



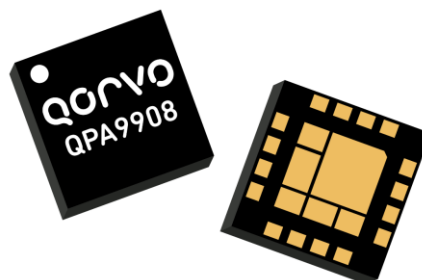
# QPA9908

## 925-960MHz 0.5 W High-Efficiency Amplifier

### Product Overview

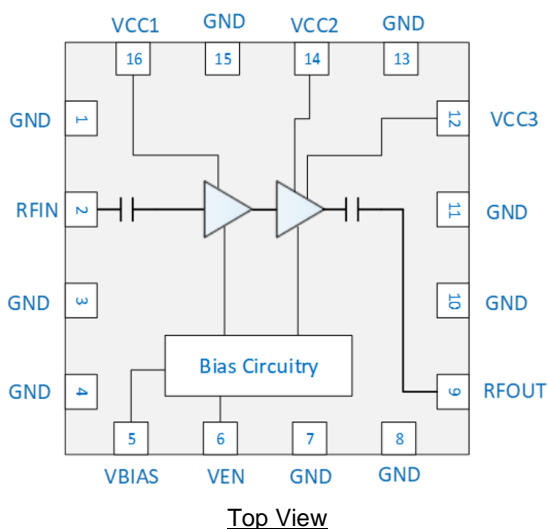
The QPA9908 is a high-efficiency, linearizable power amplifier targeting Band 8 small-cell wireless infrastructure systems. Using InGaP/GaAs HBT technology, the product delivers high efficiency of 36% at +28dBm average output power, while providing excellent DPD linearized ACPR of -48dBc for signal bandwidths of up to 40MHz.

The QPA9908 is housed in a 5x5mm SMT package. It is pin-to-pin compatible to QPA9903 (band 3 high-efficiency small cell PA).



16 Pad 5 x 5 mm Package

### Functional Block Diagram



### Key Features

- 925 – 960 MHz
- Up to 40MHz IBW capability
- 33 dB Gain typical across the band
- Over 36 dBm P3dB
- 36% PAE at +28 dBm power output
- <-48 dBc ACPR DPD linearized at +28 dBm power output
- 1.8V logic compatible PA ON/OFF control
- On chip ESD protection

### Applications

- 3GPP Band 8 Small Cells
- M-MIMO
- Repeaters / DAS
- Mobile Infrastructure
- General Purpose Wireless

### Ordering Information

Part No.	Description
QPA9908TR13	2500 on reel
QPA9908EVB01	925-960 MHz EVB

## Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-55 to +125 °C
RF Input Power, 50 Ω, T=25 °C <sup>(1)</sup>	+10 dBm
Device Voltage (V <sub>CC</sub> )	5.5 V

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Note:

1. 925-960 MHz, CW

## Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Device Voltage (V <sub>CC</sub> )	+4.75	+5	+5.25	V
T <sub>CASE</sub>	-40		+85	°C
T <sub>j</sub> for >10 <sup>6</sup> hours MTTF			+150	°C

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

## Electrical Specifications

Parameter	Conditions <sup>(1)</sup>	Min	Typ	Max	Units
Operational Frequency Range		925		960	MHz
Test Frequency			942		MHz
Gain	P <sub>out</sub> = +28 dBm	TBD	33	TBD	dB
Input Return Loss			-20		dB
Output Return Loss			-4.9		dB
Output P3dB	100 μs/1 ms, 10% duty cycle	TBD	+36.6		dBm
Power Added Efficiency <sup>(2)</sup>	P <sub>out</sub> = +28 dBm	TBD	36		%
ACPR(Uncorrected) <sup>(3)</sup>	P <sub>out</sub> = +28 dBm	TBD	-30		dBc
ACPR with DPD <sup>(3)</sup>	P <sub>out</sub> = +28 dBm		-46		dBc
Quiescent Current, I <sub>CC</sub>	Pins 12, 14 and 16	TBD	70	TBD	mA
Total Operating Current	Pins 5, 12, 14 and 16, P <sub>out</sub> = +28 dBm		350	TBD	mA
Thermal Resistance, θ <sub>JC</sub>	Junction to case		24		°C/W
V <sub>EN</sub> High		1.17	1.8	V <sub>CC</sub>	V
V <sub>EN</sub> Low		0	0	0.63	V
2nd Harmonic	P <sub>out</sub> = +28 dBm		-40	TBD	dBc
3rd Harmonic	P <sub>out</sub> = +28 dBm		-50	TBD	dBc

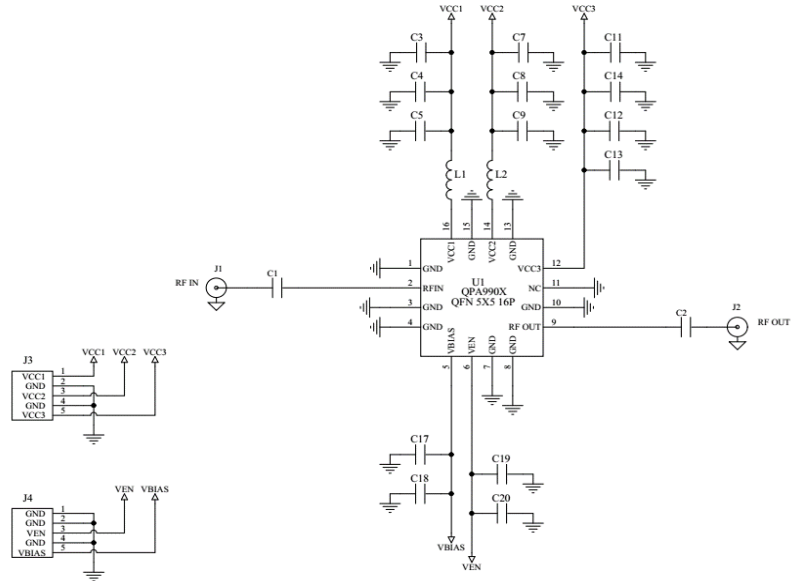
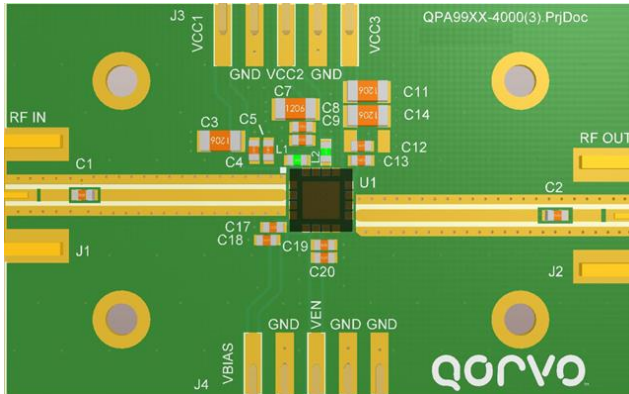
Notes:

1. Test conditions unless otherwise noted: All V<sub>CC</sub> & V<sub>BIAS</sub> = +5.0 V, V<sub>EN</sub> = +1.8 V, Temp = +25 °C, 50 Ω system.
2. LTE, 20 MHz E-UTRA Test Model 1.1 or 3.1, PAR = 8.5 dB at 0.01% Probability
3. LTE, 20 MHz x 2 E-UTRA Test Model 1.1 or 3.1, PAR = 8.5 dB at 0.01% Probability

## Power Amplifier Enable Logic Table

Parameter	High	Low
V <sub>EN</sub>	Power Amplifier ON	Power Amplifier OFF

## 925–960 MHz Evaluation Board – QPA9908



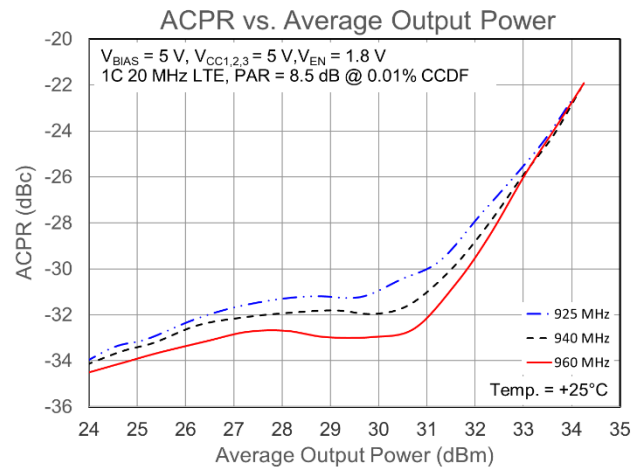
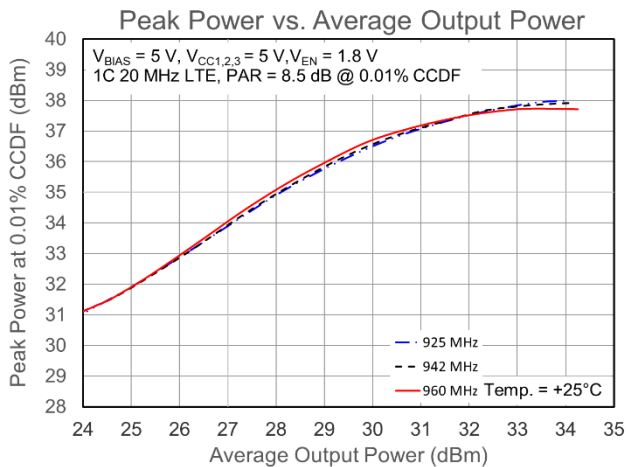
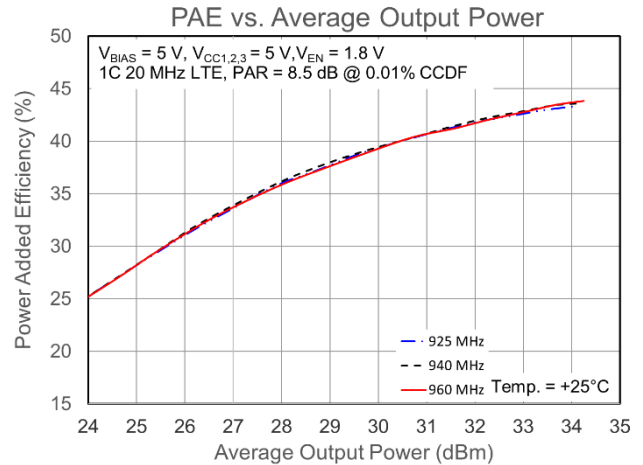
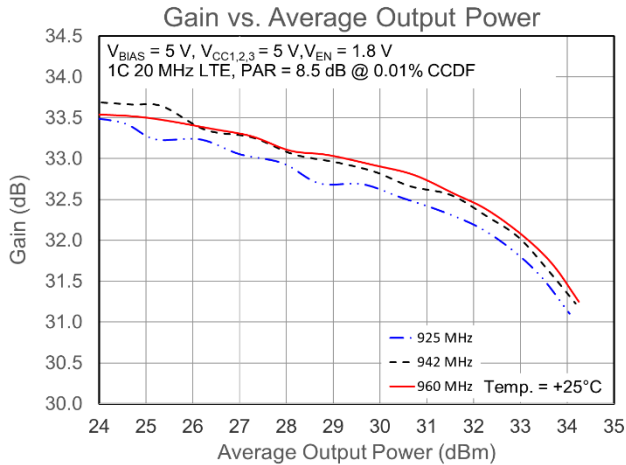
### Notes:

1. See Evaluation Board PCB Information for material and stack up.

## Bill of Material – QPA9908EVB01

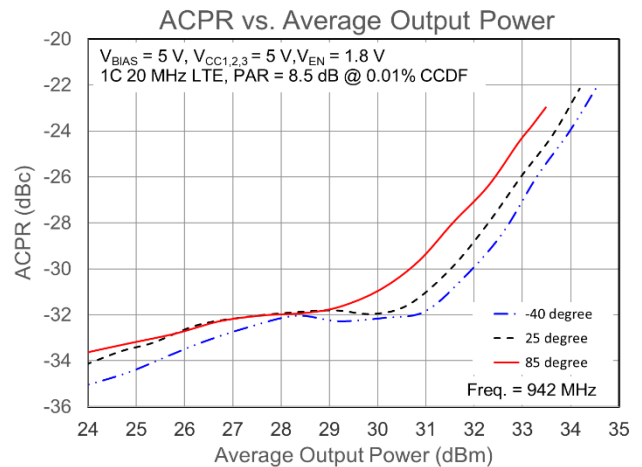
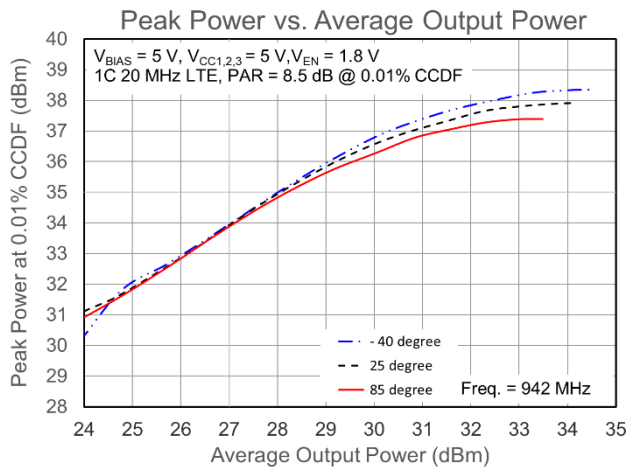
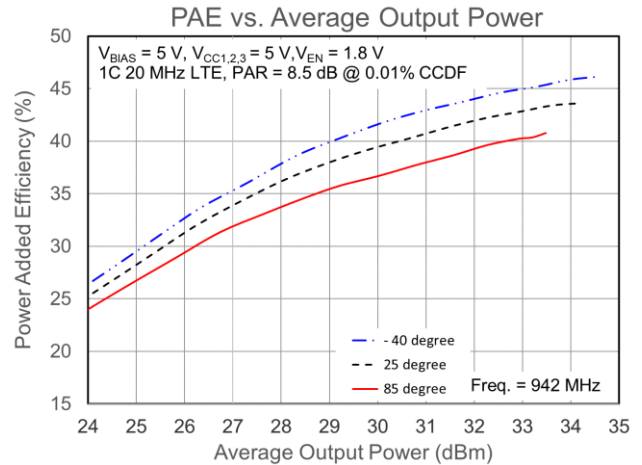
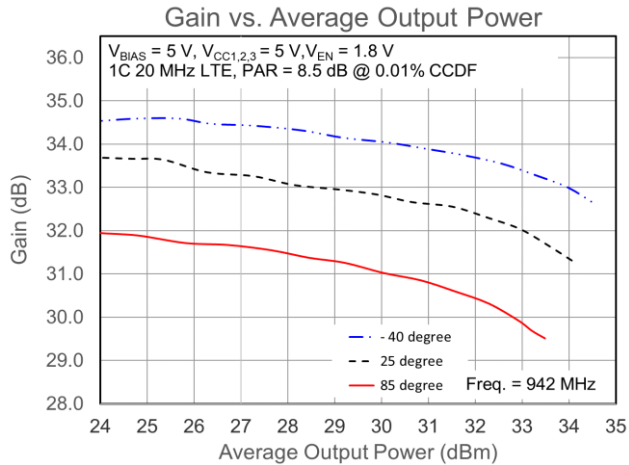
Reference Des.	Value	Description	Manuf.	Part Number
U1	-	Amplifier, QPA9908 925-960MHz, High-Efficiency	Qorvo	QPA9908
C1, C2	100 pF	CAP,100 pF, 0603, 5%, 50V, NPO	various	
C5, C9, C13, C17, C19	1000 pF	CAP,1000 pF, 0603, 5%, 50V, NPO	various	
C4, C8, C12, C18, C20	0.1 $\mu$ F	CAP,0.1 $\mu$ F, 0603, 10%, 50V, X7R	various	
C3, C7	47 $\mu$ F	CAP, 47 $\mu$ F, 1206, 16V	various	
C11, C14	47 $\mu$ F	CAP, 47 $\mu$ F, 1210, 16V	various	
L1, L2	0 $\Omega$	RES 0 $\Omega$ , 0603, 1/16W, Chip	various	

## Performance Plots - LTE



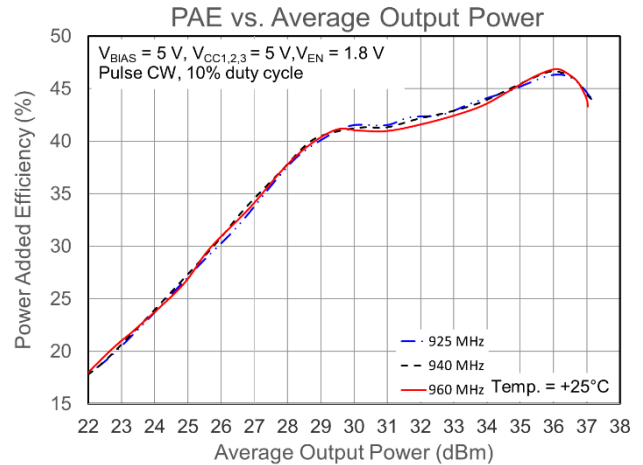
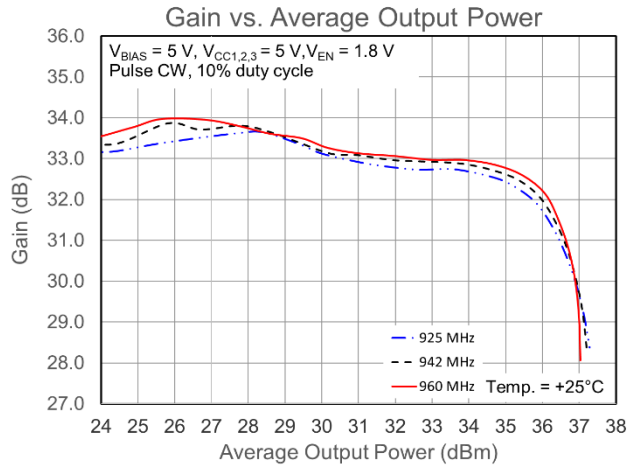
Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ ,  $T = +25^\circ\text{C}$ , tested using a single-carrier, 20 MHz LTE signal with 8.5 dB PAR at 0.01% CCDF on a reference design fixture.

## Performance Plots - LTE

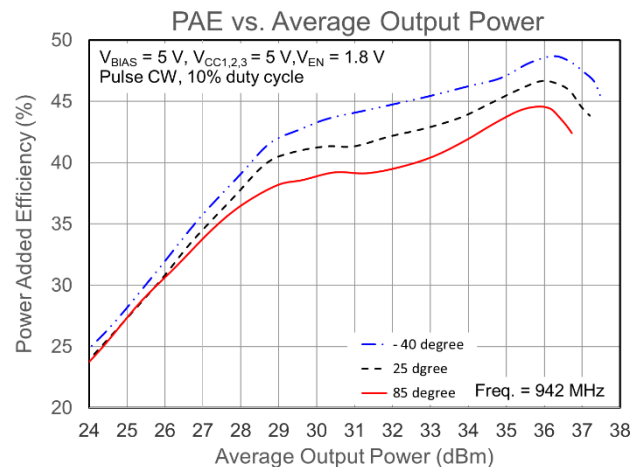
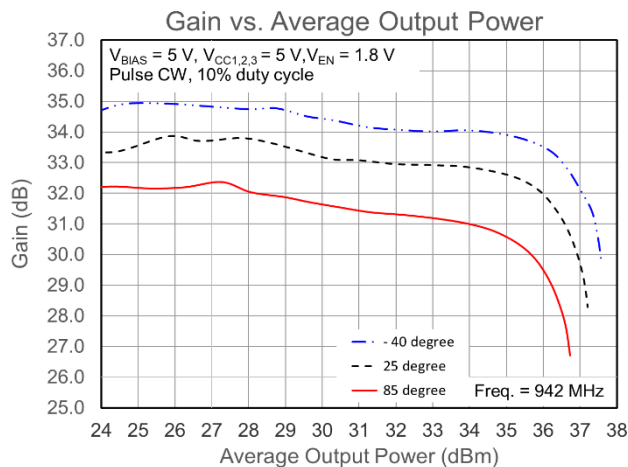


Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ , tested at 942 MHz using a single-carrier, 20 MHz LTE signal with 8.5 dB PAR at 0.01% CCDF on a reference design fixture.

## Performance Plots – Pulsed Signal Measurements

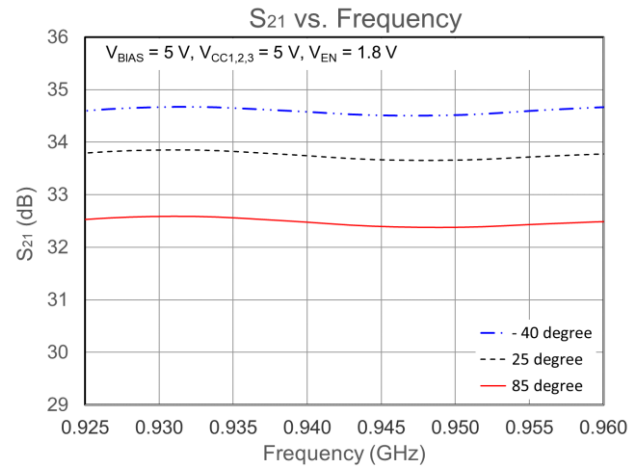
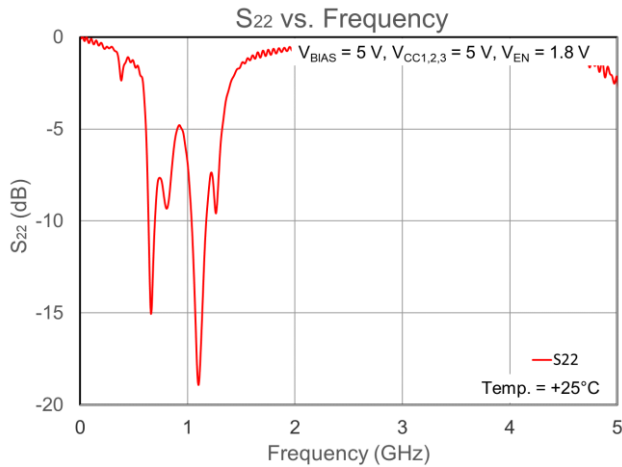
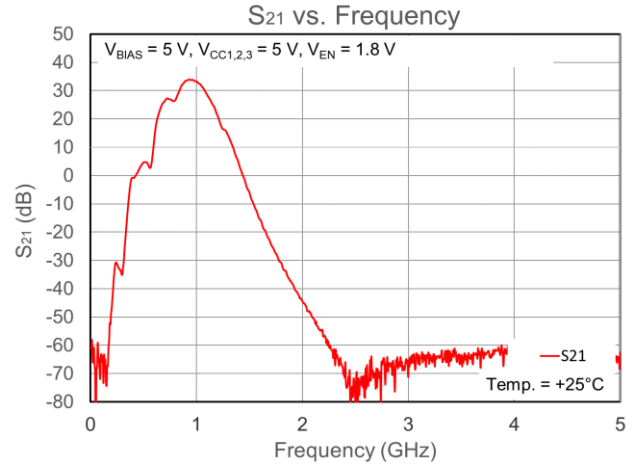
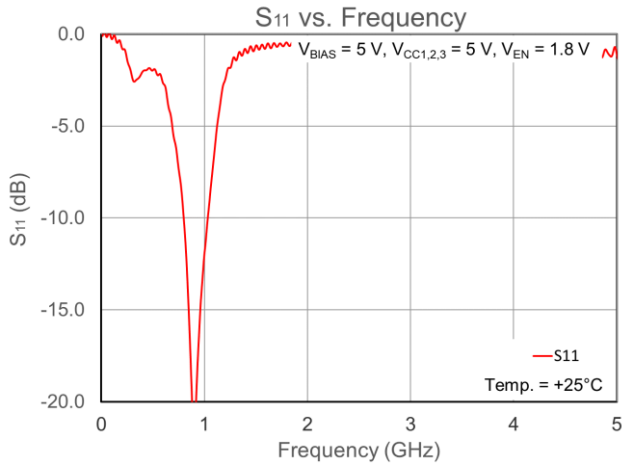


Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ ,  $T = +25^\circ\text{C}$ , tested using a pulse signal, 10% duty cycle.



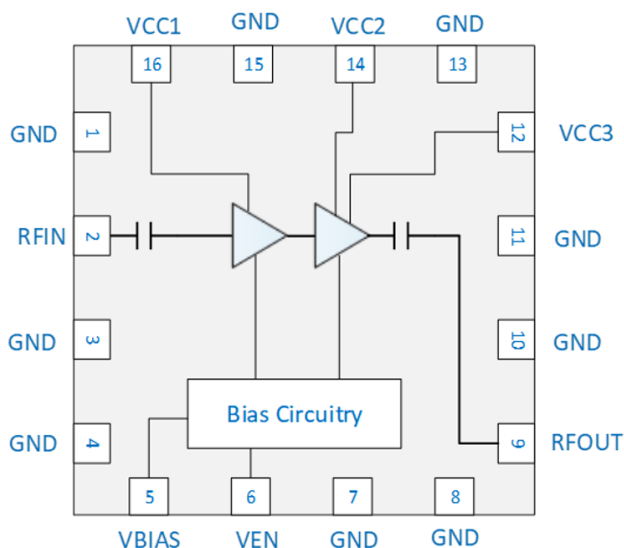
Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ , tested at 942 MHz using a pulse signal, 10% duty cycle.

## Performance Plots – S-parameter



Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ .

## Pad Configuration and Description



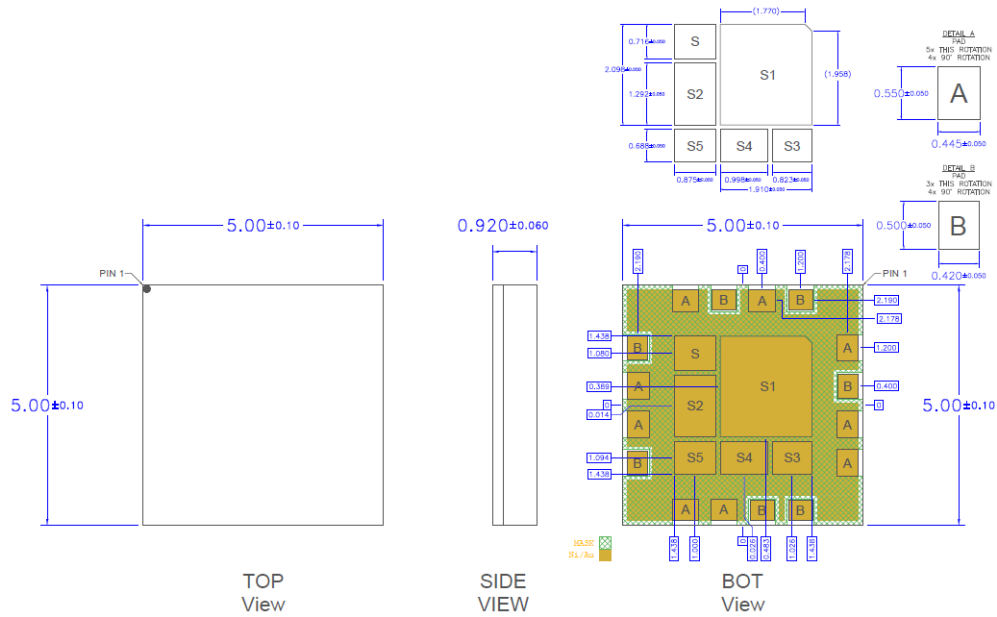
Top View

Pad No.	Label	Description
1, 3, 4, 7, 8, 10, 11, 13, 15	GND	Ground connection. This pin is not connected internally and can be left floating or connected to ground
2	RF <sub>IN</sub>	RF input, internally matched to 50Ω.
5	V <sub>BIAS</sub>	Bias circuit supply voltage
6	V <sub>EN</sub>	Amplifier enable voltage (regulated internally)
9	RF <sub>OUT</sub>	RF output, internally matched to 50Ω.
12	V <sub>CC3</sub>	Second stage (Carrier) supply voltage
14	V <sub>CC2</sub>	Second stage (Peaker) supply voltage
16	V <sub>CC1</sub>	Driver stage supply voltage
Backside Paddle	GND	Ground connection. The back side of the package should be connected to the ground plan though as short of a connection as possible. PCB via holes under the device are recommended.



## Package Marking and Dimensions

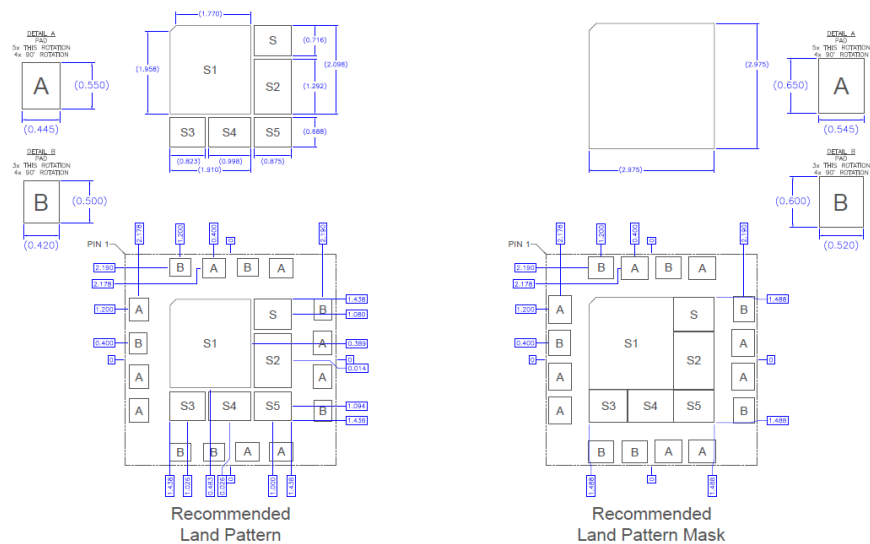
Marking: Pin 1 Indicator and Qorvo Logo



### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
3. Contact plating: ENEPIG (Electroless Nickel Electroless Palladium Immersion Gold)

## PCB Mounting Pattern



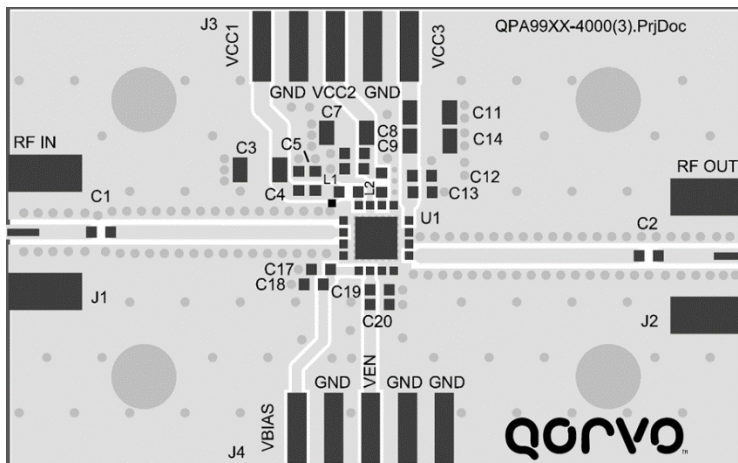
## Evaluation Board PCB Information

### PC Board Layout

PCB Material (stackup)

Layer	Name	Material	Thickness	Constant
1	Top Overlay			
2	Top Solder	Solder Resist	0.40 mil	3.5
3	Top Layer	Copper	1.40 mil	
4	Dielectric1	RO4350	20.00 mil	3.48
5	Bottom Layer	Copper	1.40 mil	

Total thickness: 23.2mil

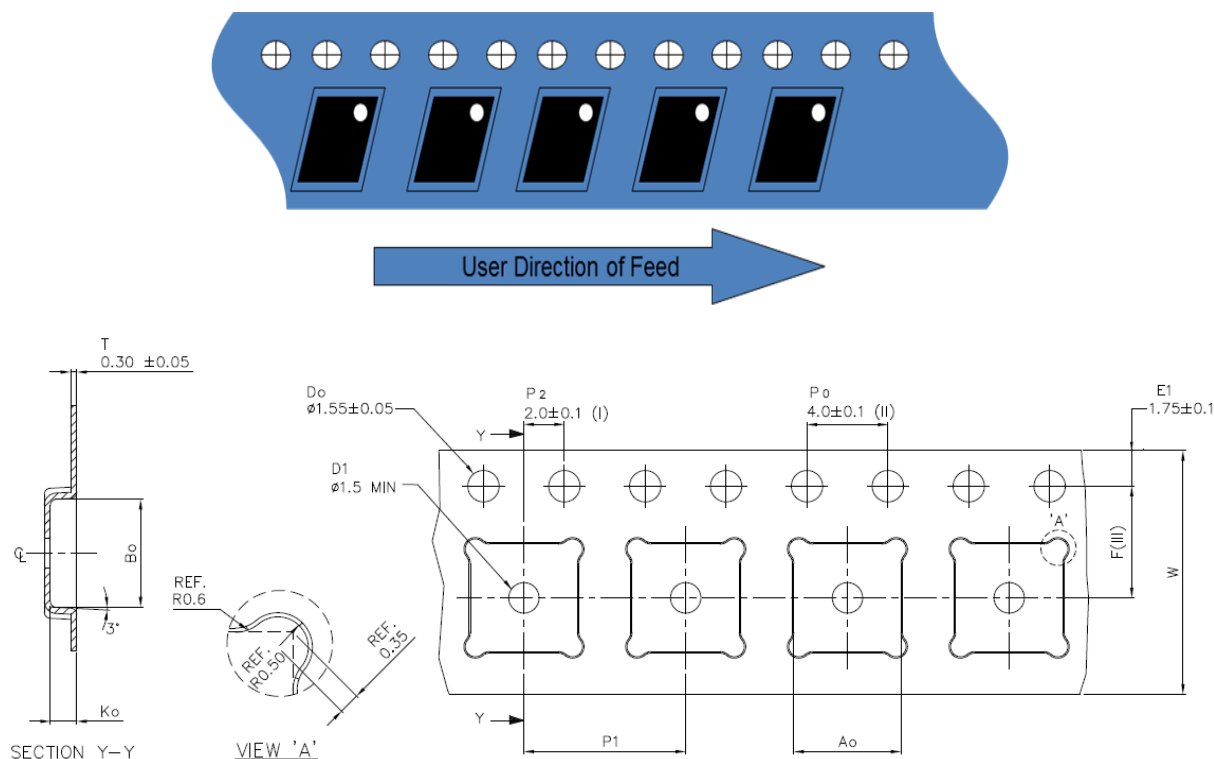


#### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. Via holes are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.10").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

## Tape and Reel Information – Carrier and Cover Tape Dimensions

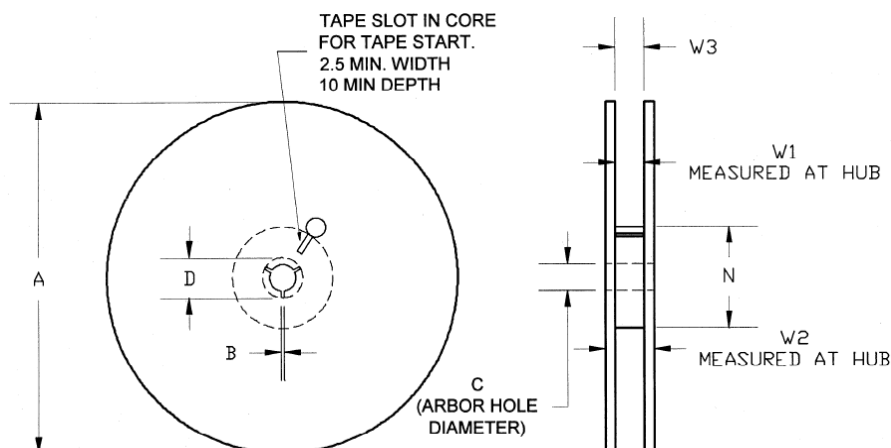
Tape and reel specifications for this part are also available on the Qorvo website.  
Standard T/R size = 2500 pieces on a 13" reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.209	5.3
	Width	B0	0.209	5.3
	Depth	K0	0.051	1.3
	Pitch	P1	0.315	8.0
Centerline Distance	Cavity to Perforation - Length Direction	P2	0.079	2.0
	Cavity to Perforation - Width Direction	F	0.217	5.5
Cover Tape	Width	C	0.362	9.2
Carrier Tape	Width	W	0.472	12

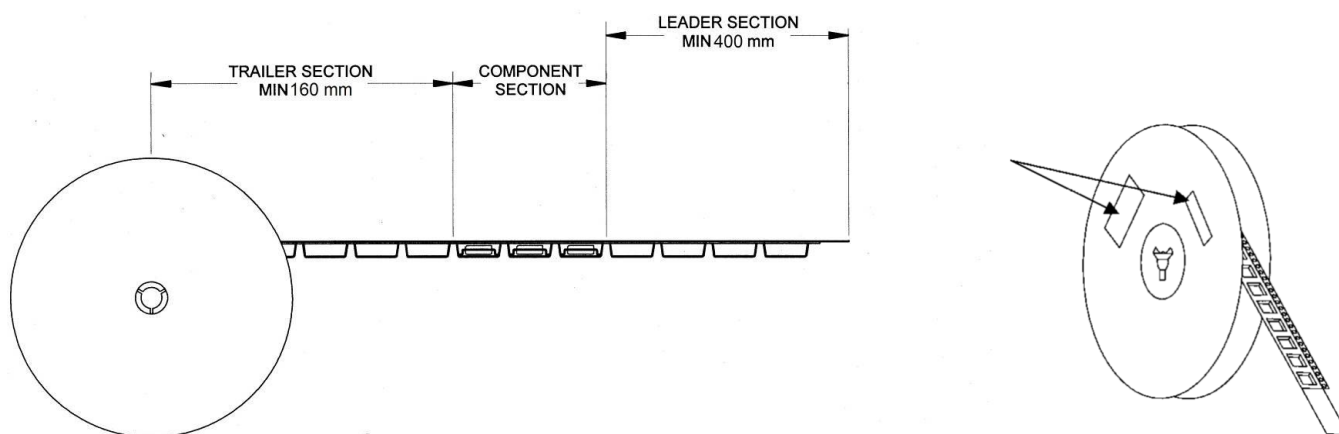
## Tape and Reel Information – Reel Dimensions

Packaging reels are used to prevent damage to devices during shipping and storage, loaded carrier tape is typically wound onto a plastic take-up reel. The reel size is 13" diameter. The reels are made from high-impact injection-molded polystyrene (HIPS), which offers mechanical and ESD protection to packaged devices.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.00
	Thickness	W2	0.717	18.20
	Space Between Flange	W1	0.504	12.80
Hub	Outer Diameter	N	4.016	102.00
	Arbor Hole Diameter	C	0.512	13.00
	Key Slit Width	B	0.079	2.00
	Key Slit Diameter	D	0.795	20.2

## Tape and Reel Information – Tape Length and Label Placement



### Notes:

1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1C	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	C3	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	3	IPC/JEDEC J-STD-020



Caution!  
ESD-Sensitive Device

## Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes.  
Solder profiles available upon request.

Contact plating: ENEPIG (Electroless Nickel Electroless Palladium Immersion Gold)

## RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Product uses RoHS Exemption 7c-I to meet RoHS Compliance requirements.
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C15H12Br4O2) Free
- PFOS Free
- SVHC Free

## Contact Information

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

**Web:** [www.qorvo.com](http://www.qorvo.com)

**Tel:** 1-844-890-8163

**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

For technical questions and application information:

**Email:** [appsupport@qorvo.com](mailto:appsupport@qorvo.com)

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