

Surface Mount Limiter, 0.4 – 2.5 GHz

LM501202-L-C-300 Series Datasheet

NEW

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Features

- Surface Mount Limiter in Compact Package: 8mm L x 5mm W x 2.5 mm H
- Incorporates PIN Limiter Diodes, DC Blocks & DC Return
- Wide Frequency Range (400 MHz to 2.5 GHz)
- Higher Peak Power Handling than Plastic-Packaged Limiters (125 W Peak)
- Higher Average Power Handling than Plastic-Packaged Limiters (5 W CW)
- Very Low Insertion Loss (0.4 dB)
- Low Flat Leakage Power (21 dBm)
- RoHS Compliant



Applications

- Receiver protection

Description

The LM501202-L-C-300 Surface Mount Silicon PIN Diode Limiter is a surface mount, passive two-stage power limiter which can operate over the frequency range of 400 MHz to 2.5 GHz. It is manufactured using Aeroflex-Metelics proven hybrid manufacturing process incorporating PIN Diodes and passive devices integrated onto a ceramic substrate. This low profile, compact, (8 mm L x 5 mm W x 2.5 mm H) surface mount component offers outstanding small and large signal performance. This product is designed for optimal small signal insertion loss for very low receiver noise figure and excellent large-input-signal flat leakage power for effective receiver protection from 400 MHz to 2.5 GHz.

The very low thermal resistance ($< 70 \text{ }^\circ\text{C/W}$) of the PIN diodes in this device enables it to reliably handle RF incident power levels up to 37 dBm CW and RF peak incident power levels up to 51 dBm (1 μs pulse width, 0.1% duty cycle) at $T_A = 85 \text{ }^\circ\text{C}$. The I layer thickness of the output stage is selected to produce flat leakage of 21 dBm typical and spike leakage energy of 0.2 ergs, typical. No external control signals are required. This limiter module includes internal DC blocking capacitors in the RF signal path, as well as an internal DC return path.

The LM501202-L-C-300 limiter is ideal for receiver protection in octave band radar applications in the 400 MHz to 2.5 GHz range which utilize high volume, surface mount, solder re-flow manufacturing. These products are durable and capable of reliably operating in military, commercial, and industrial environments. The devices are RoHS compliant and are available in tube or tape-reel.

Environmental Capabilities

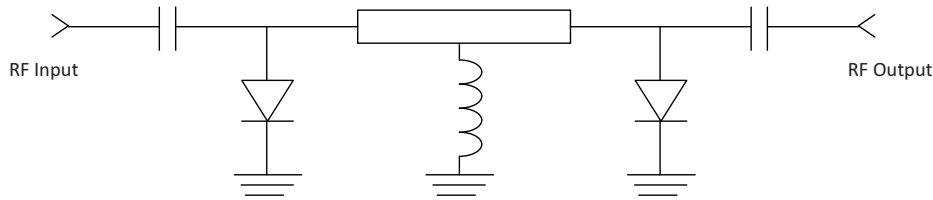
The LM501202-L-C-300 Limiters are capable of meeting the environmental requirements of MIL-STD-750 and MIL-STD-202.

ESD and Moisture Sensitivity Level Rating

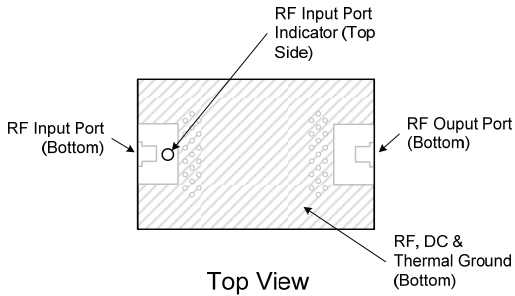
As are all semiconductor devices, PIN diode limiters are susceptible to damage from ESD events. The ESD rating for this device is Class 0 (HBM). The moisture sensitivity level rating for this device is MSL 1.

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Limiter Schematic



Pinouts



Electrical Specifications

@ $Z_0 = 50 \Omega$, $T_A = +25 \text{ }^\circ\text{C}$ (Unless Otherwise Defined)

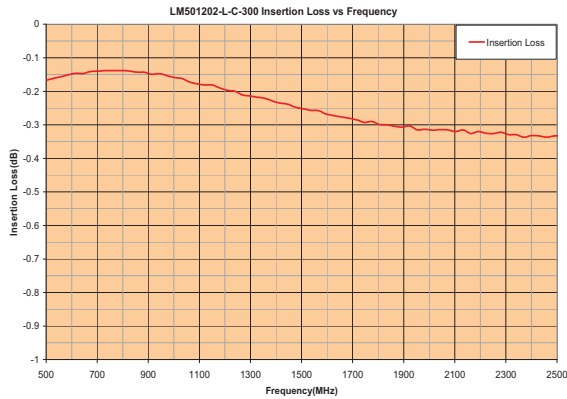
Parameter	Symbol	Test Conditions	Minimum Value	Typical Value	Maximum Value	Units
Frequency	F	$0.4 \text{ GHz} \leq F \leq 2.5 \text{ GHz}$	0.4	0.5 - 2.0	2.5	GHz
Insertion Loss	IL	$0.4 \text{ GHz} \leq F \leq 2.5 \text{ GHz}$, Pin = 0 dBm	---	0.4	0.6	dB
Return Loss	RL	$0.4 \text{ GHz} \leq F \leq 2.5 \text{ GHz}$ Pin = 0 dBm	18	20	---	dB
Input 1 dB Compression Point	IP1dB	$0.4 \text{ GHz} \leq F \leq 2.5 \text{ GHz}$	7	8	10	dBm
2 nd Harmonic	$2F_0$	Pin = 0 dBm $F_0 = 2.0 \text{ GHz}$	---	-50	-45	dBc
Peak Incident Power	$P_{inc(Pk)}$	RF Pulse Width = 1 μs , duty cycle = 0.1%	---	51	52	dBm
CW Incident Power	$P_{inc(CW)}$	$0.4 \text{ GHz} \leq F < 2.5 \text{ GHz}$	---	36	37	dBm
Flat Leakage Power	FL	Pin = 50 dBm peak, RF pulse width = 1 μs , duty cycle = 0.1%	---	21	23	dBm
Spike Leakage Energy	SL	Pin = 50 dBm peak, RF pulse width = 1 μs , duty cycle = 0.1%	---	0.2	0.3	erg
Recovery Time	T_R	50% falling edge of RF pulse to 1 dB IL, Pin = 50 dBm peak, RF pulse width = 1 μs , duty cycle = 0.1%	---	75	150	ns

Absolute Maximum Ratings

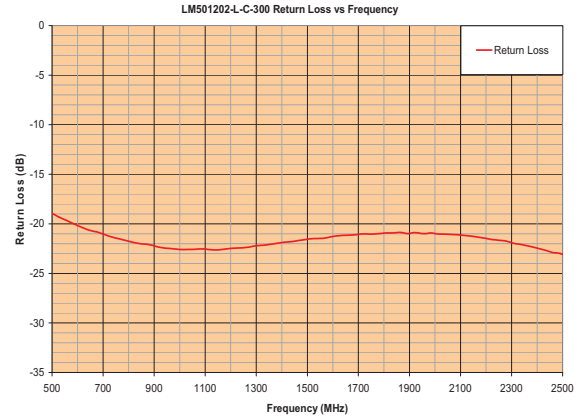
Parameter	Conditions	Absolute Maximum Value
Operating Temperature		-65 °C to 125 °C
Storage Temperature		-65 °C to 150 °C
Junction Temperature		175 °C
RF CW Incident Power	TA = 85 °C, source and load VSWR < 1.2:1	37 dBm
RF Peak Incident Power	TA = 85 °C, source and load VSWR < 1.2:1, RF pulse width = 1 μ s, duty cycle = 0.1%	+51 dBm
Insertion Loss Rate of Change with Operating Temperature		0.003 dB/°C
Θ_{jc} Thermal Resistance	Junction to case	70 °C/W
Assembly Temperature		260 °C for 10 Seconds

Typical Performance

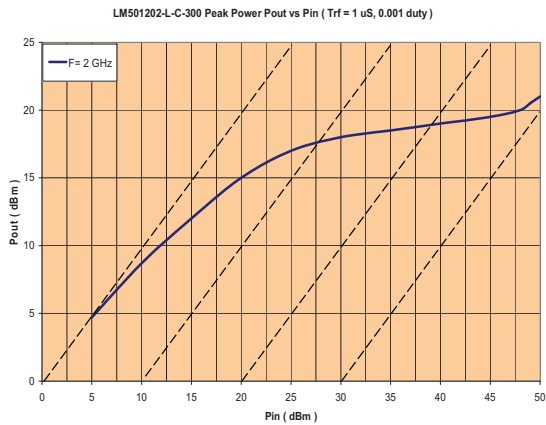
@ $Z_0 = 50 \Omega$, $T_A = +25 \text{ }^\circ\text{C}$ (Unless Otherwise Defined)



Insertion Loss vs. Frequency



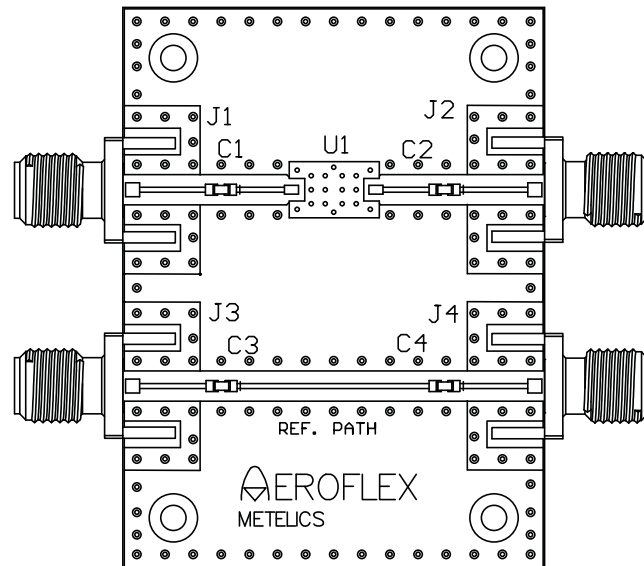
Return Loss vs. Frequency



CW Output Power vs. CW Input Power

PIN Diode Limiter

Evaluation Board



The evaluation board for the LM501202-L-C-300 is shown above. This evaluation board comprises two sections: the evaluation circuit for the LM501202-L-C-300 limiter module; and, a reference transmission line.

The limiter module is mounted in position U1. Its RF input is connected to J1 and its output port is connected to J2, via two 50 Ω microstrip transmission lines.

Since the LM501202-L-C-300 contains internal DC blocking capacitors in its input and output ports, the components mounted in the positions marked C1, C2, C3 and C4 are 0 Ω resistors.

The reference path 50 Ω microstrip transmission line structure can be utilized to determine the insertion loss of the transmission line structures connected between J1 and the limiter module input, as well as between the limiter module output and J2, so that their respective insertion losses may be subtracted from the total insertion loss measured between J1 and J2. This enables the resolution of the insertion loss of the limiter module only.

The evaluation board is supplied mounted on a heat sink. The maximum RF input power specified in the Absolute Maximum Ratings table must not be exceeded.

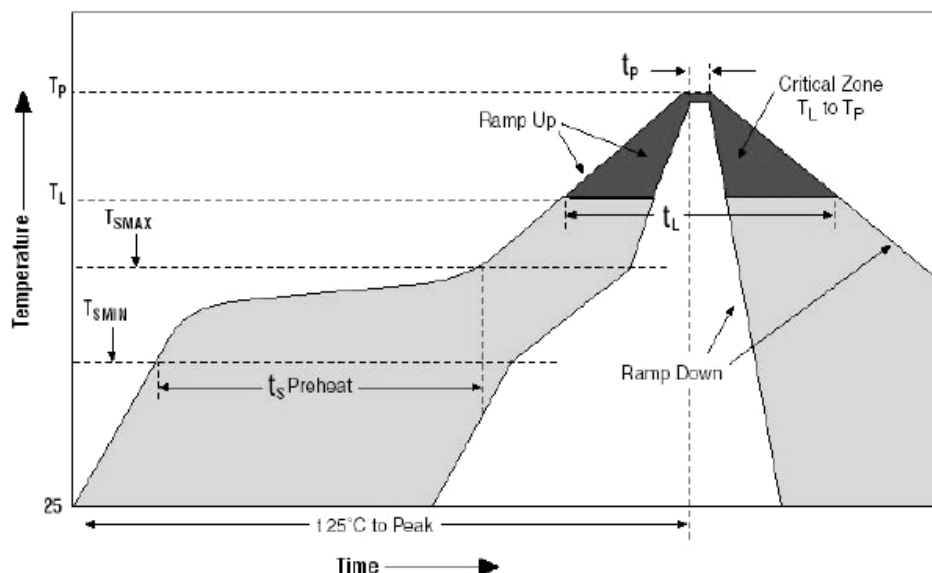
Assembly Instructions

The LM501202-L-C-300 limiter is capable of being placed onto a circuit board by pick-and-place manufacturing equipment from tube or tape-reel dispensing. The device is attached to the circuit board using conventional solder re-flow or wave soldering procedures with RoHS type or Sn60/Pb40 type solders per the recommended time-temperature profile shown below.

Table 1: Time-Temperature Profile for Sn 60/Pb40 or RoHS Type Solders

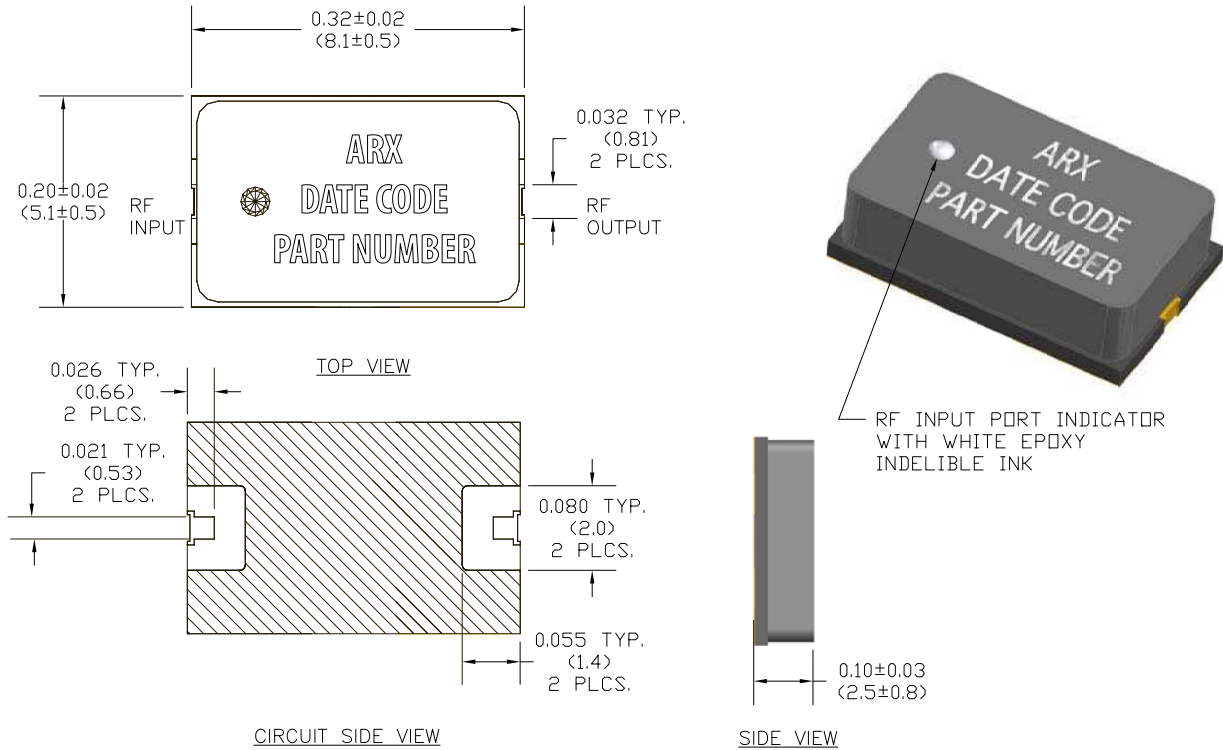
Profile Feature	Sn-Pb Solder Assembly	Pb-Free Solder Assembly
Average ramp-up rate (T _L to T _P)	3 °C/second maximum	3 °C/second maximum
Preheat - Temperature Minimum (T _S MIN) - Temperature Maximum (T _S MAX) - Time (Minimum to maximum) (t _S)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-180 seconds
T _S MAX to T _L - Ramp-up Rate		3°C/second maximum
Time Maintained above: - Temperature (T _L) - Time (t _L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak Temperature (T _P)	225 +0 / -5°C	260 +0/-5 °C
Time within 5°C of actual Peak Temperature (T _P)	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 Profile



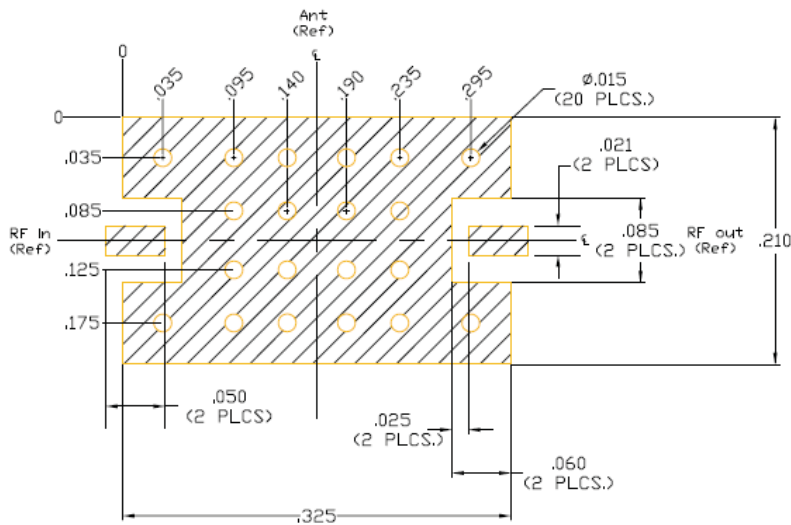
PIN Diode Limiter

Outline Drawing Case Style 300 (CS300)



- NOTES:
- SUBSTRATE MATERIAL: 20 MIL THICK ALUMINA NITRIDE (ALN) RF COVER: BLACK CERAMIC.
 - TOP SIDE AND BACKSIDE METALLIZATION: 100 μ IN. TYPICAL PLATED Au OVER Ti-Pd.
 - DIMENSION IN PARENTHESIS ARE IN MM.

RF Circuit Solder Footprint for Case Style 300 (CS 300)



- NOTES:
- RECOMMENDED RF CIRCUIT IS ROGERS, R04350B, 10 MILS THICK.

Hatched Area is RF, D.C., and Thermal Ground. Vias should be solid copper fill and gold plated for optimum heat transfer from backside of limiter module through circuit vias to metal thermal ground.

Part Number Ordering Information:

Part Number	Description
LM501202-L-C-300-T	Tube Packaging
LM501202-L-C-300-R	Tape-Reel Packaging Quantities of 250 or 500
LM501202-L-C-300-W	Waffle Packaging
LM501202-L-C-300-E	RF Evaluation Board

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