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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.

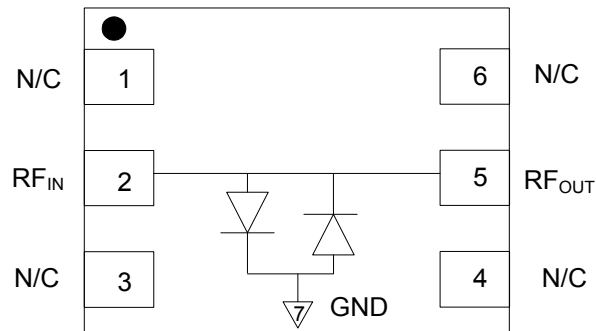
This device is ideally suitable for usage in higher frequency and lower flat leakage limiter microwave circuits applications where higher performance surface mount diode assemblies are required.

Ordering Information^{1,2}

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 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	—	0.15	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 ⁵	F = 4 GHz	dBm	—	34	—
Peak Incident Power ⁵	1 μs , 1 % duty @ 4 GHz	dBm	—	34	—
Flat Leakage Power ⁶	+34 dBm, 1 μs , 1 % duty @ 4 GHz	dBm	—	18	—
Spike Leakage Power ^{6,7}	+34 dBm, 1 μs , 1 % duty @ 4 GHz	dBm	—	20	—
Spike Leakage Energy ^{6,7}	+34 dBm, 1 μs , 1 % duty @ 4 GHz	ergs	—	0.01	—
Recovery Time ^{5,6,7} (1 db of Insertion Loss)	+34 dBm, 1 μs , 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 μs RF pulse width, 1% duty cycle

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

Absolute Maximum Ratings^{8,9}

Parameter	Absolute Maximum
Peak Incident Power 1 μs 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

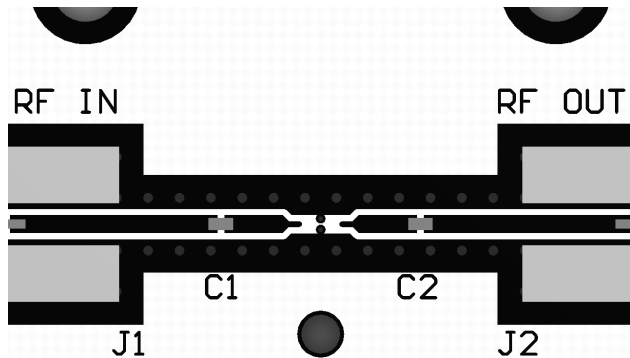
8. Exceeding any one or combination of these limits may cause permanent damage to this device.

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

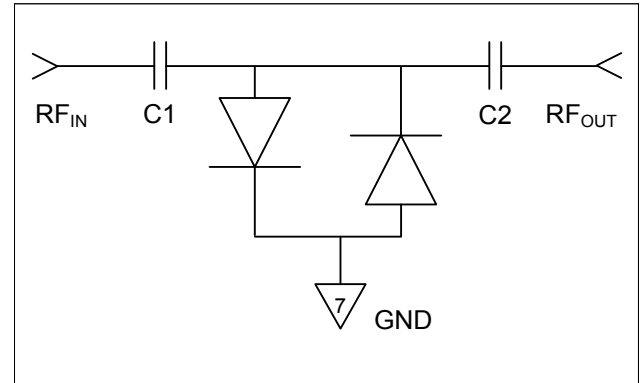
PIN-Schottky Anti-Parallel Diode Limiter 10 MHz - 6 GHz

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PCB Layout



PCB Schematic



Parts List

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

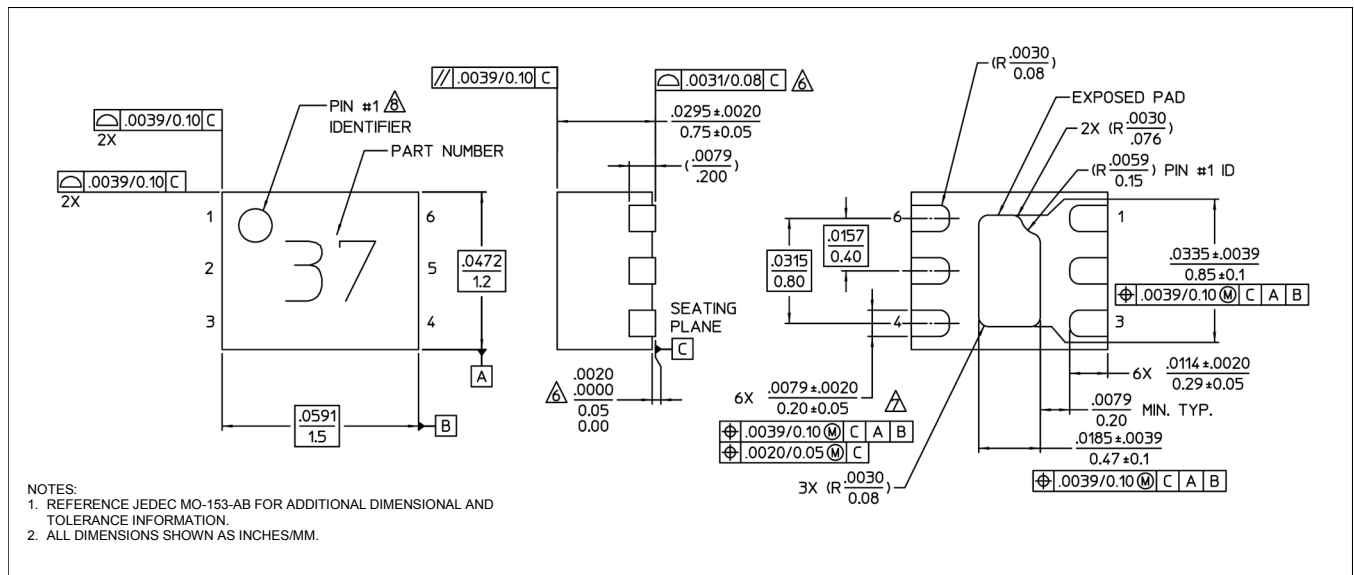
Handling Procedures

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.

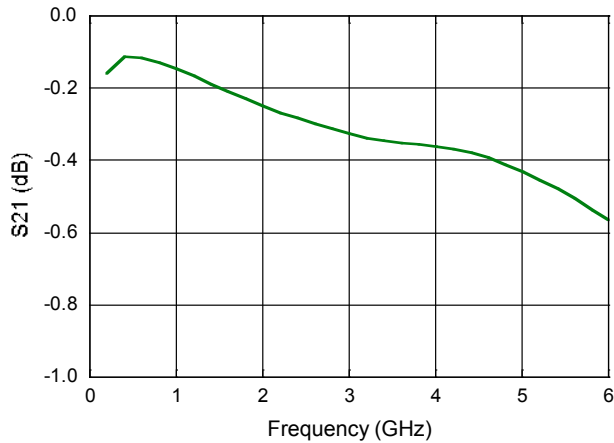
Lead-Free 1.5 x 1.2 mm 6-Lead TDFN[†]



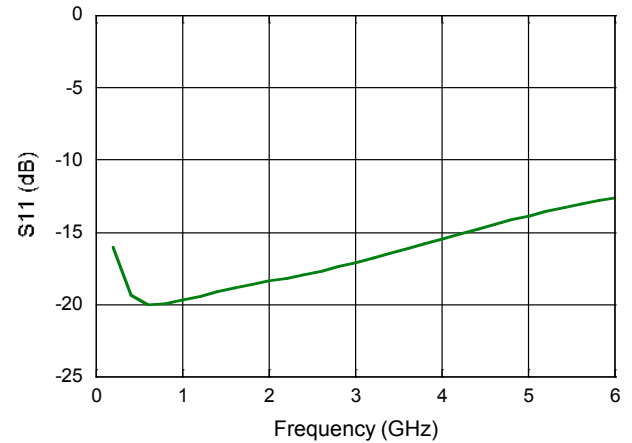
[†] Reference Application Note [S2083](#) for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

Typical Performance Curves @ +25°C

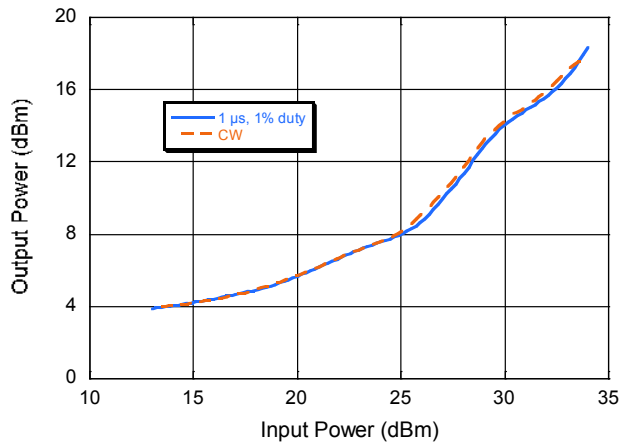
Insertion Loss vs. Frequency



Return Loss vs. Frequency

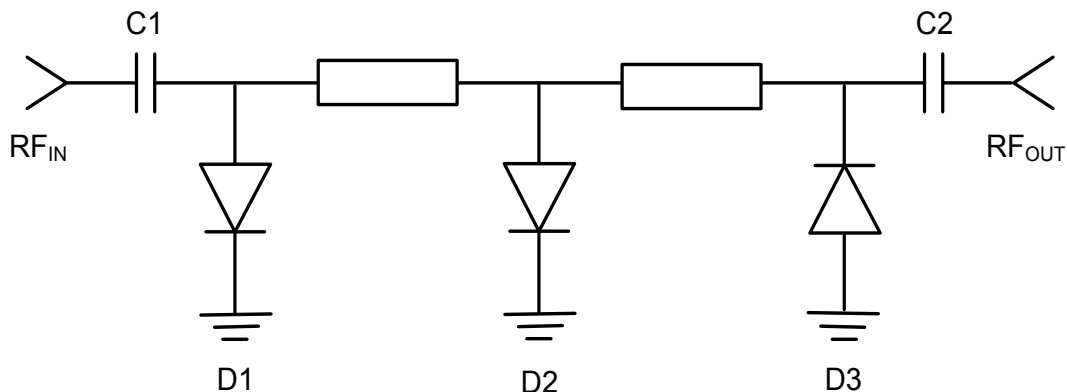


Flat Leakage Power @ CW and Pulsed Power, 4 GHz



Applications Section

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



Parts List¹⁰

Part	PN	Case Style	Description	Quantity
D1	MADP-011029-14150T	ODS-1415	Input PIN Diode	1
D2, D3 ¹¹	MADL-011021-14150T	ODS-1415	2 nd & 3 rd 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.

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