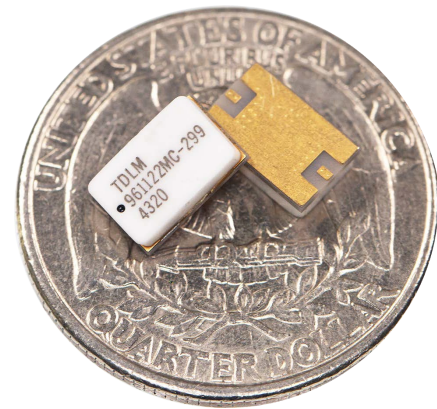


TDLM961122MC-299

High Power ARNS/IFF Limiter Module: Ultra Low Flat Leakage & Fast Recovery Time

Features

- SMT Limiter Module: 8 mm x 5 mm x 2.5 mm
- Frequency Range: 960 MHz to 1,215 MHz
- High Average Power Handling: +48 dBm
- High Peak Power Handling: +60 dBm
- Low Insertion Loss: < 0.4 dB
- Return Loss: > 15 dB
- Flat Leakage @ +30 dBm Input: < 12 dBm
- Flat Leakage @ +60 dBm Input: < 14 dBm
- Low Spike Energy Leakage: < 0.5 ergs
- Ultra Fast Recovery Time: < 200 nsec
- dc Blocking Capacitors
- RoHS Compliant



Description

The TDLM961122MC-299 SMT Silicon PIN Diode Limiter Module offers “Always On” High Power CW and Peak protection in the Aeronautical Radio Navigation Service (ARNS)/ Identification Friend or Foe (IFF) frequency range of 960 MHz to 1,215 MHz. This Limiter Module is based on proven hybrid assembly technique utilized extensively in high reliability, mission critical applications for several decades. The TDLM961122MC-299 offers excellent thermal characteristics in a compact, low profile 8 mm x 5 mm x 2.5 mm package. It was designed for optimal small signal insertion loss permitting extremely low receiver noise figure while simultaneously offering excellent large signal protection and exceptionally low Flat Leakage for effective receiver protection in the ARNS/IFF frequency range.

The TDLM961122MC-299 Limiter Module provides outstanding passive receiver protection (Always On) which protects against high average power up to +48 dBm @ $T_{case}=+85\text{ }^{\circ}\text{C}$, High Peak Power up to +60 dBm (Peak) Pulse Width = 1 μsec , Pulse Repetition Rate = 1%, $T_{case}=+85\text{ }^{\circ}\text{C}$, while maintaining low flat leakage to less than 14 dBm (typ), and reduces Spike Leakage to less than 0.5 ergs (typ).

ESD and Moisture Sensitivity Rating

The TDLM961122MC-299 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 coarse stage shunt limiter diode junction to base plate. This three stage passive limiter design employs a very sensitive detector circuit which enables ultra-fast turn on of both the intermediate and coarse stages. 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 +48 dBm CW and RF Peak Power levels up to +60 dBm (1 µsec pulse width @ 1.0% duty cycle) with base plate temperature at +85 °C. The TDLM961122MC-299 is based on a substrate designed to offer superior long term reliability in the customer's application by utilizing ultra-thin Au plating to combat corrosion.

Absolute Maximum Ratings

@ $Z_0 = 50 \Omega$, $T_A = +25 \text{ °C}$ 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 | $T_{CASE} = 85 \text{ °C}$, source and load VSWR < 1.2:1, RF Pulse width = 1 µsec, duty cycle = 1%, derated linearly to 0 W at $T_{CASE} = 150 \text{ °C}$ (note 1) | +60 dBm |
| RF CW Incident Power | $T_{CASE} = +85 \text{ °C}$, source and load VSWR < 1.2:1, derated linearly to 0 W at $T_{CASE} = 150 \text{ °C}$ (note 1) | +48 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.

TDLM961122MC-299 Electrical Specifications

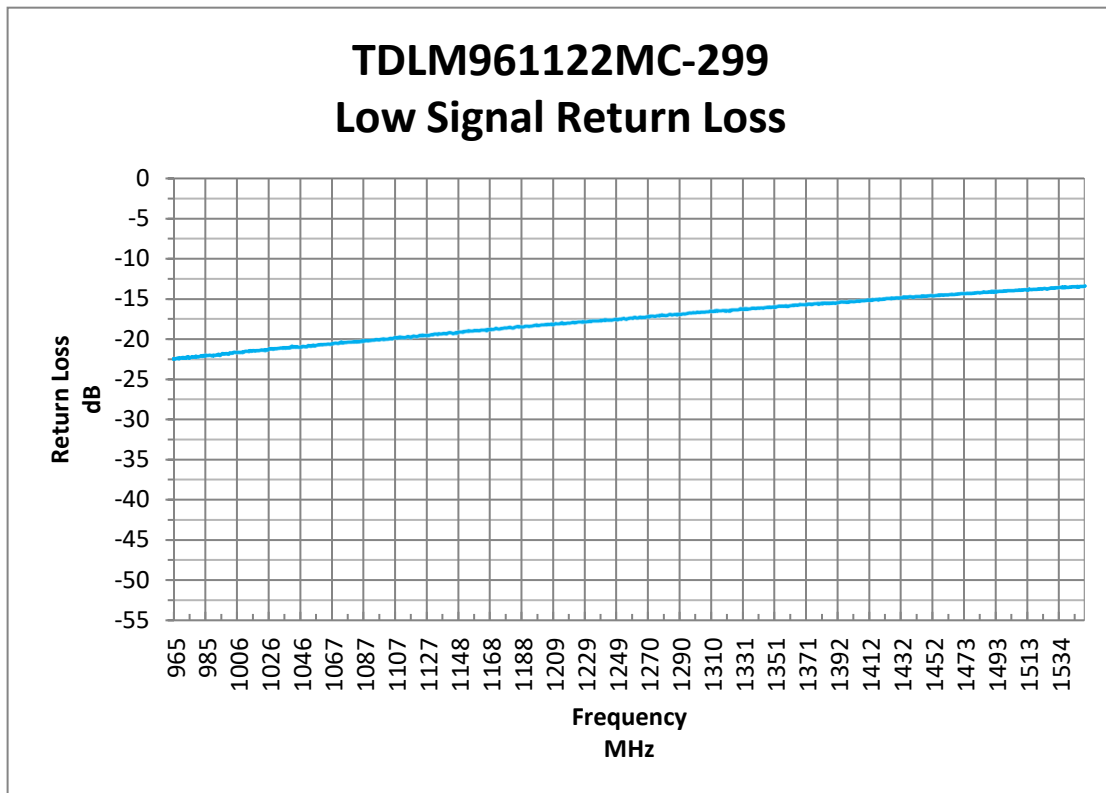
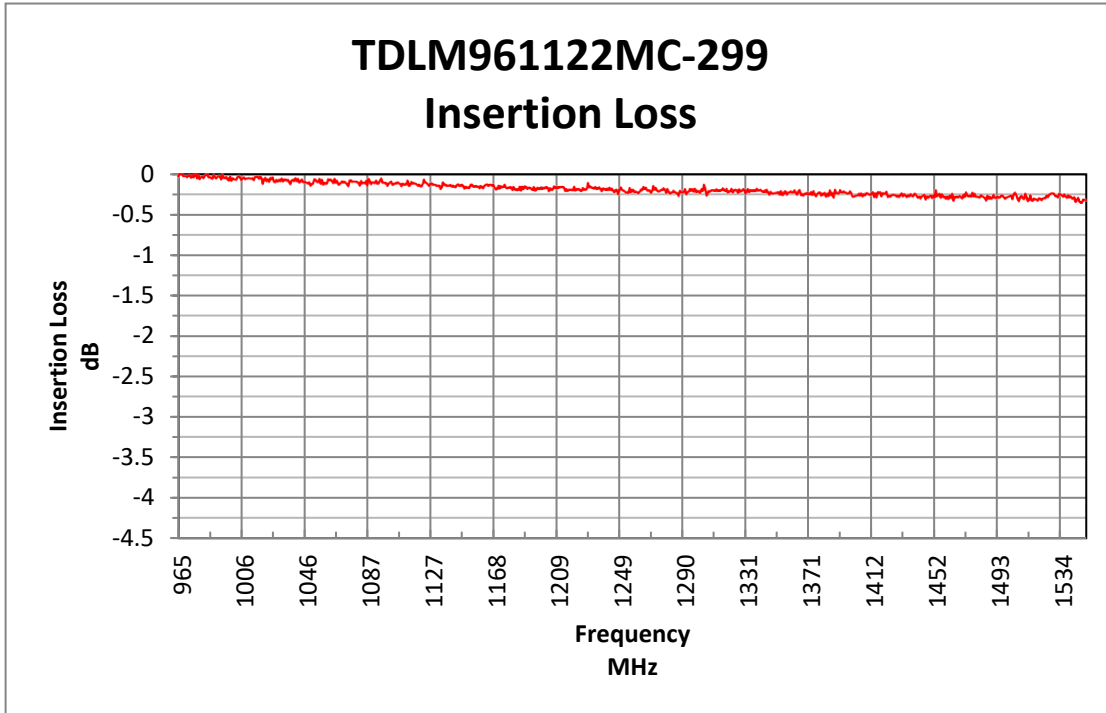
 @ $Z_0 = 50 \Omega$, $T_A = +25 \text{ }^\circ\text{C}$ as measured on the base ground surface of the device.

| Parameters | Symbol | Test Conditions | Min Value | Typ Value | Max Value | Units |
|---|---------------|---|-----------|-----------|-----------|-------|
| Frequency | F | $960 \text{ MHz} \leq F \leq 1,215 \text{ MHz}$ | 960 | | 1,215 | MHz |
| Insertion Loss | IL | $960 \text{ MHz} \leq F \leq 1,215 \text{ MHz}$, $P_{in} = -10 \text{ dBm}$ | | 0.3 | 0.4 | dB |
| Insertion Loss | IL | $F = 1,090 \text{ MHz}$, $P_{in} = -10 \text{ dBm}$ | | 0.3 | 0.4 | dB |
| IL Rate of Change vs Operating Temperature /1 | ΔIL | $960 \text{ MHz} \leq F \leq 1,215 \text{ MHz}$, $P_{in} \leq -10 \text{ dBm}$ | | 0.005 | | dB/°C |
| Return Loss | RL | $960 \text{ MHz} \leq F \leq 1,215 \text{ MHz}$, $P_{in} = -10 \text{ dBm}$ | 15 | | | dB |
| Return Loss | RL | $F = 1,090 \text{ MHz}$, $P_{in} = -10 \text{ dBm}$ | 16 | | | dB |
| Input 1 dB Compression Point | IP_{1dB} | $960 \text{ MHz} \leq F \leq 1,215 \text{ MHz}$ | 0 | 8 | 16 | dBm |
| Peak Incident Power /1 | $P_{inc(PK)}$ | RF Pulse = 1 μsec , duty cycle = 1% | | | +60 | dBm |
| CW Incident Power /1 | $P_{inc(CW)}$ | $960 \text{ MHz} \leq F \leq 1,215 \text{ MHz}$; $T_{case} = +85 \text{ }^\circ\text{C}$ | | | +48 | dBm |
| Flat Leakage /1 | FL | $P_{in} = +30 \text{ dBm}$, RF Pulse width = 1 μs , duty cycle = 1% | | | 12 | dBm |
| Flat Leakage /1 | FL | $P_{in} = +60 \text{ dBm}$, RF Pulse width = 1 μs , duty cycle = 1% | | | 14 | dBm |
| Spike Leakage /1 | SL | $P_{in} = +60 \text{ dBm}$, RF Pulse Width = 1 μs , duty cycle = 1% | | | 0.5 | erg |
| Recovery Time /1 | T_R | 50% falling edge of RF Pulse to 1 dB IL, $P_{in} = +60 \text{ dBm}$ peak, RF PW = 1 μs , duty cycle = 1% | | 100 | 200 | nsec |

Note /1: Guaranteed by characterization.

TDLM961122MC-299 Typical Performance

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

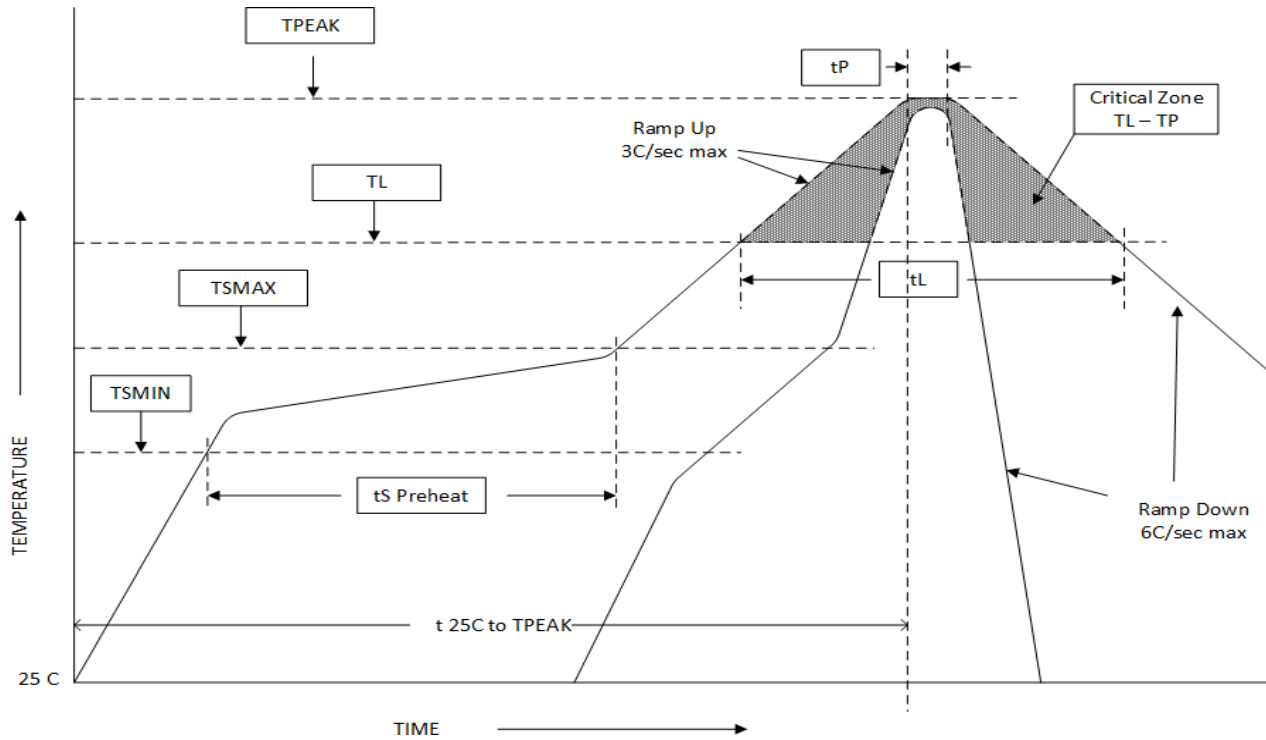


Assembly Instructions

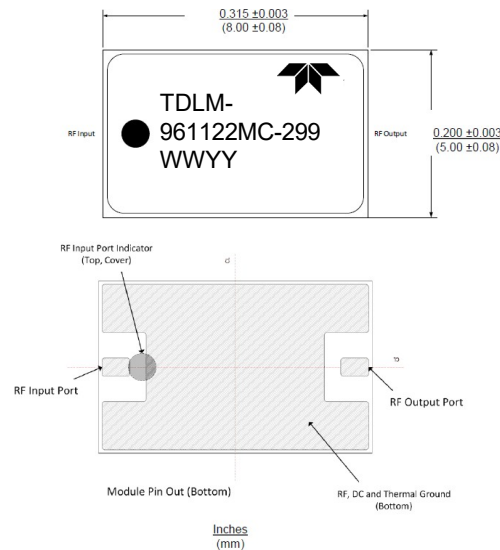
The TDLM961122MC-299 may be attached to the printed circuit card using solder reflow procedures using either RoHS or Sn63/ Pb37 type solders per the Table and Temperature Profile Graph shown below:

| 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 – 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) | 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



TDLM961122MC-299 Limiter Module Package Outline Drawing



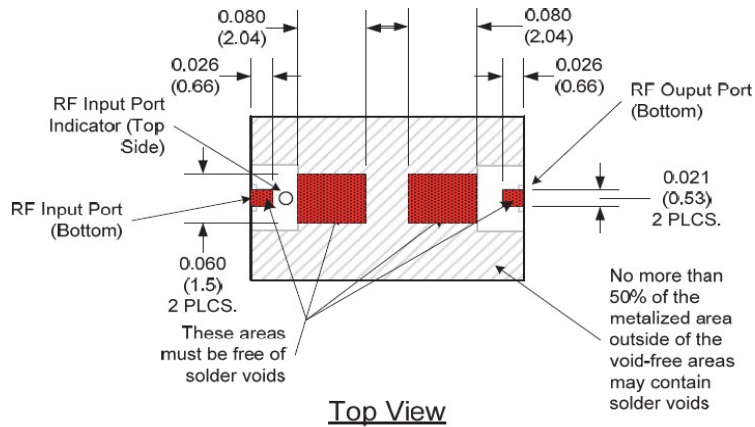
Notes:

- 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).
- 3) Unit = mils

Thermal Design Considerations:

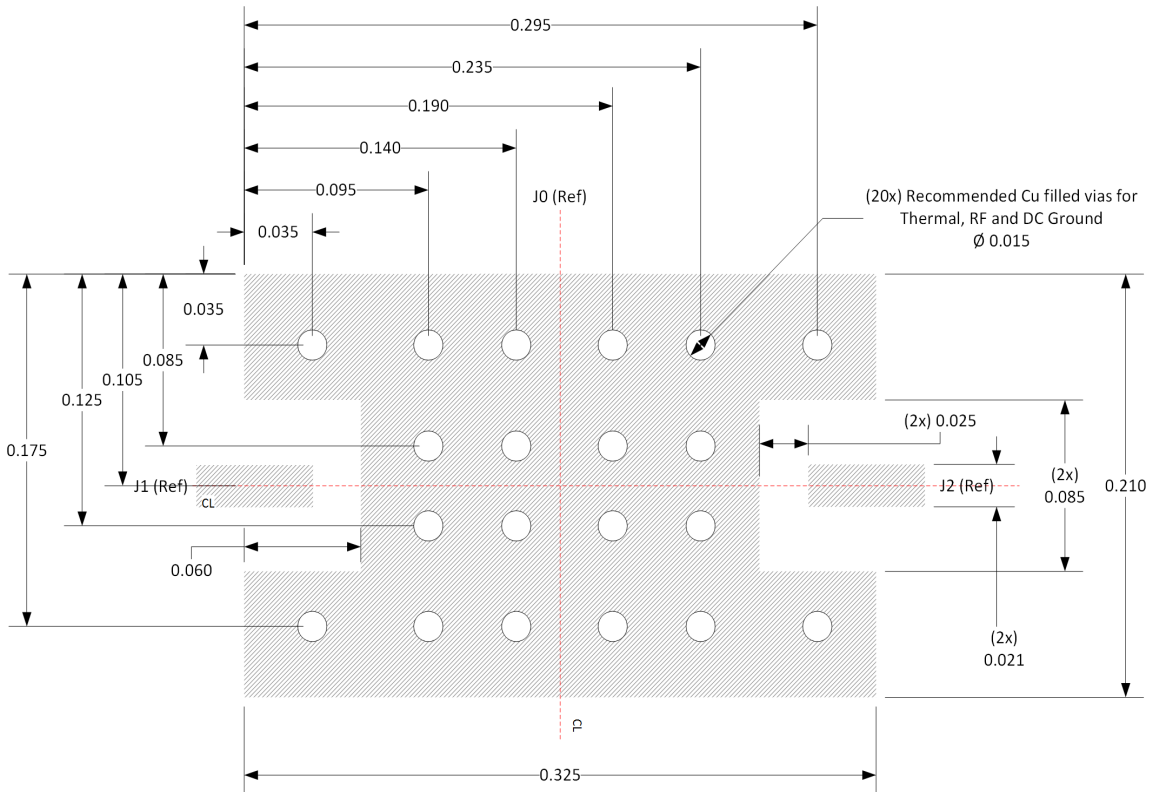
The design of the TDLM961122MC-299 Limiter Module permits the maximum efficiency in thermal management of the PIN Diodes while maintaining extremely high reliability. Optimum Limiter performance and reliability of the device can be achieved by the maintaining the base ground surface temperature of less than 85 °C.

There must be a minimal thermal and electrical resistance between the limiter module 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 areas shade in red in the figure shown below.



Dimensions in inches (mm).

Recommended RF Circuit Solder Footprint for the TDLM961122MC-299

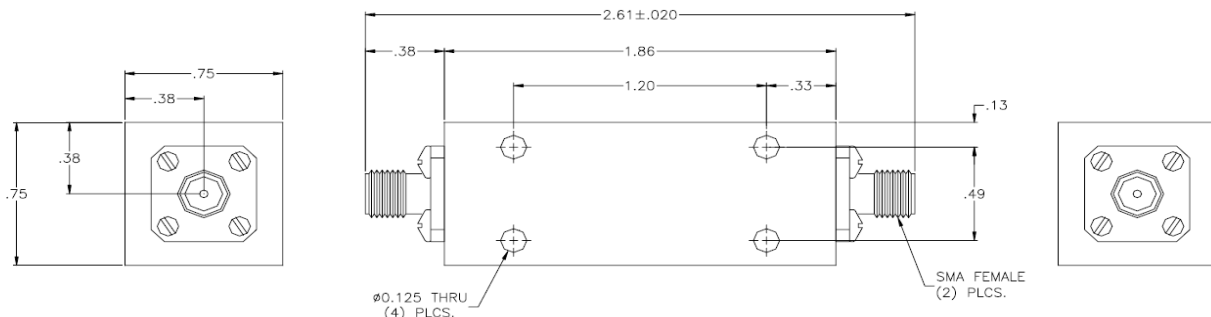


Notes:

- 1) Recommended PCB material is Rogers 4350B, 20 mils thick (RF Input and Output trace width needs to be adjusted from the recommended footprint.)
- 2) Plain surface is RF, DC and Thermal Ground. Vias should be solid Cu filled and Au plated for optimal heat transfer from backside of Limiter Module through circuit vias to thermal ground.
- 3) Unit = mils

Connectorized Package Option

The TDLM961122MC-299 High Power IFF Limiter is available in a Connectorized Package with two female SMA connectors (input & output) and is denoted by the "C" suffix: TDLM961122MC-299C. The packaged outline drawing is shown below:



TDLM961122MC-299

Product Specification

Part Number Ordering Detail:

The TDLM961122MC-299 Limiter Module is available in the following shipping formats:

| Part Number | Description | Packaging |
|----------------------|--|-----------|
| TDLM961122MC-299-EVK | TDLM961122MC-299 Evaluation Kit | 1/Box |
| TDLM961122MC-299 | IFF Band Limiter - Input & Output DC Blocking Caps | Gel Packs |
| TDLM961122MC-299C | SMA Connectorized IFF Band Limiter - Input & Output DC Blocking Caps | Gel Packs |

Contact Information

Teledyne e2v HiRel Electronics at: www.tdehirel.com
Contact us via email: hirel@teledyne.com

Document Categories

Preliminary Specification: The product is in a formative or design stage. The data sheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Advanced Information: The data sheet contains preliminary data. Additional data may be added at a later date. Teledyne e2v HiRel Electronics reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification: The data sheet contains final data.

In the event Teledyne e2v HiRel Electronics decides to change the specifications, Teledyne e2v HiRel will notify customers of the intended changes by issuing a CNF (Customer Notification Form).

Disclaimers: The information in this document is believed to be reliable. However, Teledyne e2v HiRel Electronics assumes no liability for the use of this information. Use shall be entirely at the user's own risk. No patent rights or licenses to any circuits described in this document are implied or granted to any third party. Teledyne e2v HiRel's products are not designed or intended for use in devices or systems intended for surgical implant, or in other applications intended to support or sustain life, or in any application in which the failure of the Teledyne e2v HiRel's product could create a situation in which personal injury or death might occur. Teledyne e2v HiRel Electronics assumes no liability for damages, including consequential or incidental damages, arising out of the use of its products in such applications.

Trademarks are the property of their respective owners.

Data Sheet is modified with permission from RFuW Engineering Pte, Ltd.