



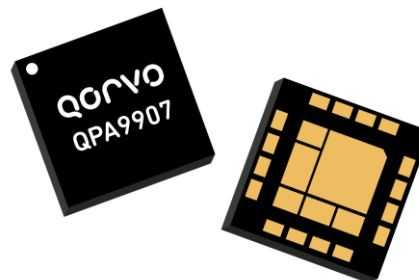
# QPA9907

2.5 – 2.7 GHz 4 W High-Efficiency Amplifier

## Product Overview

The QPA9907 is a high-efficiency, linearizable power amplifier targeting Band 7 small-cell wireless infrastructure systems. Using InGaP/GaAs HBT technology, the product delivers high efficiency of 29.5% at +28dBm average output power while providing excellent DPD linearized ACPR of -51dBc for signal bandwidths of up to 100MHz.

The QPA9907 is housed in a 5x5mm SMT package. It is pin-to-pin compatible to QPA9901, QPA9903 and QPA9908 (high-efficiency small cell PA).

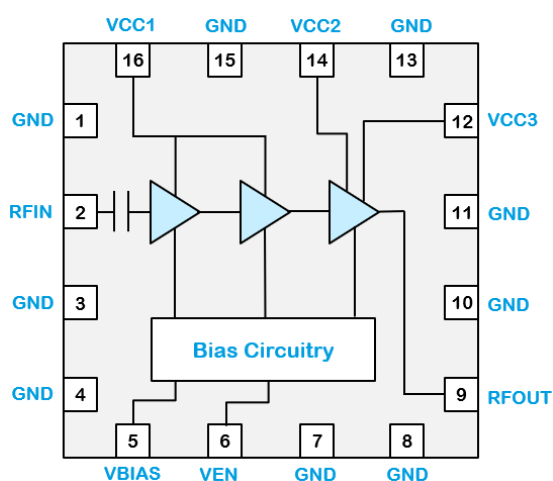


16 Pad 5 x 5 mm Package

## Key Features

- 2.5 – 2.7 GHz
- 34.5 dB gain
- Over 35 dBm P3dB
- 29.5% PAE at +28 dBm power output
- -51 dBc ACPR DPD linearized at +28 dBm power output with 5-carrier signal
- 1.8V logic compatible PA ON/OFF control
- On chip ESD protection
- 5 x 5 mm Package

## Functional Block Diagram



Top View

## Applications

- 4G/5G Small-cell BTS
- 5G M-MIMO
- Repeaters/DAS
- Mobile Infrastructure
- General Purpose Wireless

## Ordering Information

| Part No.      | Description           |
|---------------|-----------------------|
| QPA9907TR13   | 2500pcs on a 13" reel |
| QPA9907EVB-01 | 2.5-2.7 GHz EVB       |

## Absolute Maximum Ratings

| Parameter                                      | Rating         |
|------------------------------------------------|----------------|
| Storage Temperature                            | -55 to +125 °C |
| RF Input Power, Pulsed CW, 50 Ω <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.

1. 2500-2700 MHz, Pulsed CW, 10% duty cycle, 100us period

## 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   |     | +105  | °C    |
| T <sub>j</sub> for > 10 <sup>6</sup> hours MTTF |       |     | +175  | °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           |                                                                  | 2500 |       | 2700            | MHz   |
| Test Frequency                        |                                                                  |      | 2600  |                 | MHz   |
| Gain <sup>(2)</sup>                   | At +28dBm Pout and room temperature                              | 32   | 34.5  |                 | dB    |
| Input Return Loss                     |                                                                  |      | -11.2 |                 | dB    |
| Output Return Loss                    |                                                                  |      | -6.7  |                 | dB    |
| Output P3dB                           | 10 μs pulse width, 10% duty cycle                                | 34   | 35    |                 | dBm   |
| Power Added Efficiency <sup>(2)</sup> | Pout = +28 dBm                                                   | 25.5 | 29.5  |                 | %     |
| ACPR (Uncorrected) <sup>(2)</sup>     | Pout = +28 dBm                                                   |      | -31.5 |                 | dBc   |
| ACPR (Uncorrected) <sup>(3)</sup>     | Pout = +28 dBm                                                   |      | -28.7 |                 | dBc   |
| ACPR (Corrected) <sup>(3)</sup>       | Pout = +28 dBm                                                   |      | -51   |                 | dBc   |
| Quiescent Current, I <sub>CQ</sub>    | Pins 12, 14 and 16                                               |      | 109   |                 | mA    |
| Total Operating Current               | Pin 5, 12, 14 and 16, Pout = +28 dBm                             |      | 414   |                 | mA    |
| Thermal Resistance, θ <sub>JC</sub>   | Junction to case                                                 |      | 21.7  |                 | °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                          | Pout = +28 dBm                                                   |      | -41   |                 | dBc   |
| 3rd Harmonic                          | Pout = +28 dBm                                                   |      | -51   |                 | dBc   |
| Turn-on time                          | Measured from 50% PA enable voltage level to 90% of RF amplitude |      | 0.33  |                 | us    |

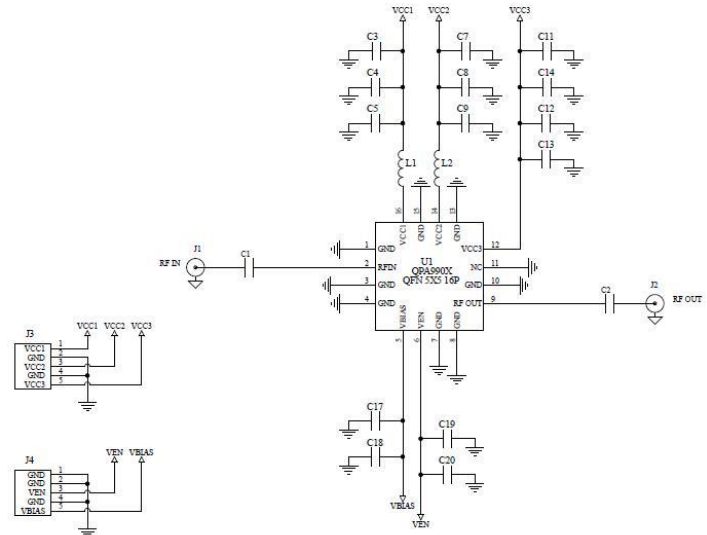
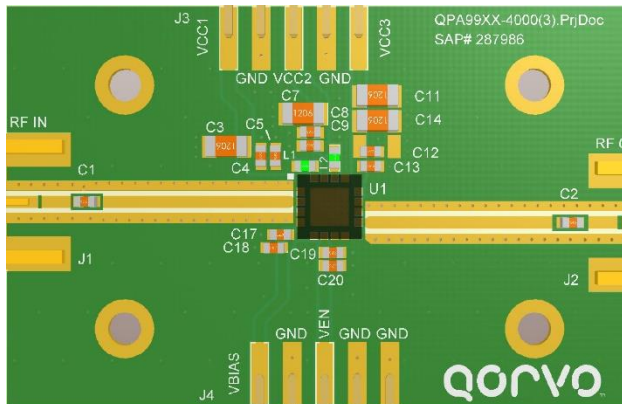
Notes:

1. Test conditions unless otherwise noted: All V<sub>CC</sub> & V<sub>BIAS</sub> = +5.0 V, V<sub>EN</sub> = +1.8V, Temp = +25 °C, 50 Ω system.
2. LTE, 20 MHz E-UTRA Test Mode 1.1 or 3.1, PAR = 8.5 dB at 0.01% probability.
3. LTE, 5X20 MHz E-UTRA LTE signal, 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 |

## QPA9907 EVB Layout and Schematic



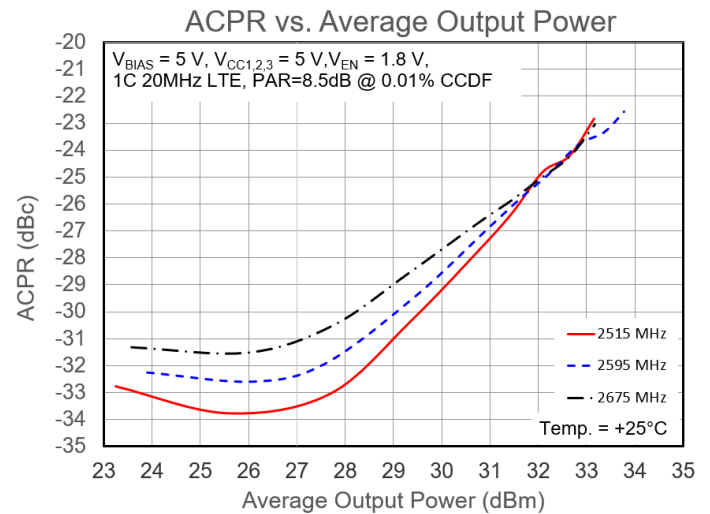
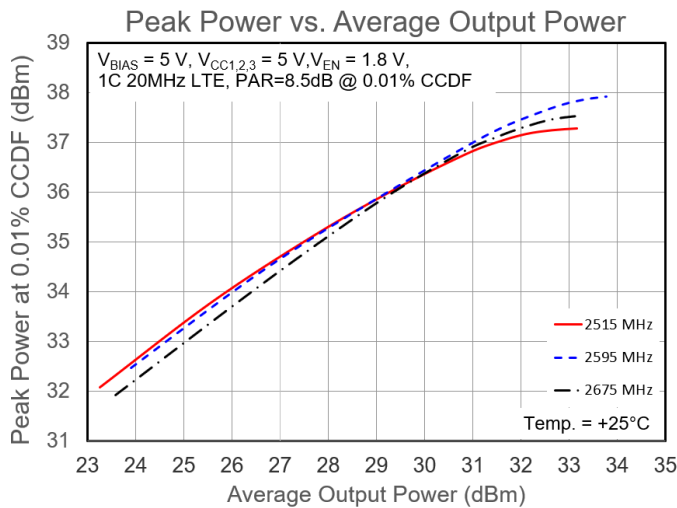
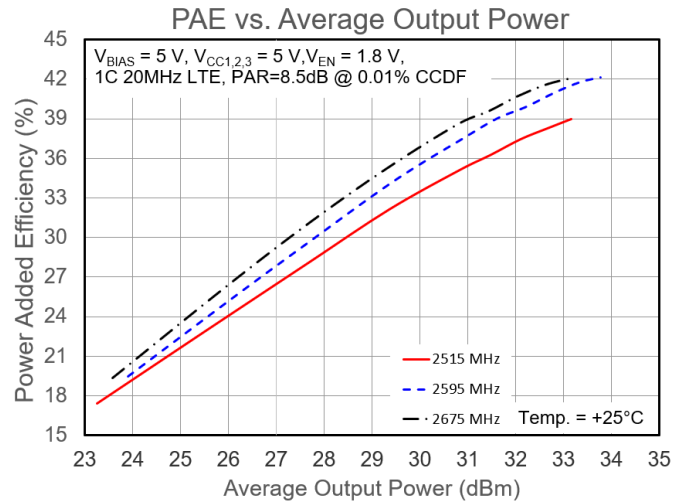
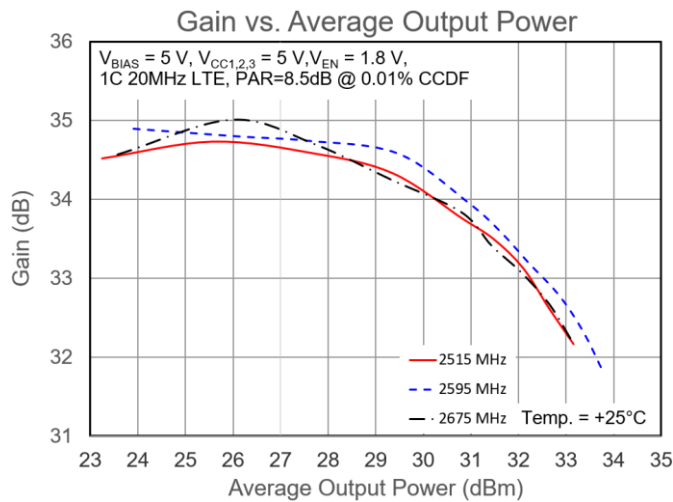
### Notes:

See Evaluation Board PCB Information for material and stack up.

## Bill of Materials – QPA9907EVB-01

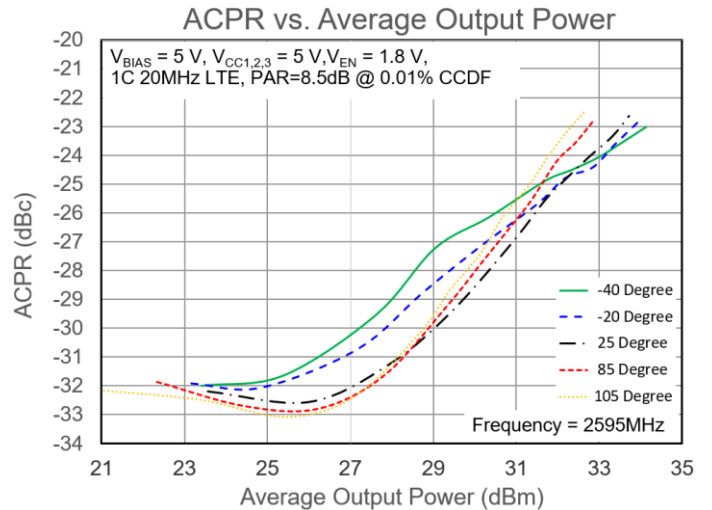
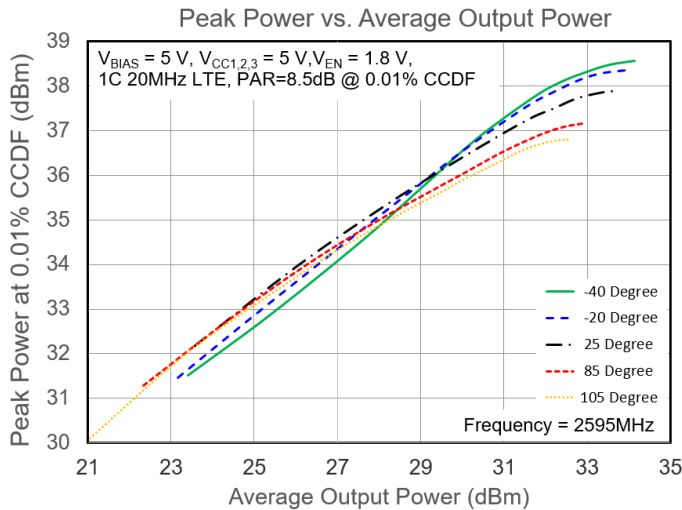
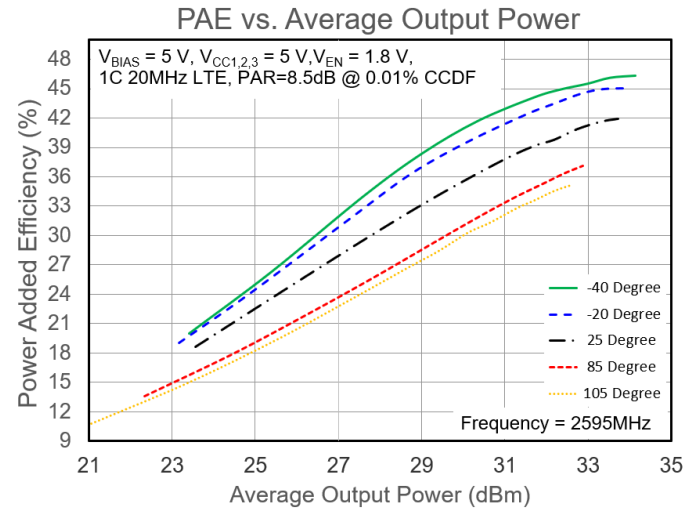
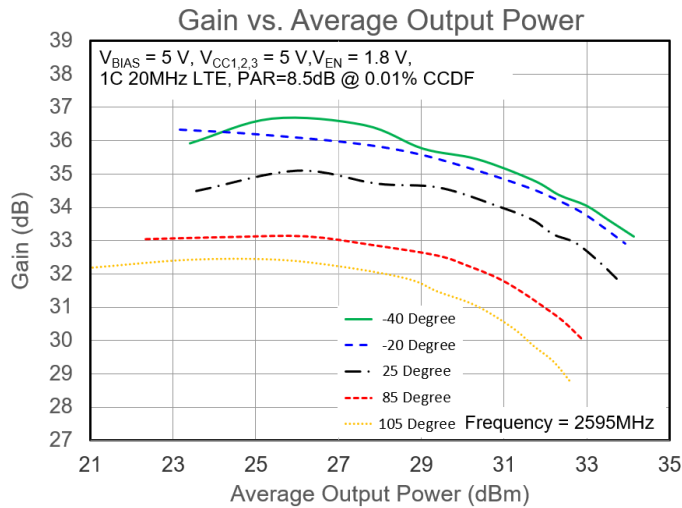
| Reference Des.        | Value       | Description                                      | Manufacturer | Part Number |
|-----------------------|-------------|--------------------------------------------------|--------------|-------------|
| U1                    | -           | Amplifier, QPA9907 2500-2700MHz, High-Efficiency | Qorvo        | QPA9907     |
| 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, C14           | 10 $\mu$ F  | CAP, 10 $\mu$ F, 1206, 16V                       | various      |             |
| L1, L2                | 0 $\Omega$  | RES 0 $\Omega$ , 0603, 1/16W, Chip               | various      |             |
| J1, J2                | -           | CONN. RF. SMA. F. STRT. Edge Mount               | various      |             |
| J3, J4                | -           | Connector, 5 Pin                                 | various      |             |

## Performance Plots - LTE



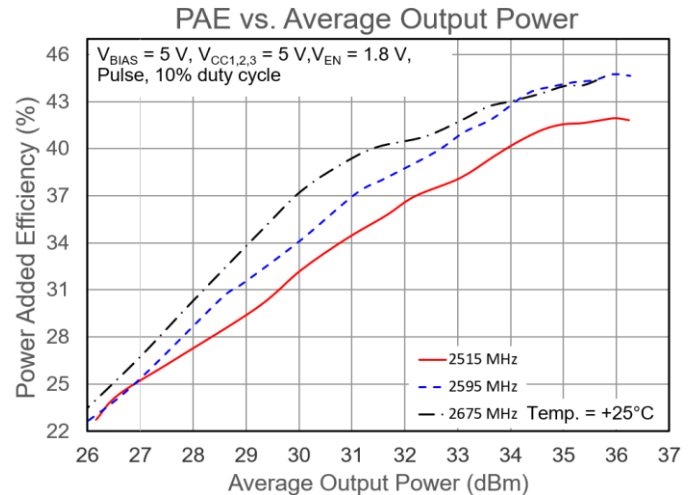
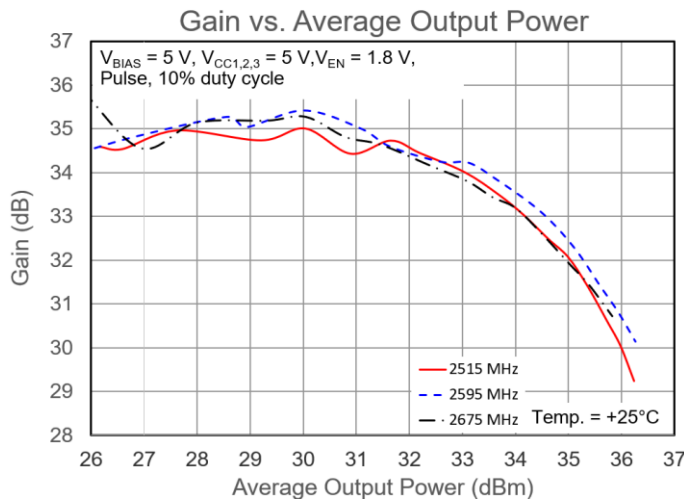
Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ ,  $T = +25^\circ\text{C}$ , tested using a single-carrier, 20 MHz LTE signal with 8.5 dB PAR at 0.01% CCDF on a reference design fixture.

## Performance Plots - LTE

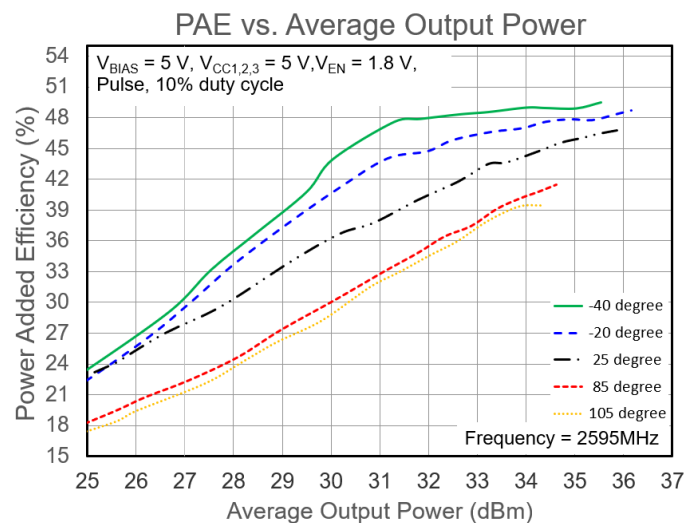
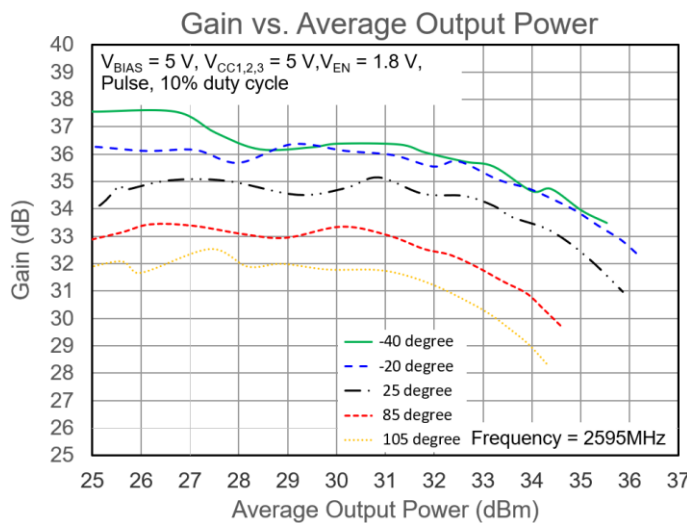


Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ , tested at 2595 MHz using a single-carrier, 20 MHz LTE signal with 8.5 dB PAR at 0.01% CCDF on a reference design fixture.

## Performance Plots - Pulse

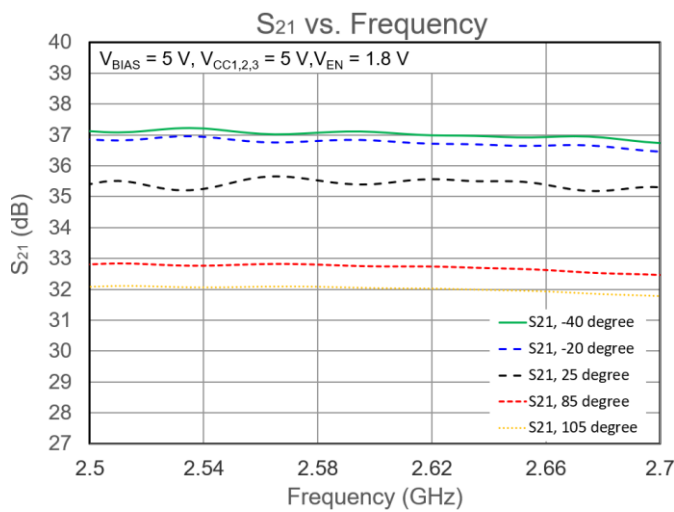
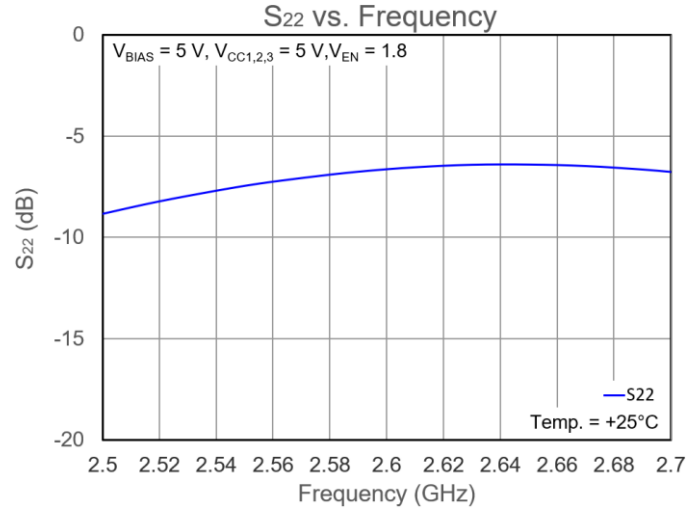
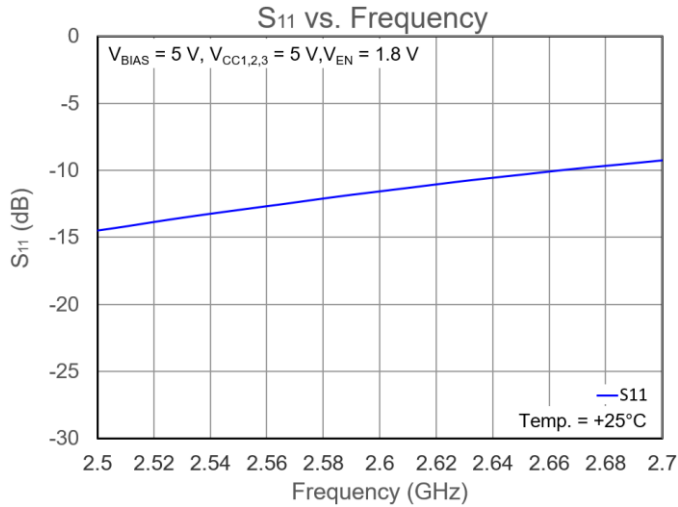


Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ ,  $T = +25^\circ\text{C}$ , tested using a pulse signal, 10% duty cycle.



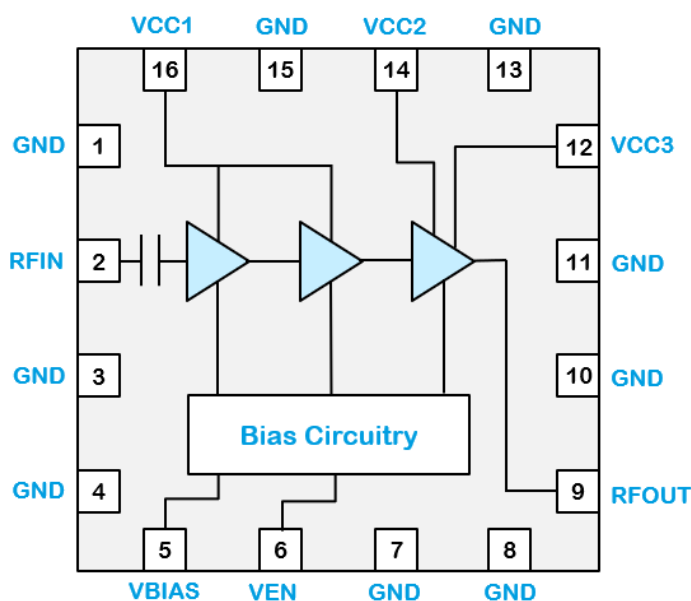
Test conditions unless otherwise noted:  $V_{BIAS} = 5\text{ V}$ ,  $V_{CC1,2,3} = 5\text{ V}$ ,  $V_{EN} = 1.8\text{ V}$ , tested at 2595 MHz using a pulse signal, 10% duty cycle.

## Performance Plots – S-parameters



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

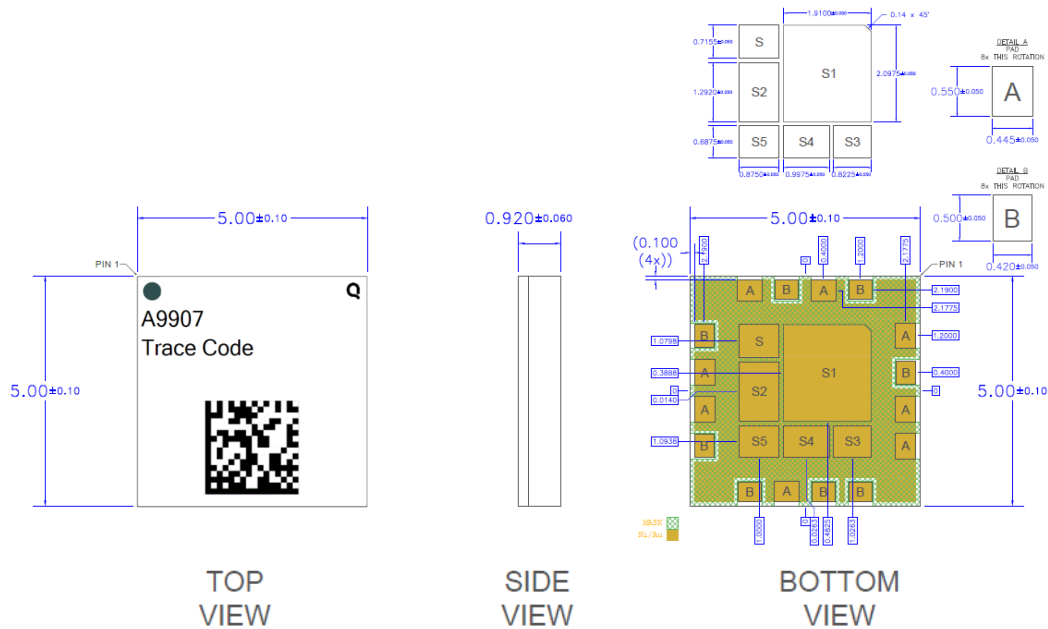
| Pad No.                      | Label             | Description                                                                                                                                                                           |
|------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1, 3, 4, 7, 8,10, 11, 13, 15 | GND               | Ground connection.                                                                                                                                                                    |
| 2                            | RF <sub>IN</sub>  | RF input internally matched to 50Ω and DC shorted.                                                                                                                                    |
| 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 and DC shorted. External DC blocking capacitor required.                                                                                          |
| 12                           | V <sub>CC3</sub>  | Supply voltage for the various amplifier stages                                                                                                                                       |
| 14                           | V <sub>CC2</sub>  | Supply voltage for the various amplifier stages                                                                                                                                       |
| 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 plane through 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

Part Number – QPA9907

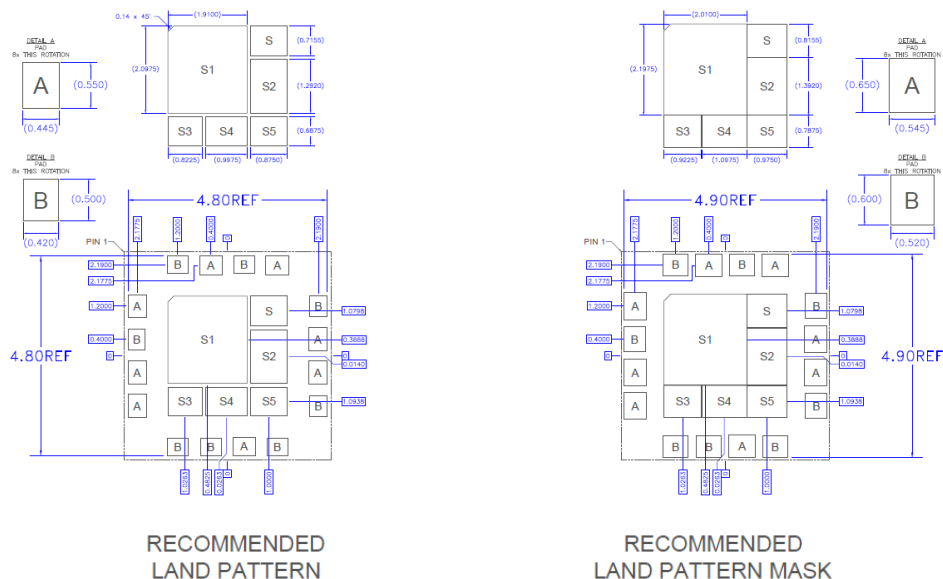
Trace Code – XXXXXX Up to 8 Characters to be Assigned by sub-Contractor



**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

## PCB Mounting Pattern

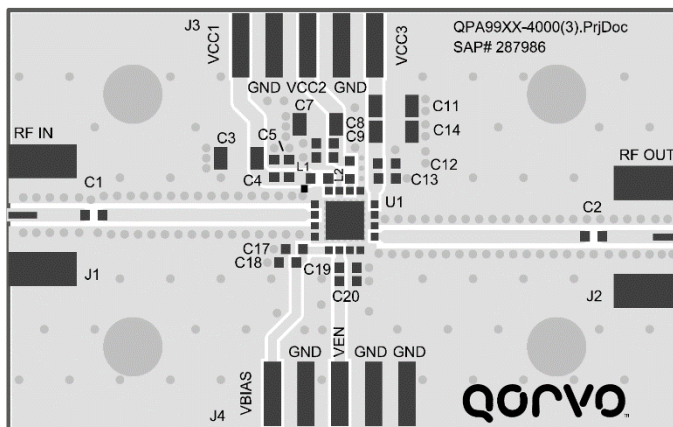


## Evaluation Board PCB Information

### PC Board Layout

| 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

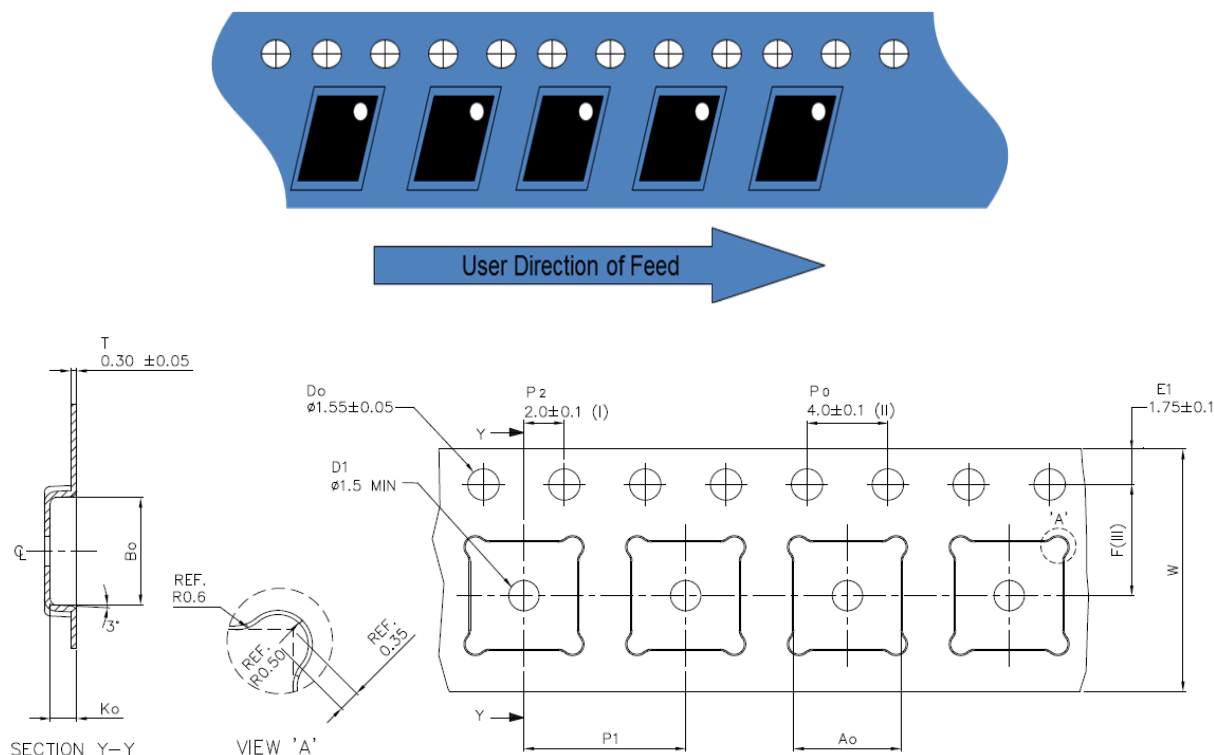


#### Notes:

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

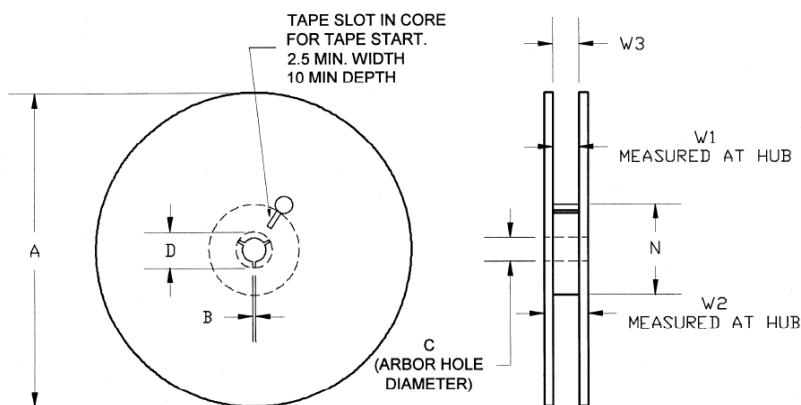
Tape and reel specifications for this part are also available on the Qorvo website.  
Standard T/R size = 2500 pieces on a 13" reel.



| 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        |

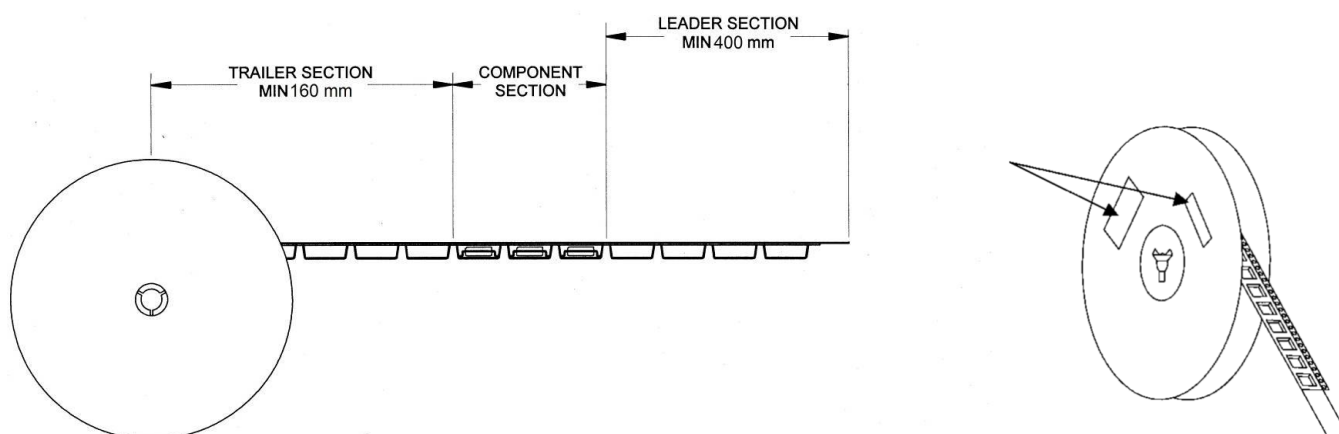
## Tape and Reel Information – Reel Dimensions

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     | 20.20     |

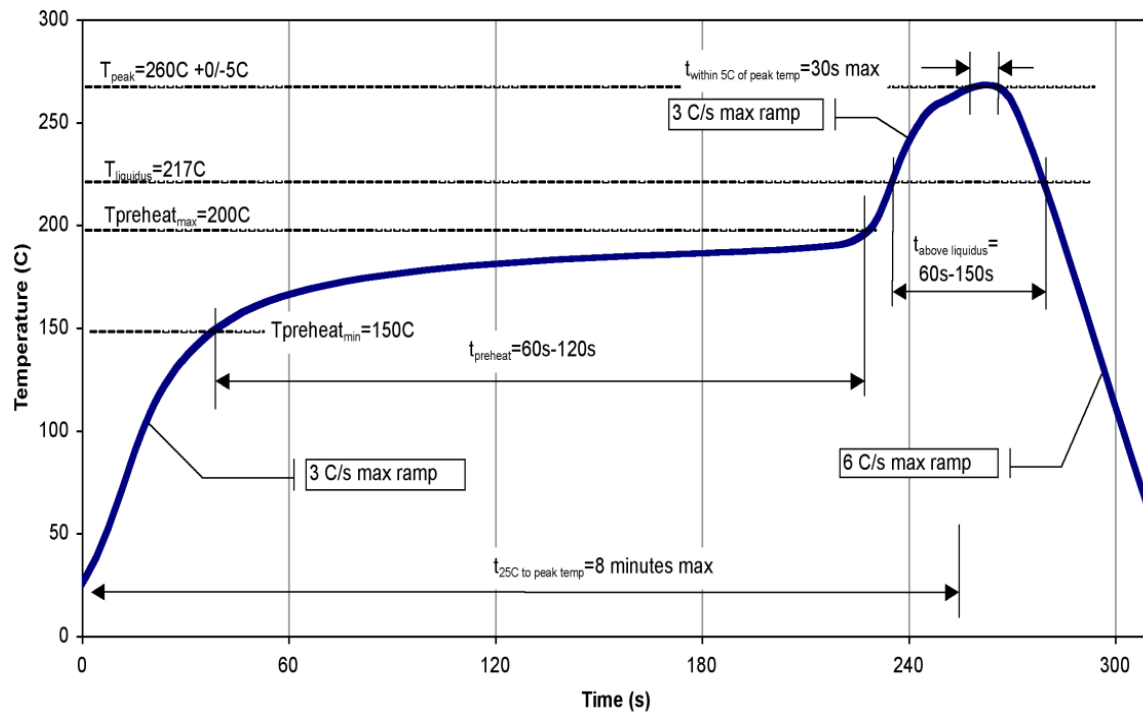
## Tape and Reel Information – Tape Length and Label Placement



### Notes:

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

## Recommended Solder Temperature Profile



## Handling Precautions

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

## 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 (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) 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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