



# QPB8808

## 20 dB CATV +12 V Power Doubler

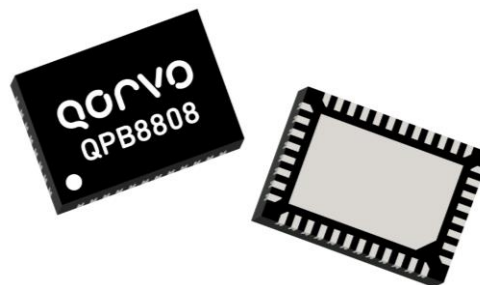
### Product Description

The QPB8808 is an ultra-linear, QFN GaAs amplifier MMIC intended for output stage amplification in CATV infrastructure applications.

The device features a push-pull cascode design which provides flat gain along with ultra-low distortion, making it ideal for use in CATV distribution systems requiring high output power capability.

The QPB8808 draws approximately 525 mA from a single +12 V supply providing ~20 dB gain with excellent linearity. Users may adjust the bias current with external voltage enabling the QPB8808 to be used in applications such as doublers or for lower power system applications.

The QPB8808 is packaged in an industry standard 40 pin 5 x 7 mm QFN package with exposed paddle (EP) beneath the device for thermal and electrical grounding

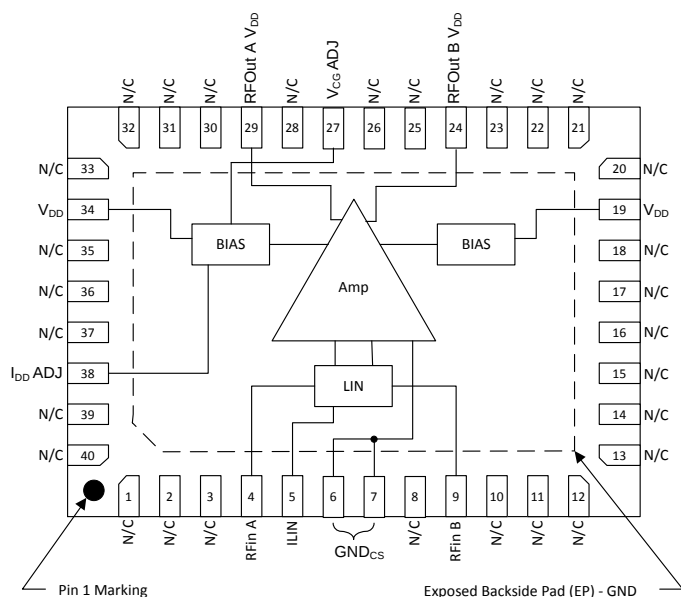


40 Pin 5 x 7 mm QFN Package

### Product Features

- 50 – 1218 MHz Bandwidth
- Excellent High Output Linearity at Reduced Supply Voltages
- Ultra-Low CSO / CTB / XMOD
- Low Noise
- Excellent Input/Output Return Loss
- High Gain, 20.6 dB typ. at 1218 MHz
- Settable bias current
- Compact 5 X 7 mm QFN Package
- +12 V Supply Voltage
- 525 mA Operating Current

### Functional Block Diagram



### Applications

- HFC Nodes
- CATV Line Amplifiers
- Head End Equipment
- 50 – 1218 MHz 75  $\Omega$  Amplifier

### Ordering Information

| Part No.      | Description                 |
|---------------|-----------------------------|
| QPB8808SQ     | Sample bag 25 pcs           |
| QPB8808SR     | 7" Reel with 100 pcs        |
| QPB8808TR13   | 13" Reel with 2500 pcs      |
| QPB8808PCK401 | EVB with 5-piece sample bag |

## Absolute Maximum Ratings

| Parameter                   | Value / Range |
|-----------------------------|---------------|
| Storage Temperature         | -40 to 100 °C |
| Operating Temperature       | -40 to 85 °C  |
| Device Voltage ( $V_{DD}$ ) | +18 V         |
| Device Current ( $I_{DD}$ ) | 650 mA        |

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

## Recommended Operating Conditions

| Parameter                          | Min | Typ | Max | Units |
|------------------------------------|-----|-----|-----|-------|
| Device Voltage ( $V_{DD}$ )        |     | +12 |     | V     |
| Tj 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.

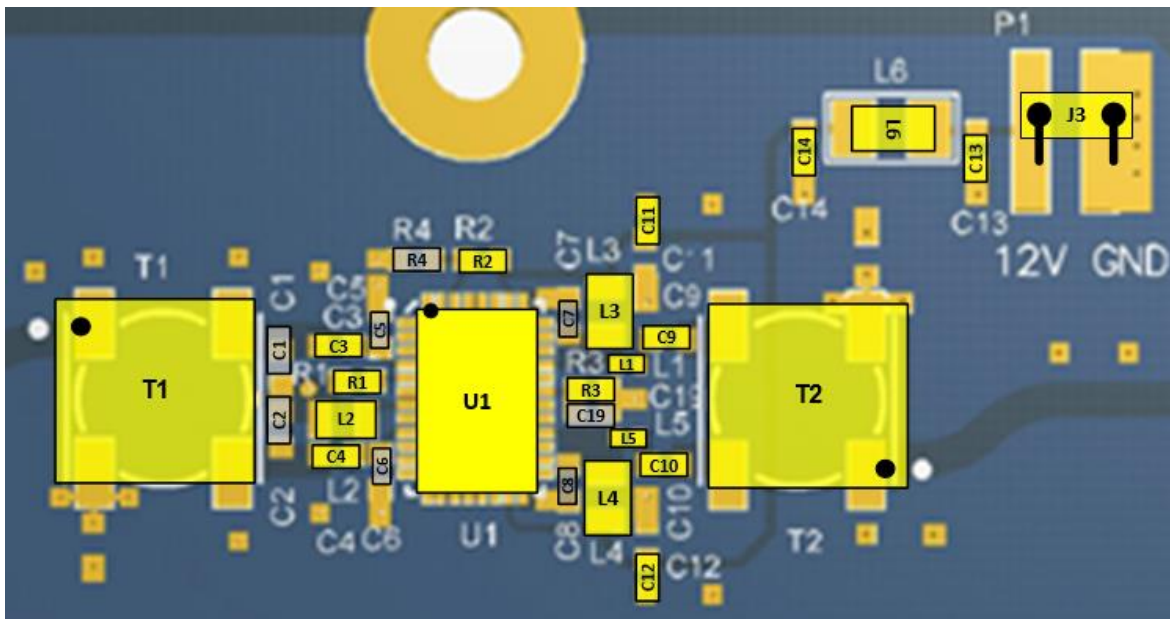
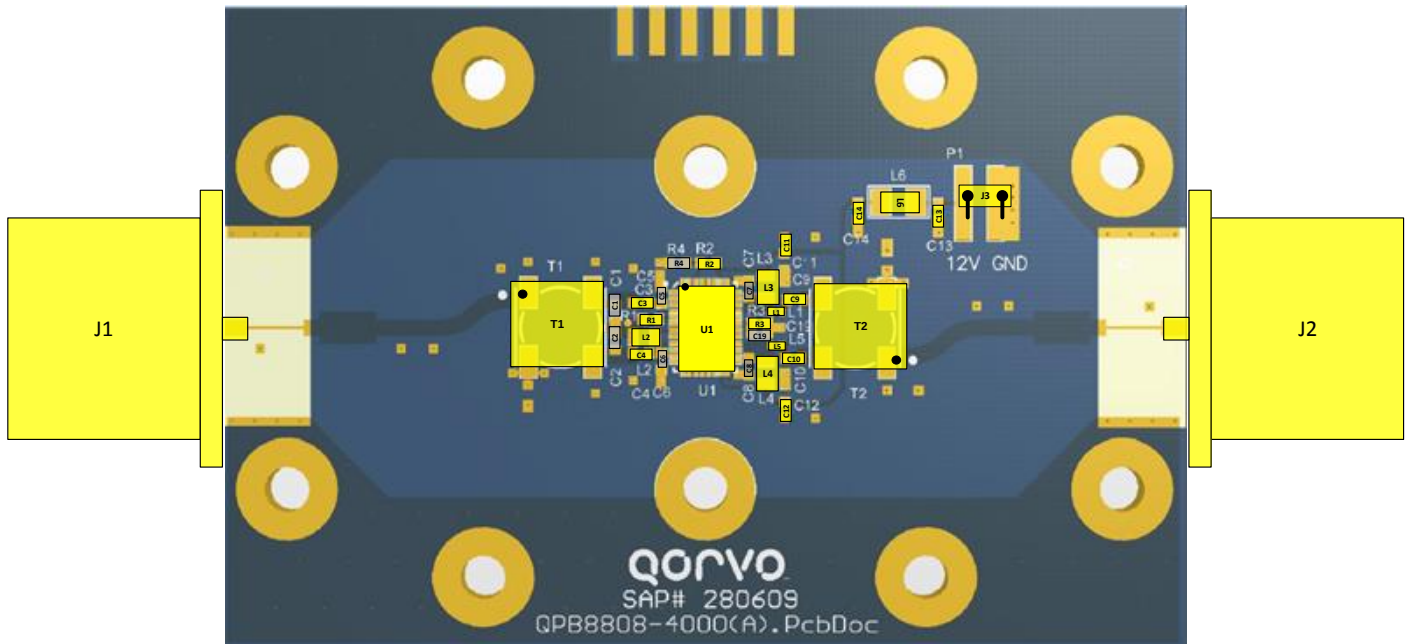
## Electrical Specifications

| Parameter                           | Conditions                                                                                                  | Min       | Typ   | Max  | Units |      |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------|-------|------|-------|------|
| Operational Frequency Range         | –                                                                                                           | 50        | –     | 1218 | MHz   |      |
| Current (I <sub>DD</sub> )          | –                                                                                                           | –         | 525   | –    | mA    |      |
| Gain                                | f <sub>o</sub> = 1218 MHz                                                                                   | –         | 20.6  | –    | dB    |      |
| Gain Flatness                       | 50 to 1218 MHz <sup>(1)</sup>                                                                               | –         | ±0.5  | –    |       |      |
| Gain Tilt                           | 50 to 1218 MHz <sup>(2)</sup>                                                                               | –         | +0.75 | –    |       |      |
| Input Return Loss                   | f <sub>o</sub> = 50 MHz                                                                                     |           | 20    | –    | dB    |      |
|                                     | f <sub>o</sub> = 1003 MHz                                                                                   | –         | 15    | –    |       |      |
|                                     | f <sub>o</sub> = 1218 MHz                                                                                   | –         | 14    | –    |       |      |
| Output Return Loss                  | f <sub>o</sub> = 50 MHz                                                                                     | –         | 20    | –    | dB    |      |
|                                     | f <sub>o</sub> = 1003 MHz                                                                                   | –         | 18    | –    |       |      |
|                                     | f <sub>o</sub> = 1200 MHz                                                                                   | –         | 15    | –    |       |      |
| CSO                                 | Vo= 57dBmV at 1218 MHz, 22 dB extrapolated tilt, 79 analog channels plus 111 digital channels (-6dB offset) | Notes 3,4 | –     | –78  | –     | dBc  |
| CTB                                 |                                                                                                             |           | –     | –79  | –     | dBc  |
| CCN                                 |                                                                                                             |           | –     | 58   | –     | dB   |
| OIP2                                | f <sub>1</sub> - f <sub>2</sub> = 50 MHz, +17 dBm / tone                                                    | Notes 3,4 | –     | +85  | –     | dBm  |
| OIP3                                | f <sub>1</sub> =550 MHz, f <sub>2</sub> =555 MHz, +17 dBm / tone                                            |           | –     | +50  | –     | dBm  |
| P1dB                                | f <sub>o</sub> =550 MHz                                                                                     |           | –     | +33  | –     | dBm  |
| Noise Figure                        | f <sub>o</sub> =1218 MHz                                                                                    | –         | 4.5   | –    | –     | dB   |
| Thermal Resistance, θ <sub>jb</sub> | Junction to base                                                                                            | –         | 7     | –    | –     | °C/W |

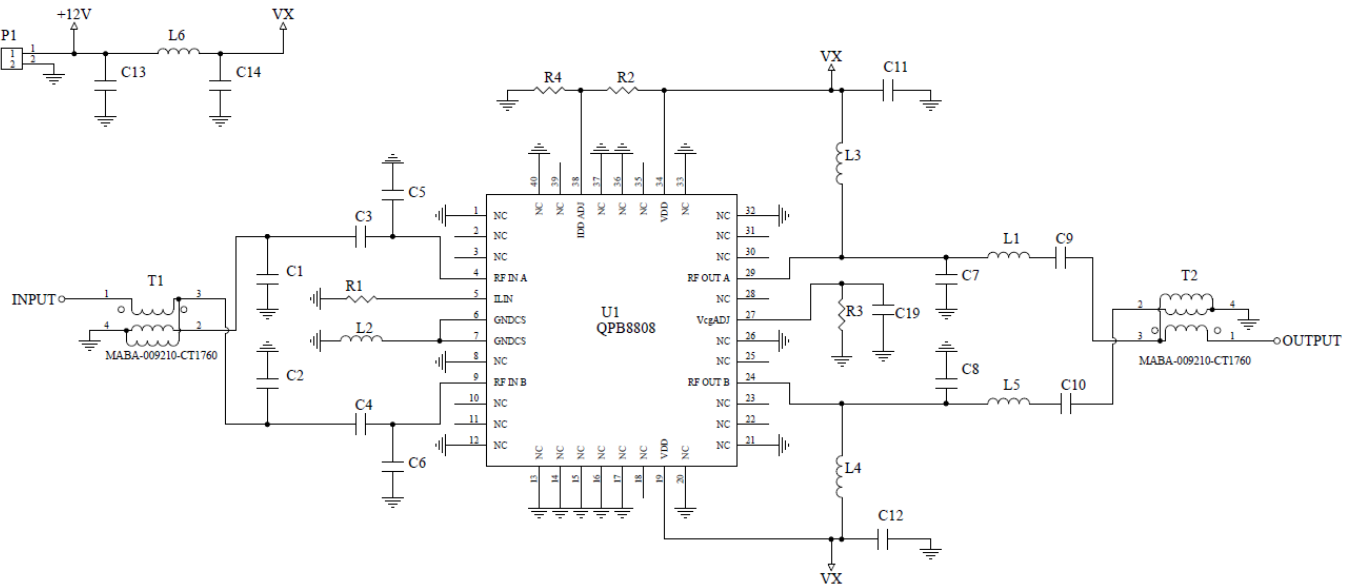
### Notes:

1. Maximum deviation from a line using least squares fit across the band 50 to 1218 MHz
2. Gain of S21 at 1218 MHz–S21 at 50 MHz
3. Standard EB configuration
4. ILIN resistor R1 set to 910 ohms, changing value may further optimize IMD performance

QPB8808PCK401 Evaluation Board



## QPB8808PCK401 Evaluation Board



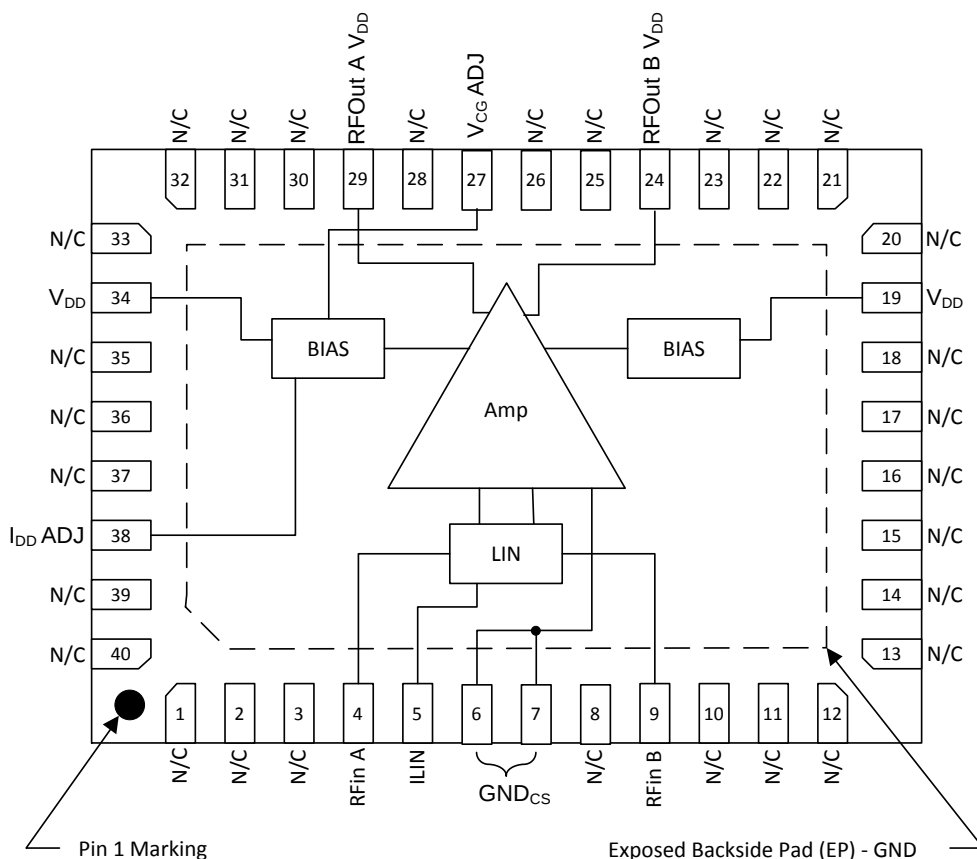
## Bill of Materials – QPB8808PCK401

| Reference Des.           | Value                  | Description                              | Manuf.      | Part Number          |
|--------------------------|------------------------|------------------------------------------|-------------|----------------------|
| PCB                      | Rev B                  | PCB QPB8808 - EVB                        | Qorvo       | –                    |
| U1                       | n/a                    | QPB8808 Mounted on EVB                   | Qorvo       | QPB8808              |
| U1 – 5 samples           | n/a                    | QPB8808 5 piece of loose samples         | Qorvo       | QPB8808              |
| T1-2                     | 1:1 BALUN, 75 $\Omega$ | MABA-009210-CT1760                       | MACOM       | MABA-009210-CT1760   |
| C11-12                   | 0.01 uF                | CAP, 0603, 10%, 50V, X7R                 | TDK         | C1608X7R1H103J       |
| C3-4                     | 1000 pF                | CAP, 0603, 5%, 50V, NPO                  | TDK         | C1608NP01H102J080AA  |
| C7-C8                    | 0.5 pF                 | CAP, 0402, $\pm 0.1$ pF, 100V, NPO       | Murata      | GQM1885C2AR50BB01J   |
| C9-10                    | 330 pF                 | CAP, 0603, 5%, 50V, NPO                  | TDK         | CGJ3E2C0G1H331J080AA |
| C13-14                   | 0.1 uF                 | CAP, 0603, 10%, 50V, X7R                 | TDK         | C1608X7R1H104K       |
| L1, L5                   | 1.5 nH                 | IND, 0402, $\pm 0.1$ nH, 6GHz SRF, 280mA | Murata      | LQP15MN1N5B02D       |
| L2 <sup>1</sup> , L3, L4 | 680 nH                 | IND, 0805, 5%, 355 MHz SRF, 660mA        | Coilcraft   | 0805AF-681XJR        |
| R1                       | 910 $\Omega$           | RES, 0603, 5%, 1/16W                     | Panasonic   | ERJ3GEYJ911          |
| R3                       | 1.21 K $\Omega$        | RES, 0603, 1%, 1/16W                     | Panasonic   | ERJ3EKF1211V         |
| R2                       | 17.4 K $\Omega$        | RES, 0603, 1%, 1/16W                     | Vishay      | CRCW060317K4FKEA     |
| L6                       | 900 nH                 | IND, 1008, 10%, 1008AF-901X              | Coilcraft   | 022-28-8021          |
| J1-2                     | 75 $\Omega$            | N-TYPE MALE, PANEL MOUNT                 | Pasternack  | PE4504               |
| J3                       | 2 pin 0.1" RA          | Molex SMT connector                      | Molex       | 022-28-8021          |
| R4, C1-2, C5-6, C19      | n/a                    | Do Not Insert                            | N/A         | N/A                  |
| PH 4-40                  | 4-40, 0.25",           | Pan Head Screw w/ lock washer            | various     | –                    |
| SH 4-40                  | 4-40, 0.25",           | Socket Head Screw                        | various     | –                    |
| –                        | Cut to 0.25" x 0.4"    | Indium foil 1"x1" x 0.004"               | Indium Corp | IND4HSD004           |
| Heatsink                 | Aluminum               | Heatsink for 62 mil board                | TriQuint    | 1094050              |

### Notes:

- Output source inductor must be rated for 650 mA min for IDD flowing through RF output devices
- Some N/C pins have been grounded but may be left open

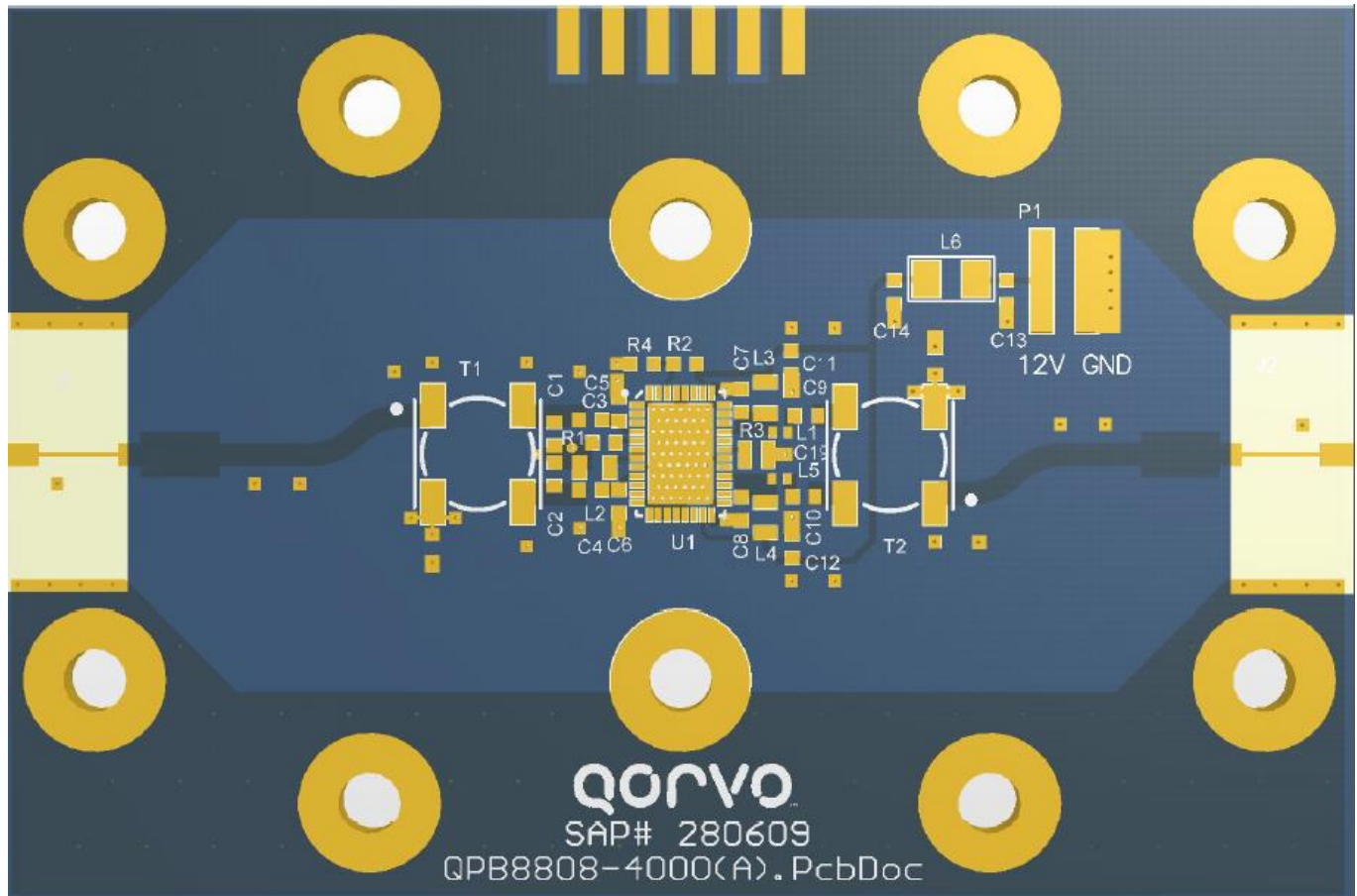
## Pin Configuration



## Pin Description

| Pin No.                                              | Label                   | Description                                                                                                                                |
|------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 4                                                    | RFin A                  | RF in A, requires external Balun. External DC Block required.                                                                              |
| 9                                                    | RFin B                  | RF in B, requires external Balun. External DC Block required.                                                                              |
| 5                                                    | ILIN                    | Current adjust pin to optimize Linearity                                                                                                   |
| 29                                                   | RFout A/V <sub>DD</sub> | RF Out A and supply voltage, external DC block & Balun required.                                                                           |
| 24                                                   | RFout B/V <sub>DD</sub> | RF Out B and supply voltage, external DC block & Balun required.                                                                           |
| 19, 34                                               | V <sub>DD</sub>         | Bias controller supply voltage                                                                                                             |
| 27                                                   | V <sub>CG</sub> ADJ     | Common Gate adjustment to optimize common gate amplifier bias voltage (normally open)                                                      |
| 38                                                   | I <sub>DD</sub> ADJ     | I <sub>DD</sub> current control (normally open), pulling to gnd lowers I <sub>DD</sub> current                                             |
| 6-7                                                  | GND <sub>CS</sub>       | Common Source ground, grounded with inductor. Full DC current flows through this pin, inductor must handle total I <sub>DD</sub> current.  |
| Backside Paddle                                      | GND                     | RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint. |
| 1-3, 8, 10-18, 20-23, 25-26, 28, 30-33, 35-37, 39-40 | N/C                     | No connection                                                                                                                              |

## Evaluation Board PCB Information

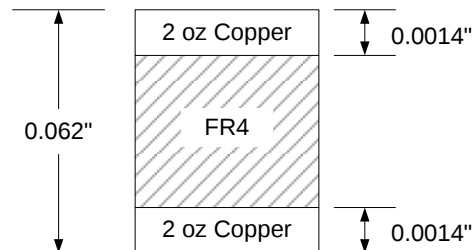


### EB & EBP EVB PCB Material and Stack-up

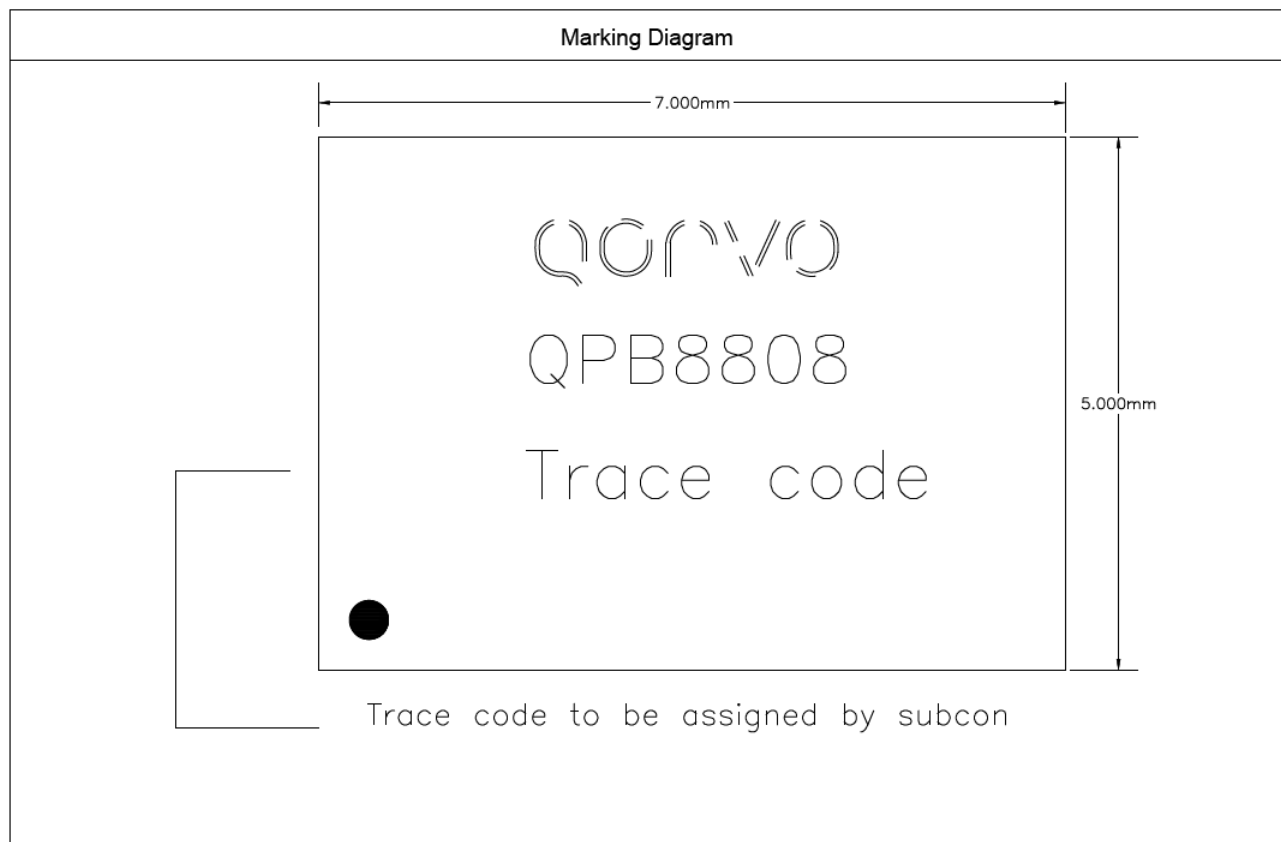
Board Material: 0.062" FR4,  $\epsilon_r=4.25$

Plating: 2oz Copper

Board Dimension: 3" x 2"



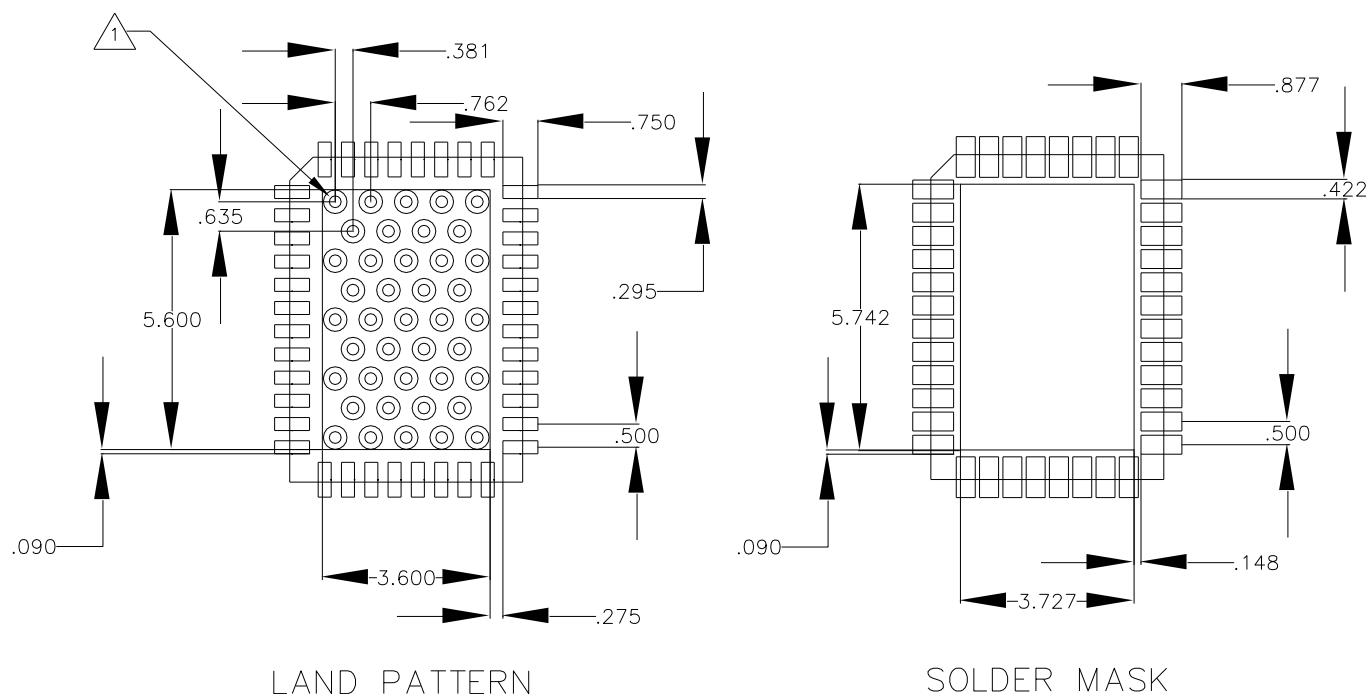
## Package Marking and Dimensions



**Notes:**

1. Dimension and tolerance formats conform to ASME Y14.4M-1994.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
3. Co-planarity applies to the exposed ground/thermal pad as well as the contact pins.
4. Package body length/width does not include plastic flash protrusion across mold parting line.

## PCB Mounting Pattern

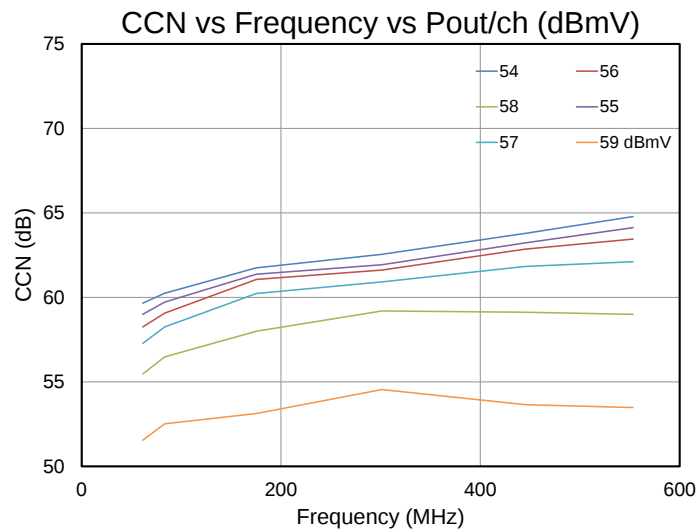
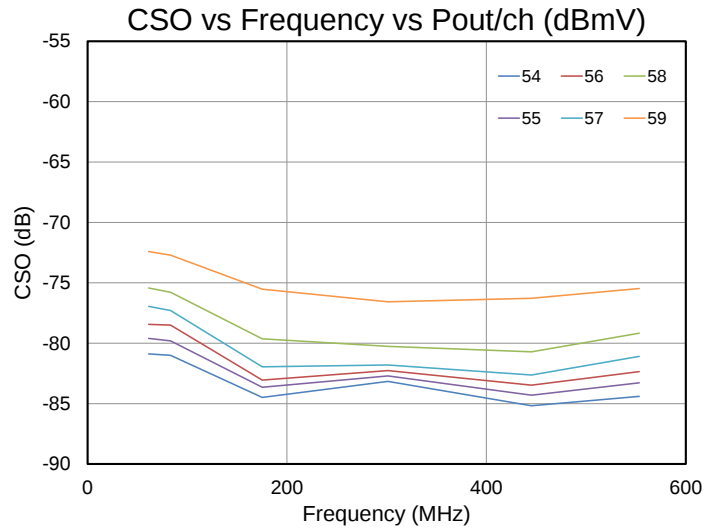
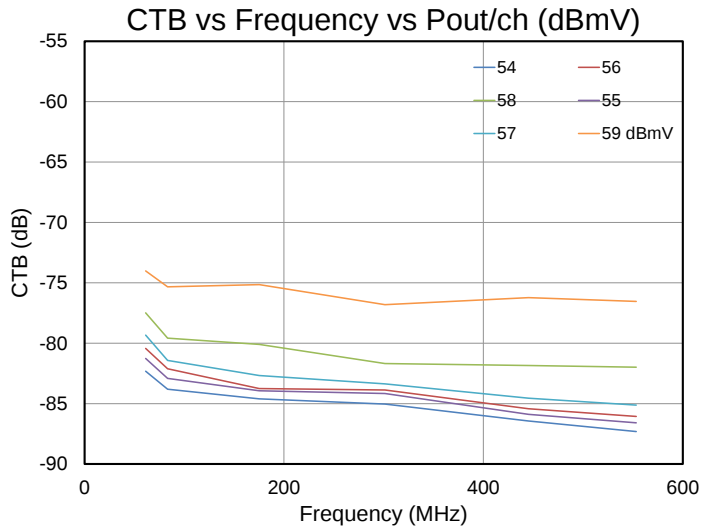


### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 2 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 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25mm (0.10").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.
5. Place mounting screws near the part to fasten a back side heat sink.
6. Do not apply solder mask to the back side of the PC board in the heat sink contact region.
7. Ensure that the backside via region makes good physical contact with the heat sink.

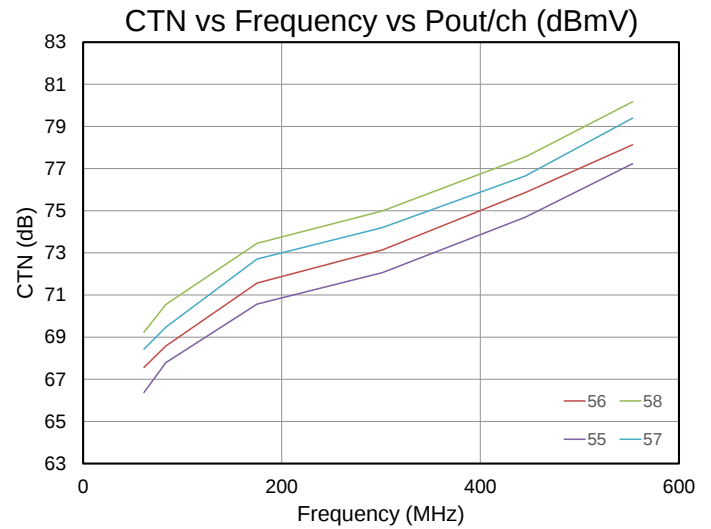
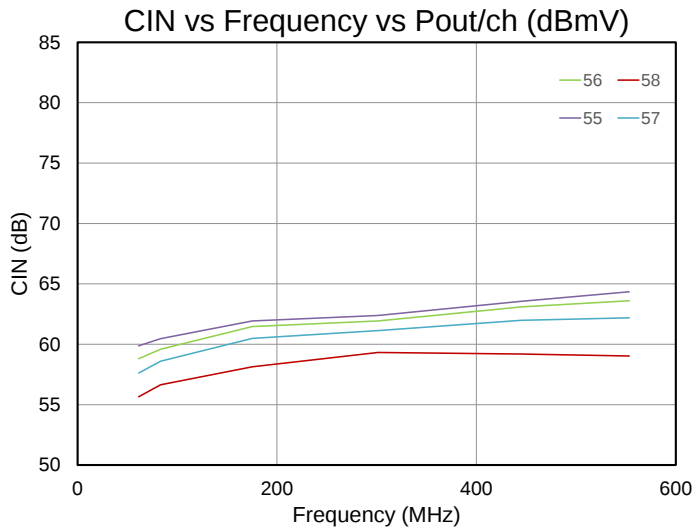
## Typical Performance Plots

$V_{DD} = +12\text{ V}$ , 525 mA, Heatsink Temp. = +35°C,  $Z_{In/Out} = 75\ \Omega$  using evaluation board EB,  $V_o = 54$  to 57 dBmV at 1218 MHz, 22 dB extrapolated tilt, 79 analog channels plus 111 digital channels (-6 dB offset)

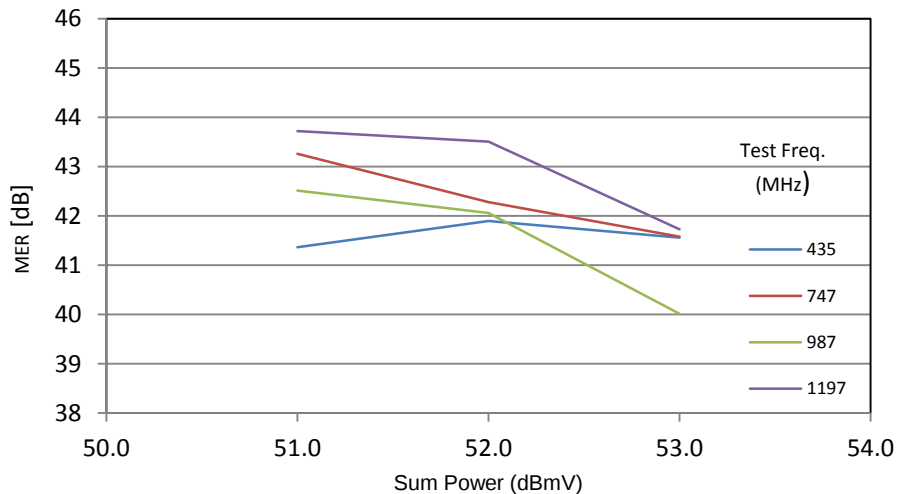


## Typical Performance Plots

VDD = +12 V, 525 mA, Heatsink Temp. = +35°C, Z<sub>In/Out</sub> = 75 Ω using evaluation board EB, Vo = 54 to 57 dBmV at 1218 MHz, 22 dB extrapolated tilt, 79 analog channels plus 111 digital channels (-6 dB offset)



Test conditions unless otherwise noted: V<sub>DD</sub> = +12 V, 515mA, Heatsink Temp. = +35°C, Z<sub>In/Out</sub> = 75 Ω using evaluation board EB  
261MHz to 1215MHz, 18.6dB tilt, 160 channels Includes input and output  
balun/transformer losses of tuned application circuit, ITU-T, Annex B, QAM256, 5.36 Msps



## Handling Precautions

| Parameter                        | Rating  | Standard                   |
|----------------------------------|---------|----------------------------|
| ESD – Human Body Model (HBM)     | 1A      | ANSI/ESD/JEDEC JS-001-2012 |
| ESD – Charged Device Model (CDM) | C1      | 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: 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)

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