

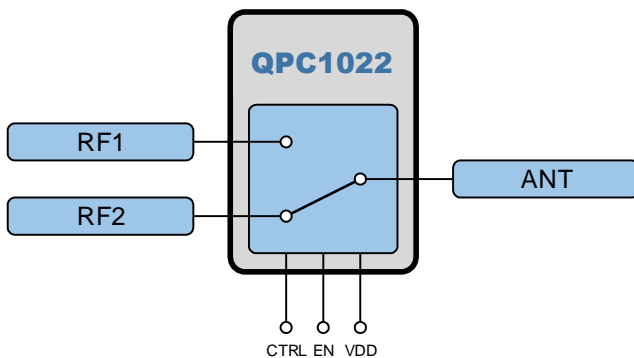
General Description

The QPC1022 is a single pole dual-throw (SPDT) switch designed for switching applications requiring very low insertion loss and high power handling capability with minimal DC power consumption. The excellent linearity performance achieved by the QPC1022 makes it ideal for use in cellular base. This switch offers very high isolation between RF ports providing greater separation between transmit and receive paths. The QPC1022 is packaged in a very compact 1.1mm x 1.5mm x 0.375mm (typical) 9-Pin LGA package.



9 Pin 1.1 x 1.5 mm LGA Package

Functional Block Diagram



Product Features

- 5MHz to 6GHz Operation
- Low Insertion Loss: 0.25dB at 2GHz
- Harmonics:
 - 2fo of -106dBc at 1980MHz
 - 3fo of -94dBc at 1980MHz
- High Isolation:
 - 56dB at 204MHz
 - 39dB at 2GHz
- High IP3:
 - 76 dBm at 1.9GHz
- Compatible with Low Voltage Logic (VHIGH Minimum = 1.3V)
- No External DC Blocking Capacitors Required on RF Paths Unless DC is Applied Externally
- 1000V HBM ESD Rating on All Ports

Applications

- Cellular BTS
- Post PA Switching
- General Purpose Switching Applications

Ordering Information

| Part No. | Description |
|---------------|--|
| QPC1022SB | Sample Bag with 5 pieces |
| QPC1022SR | Sample Reel with 100 pieces |
| QPC1022TR7 | Standard 7" Reel with 2,500 pieces |
| QPC1022PCK401 | Fully Assembled 50 Ohm Evaluation Board and Sample Bag with 5 pieces |

Absolute Maximum Ratings

| Parameter | Rating |
|-------------------------------|-----------------|
| Storage Temperature | -40 to +150 °C |
| Operating Temperature (Tcase) | -40 to 105 °C |
| Maximum Vdd | 6.0 V |
| Maximum EN | 3.0 V |
| Maximum CTRL | 3.0 V |
| Max Input Power at 105 °C | 33 dBm : 5MHz |
| | 37 dBm : >20MHz |

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.

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|-----------------------------------|------|-----|------|-------|
| Device Voltage (V _{dd}) | +2.4 | +5 | +5.8 | V |
| T _{CASE} | -40 | | +105 | °C |
| T _j | | | +125 | °C |
| RF input Power 5MHz @ 85 °C | | | 33 | dBm |
| RF input power >20MHz @ 85 °C | | | 37 | dBm |

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

Electrical Specifications

| Parameter | Conditions ⁽¹⁾ | Min | Typ | Max | Units |
|-------------------------------------|---------------------------|-----|------|------|-------|
| Operational Frequency Range | | 5 | | 6000 | MHz |
| Insertion Loss RF1/RF2 to ANT | 5.0MHz to 1.0GHz | | 0.2 | 0.4 | dB |
| | 1GHz to 2.0GHz | | 0.25 | 0.4 | dB |
| | 2.0GHz to 2.5GHz | | 0.26 | | dB |
| | 2.5GHz to 3.5GHz | | 0.35 | | dB |
| | 3.5GHz to 3.8GHz | | 0.38 | | dB |
| | 3.8GHz to 6GHz | | 0.46 | | dB |
| Isolation RF1 to RF2 | 5.0MHz to 200MHz | | 56 | | dB |
| | 200MHz to 1.0GHz | 39 | 46 | | dB |
| | 1.0GHz to 2.0GHz | 32 | 39 | | dB |
| | 2.0GHz to 2.5GHz | | 36 | | dB |
| | 2.5GHz to 3.5GHz | | 34 | | dB |
| | 3.5GHz to 3.8GHz | | 33 | | dB |
| RF Port Return Loss (ANT, RF1, RF2) | 3.8GHz to 6GHz | | 29 | | dB |
| | 5.0MHz to 1.0GHz | | 31 | | dB |
| | 1GHz to 2.0GHz | | 23 | | dB |
| | 2.0GHz to 2.5GHz | | 22 | | dB |
| Harmonics 2fo | 2.5GHz to 3.5GHz | | 18 | | dB |
| | 3.5GHz to 3.8GHz | | 17.5 | | dB |
| | 3.8GHz to 6GHz | | 14.5 | | dB |
| | RFin = 35dBm, 915MHz | | -109 | | dBc |
| Harmonics 3fo | RFin = 33dBm, 1980MHz | | -106 | -80 | dBc |
| | RFin = 35dBm, 915MHz | | -98 | | dBc |
| | RFin = 33dBm, 1980MHz | | -94 | -80 | dBc |

Notes:

1. Test conditions unless otherwise noted: V_{DD} = +5.0V, Temp = +25 °C, 50 Ω system.

Electrical Specifications

| Parameter | Conditions ⁽¹⁾ | Min | Typ | Max | Units |
|--------------------------------|---|-----|------------|--------------|-------|
| OIP2 RFx to ANT (5MHz) | Tone 1: 5MHz at 10dBm Tone 2: 4.95MHz at 10dBm | | 103 | | dBm |
| OIP2 RFx to ANT(450MHz) | Tone 1: 450MHz at 10dBm Tone 2: 445.5MHz at 10dBm | | 131 | | dBm |
| OIP2 RFx to ANT | Tone 1: 2480MHz at 10dBm Tone 2: 2690MHz at 10dBm | | 132 | | dBm |
| OIP3 RFX to ANT (5MHz) | Tone 1: 5MHz at 10dBm Tone 2: 4.95MHz at 10dBm Tone 3: 4.85MHz at 10dBm | | 73 | | dBm |
| OIP3 RFX to ANT (450MHz) | Tone 1: 450MHz at 10dBm Tone 2: 445.5MHz at 10dBm Tone 3: 436.5MHz at 10dBm | | 73 | | dBm |
| OIP3 RFX to ANT(850MHz) | 30MHz spacing at 20dBm/Tone | | 76 | | dBm |
| OIP3 RFX to ANT (1900MHz) | 30MHz spacing at 20dBm/Tone | | 76 | | dBm |
| Supply Current I _{dd} | EN = High EN = Low | | 52 2 | 100 5 | uA |
| Control Voltage (EN, CTRL) | V _{High} V _{Low} | 1.3 | 1.8 0 | 2.75 0.45 | V |
| Control Current (EN, CTRL) | I _{high} I _{Low} | | 2.5 0.1 | 5 3 | uA |
| Switching Speed RF ON | 50% control to 90% RF ON | | 2.6 | | us |
| Switching Speed RF OFF | 50% control to 10% RF ON | | 1.5 | | us |
| Startup Time from Shutdown | Maximum time for switch to reach full compliant operation | | 6 | | us |
| Turn on Time | Time from V _{dd} 50% of operational voltage to RF signal at 90% | | 5 | 20 | us |

Notes:

1. Test conditions unless otherwise noted: V_{DD} = +5.0V, Temp = +25 °C, 50 Ω system.

Thermal Information

| Parameter | Conditions | Value | Units |
|--|-------------------------------------|-------|-------|
| Thermal Resistance (θ _{JC}) ⁽¹⁾ | 37dBm @ 2GHz, 85C Stage Temperature | 156 | °C/W |
| Channel Temperature, T _{CH} (Under RF) | 37dBm@ 2GHz, 85C Stage Temperature | 125 | °C |

Notes:

1. Thermal Resistance is referenced to back of EVB.

Power-Up, Power-Down sequence and operation controls

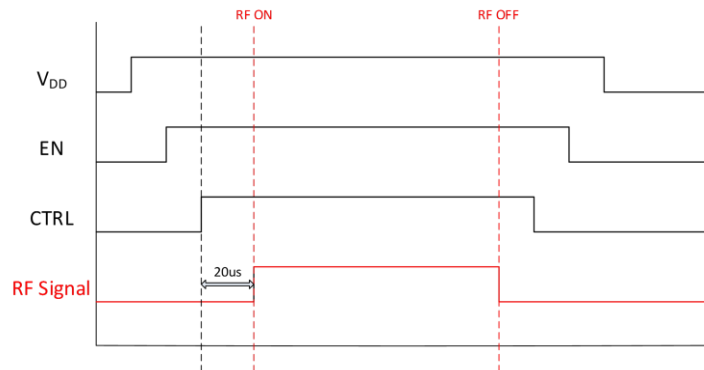
Sequence for Power UP and Power DOWN from the supply that is connected to QPC1022 V_{DD} pin.

Power-up Sequence:

- 1) Turn on V_{DD} (supply)
- 2) Then EN
- 3) Then CTRL
- 4) Then (20µs or greater)
- 5) Apply RF signal

Power-Down Sequence:

- 1) Turn off RF signal
- 2) Then CTRL
- 3) Then EN
- 4) Turn off V_{DD} (supply)



shutdown on, but the EN pin.

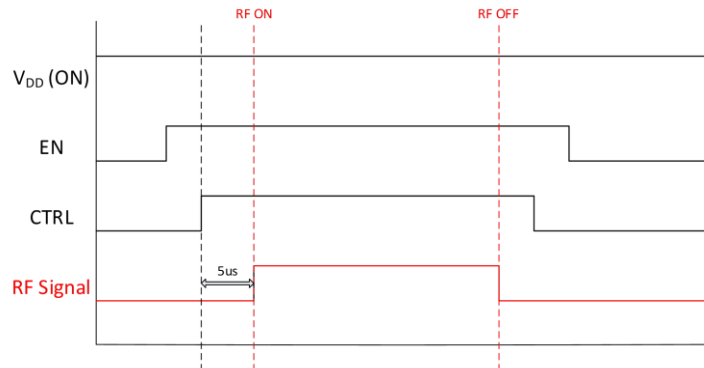
Sequence for going in and out of a mode, keeping the V_{DD} or supply disabling/enabling the QPC1022 by

Power-Up Sequence:

- 1) Turn-on EN (enable)
- 2) Then CTRL
- 3) Then (5µs or greater)
- 4) Turn-on RF signal

Power-Down Sequence:

- 1) Turn-off RF signal
- 2) Then CTRL
- 3) Then EN (disable)



between be applied changing

When changing switch positions RF1 and RF2, no RF signal should to any RF port while the CTRL is states.

Switching Ports:

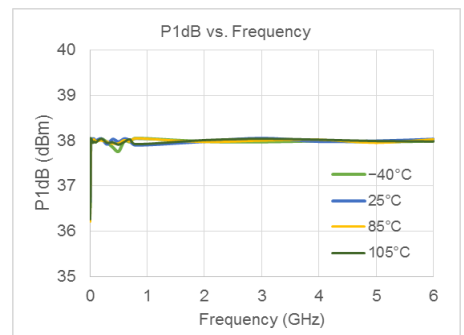
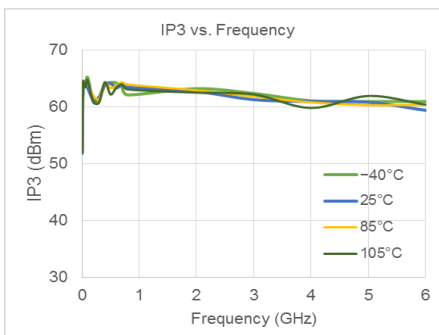
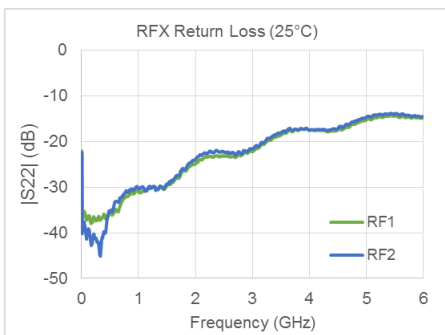
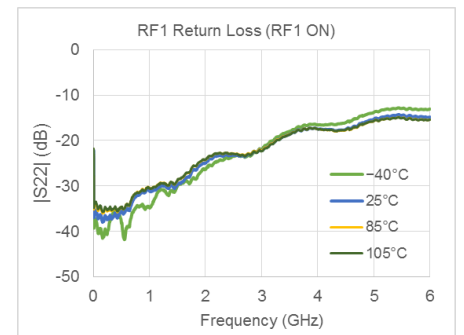
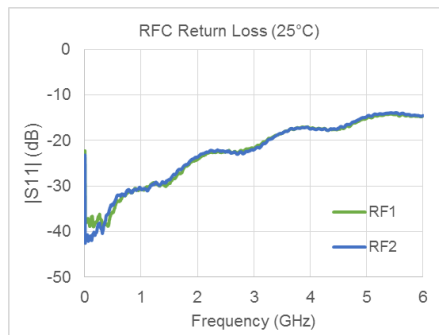
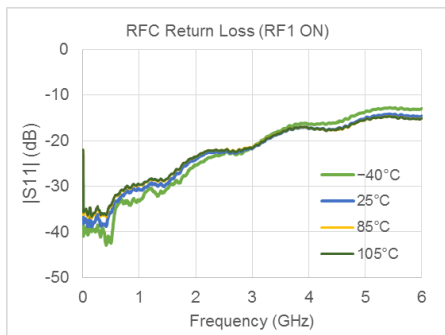
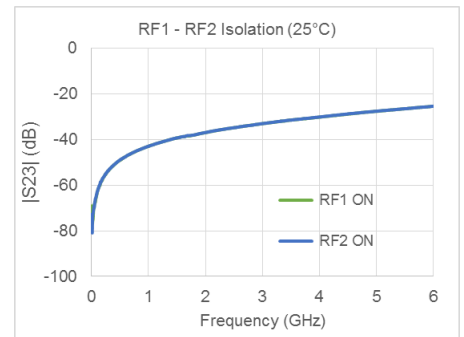
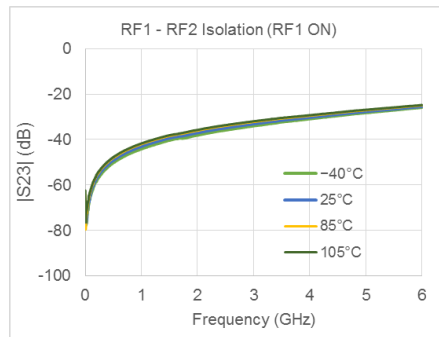
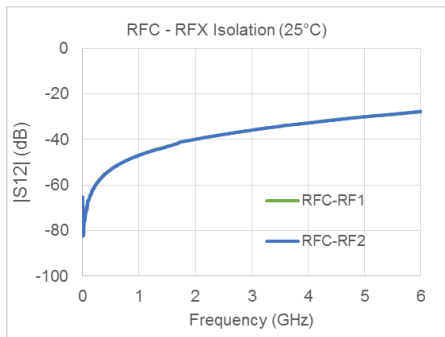
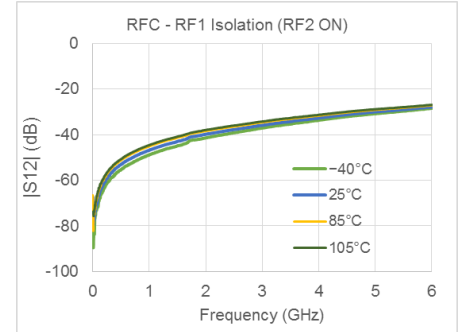
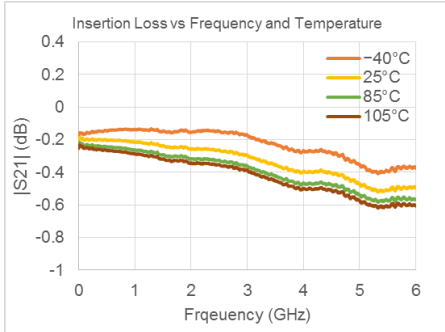
- 1) Turn-off RF signal
- 2) Then change CTRL state
- 3) Then (5µs or greater)
- 4) Turn-on RF signal

Control Logic for Valid Operational States

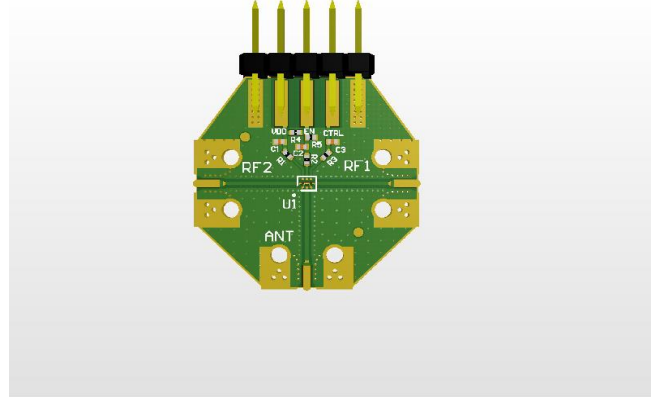
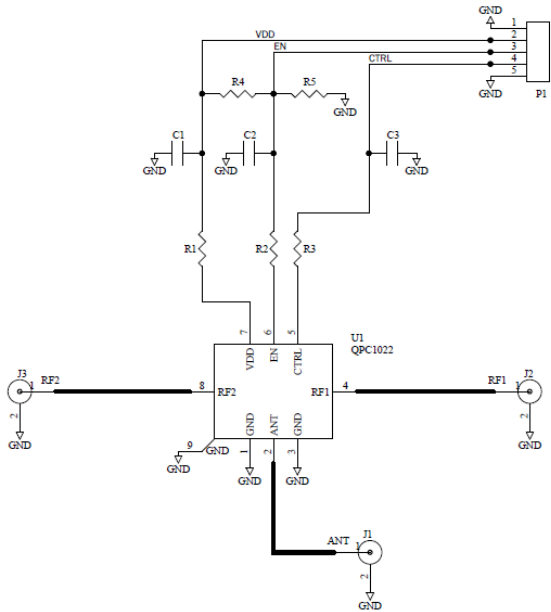
| State | V _{DD} | CTRL | EN | RF Path |
|----------|-----------------|-------------------|-------------------|----------|
| 1 | 2.4V to 5.8V | V _{HIGH} | V _{HIGH} | ANT-RF1 |
| 2 | 2.4V to 5.8V | V _{LOW} | V _{HIGH} | ANT-RF2 |
| Shutdown | 2.4V to 5.8V | X | V _{LOW} | Shutdown |

Performance Plots – 50 Ω

Test conditions unless otherwise noted: $V_{DD} = +5V$



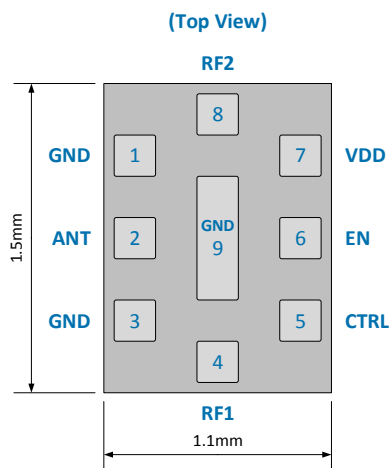
Evaluation Board Schematic & Layout for 50 Ω Application



Bill of Material – QPC1022 - 50Ω

| Reference Des. | Value | Description | Manuf. | Part Number |
|----------------|--------|--------------------------------------|---------|----------------|
| | | Printed Circuit Board | Qorvo | QPC1022-411(B) |
| U1 | | QPC1022 Switch, QFN pkg. | Qorvo | QPC1022SB |
| R1, R2, R3 | 0 Ω | Resistor, Chip, 0402 | various | |
| R4, R5 | DNI | | | |
| C2, C3 | 100pF | Cap., Chip, 0402, 5%, 50V. NPO/COG | various | |
| C1 | 2200pF | Cap, 10%, 50V, X7R, 0402 | various | |
| J1, J2, J3 | | CONN, SMA, EL FLT VIPER, MAT-21-1038 | | |
| P1 | | CONN, HDR, ST, PLRZD, 5-PIN, 0.100" | | |

Pin Configuration and Description

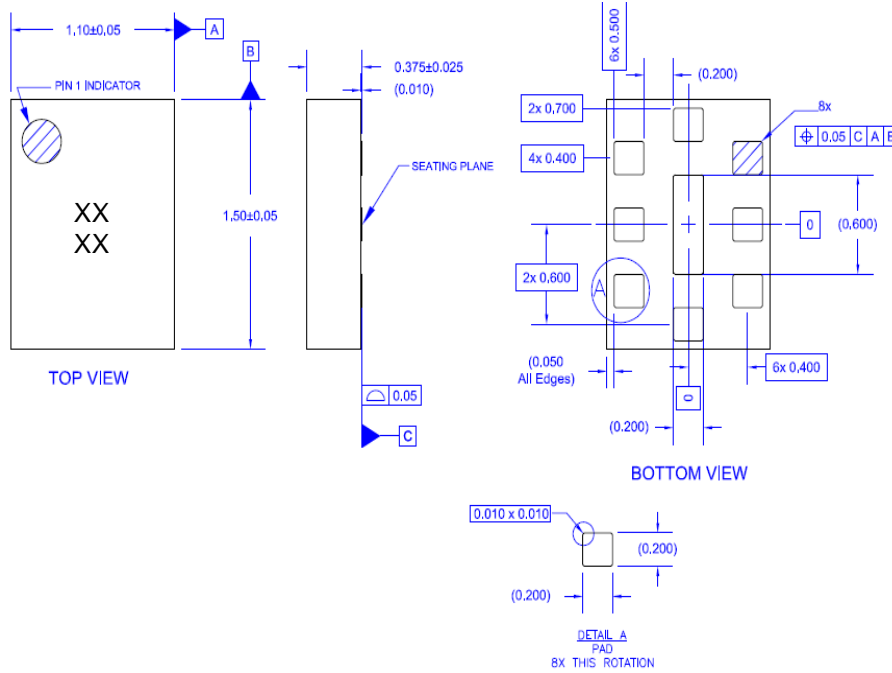


| Pad No. | Label | Description |
|---------|-----------------|---|
| 1,3,9 | GND | Connect with Low inductive path to ground |
| 2 | ANT | Single-Ended RF port |
| 4 | RF1 | Single-Ended RF port |
| 5 | CTRL | Switch Logic control input |
| 6 | EN | Shutdown logic control input |
| 7 | V _{DD} | Supply Voltage |
| 8 | RF2 | Single-Ended RF port |

Package Marking and Dimensions

Marking:

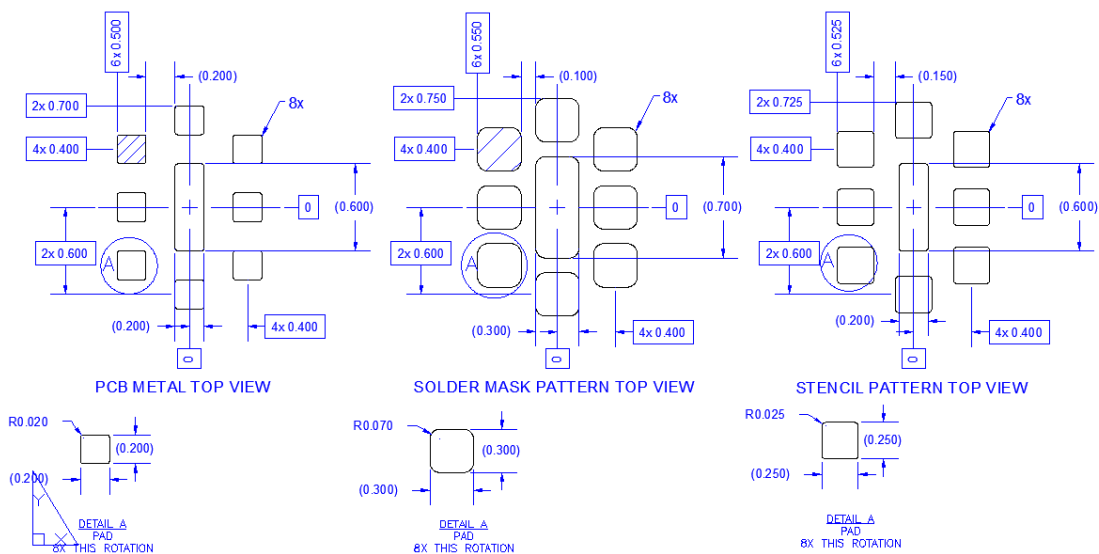
Trace Code –XXXX



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: NiAu

PCB Mounting Pattern



Notes:

1. All dimensions are in millimeters. Angles are in degrees.

Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|----------|--------------------------|
| ESD – Human Body Model (HBM) | Class 2 | ESDA / JEDEC JS-001-2012 |
| ESD – Charged Device Model (CDM) | Class C3 | JEDEC JESD22-C101F |
| MSL – Moisture Sensitivity Level | 2 | IPC/JEDEC J-STD-020 |



Caution!
ESD-Sensitive Device

Solderability

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

Solder profiles available upon request.

Contact plating: Au plating 0.5µm, over a 2µm Ni Plating

RoHS Compliance

This part is compliant with EU 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 (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free
- Qorvo Green



Contact Information

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For technical questions and application information: Email: sicapplications.engineering@qorvo.com

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