

Applications

- Wireless Infrastructure
- CATV / SATV / MoCA
- Point to Point
- Defense & Aerospace
- Test & Measurement Equipment
- General Purpose Wireless

Product Features

- DC – 6000 MHz
- Flat, broadband frequency response
- 20.3 dB Gain at 1900 MHz
- 3.9 dB Noise Figure at 1900 MHz
- +28.5 dBm Output IP3 at 1900 MHz
- +15.5 dBm P1dB at 1900 MHz
- 50 Ohm Cascadable Gain Block
- Single Supply, 45 mA Current
- SOT-363 Package

General Description

The TQP369184 is a general-purpose buffer amplifier that offers high dynamic range in a low-cost surface-mount package. At 1900 MHz, the amplifier typically provides 20.3 dB gain, +28.5 dBm OIP3, and 3.9 dB Noise Figure while drawing 45 mA current. The device combines dependable performance with consistent quality to maintain MTTF values exceeding 100 years at mounting temperatures of +85 °C. The device is housed in a lead-free/green/RoHS-compliant industry-standard SOT-363 package.

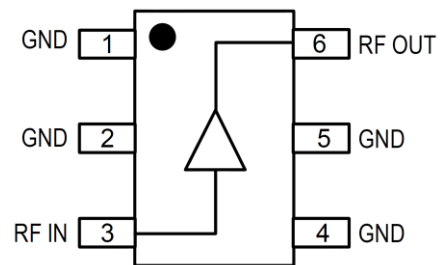
The TQP369184 consists of a Darlington-pair amplifier using the high reliability InGaP/GaAs HBT process technology. Only DC-blocking capacitors, a bias resistor, and an inductive RF choke are required for operation.

This broadband MMIC amplifier can be directly applied to various current and next generation wireless technologies such as CDMA, W-CDMA, and LTE. In addition, the TQP369184 will work for other applications within the DC to 6 GHz frequency range.



SOT-363 Package

Functional Block Diagram



Pin Configuration

| Pin No. | Label |
|------------|--------|
| 3 | RF IN |
| 6 | RF OUT |
| 1, 2, 4, 5 | GND |

Ordering Information

| Part No. | Description |
|---------------|-------------------------------|
| TQP369184 | InGaP/GaAs HBT Gain Block |
| TQP369184-PCB | 500-6000 MHz Evaluation Board |

Standard T/R size = 3000 pieces on a 7" reel

Absolute Maximum Ratings

| Parameter | Rating |
|-----------------------------------|---------------|
| Storage Temperature | -55 to 150 °C |
| RF Input Power, CW, 50Ω, T=25°C | +24 dBm |
| Device Voltage (V _{CC}) | +4.5 V |

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

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|--|-----|-----|------|-------|
| T _{CASE} | -40 | | +105 | °C |
| T _j for >10 ⁶ hours MTTF | | | +160 | °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: I_{CC} =45 mA, T_{CASE}= +25 °C, 50Ω system

| Parameter | Conditions | Min | Typ | Max | Units |
|---------------------------------------|---|-------|-------|------|-------|
| Operational Frequency Range | | DC | | 6000 | MHz |
| Test Frequency | | | 1900 | | MHz |
| Gain | | 18.8 | 20.3 | 21.8 | dB |
| Input Return Loss | | | 15 | | dB |
| Output Return Loss | | | 24 | | dB |
| Output P1dB | | | +15.5 | | dBm |
| Output IP3 | P _{out} =0 dBm/tone, Δf= 1 MHz | +25.5 | +28.5 | | dBm |
| Noise Figure | | | 3.9 | | dB |
| Device Voltage (V _{CC}) | | 3.0 | 3.9 | 4.5 | V |
| Device Current (I _{CC}) | | | 45 | | mA |
| Thermal Resistance (θ _{jc}) | Junction to case ⁽¹⁾ | | | 226 | °C/W |

Notes:

1. Thermal path is from the device junction through the package ground tab (pins 2,4) to the backside mounting surface.

S-Parameters

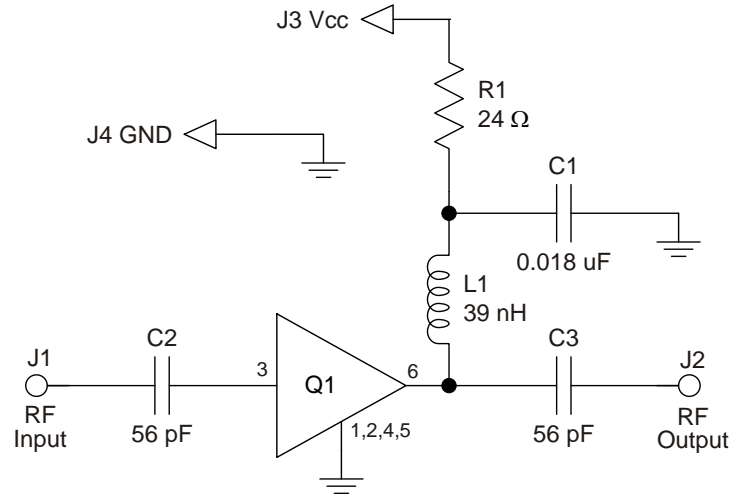
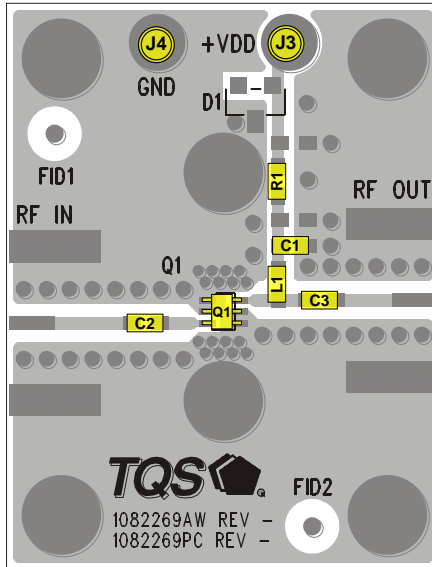
Test Conditions: $V_{CC}=+3.9$ V (typ.), $I_{CC}=45$ mA (typ.), $T_{CASE}=+25$ °C, 50 Ω system, calibrated to device leads

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 10 | -32.5 | -177.9 | 22.6 | 179.6 | -24.1 | 0.9 | -35.7 | 85.5 |
| 20 | -31.3 | 178.1 | 22.6 | 179.2 | -24.0 | 0.4 | -41.7 | 59.7 |
| 50 | -30.7 | 168.6 | 22.6 | 178.0 | -24.2 | 0.0 | -58.8 | 111.5 |
| 100 | -29.9 | 152.6 | 22.6 | 176.2 | -24.1 | -0.4 | -54.6 | -176.0 |
| 200 | -27.9 | 131.8 | 22.5 | 172.5 | -24.2 | 0.7 | -60.3 | 133.2 |
| 500 | -23.9 | 102.6 | 22.3 | 162.2 | -24.2 | 1.7 | -41.7 | 104.5 |
| 900 | -20.3 | 77.3 | 21.9 | 149.2 | -24.2 | 2.6 | -45.1 | 135.2 |
| 1000 | -19.9 | 73.3 | 21.8 | 145.9 | -24.1 | 3.4 | -52.6 | 109.9 |
| 1500 | -17.2 | 47.4 | 21.1 | 131.1 | -24.2 | 4.1 | -39.7 | -28.7 |
| 1900 | -15.7 | 26.3 | 20.5 | 120.0 | -24.2 | 5.1 | -26.2 | -35.1 |
| 2000 | -15.1 | 21.0 | 20.3 | 117.4 | -24.2 | 5.5 | -24.6 | -39.5 |
| 2500 | -12.4 | -5.3 | 19.4 | 105.2 | -24.4 | 6.5 | -18.2 | -46.9 |
| 3000 | -10.0 | -17.9 | 18.5 | 94.3 | -24.7 | 7.3 | -14.6 | -43.4 |
| 3500 | -9.0 | -24.3 | 17.6 | 85.2 | -24.9 | 8.7 | -12.9 | -40.9 |
| 4000 | -8.5 | -27.4 | 16.9 | 77.1 | -24.9 | 12.1 | -12.9 | -36.9 |
| 4500 | -9.1 | -27.6 | 16.5 | 69.6 | -25.0 | 14.4 | -14.7 | -31.4 |
| 5000 | -10.8 | -26.9 | 16.2 | 61.0 | -24.9 | 17.4 | -20.0 | -16.1 |
| 5500 | -14.5 | -28.1 | 16.1 | 51.2 | -24.8 | 20.0 | -25.7 | 73.4 |
| 6000 | -22.4 | -51.2 | 15.9 | 39.3 | -24.9 | 20.7 | -17.1 | 126.2 |

Notes:

1. Measured on TQP369184-PCB with L1 removed and C2, C3 replaced with 0 Ω resistors.
2. Bias applied to device output via internal network analyzer wide-band bias tee.
3. SOLT Ecal at network analyzer test cable ends.
4. Input and output reference planes extended to the device leads.

TQP369184-PCB Evaluation Board



Notes:

1. See Evaluation Board PCB Information section for material and stack-up.
2. All components are of 0603 size unless otherwise stated.

Bill of Material – TQP369184-PCB

| Reference Des. | Value | Description | Manuf. | Part Number |
|----------------|----------|--------------------------------|-----------|---------------|
| Q1 | n/a | High Linearity LNA Gain Block | TriQuint | TQP369184 |
| C1 | 0.018 uF | Cap, Chip, 0603, 16V, X7R, 10% | various | |
| C2, C3 | 56 pF | Cap, Chip, 0603, 50V, NPO, 5% | various | |
| L1 | 39 nH | Inductor, 0603, 5%, CS Series | Coilcraft | 0603CS-39NXJL |
| R1 | 24 Ω | Res, Chip, 0805, 1/10W, 5% | various | |

Component Values for Specific Frequencies

| Frequency (MHz) | 50 | 500 | 900 | 1900 | 2200 | 2500 | 3500 |
|-----------------|---------|---------|--------|-------|-------|-------|-------|
| L1 | 820 nH | 220 nH | 68 nH | 27 nH | 22 nH | 18 nH | 15 nH |
| C2, C3 | .018 uF | 1000 pF | 100 pF | 68 pF | 68 pF | 56 pF | 39 pF |

Bias Resistor Values for Various Supply Voltages

| V _{SUPPLY} (V) | 5 | 6 | 7 | 8 | 9 | 10 | 12 |
|-------------------------|------|------|------|------|-------|-------|-------|
| R1 | 24 Ω | 47 Ω | 68 Ω | 91 Ω | 110 Ω | 130 Ω | 180 Ω |
| Component Size | 0805 | 1206 | 1210 | 1210 | 1210 | 2010 | 2010 |

Typical Performance – TQP369184-PCB

Test conditions unless otherwise noted: $V_{SUPPLY} = +5\text{ V}$, $R_1 = 24\ \Omega$, $I_{CC} = 45\text{ mA}$, $T_{CASE} = +25^\circ\text{C}$

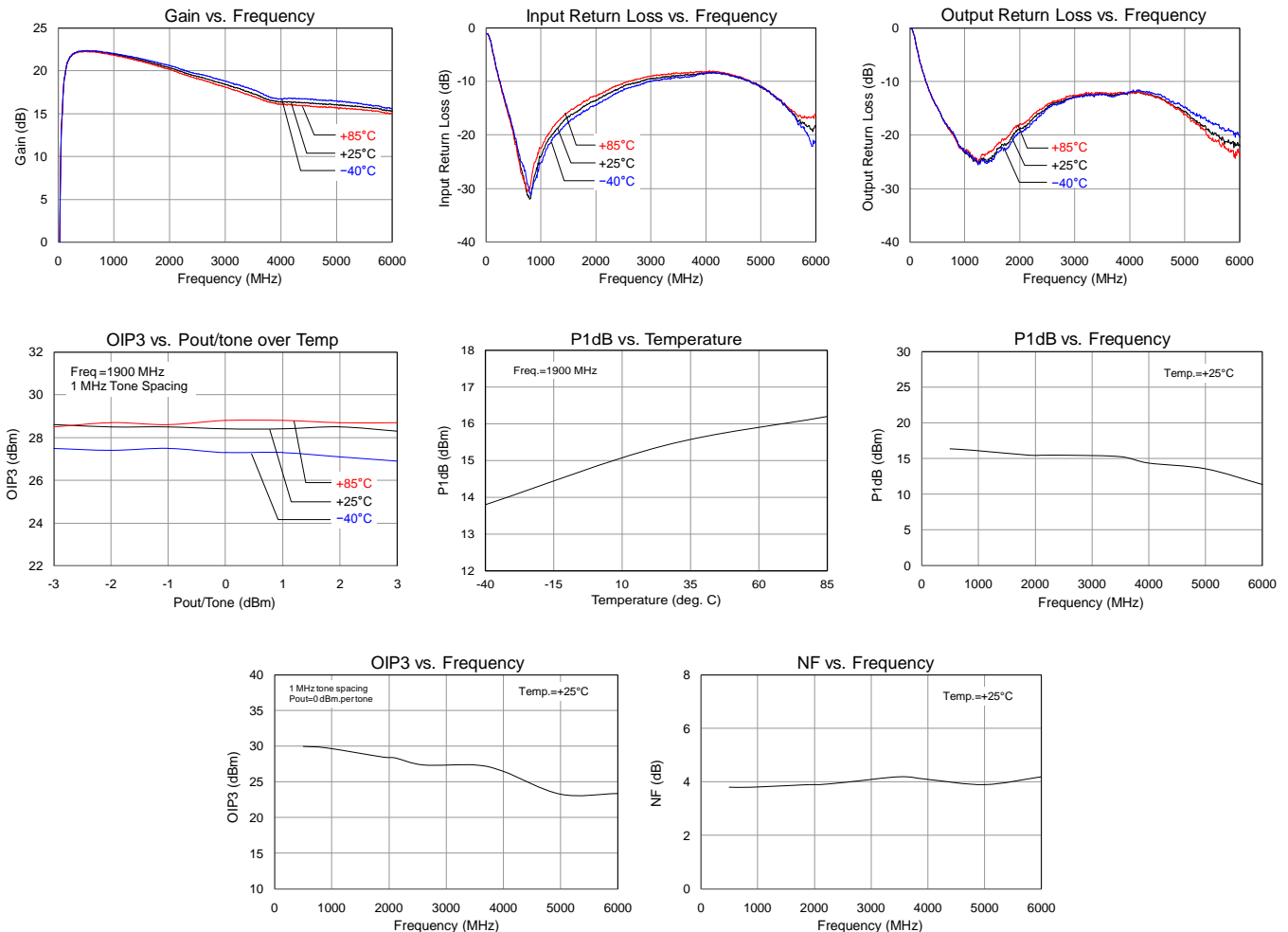
| Parameter | Typical Value | | | | | | | | | Units |
|--------------------|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Frequency | 500 | 900 | 1900 | 2100 | 2600 | 3500 | 4000 | 5000 | 6000 | MHz |
| Gain | 22.2 | 22.0 | 20.3 | 20.0 | 19.0 | 17.6 | 16.9 | 16.2 | 15.9 | dB |
| Input Return Loss | 20 | 32 | 15 | 13 | 10 | 9 | 9 | 11 | 22 | dB |
| Output Return Loss | 15 | 21 | 24 | 18 | 14 | 13 | 13 | 20 | 17 | dB |
| Output P1dB | +16.4 | +16.2 | +15.5 | +15.5 | +15.5 | +15.3 | +14.4 | +13.6 | +11.4 | dBm |
| OIP3 | +30.0 | +29.8 | +28.5 | +28.4 | +27.4 | +27.4 | +26.5 | +23.3 | +23.4 | dBm |
| Noise Figure | 3.8 | 3.8 | 3.9 | 3.9 | 4.0 | 4.2 | 4.1 | 3.9 | 4.2 | dB |

Notes:

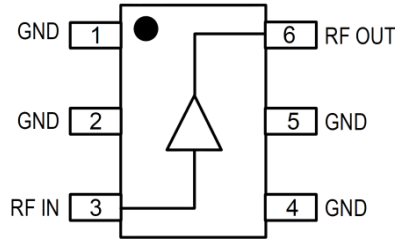
- OIP3 measured with two tones at an output power of 0 dBm / tone separated by 1 MHz.

Performance Plots – TQP369184-PCB

Test conditions unless otherwise noted: $V_{SUPPLY} = +5\text{ V}$, $R_1 = 24\ \Omega$, $I_{CC} = 45\text{ mA}$, $T_{CASE} = +25^\circ\text{C}$



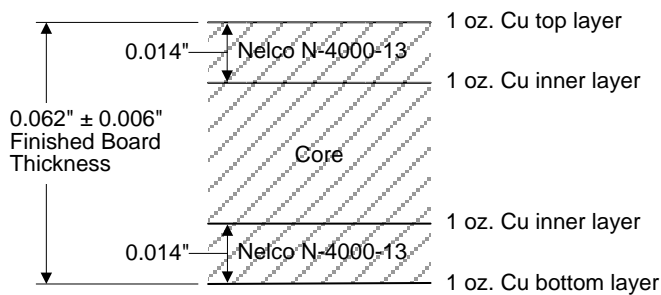
Pin Configuration and Description



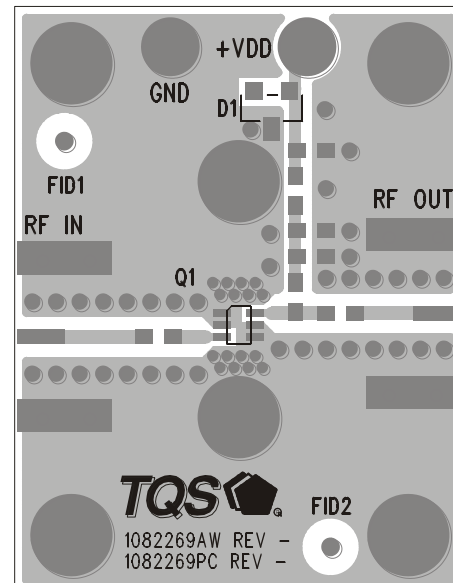
| Pin No. | Label | Description |
|------------|--------|--|
| 3 | RF IN | RF input, matched to 50 Ohms. External DC Block is required. |
| 6 | RF OUT | RF output / DC supply, matched to 50 Ohms. External DC |
| 1, 2, 4, 5 | GND | RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint. |

Evaluation Board PCB Information

TriQuint PCB 1082269 Material and Stack-up

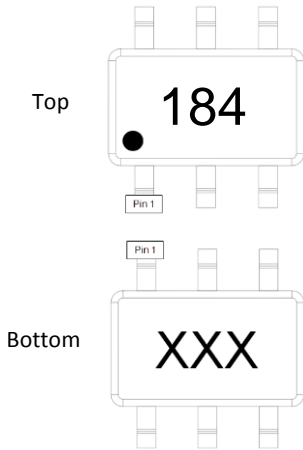


50 Ohm Line Dimensions: Width=0.029"
 Spacing=0.035"

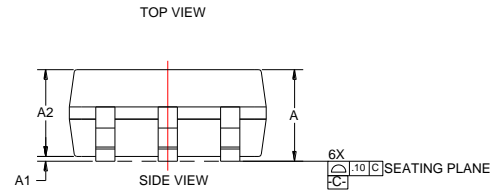
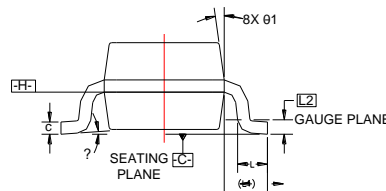
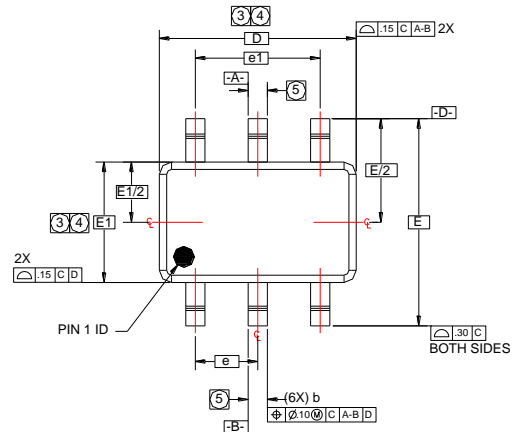


Package Marking and Dimensions

The top surface of the package is marked with a “184” designator and the bottom surface is marked with an alphanumeric lot code.



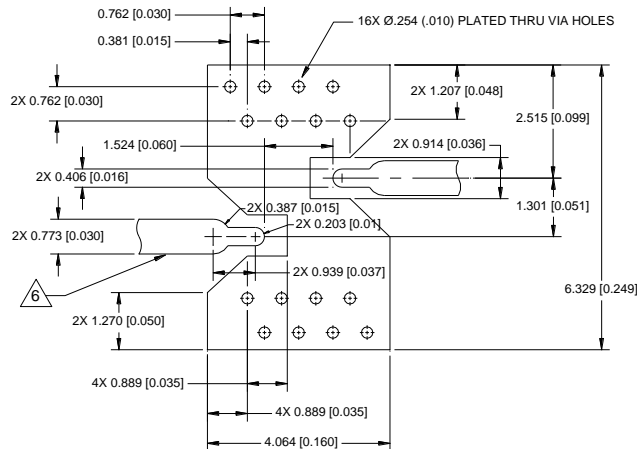
| SYMBOL | MIN | MAX |
|--------|--------------------|--------------|
| A | - | 1.10 (0.043) |
| A1 | 0 | 0.10 (0.004) |
| A2 | 0.70 (0.028) | 1.00 (0.039) |
| D | 2.00 (0.079) BASIC | |
| E | 2.10 (0.083) BASIC | |
| E1 | 1.25 (0.049) BASIC | |
| L | 0.21 (0.008) | 0.41 (0.016) |
| L1 | 0.42 (0.017) REF | |
| L2 | 0.15 (0.006) BASIC | |
| ? | 0.8 | 8.8 |
| ?1 | 4.8 | 12.8 |
| b | 0.15 (0.006) | 0.30 (0.012) |
| c | 0.08 (0.003) | 0.22 (0.009) |
| e | 0.65 (0.026) BASIC | |
| e1 | 1.30 (0.051) BASIC | |



Notes:

1. Dimensions are in millimeters (Inches)
2. Dimensions and tolerances per ASME Y14.5M-1194. Package conforms to JEDEC MO-203, Issue B.

PCB Mounting Pattern



Notes:

1. All dimensions are in millimeters(inches). 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.
4. Do not remove or minimize via hole structure in the PCB. Thermal and RF grounding is critical.
5. 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").
6. The RF I/O trace transition shown is to a 30 mil wide line. Modify transition as required to interface with other line widths.

Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: Class 1C
Value: ≥ 1000 V and < 2000 V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JS-001-2012

ESD Rating: Class C3
Value: ≥ 1000 V
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101F

MSL Rating

MSL Rating: Level 1
Test: 260°C convection reflow
Standard: JEDEC Standard IPC/JEDEC J-STD-020

Solderability

Compatible with both lead-free (260 °C maximum reflow temperature) and tin/lead (245 °C maximum reflow temperature) soldering processes.

Contact plating: NiPdAu

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
- 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.triquint.com Tel: 877-800-8584
Email: customer.support@qorvo.com

For information about the merger of RFMD and TriQuint as Qorvo:

Web: www.qorvo.com

For technical questions and application information:

Email: sjcappliations.engineering@qorvo.com

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