

## 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.

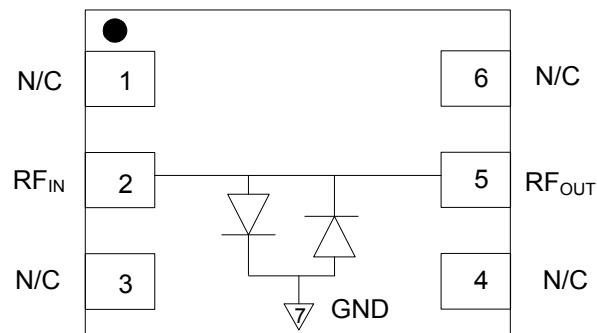
This device is ideally suitable for usage in higher frequency and lower flat leakage limiter microwave circuits applications where higher performance surface mount diode assemblies are required.

### 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.

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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 <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><br>( 1 db of Insertion Loss ) | +34 dBm, 1 $\mu\text{s}$ , 1 % duty @ 4 GHz             | ns    | —    | 100  | —    |
| Input 3rd Order<br>Intermodulation Products (IIP3)           | P incident = -10 dBm,<br>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<br>1 $\mu\text{s}$ pulse, 1% duty<br>(+85°C) | +33 dBm          |
| CW Incident Power<br>(+85°C)                                     | +33 dBm          |
| Junction Temperature                                             | +175°C           |
| Operating Temperature                                            | -65°C to +125°C  |
| Storage Temperature                                              | -65°C to +150°C  |

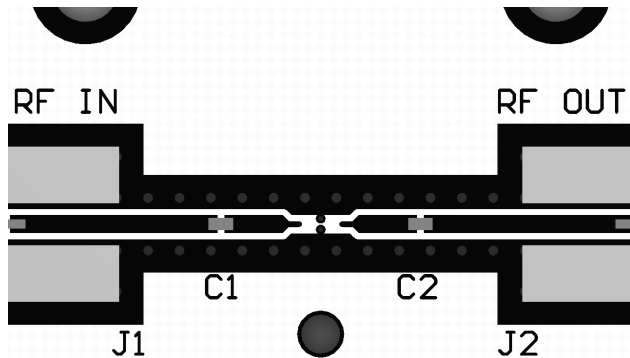
8. Exceeding any one or combination of these limits may cause permanent damage to this device.

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

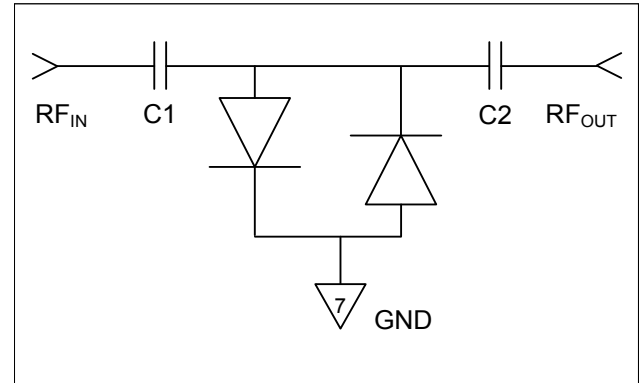
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### PCB Layout



### PCB Schematic



### Parts List

| Part                    | Value  | Case Style |
|-------------------------|--------|------------|
| C1, C2<br>( DC Blocks ) | 100 pF | 0402       |

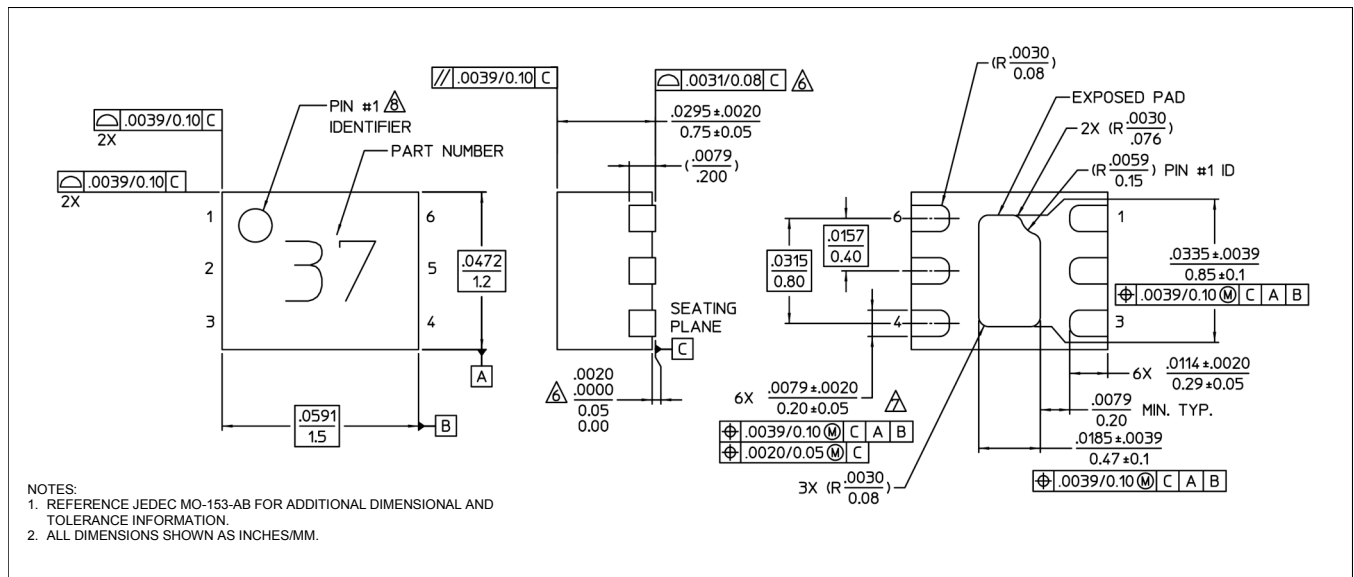
### Handling Procedures

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.

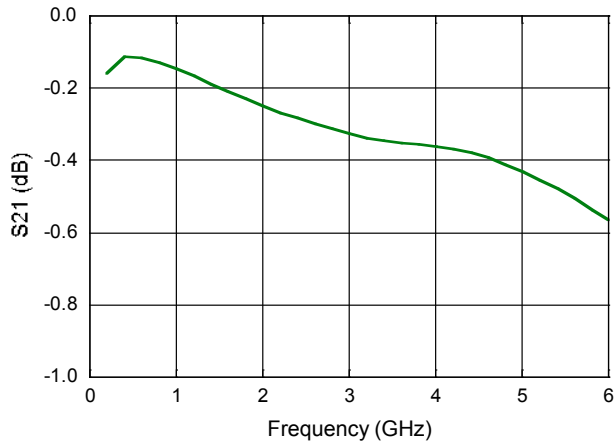
### Lead-Free 1.5 x 1.2 mm 6-Lead TDFN<sup>†</sup>



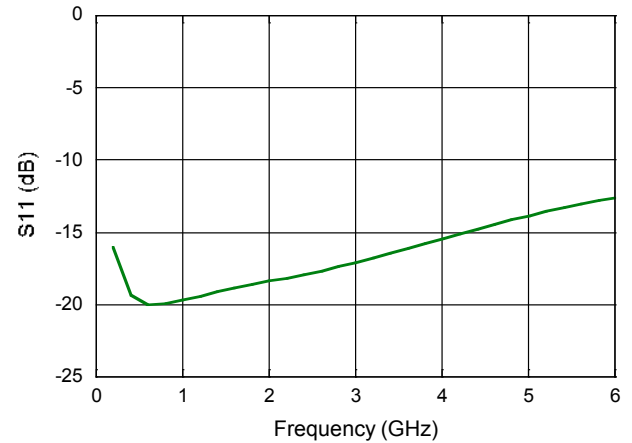
<sup>†</sup> Reference Application Note [S2083](#) for lead-free solder reflow recommendations.  
 Meets JEDEC moisture sensitivity level 1 requirements.  
 Plating is 100% matte tin over copper.

## Typical Performance Curves @ +25°C

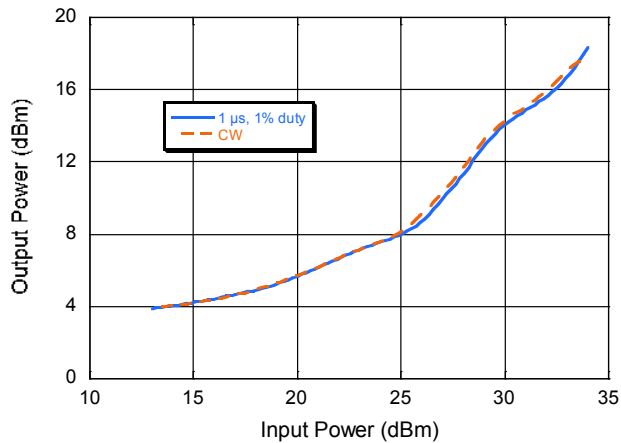
*Insertion Loss vs. Frequency*



*Return Loss vs. Frequency*

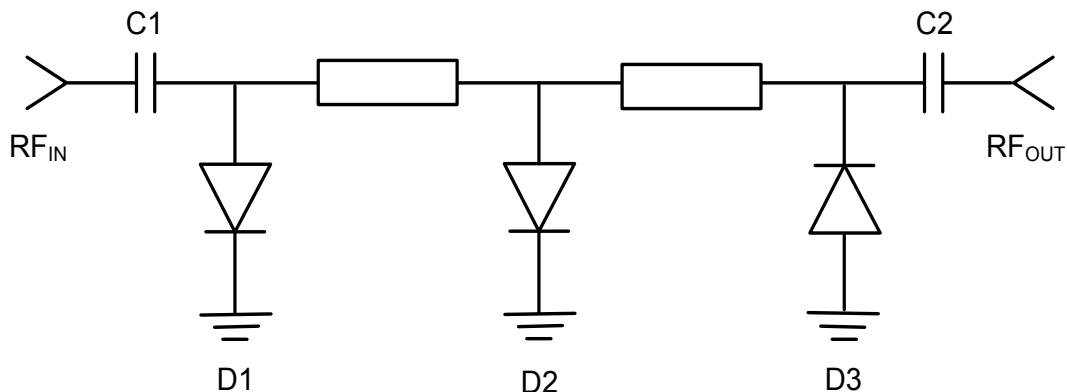


*Flat Leakage Power @ CW and Pulsed Power, 4 GHz*



## Applications Section

**Schematic of 3 Stage Limiter using MADL-011021-14150T**  
*F = 1 - 6 GHz, P<sub>inc</sub> = +40 dBm CW, + 47 dBm, 5 us, 1 % 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.

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