TriQuint | Qorvo

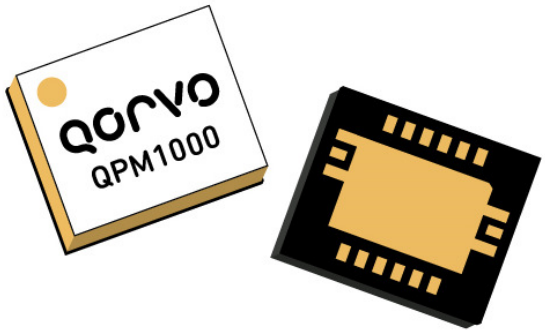
RFMD + TriQuint = Qorvo

QPM1000

2 -20 GHz Limiter/Low-Noise Amplifier

Applications

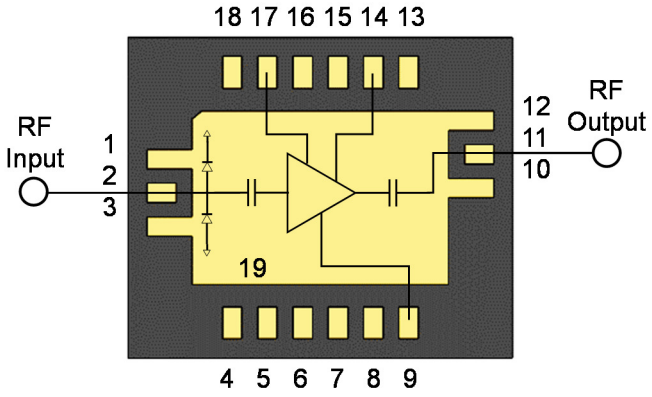
- Receiver Front End Building Block



Product Features

- Frequency Range: 2 – 20 GHz
- Input Power CW Survivability: 4 W
- Gain: > 17 dB
- Adjustable gain (> 30 dB using V_{G2})
- Noise Figure: < 2.0 dB (3-12 GHz)
  < 4.0 dB (outer frequencies)
- IM3: < –21 dBc (P_{IN} ≤ 0 dBm)
- Bias: V_D = 5 V, I_D = 100 mA, V_{G1} = -0.6 V typical, V_{G2} = +1.3 V
- Package dimensions: 6.00 x 5.00 x 1.72 mm

Functional Block Diagram



General Description

The Qorvo QPM1000 is an integrated limiter/LNA providing robust, high performance over the 2–20GHz frequency range. The QPM1000 delivers 17 dB small signal gain with gain control and > 18 dBm P1dB with a range of noise figure of 1.5–4 dB across frequency. In addition, the integrated limiter provides a robustness level of up to 4 W of incident power without performance degradation.

The QPM1000 is packaged in an air cavity, laminate-based 6 x 5 mm QFN for easy handling. With a small form factor coupled with both ports matched to 50 ohms and DC blocked, the QPM1000 is ideally suited to support both commercial and defense related applications where robust receiver front ends are required.

Lead-free and RoHS compliant.

Evaluation boards are available upon request.

Pad Configuration

Pad No.	Symbol
1, 3, 10, 12, 19	GND
2	RF Input
4 – 8, 13, 15, 16, 18	NC
9	V_{G1}
11	RF Output
14	V_D
17	V_{G2}

Ordering Information

Part	ECCN	Description
QPM1000	EAR99	2 – 20 GHz Limiter/LNA

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_D)	7 V
Gate Voltage Range (V_{G1})	-2 to 0 V
Gate Voltage Range (V_{G2})	-2 to +3 V
Drain Current (I_D)	144 mA
Gate Current Range (I_{G1})	–24 to +24 mA
Gate Current Range (I_{G2})	–24 to +24 mA
RF Input Power, CW, 50 Ω, 25 °C	36 dBm
RF Input Power, CW, 50 Ω, 85 °C	33 dBm
Incident Power, Pulsed[1], 50 W, 85 °C	40 dBm
Channel Temperature (T_{CH})	200 °C
Mounting Temperature (30 seconds)	260 °C
Storage Temperature	-55 to 150 °C

Note:
[1] Pulse conditions: PW = 100 us, Duty Cycle = 10%

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Recommended Operating Conditions

Parameter	Value
Drain Voltage (V_D)	5 V
Drain Current (I_{DQ})	100 mA
Gate Voltage (V_{G1}), typical	–0.6 V
Gate Voltage (V_{G2})	1.3 V
Operating Temperature Range	–40 to 85 °C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: 25 °C , V_D = 5 V, I_{DQ} = 100 mA, V_{G1} = -0.6 V Typical, V_{G2} = 1.3 V

Parameter	Min	Typical	Max	Units
Operation Frequency Range	2		20	GHz
Small Signal Gain		> 17		dB
Input Return Loss		> 9.7		dB
Output Return Loss		> 7.6		dB
Noise Figure: 2 GHz		2.8		dB
8 GHz		1.7		dB
14 GHz		2.3		dB
20 GHz		4.0		dB
Third-Order Intermodulation Distortion (P_{IN} ≤ 0 dBm/Tone, 10 MHz Tone Spacing)		> –21		dBc
Output Power (Saturation; P_{IN} = 10 dBm)		> 21		dBm
Output Power (1 dB Compression)		> 17		dBm
Gain Temperature Coefficient		–0.010		dB/°C
Noise Figure Temperature Coefficient		0.010		dB/°C
Output Power Temperature Coefficient		–0.004		dB/°C

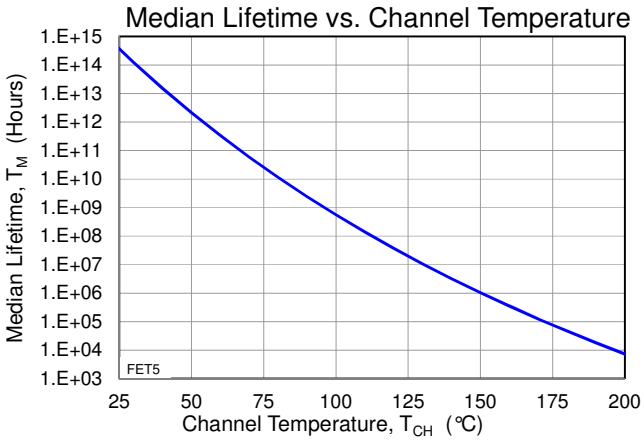
Thermal and Reliability Information

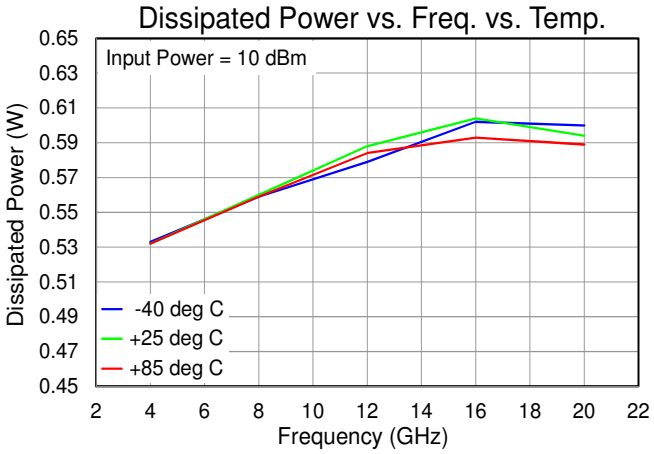
Parameter	Test Conditions	Value	Units
Thermal Resistance (θ_{JC}) (1)	T_{base} = 85°C, V_D = 5 V, I_{DQ} = 144 mA, Freq = 16 GHz, I_{D_Drive} = 144 A, P_{IN} = 10 dBm, P_{OUT} = 20.3 dBm, P_{DISS} = 0.562 W	30.2	ºC/W
Channel Temperature (T_{CH}) (Under RF drive)		102.0	°C
Median Lifetime (T_M)		4.77E08	Hrs

Notes:
1. Thermal resistance measured to back of package.

Median Lifetime

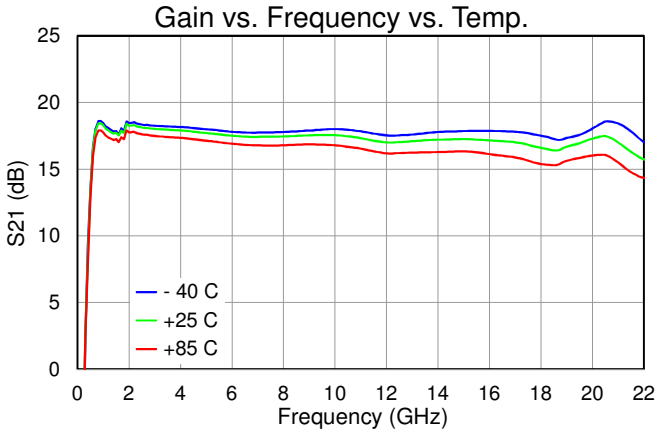
Test Conditions: V_D = 6 V
Failure Criteria = 10% reduction in I_{D_MAX}

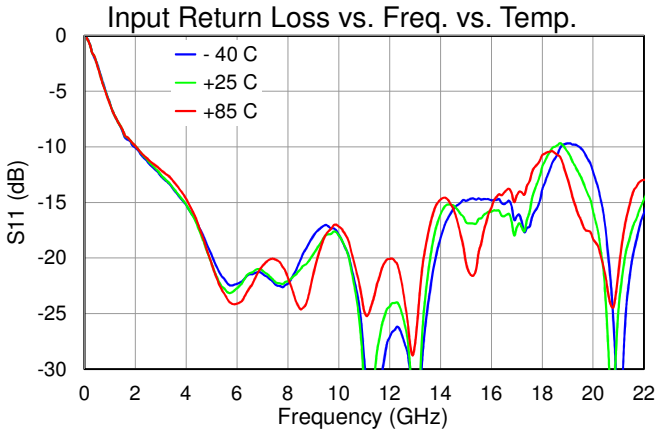


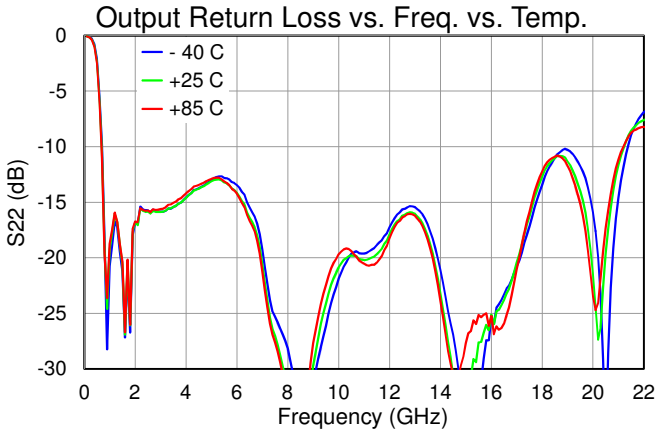


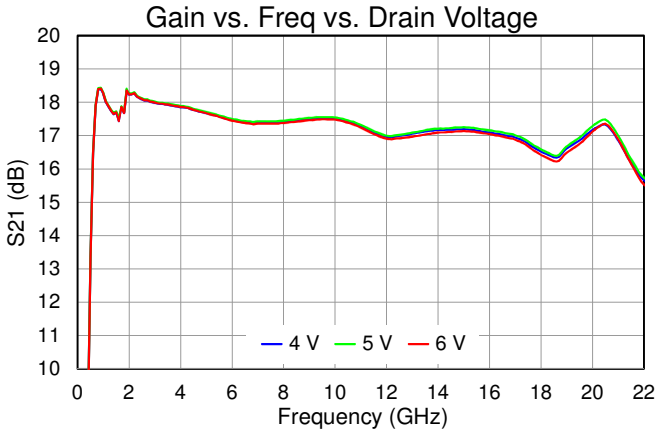
Typical Performance: Small Signal

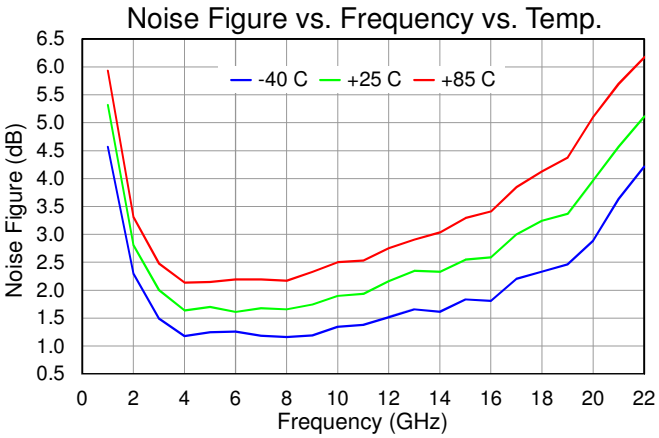
Test conditions unless otherwise noted: 25 °C , V_D = 28 V, I_{DQ} = 100 mA, V_{G2} = 1.3 V

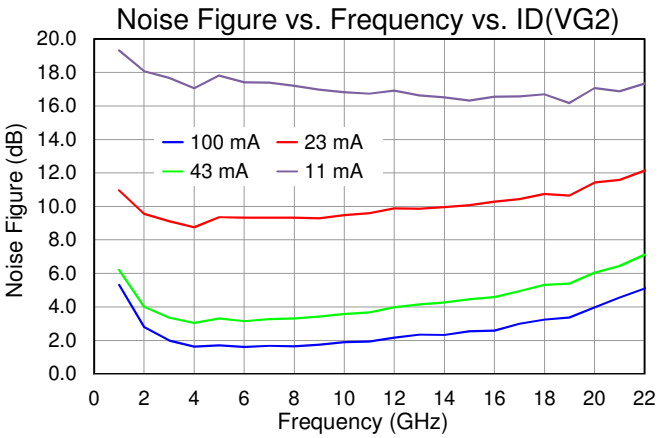








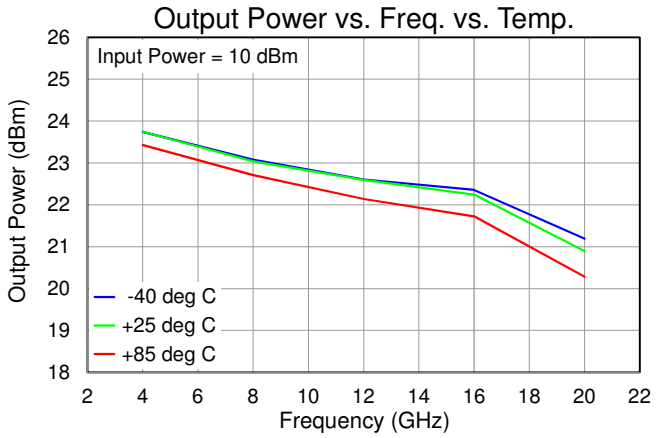


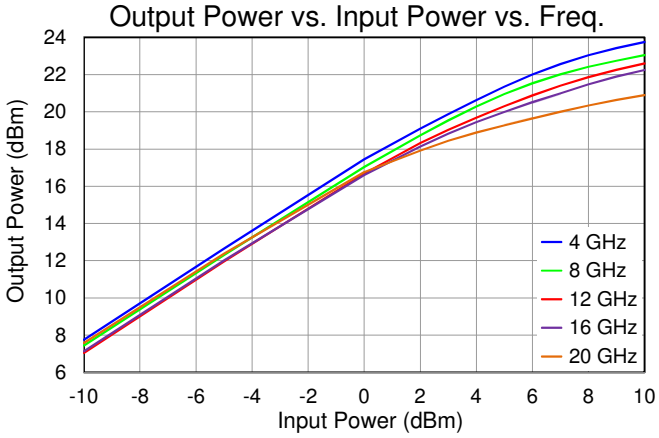


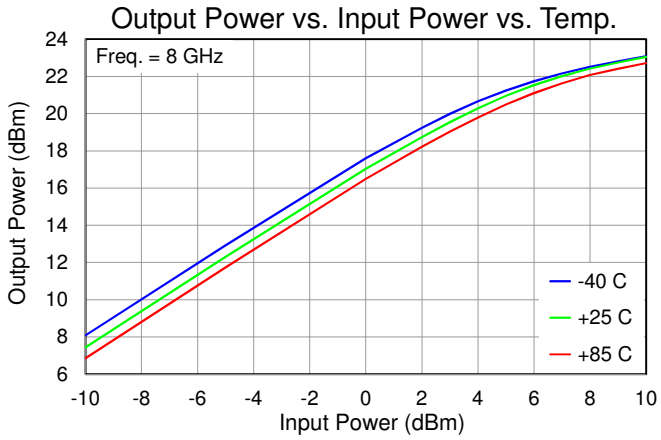
Note: V_{G2} adjusted to change I_{DQ}

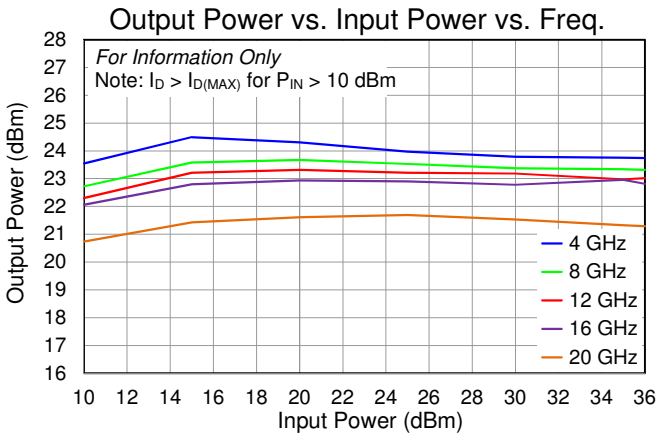
Typical Performance: Large Signal

Test conditions unless otherwise noted: 25 °C , V_D = 5 V, I_{DQ} = 100 mA, V_{G2} = 1.3 V



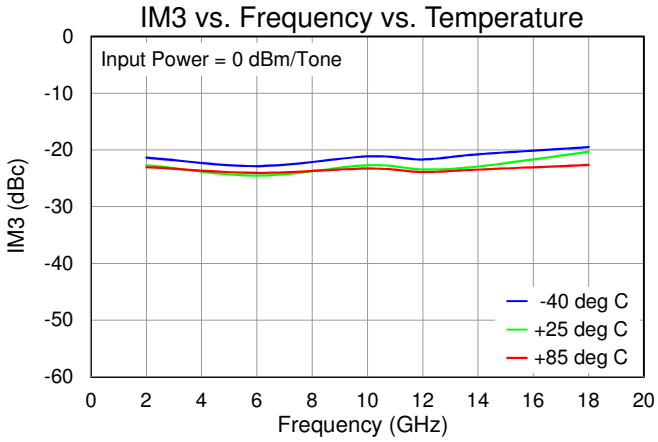


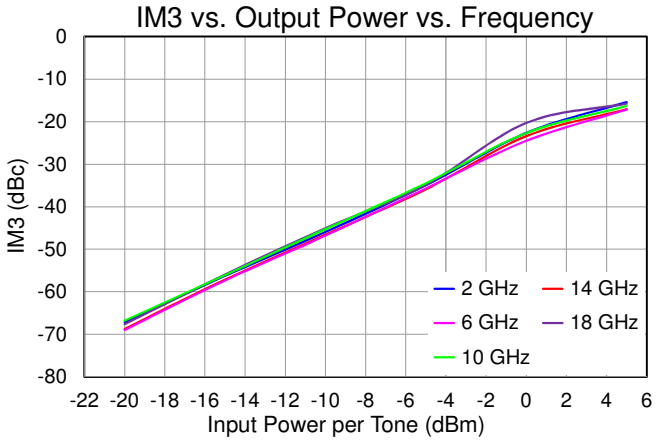


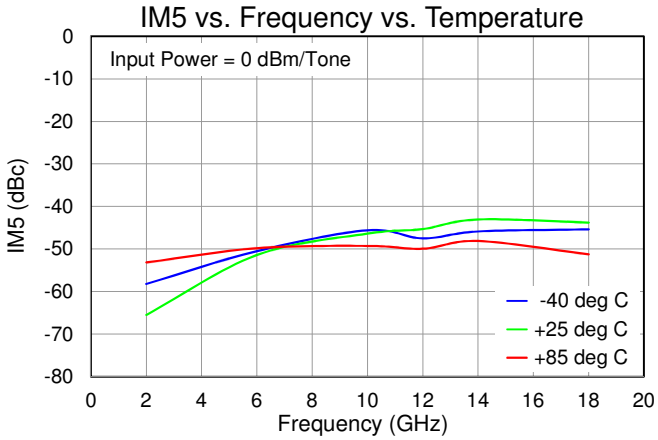


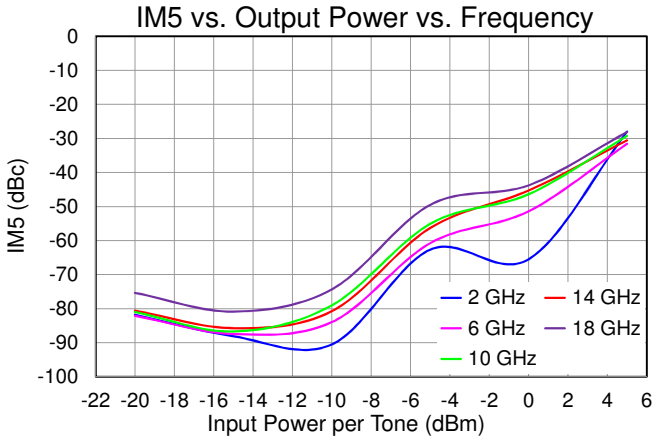
Typical Performance: Linearity

Test conditions unless otherwise noted: 25 °C , V_D = 5 V, I_{DQ} = 100 mA, 10 MHz Tone Spacing

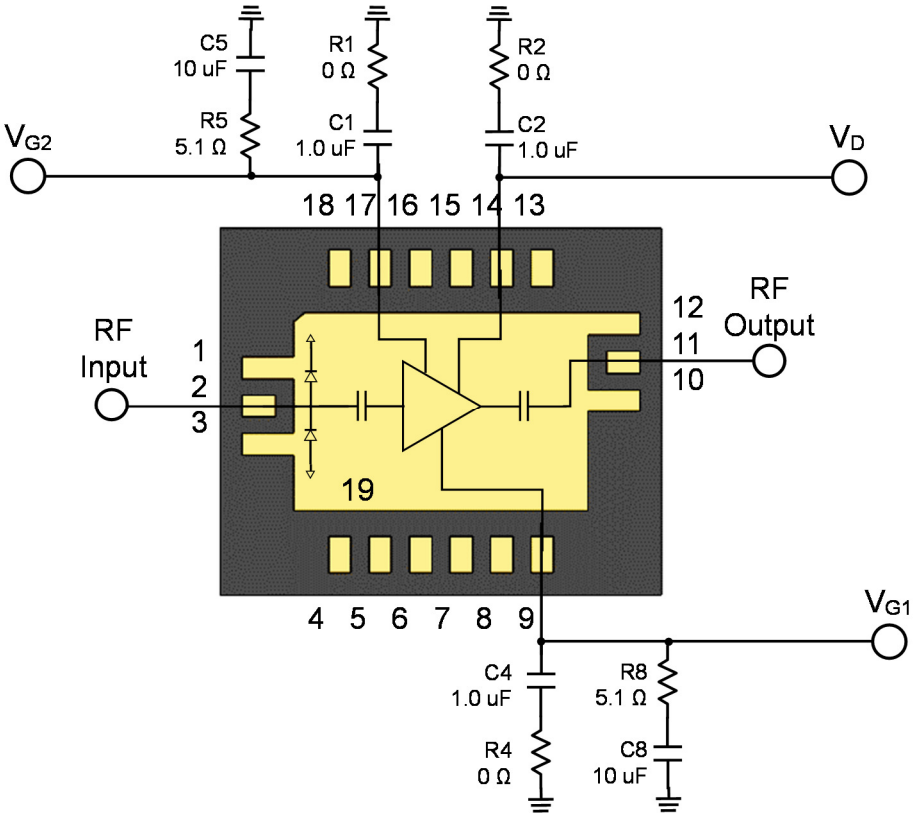








Application Circuit



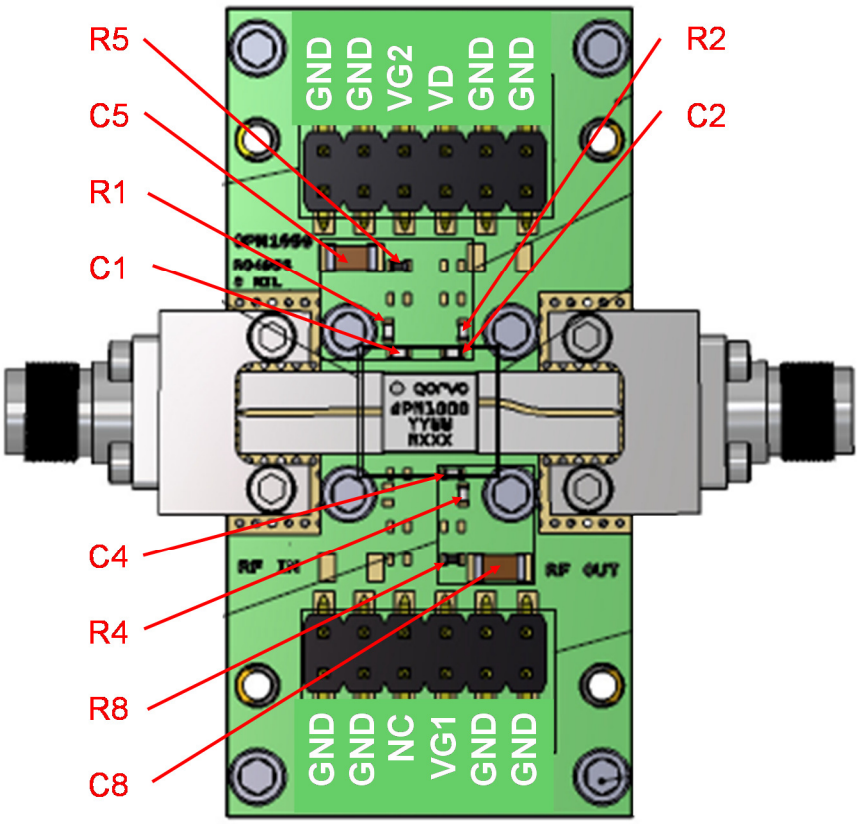
Bias-up Procedure

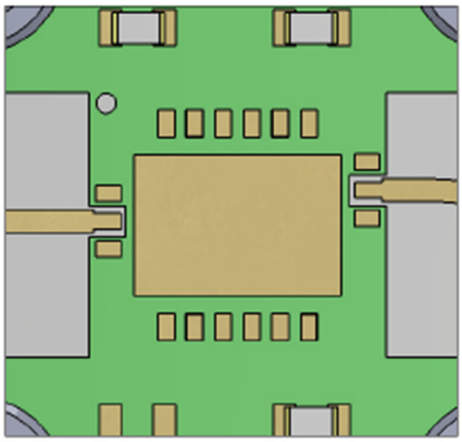
1. Set I_D limit to 145 mA, I_G limits to 24 mA each
2. Set V_G to –1.5 V
3. Set V_D +5 V
4. Set V_{G2} to 1.3 V
5. Adjust V_{G1} more positive until I_{DQ} = 100 mA (V_{G1} ~ –0.6 V Typical)
6. Apply RF signal

Bias-down Procedure

1. Turn off RF signal
2. Reduce V_{G1} to –1.5 V. Ensure I_{DQ} ~ 0mA
3. Set V_{G2} to 0V
4. Set V_D to 0V
5. Turn off V_D supply
6. Turn off V_{G1} and V_{G2} supplies

Evaluation Board and Mounting Detail



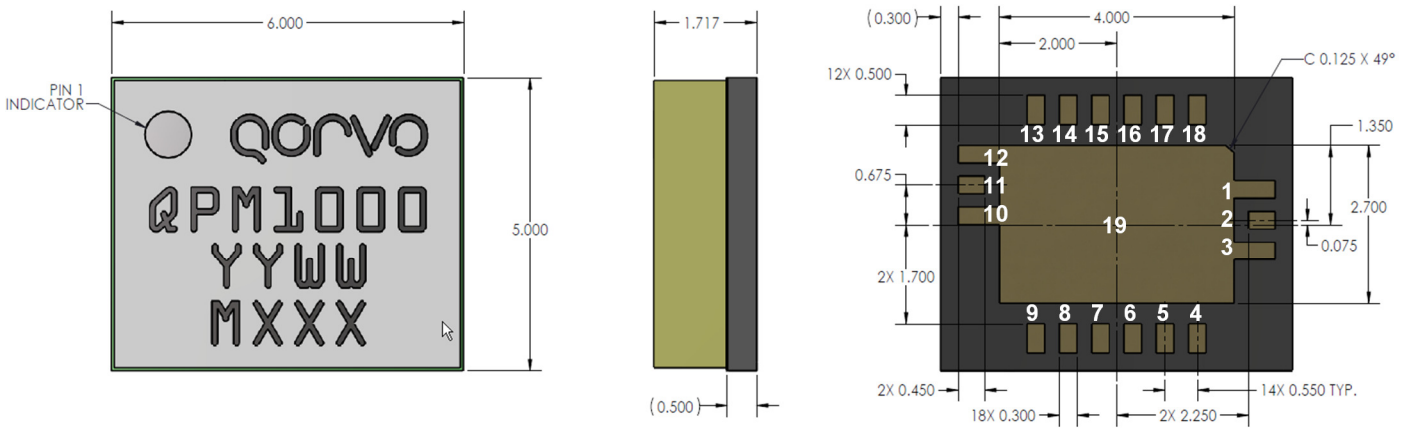


Mounting Detail

RF Layer is 0.008" thick Rogers Corp. RO40003C (ε_r = 3.35). Metal layers are 1.0 oz. copper. The microstrip line at the connector interface is optimized for the Southwest Microwave end launch connector 1092-02A-5.

Reference Des.	Component	Value	Manuf.	Part Number
C1, C2, C4	Surface Mount Cap	1.0 uF, ±10 %, 50 V (0402), X7R	Various	
C5, C8	Surface Mount Cap	10 uF, ±20 %, 50 V (1206), X5R	Various	
R1, R2, R4	Surface Mount Cap	Resistor, SMT, 0402, 0 ohms	Various	
R5, R8	Surface Mount Cap	Resistor, SMT, 0402, 5.1 ohms	Various	

Mechanical Drawing & Pad Description



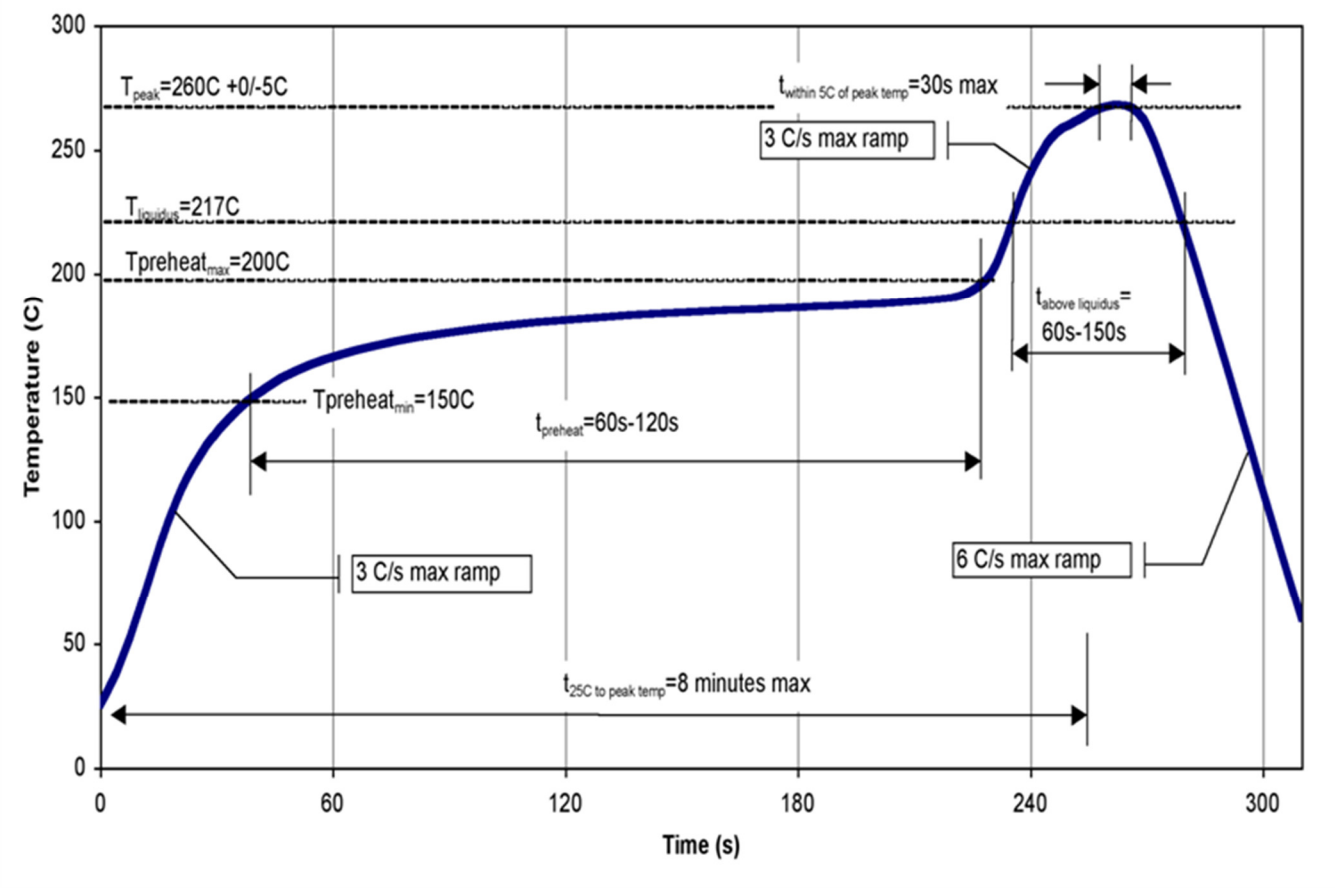
NOTES:
PACKAGE METAL BASE AND LEADS ARE GOLD PLATED.

PART MARKING:
QPM1000: PART NUMBER
YY: PART ASSY YEAR
WW: PART ASSY WEEK
MXXX: LOT NUMBER

DIMENSIONS IN MM

Pin Number	Label	Description
1, 3, 10, 12, 19	GND	RF Ground
2	RF Input	RF Input; matched to 50Ω
4 – 8, 13, 15, 16, 18	NC	No connection in package. Can be grounded on PCB if desired.
9	V_{G1}	Gate voltage 1. Bias network is required; see Application Circuit as an example
11	RF Output	RF Output; matched to 50Ω; DC Blocked
14	V_D	Drain voltage. Bias network is required; see Application Circuit as an example
17	V_{G2}	Gate voltage 2. Bias network is required; see Application Circuit as an example

Recommended Soldering Temperature Profile



Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: TBD
Value: TBD
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating

Level 5a at 260 °C convection reflow
The part is rated Moisture Sensitivity Level 5a
JEDEC standard IPC/JEDEC J-STD-020.

ECCN

US Department of Commerce: EAR99

Solderability

Compatible with the latest version of J-STD-020 Lead free solder, 260 °C.

RoHS Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

ontact Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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