

## PIN-Schottky Anti-Parallel Diode Limiter 10 MHz - 6 GHz

Rev. V2

### Features

- 3 Terminal LPF Broadband Shunt Structure
- 10 MHz - 6 GHz Broadband Frequency
- > 2.5 W Peak and CW Power Handling
- < 0.5 dB Shunt Insertion Loss
- < +15 dBm Flat Leakage Power
- Lead-Free 1.5 x 1.2 mm 6-lead TDFN Package
- RoHS\* Compliant and 260°C Reflow Compatible

### Description

The MADL-011021 is a lead-free 1.5 x 1.2 mm TDFN surface mount plastic packaged that provides both low and high signal frequency operation from 10 MHz to 6 GHz. The anti-parallel arrangement of the PIN limiter and schottky diode provides for broadband performance, eliminating the need for a shunt coil as a DC return.

This device is ideally suitable for usage in higher frequency and lower flat leakage limiter microwave circuits applications where higher performance surface mount diode assemblies are required.

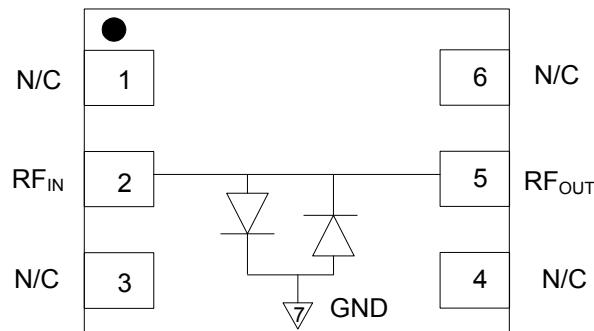
### Ordering Information<sup>1,2</sup>

Part Number	Package
MADL-011021-14150T	3000 piece reel
MADL-011021-000SMB	Sample board

1. Reference Application Note [M513](#) for reel size information.

2. All RF Sample boards include 5 loose parts.

### Functional Schematic



Top view

### Pin Configuration<sup>3</sup>

Pin No.	Pin Name	Description
1	N/C	No Connection
2	RF <sub>IN</sub>	RF Input
3	N/C	No Connection
4	N/C	No Connection
5	RF <sub>OUT</sub>	RF Output
6	N/C	No Connection
7	Paddle <sup>4</sup>	Ground

3. MACOM recommends connecting unused package pins to ground.

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

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

**PIN-Schottky Anti-Parallel Diode Limiter**  
**10 MHz - 6 GHz**

Rev. V2

**Electrical Specifications:  $T_A = +25^\circ\text{C}$** 

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	P incident = -10 dBm, F = 750 MHz	dB	—	0.15	0.20
Return Loss	P incident = -10 dBm, F = 750 MHz	dB	—	20	—
P1dB Input Compression Power	F = 1 GHz	dBm	—	+5	—
C.W. Incident Power <sup>5</sup>	F = 4 GHz	dBm	—	34	—
Peak Incident Power <sup>5</sup>	1 $\mu\text{s}$ , 1 % duty @ 4 GHz	dBm	—	34	—
Flat Leakage Power <sup>6</sup>	+34 dBm, 1 $\mu\text{s}$ , 1 % duty @ 4 GHz	dBm	—	18	—
Spike Leakage Power <sup>6,7</sup>	+34 dBm, 1 $\mu\text{s}$ , 1 % duty @ 4 GHz	dBm	—	20	—
Spike Leakage Energy <sup>6,7</sup>	+34 dBm, 1 $\mu\text{s}$ , 1 % duty @ 4 GHz	ergs	—	0.01	—
Recovery Time <sup>5,6,7</sup> ( 1 db of Insertion Loss )	+34 dBm, 1 $\mu\text{s}$ , 1 % duty @ 4 GHz	ns	—	100	—
Input 3rd Order Intermodulation Products (IIP3)	P incident = -10 dBm, F1 = 1.000 GHz, F2 = 1.010 GHz	dBm	—	15	—

5. Incident power ratings defined with 1.2:1 source VSWR and 1.2:1 max load VSWR.

6. Peak incident power defined at 1  $\mu\text{s}$  RF pulse width, 1% duty cycle

7. Spike leakage power and recovery time values are defined at peak power conditions.

**Absolute Maximum Ratings<sup>8,9</sup>**

Parameter	Absolute Maximum
Peak Incident Power 1 $\mu\text{s}$ pulse, 1% duty (+85°C)	+33 dBm
CW Incident Power (+85°C)	+33 dBm
Junction Temperature	+175°C
Operating Temperature	-65°C to +125°C
Storage Temperature	-65°C to +150°C

8. Exceeding any one or combination of these limits may cause

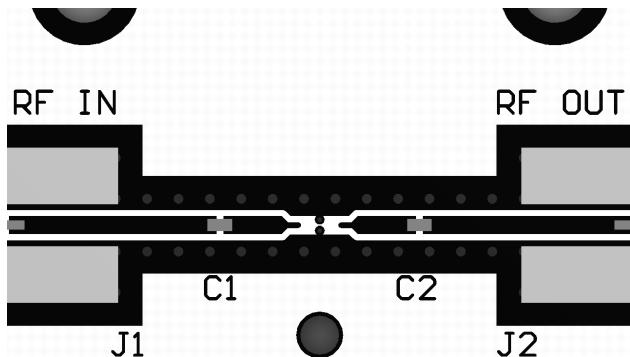
permanent damage to this device.

9. MACOM does not recommend sustained operation near these survivability limits.

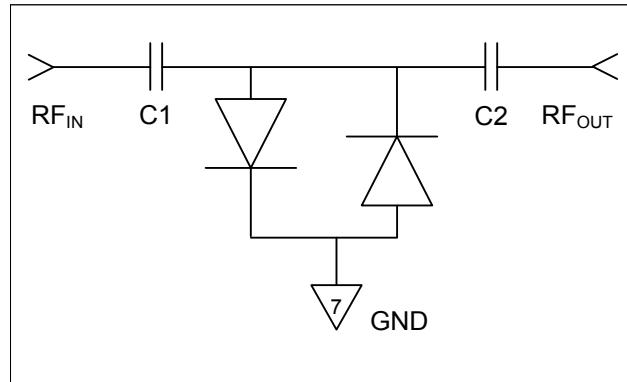
## **PIN-Schottky Anti-Parallel Diode Limiter 10 MHz - 6 GHz**

Rev. V2

# PCB Layout



## PCB Schematic



## Parts List

Part	Value	Case Style
C1, C2 ( DC Blocks )	100 pF	0402

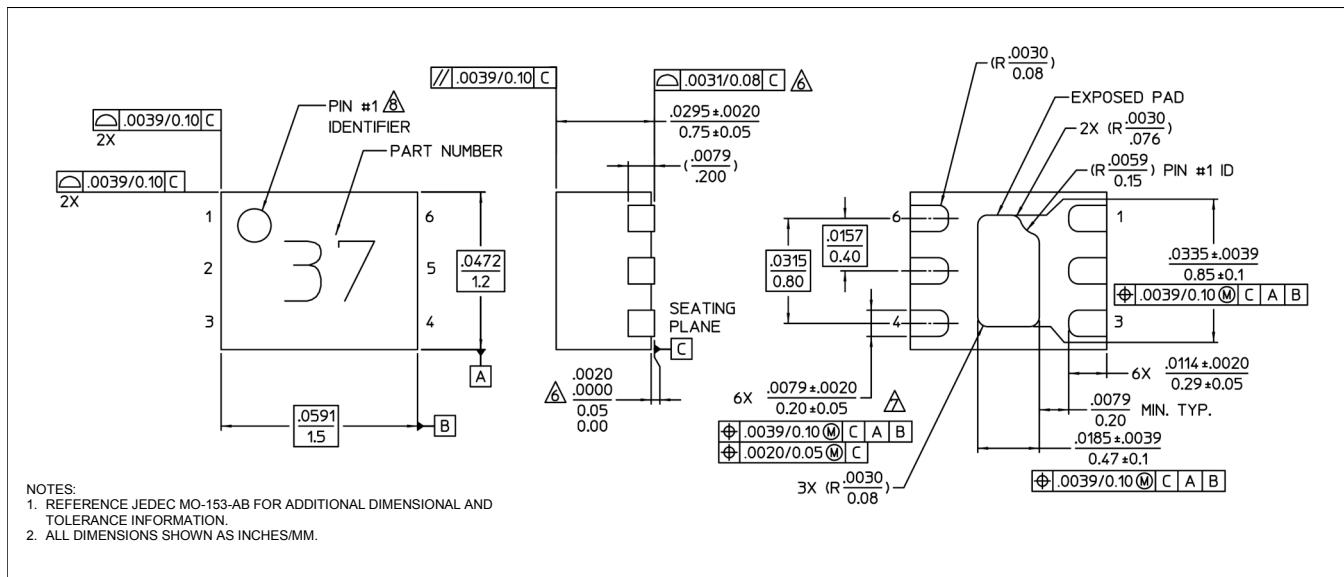
## Handling Procedures

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 devices.

### **Lead-Free 1.5 x 1.2 mm 6-Lead TDFN<sup>†</sup>**



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations

Meets JEDEC moisture sensitivity level 1 requirements

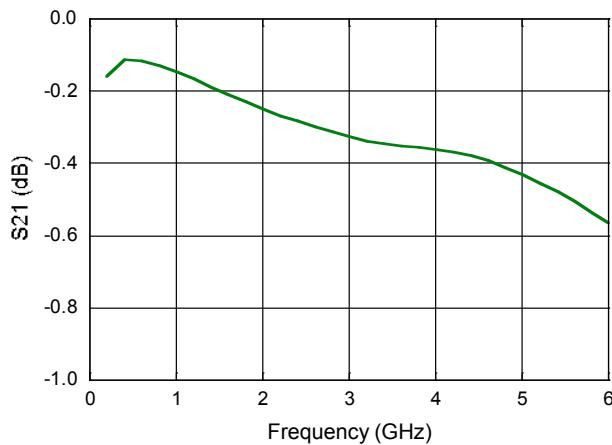
Meets JEDEC moisture sensitivity level  
Plating is 100% matte tin over copper

## PIN-Schottky Anti-Parallel Diode Limiter 10 MHz - 6 GHz

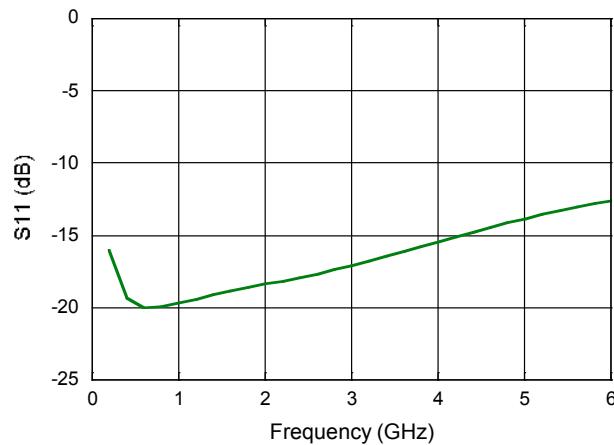
Rev. V2

### Typical Performance Curves @ +25°C

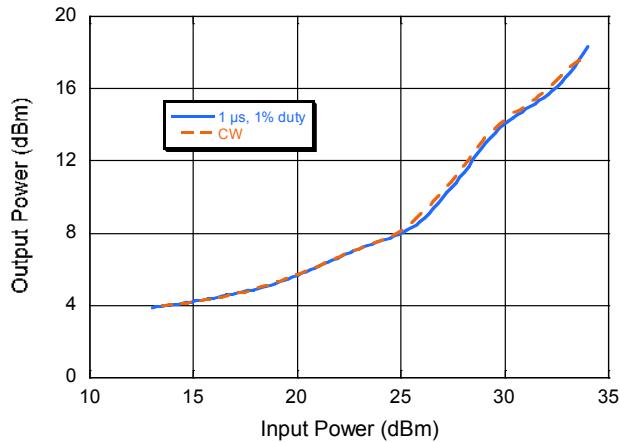
Insertion Loss vs. Frequency



Return Loss vs. Frequency



Flat Leakage Power @ CW and Pulsed Power, 4 GHz

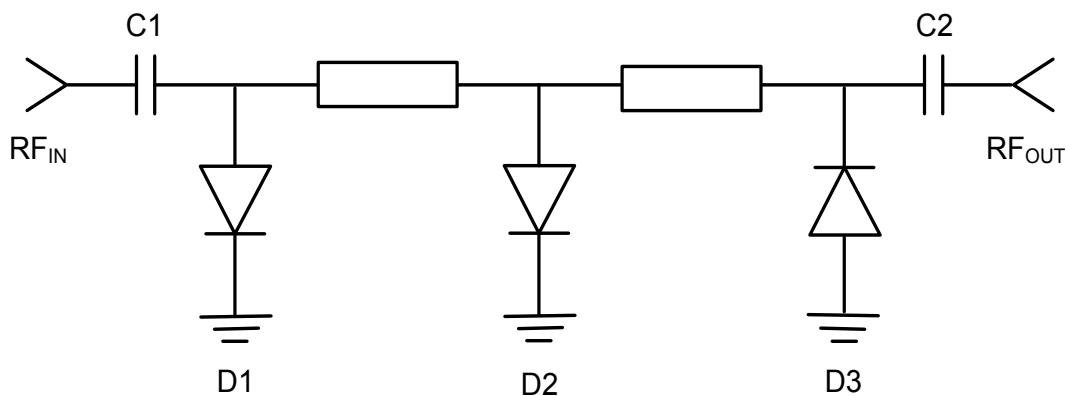


**PIN-Schottky Anti-Parallel Diode Limiter**  
**10 MHz - 6 GHz**

Rev. V2

## Applications Section

**Schematic of 3 Stage Limiter using MADL-011021-14150T**  
 $F = 1 - 6 \text{ GHz}$ ,  $P_{inc} = +40 \text{ dBm CW}$ ,  $+47 \text{ dBm}$ ,  $5 \text{ us}$ ,  $1\% \text{ duty}$



## Parts List<sup>10</sup>

Part	PN	Case Style	Description	Quantity
D1	MADP-011029-14150T	ODS-1415	Input PIN Diode	1
D2, D3 <sup>11</sup>	MADL-011021-14150T	ODS-1415	2 <sup>nd</sup> & 3 <sup>rd</sup> Stage PIN Diode	1
C1, C2	22 pF	0402	DC Block	2

10. Parts list is shown for 1 - 6 GHz operation. Component values can be scaled for various frequency bands.  
 11. D2 and D3 are combined as single MADL-011021-14150T.

## PIN-Schottky Anti-Parallel Diode Limiter 10 MHz - 6 GHz

Rev. V2

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 estoppel 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.