



# QPL9095

## Ultra Low-Noise, Bypass LNA

### General Description

The QPL9095 is a high-linearity, ultra-low noise gain block amplifier with a bypass mode functionality integrated in the product. At 900MHz, the amplifier typically provides 22 dB gain, +33 dBm OIP3, and 0.6 dB noise figure while drawing 50 mA current from a +4.2V supply.

The QPL9095 is internally matched using a high performance E-pHEMT process and only requires four external components for operation from a single positive supply: an external RF choke and blocking/bypass capacitors. This low noise amplifier contains an internal active bias to maintain high performance over temperature.

The QPL9095 is optimized for the 500MHz–1000MHz frequency band and is targeted for wireless infrastructure. The QPL9095 is packaged in a 2 x 2 mm DFN.

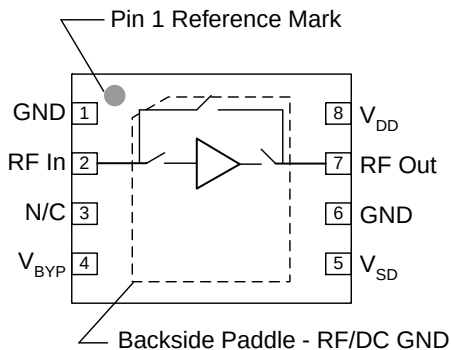


8 Pin 2X2 mm DFN Package

### Product Features

- 500MHz – 1000MHz Operational bandwidth
- LNA with integrated bypass mode
- Ability to turn LNA and bypass mode OFF
- Ultra low noise, 0.6 dB at 900MHz
- 22 dB Gain at 900MHz
- +33 dBm Output IP3 in LNA Mode
- +35 dBm Output IP3 in Bypass Mode
- Internally matched
- Positive supply only, +3.3 to +5 V
- 2x2 mm 8-pin DFN plastic package

### Functional Block Diagram



Top View

### Applications

- Base-station Receivers
- Repeaters / DAS
- Tower Mounted Amplifiers
- Mobile Infrastructure
- General Purpose Wireless
- TDD or FDD systems

### Ordering Information

| Part No.     | Description         |
|--------------|---------------------|
| QPL9095SR    | 100 pcs on 7" reel  |
| QPL9095TR7   | 2500 pcs on 7" reel |
| QPL9095EVB01 | Evaluation Board    |

## Absolute Maximum Ratings

| Parameter                         | Rating       |
|-----------------------------------|--------------|
| Storage Temperature               | -65 to 150°C |
| Supply Voltage (V <sub>DD</sub> ) | +7 V         |
| RF Input Power, CW, 50Ω, T=25°C   | +30 dBm      |

Operation of this device outside the parameter ranges given above may cause permanent damage.

## Recommended Operating Conditions

| Parameter                                   | Min | Typ | Max  | Units |
|---------------------------------------------|-----|-----|------|-------|
| Supply Voltage (V <sub>DD</sub> )           | 3.0 | 4.2 | 5.25 | V     |
| T <sub>CASE</sub>                           | -40 |     | +105 | °C    |
| T <sub>j</sub> at T <sub>CASE</sub> = 125°C |     |     | +142 | °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: V<sub>DD</sub> = +4.2 V, Temp.=+25°C.

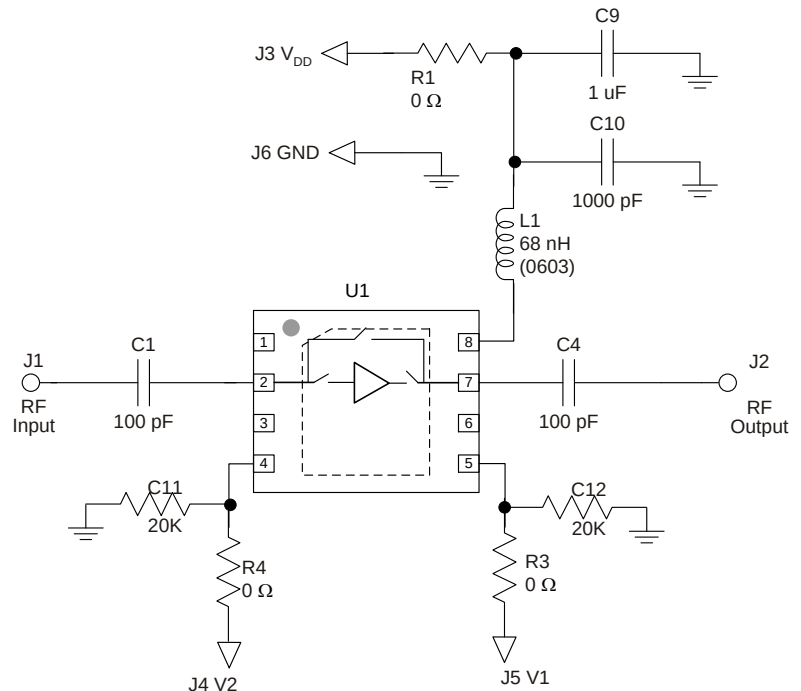
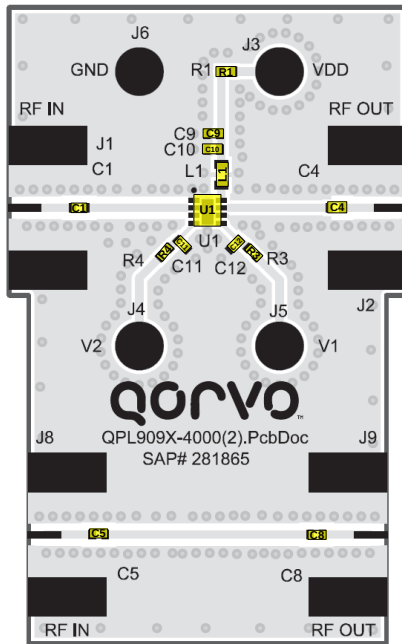
| Parameter                                        | Conditions                                                     | Min   | Typ | Max             | Units |
|--------------------------------------------------|----------------------------------------------------------------|-------|-----|-----------------|-------|
| Operational Frequency Range                      |                                                                | 500   |     | 1000            | MHz   |
| Test Frequency                                   |                                                                |       | 900 |                 | MHz   |
| Gain                                             | LNA ON, Bypass OFF                                             | 20.5  | 22  | 23.5            | dB    |
| Input Return Loss                                | LNA ON, Bypass OFF                                             |       | 8.5 |                 | dB    |
| Output Return Loss                               | LNA ON, Bypass OFF                                             |       | 11  |                 | dB    |
| Noise Figure <sup>(2)</sup>                      | LNA ON, Bypass OFF                                             |       | 0.6 | 0.9             | dB    |
| Output P1dB <sup>(1)</sup>                       | LNA ON, Bypass OFF                                             | +18.5 | +20 |                 | dBm   |
| Output IP3                                       | LNA ON, Bypass OFF,<br>P <sub>out</sub> =+2 dBm/tone, Δf=1 MHz | +30   | +33 |                 | dBm   |
| Insertion Loss                                   | LNA OFF, Bypass ON                                             |       | 1.2 | 2.5             | dB    |
| Return Loss                                      | LNA OFF, Bypass ON                                             |       | 12  |                 | dB    |
| Isolation <sup>(1)</sup>                         | LNA OFF, Bypass OFF                                            | 15    | 18  |                 | dB    |
| Output IP3                                       | LNA OFF, Bypass ON<br>Pin=+2 dBm/tone, Δf=1 MHz                | +30   | +35 |                 | dBm   |
| Control Voltage, V <sub>1</sub> , V <sub>2</sub> | V <sub>IH</sub>                                                | 1.17  |     | V <sub>DD</sub> | V     |
|                                                  | V <sub>IL</sub>                                                | 0     |     | 0.63            | V     |
| Current, I <sub>D</sub>                          | Bypass OFF                                                     | 40    | 53  | 75              | mA    |
|                                                  | Bypass ON                                                      |       | 5   |                 | mA    |
| Switching Speed                                  | LNA-Bypass (50% V <sub>ctrl</sub> to 10% RF)                   |       | 40  |                 | ns    |
|                                                  | Bypass-LNA(50% V <sub>ctrl</sub> to 90% RF)                    |       | 185 |                 | ns    |
|                                                  | LNA-OFF(50% V <sub>ctrl</sub> to 10% RF)                       |       | 40  |                 | ns    |
|                                                  | OFF-LNA(50% V <sub>ctrl</sub> to 90% RF)                       |       | 65  |                 | ns    |
| Thermal Resistance, θ <sub>jc</sub>              | Channel to case                                                |       | 44  |                 | °C/W  |

1. Minimum specification listed is guaranteed by design. Not tested in production.
2. Input trace loss de-embedded from Noise Figure data.

## Control Truth Table

| V <sub>BYP</sub> | V <sub>SD</sub> | State               |
|------------------|-----------------|---------------------|
| 0                | 0               | LNA ON, Bypass OFF  |
| 0                | 1               | LNA OFF, Bypass OFF |
| 1                | x               | LNA OFF, Bypass ON  |

### QPL9095 Evaluation Board



#### Notes:

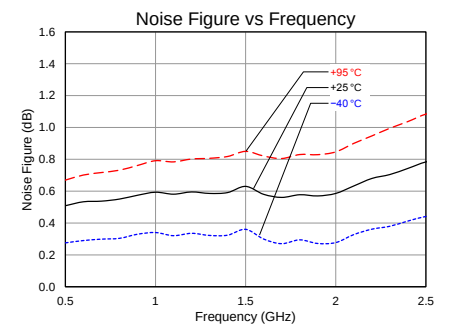
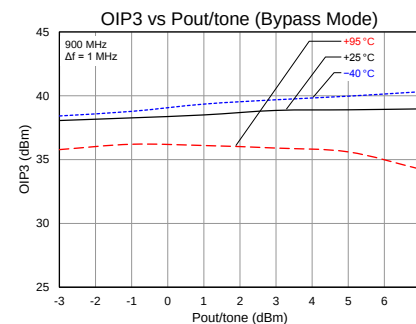
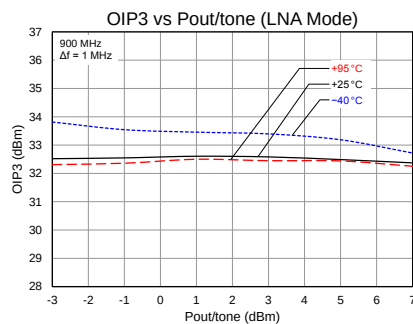
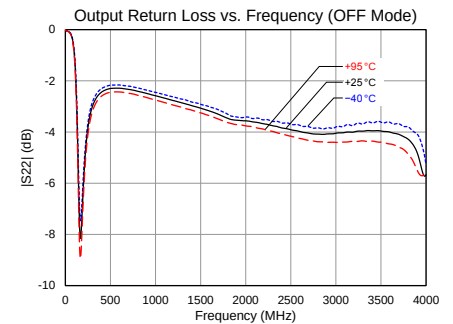
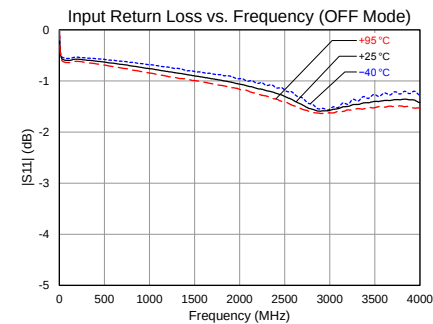
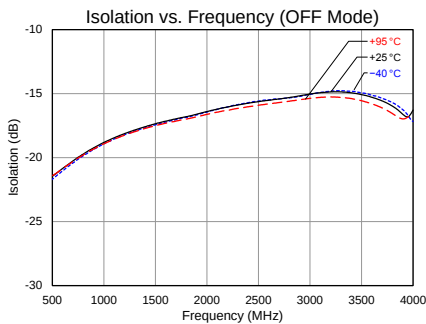
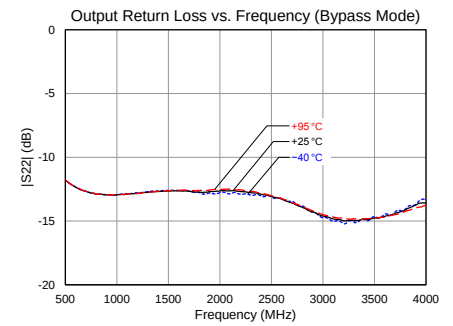
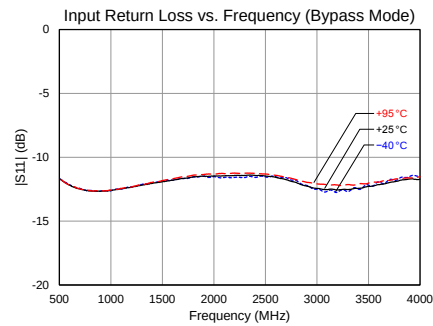
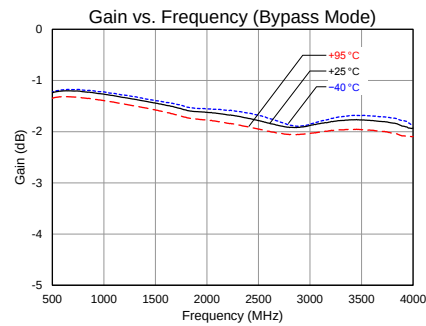
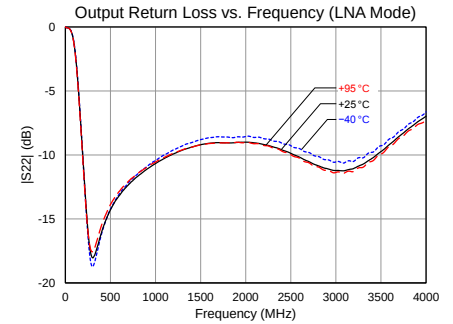
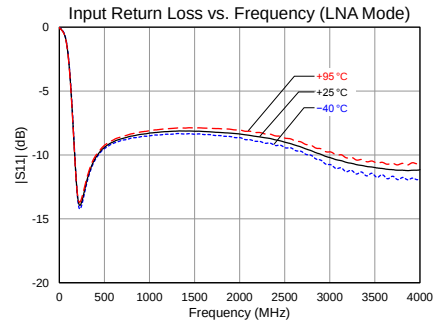
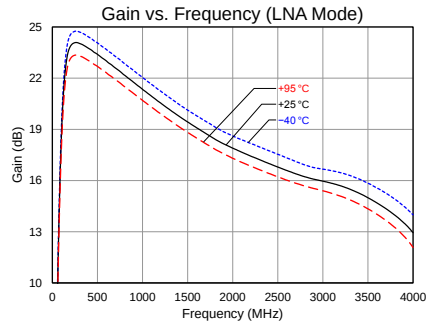
1. A through line is included on the evaluation board to de-embed the board losses.

### Bill of Material – QPL9095 Evaluation Board

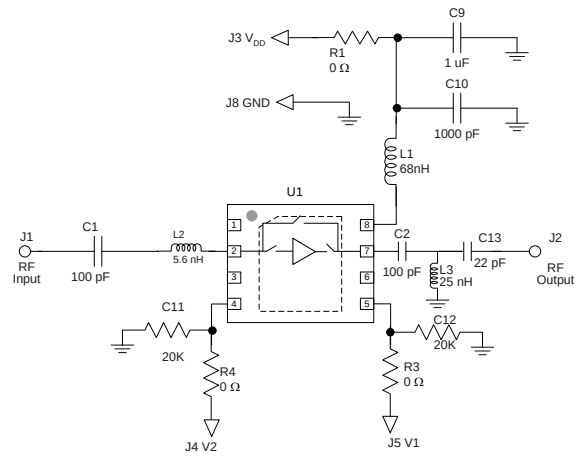
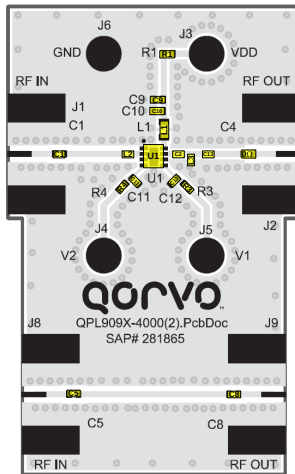
| Reference Des. | Value      | Description                     | Manuf.    | Part Number                  |
|----------------|------------|---------------------------------|-----------|------------------------------|
| N/A            | N/A        | Printed Circuit Board           | Qorvo     |                              |
| U1             | n/a        | Ultra Low Noise, Bypass LNA     | Qorvo     | QPL9095                      |
| C10            | 1000 pF    | CAP, 0402, 10%, 50V, X7R        | Murata    | GRM155R71H102KA01D (1067924) |
| C9             | 1.0 uF     | Cap., 0402, 10%, 6.3V, X5R      | Murata    | GRM155R60J105KE19D (1068381) |
| C1, C4, C5, C8 | 100 pF     | Cap., 0402, 5%, 50V, NPO/COG    | Murata    | GRM1555C1H101JZ01D (1068365) |
| R1, 3, 4       | 0 $\Omega$ | Resistor, Chip, 0402, 5%, 1/16W | Various   |                              |
| C11, C12       | 20K        | Resistor, Chip, 0402, 5%, 1/16W | Various   |                              |
| L1             | 68 nH      | Inductor, 0603, 5%, coil        | Coilcraft |                              |

## Performance Plots

Test conditions unless otherwise noted:  $V_{DD} = +4.2$  V, Temp. = +25 °C

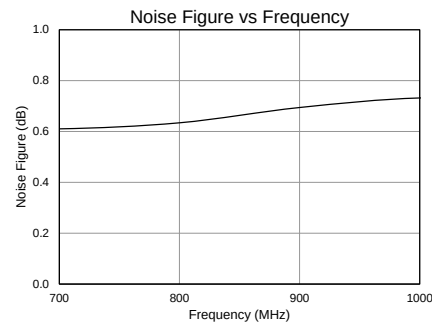
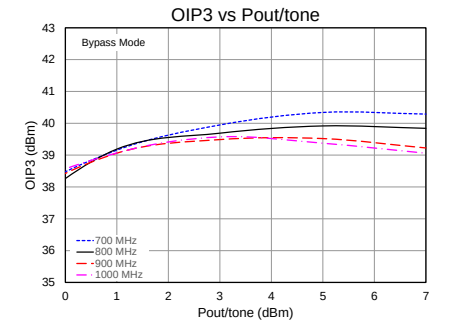
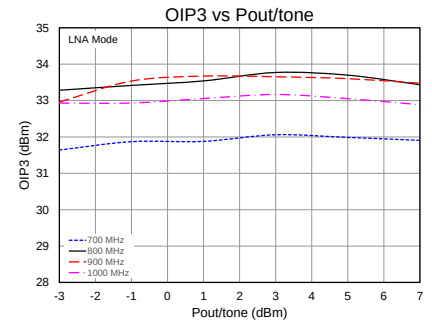
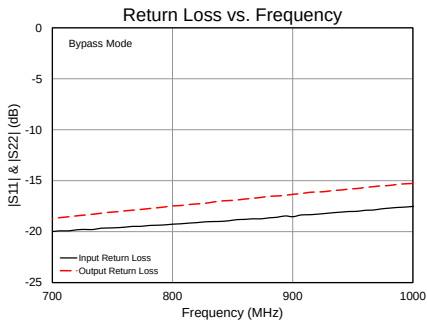
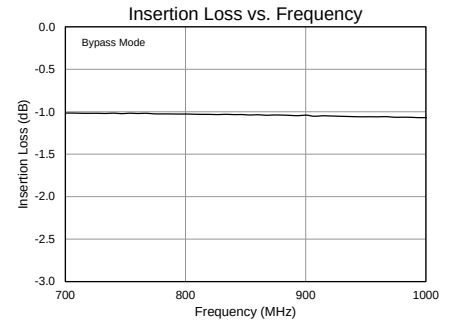
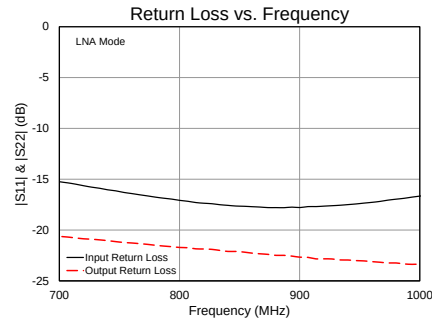
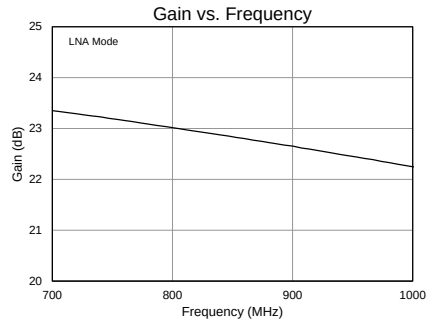


## QPL9095 Improved Return Loss Tune

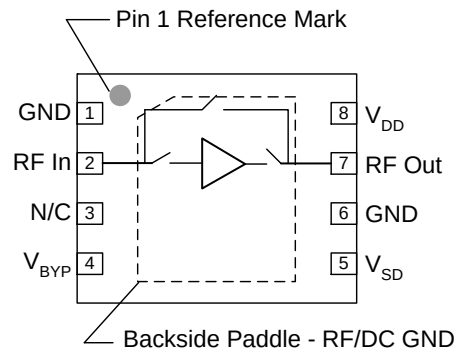


## Performance Plots

Test conditions unless otherwise noted:  $V_{DD} = +4.2$  V, Temp. = +25 °C



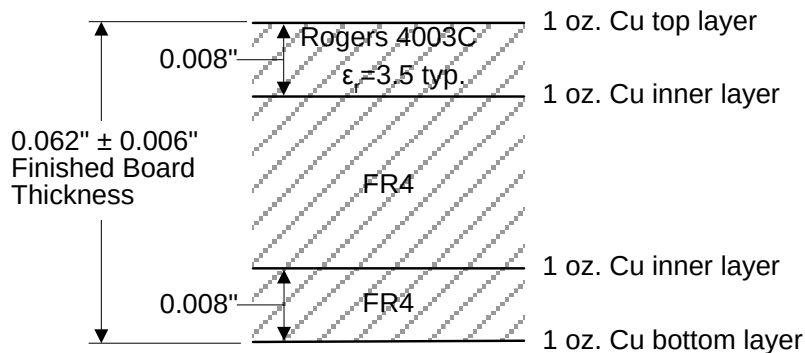
## Pin Configuration and Description



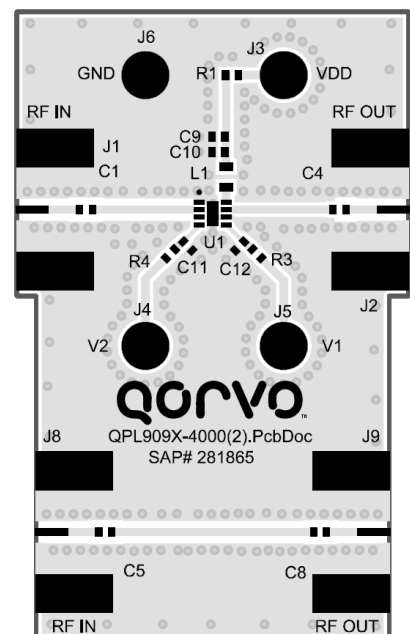
| Pin No.         | Label            | Description                                                                                                                       |
|-----------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1, 6            | GND              | RF/DC Ground pin.                                                                                                                 |
| 2               | RFin             | RF input pin. DC block required.                                                                                                  |
| 3               | N/C              | No internal connection. Provide grounded PCB land pads for mounting integrity.                                                    |
| 4               | V <sub>BYP</sub> | Control pin for bypass mode. The LNA is automatically turned off when the bypass mode is activated. Refer to truth table on pg 2. |
| 5               | V <sub>SD</sub>  | Control pin to disable the LNA. Refer to truth table on pg. 2.                                                                    |
| 7               | RFout            | RF output pin. DC block required.                                                                                                 |
| 8               | V <sub>DD</sub>  | Supply voltage pin. External choke and bypass capacitors needed.                                                                  |
| Backside Paddle | RF/DC GND        | RF/DC Ground. Follow recommended via pattern and ensure good solder attach for best thermal and electrical performance.           |

## Evaluation Board PCB Information

### Qorvo PCB 281865 Material and Stack-up

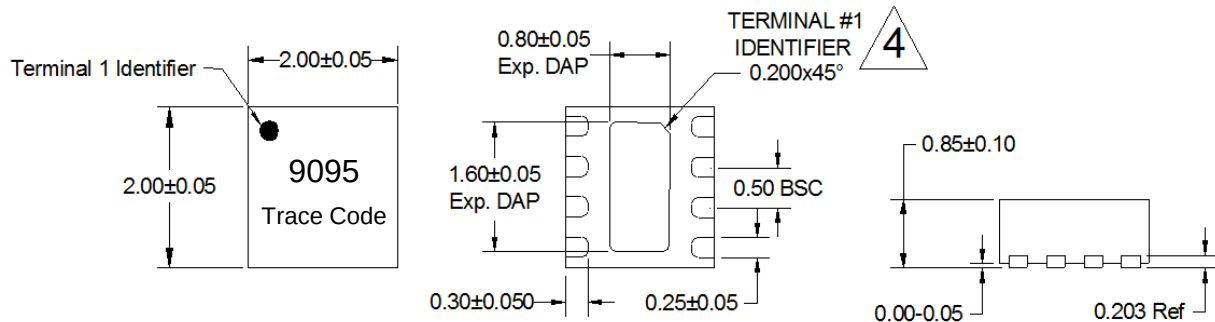


50 ohm line dimensions: width = 0.0182", spacing = 0.020"



## Mechanical Information

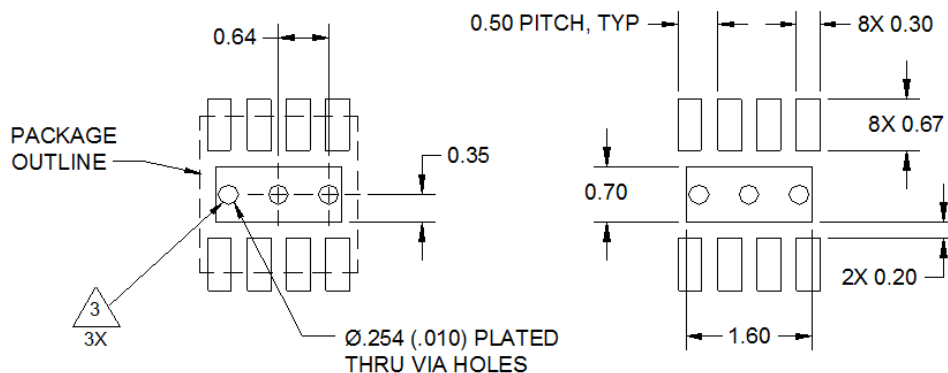
### Package Marking and Dimensions



#### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-220, Issue E (Variation VGGC) for thermally enhanced plastic very thin fine pitch quad flat no lead package (QFN).
3. Dimension and tolerance formats conform to ASME Y14.4M-1994.
4. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

### PCB Mounting Pattern



#### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. We recommend a  $0.35$  mm ( $\#80/.0135$ ") 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.

## Handling Precautions

| Parameter                        | Rating   | Standard                 |
|----------------------------------|----------|--------------------------|
| ESD – Human Body Model (HBM)     | Class 1B | ESDA / JEDEC JS-001-2014 |
| ESD – Charged Device Model (CDM) | Class C3 | ESDA / JEDEC JS-002-2014 |
| MSL – Moisture Sensitivity Level | 1        | IPC/JEDEC J-STD-020      |



Caution!  
ESD-Sensitive Device

## Solderability

Compatible with lead-free (260°C max. reflow temp.) soldering process.

Solder profiles available upon request.

Contact plating: NiPdAu

## 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:

- Lead Free
- 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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«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

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