

PIN Diode Limiter 0.4 - 2.5 GHz

Rev. V1

Features

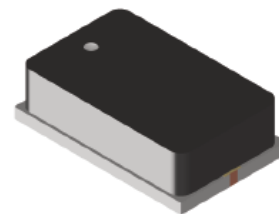
- Surface Mount Limiter in 8 mm x 5 mm x 2.5 mm Package
- Incorporates PIN Limiter Diodes
- DC Blocks & DC Return
- Higher Peak Power Handling than Plastic: 200 W
- Higher Average Power Handling than Plastic: 30 W CW
- Lower Insertion Loss: 0.4 dB
- Lower Flat Leakage Power: 21 dB
- RoHS* Compliant

Description

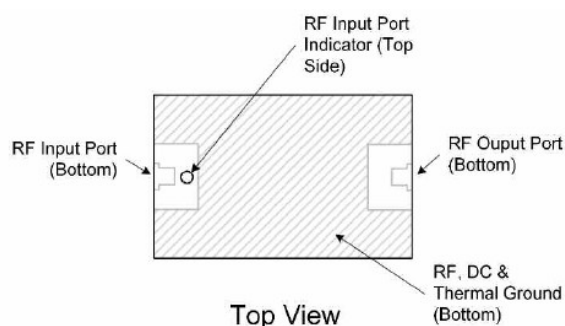
The LM501202-M-C-300 surface mount silicon PIN diode limiter is manufactured using a proven hybrid manufacturing process incorporating PIN diodes and passive devices integrated within a ceramic substrate. This low profile, compact, surface mount component offers superior low and high signal performance to comparable MMIC devices in QFN packages. The limiter modules are designed to optimize small signal insertion loss, noise figure and high signal flat leakage performance from 0.5 - 2.0 GHz.

Using PIN diodes with lower thermal resistance ($<15^{\circ}\text{C/W}$), RF CW incident power levels of 45 dBm and RF peak incident power levels of 53 dBm @ 1 μs RF pulse width, 0.1% duty cycle are very achievable. In addition, this design concept provides lower flat leakage power (<21 dBm) and lower spike leakage energy (<0.3 Ergs) for superior LNA protection.

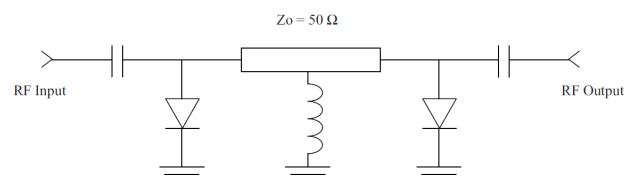
This LM501202-M-C-300 limiters are ideal for octave band radar applications, requiring high volume, surface mount, solder re-flow manufacturing. These products are durable, reliable, and capable of meeting all military, commercial, and industrial environments. The devices are fully RoHS compliant and are available in tube or tape-reel.



Pin Out



Limiter Schematic



Ordering Information

Part Number	Package
LM501202-M-C-300-T	tube packaging
LM501202-M-C-300-R	250 or 500 piece reel
LM501202-M-C-300-W	waffle packaging
LM501202-M-C-300-E	RF evaluation board

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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Electrical Specifications: Freq. = 0.4 - 2.5 GHz, $P_{IN} = 0$ dBm, $T_A = +25^\circ\text{C}$, $Z_0 = 50\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	Swept Frequency	dB	—	-0.4	-0.6
Return Loss	Swept Frequency	dB	-18	-20	—
P1dB	Swept Frequency	dBm	7	8	10
2nd Harmonic	Output Frequency = 2 GHz	dBc	45	50	—
Peak Incident Power	RF Pulse Width = 1 μs , 1% Duty	dBm	—	53	54
CW Incident Power	—	dBm	—	45	45
Flat Leakage Power	$P_{IN} = 50$ dBm RF Pulse Width = 1 μs , 0.1% Duty	dBm	—	21	22
Spike Leakage Power	$P_{IN} = 50$ dBm peak, RF Pulse Width = 1 μs , 0.1% Duty	Ergs	—	0.3	0.5
Recovery Time	50% falling edge of RF Pulse to 1 dB IL, $P_{IN} = 50$ dBm peak, RF Pulse Width = 1 μs , 0.1% Duty	ns	—	500	1000

Absolute Maximum Ratings^{1,2}

Parameter	Absolute Maximum
RF CW Incident Power @ $+85^\circ\text{C}$, Source & Load VSWR $<1.2:1$ Derate linearly to 0 W @ $T_C = +150^\circ\text{C}$ ³	45 dBm
RF Peak Incident Power @ $+85^\circ\text{C}$, Source & Load VSWR $<1.2:1$ Derate linearly to 0 W @ $T_C = +150^\circ\text{C}$ ³	53 dBm
Insertion Loss Rate of Change with Operating Temperature	-0.003 dB / $^\circ\text{C}$
Thermal Resistance Junction to bottom surface of package	15°C/W
Junction Temperature	$+175^\circ\text{C}$
Operating Temperature	-65°C to $+125^\circ\text{C}$
Storage Temperature	-65°C to $+150^\circ\text{C}$
Assembly Temperature	260°C for 30 seconds

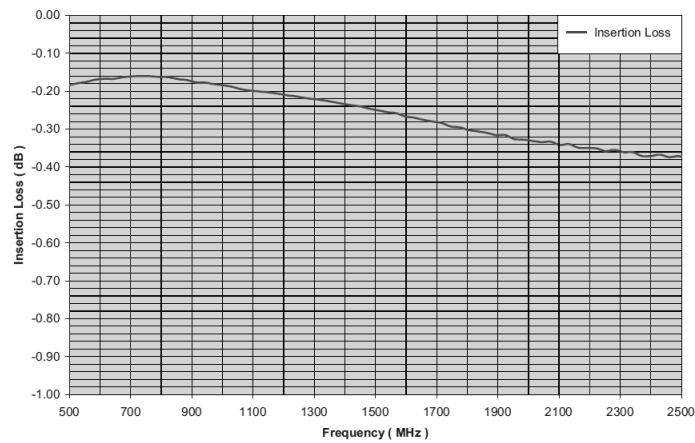
1. Exceeding any one or combination of these limits may cause permanent damage to this device.

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

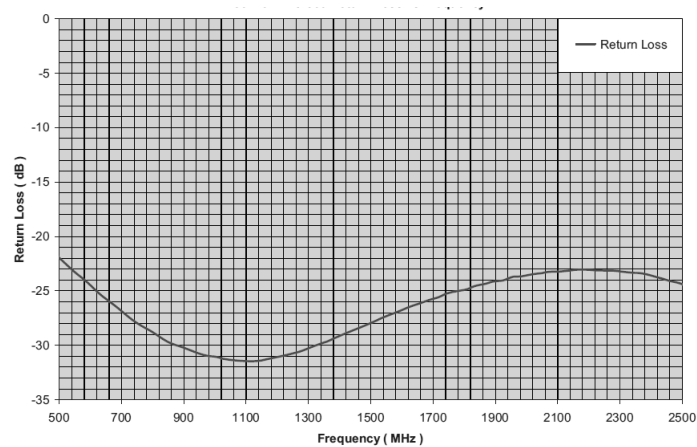
3. T_C is defined as the temperature of the bottom surface of the package.

Typical Performance Curves

Insertion Loss vs. Frequency



Return Loss vs. Frequency



CW Output Power vs. CW Input Power

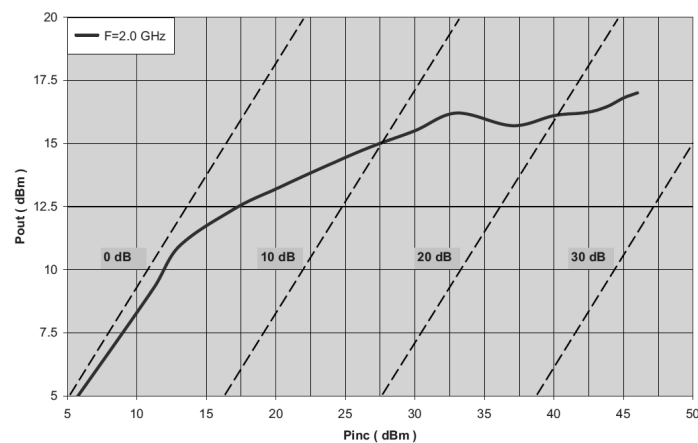
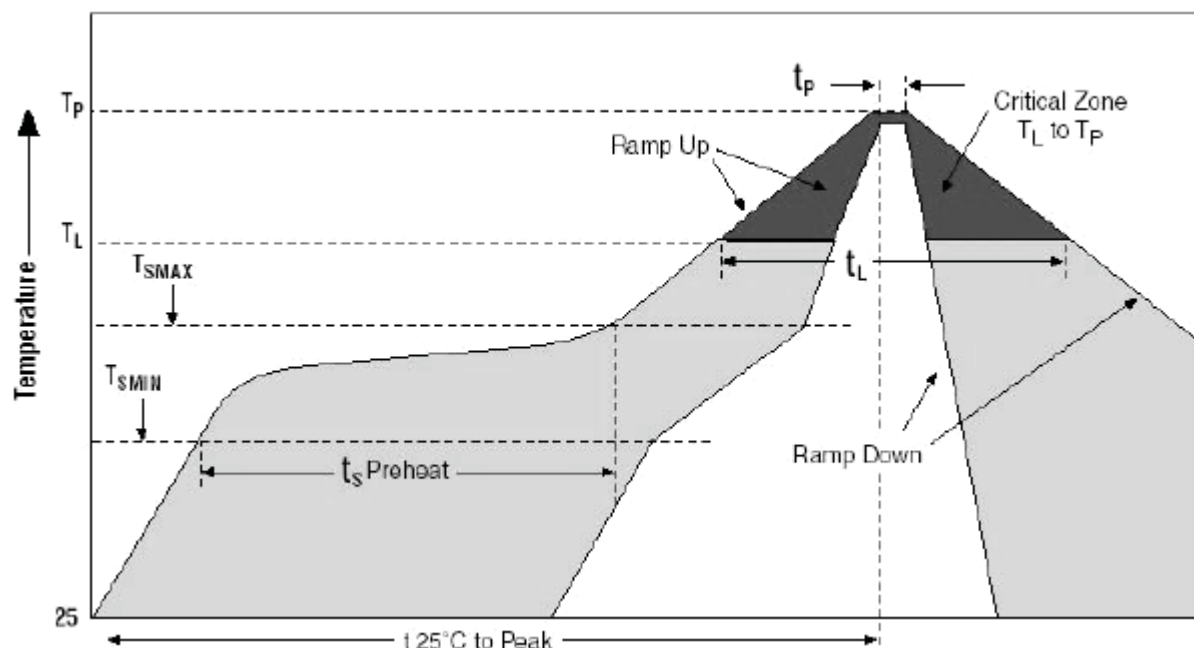


Table 1: Time-Temperature Profile for Sn 60 / Pb 40 or RoHS Type Solders

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (TL to TP)	3°C/second maximum	3°C/second maximum
Preheat - Temperature Minimum (TSMIN) - Temperature Maximum (TSMAX) - Time (Minimum to maximum) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
TSMAX to TL - Ramp-up Rate	—	3°C/second maximum
Time Maintained above: - Temperature (TL) - Time (tL)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature (TP)	225 +0 / -5°C	245 +0 / -5°C
Time within 5°C of actual Peak Temperature (TP)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second maximum	6°C/second maximum
Time 25°C to Peak Temperature	6 minutes maximum	8 minutes maximum

Graph1: Solder Re-Flow Time-Temperature Function



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Handling Procedures

Please observe the following precautions to avoid damage:

Static and Moisture 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 Class 0 (HBM) devices.

The moisture sensitivity level rating for this device is MSL 2.

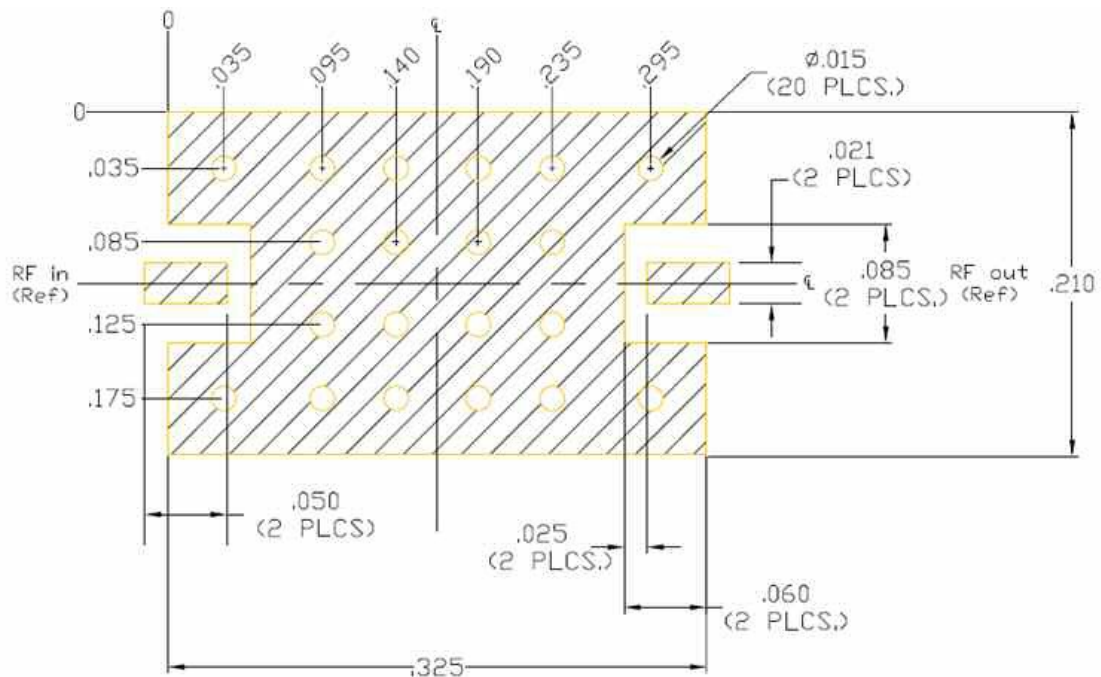
Environmental Capabilities

This limiter is capable of meeting the environmental requirements of MIL-STD-750 and MIL-STD-202.

Assembly Instructions

LM501202-M-C-300 may be placed onto circuit boards with pick and place manufacturing equipment from tube or tape-reel dispensing. The devices are attached to the circuit board using conventional solder re-flow or wave soldering procedures with RoHS type or Sn63/Pb37 type solders per Table 1 and Graph 1 Time-Temperature recommended profile.

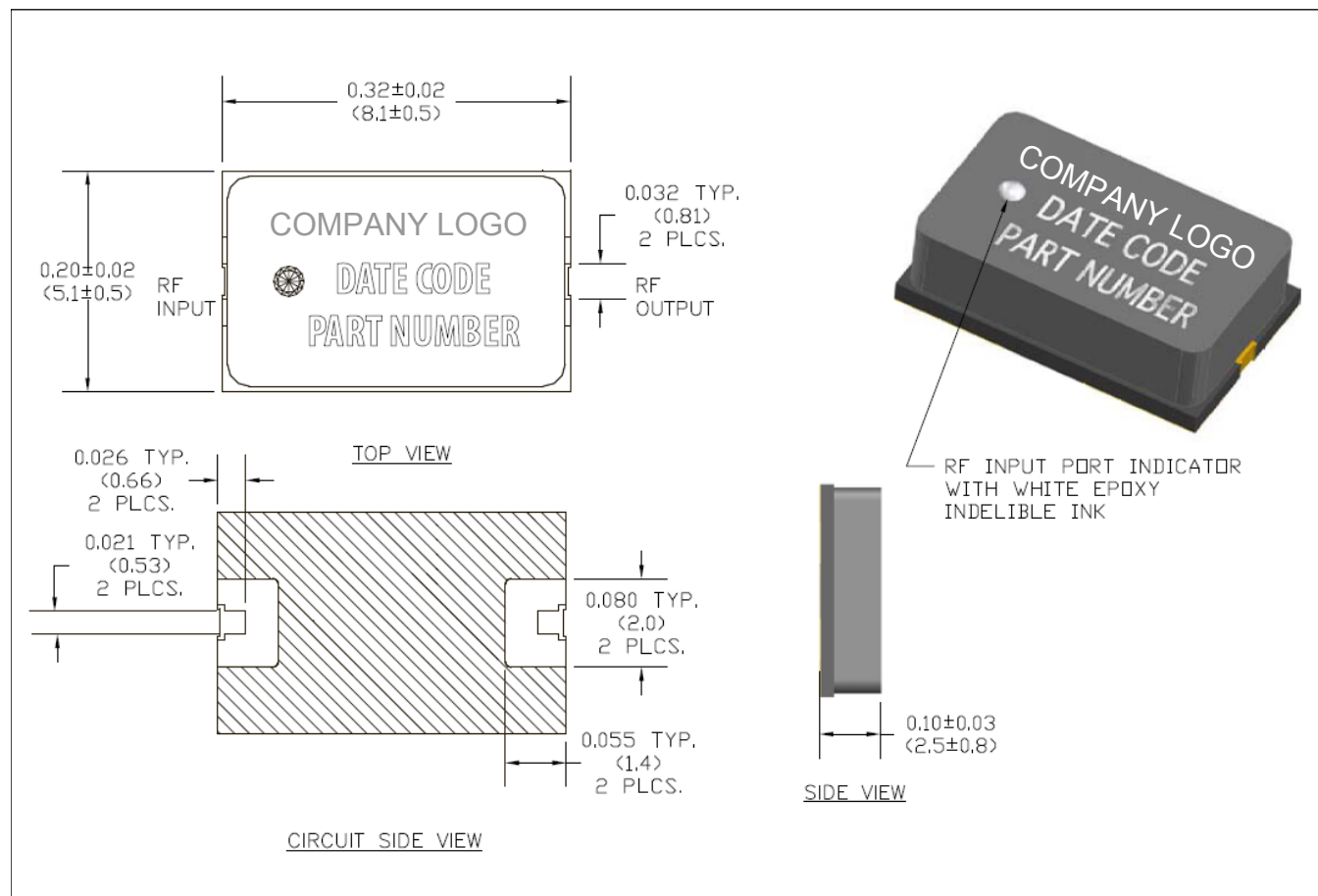
RF Circuit Solder Footprint, case style 300 (CS300)



Recommended RF circuit is Rogers R04350B, 10 mils thick.

The hatched metal area on circuit side of device is RF, DC and thermal grounded. Vias should be solid copper fill and gold plated for optimum heat transfer from backside of switch module through circuit vias to metal thermal ground.

Outline Drawing, Case Style 300 (CS300)



The hatched metal area on circuit side of device is RF, DC and thermal grounded.

Dimensions are in inches (mm)

Substrate Material: 20 mil thick Alumina Nitride (ALN)

RF Cover: Black Ceramic

Top Side and Backside Metallization: 100 μ IN. typical plated over Ti-Pd.

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