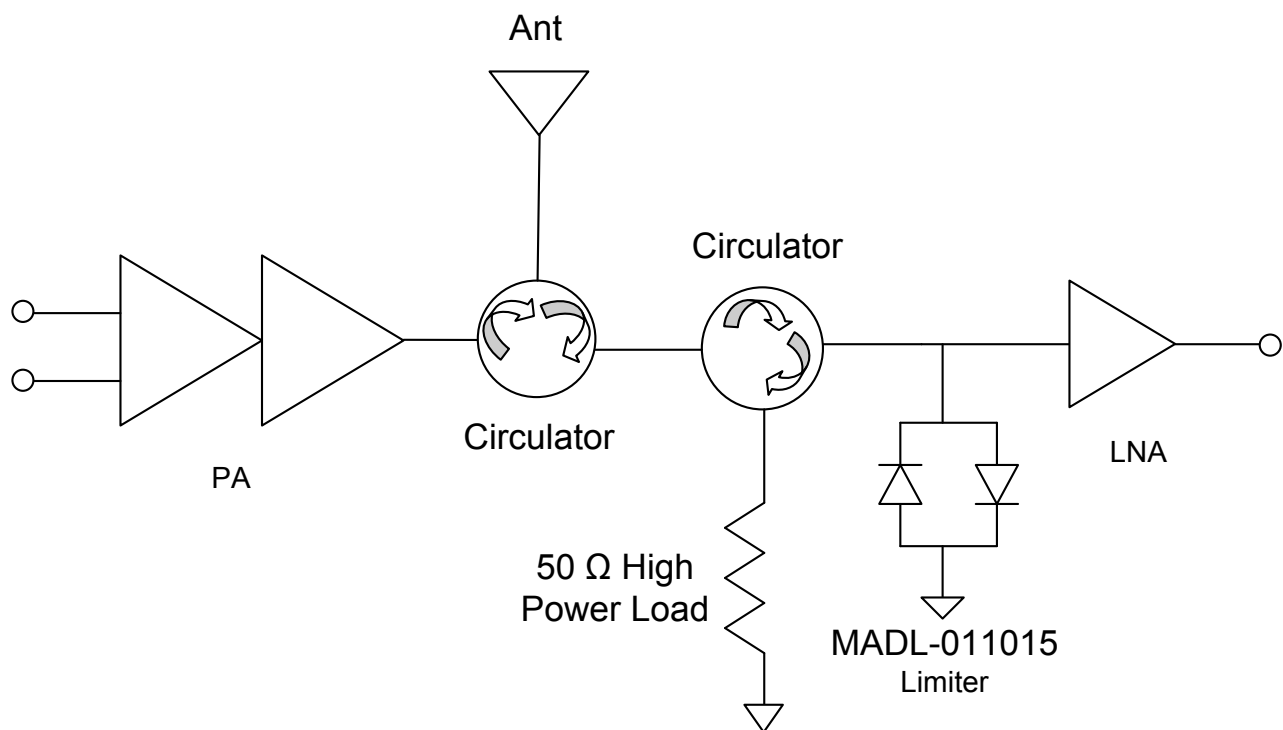
## Lead-Free 10.1 x 6.2 x 3.2 mm<sup>3</sup> 2-Lead package<sup>†</sup>



<sup>†</sup> Reference Application Note [S2083](#) for lead-free solder reflow recommendations.  
 Plating is Au over Ni over Cu.

## Application Section

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



M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.