Features

- Peak Power Handling: 316 W
- Low Insertion Loss: 0.7 dB @ 2 GHz
- Low Flat Leakage Power: < +18 dBm
- 3.52 mm x 2.70 mm Die
- Passive Device
- RoHS* Compliant

Applications

- Receiver Protection
- Radar Systems
- Radio Frequency Front-End Modules

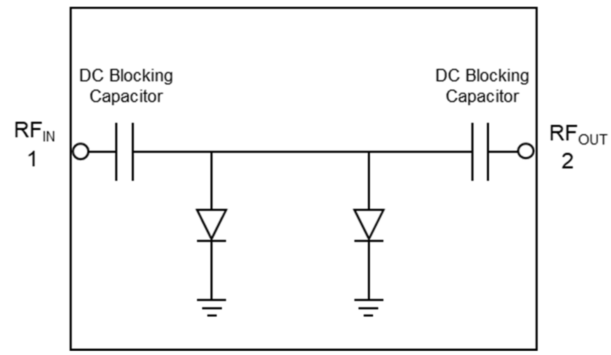
Description

The MADL-011134-DIE is a fully integrated HMIC PIN diode limiter. It is a passive device, DC blocked at both input and output ports.

The limiter provides low small signal insertion loss and low flat leakage power from 2 GHz to 4 GHz. It is available in a compact die form with dimensions of 3.52 x 2.70 mm.

The MADL-011134-DIE is ideally suited for use in passive limiter control circuits to protect sensitive receiver components such as low noise amplifiers (LNA), detectors, and mixers.

Functional Schematic



Pin Configuration[1]

Pin #	Function
1	RF Input
2	RF Output
Backside[1]	Ground

1. The bottom of the die must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MADL-011134-DIE	Die in Gel Pack

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications: T_A = +25°C, Z_0 = 50 Ω, P_{IN} = -10 dBm (unless otherwise specified)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	2 GHz 4 GHz	dB	—	0.7 0.8	0.9 1.1
Return Loss	2 GHz 4 GHz	dB	20 15	25 20	—
P1dB	2 GHz 4 GHz	dBm	—	13 12	—
IIP3	-10 dBm per Tone, 10 MHz Spacing, 2 GHz 4 GHz	dBm	—	29 28	—
IIP2	-10 dBm per Tone, 10 MHz Spacing, 2 GHz 4 GHz	dBm	—	45 41	—
Output Power	P_{IN} = 27 dBm, 2 & 4 GHz	dBm		15	18
Flat Leakage Power	Up to 55 dBm Input	dBm	—	18	—
Spike Leakage Power	10 µs PW, 1% Duty Cycle, 55 dBm Input	dBm	—	27	—
Spike Leakage Energy	10 µs PW, 1% Duty Cycle, 55 dBm Input	erg	—	0.1	—
1 dB Recovery Time	10 µs PW, 1% Duty Cycle, 55 dBm Input	µs	—	3	—
3 dB Recovery Time	10 µs PW, 1% Duty Cycle, 55 dBm Input	µs	—	1	—

Maximum Operating Ratings[2]

Parameter	Maximum
CW Incident Power @ +85°C	41 dBm @ 2 GHz 35 dBm @ 4 GHz
Peak Incident Power @ +85°C, 10 µs Pulse Width, 1% Duty Cycle	55 dBm @ +85°C
Junction Temperature	+175°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

2. Operating at nominal conditions with $T_J \leq$ +175°C will ensure MTTF > 1 x 10^6 hours.

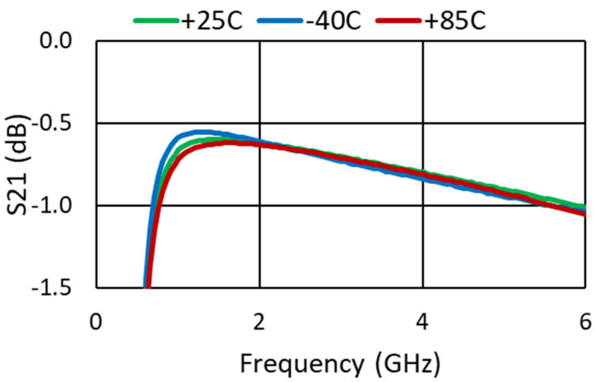
Maximum Survivability Ratings[3,4]

Parameter	Maximum Survivability
CW Incident Power @ +85°C	44 dBm @ 2 GHz 40 dBm @ 4 GHz
Peak Incident Power @ +85°C, 10 µs Pulse Width, 1% Duty Cycle	55.5 dBm

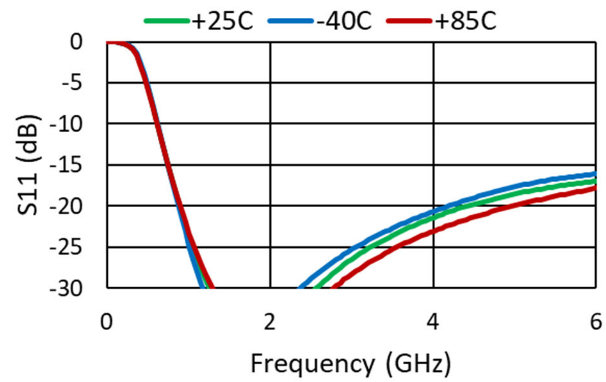
3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.

Typical Performance Curves: On-Wafer, Z_0 = 50 Ω

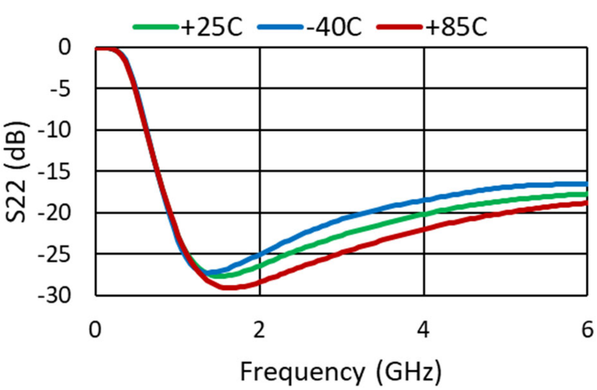
Insertion Loss



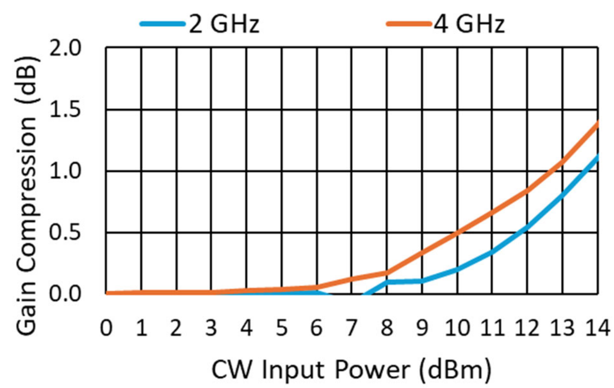
Input Return Loss



Output Return Loss

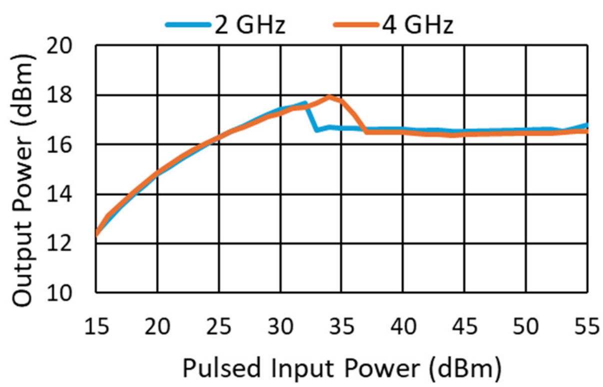


Gain Compression @ T_A = +25°C

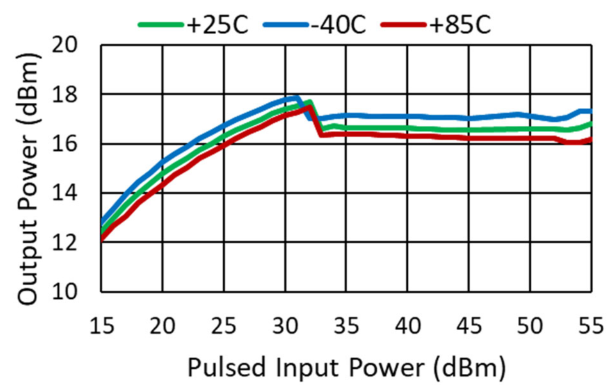


Typical Performance Curves: 10 µs Pulse Width, 1% Duty Cycle, Z_0 = 50 Ω

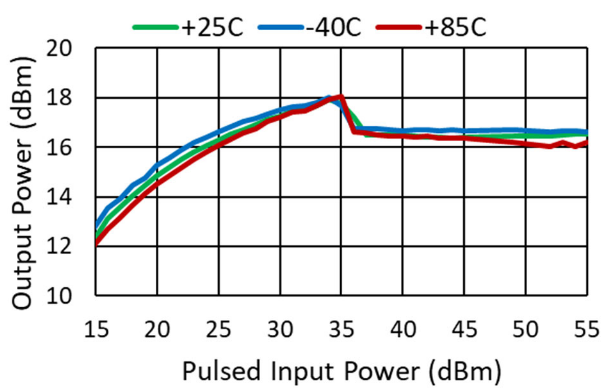
Pulsed Flat Leakage Power @ T_A = +25°C



Pulsed Flat Leakage Power @ 2 GHz

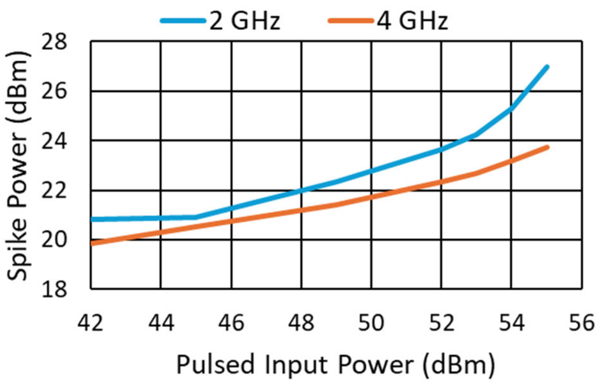


Pulsed Flat Leakage Power @ 4 GHz

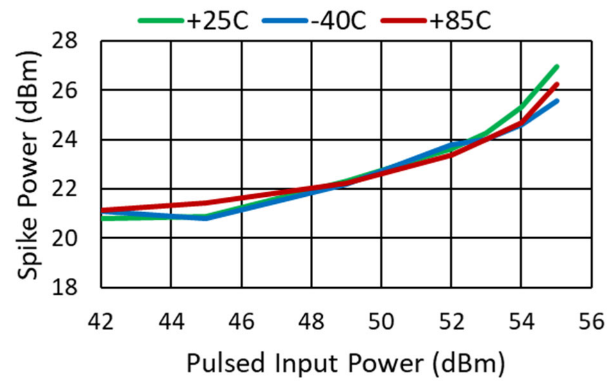


Typical Performance Curves: 10 µs Pulse Width, 1% Duty Cycle, Z_0 = 50 Ω

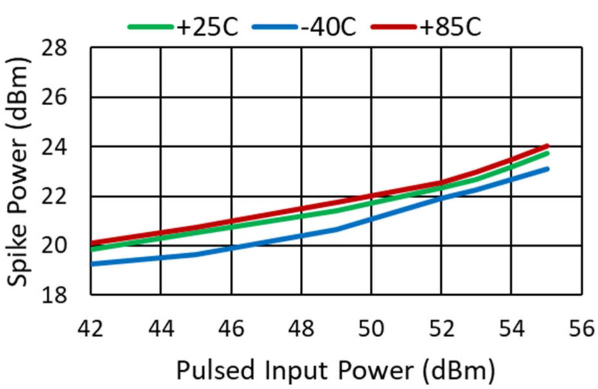
Spike Leakage Power @ T_A = +25°C



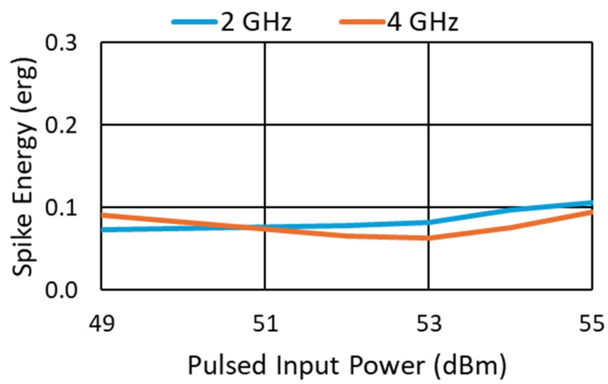
Spike Leakage Power @ 2 GHz



Spike Leakage Power @ 4 GHz

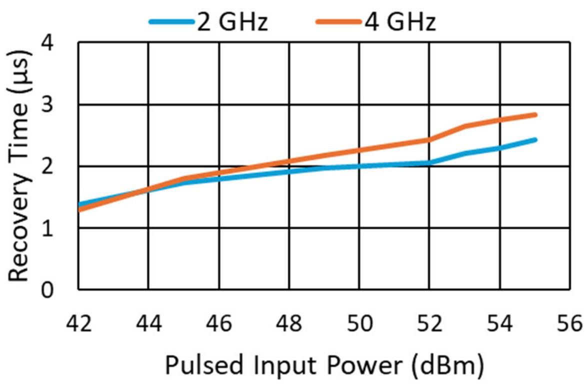


Spike Leakage Energy @ T_A = +25°C

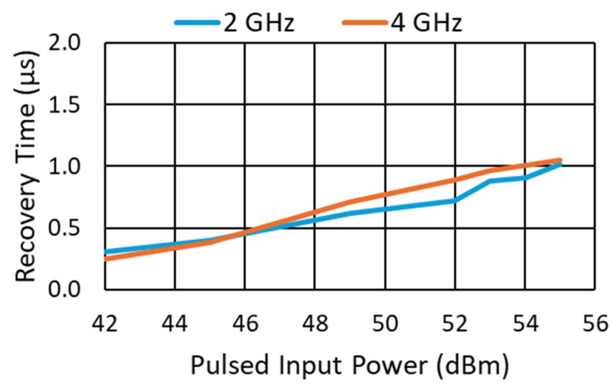


Typical Performance Curves: 10 µs Pulse Width, 1% Duty Cycle, Z_0 = 50 Ω

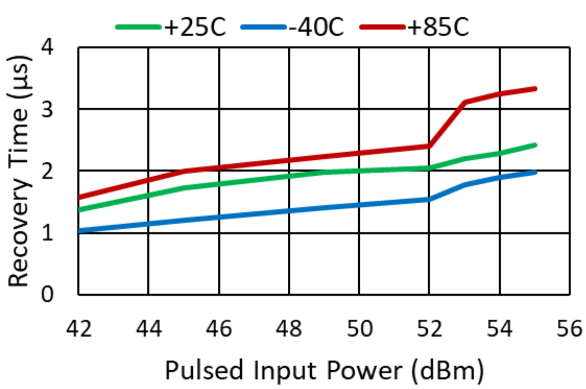
1 dB Recovery Time @ T_A = +25°C



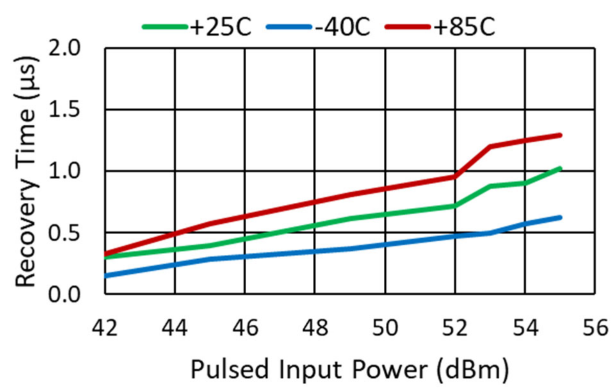
3 dB Recovery Time @ T_A = +25°C



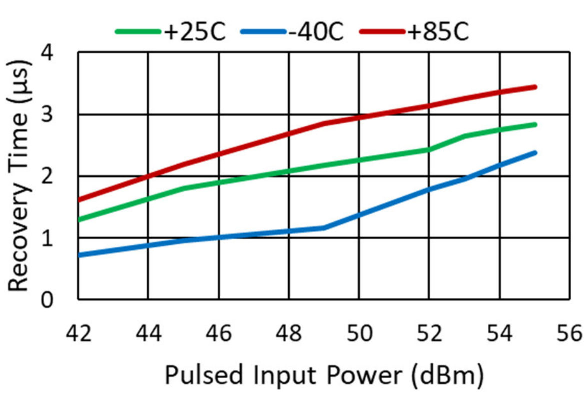
1 dB Recovery Time @ 2 GHz



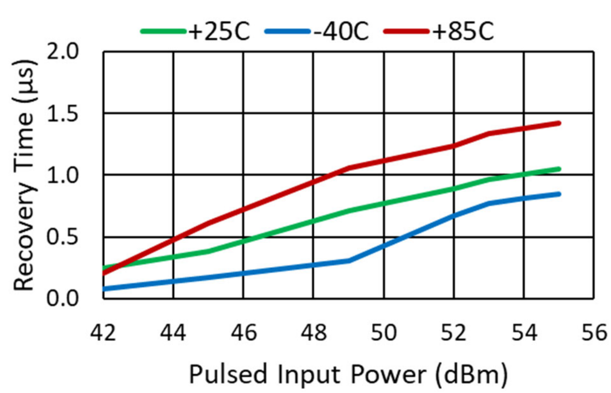
3 dB Recovery Time @ 2 GHz



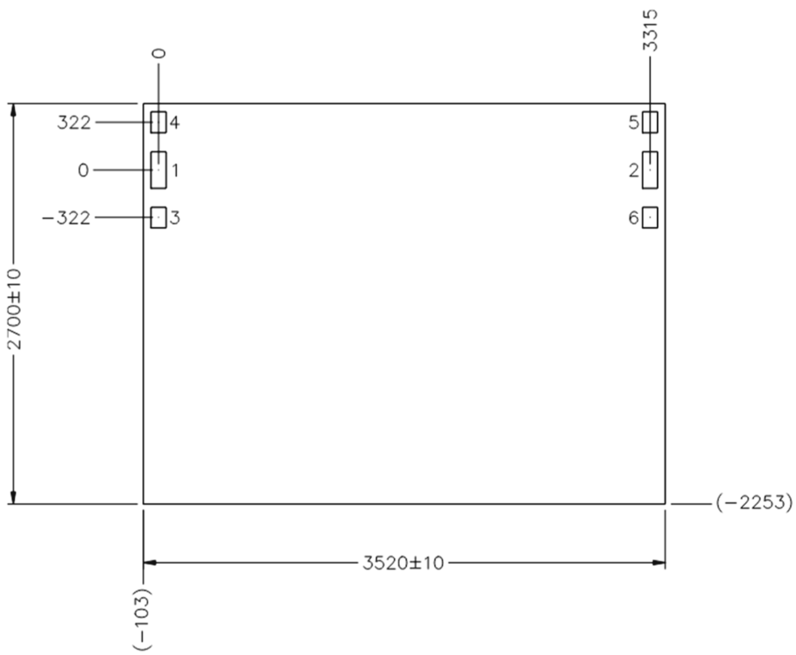
1 dB Recovery Time @ 4 GHz



3 dB Recovery Time @ 4 GHz



Outline Drawing



BOND PAD DIM. (µm)			
PAD	X	Y	PIN LABEL
1	102	246	RFIN
2	102	246	RFOUT
3–6	102	142	GND

NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHOWN ARE µm WITH A TOLERANCE OF ±5µm.
2. DIE THICKNESS IS 125 ±10µm
3. BOND PAD/BACKSIDE METALLIZATION: GOLD.
4. DIE SIZE REFLECTS FINAL CUT DIMENSIONS.

Solder Die Attach

All die attach and bonding methods should be compatible with gold metal. Solder which does not scavenge gold, such as 80 Au/20 Sn or Indalloy #2, is recommended. Do not expose die to a temperature greater than 300°C for more than 10 seconds.

Electrically Conductive Epoxy Die Attach

Assembly can be preheated to approximately 125°C. Use a controlled thickness of approximately 1 mils for best electrical conductivity and lower thermal resistance. A thin epoxy fillet should be visible around the perimeter of the chip after placement. Cure epoxy per manufacturer’s schedule. For extended cure times, temperatures should be kept below 150°C.

Wire / Ribbon Bonding

Wedge thermo compression bonding may be used to attach ribbons to the RF bonding pads. Gold ribbons should be at least 1/2 by 3 mil for lowest inductance.

Handling Procedures

The protective polymer coating on the active areas of the die provides scratch and impact protection, particularly for the metal air bridge, which contacts the diode’s anode. Die should primarily be handled with vacuum pickup tools, or alternatively with plastic tweezers.

Static Sensitivity

These HBM Class 1B electronic 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.