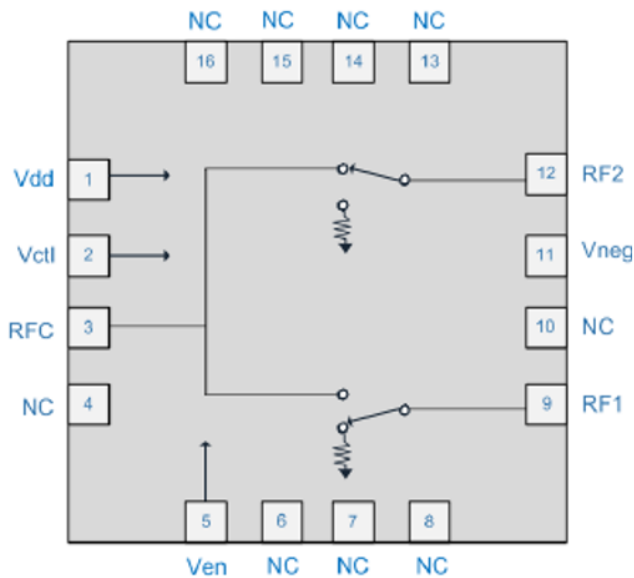


Product Overview

The QPC3024 is a 75Ω Silicon on Insulator (SOI) single-pole, double throw (SPDT) switch designed for use in CATV, satellite set top, and other high performance communications systems. It offers a high isolation symmetric topology with excellent linearity and power handling capability. No blocking caps are necessary on the RF ports. The design is non-reflective such that RF ports 1 and 2 are terminated in in the off-state. The V_{EN} pin allows for a terminated “all-off state”. Applying a negative voltage to the V_{NEG} pin will turn the negative voltage generator off and allow for external supply input.

Functional Block Diagram



Top View



16 Pad 4 x 4 mm QFN Package

Key Features

- 5 MHz to 3000 MHz Operation
- Symmetric SPDT
- Non-Reflective (RF1, RF2)
- Terminated All-Off State
- No Blocking Caps Required Unless Voltage on RF Line
- High Isolation: >65 dB at 1.2 GHz
- High Input IP3: >60 dBm
- Option to Turn Off Negative Voltage Generator and Supply V_{NEG} Externally
- 2 kV ESD
- +1.8 V Logic Compatible

Applications

- MDU Amplifiers
- Point To Point
- Optical Nodes
- Set Top Box
- PCTV
- Multi-tuner DVR

Ordering Information

| Part No. | Description |
|-------------|---|
| QPC3024SQ | Sample bag with 25 pieces |
| QPC3024SR | 7" Reel with 100 pieces |
| QPC3024TR13 | 13" Reel with 2500 pieces |
| QPC3024PCK | 5 – 3000 MHz PCBA with 5 pc. sample bag |

Absolute Maximum Ratings

| Parameter | Rating |
|--|---------------|
| Control Voltage (V_{CTL} , V_{EN}) | +6.0 V |
| Supply Voltage (V_{DD}) | +6.0 V |
| External Negative Supply (V_{NEG}) | -6.0 V |
| Maximum CW Input Power at 25°C | +36 dBm |
| Maximum CW Input Power, Terminated Port | +28 dBm |
| Junction Temperature | +125°C |
| Storage Temperature Range | -40 to +150°C |

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 |
|---------------------------|------|-----|------|-------|
| Supply Voltage, V_{DD} | +2.7 | +3 | +5.5 | V |
| Supply Voltage, V_{NEG} | -5.5 | -5 | -3 | V |
| Temperature Range | -40 | | +105 | °C |

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 |
|--|---------------------------|-----|------|------|-------|
| Frequency Range | | 5 | | 3000 | MHz |
| Insertion Loss | 5 MHz | | 0.38 | | dB |
| | 50 MHz | | 0.42 | | |
| | 1.2 GHz | | 0.82 | | |
| | 2 GHz | | 0.83 | | |
| | 3 GHz | | 1.4 | | |
| Isolation (RFC to RF1/RF2) | 5 MHz | | 75 | | dB |
| | 50 MHz | | 70 | | |
| | 1.2 GHz | | 66 | | |
| | 2 GHz | | 66 | | |
| | 3 GHz | | 56 | | |
| Isolation (RF1 to RF2) | 5 MHz | | 75 | | dB |
| | 50 MHz | | 70 | | |
| | 1.2 GHz | | 56 | | |
| | 2 GHz | | 52 | | |
| | 3 GHz | | 45 | | |
| Return Loss (RFC On-state) | 5 MHz | | 33 | | dB |
| | 50 MHz | | 32 | | |
| | 1.2 GHz | | 15 | | |
| | 2 GHz | | 17 | | |
| | 3 GHz | | 13 | | |
| Return Loss (RF1/RF2 Off-state) Terminated Ports | 5 MHz | | 40 | | dB |
| | 50 MHz | | 39 | | |
| | 1.2 GHz | | 19 | | |
| | 2 GHz | | 18 | | |
| | 3 GHz | | 25 | | |

Notes:

1. Test Conditions Unless Otherwise Specified: $T_A = +25^\circ\text{C}$, $V_{CTL} = 0/+5\text{ V}$, $V_{DD} = +5\text{ V}$, 75 Ω system.

Electrical Specifications (cont'd.)

| Parameter | Conditions ⁽¹⁾ | Min | Typ | Max | Units |
|--|--|-----|------|-----|-------|
| Input IP3 ⁽²⁾ | 1 GHz +12 dBm input power per tone, 1 MHz tone spacing | | 61 | | dBm |
| Input 1dB Compression Point ⁽²⁾ | 1 GHz | | 36 | | |
| Input 0.1dB Compression Point ⁽²⁾ | 1 GHz | | 36 | | |
| CSO | 130 Channel, Flat Tilt, +42 dBmV/ch | | >100 | | dBc |
| CTB | 130 Channel, Flat Tilt, +42 dBmV/ch | | >90 | | |
| Turn On Time | 90% VDD to steady state harmonics | | 7.4 | | μs |
| Settling Time | 50% control to steady state harmonics | | 3.8 | | |
| Switching Speed | 50% control to 10/90% RF | | 1.5 | | |
| NVG Spurs | Internal NVG on (F<10MHz) | | -113 | | dBm |
| Harmonics-2nd | 5 MHz | | -77 | | |
| | 17 MHz | | -82 | | |
| | 170 MHz | | -95 | | |
| | 800 MHz | | -106 | | |
| Harmonics-3rd | 5 MHz | | -93 | | dBc |
| | 17 MHz | | -115 | | |
| | 170 MHz | | -119 | | |
| | 800 MHz | | -121 | | |

Notes:

1. Test Conditions Unless Otherwise Specified: T_A = +25 °C, V_{CTL} = 0/+5 V, V_{DD} = +5 V, V_{NEG} = -5 V, 75 Ω system. Drive RFC, RFx output.
2. Tested at 50Ω.

Electrical Specifications - Power Supply

| Parameter | Conditions ⁽¹⁾ | Min | Typ | Max | Units |
|--|---------------------------|-----|-----|------|-------|
| Supply Current (I _{DD}) | V _{DD} = +5.0V | | 130 | 200 | μA |
| Control Current (I _{CTL} , I _{EN}) | V _{CTL} = +5.0V | | 0.5 | 5 | μA |
| Low Control Voltage (V _{CTL} , V _{EN}) | +1.8V Logic compatible | 0 | | 0.63 | V |
| High Control Voltage (V _{CTL} , V _{EN}) | | 1.1 | | VDD | V |

Maximum Operating Power

| Input | State | VEN | Power at 85C (dBm) | Power at 105C (dBm) | Theta-J (°C/W) |
|----------------------|----------|-------------|--------------------|---------------------|----------------|
| RFC, RF1/2 | On | Low | 34 ⁽¹⁾ | 31 ⁽¹⁾ | 125 |
| RFC | Both Off | High | 30 | 27 | N/A |
| RF1/2 | Off | Low or High | 27 | 24 | 77 |
| RF1/2 (Simultaneous) | Both Off | High | 29 ⁽²⁾ | 26 ⁽²⁾ | 50 |

Notes:

1. Assuming load VSWR <3:1, for high VSWR loads, this value reduces by 3dB.
2. Total power in both loads being driving simultaneously.

Power Supply Sequencing Requirements

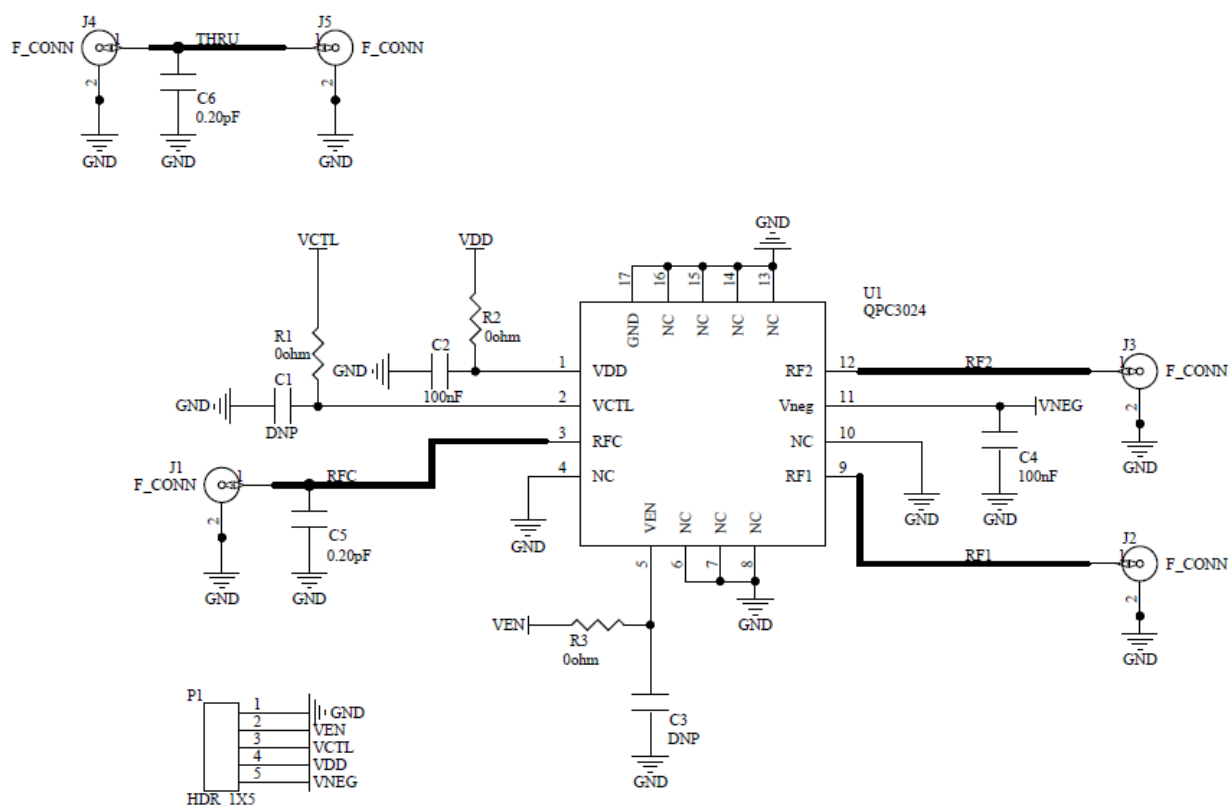
No power supply sequencing is required if VCTL or VEN are less than 4.1V. When VCTL and VEN are greater than 4.1V, for best reliability, apply V_{DD} before the applying the control voltage.

If the internal Negative Voltage Generator (NVG) is disabled by applying a negative voltage on V_{NEG}, V_{DD} must be power cycled after changing V_{NEG} to 0V to enable it again.

Truth Table

| Control Input | | Signal Path State | |
|------------------|-----------------|-------------------|---------|
| V _{CTL} | V _{EN} | RFC-RF1 | RFC-RF2 |
| 0 | 0 | On | Off |
| 1 | 0 | Off | On |
| 0 | 1 | Off | Off |
| 1 | 1 | Off | Off |

5-3000 MHz Evaluation Board Schematic (QPC3024PCK)



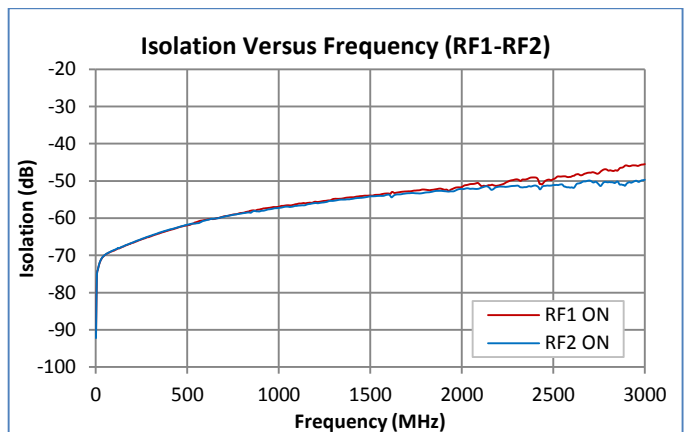
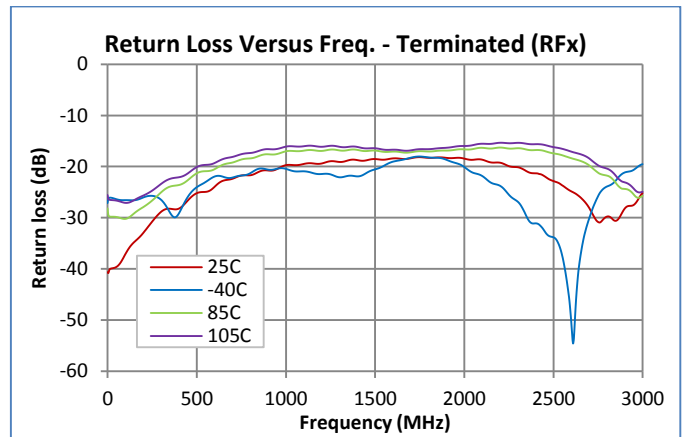
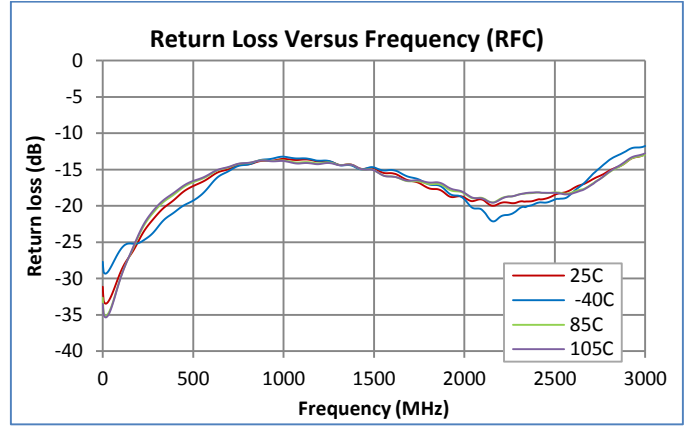
| Ref. Designator | Description | Manufacturer | Part Number |
|--------------------|--|--------------------|--------------------|
| PCB | Evaluation Board PCB | Viasystems | QPC3024-4000 |
| U1 | 75ohm High Isolation Switch | Qorvo | QPC3024SB |
| J1, J2, J3, J4, J5 | Conn, Type F, Edge Mount, 75 Ω, 0.065" | Genesis Technology | GT20-300204 |
| R1, R2, R3 | 0 Ω RES, 0402 | Panasonic | ERJ-2GE0R00X |
| P1 | Conn, HDR, ST, 5-Pin, T/H | Molex | 22-28-4053 |
| C2, C4 | 100nF 10% X7R 16V CAP, 0402 | Murata | GJM1555C1HR20RB12D |
| C5, C6 | 0.2pF +/- 0.03pF COG 50V CAP, 0402 | Murata | GRM155R71C104KA88D |
| C1, C3 | DNP | N/A | N/A |

Evaluation Board Assembly Drawing



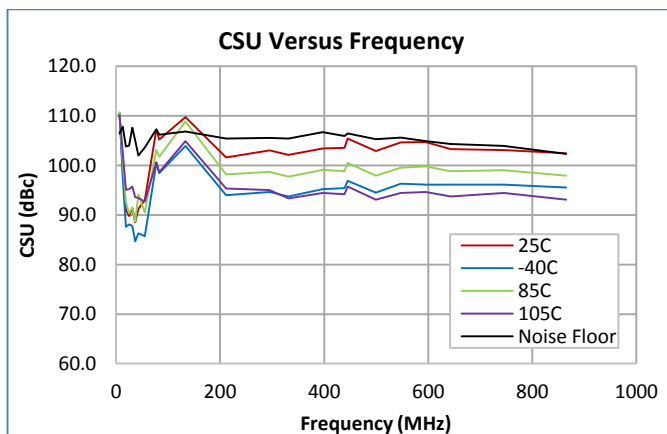
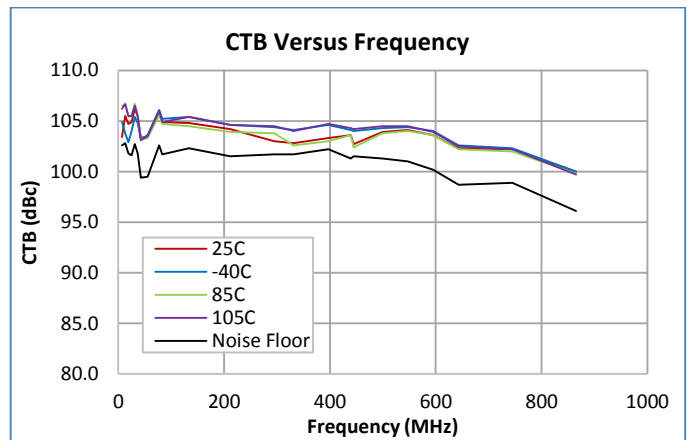
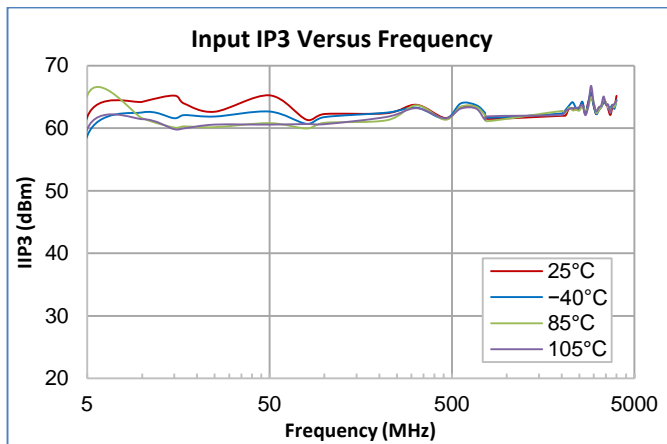
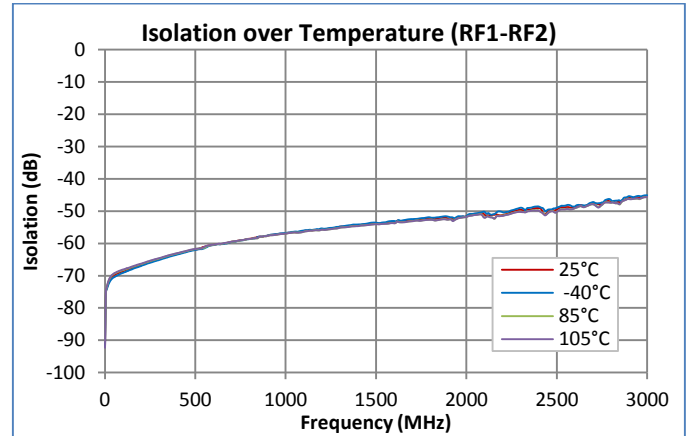
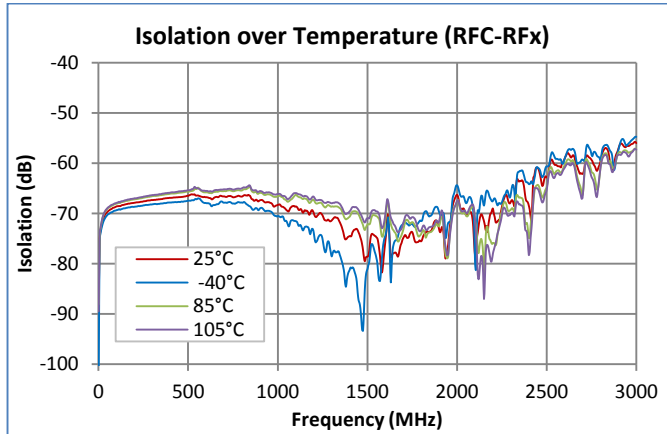
Performance Plots

Test conditions unless otherwise noted: $V_{DD} = +5V$, $V_{NEG} = -5V$, $Temp = +25^{\circ}C$, $Z_o = 75\Omega$



Performance Plots (cont'd.)

Test conditions unless otherwise noted: $V_{DD} = +5V$, $V_{NEG} = -5V$, Temp = $+25^\circ C$, $Z_o = 75\Omega$



Test Conditions:

1. IIP3: Two tone, 50Ω, +12dBm per Tone.
2. CSO/CTB: 130 Channels, 42dBmV per Channel, Flat Tilt.

Performance Plots (cont'd.)

Test conditions unless otherwise noted: $V_{DD} = +5V$, $V_{NEG} = -5V$, Temp = $+25^{\circ}C$, $Z_o = 75\Omega$



MER/CCN Test Conditions:

1. 190 QAM256 Channels, 57-1215MHz, ITU-T J.83, Annex B
2. CCN test procedure according to ANSI/SCTE 17. System BW 5.36MHz.

Pad Configuration and Description



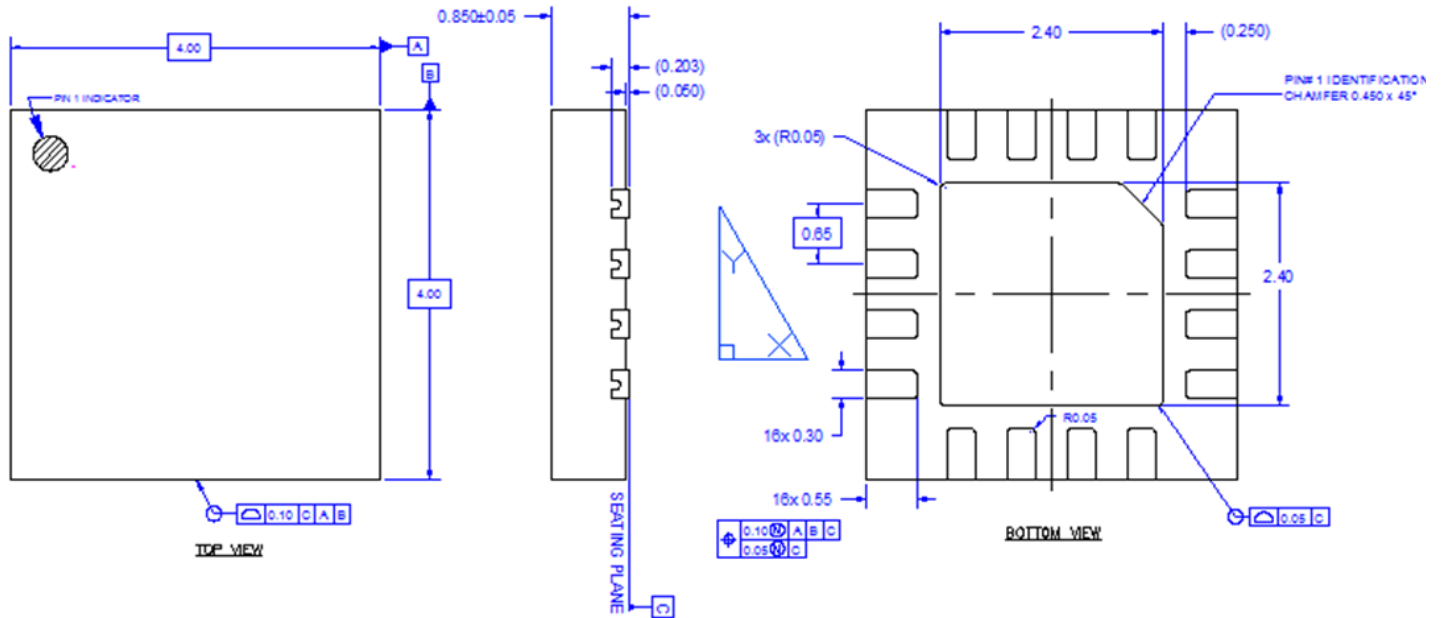
Top View

| Pad No. | Label | Description |
|-------------------------|-------|--|
| 1 | VDD | Supply Voltage |
| 2 | VCTL | Logic Control Input |
| 3 | RFC | RF Common Port |
| 4 | NC | Grounding this pin is recommended for performance |
| 5 | VEN | Logic input for putting switch in "all-off state". Logic high for "all-off state". |
| 6, 7, 8, 13, 14, 15, 16 | NC | Grounding this pin is recommended to maximize isolation |
| 9 | RF1 | RF Port 1 |
| 10 | NC | Grounding this pin is recommended for performance |
| 11 | VNEG | Negative Voltage Generator (NVG) control pin. Supply GND (Low inductive path to ground) to enable internal NVG or supply -2.7 V to -5 V to disable internal NVG. Once disabled, internal NVG cannot be enabled without cycling V _{DD} . |
| 12 | RF2 | RF Port 2 |
| EPAD | GND | RF and DC Ground: Must be soldered to EVB ground plane. |

Applications Schematic; 5-1200MHz



Package Dimensions



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

Package Marking



Pin 1 Indicator

Trace Code to be assigned by SubCon

Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|-----------------|-----------------------------|
| ESD – Human Body Model (HBM) | 1000V, Class C3 | ANSI/ESDA/JEDEC JS-002-2014 |
| ESD – Charged Device Model (CDM) | 2000V, Class 2 | ANSI/ESDA/JEDEC JS-002-2014 |
| MSL – Moisture Sensitivity Level | Level 2 | 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 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
- 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

Email: customer.support@qorvo.com

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