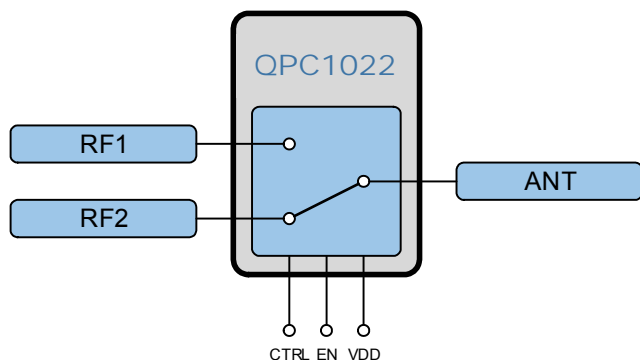


### General Description

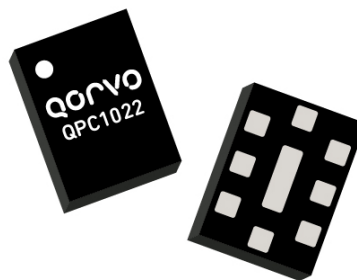
The QPC1022 is a single pole dual-throw (SPDT) switch designed for switching applications requiring very low insertion loss and high power handling capability with minimal DC power consumption. The excellent linearity performance achieved by the QPC1022 makes it ideal for use in cellular base. This switch 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.

### Functional Block Diagram



### 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 |



9 Pin 1.1 x 1.5 mm LGA Package

### 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



## 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.

## Electrical Specifications

| Parameter                           | Conditions <sup>(1)</sup> | Min | Typ  | Max  | Units |
|-------------------------------------|---------------------------|-----|------|------|-------|
| Operational Frequency Range         |                           | 5   |      | 6000 | MHz   |
| Insertion Loss RF1/RF2 to ANT       | 5.0MHz to 1.0GHz          |     | 0.2  |      | dB    |
|                                     | 1GHz to 2.0GHz            |     | 0.25 |      | 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          |     | 46   |      | dB    |
|                                     | 1.0GHz to 2.0GHz          |     | 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    |
|                                     | 2.5GHz to 3.5GHz          |     | 18   |      | dB    |
|                                     | 3.5GHz to 3.8GHz          |     | 17.5 |      | dB    |
| Harmonics 2fo                       | 3.8GHz to 6GHz            |     | 14.5 |      | dB    |
|                                     | RFin = 35dBm, 915MHz      |     | -109 |      | dBc   |
|                                     | RFin = 33dBm, 1980MHz     |     | -106 |      | dBc   |
| Harmonics 3fo                       | RFin = 35dBm, 915MHz      |     | -98  |      | dBc   |
|                                     | RFin = 33dBm, 1980MHz     |     | -94  |      | dBc   |

### Notes:

1. Test conditions unless otherwise noted: V<sub>DD</sub> = +5.0 V, Temp = +25 °C, 50 Ω system.

# QPC1022

## Broad Band Low Distortion SPDT Switch

## Recommended Operating Conditions

| Parameter                         | Min  | Typ | Max  | Units |
|-----------------------------------|------|-----|------|-------|
| Device Voltage (V <sub>dd</sub> ) | +2.4 | +5  | +5.8 | V     |
| T <sub>CASE</sub>                 | -40  |     | +105 | °C    |
| T <sub>j</sub>                    |      |     | +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 <sup>(1)</sup>   | Min | Typ        | Max          | Units |
|----------------------------|---|-----|------------|--------------|-------|
| OIP2 RFx to ANT (5MHz)     | Tone 1: 5MHz at 10dBm<br>Tone 2: 4.95MHz at 10dBm                                 |     | 103        |              | dBm   |
| OIP2 RFx to ANT(450MHz)    | Tone 1: 450MHz at 10dBm<br>Tone 2: 445.5MHz at 10dBm                              |     | 131        |              | dBm   |
| OIP2 RFx to ANT            | Tone 1: 2480MHz at 10dBm<br>Tone 2: 2690MHz at 10dBm                              |     | 132        |              | dBm   |
| OIP3 RFX to ANT (5MHz)     | Tone 1: 5MHz at 10dBm<br>Tone 2: 4.95MHz at 10dBm<br>Tone 3: 4.85MHz at 10dBm     |     | 73         |              | dBm   |
| OIP3 RFX to ANT (450MHz)   | Tone 1: 450MHz at 10dBm<br>Tone 2: 445.5MHz at 10dBm<br>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 Idd         | EN = High<br>EN = Low   |     | 52<br>2    | 100<br>5     | uA    |
| Control Voltage (EN, CTRL) | VHigh<br>Vlow   | 1.3 | 1.8<br>0   | 2.75<br>0.45 | V     |
| Control Current (EN, CTRL) | Ihigh<br>ILow   |     | 2.5<br>0.1 | 5<br>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 Vdd 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  $\Omega$  system.

### Thermal Information

| Parameter   | Conditions                          | Value | Units |
|---|-------------------------------------|-------|-------|
| Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup> | 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.

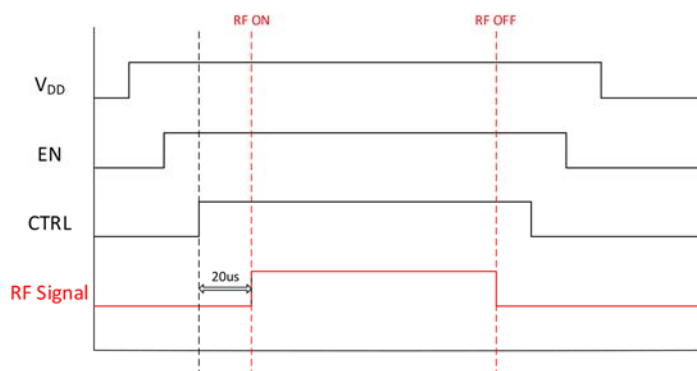
Power-up Sequence:

- 1) Turn on  $V_{DD}$  (supply)
- 2) Then EN
- 3) Then CTRL
- 4) Then (20 $\mu$ s 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)

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



shutdown  
on, but  
the EN pin.

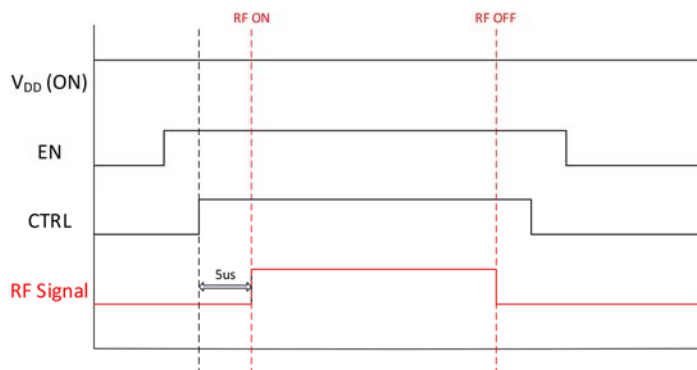
Power-Up Sequence:

- 1) Turn-on EN (enable)
- 2) Then CTRL
- 3) Then (5 $\mu$ s or greater)
- 4) Turn-on RF signal

Power-Down Sequence:

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

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



between  
be applied  
changing

Switching Ports:

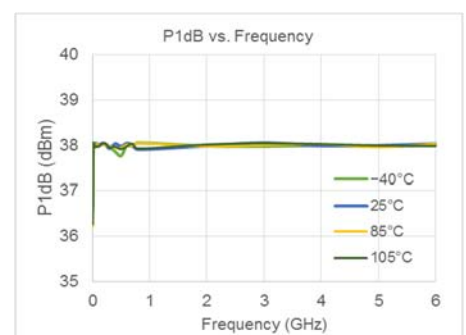
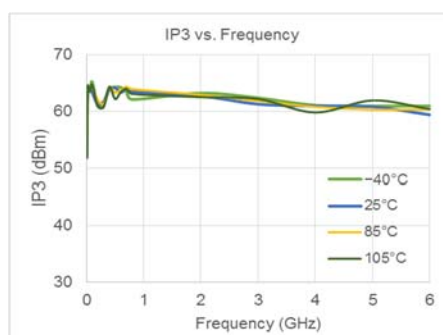
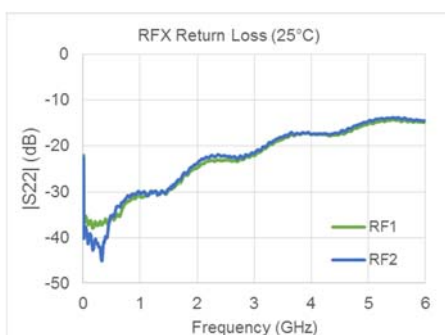
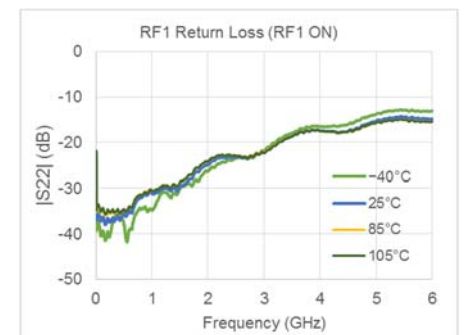
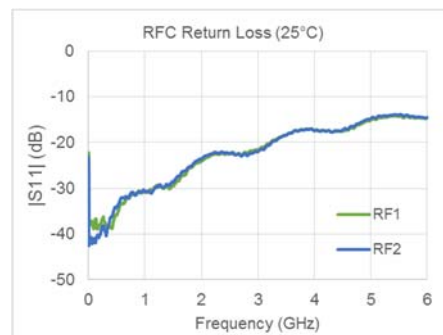
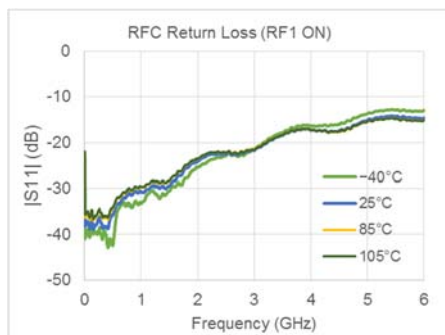
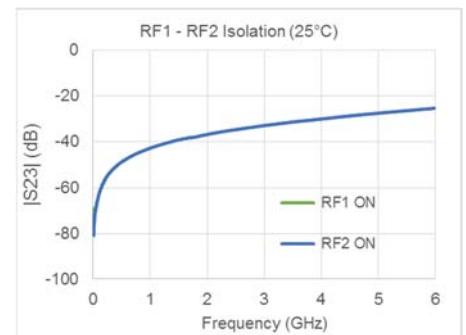
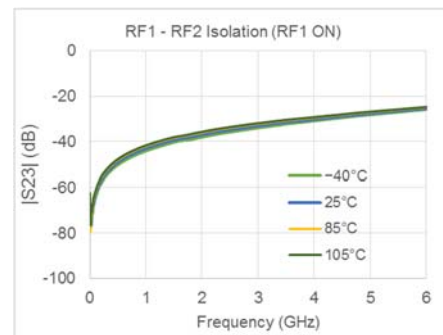
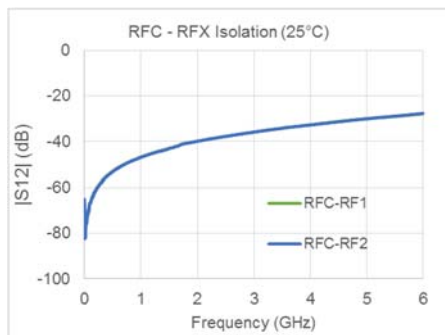
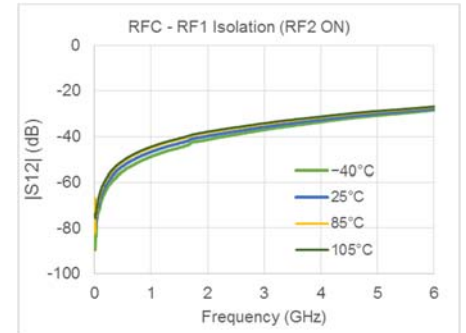
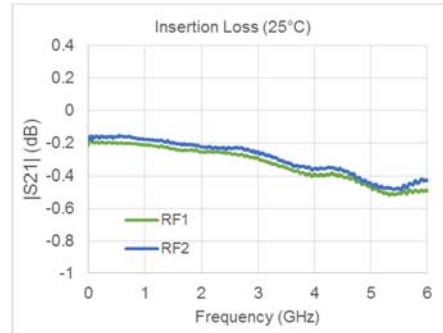
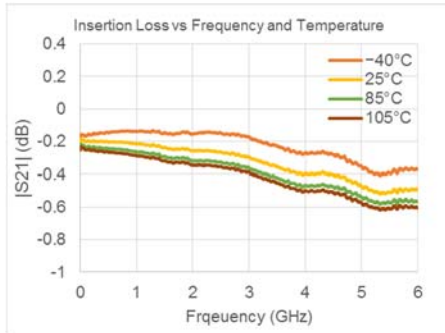
- 1) Turn-off RF signal
- 2) Then change CTRL state
- 3) Then (5 $\mu$ s or greater)
- 4) Turn-on RF signal

### Control Logic for Valid Operational States

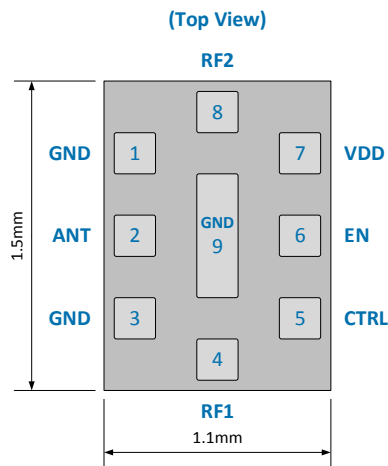
| State    | $V_{DD}$     | CTRL       | EN         | RF Path  |
|----------|--------------|------------|------------|----------|
| 1        | 2.4V to 5.8V | $V_{HIGH}$ | $V_{HIGH}$ | ANT-RF1  |
| 2        | 2.4V to 5.8V | $V_{LOW}$  | $V_{HIGH}$ | ANT-RF2  |
| Shutdown | 2.4V to 5.8V | X          |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

### Performance Plots – 50 $\Omega$

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

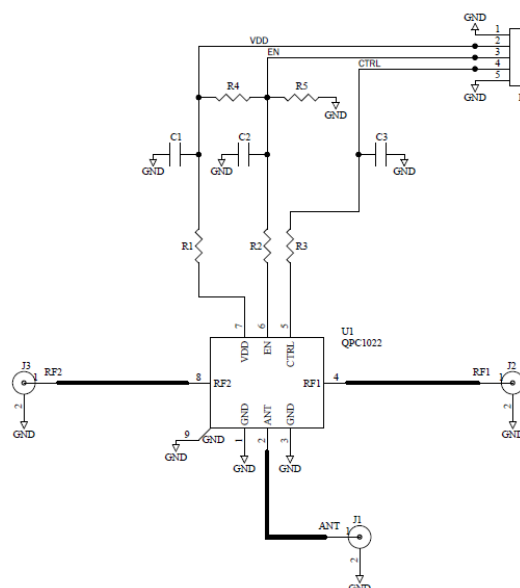


### Pin Configuration and Description

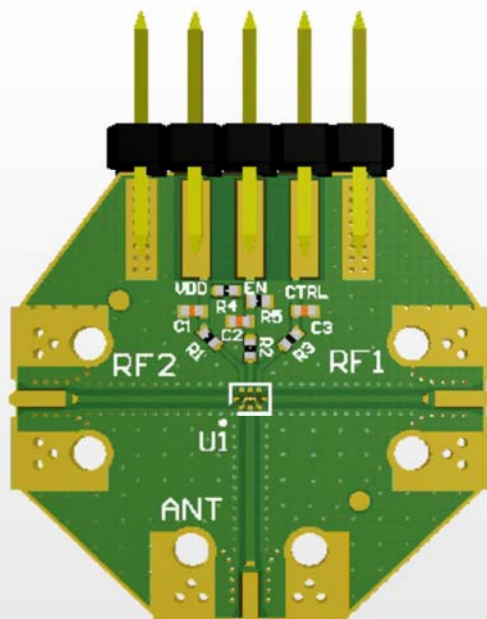


| Pad No. | Label | Description                               |
|---------|-------|---|
| 1,3,9   | GND   | Connect with Low inductive path to ground |
| 2       | ANT   | Single-Ended RF port                      |
| 4       | RF1   | Single-Ended RF port                      |
| 5       | CTRL  | Switch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

### Evaluation Board Schematic



### Evaluation Board Layout for 50 $\Omega$ Application



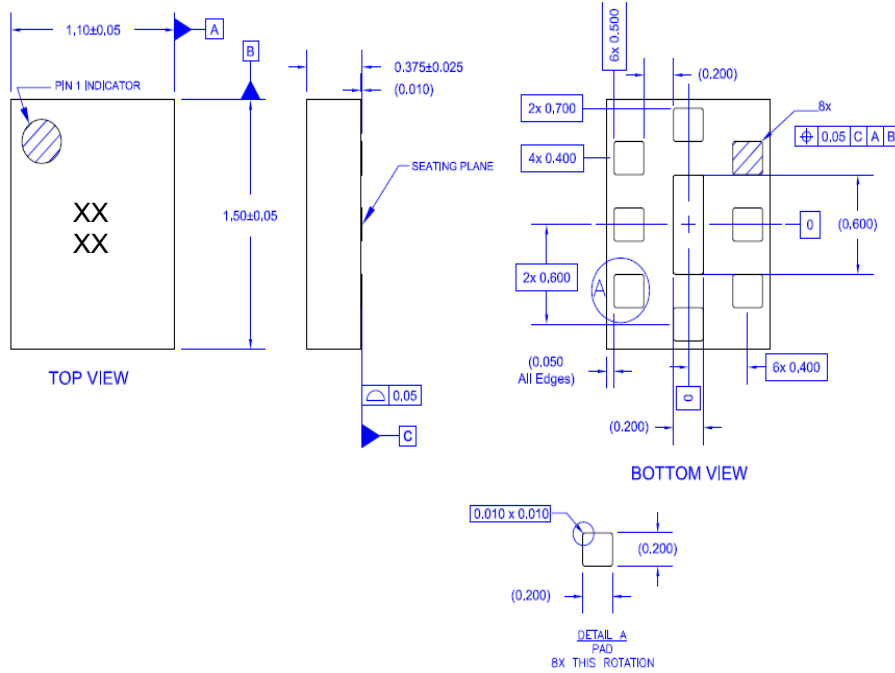
### Bill of Material – QPC1022 - 50 $\Omega$

| 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 $\Omega$ | 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"  |         |                |

### Package Marking and Dimensions

Marking:

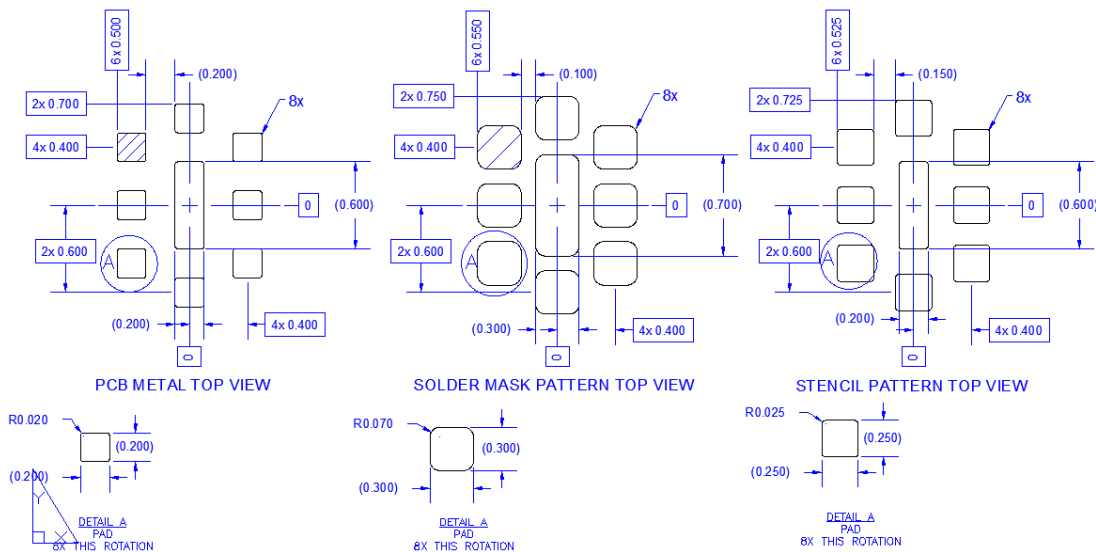
Trace Code –XXXX



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: NiPdAu

### 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: NiAu

### 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 (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free
- Qorvo Green



### Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Tel: 1-844-890-8163

Web: [www.qorvo.com](http://www.qorvo.com)

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

For technical questions and application information: Email: [sicapplications.engineering@qorvo.com](mailto:sicapplications.engineering@qorvo.com)

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