

Applications

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

Product Features

- General Purpose
- Low Insertion Loss
- +56 dBm Input IP3
- High Isolation
- Absorptive
- Single Positive Voltage Control
- Standard SMT Package
- 100 to 6000 MHz Operating Range

General Description

The TQP4M0010 is a GaAs FET single-pole, double throw (SPDT) high isolation absorptive switch that provides 100-6000 MHz broadband performance. The TQP4M0010 may be operated using a DC supply ranging from 3 to 5 Volts and with control signals operating from 1.8 to 5 Volts.

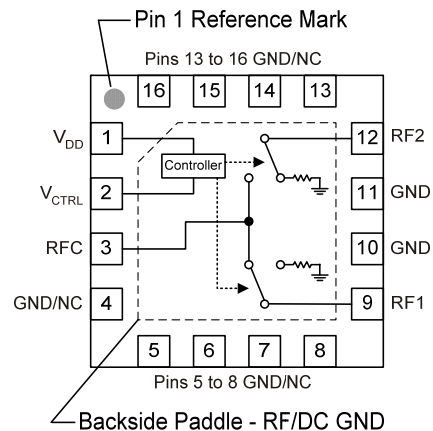
The TQP4M0010 is packaged in a RoHS-compliant, compact 4x4 mm surface-mount leadless package.

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 4x4mm QFN Package

Functional Block Diagram



Pin Configuration

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

Ordering Information

Part No.	Description
TQP4M0010	SPDT Absorptive Switch
TQP4M0010-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 +150°C
RF Input Power, CW, 50Ω, T = 25°C	+36 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}	2.75	5.0	5.25	V
Operating Temp. Range	-40		+95	°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} = +5 V, V_{CTRL} = +3 V, Temp. = +25°C, 50 Ω system

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		100		6000	MHz
Control Voltage	Low	0		0.4	V
	High	1.8		V _{DD} +0.5 V	V
Insertion Loss	0.1 – 1.0 GHz		0.5	0.8	dB
	1.0 – 2.5 GHz		0.6	0.9	
	2.5 – 3.0 GHz		0.7	1.0	
	3.0 – 4.5 GHz		0.8		
Isolation – RFC to RF1/RF2	0.1 – 1.0 GHz	50	55		dB
	1.0 – 2.5 GHz	45	48		
	2.5 – 3.0 GHz	45	47		
	3.0 – 4.5 GHz		44		
Isolation – RF1 to RF2	0.1 – 1.0 GHz		50		dB
	1.0 – 2.5 GHz		44		
	2.5 – 3.0 GHz		43		
	3.0 – 4.5 GHz		40		
Return Loss – RFC Port	0.1 – 1.0 GHz	16	20		dB
	1.0 – 4.5 GHz		13		
Input P1dB	f = 2 GHz		+33		dBm
Input IP3	f = 2 GHz, Pin/tone = +15 dbm, Δf = 1 MHz		+56		dBm
Switching Speed	t _{ON} (50% CTL to 90% RF)		233	290	ns
	t _{ON} (50% CTL to 90% RF), -40 to +85°C			1	us
	t _{OFF} (50% CTL to 10% RF)		96		ns
	t _{ON} (50% CTL to 98% RF)		300		
	t _{OFF} (50% CTL to 2% RF)		110		
Total Supply current (I _{DD})			70	150	uA

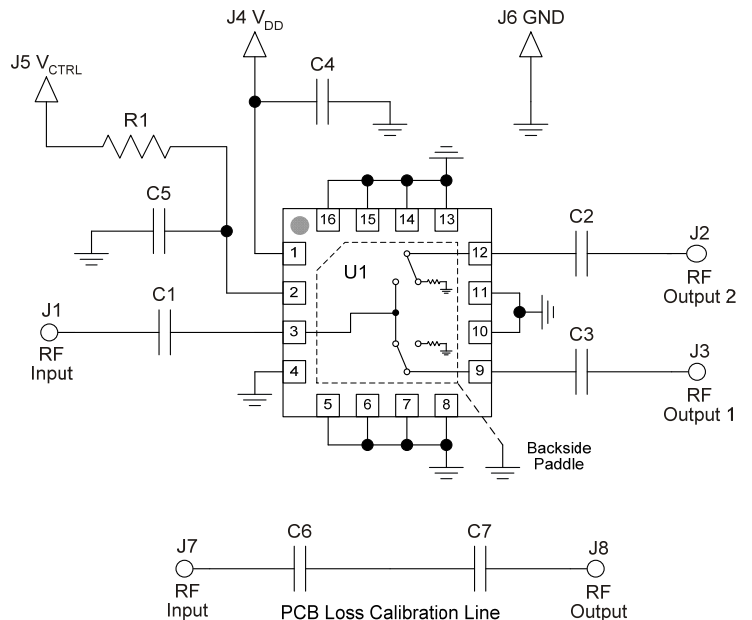
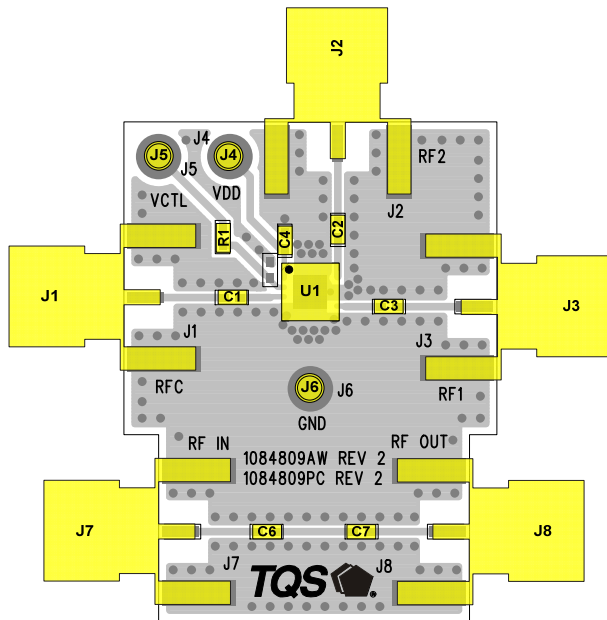
Digital Control Voltages

State	Bias Condition
Low	≤ 0.4 V
High	≥ 1.8 V

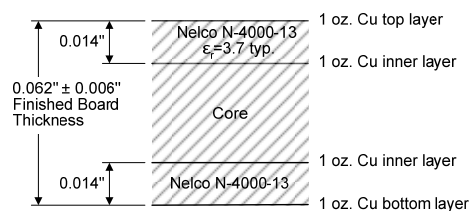
Switch Control Truth Table

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

TQP4M0010-PCB Evaluation Board



TriQuint PCB 1084809 Material and Stack-up



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

Bill of Material – TQP4M0010-PCB

Reference Des.	Value	Description	Manuf.	Part Number
n/A	n/A	Printed Circuit Board	TriQuint	1084809 Rev. 2
U1	n/A	SPDT Switch	TriQuint	TQP4M0010
R1 ⁽¹⁾	0 Ohm	Res., 0402, 5%, 1/16W	various	
C1, C2, C3, C6, C7	100 pF	Cap., 0402, 5%, 50V, NPO/COG	various	
C4	1000 pF	Cap., 0402, 5%, 50V, NPO/COG	various	
C5	DNP	Do not populate		
J4, J5, J6	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

Notes:

1. R1 may be omitted (replaced with circuit trace) in end user circuits.

Typical Performance – TQP4M0010-PCB

Test conditions unless otherwise noted: $V_{DD} = +5\text{ V}$, $V_{CTRL} = +3\text{ V}$, Temp= 25°C , $50\ \Omega$ system

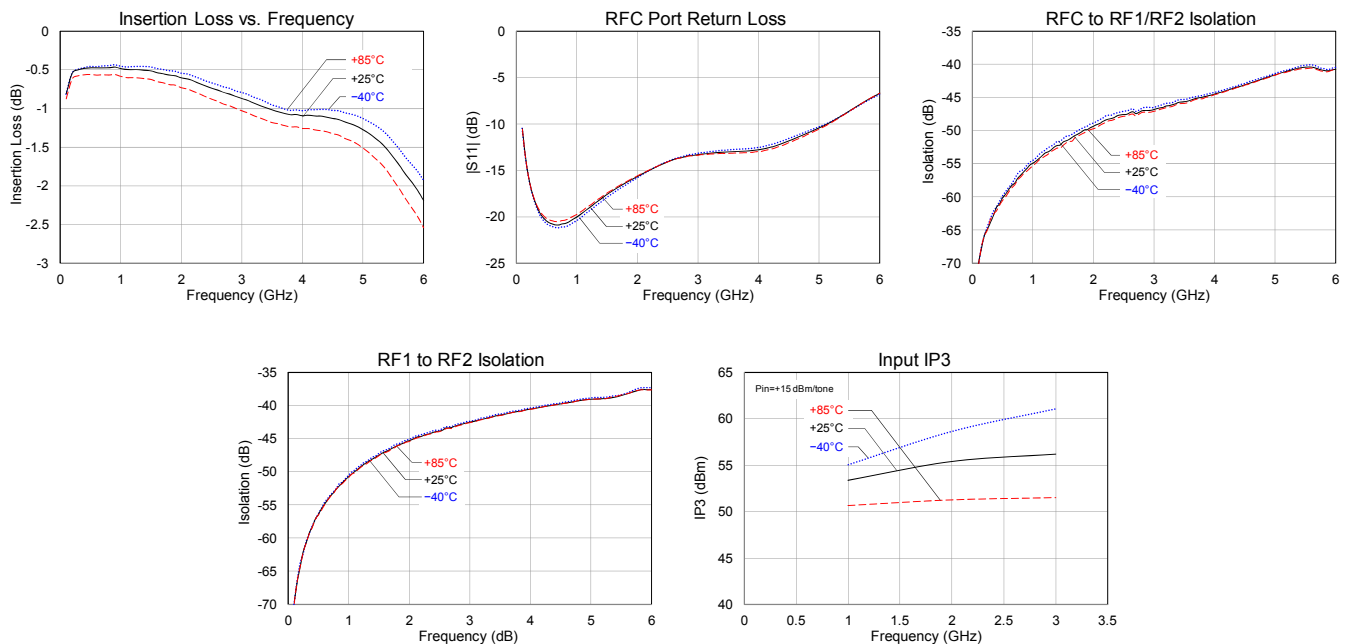
Parameter	Typical Value			Units
Frequency	1	2	3	GHz
Insertion Loss ⁽¹⁾	0.5	0.6	0.7	dB
RFC Port Return Loss	20	16	13	dB
RFC to RF1/RF2 Isolation	55	50	47	dB
RF1 to RF2 Isolation	50	45	43	dB
Input P1dB	+36	+33	+30	dBm
Input IP3 ⁽²⁾	+53	+56	+56	dBm

Notes:

1. The Insertion Loss values reflect de-embedding of eval board RF I/O line losses that would not be present in target applications.
2. IIP3 measured with two tones at an input power of +15 dBm / tone separated by 1 MHz.

Performance Plots – TQP4M0010-PCB

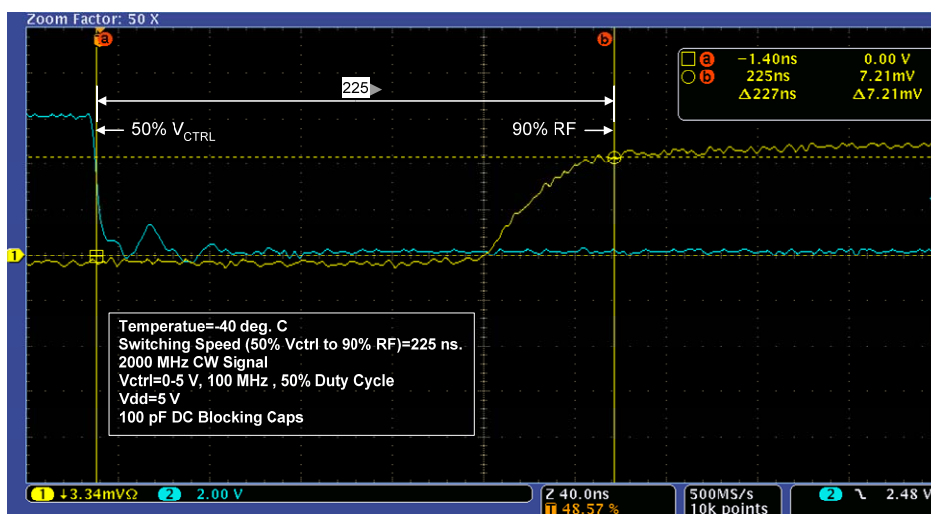
Test conditions unless otherwise noted: $V_{DD} = +5\text{ V}$, $V_{CTRL} = +3\text{ V}$, Temp= 25°C , $50\ \Omega$ system



Switching Speed Over Temperature (t_{ON})– TQP4M0010-PCB

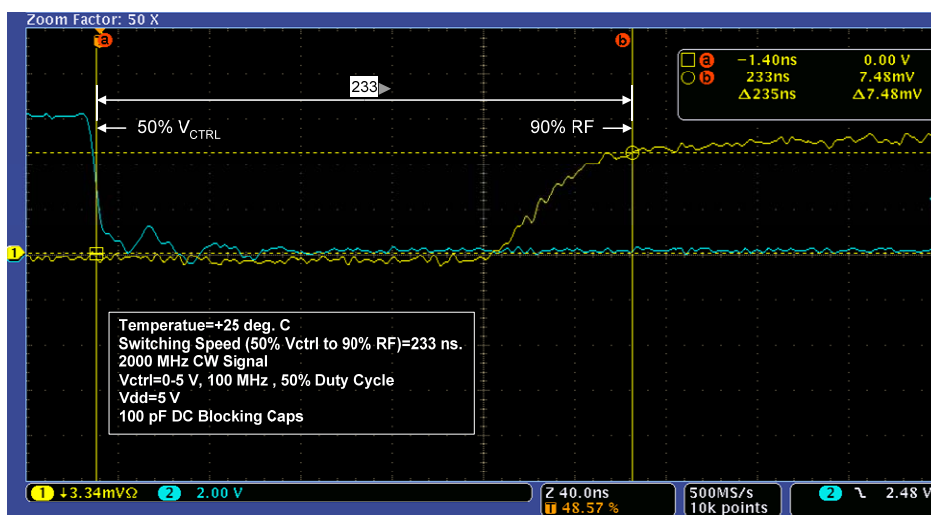
Temp.= -40°C

Switching Speed(t_{ON})=225 ns.
(50% CTL to 90% RF)



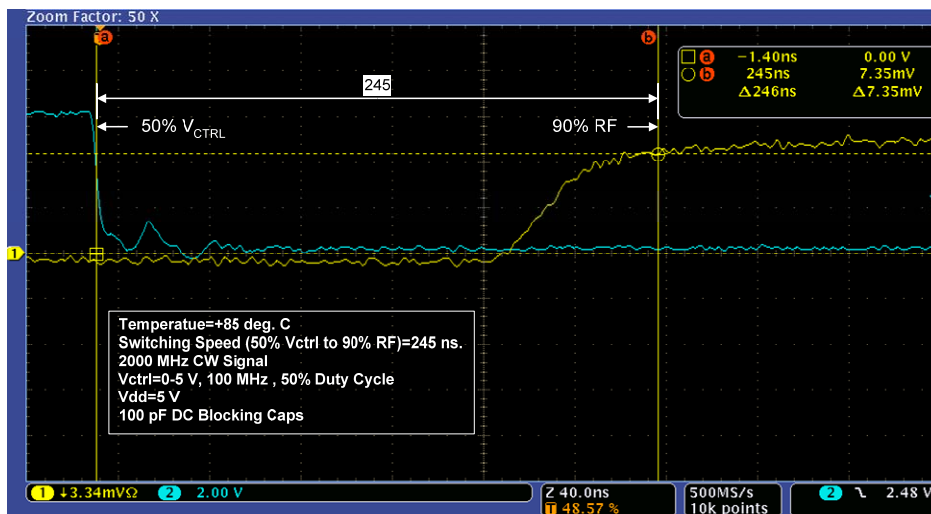
Temp.= $+25^{\circ}\text{C}$

Switching Speed(t_{ON})=233 ns.
(50% CTL to 90% RF)



Temp.= $+85^{\circ}\text{C}$

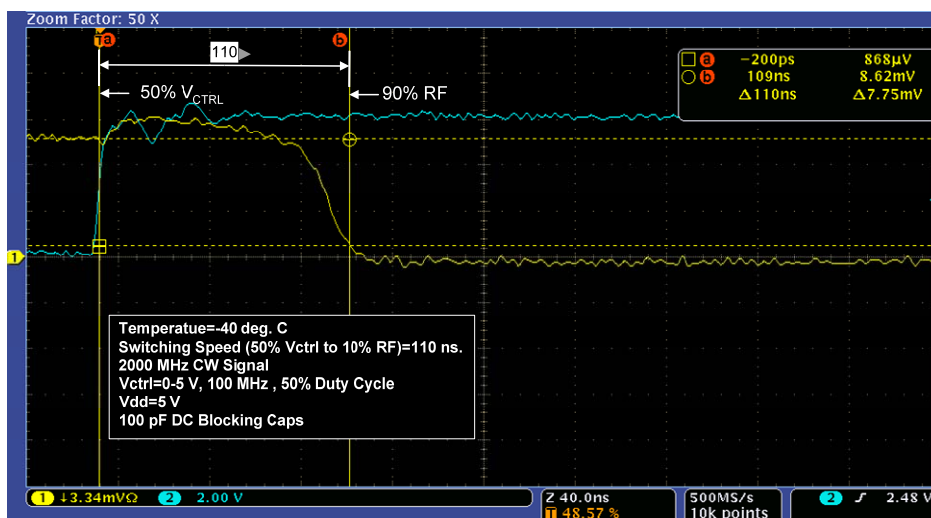
Switching Speed(t_{ON})=245 ns.
(50% CTL to 90% RF)



Switching Speed Over Temperature (t_{OFF})– TQP4M0010-PCB

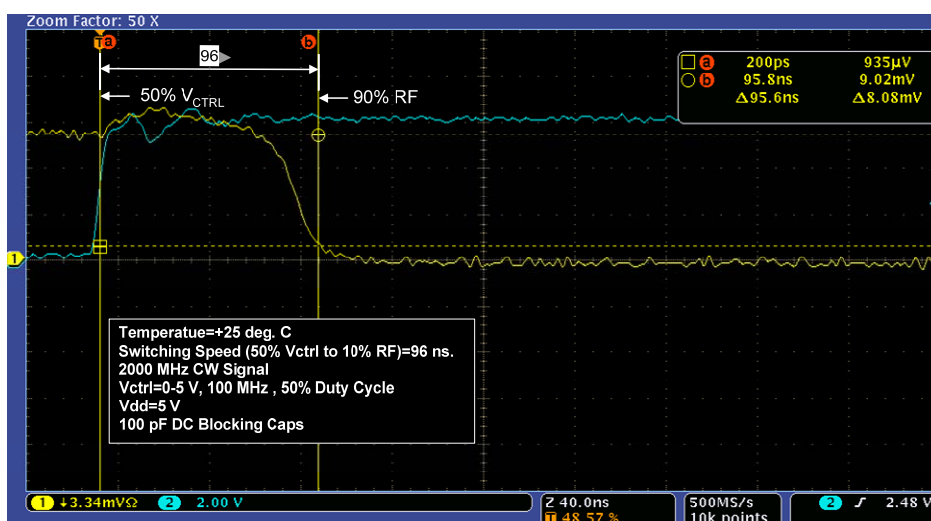
Temp.= -40°C

Switching Speed(t_{OFF})=110 ns.
(50% CTL to 10% RF)



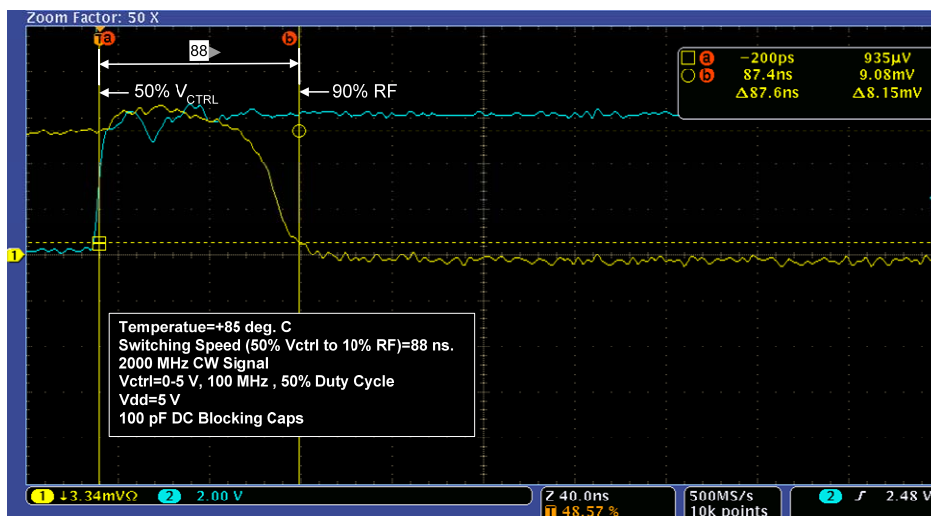
Temp.= $+25^{\circ}\text{C}$

Switching Speed(t_{OFF})=96 ns.
(50% CTL to 10% RF)



Temp.= $+85^{\circ}\text{C}$

Switching Speed(t_{OFF})=88 ns.
(50% CTL to 10% RF)



Switching Speed using different Blocking Caps

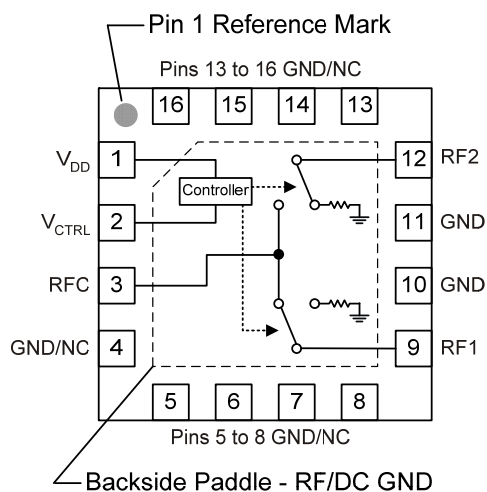
Switching Speed Measurement based on TQS Application Board

Using Shutdown Circuit: $V_{CTRL}=3.0V$, $V_{DD}=5.0V$

With C1, C2, C3 = 100pF	-40C	+25C	+85C
Turn-off Transition (50% CNTR – 10% RF)	110 ns	96 ns	88 ns
Turn-on Transition (50% CNTR – 90% RF)	225 ns	233 ns	245 ns

With C1, C2, C3 = 10pF	-40C	+25C	+85C
Turn-off Transition (50% CNTR – 10% RF)	85 ns	77 ns	69 ns
Turn-on Transition (50% CNTR – 90% RF)	2.71 us	2.55 us	2.10 us

Pin Configuration and Description

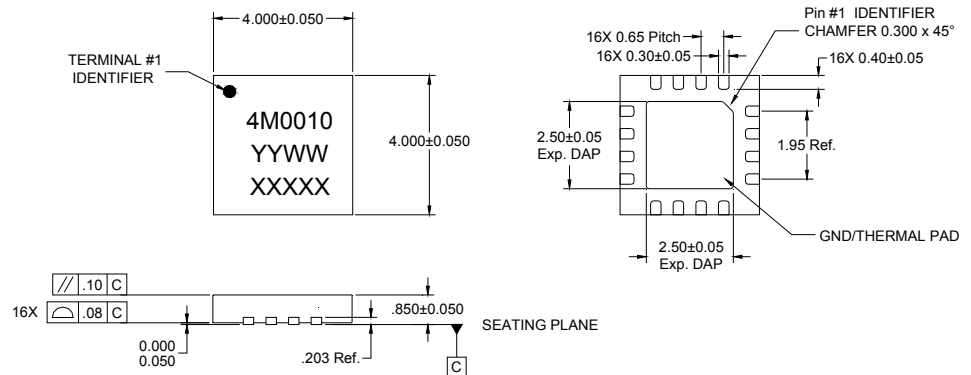


Pin No.	Label	Description
1	V_{DD}	DC voltage supply
2	V_{CTRL}	Digital control voltage
3	RFC	Antenna input. DC blocking capacitor required.
4-8, 13-16	GND or NC	No electrical connection. Provide grounded land pads for PCB mounting integrity.
10, 11	GND	RF/DC Ground
9	RF1	RF output 1. DC blocking capacitor required.
12	RF2	RF output 2. DC blocking capacitor required.
Backside Paddle	RF/DC GND	RF/DC Ground. Use recommended via pattern and ensure good solder attach for best thermal and electrical performance.

Mechanical Information

Package Marking and Dimensions

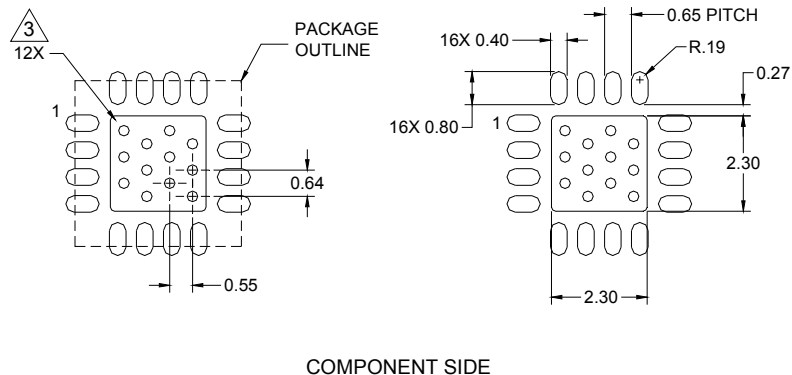
Marking: Part number – 4M0010
 Year, week - YYWW
 Assembly code - XXXXX



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



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 0.35 mm ($\#80/.0135$ ") 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 (RF Ports)
Value: <250 V
ESD Rating: Class 1A (DC Lines)
Value: ≥250 volts to < 500 volts
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class IV
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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