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PIN Diode Limiter 10 MHz - 12 GHz

Rev. V3

Features

- 3 Terminal LPF Broadband Shunt Structure
- 10 MHz - 12 GHz Broadband Frequency
- >50 dBm Peak Power Handling
- >40 dBm CW Power Handling
- <0.2 dB Insertion Loss
- 20 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-011023 is a PIN diode limiter assembled in a lead-free 1.5 x 1.2 mm 6-lead TDFN plastic package. This PIN diode limiter provides exceptional low and high signal frequency operation from 10 MHz to 12 GHz.

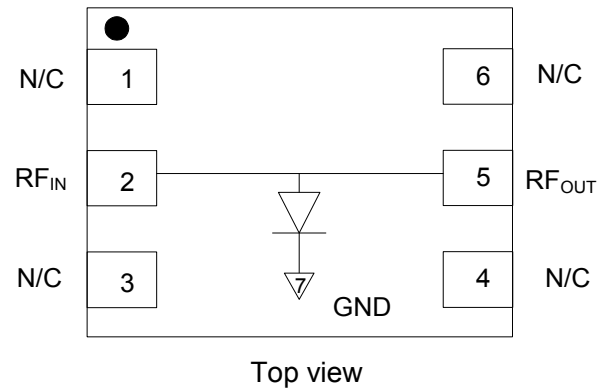
This device is ideally suited for higher frequency and lower flat leakage limiter microwave circuit applications where compact and higher performance surface mount diode assemblies are required.

Ordering Information^{1,2}

Part Number	Package
MADL-011023-14150T	3000 piece reel
MADL-011023-000SMB	Sample board

1. Reference Application Note [M513](#) for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration³

Pin No.	Pin Name	Description
1	N/C	No Connection
2	RF _{IN}	RF Input
3	N/C	No Connection
4	N/C	No Connection
5	RF _{OUT}	RF Output
6	N/C	No Connection
7	Paddle ⁴	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.

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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	—	0.05	0.10
Return Loss	P incident = -10 dBm, F = 750 MHz	dB	—	35	—
P1dB Input Compression Power	F = 1 GHz	dBm	—	8	—
C.W. Incident Power ⁵	F = 1 GHz	dBm	—	40	—
Peak Incident Power ⁵	1 μs , 1 % duty @ 1 GHz	dBm	—	50	—
CW Flat Leakage Power	F = 1 GHz	dBm	—	20	—
Pulsed Flat Leakage Power	50 dBm, 1 μs , 1 % duty @ 1 GHz	dBm	—	26	—
Spike Leakage Power	50 dBm, 1 μs , 1 % duty @ 1 GHz	dBm	—	28	—
Spike Leakage Energy	50 dBm, 1 μs , 1 % duty @ 1 GHz	ergs	—	0.1	—
Recovery Time (1 dB of Insertion Loss)	50 dBm, 1 μs , 1 % duty @ 1 GHz	ns	—	100	—
Input 3rd Order Intermodulation Products (IIP3)	F1 = 1.000 GHz, F2 = 1.010 GHz @ 0 dBm	dBm	—	20	—

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

Absolute Maximum Ratings^{6,7}

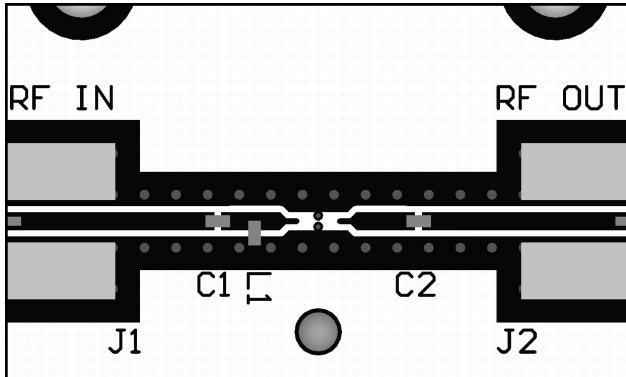
Parameter	Absolute Maximum
Peak Incident Power 1 μs pulse, 1% duty @ +85°C	48 dBm
CW Incident Power @ +85°C	37 dBm
Junction Temperature	175°C
Operating Temperature	-65°C to +125°C
Storage Temperature	-65°C to +150°C

- 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.

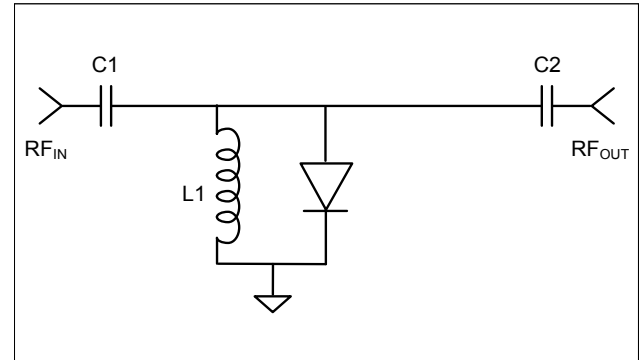
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PCB Layout



PCB Schematic



Parts List

Part	Value	Case Style
C1, C2 (DC Blocks)	100 pF	0402
L1 (DC Return)	27 nH	0402

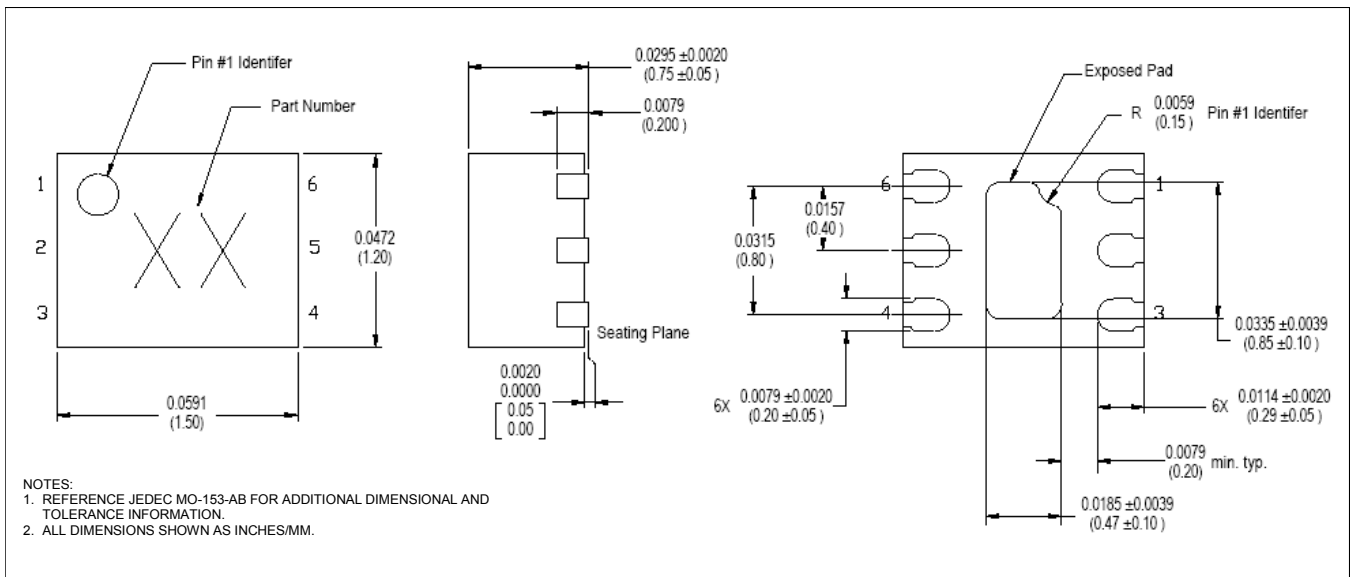
Handling Procedures

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.

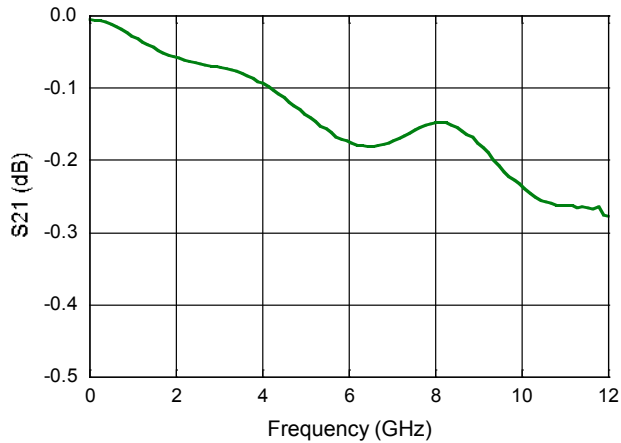
Lead-Free 1.5 x 1.2 mm 6-Lead TDFN[†]



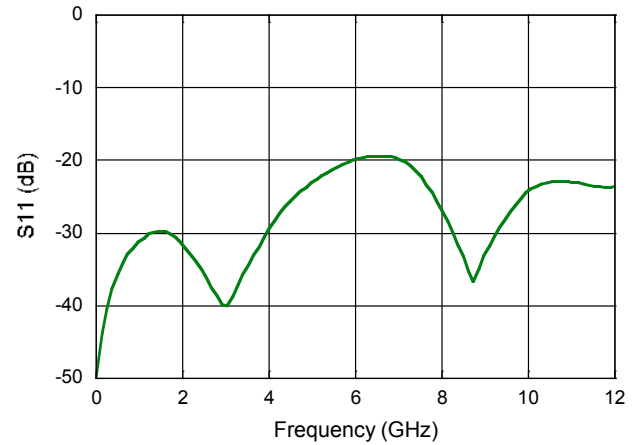
[†] Reference Application Note [S2083](#) for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

Typical Performance Curves @ +25°C

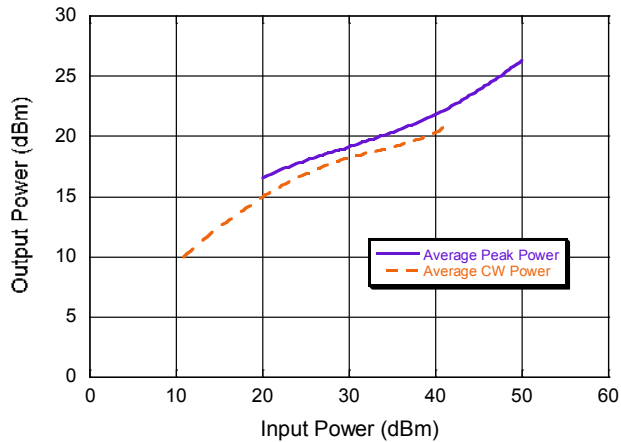
Insertion Loss vs. Frequency



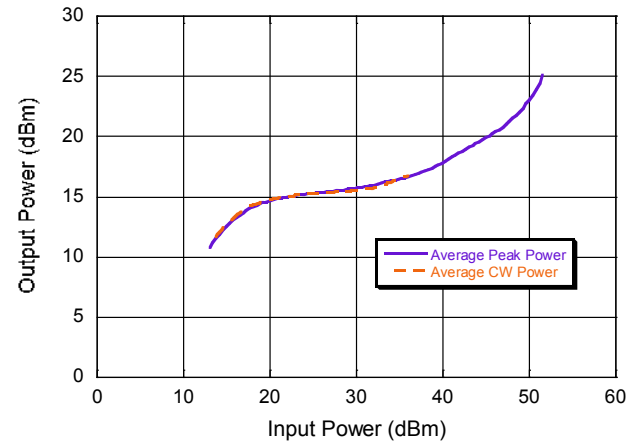
Return Loss vs. Frequency



Flat Leakage Power @ CW and Pulsed Power, RF Pulse Width = 1 μs, Duty Cycle = 1% @ 1 GHz

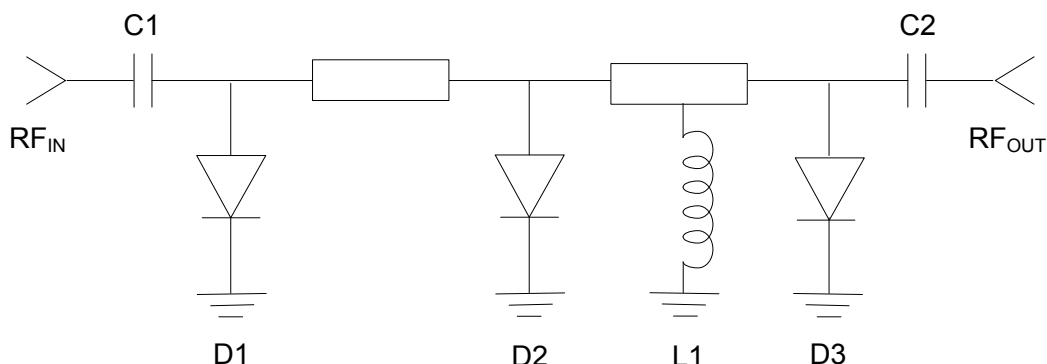


Flat Leakage Power @ CW and Pulsed Power, RF Pulse Width = 1 μs, Duty Cycle = 1% @ 4 GHz



Applications Section

Schematic of 3 Stage Limiter using MADL-011023-14150T and MADP-011029-14150T
 $F = 1 - 8 \text{ GHz}$, $P_{INC} = 47 \text{ dBm CW}$, or 50 dBm , $10 \mu\text{s}$, 1% duty cycle



Parts List⁸

Part	PN	Case Style	Description	Quantity
D1	MADP-011029-14150T	ODS-1415	Input PIN Diode	1
D2	MADL-011023-14150T	ODS-1415	2nd Stage PIN Diode	1
D3	MADL-011023-14150T	ODS-1415	3rd Stage PIN Diode	1
C1, C2	27 pF	0402	DC Block	2
L1	33 nH	0402	DC Return	1

8. Parts list is shown for 1 - 8 GHz operation. Component values can be scaled for various frequency bands.

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