



## RFLM-102202Qx-290

### Quasi Active High Power L Band PIN Diode Limiter Module - SMT

#### Features:

- Frequency Range: 1.0 to 2.0 GHz
- Surface Mount L- Band Limiter Module: 8mm x 5mm x 2.5mm
- Peak Power: +60 dBm
- Average Power: +50 dBm
- Insertion Loss: < 0.30 dB
- Return Loss: >17 dB
- Flat Leakage: <17 dBm
- Spike Energy Leakage: <0.5 ergs
- Optional DC Coupling Capacitors
- No external control lines or power supply required
- RoHS Compliant

#### Description:

The RFLM-102202Qx-290 SMT Silicon PIN Diode Limiter Modules offer both High Power CW and Peak protection in the L-Band region. They are based on a proven hybrid assembly technique utilized extensively in high reliability, mission critical applications. The RFLM102202Qx-290 offers excellent thermal characteristics in a compact, low profile 8mm x 5mm x 2.5mm package. The RFLM-102202Qx-290 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 L Band frequency range.

The limiter RF circuit characteristics provide outstanding passive receiver protection (always on) which protects against High Average Power up to +50 dBm, High Peak Power up to +60 dBm pulsed, maintains low flat leakage to less than 17 dBm, and reduces Spike Leakage to less than 0.5 ergs.

#### ESD and Moisture Sensitivity Rating

The RFLM102202QX-290 Limiter Module carries a Class 1C ESD rating (HBM) and an MSL 1 moisture rating.

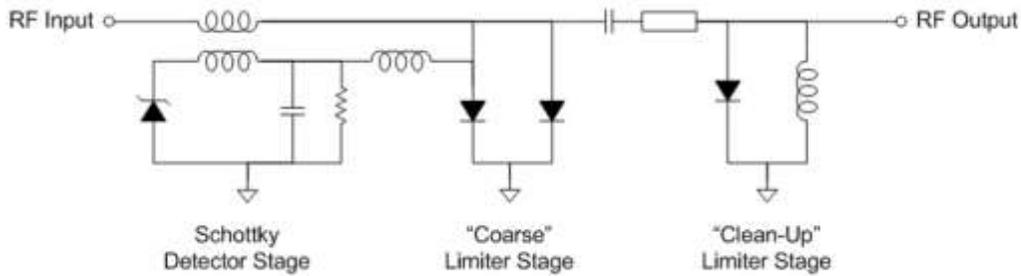
### Thermal Management Features

The RFLM-102202Qx-290 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. Also, a proprietary design methodology has minimized the thermal resistance from the PIN Diode junction to base plate ( $R_{THJ-A}$ ). The two stage limiter design employs a ultra-fast acting Clean Up Stage and quarter wavelength spacer circuit which permits ultra-fast turn on of the Coarse Stage 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 +50 dBm CW and RF Peak Power levels up to +60 dBm (25 uSec pulse width @ 5% duty cycle with base plate temperature at +85°C).

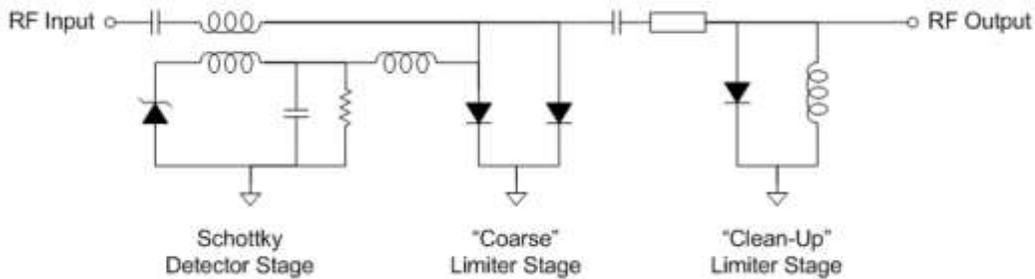
### Optional RF Coupling Capacitors

The RFLM-102202Qx-290 is offered in three different configurations: no RF coupling capacitors (x=A), a single input RF coupling capacitor (x=B), or both input & output RF coupling capacitors (x=C) as is show in the three options below:

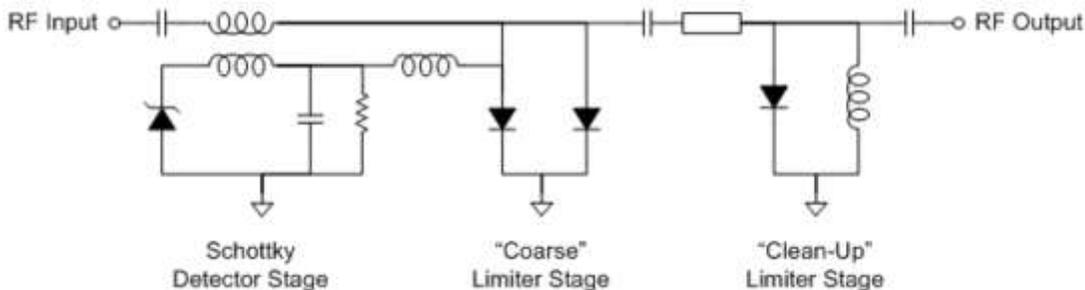
#### RFLM-102202QA-290 Limiter Module Schematic - No RF Coupling Capacitors



#### RFLM-102202QB-290 Limiter Module Schematic - RF Input Coupling Capacitors



#### RFLM-102202QC-290 Limiter Module Schematic - RF Input & Output Coupling Capacitors



## Absolute Maximum Ratings

@  $Z_0=50\Omega$ ,  $T_A= +25^\circ\text{C}$  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	$T_{\text{CASE}}= +85^\circ\text{C}$ , source and load VSWR < 1.2, RF Pulse width = 25 usec, duty cycle = 5%, derated linearly to 0 W at $T_{\text{CASE}}= +150^\circ\text{C}$ (See note 1)	+60 dBm
RF CW Incident Power		+50 dBm
RF Input & Output DC Block Capacitor Voltage Breakdown		100 VDC

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

## RFLM102202Qx-290 Electrical Specifications

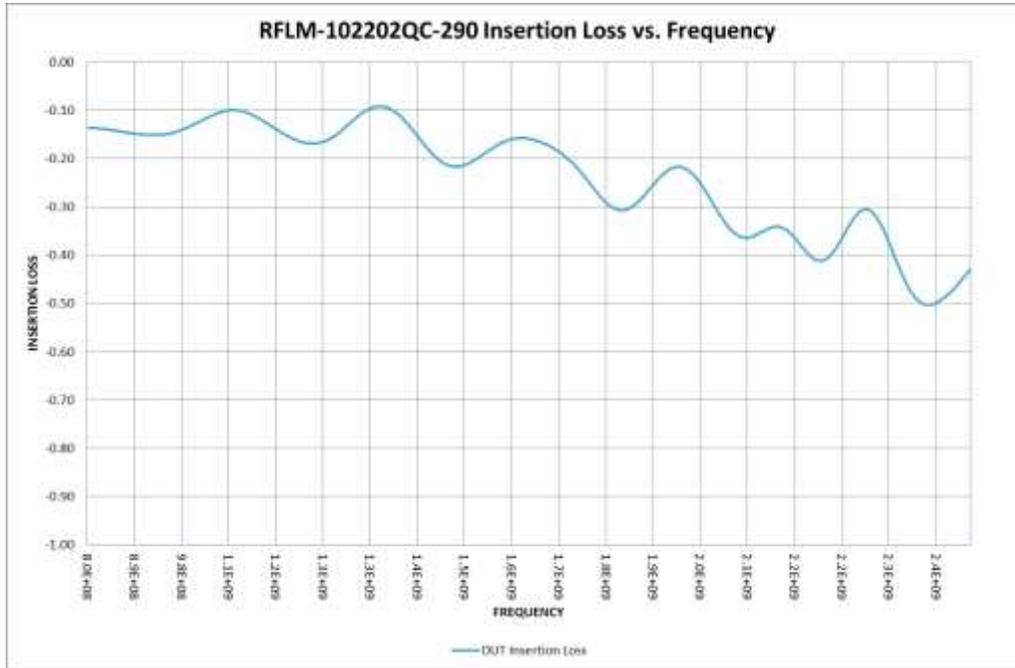
@  $Z_0=50\Omega$ ,  $T_A= +25^\circ\text{C}$  as measured on the base ground surface of the device.

Parameters	Symbol	Test Conditions	Min Value	Typ Value	Max Value	Units
Frequency	F	$1\text{ GHz} \leq F \leq 2\text{ GHz}$	0.4		2	GHz
Insertion Loss	IL	$1\text{ GHz} \leq F \leq 2\text{ GHz}$ , $P_{\text{in}}= 0\text{ dBm}$		0.25	0.35	dB
Insertion Loss Rate of Change vs Operating Temperature	$\Delta\text{IL}$	$1\text{ GHz} \leq F \leq 2\text{ GHz}$ , $P_{\text{in}} \leq -10\text{ dBm}$		0.005		dB/°C
Return Loss	RL	$1\text{ GHz} \leq F \leq 2\text{ GHz}$ , $P_{\text{in}}= 0\text{ dBm}$	15	17		dB
Input 1 dB Compression Point	$\text{IP}_{1\text{dB}}$	$1\text{ GHz} \leq F \leq 2\text{ GHz}$		10	12	dBm
2 <sup>nd</sup> Harmonic	$2F_0$	$P_{\text{in}}= 0\text{ dBm}$ , $F_0= 2.0\text{ GHz}$		-50	-45	dBc
Peak Incident Power	$P_{\text{inc}}(\text{PK})$	RF Pulse = 25 usec, duty cycle = 5%, $t_{\text{rise}} \leq 2\text{ us}$ , $t_{\text{fall}} \leq 2\text{ usec}$			60	dBm
CW Incident Power	$P_{\text{inc}}(\text{CW})$	$1\text{ GHz} \leq F \leq 2\text{ GHz}$			50	dBm
Flat Leakage	FL	$P_{\text{in}} = 60\text{ dBm}$ , RF Pulse width = 25 us, duty cycle = 5%, $t_{\text{rise}} \leq 2\text{ us}$ , $t_{\text{fall}} \leq 2\text{ us}$		17	19	dBm
Spike Leakage	SL	$P_{\text{in}} = 60\text{ dBm}$ , RF Pulse width = 25 us, duty cycle = 5%		0.5	0.6	erg
Recovery Time	$T_R$	50% falling edge of RF Pulse to 1 dB IL, $P_{\text{in}} = 50\text{ dBm}$ peak, RF PW = 25 us, duty cycle = 5%, $t_{\text{rise}} \leq 2\text{ us}$ , $t_{\text{fall}} \leq 1\text{ usec}$  50% falling edge of RF Pulse to 1 dB IL, $P_{\text{in}} = 60\text{ dBm}$ peak, RF PW = 50 us, duty cycle = 10%, $t_{\text{rise}} \leq 2\text{ us}$ , $t_{\text{fall}} \leq 1\text{ usec}$		1  1.5	2  3	usec

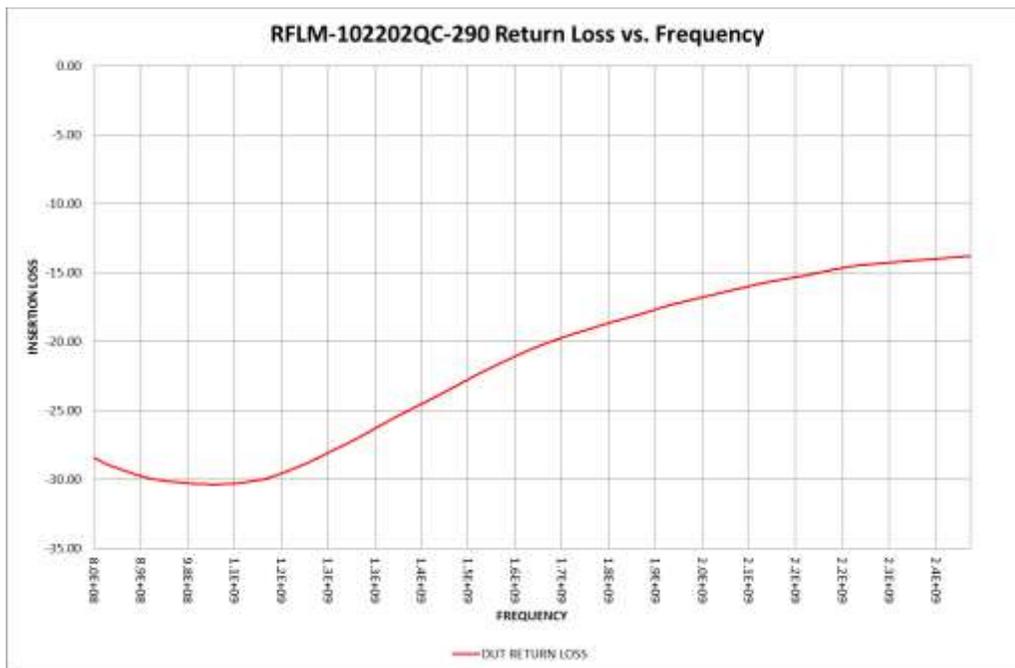
### RFLM-102202Qx-290 Typical Performance

$Z_0 = 50\Omega$ ,  $T_{CASE} = 25^\circ C$ , PIN = -20 dBm as measured on the Ground Plane of the device.

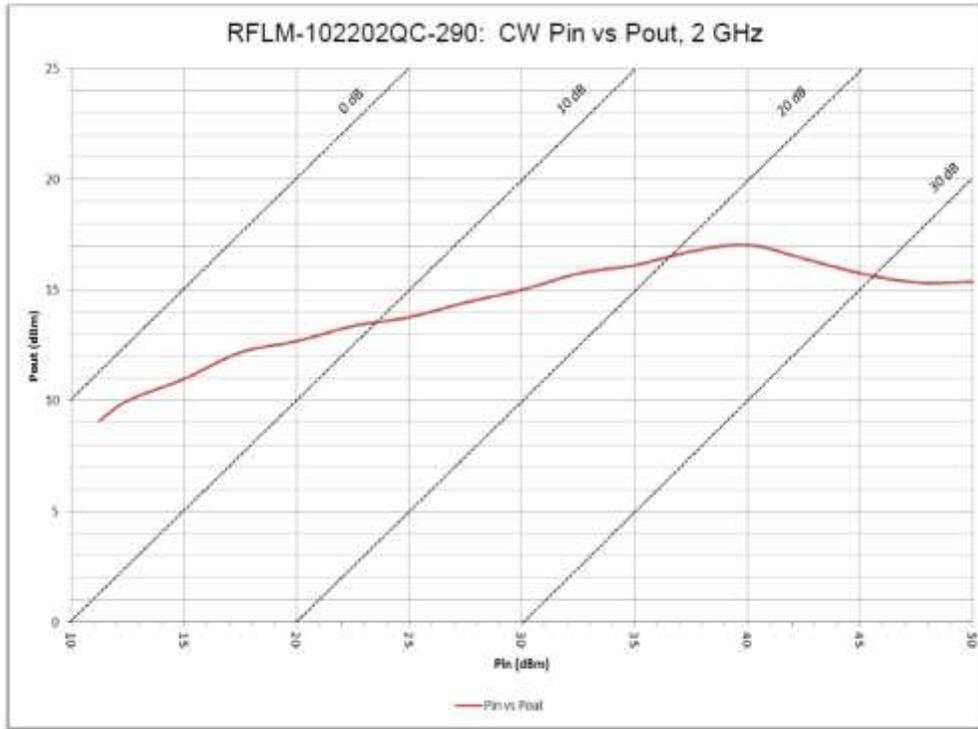
#### RFLM-102202QC-290 Insertion Loss vs Frequency



#### RFLM-102202QC-290 Return Loss vs Frequency



### RFLM-102202QC-290 Flat Leakage: Input Power vs Output Power, CW, 2GHz



### RFLM-102202QC-290 Flat Leakage Output Power vs Input Power

Pulse Width = 10usec; Duty Cycle = 1%; F = 2 GHz

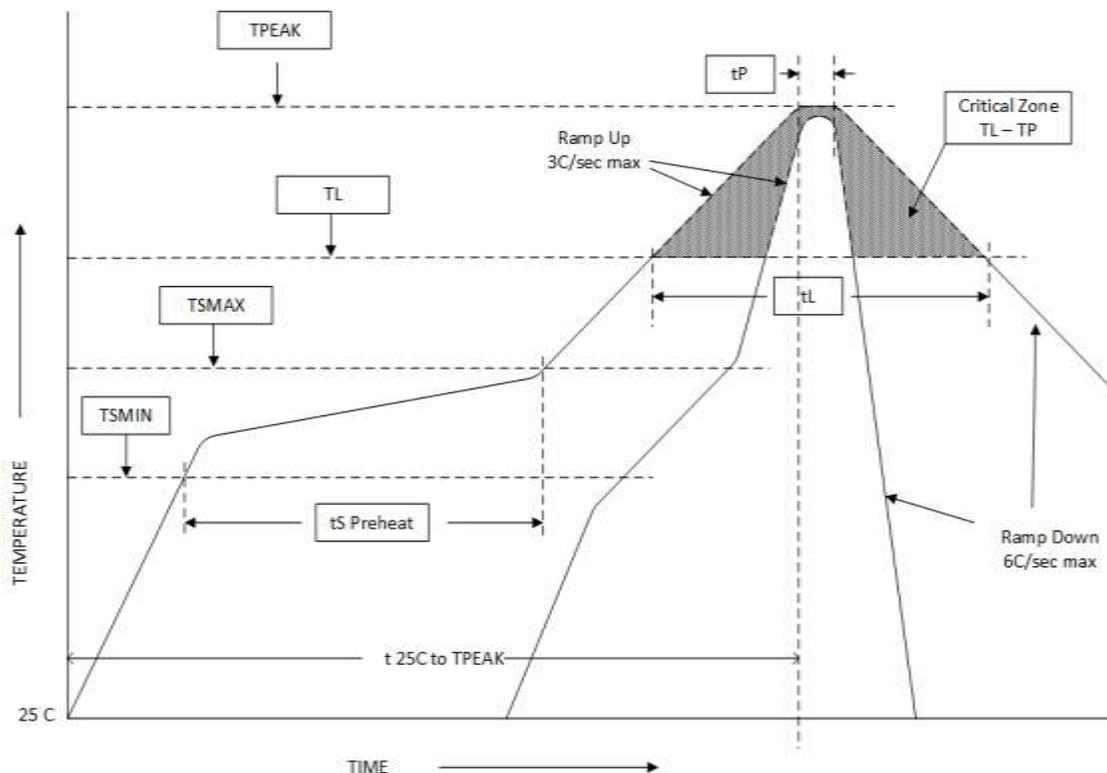


## Assembly Instructions

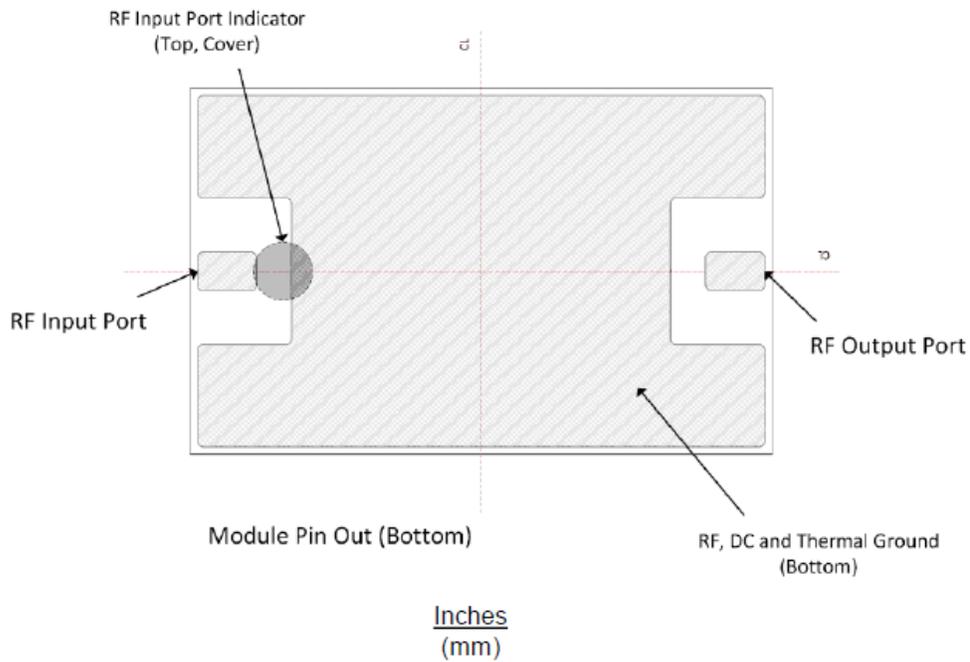
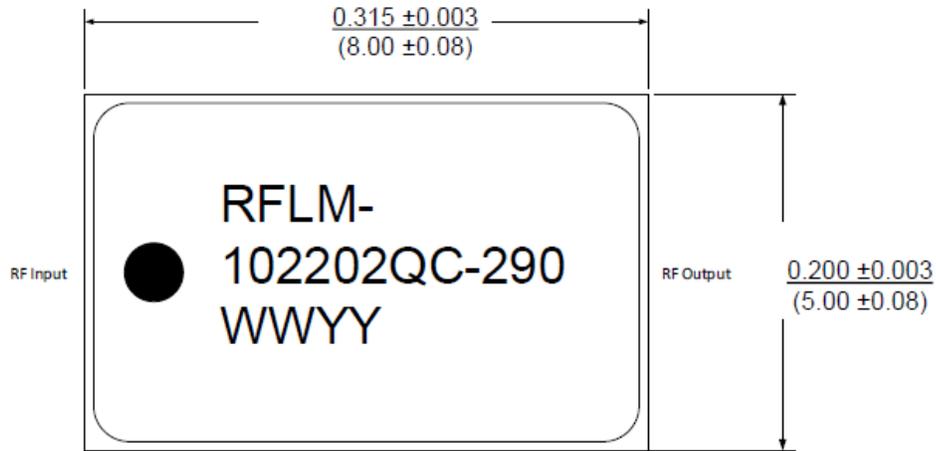
The RFLM-102202QX-290 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

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 ( $T_{smin}$ )	100°C	100°C
Temp Max ( $T_{smax}$ )	150°C	150°C
Time (min to max) ( $t_s$ )	60 – 120 sec	60 – 120 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 ( $T_L$ )	183°C	217°C
Time ( $t_L$ )	60 to 150 sec	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-102202Qx-290 Limiter Module Package Outline Drawing

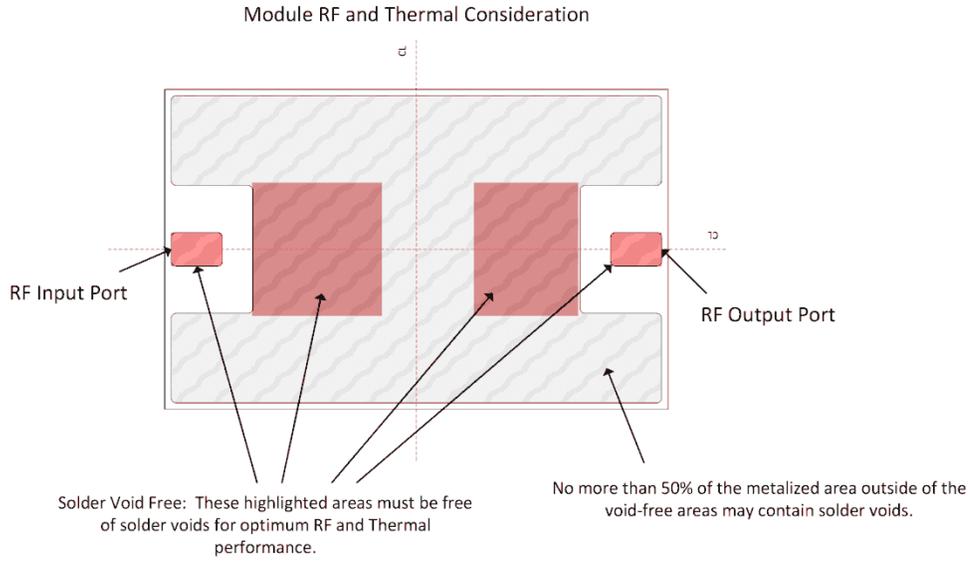


Notes:

- 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).







### Part Number Ordering Detail:

The RFLM-102202QXx290 family of Limiter Modules are available in the following formats:

Part Number	Description	Packaging
RFLM-102202QA-290	L-Band Limiter, No DC Blocking Caps	Gel Pack
RFLM-102202QB-290	L-Band Limiter, Input Blocking Cap Only	Gel Pack
RFLM-102202QC-290	L-Band Limiter, Input & Output Blocking Caps	Gel Pack