

### Applications

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

### Product Features

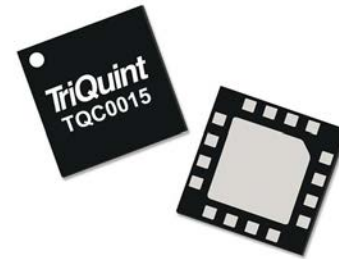
- Low Insertion Loss
- +56 dBm Input IP3
- High Isolation
- Absorptive
- +1.8 V logic compatible
- Termination “off” state functionality for output ports
- Single Positive Voltage Control
- 4 x 4 mm 16-pin QFN package

### 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.

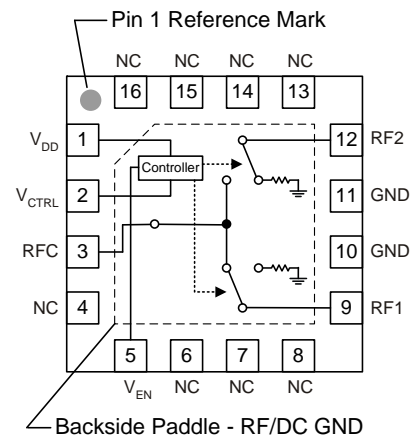
The TQC0015 is packaged in a RoHS-compliant, compact 4 x 4 mm surface-mount leadless package.

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 <sub>DD</sub>
2	V <sub>CTRL</sub>
3	RFC
4, 6–8, 13–16	NC
5	V <sub>EN</sub>
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 <sub>DD</sub> )	+6 V
Control Voltage (V <sub>CTRL</sub> )	V <sub>DD</sub> + 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 <sub>DD</sub>	+3.0	+3.3	+5.5	V
V <sub>CTRL</sub>	+1.8		V <sub>DD</sub>	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<sub>DD</sub> = +3.3 V, V<sub>CTRL</sub> = +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 <sub>DD</sub>	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 <sub>ON</sub> (50% CTL to 90% RF)		240		nS
	t <sub>OFF</sub> (50% CTL to 10% RF)		100		nS
Total Supply current (I <sub>DD</sub> )			170	250	uA

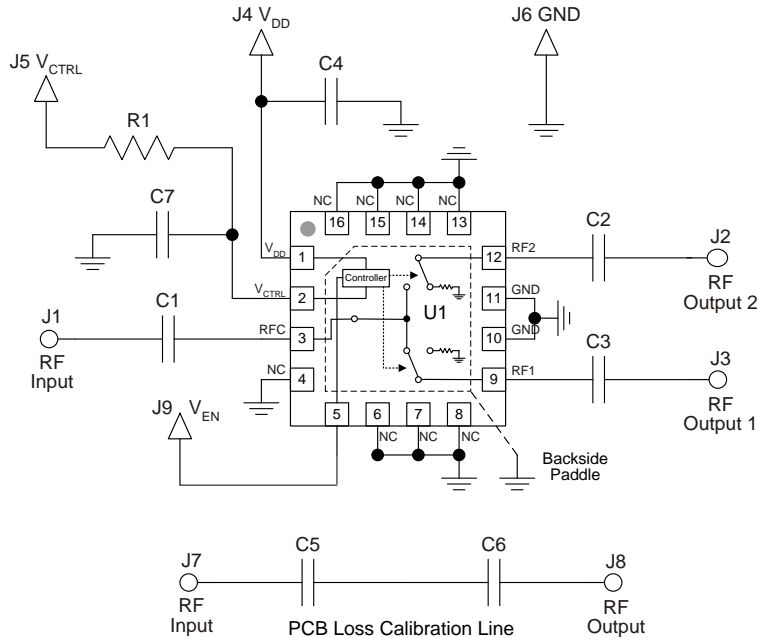
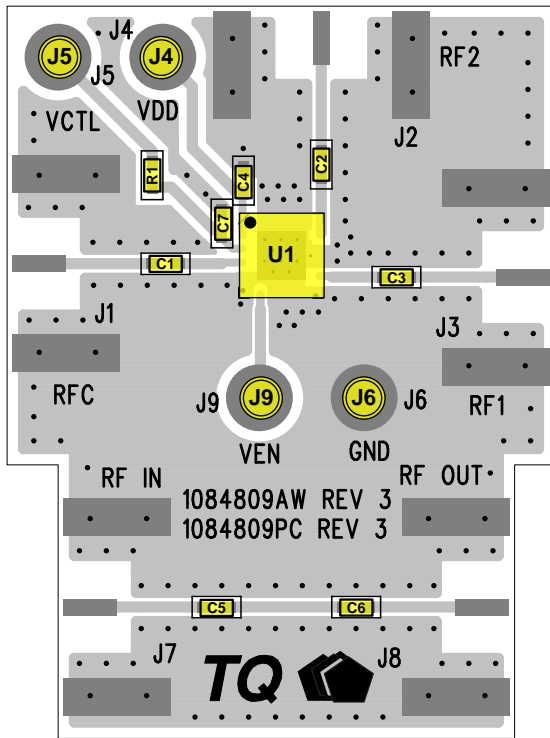
### Digital Control Voltages

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

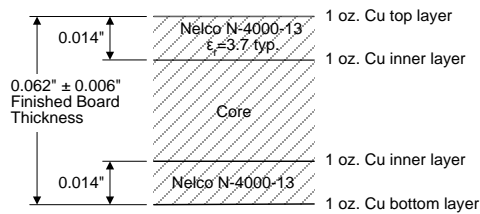
### Switch Control Truth Table

		Signal Path State	
V <sub>EN</sub>	V <sub>CTRL</sub>	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)

## TQC0015-PCB Evaluation Board



TriQuint PCB 1084809 Material and Stack-up



50 ohm line dimensions: Width = .021"  
Spacing = .006"

## Bill of Material – TQC0015-PCB

Reference Des.	Value	Description	Manuf.	Part Number
n/A	n/A	Printed Circuit Board	TriQuint	1084809 Rev. 3
U1	n/A	SPDT Switch	TriQuint	TQC0015
C1 – C6	100 pF	Cap., 0402, 5%, 50V, NPO/COG	various	
C7	3 pF	Cap., 0402, +/-0.25pF, 50V, NPO/COG	various	
R1	0 Ω	Jumper, 0402	various	
J4, J5, J6, J9	n/A	Solder Turret	Mill Max	2533-0-00-44-00-00-07-0
J1, J2, J3, J7, J8	n/A	Conn, RF, SMA F STRT, .062 PCB	Radiall Inc.	9602-1111-018

### 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

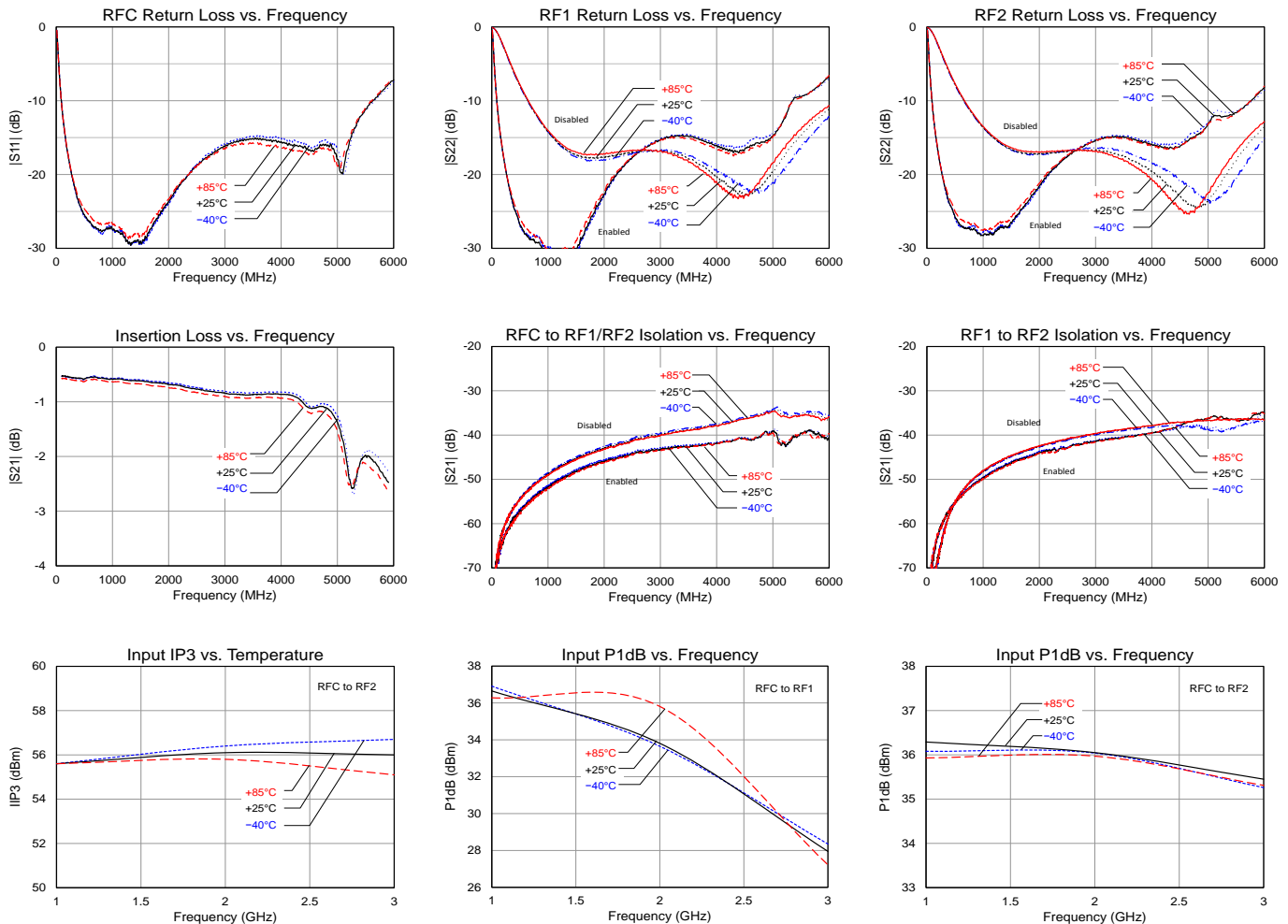
Parameter	Typical Value			Units
Frequency	1	2	3	GHz
Insertion Loss <sup>(1)</sup>	0.5	0.6	0.7	dB
RFC Port Return Loss	20	20	16	dB
RFC to RF1/RF2 Isolation	52	46	43	dB
RFC to RF1/RF2 Isolation (disabled)	49	43	40	dB
RF1 to RF2 Isolation	50	44	41	dB
Input P1dB	+36	+34	+28	dBm
Input IP3 <sup>(2)</sup>	+56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



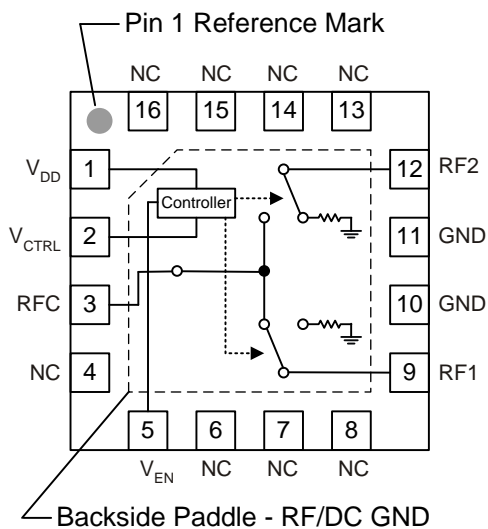
### Switching Speed

#### Switching Speed Measurement based on TQS Application Board

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

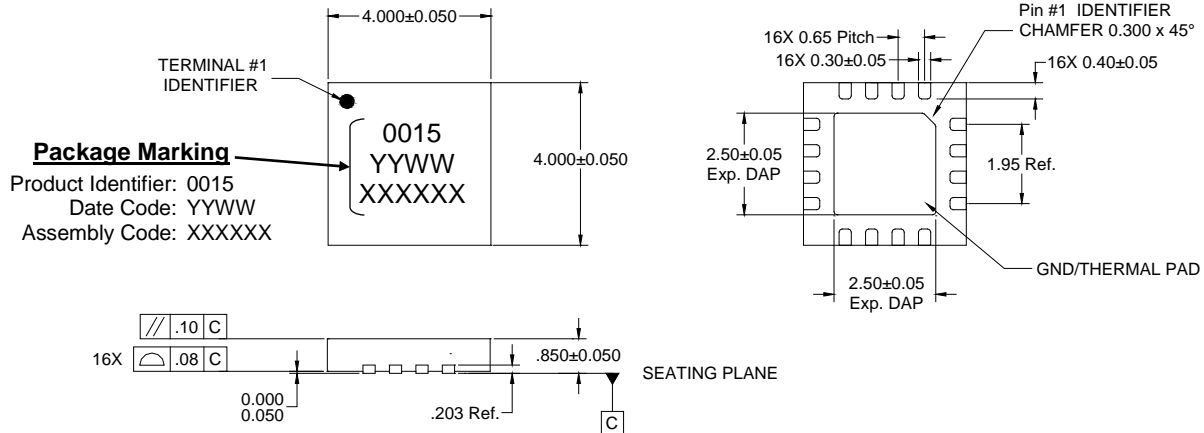
With C1, C2, C3 = 100 pF				Units
Temperature	-40	+25	+85	°C
Turn-off Transition (50% CNTL – 10% RF)	50	47	46	ns
Turn-on Transition (50% CNTL – 90% RF)	122	127	132	ns
With C1, C2, C3 = 10 pF				Units
Temperature	-40	+25	+85	°C
Turn-off Transition (50% CNTL – 10% RF)	32	32	30	ns
Turn-on Transition (50% 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.

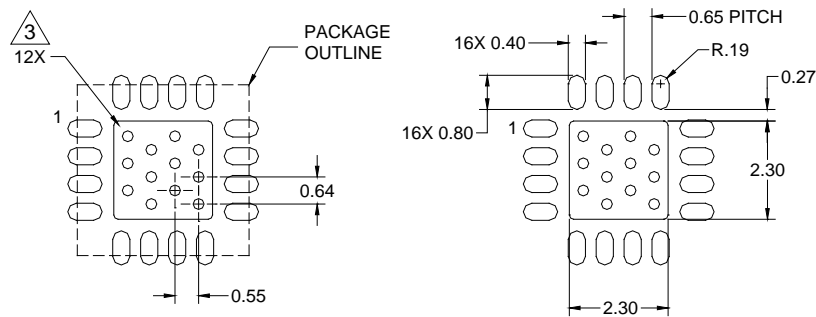
## Package Marking and Dimensions



**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:  $\geq 125$  V to  $< 250$  V  
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JS-001-2012

ESD Rating: Class C3  
Value:  $\geq 1000$  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 (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

**Important Notice**

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