

### Applications

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

### Product Features

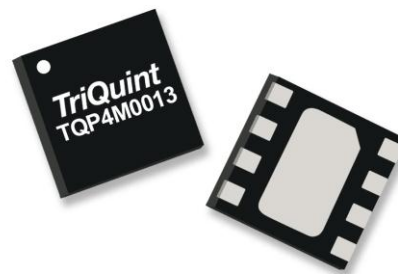
- General Purpose
- Low Insertion Loss
- +49 dBm Input IP3
- High Isolation
- Absorptive
- Single Positive Voltage Control
- Small 2x2 mm SMT Package

### 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.

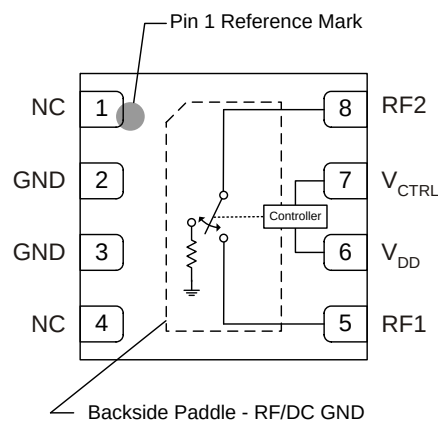
The TQP4M0013 is packaged in a RoHS-compliant, compact 2x2 mm surface-mount leadless package.

This SPDT 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 |     | +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> = +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<br>Insertion Loss State | 1 GHz                                                    |     | 15   |                 | dB    |
|                                             | 2 GHz                                                    |     | 15   |                 |       |
|                                             | 3 GHz                                                    |     | 17   |                 |       |
| RF2 Return Loss<br>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<br>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    |

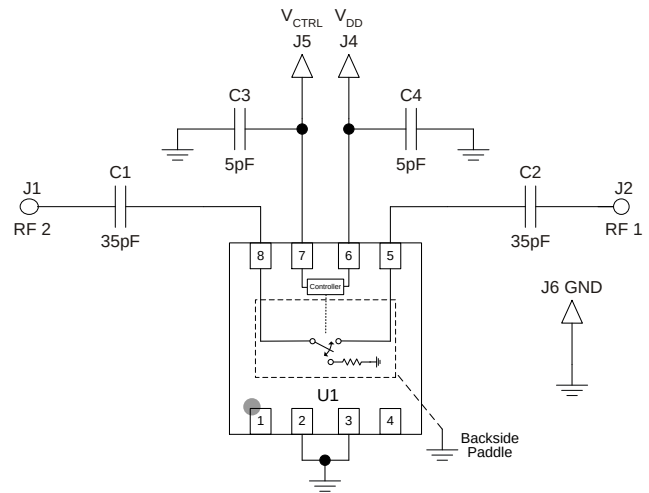
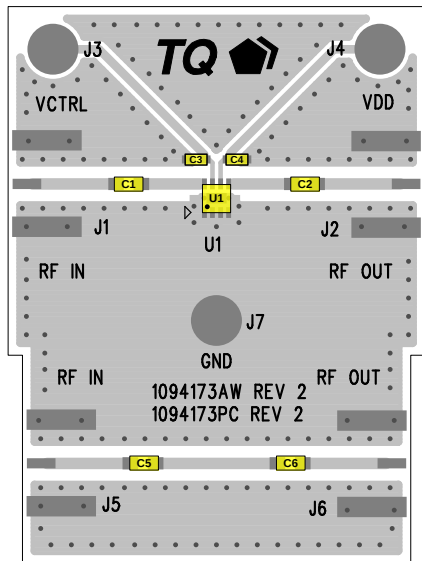
### Control Voltages

| 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

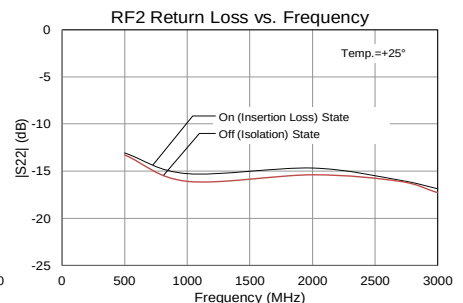
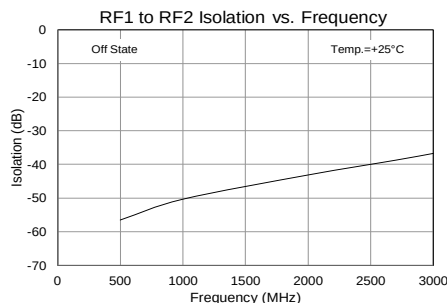
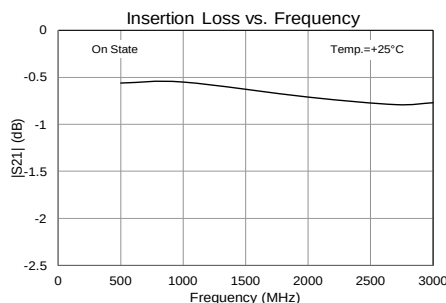
| Parameter                                                | Typical Value |      |      | Units |
|----------------------------------------------------------|---------------|------|------|-------|
| Frequency                                                | 1             | 2    | 3    | GHz   |
| Insertion 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:

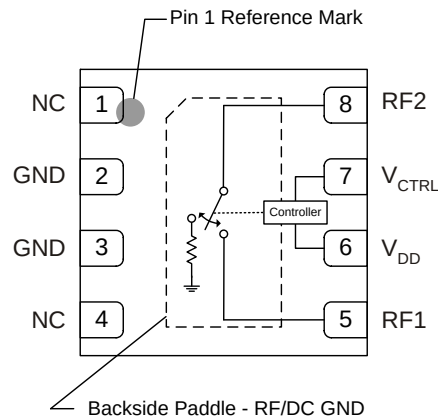
1. Insertion loss values reflect de-embedding of eval board RF line losses.

### 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



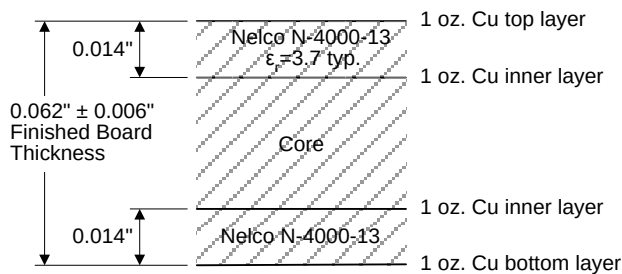
### Pin Configuration and Description



| 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

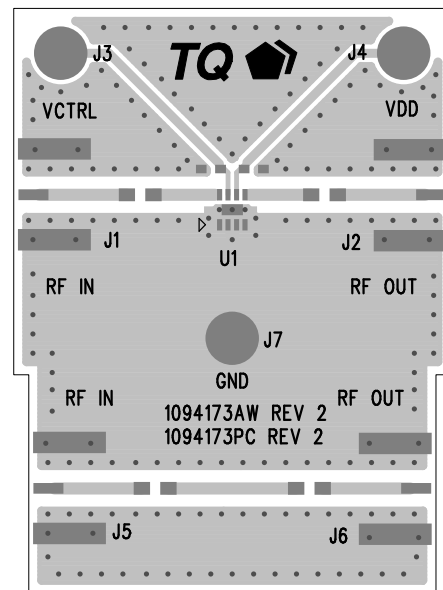
#### PCB 1094173 Material and Stack-Up



#### 50 ohm input/output (I/O) line structure

Width = 0.028"

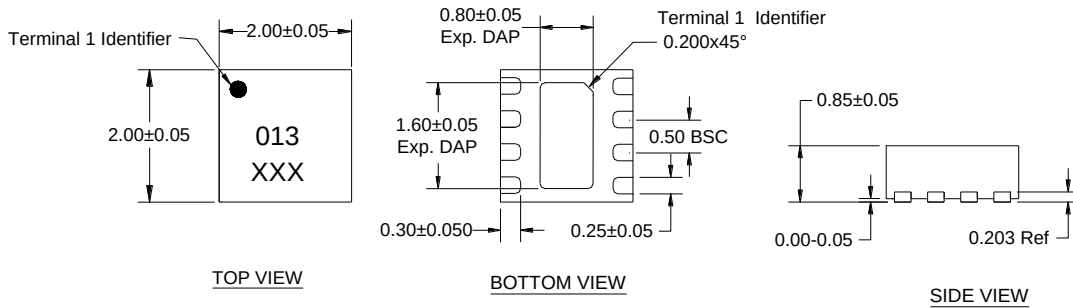
Gap = 0.028"



### Mechanical Information

#### Package Marking and Dimensions

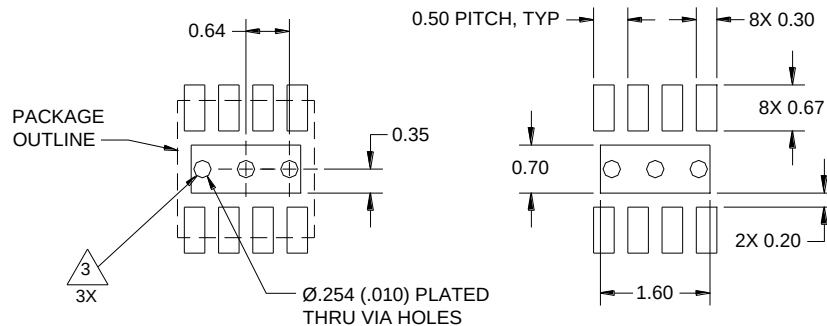
Marking: Product Code – 013  
Assembly code - XXX



#### 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 0  
Value: Passes >125 V and < 250 V  
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class IV  
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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