X-Band PIN Diode Limiter
6 - 12 GHz

MADL-011088-DIE
Rev. V2

Features

- Insertion Loss <0.5 dB
- Return Loss >18 dB
- Handles 39 dBm CW Power
- Low Flat Leakage Power <15 dBm
- Die Size: 1.78 x 0.98 mm
- RoHS* Compliant
- External DC Bias May Be Applied

Applications

- ISM/MM
- Radar
- EW

Description

The MADL-011088-DIE is an integrated AlGaAs PIN Diode limiter. It is DC de-coupled at both the input and output ports and can be used with or without DC bias applied.

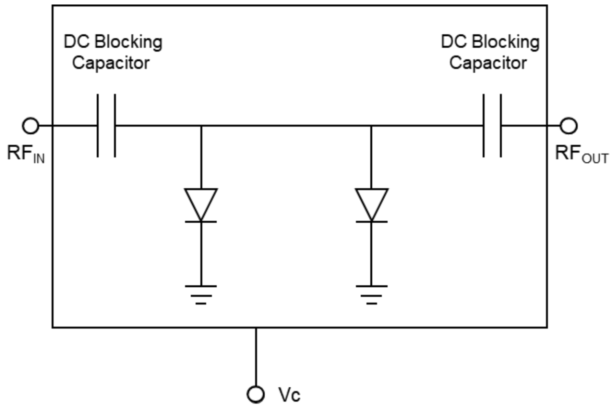
The limiter DC bias can be grounded to achieve low insertion loss, typically 0.35 dB up to 12 GHz. When applying a DC bias up to 0.7 V, ultra low flat leakage of less than 14 dBm across the power range can be achieved.

The MADL-011088-DIE can limit up to 39 dBm incident CW power at room temperature. It is available in die form with a compact die dimension of 1.78 x 0.98 mm.

Ordering Information

Part Number	Package
MADL-011088-DIE	Die in Gel Pack

Functional Schematic



Pin Configuration

Pin #	Pin Name	Description
1, 3, 4, 6	GND	Ground
2	RF_{IN}	RF Input
5	RF_{OUT}	RF Output
7	V_C	Limiter DC Bias

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

Electrical Specifications: Freq. 6 - 12 GHz, T_A = 25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	P_{IN} = -10 dBm, V_C = 0 V P_{IN} = -10 dBm, V_C = 0.7 V	dB	—	0.35 0.45	0.6 0.7
Input Return Loss	P_{IN} = -10 dBm, V_C = 0 V	dB	16	21	—
Output Return Loss	P_{IN} = -10 dBm, V_C = 0 V	dB	16	21	—
CW Incident Power	—	dBm	—	39	—
CW Flat Leakage	P_{IN} > 32 dBm, V_C = 0 V P_{IN} > 25 dBm, V_C = 0.7 V	dBm	—	17.5 12.0	19 14
Spike Leakage Power	P_{IN} = 40 dBm, 100 µs, 1% DC, V_C = 0 V, 12 GHz P_{IN} = 40 dBm, 100 µs, 1% DC, V_C = 0.7 V, 12 GHz	dBm	—	21.4 19.0	—
Recovery Time (1 dB Insertion Loss)	P_{IN} = 40 dBm, 100 µs, 1% DC, V_C = 0 V, 12 GHz P_{IN} = 40 dBm, 100 µs, 1% DC, V_C = 0.7 V, 12 GHz	ns	—	50 95	—
Input IP3	10 MHz Offset, P_{IN}/tone = 0 dBm, V_C = 0 V, 12 GHz 10 MHz Offset, P_{IN}/tone = 0 dBm, V_C = 0.7 V, 12 GHz	dBm	—	38 25	—

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Incident CW RF Power @ +85°C	35
Bias Voltage	1 V
Junction Temperature[3]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +150°C

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
3. Operating at nominal conditions with $T_J \leq +150°C$ will ensure MTTF > 1 x 10^6 hours.

Handling Procedures

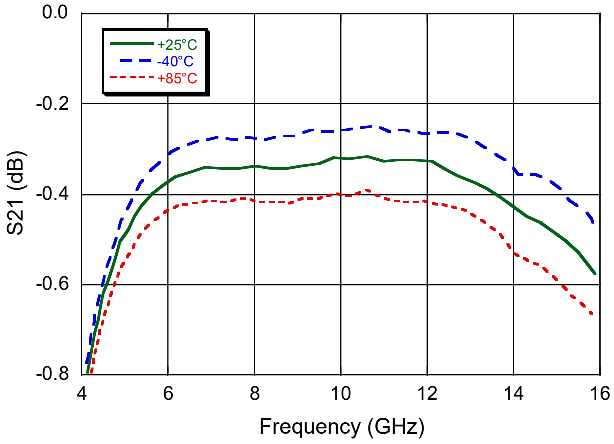
The protective polymer coating on the active areas of the die provides scratch and impact protection, particularly for the metal air bridge, which contacts the diode's anode. Die should primarily be handled with vacuum pickup tools, or alternatively with plastic tweezers.

Static Sensitivity

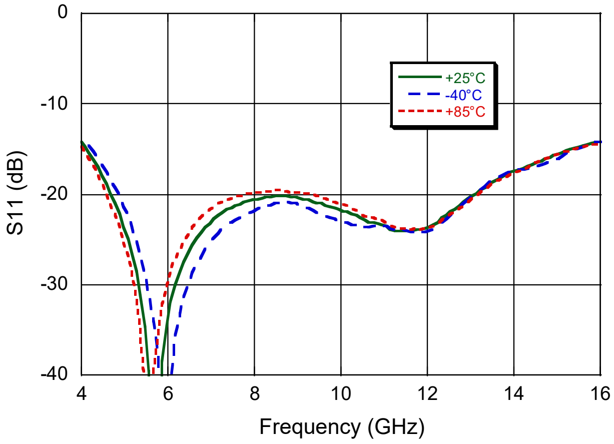
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling HBM Class 1B devices.

Typical Small-Signal Performance, On-Wafer Over Temperature, V_C = 0 V, Z_0 = 50 Ω

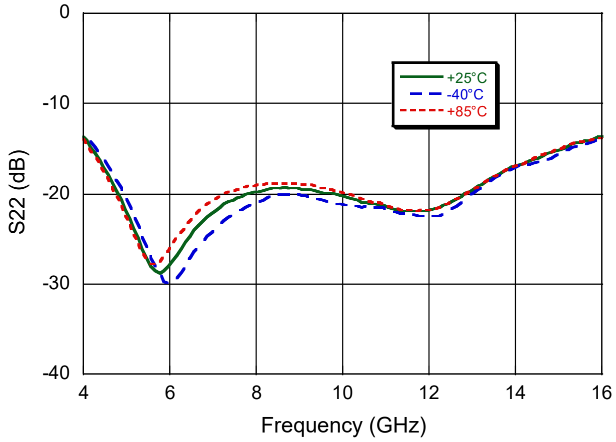
Insertion Loss



Input Return Loss

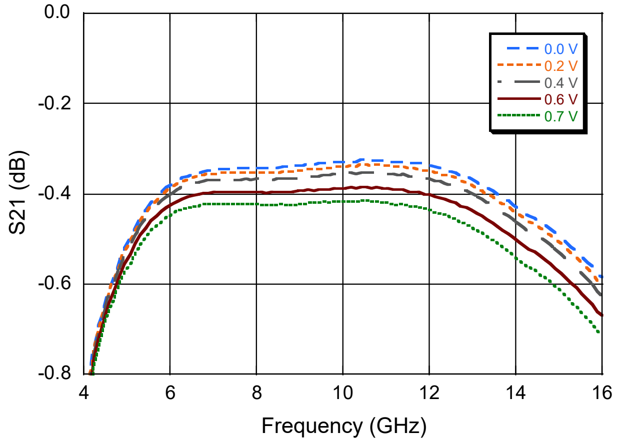


Output Return Loss

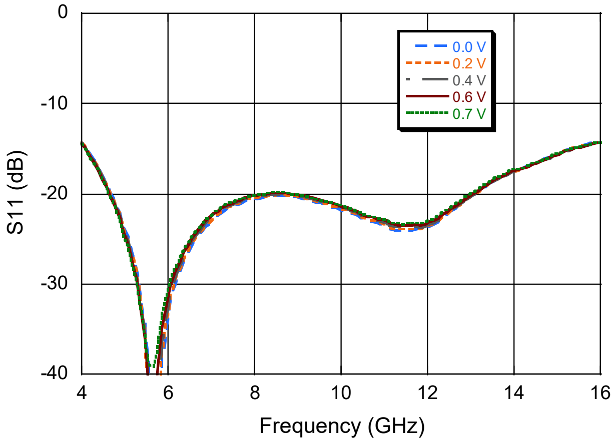


Typical Small-Signal Performance, On-Wafer: T_A = 25°C, Z_0 = 50 Ω

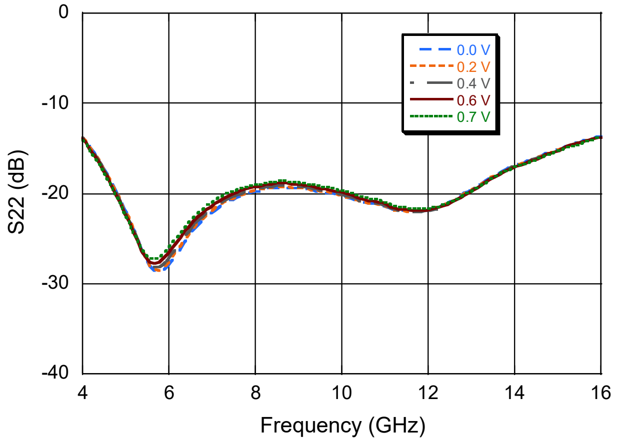
Insertion Loss over V_C Bias



Input Return Loss over V_C Bias

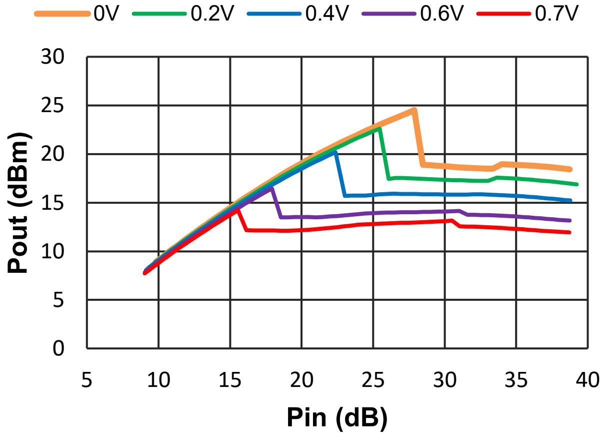


Output Return Loss over V_C Bias

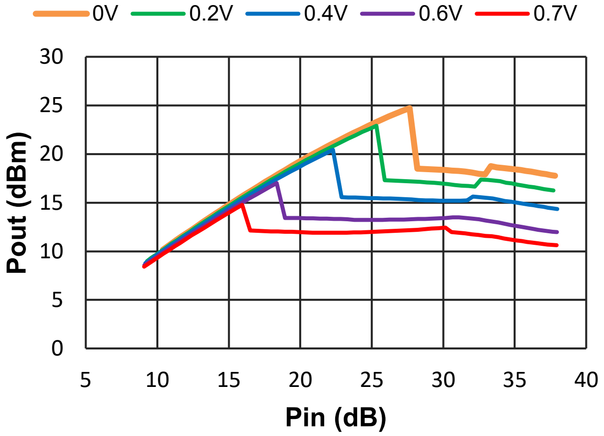


Typical RF Power Performance, Die On-Board: T_A = 25°C, Z_0 = 50 Ω

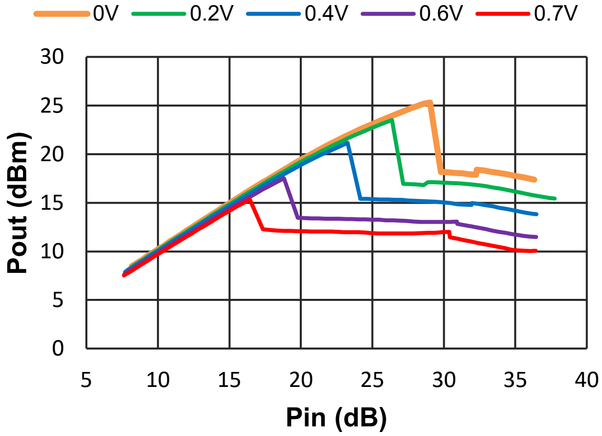
CW Flat leakage Power over V_C Bias at 8 GHz



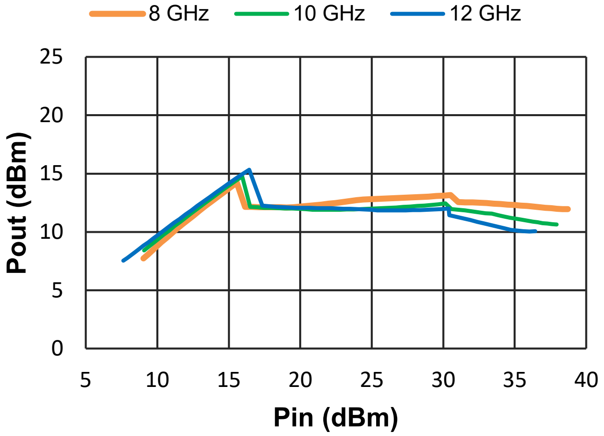
CW Flat leakage Power over V_C Bias at 10 GHz



CW Flat leakage Power over V_C Bias at 12 GHz

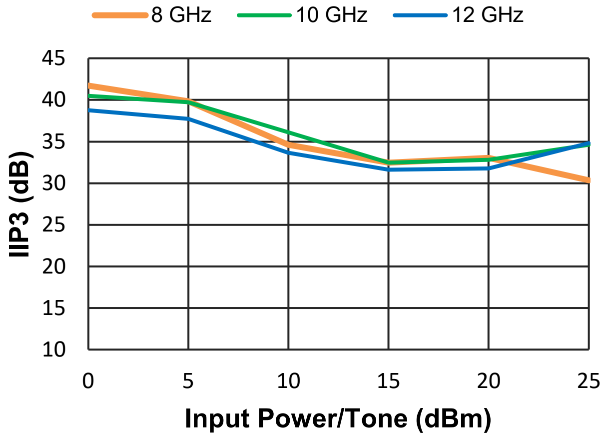


CW Flat leakage Power over Frequency at V_C = 0.7 V

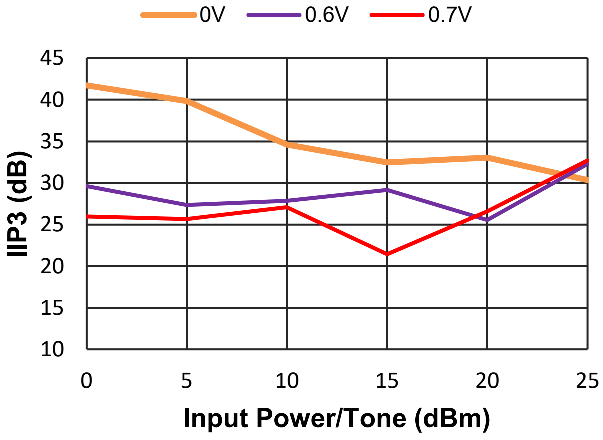


Typical RF Power Performance, Die On-Board: T_A = 25°C, Z_0 = 50 Ω

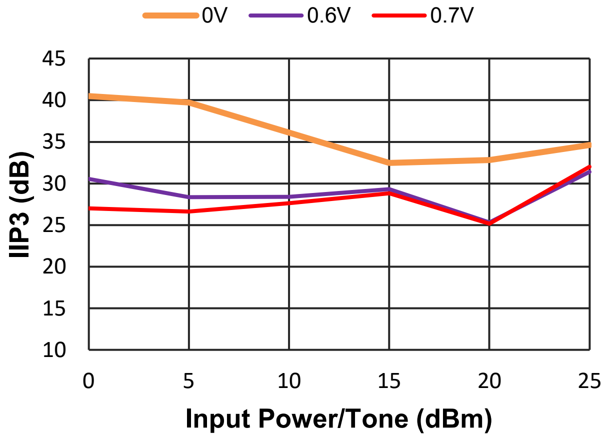
Input IP3 over Frequency at V_C = 0 V



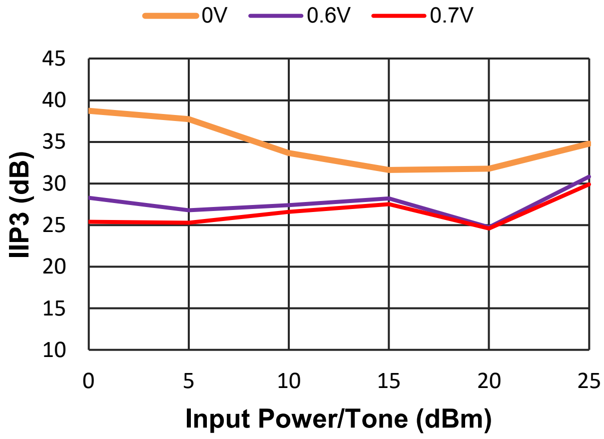
Input IP3 over V_C Bias at 8 GHz



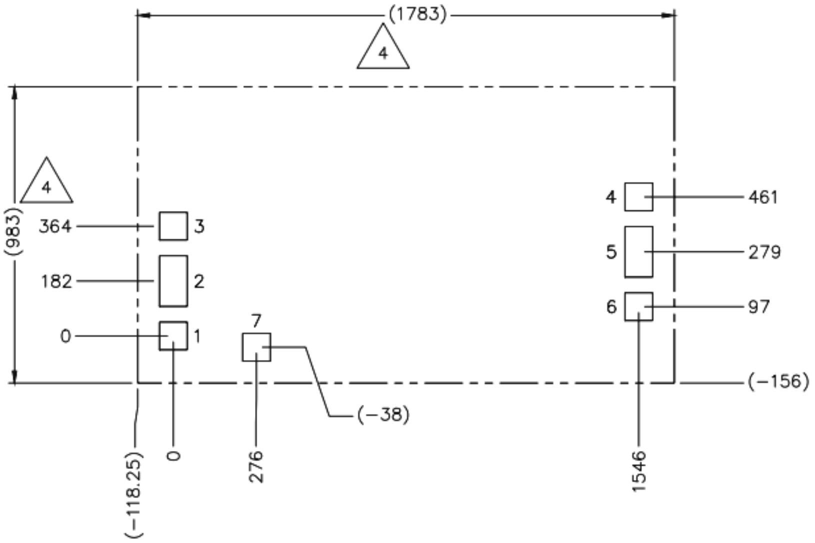
Input IP3 over V_C Bias at 10 GHz



Input IP3 over V_C Bias at 12 GHz



Die Outline Drawing



BOND PAD DIM (µm)			
PAD	X (µm)	Y (µm)	REF. DES.
1,3,4,6	100	100	GND
2	100	180	RF_{INPUT}
5	100	180	RF_{OUTPUT}
7	100	100	V_C

NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS SHOWN ARE µm WITH A TOLERANCE OF ±5µm.
2. DIE THICKNESS IS 100 ±10µm
3. BOND PAD/BACKSIDE METALLIZATION: GOLD.

4. OVERALL DIMENSIONS ARE FINAL, POST−SINGULATION, TOLERANCE ±10µm EACH DIMENSION.

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