MADP-011028-14150T

High Power PIN Diode
50 MHz - 12 GHz

Rev. V3

Features

- 3 Terminal LPF Broadband Shunt Structure
- 50 MHz - 12 GHz Broadband Frequency
- >100 W Peak Power Handling
- < 0.1 dB Shunt Insertion Loss
- >19 dB Shunt Isolation
- < 35°C/W Thermal Resistance
- Lead-Free 1.5 x 1.2 mm 6-lead TDFN Package
- RoHS* Compliant and 260°C Reflow

Description

The MADP-011028 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 50 MHz to 12 GHz. The higher breakdown voltage and lower thermal resistance of the PIN diode provides peak power handling in excess of 100 W.

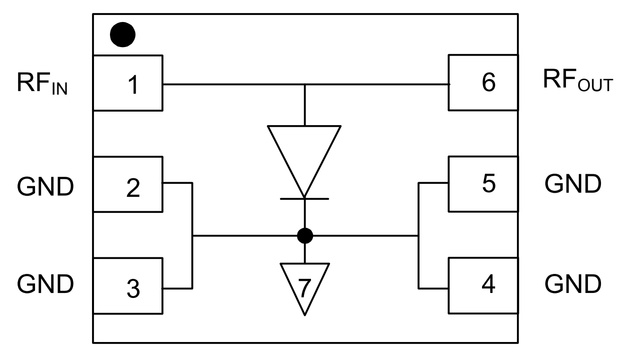
This device is ideally suitable for usage in higher incident power switches, phase shifters, attenuators, and limiter microwave circuits over a broad frequency where higher performance surface mount diode assemblies are required.

Ordering Information[1,2]

Part Number	Package
MADP-011028-14150T	3000 piece reel
MADP-011028-000SMB	Sample board

1. Reference Application Note M513 for reel size information.
2. All RF Sample boards include 5 loose parts.

Functional Schematic



Pin Configuration[3]

Pin No.	Pin Name	Description
1	RF_{IN}	RF Input
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	GND	Ground
6	RF_{OUT}	RF Output
7	Paddle[4]	Ground

3. M/A-COM Technology Solutions 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 2002/95/EC.

Electrical Specifications: T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Forward Voltage	+50 mA D.C.	V	0.7	0.9	1.1
Reverse Leakage Current	-200 V D.C.	nA	—	|- 20|	|-1000|
Total Capacitance[5]	-50 V @ 1 MHz	pF	—	0.24	0.30
Series Resistance[6]	+10 mA @ 1 GHz	Ω	—	3.4	4.4
Parallel Resistance[6]	-Vdc = -40 V, @ 100 MHz	KΩ	—	500	—
Minority Carrier Lifetime	+If = 10 mA / -Ir = -6 mA (50% Control Voltage, 90% Output Voltage)	µs	—	2.0	3.0
C.W. Thermal Resistance (Infinite Heat Sink at Thermal Ground Plane)	I High = 4 A, I low = 10 mA @ 10 kHz	ºC/W	—	35	—
Power Dissipation[7,8] (Infinite Heat Sink at Thermal Ground Plane)	+If = 50 mA @ 1 GHz	W	—	4.3	—
Insertion Loss	F = 1 GHz, -Vdc = -10 V	dB		0.05	
Isolation	F = 1 GHz, +I bias = +10 mA	dB	16.5	18.5	

5. Ct (Total Capacitance) = CJ (Junction Capacitance) + Cp (Parasitic Package Capacitance).
6. Rs and Rp are measured on an HP4291A Impedance Analyzer.
7. De-rate power dissipation linearly by -28.6 mW/ºC to 0 W @ +175ºC: Pd (T) = Pd (+ 25ºC) - ΔP = Pd (+ 25º) - (28.6 mV/ºC) (ΔT).
8. PD = ΔTj / Θ or PD=(IF + IRF) 2 (Rs), where IF is the forward bias DC current and IRF is the forward bias RMS RF current.

Absolute Maximum Ratings[9,10]

Parameter	Absolute Maximum
D.C. Forward Voltage @ +250 mA	1.2 V
D.C. Forward Current	250 mA
D.C. Reverse Voltage	|-200V|
Junction Temperature	+175°C
Operating Temperature	-65°C to +125°C
Storage Temperature	-65°C to +150°C
Re-flow Temperature	+260°C for 360 seconds

9. Exceeding any one or combination of these limits may cause permanent damage to this device.
10. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.

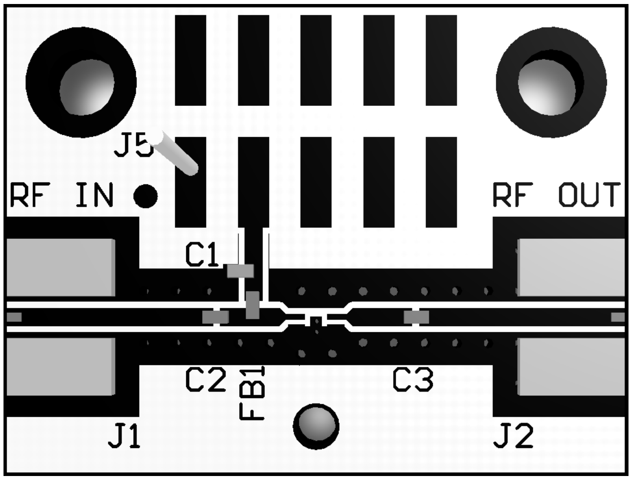
Handling Procedures

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 Class 1B devices.

PCB Layout

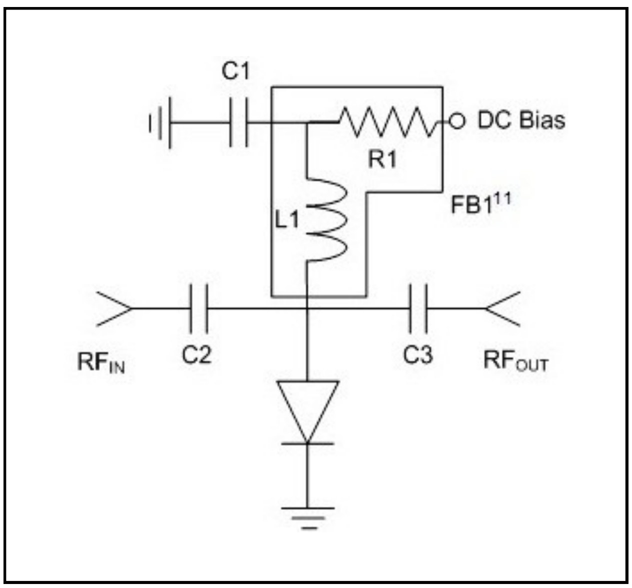


500 - 5000 MHz Parts List[12]

Part	Value	Case Style
C1	62 pF	0402
C2, C3	100 pF	0402
FB1	470 Ω @ 1 GHz	0402
R1	150 Ω	0402
L1	82 nH	0402

12. Max DC voltage with recommended components not to exceed 100 V.

PCB Schematic



11. R1 is not needed when using the recommended ferrite FB1.

Assembly Recommendations

Devices may be soldered using standard Pb60/Sn40, or RoHS compliant solders. Leads are plated NiPdAuAg to ensure an optimum solderable connection.

For recommended Sn/Pb and RoHS soldering profile See Application Note M538 on the MACOM website.

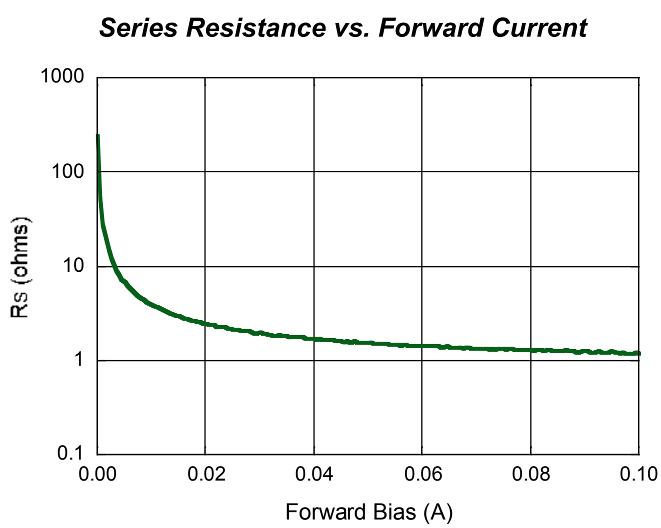
Cleanliness and Storage

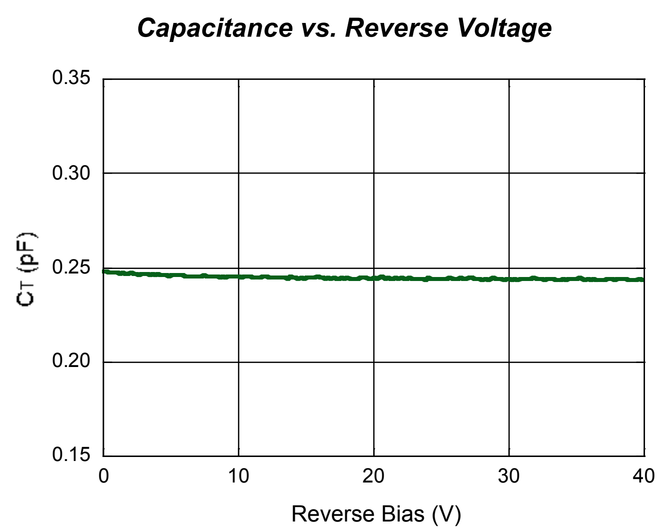
These devices should be handled and stored in a clean environment. Ends of the device are NiPdAuAg plated for greater solderability. Exposure to high humidity (>80%) for extended periods may cause the surface to oxidize. Caution should be taken when storing devices for long periods.

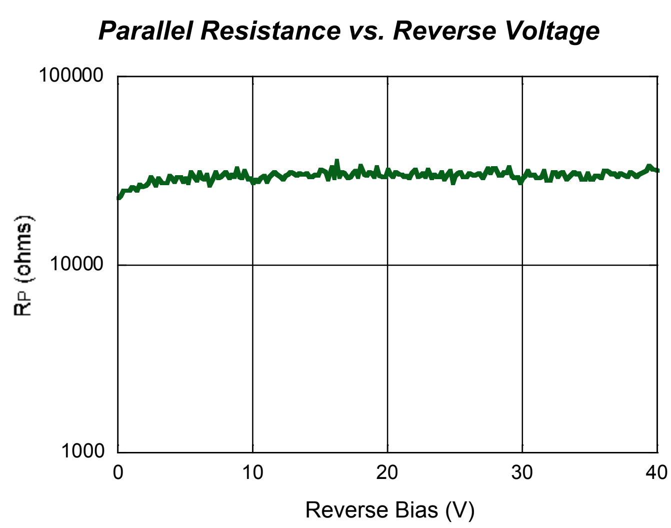
General Handling

Device can be handled with tweezers or vacuum pickups and are suitable for use with automatic pick-and-place equipment.

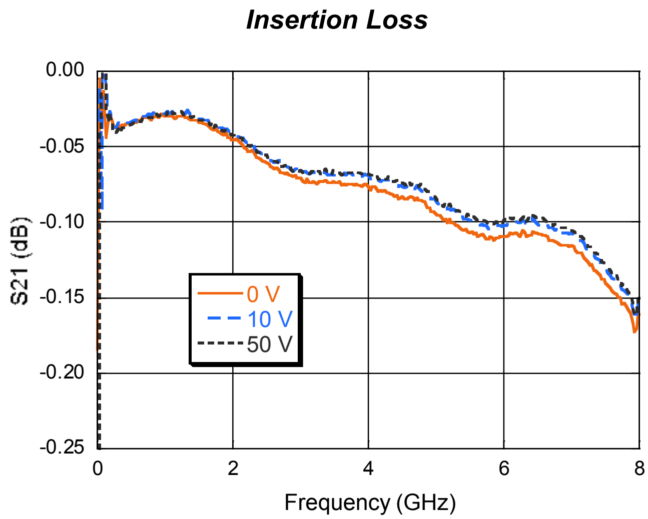
Typical 1 GHz Parametric Curves

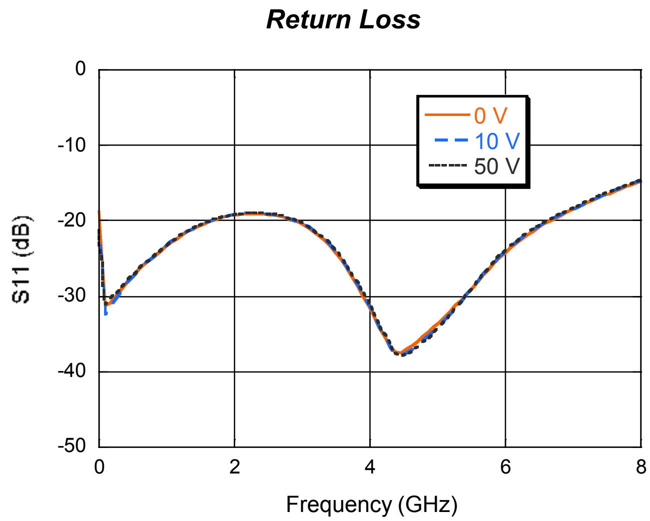


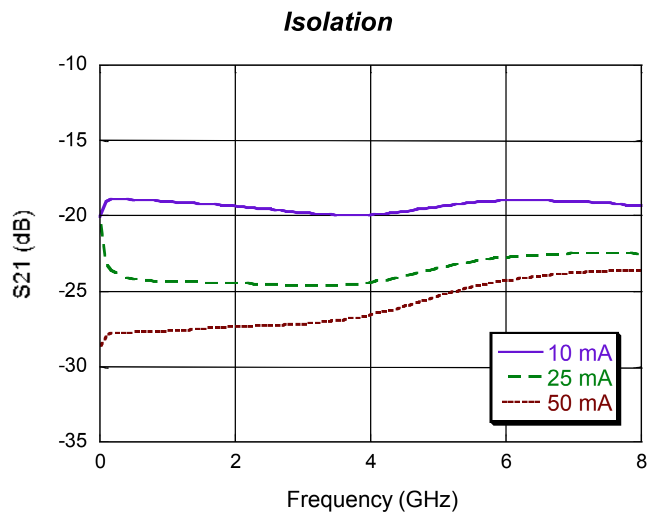




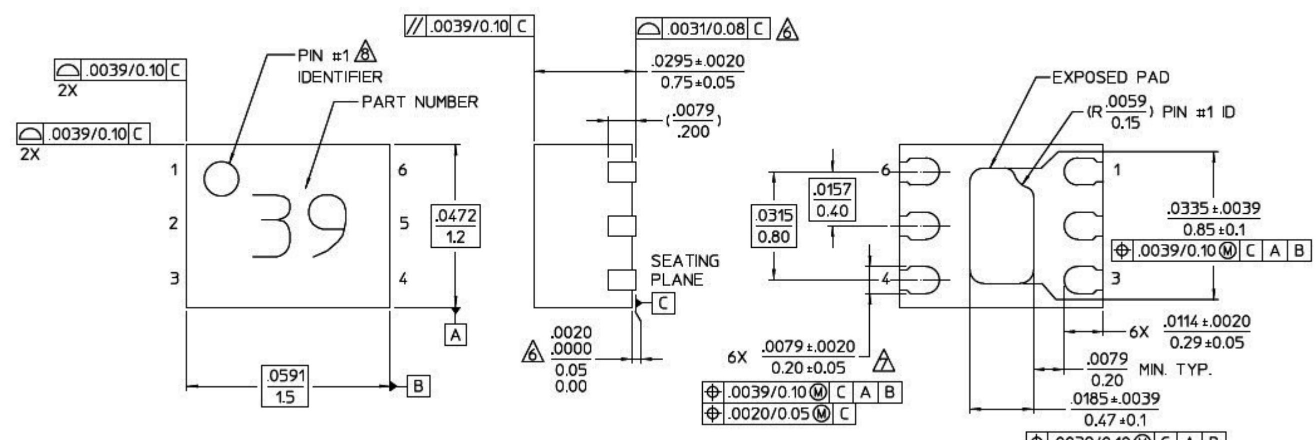
Typical RF Small Signal Performance Curves







Lead-Free 1.5 x 1.2 mm 6-Lead TDFN†

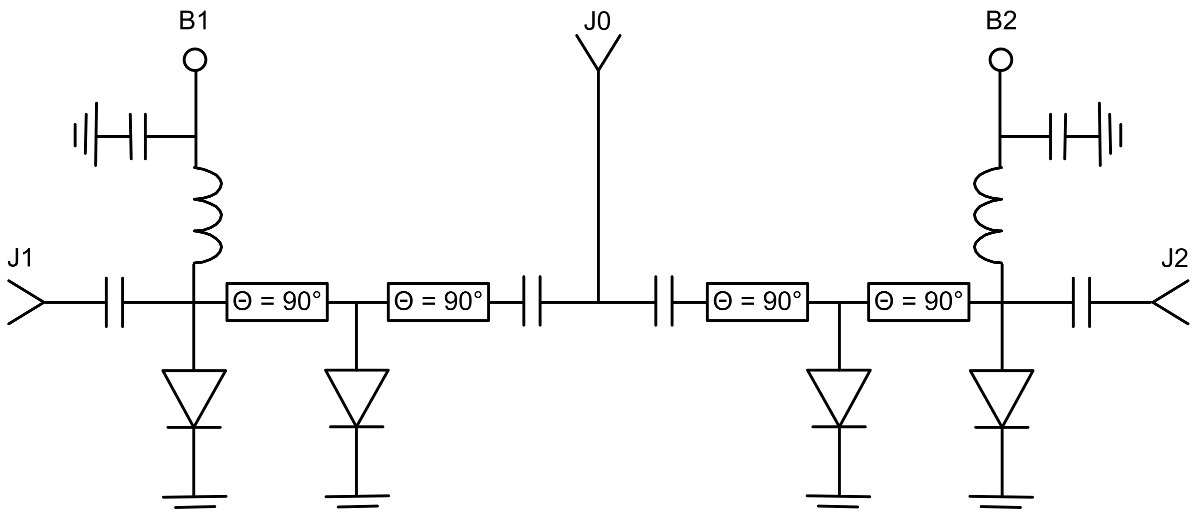


NOTES:
1. REFERENCE JEDEC MO-153-AB FOR ADDITIONAL DIMENSIONAL AND TOLERANCE INFORMATION.
2. ALL DIMENSIONS SHOWN AS INCHES/MM.

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is NiPdAuAg.

Applications Section

Schematic of High Power SP2T Shunt Switch using MADP-011028-14150T PIN Diodes
F = Octave Bandwidth from 1 to 12 GHz
P_{inc}= +40 dBm CW
P_{inc} = +50 dBm, 10 µs PW, 1 % Duty



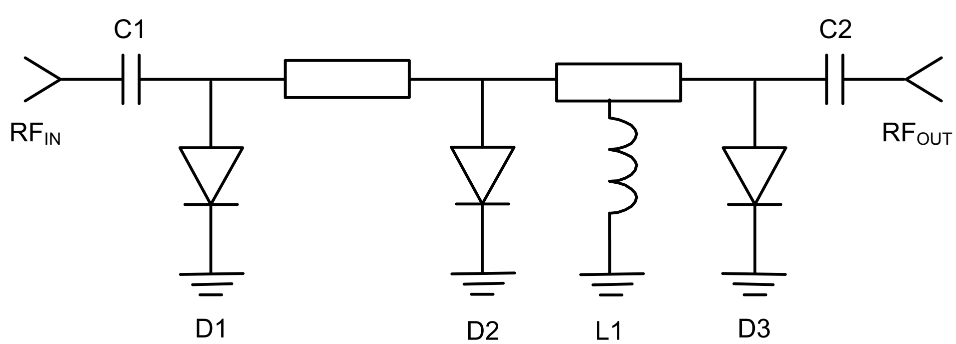
L = 11.807 / ($\varepsilon_{eff}^{1/2}$ * F * 4) inches, θ = β * L = (2 π / λ) * L = 90 °

Frequency is in GHz, εeff is Effective Dielectric Constant of Transmission Line Medium

RF State	B1 Bias	B2 Bias
J0-J1 Low Loss & J0-J2 Isolation	-50 V @ 0 mA	+1 V @ +20 mA
J0-J2 Low Loss & J0-J1 Isolation	+1 V @ +20 mA	-50 V @ 0 mA

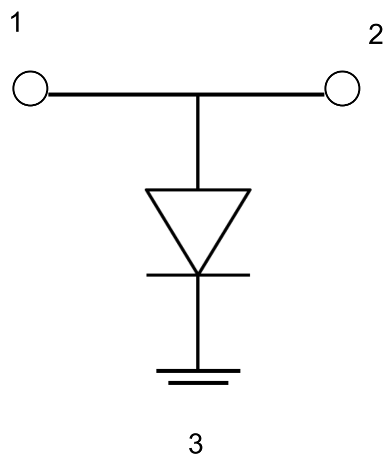
Applications Section

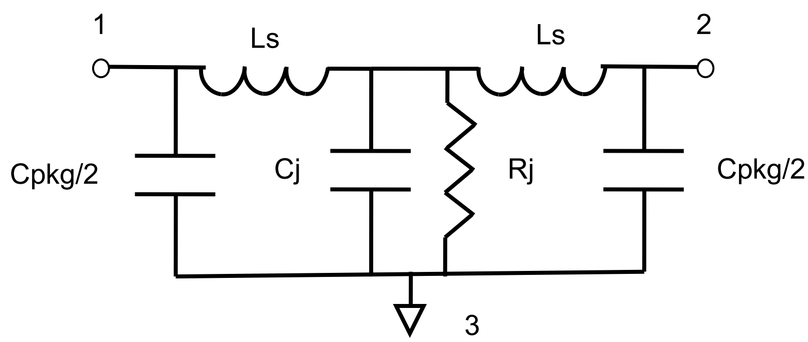
Schematic of 3 Stage Limiter using MADP-011028-14150T
F = 1000 - 8,000 MHz
P_{inc} = +47 dBm CW
P_{inc} = +50 dBm, 10 µs P.W., 1 % Duty



Part	PN	Case Style	Description	Quantity
D1	MADP-011028-14150T	ODS-1415	Input PIN Diode	1
D2	MADL-011023-14150T	ODS-1415	2nd Stage PIN Diode	1
D3	MADL-011023-14150T	ODS-1415	3rd Stage PIN Diode	1
L1	33 nH	0402	RF Choke / DC Return	1
C1	27 pF	0402	DC Block	1
C2	27 pF	0402	DC Block	1

Microwave Model of MADP-011028-14150T





Rj = Rs (Forward Bias Current)
Rj = Rp (Reverse Bias Voltage)

Parameter	Value
$C_{package}$	8.0E-14 F
L bond = Ls	4.0E-10 H
Rs	0.9 Ω
Rp	5E+5 Ω