

Applications

- Cellular Infrastructure
- Test and Measurement
- Smart Energy
- UHF/VHF
- LMR
- General Purpose Broadband Wireless
- Enable Pin Functionality

Product Features

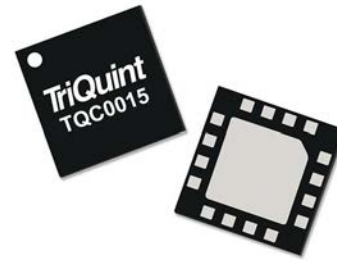
- Low Insertion Loss
- +56 dBm Input IP3
- High Isolation
- Absorptive
- +1.8 V logic compatible
- Termination “off” state functionality for output ports
- Single Positive Voltage Control
- 4 x 4 mm 16-pin QFN package

General Description

The TQC0015 is a GaAs FET single-pole, double throw (SPDT) high isolation absorptive switch that provides 100–6000 MHz broadband performance. The TQC0015 may be operated using a DC supply ranging from +3 to +5 Volts and with control signals compliant to +1.8 CMOS logic. The switch has an added functionality with a Disable pin where both output ports are terminated in 50 ohms.

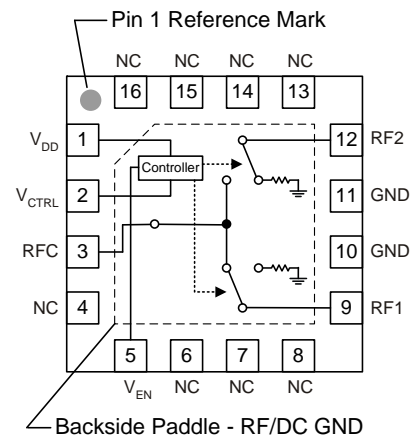
The TQC0015 is packaged in a RoHS-compliant, compact 4 x 4 mm surface-mount leadless package.

This SPDT switch is targeted for use in wireless infrastructure, test and measurement, or can be used for any general purpose wireless application.



16-pin 4 x 4 mm QFN Package

Functional Block Diagram



Pin Configuration

| Pin No. | Symbol |
|-----------------|-------------------|
| 1 | V _{DD} |
| 2 | V _{CTRL} |
| 3 | RFC |
| 4, 6–8, 13–16 | NC |
| 5 | V _{EN} |
| 9 | RF1 |
| 10, 11 | GND |
| 12 | RF2 |
| Backside Paddle | RF/DC GND |

Ordering Information

| Part No. | Description |
|---|-------------------------------|
| TQC0015 | SPDT Absorptive Switch |
| TQC0015-PCB | 100–4500 MHz Evaluation Board |
| Standard T/R size = 2500 pieces on a 13" reel | |

Absolute Maximum Ratings

| Parameter | Rating |
|--------------------------------------|-------------------------|
| Storage Temperature | -65 to +165 °C |
| RF Input Power, CW, 50Ω, T = 25°C | +33 dBm |
| Supply Voltage (V _{DD}) | +6 V |
| Control Voltage (V _{CTRL}) | V _{DD} + 0.5 V |

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

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|-----------------------|------|------|-----------------|-------|
| V _{DD} | +3.0 | +3.3 | +5.5 | V |
| V _{CTRL} | +1.8 | | V _{DD} | V |
| Operating Temp. Range | -40 | | +85 | °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: V_{DD} = +3.3 V, V_{CTRL} = +1.8 V, Temp. = +25 °C, 50 Ω system

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|------|-----|-----------------|-------|
| Operational Frequency Range | | 100 | | 6000 | MHz |
| Control Voltage | Low | 0 | | +0.5 | V |
| | High | +1.2 | | V _{DD} | V |
| Insertion Loss | 0.1 – 1.0 GHz | | 0.5 | 0.8 | dB |
| | 1.0 – 2.6 GHz | | 0.7 | 1.0 | |
| | 2.6 – 3.0 GHz | | 0.8 | | |
| | 3.0 – 4.5 GHz | | 0.9 | | |
| Isolation – RFC to RF1/RF2 | 0.1 – 1.0 GHz | 45 | 52 | | dB |
| | 1.0 – 2.6 GHz | 38 | 43 | | |
| | 2.6 – 3.0 GHz | | 42 | | |
| | 3.0 – 4.5 GHz | | 40 | | |
| Isolation – RF1 to RF2 | 0.1 – 1.0 GHz | 45 | 50 | | dB |
| | 1.0 – 2.6 GHz | 35 | 42 | | |
| | 2.6 – 3.0 GHz | | 41 | | |
| | 3.0 – 4.5 GHz | | 38 | | |
| Return Loss – RFC Port | 0.1 – 1.0 GHz | 13 | 20 | | dB |
| | 1.0 – 2.6 GHz | | 17 | | |
| | 2.6 – 4.5 GHz | | 15 | | |
| Input P1dB | f = 2 GHz | | +34 | | dBm |
| Input IP3 | f = 2 GHz, Pin/tone = +15 dbm, Δf = 1 MHz | | +56 | | dBm |
| Switching Speed | t _{ON} (50% CTL to 90% RF) | | 240 | | nS |
| | t _{OFF} (50% CTL to 10% RF) | | 100 | | nS |
| Total Supply current (I _{DD}) | | | 170 | 250 | uA |

Digital Control Voltages

| State | Bias Condition |
|-------|----------------|
| Low | ≤ +0.45 V |
| High | ≥ +1.4 V |

Switch Control Truth Table

| | | Signal Path State | |
|-----------------|-------------------|---------------------|---------------------|
| V _{EN} | V _{CTRL} | RFC to RF1 | RFC to RF2 |
| Low | Low | Off (Isolation) | On (Insertion Loss) |
| Low | High | On (Insertion Loss) | Off (Isolation) |
| High | Low | Off (Terminated) | Off (Terminated) |
| High | High | Off (Terminated) | Off (Terminated) |

Typical Performance – TQC0015-PCB

Test conditions unless otherwise noted: $V_{DD} = +3.3\text{ V}$, $V_{CTRL} = +1.8\text{ V}$, $V_{EN} = 0\text{ V}$, $\text{Temp} = 25^\circ\text{C}$, $50\ \Omega$ system

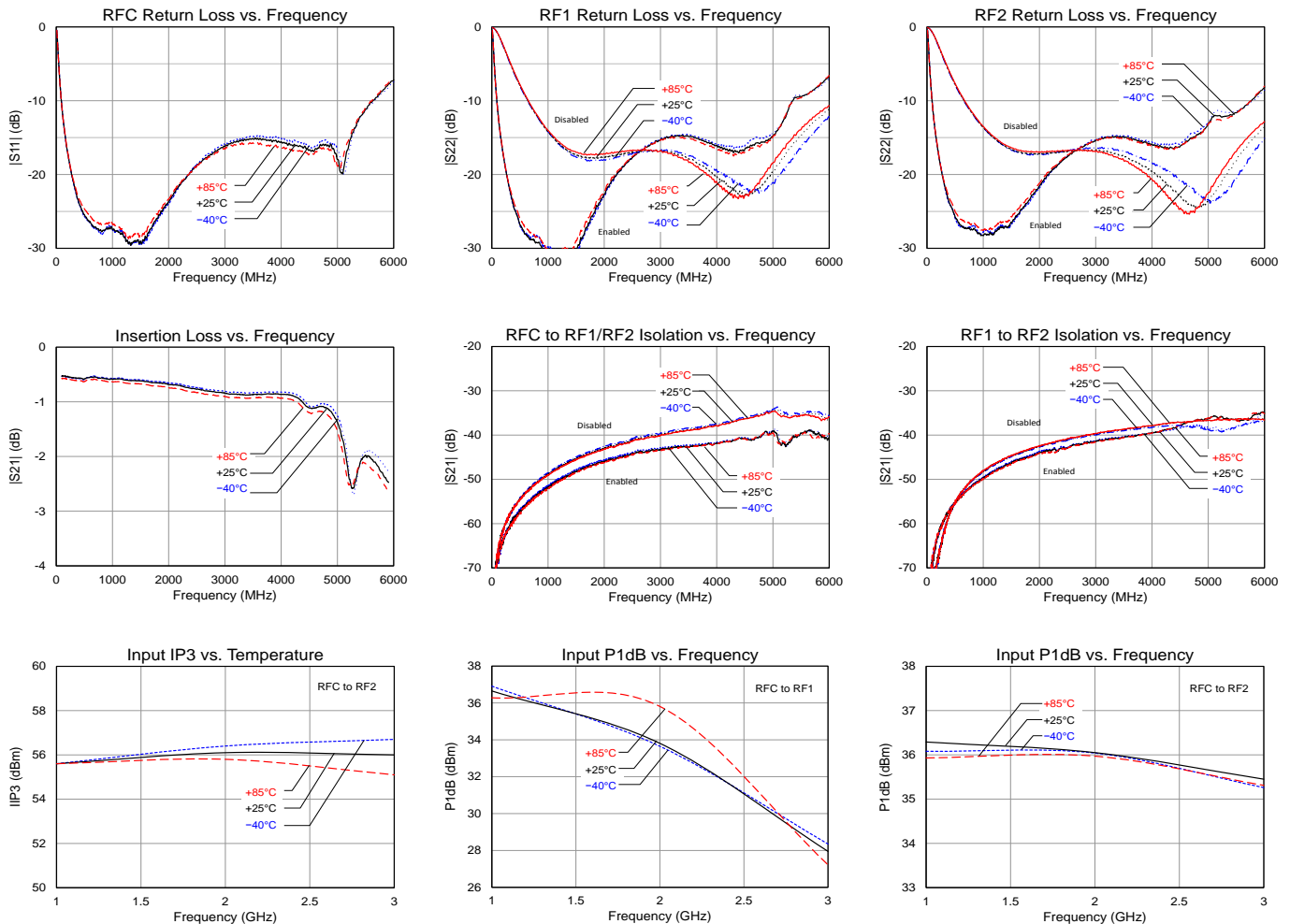
| Parameter | Typical Value | | | Units |
|-------------------------------------|---------------|-----|-----|-------|
| Frequency | 1 | 2 | 3 | GHz |
| Insertion Loss ⁽¹⁾ | 0.5 | 0.6 | 0.7 | dB |
| RFC Port Return Loss | 20 | 20 | 16 | dB |
| RFC to RF1/RF2 Isolation | 52 | 46 | 43 | dB |
| RFC to RF1/RF2 Isolation (disabled) | 49 | 43 | 40 | dB |
| RF1 to RF2 Isolation | 50 | 44 | 41 | dB |
| Input P1dB | +36 | +34 | +28 | dBm |
| Input IP3 ⁽²⁾ | +56 | +56 | +56 | dBm |

Notes:

1. Values are insertion loss from device input pin to device output pin. Eval board RF I/O line losses have been subtracted.
2. IIP3 measured with two tones at an input power of +15 dBm / tone separated by 1 MHz.

Performance Plots – TQC0015-PCB

Test conditions unless otherwise noted: $V_{DD} = +3.3\text{ V}$, $V_{CTRL} = +1.8\text{ V}$, $V_{EN} = 0\text{ V}$, $\text{Temp} = 25^\circ\text{C}$, $50\ \Omega$ system



Switching Speed

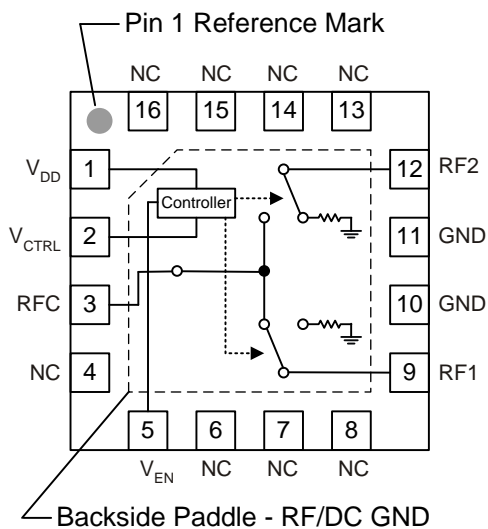
Switching Speed Measurement based on TQS Application Board

Using Shutdown Circuit: $V_{CTRL} = +1.8V$, $V_{EN} = 0V$, $V_{DD} = +3.3V$

| With C1, C2, C3 = 100 pF | | | | Units |
|---|-----|-----|-----|-------|
| Temperature | -40 | +25 | +85 | °C |
| Turn-off Transition (50% CNTL – 10% RF) | 50 | 47 | 46 | ns |
| Turn-on Transition (50% CNTL – 90% RF) | 122 | 127 | 132 | ns |

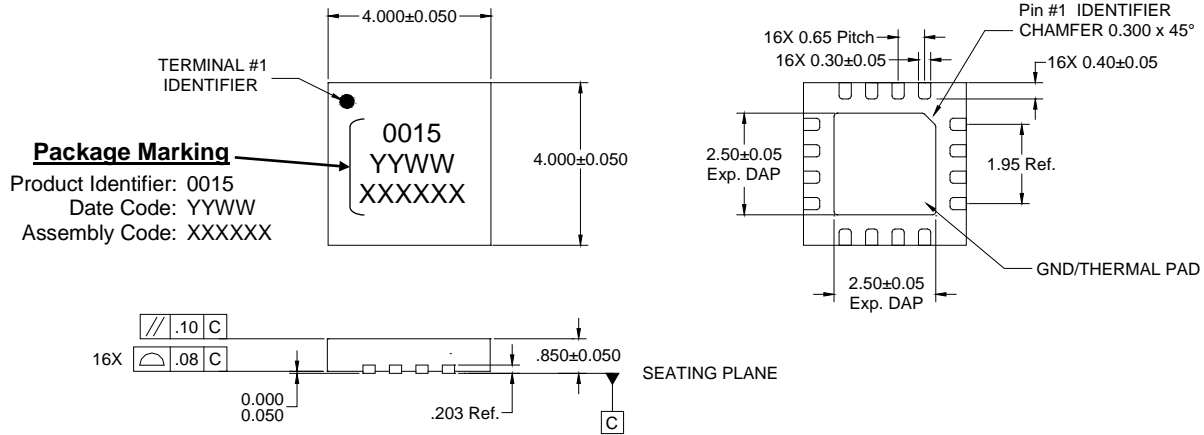
| With C1, C2, C3 = 10 pF | | | | Units |
|---|------|------|------|-------|
| Temperature | -40 | +25 | +85 | °C |
| Turn-off Transition (50% CNTL – 10% RF) | 32 | 32 | 30 | ns |
| Turn-on Transition (50% CNTL – 90% RF) | 0.58 | 0.95 | 1.23 | ns |

Pin Configuration and Description



| Pin No. | Label | Description |
|-----------------|------------|--|
| 4, 6–8, 13–16 | NC | No electrical connection. Provide grounded land pads for PCB mounting integrity. |
| 9 | RF1 | RF output 1. DC blocking capacitor required. |
| 3 | RFC | Antenna input. DC blocking capacitor required. |
| 12 | RF2 | RF output 2. DC blocking capacitor required. |
| 5 | V_{EN} | Digital enable voltage. If LOW then switch active, if HIGH then RF1 and RF2 in isolation mode. |
| 2 | V_{CTRL} | Digital control voltage |
| 1 | V_{DD} | DC voltage supply |
| 10, 11 | GND | RF/DC Ground. |
| Backside Paddle | RF/DC GND | RF/DC Ground. Use recommended via pattern and ensure good solder attach for best thermal and electrical performance. |

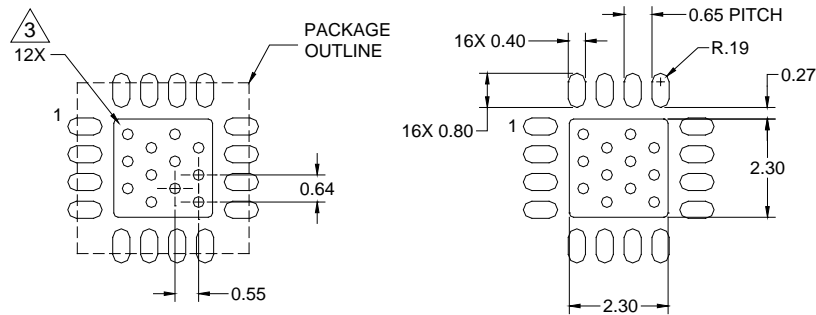
Package Marking and Dimensions



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-220, Issue E (Variation VGGC) for thermally enhanced plastic very thin fine pitch quad flat no lead package (QFN).
3. Dimension and tolerance formats conform to ASME Y14.4M-1994.
4. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012
5. Contact plating: NiPdAu

PCB Mounting Pattern



COMPONENT SIDE

Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. 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").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Product Compliance Information**ESD Sensitivity Ratings**

Caution! ESD-Sensitive Device

ESD Rating: Class 0B
Value: ≥ 125 V to < 250 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-C101

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 max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package 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

Important Notice

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

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