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RFuW Engineering Pte. Ltd.

RFLM-872113HC-150

X Band Medium Power Passive Limiter Module: Ultra Low Flat Leakage & Fast Recovery Time

Features:

- Frequency Range: 8.7 to 10.7 GHz
- Peak Power +46 dBm
- Average Power: +43 dBm
- Insertion Loss: <1.0 dB
- Return Loss: >13 dB
- Flat Leakage Power: <14 dBm
- Spike Energy Leakage: <0.5 ergs
- Recovery Time: 500 nsec
- SMT Limiter Module: 9mm x 6mm x 2.5mm
- DC Blocking Capacitors
- "Always On Protection"
    - - No external control lines or power supply required
- RoHS Compliant

Description:

The RFLM-872113HC-150 SMT Limiter Module offers "Always On" High Power Peak and CW protection in the X-Band region. This Limiter Module is based on proven hybrid assembly technique utilized extensively in high reliability, mission critical applications. The RFLM-872113HC-150 offers excellent thermal characteristics in a compact, low profile 9mm x 6mm x 2.5mm package. It was 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 X-Band frequency range. The RFLM-872113HC-150 offers exceptionally short Recovery Time to minimize blind periods following a receiving a high power pulsed signal.

The RFLM-872113HC-150 Limiter Module provides outstanding passive receiver protection (Always on) which protects against High Average Power up to +43 dBm @ T_{case}=+55°C, and up to +46 dBm (Peak) Pulse Width = 10 usec, Pulse Repetition Rate = 5%, T_{case}=+55°C, maintains low flat leakage to less than 14 dBm (typ), and reduces typical Spike Leakage to less than 0.5 ergs.

ESD and Moisture Sensitivity Rating

The RFLM-872113HC-150 Limiter Module carries a Class 1C ESD rating (HBM) and an MSL 1 moisture rating.

Thermal Management Features

The proprietary design methodology minimizes the thermal resistance from the diode junction to the base plate. The multi stage limiter design employs a detector circuit which enables ultra-fast turn on of the coarse stage limiters shunting high power signals to ground. This circuit topology coupled with the thermal characteristic of the substrate design enables the Limiter Module to reliably handling High Input RF Power up to +43 dBm CW and RF Peak Power levels up to +46 dBm (10 uSec pulse width @ 5.0% duty cycle) with base plate temperature at +55°C. The RFLM-872113HC-150 based substrate has been design to offer superior long term reliability in the customer's application by utilizing ultra-thin Au plating to combat Au embrittlement concerns.

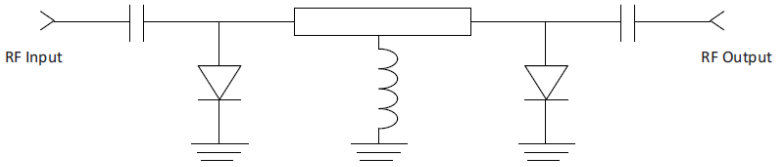
Absolute Maximum Ratings

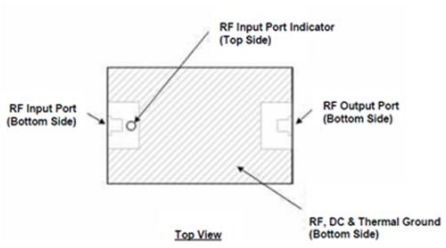
@ Z_0=50Ω, T_A= +25°C as measured on the base ground surface of the device.

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}= +55°C, RF Pulse width = 10 usec, Duty Cycle = 5%, derated linearly to 0 W at T_{CASE}=150°C (note 1)	+46 dBm
RF CW Incident Power	T_{CASE}= +55°C, derated linearly to 0 W at T_{CASE}=150°C (note 1)	+43 dBm
RF Input & Output DC Block Capacitor Voltage Breakdown		100 V DC

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

RFLM-872113HC-159 Limiter Module Schematic - with RF Coupling Capacitors



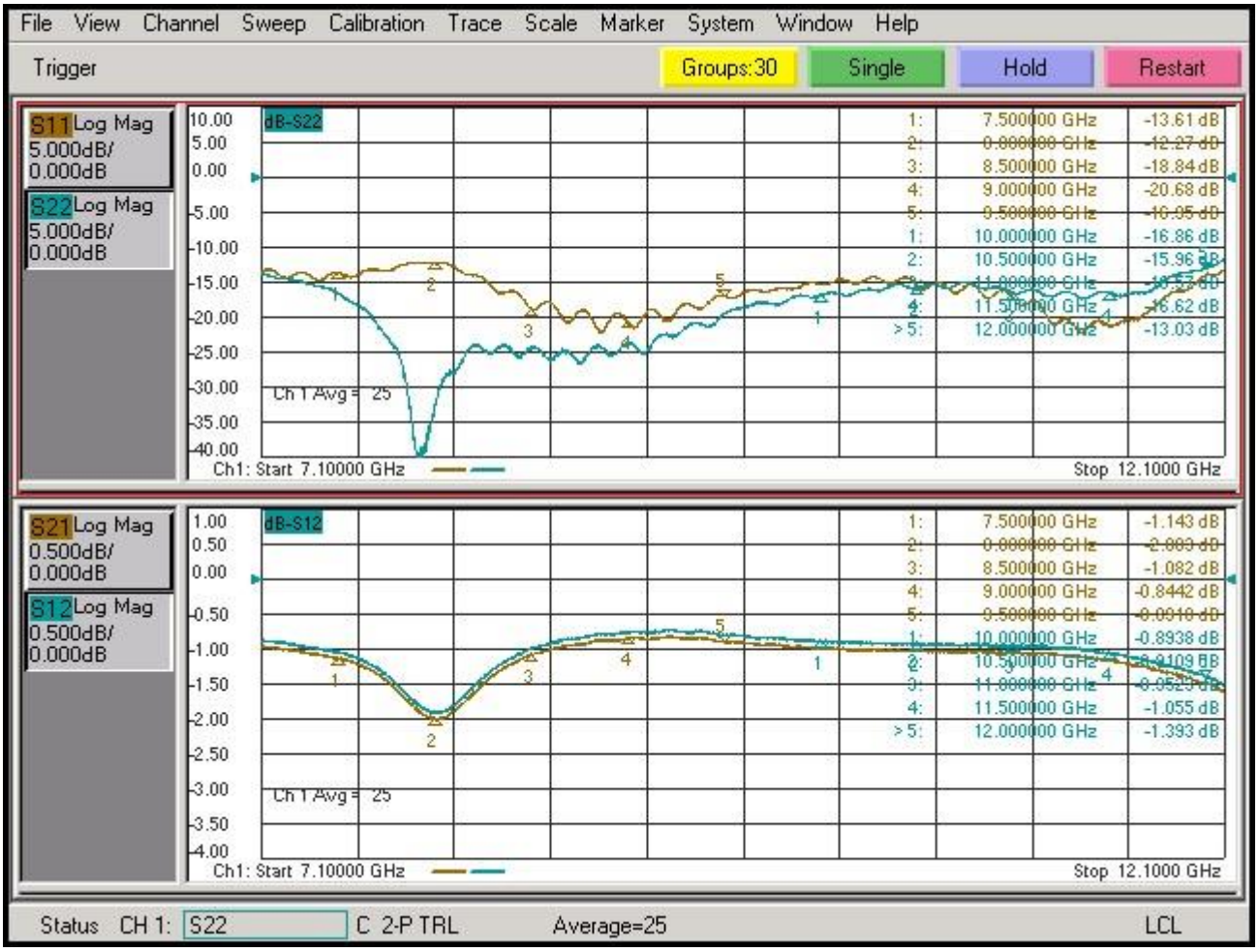


RFLM-872113HC-150 Electrical Specifications

@ Z_o=50Ω, TA= +25°C as measured on the base ground surface of the device unless otherwise noted

Parameters	Symbol	Test Conditions	Min Value	Typ Value	Max Value	Units
Frequency	F	8.6 GHz ≤ F ≤ 10.7 GHz	8.7		10.7	GHz
Insertion Loss	IL	8.6 GHz ≤ F ≤ 10.7 GHz, P_{in} = -20 dBm			1.0	dB
Insertion Loss Rate of Change vs Operating Temperature	ΔIL	8.6 GHz ≤ F ≤ 10.7 GHz, Pin ≤ -20 dBm		0.005		dB/°C
Return Loss	RL	8.6 GHz ≤ F ≤ 10.7 GHz, Pin= -20dBm	13	15		dB
Peak Incident Power	$P_{inc\ (PK)}$	RF Pulse = 10 usec, Duty Cycle = 5%, T_{case} = +55°C			+46	dBm
CW Incident Power	$P_{inc(CW)}$	8.6 GHz ≤ F ≤ 10.7 GHz T_{case} = +55°C			+43	dBm
Flat Leakage	FL	P_{in} = +46 dBm, RF Pulse Width = 10 us, Duty Cycle = 5%		14		dBm
Spike Leakage	SL	Pin = +46 dBm, RF Pulse Width = 10 us, Duty Cycle = 5%		0.5		ergs
Recovery Time	T_R	50% falling edge of RF Pulse to 1 dB IL, Pin = +46 dBm peak, RF PW = 10 us, Duty Cycle = 5%		500		nsec

Small Signal RF Characteristics

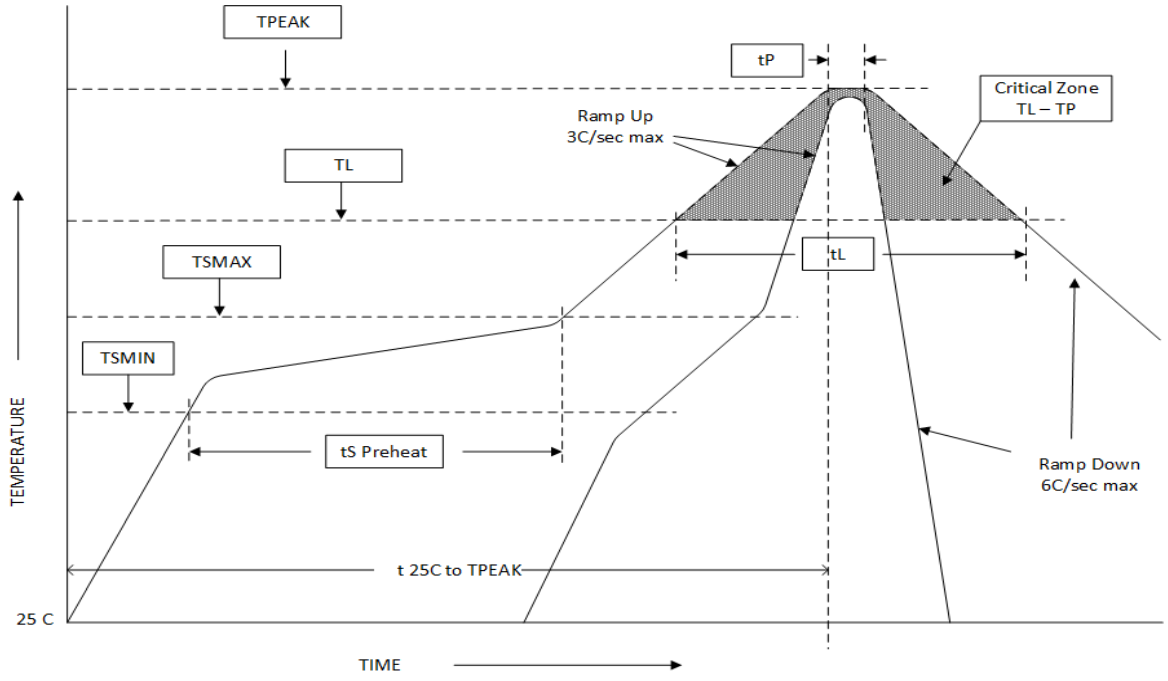


Assembly Instructions

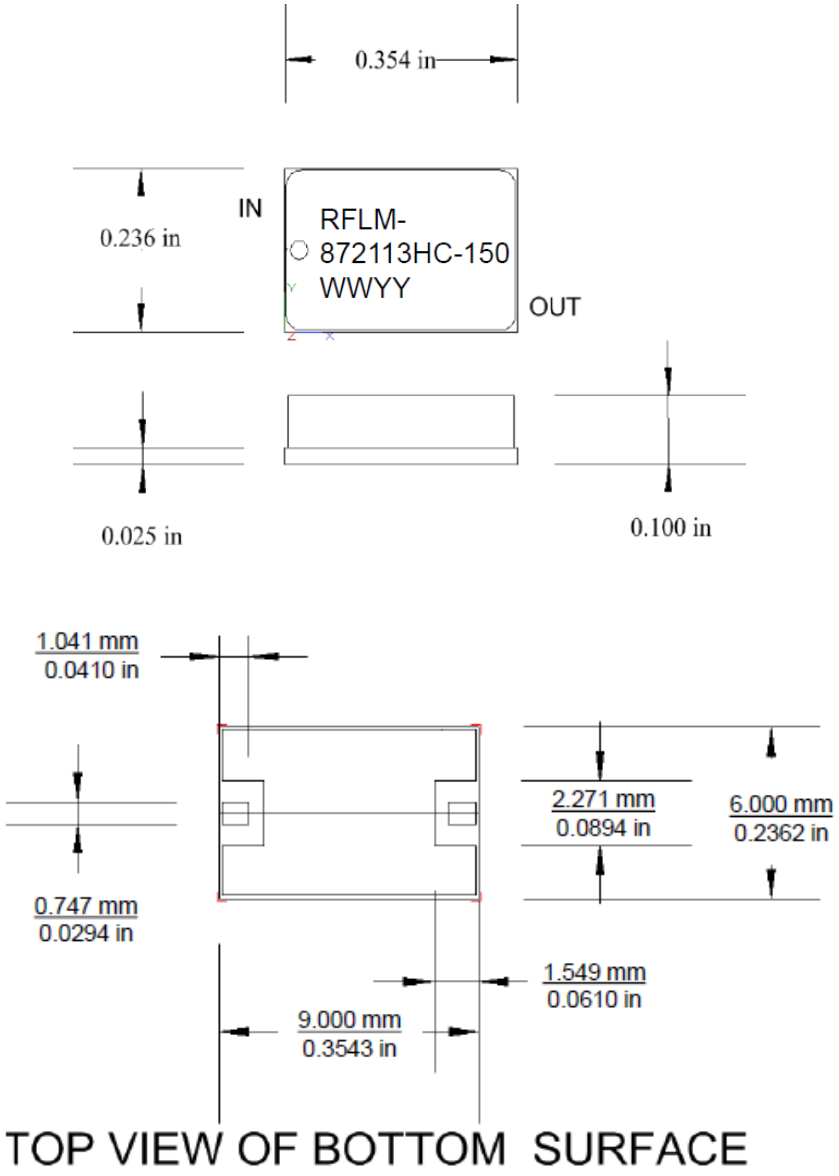
The RFLM-872113HC-150 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

Profile Parameter	Sn-Pb Assembly Technique	RoHS Assembly Technique
Average ramp-up rate (T_L to T_P)	3°C/sec (max)	3°C/sec (max)
Preheat Temp Min (T_{smin}) Temp Max (T_{smax}) Time (min to max) (t_s)	 100°C 150°C 60 – 120 sec	 100°C 150°C 60 – 180 sec
T_{smax} to T_L Ramp up Rate		3°C/sec (max)
Peak Temp (T_P)	225°C +0°C / -5°C	260°C +0°C / -5°C
Time within 5°C of Actual Peak Temp (T_P)	10 to 30 sec	20 to 40 sec
Time Maintained Above: Temp (T_L) Time (t_L)	 183°C 60 to 150 sec	 217°C 60 to 150 sec
Ramp Down Rate	6°C/sec (max)	6°C/sec (max)
Time 25°C to T_P	6 minutes (max)	8 minutes (max)

Solder Re-Flow Time-Temperature Profile



RFLM-872113HC-150 Limiter Module Foot Print Drawing



Notes:

1) Plain surface 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-872113HC-150 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 plate temperature to a minimum via the use of a heat sink applied in the direct thermal path beneath the surface of the limiter.

There must be a minimal thermal and electrical resistance between the limiter module and ground. Adequate thermal management is required to maintain a Tjc 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 beneath the limiter.

Part Number Ordering Detail:

The RFLM-872113HC-150 Limiter Module is available in the following format.

Part Number	Description	Packaging
RFLM-872113HC-150	X-Band Limiter with Input & Output DC Blocking Caps	Gel Pack
RFLM-872113HC-150 SS EVB	RFLM-872113HC-150 Small Signal Evaluation Board	Box
RFLM-872113HC-150 HP EVB	RFLM-872113HC-150 High Power Evaluation Board	Box