RELEASED

RFLM-301511QC-392

Quasi Active High Power UHF Band Limiter Module

Features:

- Frequency Range: 300 MHz to 512 MHz
- High Average Power Handling: +56 dBm
- High Peak Power Handling: +56 dBm
- Low Insertion Loss: <0.4 dB
- Return Loss: >18 dB
- Low Flat Leakage Power: <19 dBm
- SMT Module: 10.1mm x 6.2mm x 2.5mm
- DC Coupling Capacitors
- No external control lines or power supply required
- RoHS Compliant

Description:

The RFLM-301511QC-392 SMT Silicon PIN Diode Limiter Module offers both High Power CW and Peak protection in the UHF Band region. It is based on proven hybrid assembly techniques utilized extensively in high reliability, mission critical applications. The RFLM-301511QC-392 offers excellent thermal characteristics in a compact, low profile 10mm x 6mm x 2.5mm package. The RFLM-301511QC-392 is designed for optimal small signal insertion loss permitting extremely low receiver noise figure while simultaneously offering excellent large input signal Flat Leakage for effective receiver protection in the UHF Band frequency range.

The limiter RF circuit characteristics provide outstanding passive receiver protection (Always On) which protects against High Average Power up to +56 dBm, High Peak Power up to +56 dBm pulsed, and maintains low flat leakage to less than +19 dBm.

ESD and Moisture Sensitivity Rating

The RFLM-301511QC-392 Limiter Module carries a Class 0 ESD rating (HBM) and an MSL 1 moisture rating.

Thermal Management Features

The RFLM-301511QC-392 base substrate has been designed to offer superior long term reliability in the customer's application by utilizing ultra-thin Au plating to combat Au embrittlement concerns. Also, a proprietary

design methodology has minimized the thermal resistance from the PIN Diode junction to base plate. The two stage limiter design employs a second stage Schottky and quarter wavelength spacer detector circuit which permits ultra-fast turn on of the High Power PIN Diodes. This circuit topology coupled with the thermal characteristic of the substrate design enables reliably handling High Input RF Power up to +56 dBm CW and RF Peak Power levels up to +56 dBm (20 ms pulse width @ 40% duty cycle with base plate temperature at 75°C).

Absolute Maximum Ratings

@ Zo=50Ω, T_A= +25°C as measured on the base ground surface of the device.

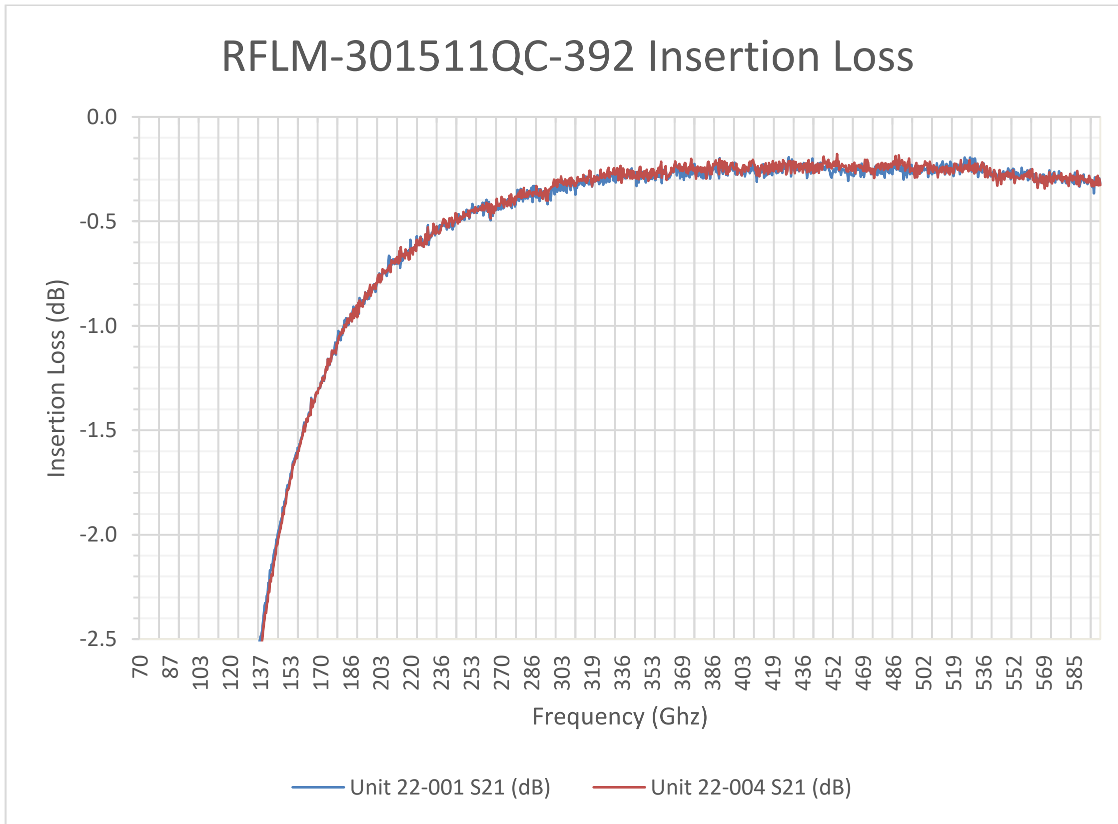
Parameter	Conditions	Absolute Maximum Value
Operating Temperature		-65°C to 125°C
Storage Temperature		-65°C to 150°C
Junction Temperature		175°C
Assembly Temperature	T = 30 seconds	260°C
RF Peak Incident Power	T_{CASE}=75°C, source and load VSWR < 1.2, RF Pulse width = 20 msec, duty cycle = 40%, derated linearly to 0 W at T_{CASE}=150°C (See note 1)	+56 dBm
RF CW Incident Power		+56 dBm
RF Input & Output DC Block Capacitor Voltage Breakdown		100 V DC
Thermal Resistance θ_{JC}	Junction to bottom of package	24.5 °C/W

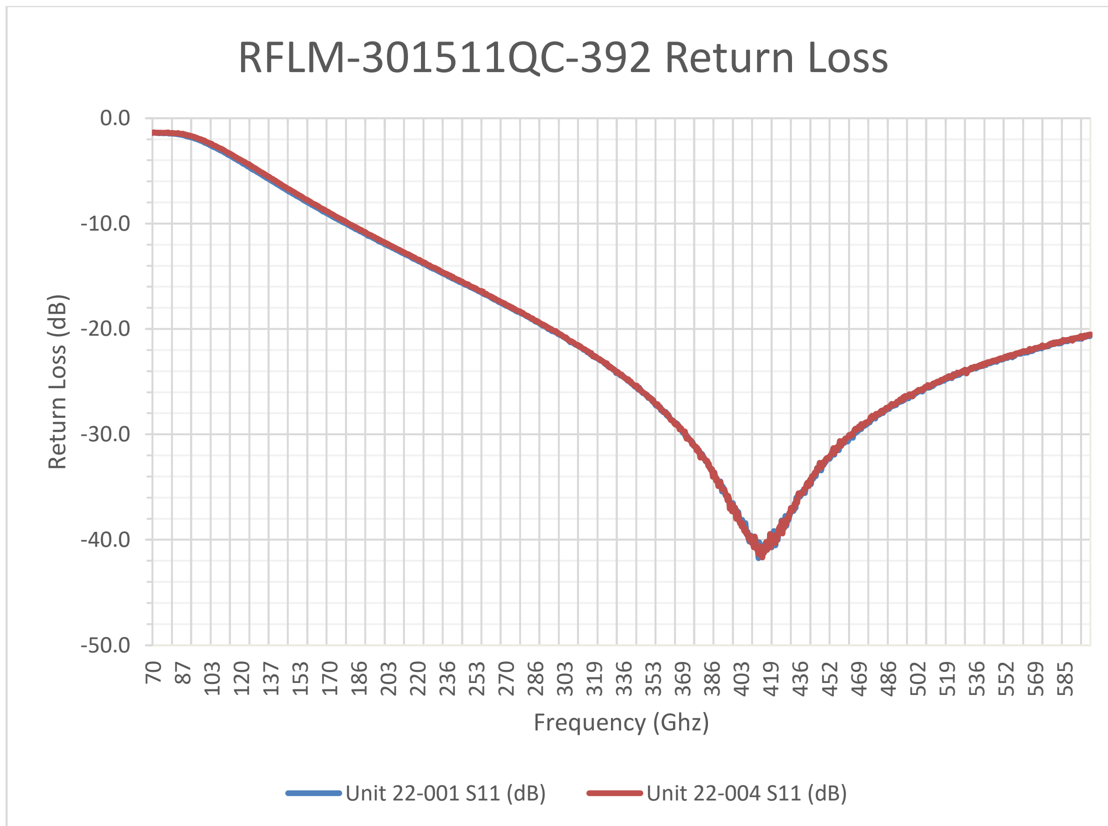
Note 1: T_{CASE} is defined as the temperature of the bottom ground surface of the device.

RFLM-301511QC-392 Electrical Specifications

@ Zo=50Ω, TA= +25°C as measured on the base ground surface of the device.

Parameters	Symbol	Test Conditions	Min Value	Typ Value	Max Value	Units
Frequency	F	300 MHz ≤ F ≤ 512 MHz	300		512	MHz
Insertion Loss	IL	P_{in}= -20 dBm, F = 300 – 512 MHz		0.4	0.7	dB
Insertion Loss Rate of Change vs Operating Temperature	ΔIL	300 MHz ≤ F ≤ 512 MHz, Pin ≤ -20 dBm		0.005		dB/°C
Return Loss	RL	Pin= -20 dBm, F = 300 - 512 MHz	18			dB
Input 1 dB Compression Point	IP_{1dB}	300 MHz ≤ F ≤ 512 MHz		12		dBm
2nd Harmonic	$2F_o$	P_{in}= 0 dBm, F_o= 512 MHz		-45		dBc
Peak Incident Power	$P_{inc\ (PK)}$	RF Pulse = 20 msec, duty cycle = 40%, t_{rise} ≤ 2us, t_{fall} ≤ 2 usec			56	dBm
CW Incident Power	$P_{inc(CW)}$	300 MHz ≤ F ≤ 512 MHz			56	dBm
Flat Leakage	FL	P_{in} = 56 dBm, RF Pulse width = 20 ms, duty cycle = 40%, t_{rise}≤ 2 us, t_{fall}≤ 2 us		19		dBm
Spike Leakage Power	SLP	Pin = 56 dBm, RF Pulse width = 20 ms, duty cycle = 40%		28		dBm
Spike Leakage Energy	SLE	Pin = 56 dBm, RF Pulse width = 20 ms, duty cycle = 40%		0.5		erg
Recovery Time	T_R	50% falling edge of RF Pulse to 1 dB IL, Pin = 56 dBm peak, RF PW = 20 ms, duty cycle = 40%, trise ≤ 2us, t_{fall} ≤ 1 usec		7.5		usec


RFLM-301511QC-392 Insertion Loss
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
Insertion Loss (dB)
70
87
103
120
137
153
170
186
203
220
236
253
270
286
303
319
336
353
369
386
403
419
436
452
469
486
502
519
536
552
569
585
Frequency (Ghz)
Unit 22-001 S21 (dB)
Unit 22-004 S21 (dB)

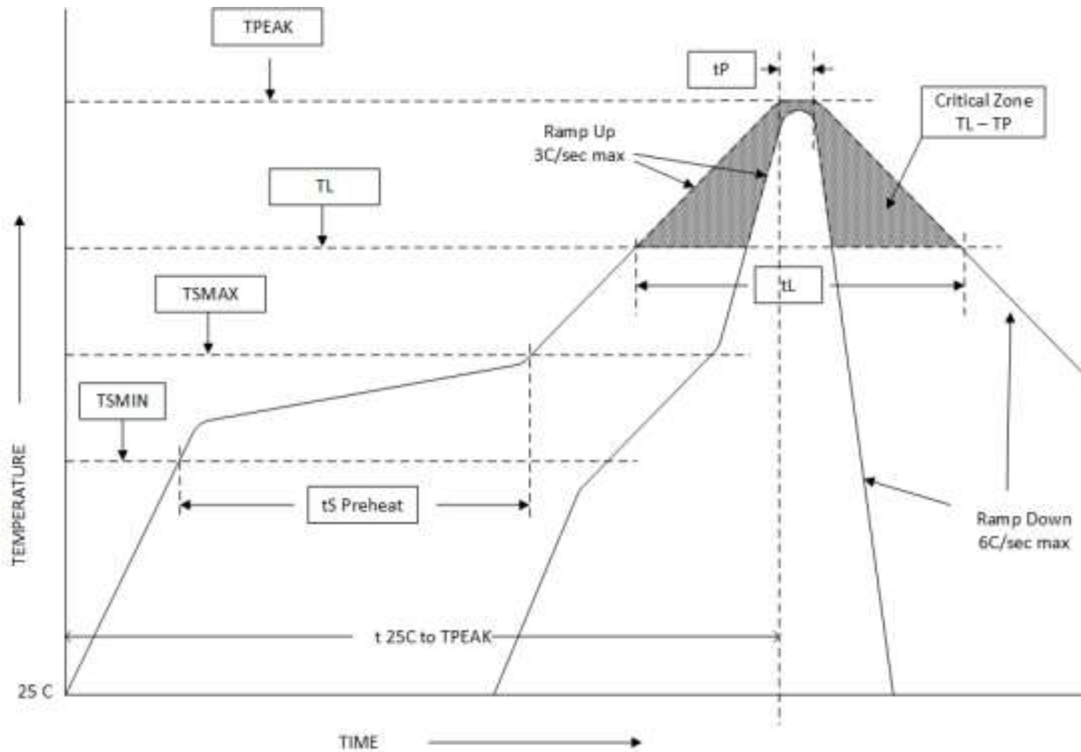

RFLM-301511QC-392 Return Loss
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
Return Loss (dB)
70
87
103
120
137
153
170
186
203
220
236
253
270
286
303
319
336
353
369
386
403
419
436
452
469
486
502
519
536
552
569
585
Frequency (Ghz)
Unit 22-001 S11 (dB)
Unit 22-004 S11 (dB)

Assembly Instructions

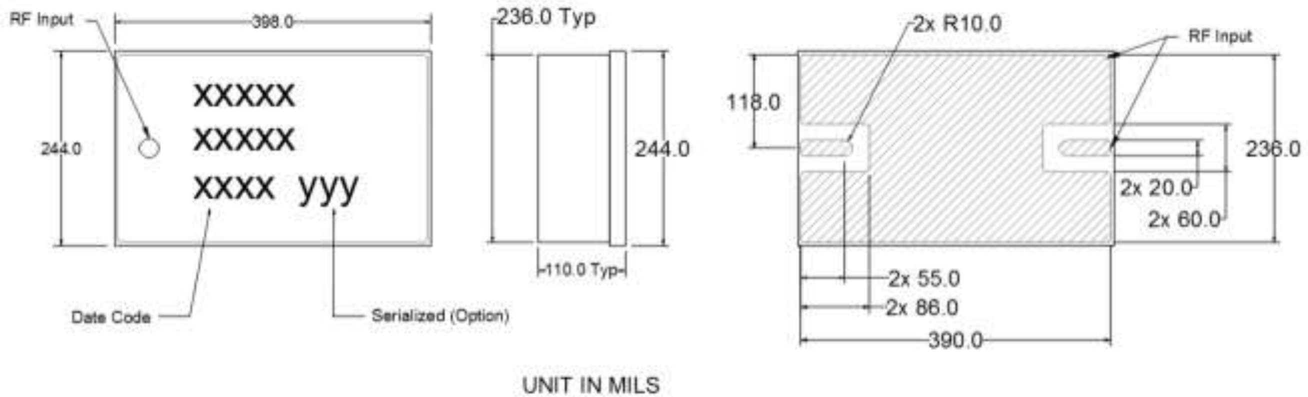
The RFLM-301511QC-392 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

Profile Parameter	Sn-Pb Assembly Technique	RoHS Assembly Technique
Average ramp-up rate (T_L to T_P)	3^oC/sec (max)	3^oC/sec (max)
Preheat Temp Min (T_{smin}) Temp Max (T_{smax}) Time (min to max) (t_s)	 100^oC 150^oC 60 – 120 sec	 100^oC 150^oC 60 – 120 sec
T_{smax} to T_L Ramp up Rate		 3^oC/sec (max)
Peak Temp (T_P)	225^oC $+0^oC$ / -5^oC	260^oC $+0^oC$ / -5^oC
Time within 5^oC of Actual Peak Temp (T_P)	10 to 30 sec	20 to 40 sec
Time Maintained Above: Temp (T_L) Time (t_L)	 183^oC 60 to 150 sec	 217^oC 60 to 150 sec
Ramp Down Rate	6^oC/sec (max)	6^oC/sec (max)
Time 25^oC to T_P	6 minutes (max)	8 minutes (max)

Solder Re-Flow Time-Temperature Profile



RFLM-301511QC-392 Limiter Module Package Outline Drawing



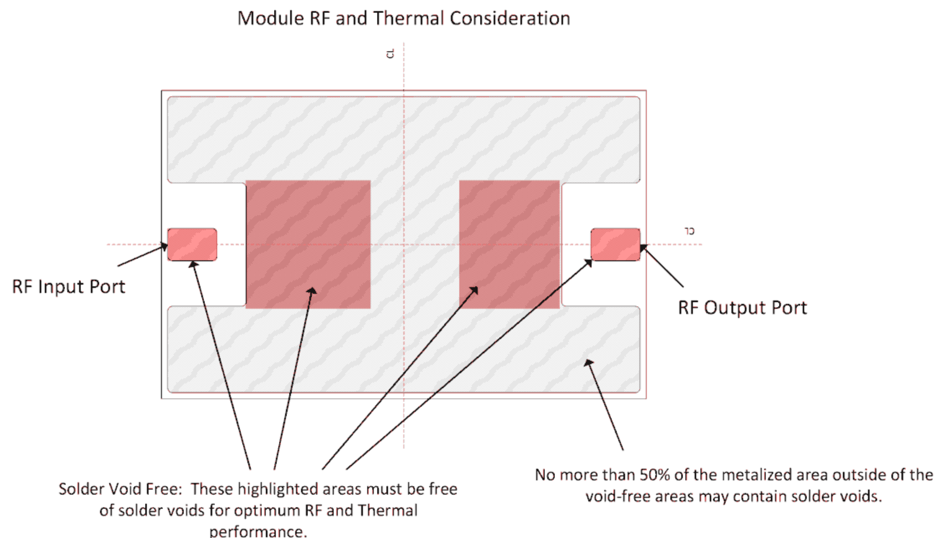
Notes:

1) Metalized area on backside is the RF, DC and Thermal ground. In user's end application this surface temperature must be managed to meet the power handling requirements.
2) Back side metallization is thin Au termination plating to combat Au embrittlement (Au plated over Cu).

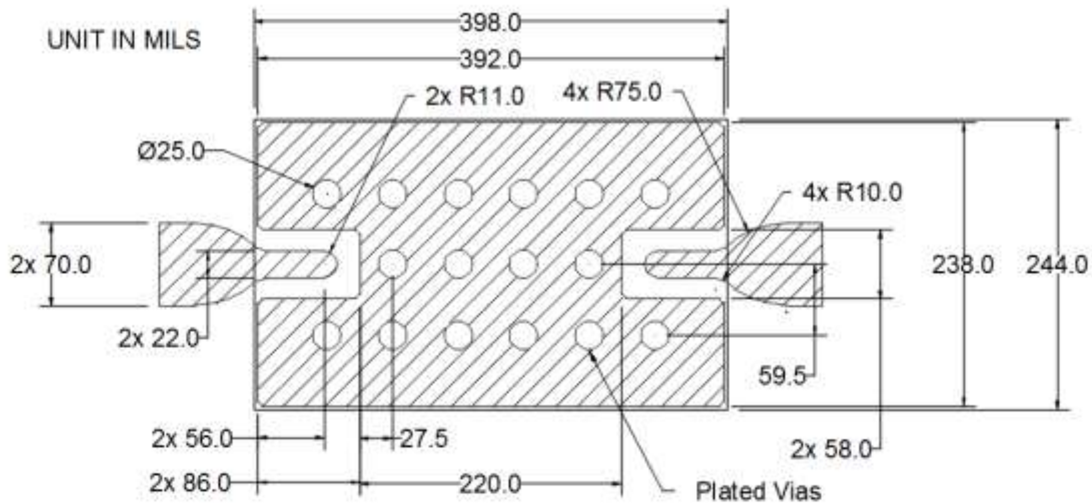
Thermal Design Considerations:

The design of the RFLM-301511QC-392 Limiter Module permits the maximum efficiency in thermal management of the PIN Diodes while maintaining extremely high reliability. Optimum Limiter performance and reliability of the device can be achieved by the maintaining the base ground surface temperature of less than 85°C.

There must be a minimal thermal and electrical resistance between the limiter bottom surface and ground. Adequate thermal management is required to maintain a T_{JC} at less than +175°C and thereby avoid adversely affecting the semiconductor reliability. Special care must be taken to assure that minimal voiding occurs in the solder connection in the area shaded in red in the figure shown below:



Recommended RFLM-301511QC-392 Solder Foot Print



Notes:

1) Recommended PCB material is Rogers 4003C, 32 mils thick (RF Input and Output trace width needs to be adjusted from the recommended footprint.)
2) Hatched area is RF, DC and Thermal Ground.
3) Unit = mils
4)

Part Number Ordering Detail:

The RFLM-301511QC-392 Limiter Module is available in the following format:

Part Number	Description	Packaging
RFLM-301511QC-392	UHF Band Limiter, Input & Output Blocking Caps	Gel-Pack