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## Applications

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

## Product Features

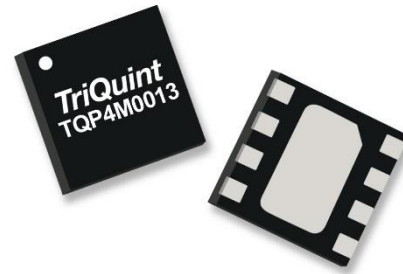
- General Purpose
- Low Insertion Loss
- +49 dBm Input IP3
- High Isolation
- Absorptive
- Single Positive Voltage Control
- Small 2x2 mm SMT Package

## General Description

The TQP4M0013 is a GaAs FET single-pole, single throw (SPST) high isolation absorptive switch. The TQP4M0013 may be operated using a DC supply range from 3 to 5 Volts and with control signals operating from 3 to 5 Volts. The TQP4M0013 has 100-4000 MHz broadband performance.

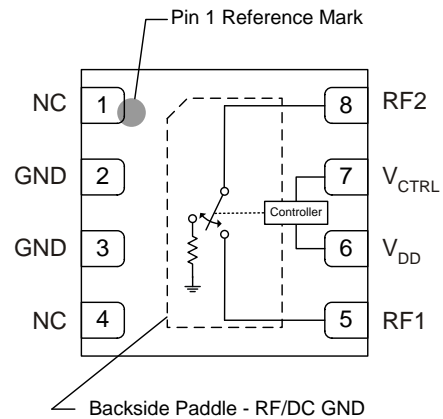
The TQP4M0013 is packaged in a RoHS-compliant, compact 2x2 mm surface-mount leadless package.

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



8-pin 2x2 mm DFN Package

## Functional Block Diagram



## Pin Configuration

Pin No.	Label
1, 4	NC
2, 3	GND
5	RF1
6	V <sub>DD</sub>
7	V <sub>CTRL</sub>
8	RF2

## Ordering Information

Part No.	Description
TQP4M0013	SPST Absorptive Switch
TQP4M0013-PCB	0.1-4.0 GHz Evaluation Board

Standard T/R size = 2500 pieces on a 7" 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		5.0	V
Operating Temp. Range	-40		+105	°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> = +5 V, V<sub>CTRL</sub> = 0 V (low) or 3.3 V (high), Temp.=+25°C, 50 Ω system

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		100		4000	MHz
Control Voltage (V <sub>CTRL</sub> )	Low	0		0.2	V
	High	1.8		V <sub>DD</sub>	V
Insertion Loss	1 GHz		0.55	0.87	dB
	2 GHz		0.71		
	3 GHz		0.77		
Isolation	1 GHz	38	50		dB
	2 GHz		43		
	3 GHz		37		
RF1/RF2 Return Loss Insertion Loss State	1 GHz		15		dB
	2 GHz		15		
	3 GHz		17		
RF2 Return Loss Isolation Loss State	1 GHz		16		dB
	2 GHz		15		
	3 GHz		17		
Input P1dB	f=1 GHz		+35		dBm
Input IP3	f=1 GHz Pin=+15 dBm/tone, Δf= 1 MHz		+49		dBm
Switching Speed	t <sub>ON</sub> ,t <sub>OFF</sub> (50% CTL to 10/90% RF)		150		ns
	t <sub>ON</sub> ,t <sub>OFF</sub> (50% CTL to 2/98% RF)		150		ns
Total Supply current (I <sub>DD</sub> )			82		uA

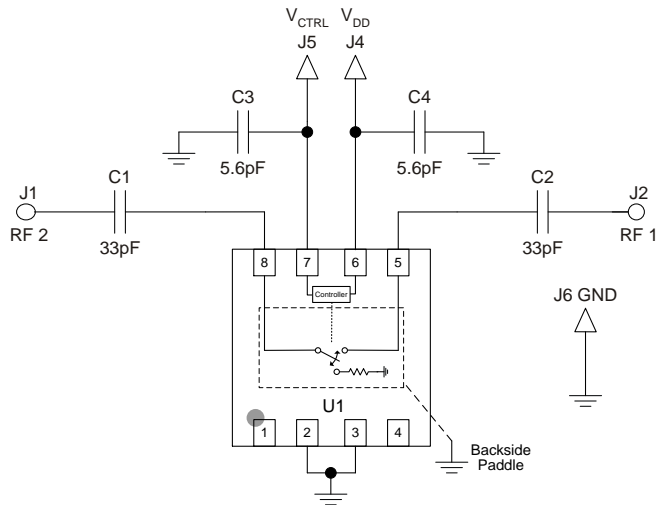
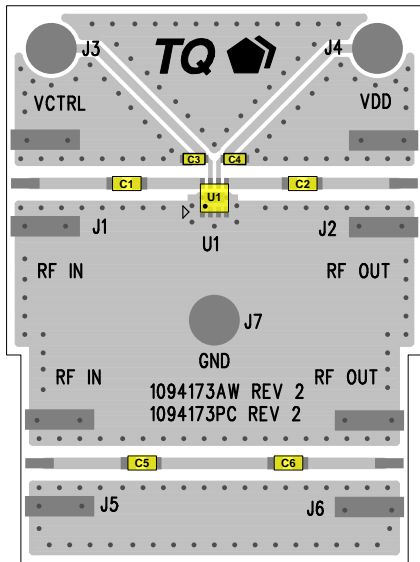
### Control Voltages

State	Bias Condition
Low	≤ 0.2 V
High	≥ 1.8 V

### Switch Control Truth Table

V <sub>CTRL</sub>	Signal Path State (RF1 to RF2)
Low	Off (isolation)
High	On (Insertion Loss)

**TQP4M0013-PCB Evaluation Board**



Notes:

1. Capacitance values shown for C1, C2, C3 and C4 are required to achieve data sheet RF performance specifications.

**Typical Performance – TQP4M0013-PCB**

Test conditions unless otherwise noted:  $V_{DD} = +5\text{ V}$ ,  $\text{Temp} = +25^\circ\text{C}$ ,  $50\ \Omega$  system

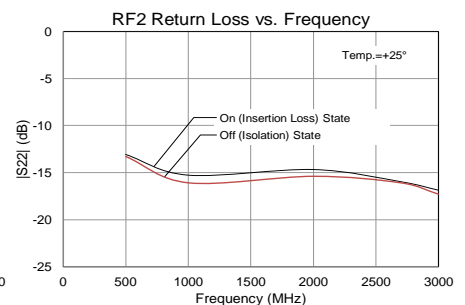
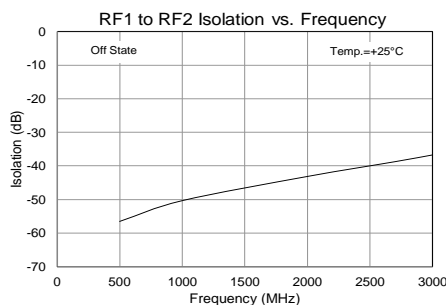
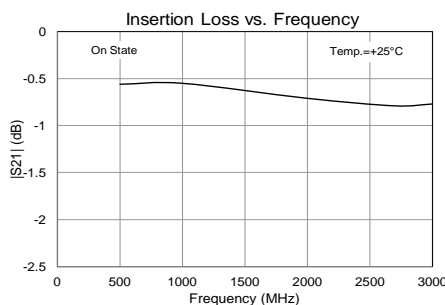
Parameter	Typical Value			Units
Frequency	1	2	3	GHz
Insertion Loss <sup>(1)</sup>	0.55	0.71	0.77	dB
RF1/RF2 Port Return Loss (Insertion Loss State)	15	15	17	dB
RF1 to RF2 Isolation	50	43	37	dB
Input P1dB	+35			dBm
Input IP3 (Pin=+15 dBm/tone, $\Delta f = 1\text{ MHz}$ )	+49	+50		dBm

Notes:

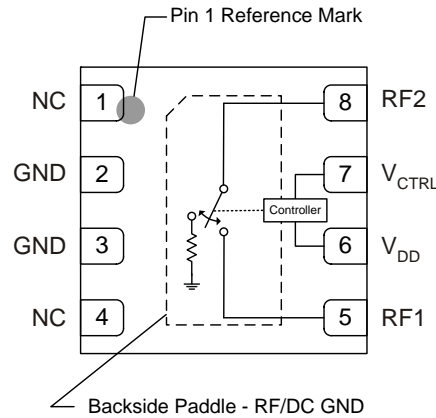
1. Insertion loss values reflect de-embedding of eval board RF line losses.

**Performance Plots – TQP4M0013-PCB**

Test conditions unless otherwise noted:  $V_{DD} = +5\text{ V}$ ,  $V_{CTRL} = +3.3\text{ V}$ ,  $\text{Temp} = +25^\circ\text{C}$ ,  $50\ \Omega$  system



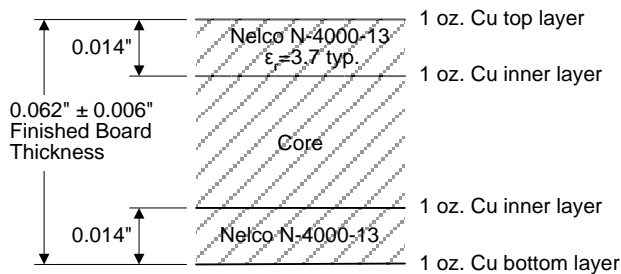
**Pin Configuration and Description**



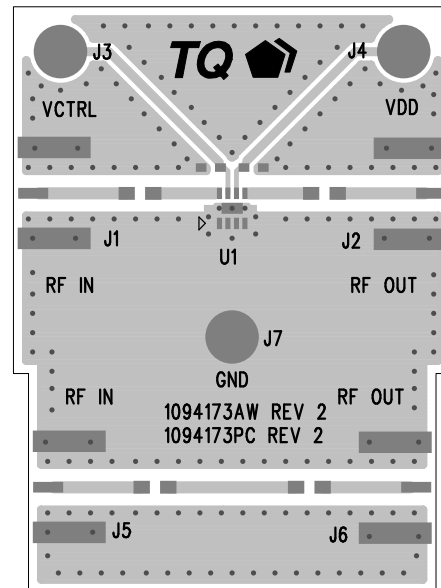
Pin No.	Symbol	Description
1, 4	N/C	No electrical connection. Provide grounded land pads for PCB mounting integrity.
2, 3	GND	RF/DC Ground
5	RF1	RF Port 1. DC block required.
6	V <sub>DD</sub>	Bias Voltage
7	V <sub>CTRL</sub>	Control Voltage
8	RF2	RF Port 2. DC block required. Internal resistive termination in off (isolation) state.
Backside Paddle	RF/DC GND	RF/DC Ground. Use recommended via pattern and ensure good solder attach for best thermal and electrical performance.

**Evaluation Board PCB Specifications**

PCB 1094173 Material and Stack-Up



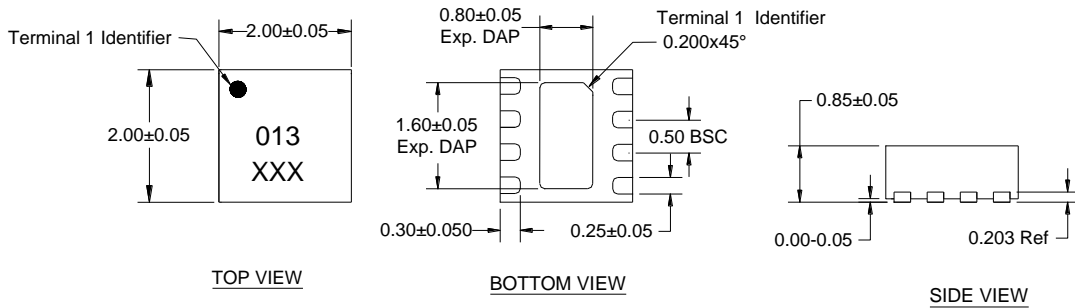
50 ohm input/output (I/O) line structure  
Width = 0.028"  
Gap = 0.028"



**Mechanical Information**

**Package Marking and Dimensions**

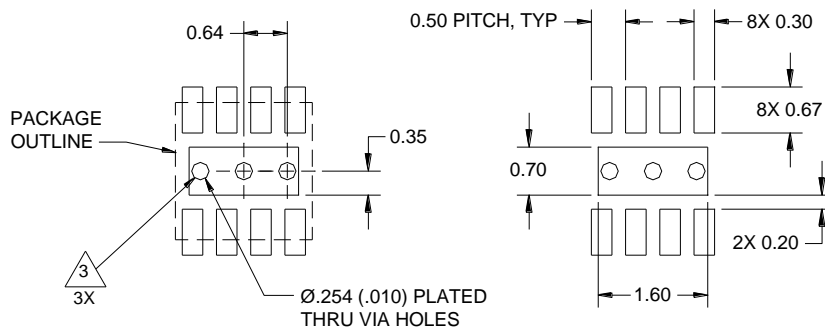
Marking: Product Code – 013  
Assembly code - XXX



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012

**PCB Mounting Pattern**



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: Passes >125 V and < 250 V  
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JS-001-2012

ESD Rating: Class C3  
Value: Passes >1000 volts  
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

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