C-Band PIN Diode Limiter
4 - 8 GHz

MADL-011078-DIE
Rev. V1

Features

- Low Insertion Loss < 0.6 dB
- Return loss > 20 dB
- Handles 41 dBm CW Power
- Low Flat Leakage Power < 16 dBm
- Die Size: 2.79 x 1.95 mm
- RoHS* Compliant

Applications

- ISM
- Multi Market
- Radar
- EW

Description

The MADL-011078-DIE is an integrated AlGaAs PIN Diode limiter. It is DC blocked 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 of less than 0.6 dB up to 8 GHz. When applying a DC bias up to 0.6 V, low flat leakage of less than 16 dBm across the power range can be achieved.

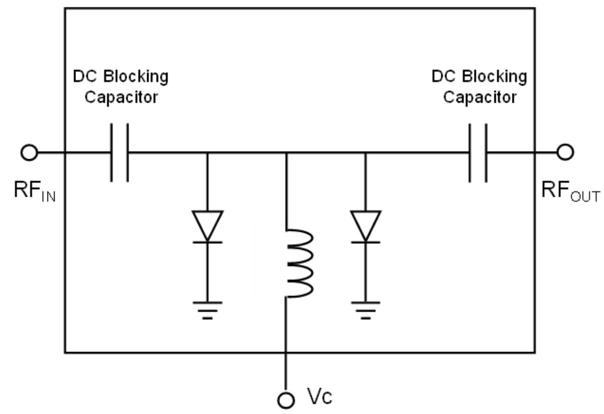
The MADL-011078-DIE can limit up to 41 dBm incident CW power at room temperature. It is available in die form with a compact die dimension of 2.79 x 1.95 mm.

Performance measured on board is de-embedded from board losses.

Ordering Information

Part Number	Package
MADL-011078-DIE	Die in Gel Pack

Functional Schematic



Pin Configuration

Pin #	Pin Name	Description
1	RF_{IN}	RF Input
2	RF_{OUT}	RF Output
3 - 6	GND	GND
7	Vc	Limiter DC Bias

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

Electrical Specifications: 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, 4 GHz V_C = 0 V, 8 GHz V_C = 0.6 V, 4 GHz V_C = 0.6 V, 8 GHz	dB	—	0.6 0.7 0.8 1.1	0.8 0.9 1.0 1.3
Input Return Loss	P_{IN} = -10 dBm V_C = 0 V, 4 - 8 GHz	dB	—	20	—
Output Return Loss	P_{IN} = -10 dBm V_C = 0 V, 4 - 8 GHz	dB	—	20	—
Max CW Incident Power	4 - 8 GHz	dBm	—	41	—
CW Flat Leakage	V_C = 0 V, 4 - 8 GHz V_C = 0.6 V, 4 - 8 GHz	dBm	—	21 15	22 16
Spike Leakage Power	P_{IN} = 42 dBm, 100 µs, 1% DC 4 - 8 GHz	dBm	—	27	—
Recovery Time (1dB Insertion Loss)	P_{IN} = 42 dBm, 100 µs, 1% DC V_C = 0 V, 4 - 8 GHz V_C= 0.6 V, 4 - 8 GHz	ns	—	75 115	—
Input IP3	10 MHz Offset, P_{IN}/tone = 0 dBm, V_C = 0 V 10 MHz Offset, P_{IN}/tone = 0 dBm, V_C = 0.6 V	dBm	—	31 20	—

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Incident CW RF Power @ +25°C	41.3 dBm
Peak Incident Power 1 µs pulse, 1% DC @ +25°C	44 dBm
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.

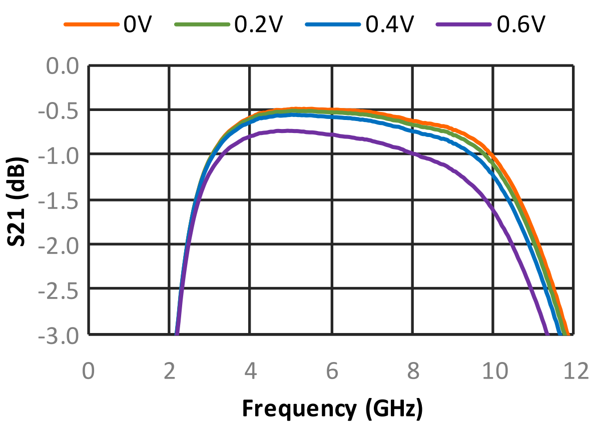
Static Sensitivity

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 these HBM Class 1B devices.

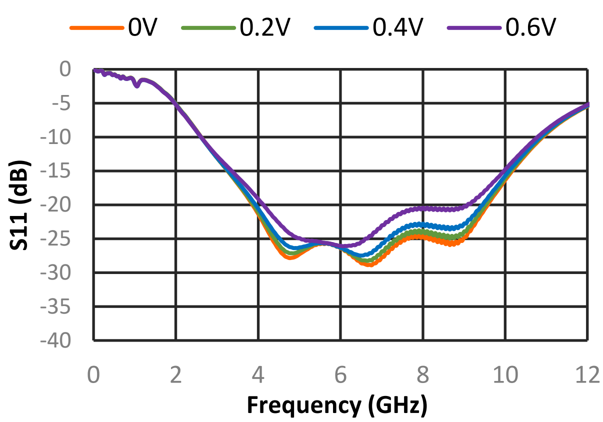
Typical Small-Signal Performance: T_A = 25°C, Z_0 = 50 Ω

Probed On-Wafer

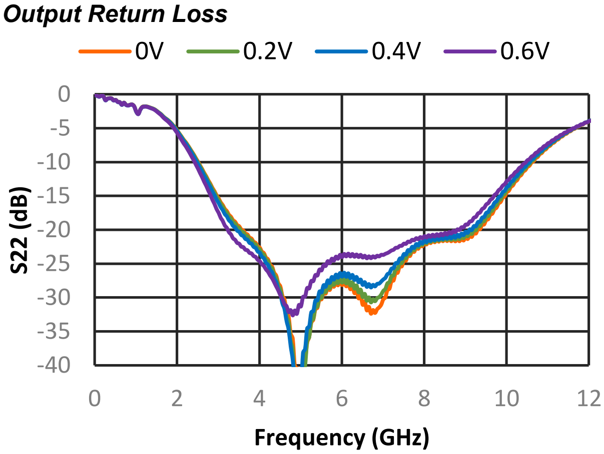
Insertion Loss



Input Return Loss

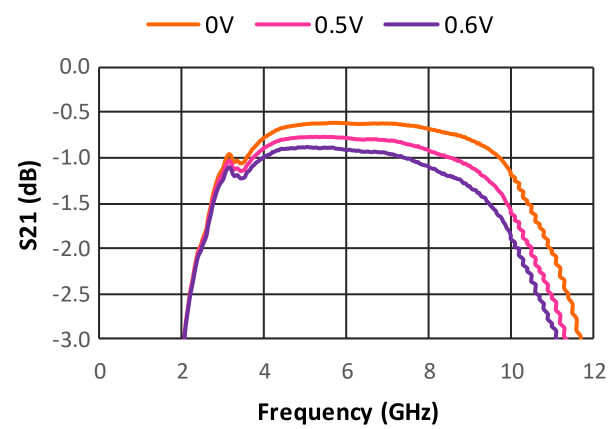


Output Return Loss

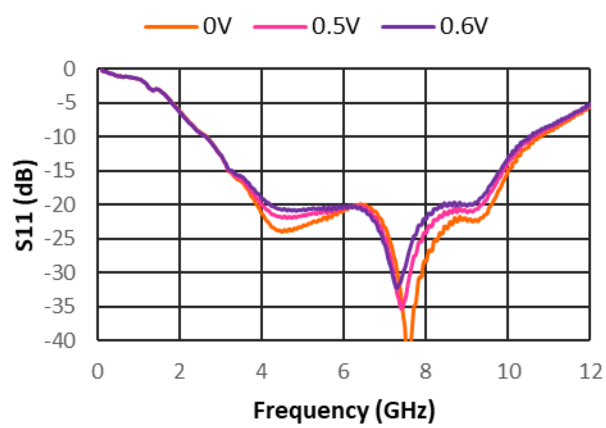


On-Board with Bond-wires

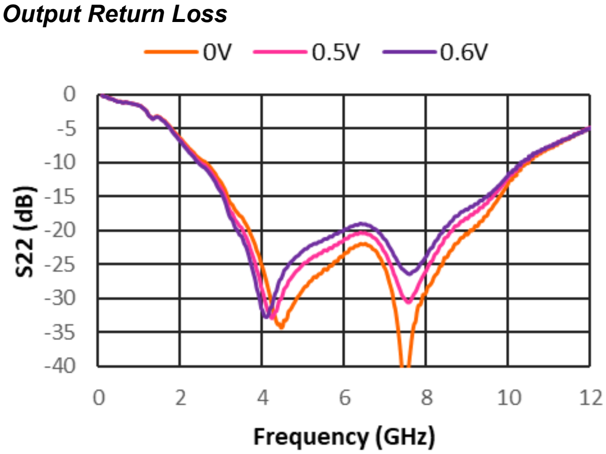
Insertion Loss



Input Return Loss

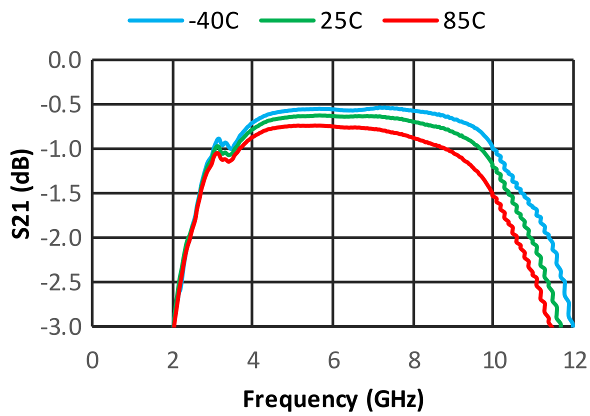


Output Return Loss

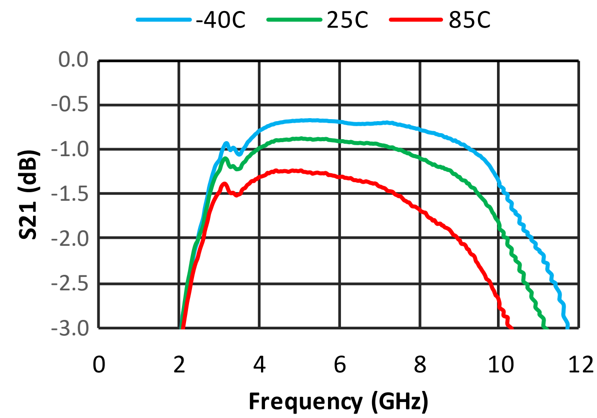


Typical Small-Signal Performance, Die On-Board: T_A = -40°C, +25°C, +85°C, Z_0 = 50 Ω

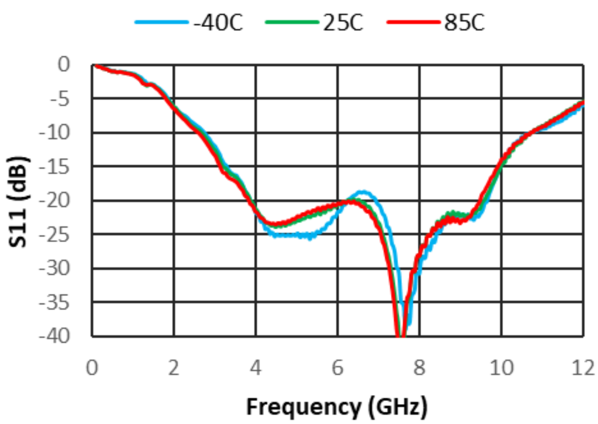
Insertion Loss @ V_C = 0 V



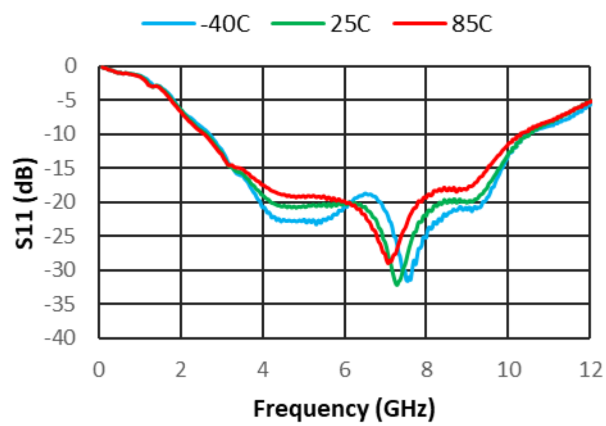
Insertion Loss @ V_C = 0.6 V



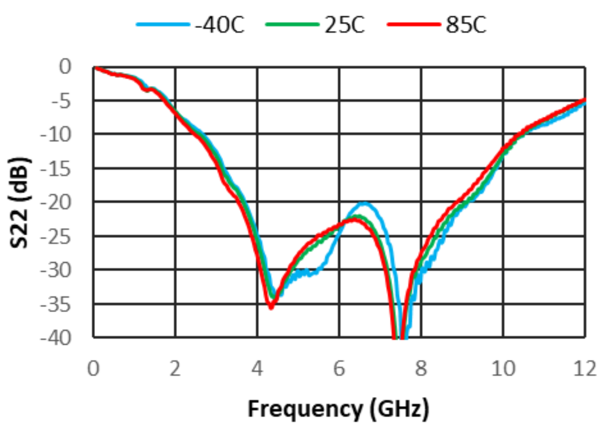
Input Return Loss @ V_C = 0 V



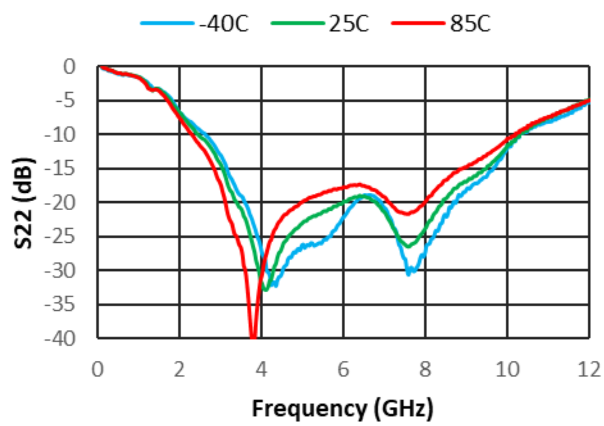
Input Return Loss @ V_C = 0.6 V



Output Return Loss @ V_C = 0 V

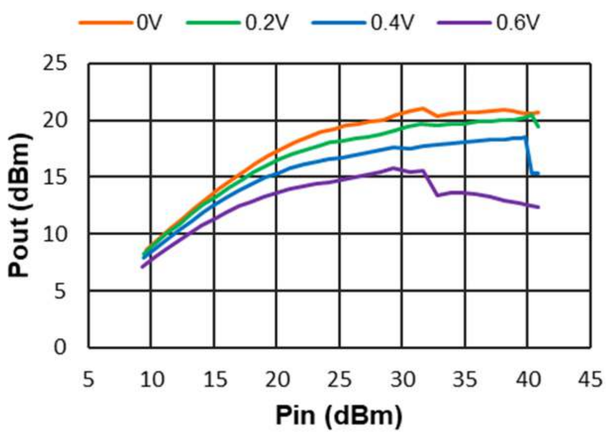


Output Return Loss @ V_C = 0.6 V

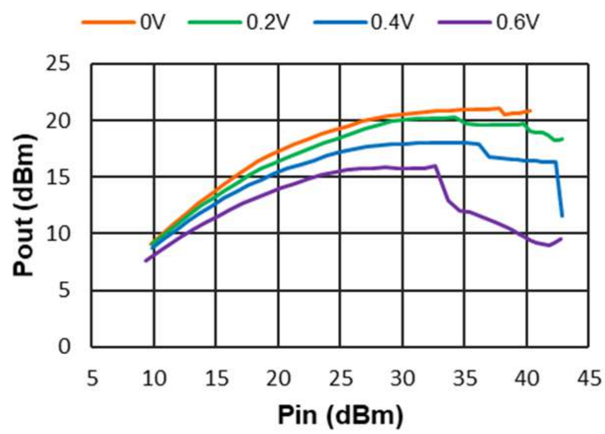


Typical RF Power Performance, Die On-Board: T_A = 25°C, Z_0 = 50 Ω

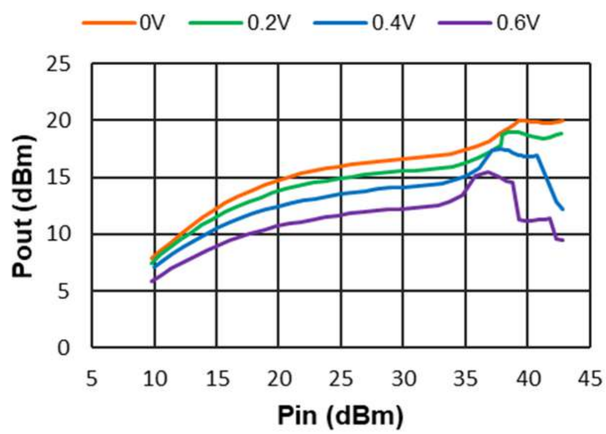
CW Flat leakage Power over V_C bias @ 4 GHz



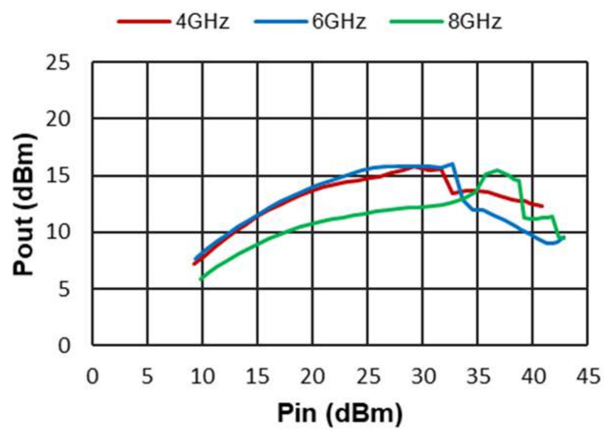
CW Flat leakage Power over V_C bias @ 6 GHz



CW Flat leakage Power over V_C bias @ 8 GHz

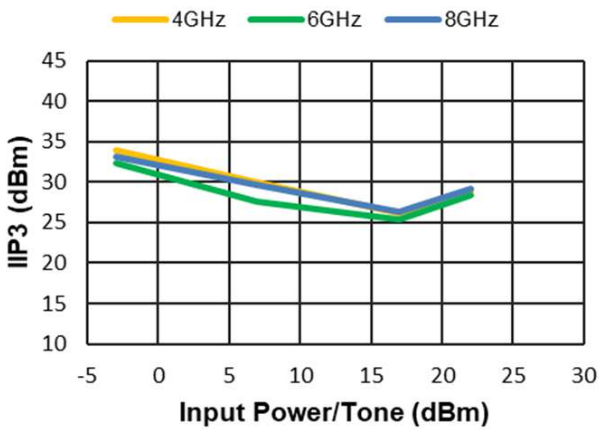


CW Flat leakage Power over frequency @ V_C = 0.6 V

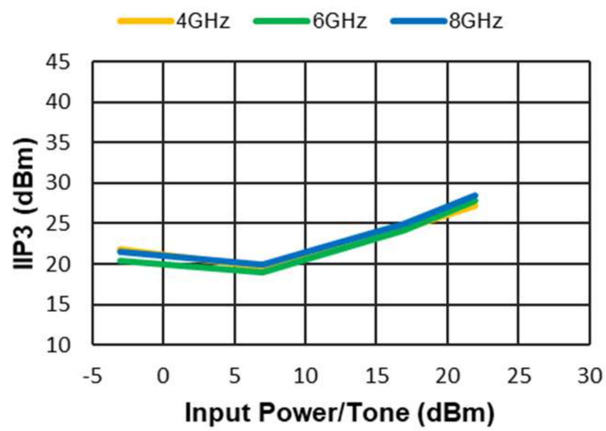


Typical RF Power Performance, Die On-Board: T_A = 25°C, Z_0 = 50 Ω

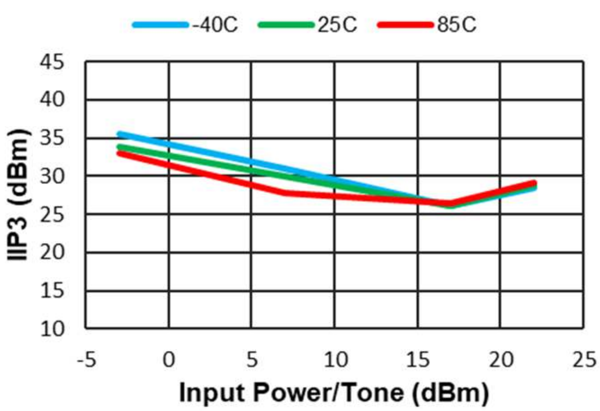
Input IP3 over frequency @ V_C = 0 V



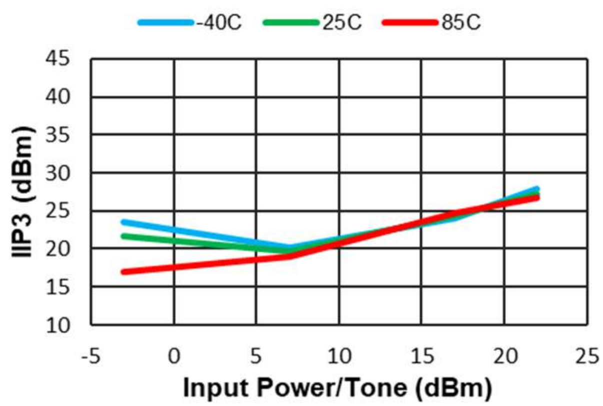
Input IP3 over frequency @ V_C = 0.6 V



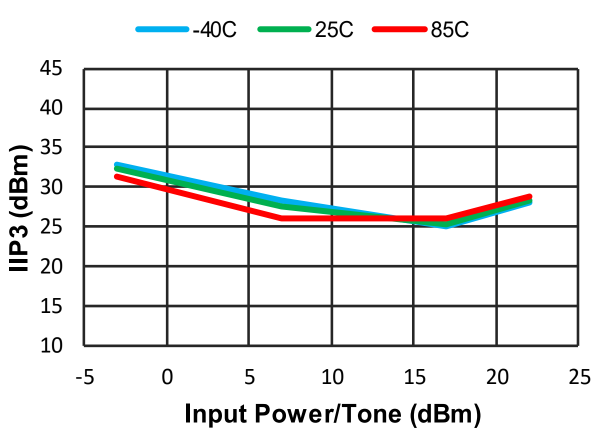
Input IP3 over temperature @ 4 GHz, V_C = 0 V



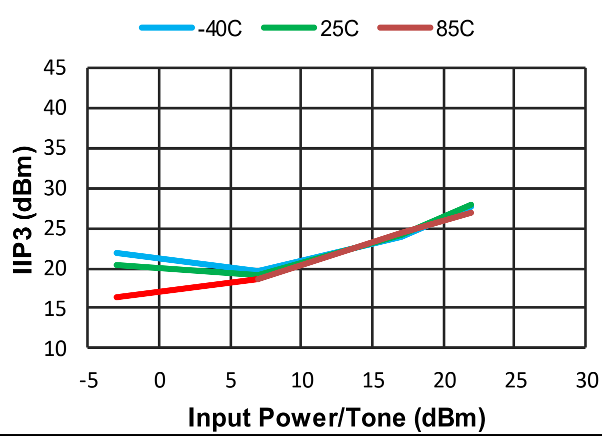
Input IP3 over temperature @ 4 GHz, V_C = 0.6 V



Input IP3 over temperature @ 6 GHz, V_C = 0 V

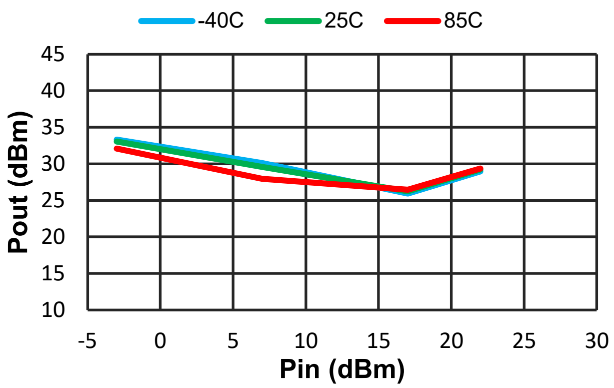


Input IP3 over temperature @ 6 GHz, V_C = 0.6 V

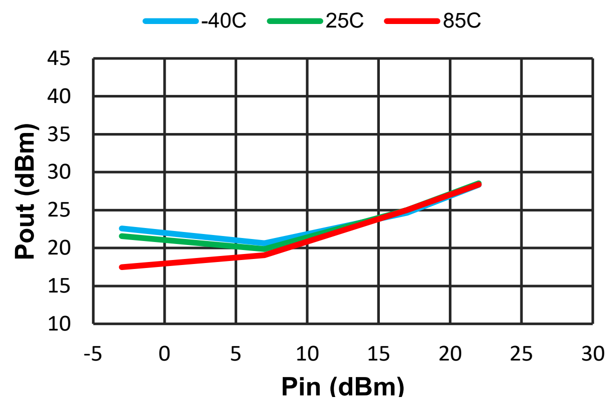


Typical RF Power Performance, Die On-Board: T_A = 25°C, Z_0 = 50 Ω

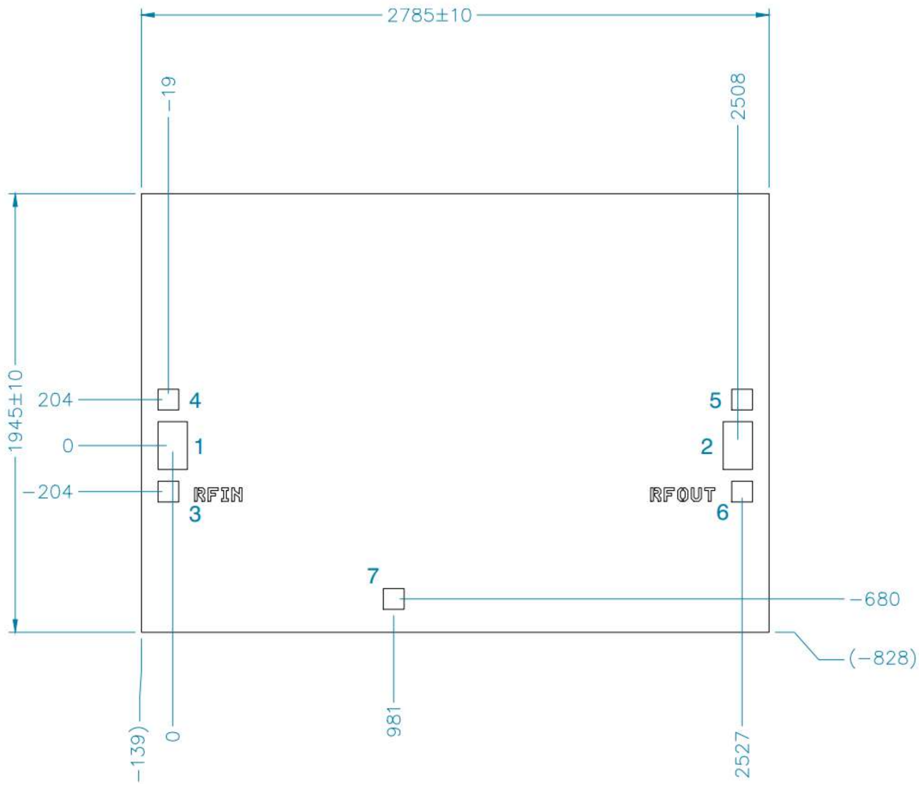
Input IP3 over temperature @ 8 GHz, V_C = 0 V



Input IP3 over temperature @ 8 GHz, V_C = 0.6 V



Die Outline Drawing



BOND PAD DIM (µm)		
PAD	X	Y
1,2	130	212
3,4,5,6,7	92	92

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.

Recommended Die Attachment

The die edge to die attach pad edge is recommended to be 5 mils minimum. High density solid Cu via farm or Solid Cu heat Slug is recommended under the attach pad for optimum thermal heat dissipation.

Eutectic die attachment is not recommended for this part. A high thermal conductivity epoxy shall be used. Voiding under the die should be minimized and no voiding should be present under the diode locations.

Wire Bonding Recommendation

For optimum bonding power handling performance and minimum bonding inductance, it is recommended to bond this part with two 3 x 0.5 mil gold ribbon wires on both the input and output RF pads. Low loop profile and minimum bond length are recommended.