



# QPC1005

## 0.15 – 2.8 GHz 50 W GaN SPDT Switch

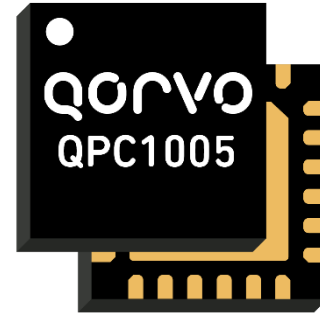
### Product Overview

Qorvo's QPC1005 is a Single-Pole, Double-Throw (SPDT) switch fabricated on Qorvo's QGaN25 0.25um GaN on SiC production process.

Operating from 0.15 to 2.8 GHz, the QPC1005 typically supports 50 W input power handling at control voltages of 0/-40 V for both CW and pulsed RF operations. This switch maintains low insertion loss less than 0.7 dB and greater than 30 dB isolation, making it ideal for high power switching applications across both defense and commercial platforms.

QPC1005 is offered in a 4 x 4 mm plastic overmolded QFN package.

Lead-free and RoHS compliant



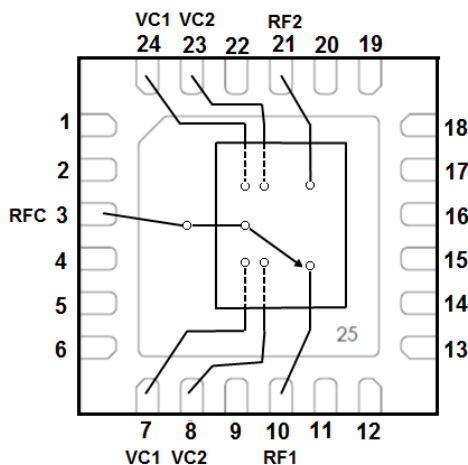
4mm x 4mm 24 Lead OVM QFN

### Key Features

- SPDT
- Frequency Range: 0.15 to 2.8 GHz
- Input Power: 50 W
- Insertion Loss: < 0.7 dB
- Isolation: >30 dB Typical
- Switching Speed: 30 ns
- Control Voltages: 0 V/-40 V
- Redundant Control Lines
- Package Dimensions: 4 x 4 x 0.85 mm

*Performance is typical across frequency. Please reference electrical specification table and data plots for more details.*

### Functional Block Diagram



### Applications

- Commercial and Military Radar
- Land Mobile Radios
- Military Communications Radios
- Electronic Warfare
- Test Instrumentation
- General Purpose

### Ordering Information

Part No.	ECCN	Description
QPC1005	EAR99	0.15–2.8 GHz 50 W GaN SPDT Switch

## Absolute Maximum Ratings

Parameter	Rating
Control Voltage (V <sub>C</sub> )	-50 V
Control Current (I <sub>C</sub> )	-1.5 / +1.5 mA
Power Dissipation	12 W
RF Input Power, CW, 50 Ω, T = 25 °C	60 W
Channel Temperature, T <sub>CH</sub>	275 °C
Mounting Temperature (30 sec)	260 °C
Storage Temperature	-40 to 150 °C

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

## Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
V <sub>C1</sub>		0/-40		V
V <sub>C2</sub>		-40/0		V
Channel Temp., T <sub>CH</sub>		≤ 225		°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

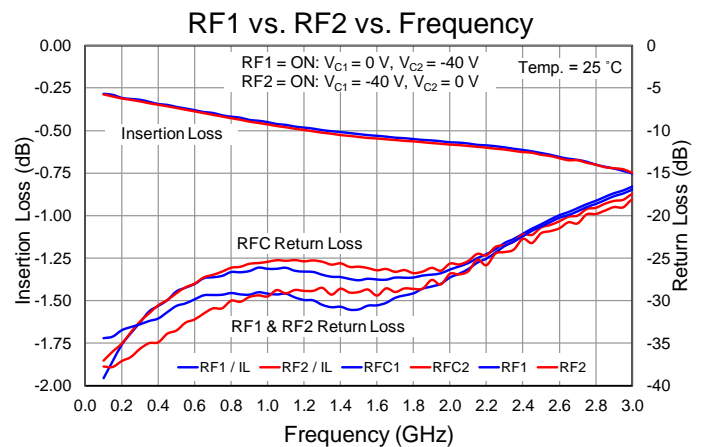
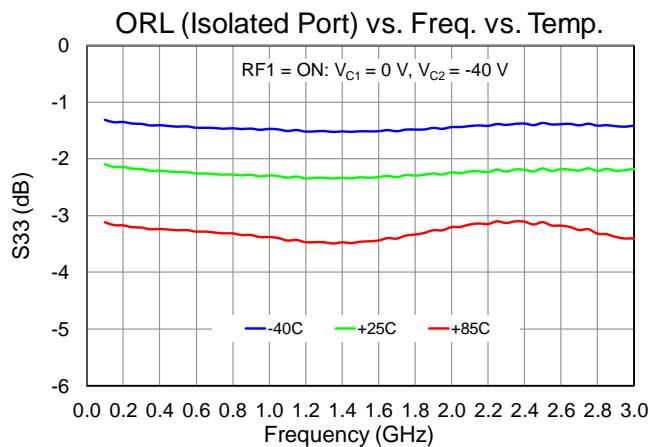
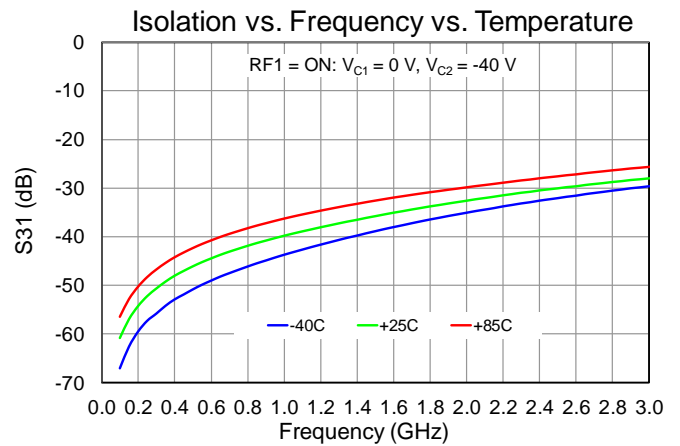
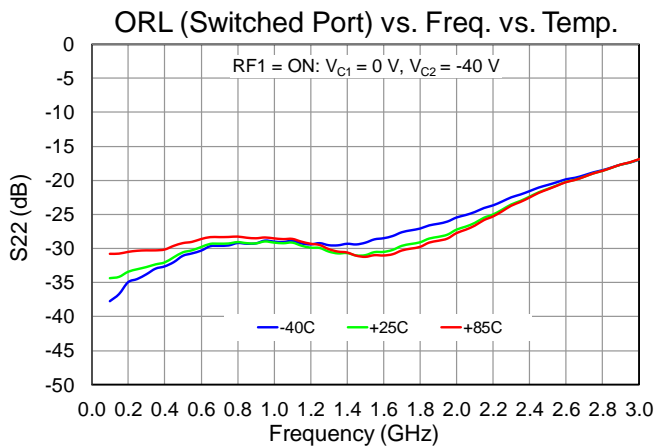
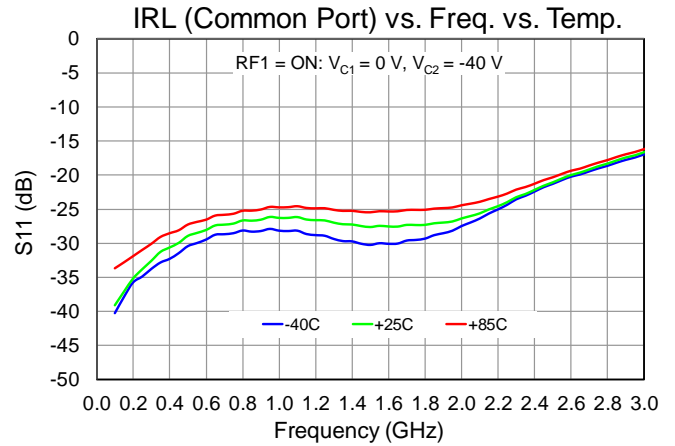
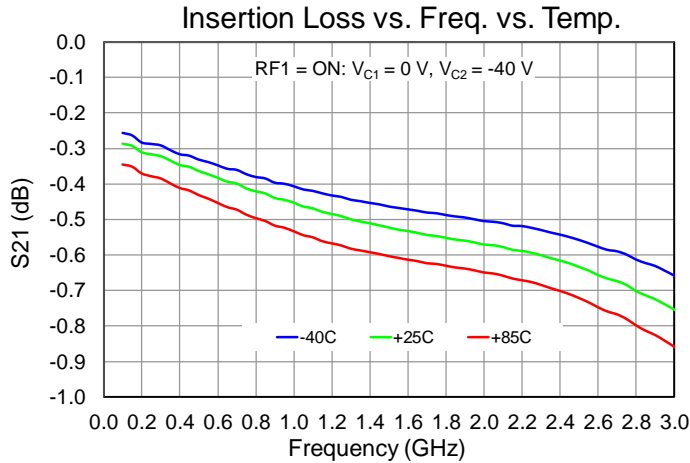
## Electrical Specifications

Test conditions unless otherwise noted: 25 °C,  $V_{C1} = 0\text{ V}/-40\text{ V}$ ,  $V_{C2} = -40\text{ V}/0\text{ V}$ , see function table on page 12.

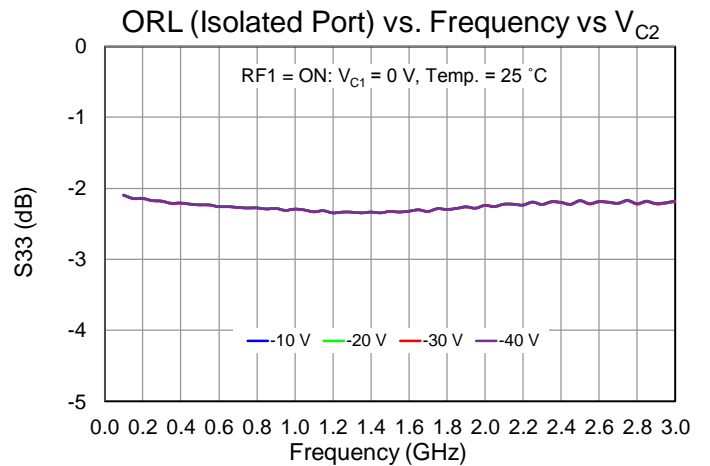
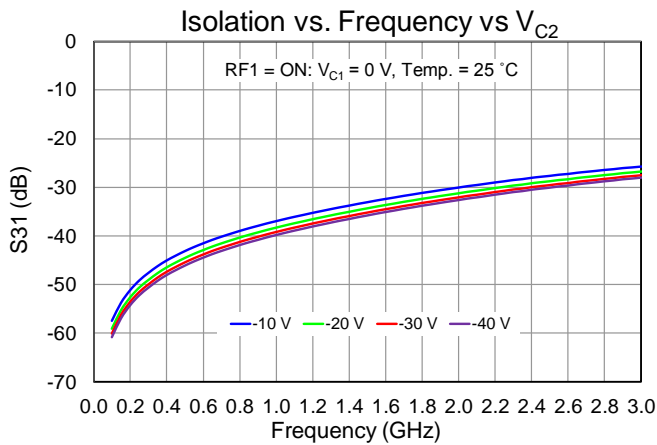
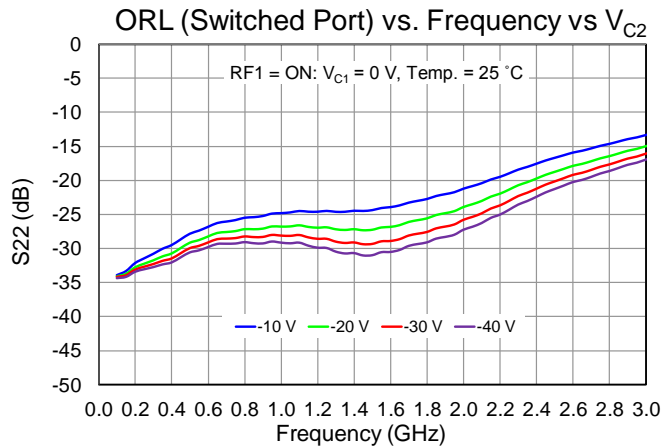
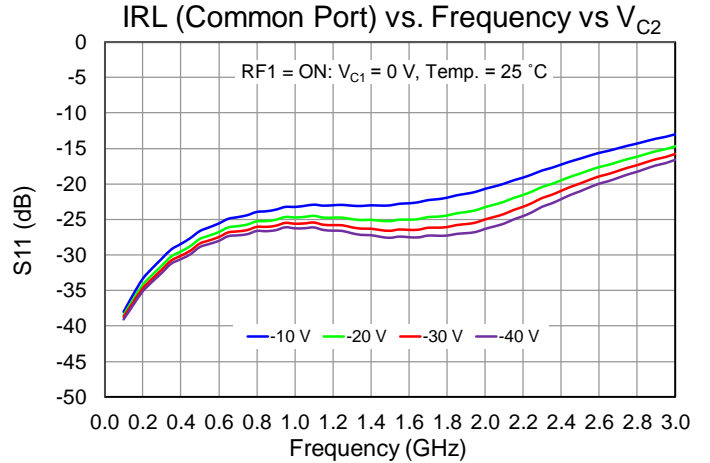
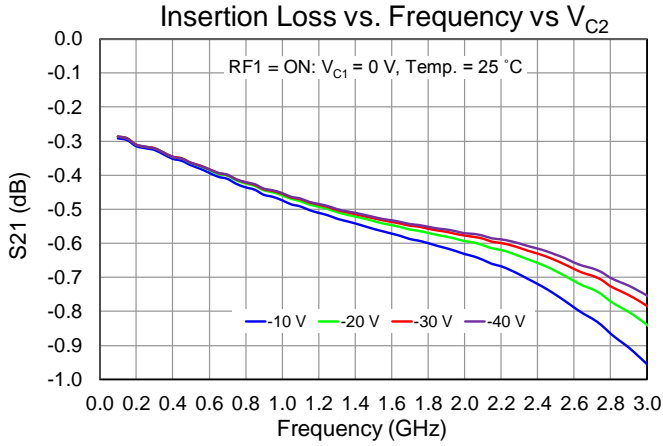
Parameter	Min	Typ	Max	Units
Operational Frequency Range	0.15	–	2.8	GHz
Insertion Loss (On-State)	Frequency = 0.15 GHz	0.30	–	dB
	Frequency = 1.0 GHz	0.45	–	
	Frequency = 2.8 GHz	0.70	–	
Input Return Loss (On-State) Common Port RL	Frequency = 0.15 GHz	37	–	dB
	Frequency = 1.0 GHz	26	–	
	Frequency = 2.8 GHz	18	–	
Output Return Loss (On-State) Switched Port RL	Frequency = 0.15 GHz	34	–	dB
	Frequency = 1.0 GHz	29	–	
	Frequency = 2.8 GHz	18	–	
Isolation (Off-State)	Frequency = 0.15 GHz	57	–	dB
	Frequency = 1.0 GHz	40	–	
	Frequency = 2.8 GHz	29	–	
Output Return Loss Isolated Port	Frequency = 0.15 GHz	2.1	–	dB
	Frequency = 1.0 GHz	2.3	–	
	Frequency = 2.8 GHz	2.2	–	
Insertion Loss @ $P_{IN} = 47\text{ dBm}$ (Pulsed RF) PW = 100us; DC = 10%	Frequency = 0.15 GHz	0.30		dB
	Frequency = 1.0 GHz	0.50		
	Frequency = 2.8 GHz	0.70		
Insertion Loss @ $P_{IN} = 47\text{ dBm}$ (CW)	Frequency = 0.15 GHz	0.30		dB
	Frequency = 1.0 GHz	0.50		
	Frequency = 2.8 GHz	0.75		
Input Power ( $P_{0.1dB}$ )		47		dBm
Control Voltage		-40	-50	V
Total Supply Current		<3		mA
Switching Speed		30		nS
Insertion Loss Temperature Coefficient	–	-0.0015	–	dB/°C

## Performance Plots – Small Signal

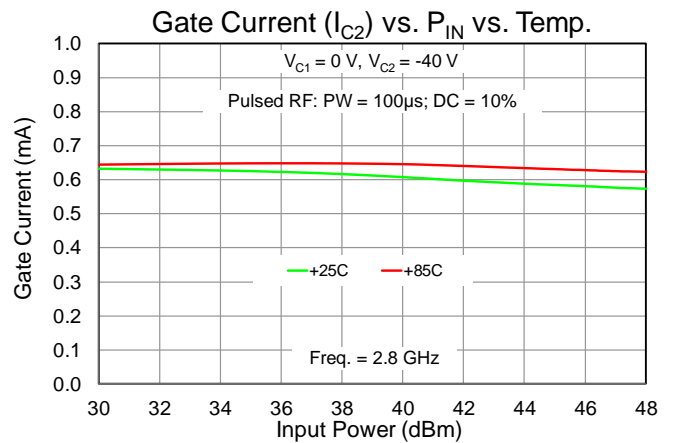
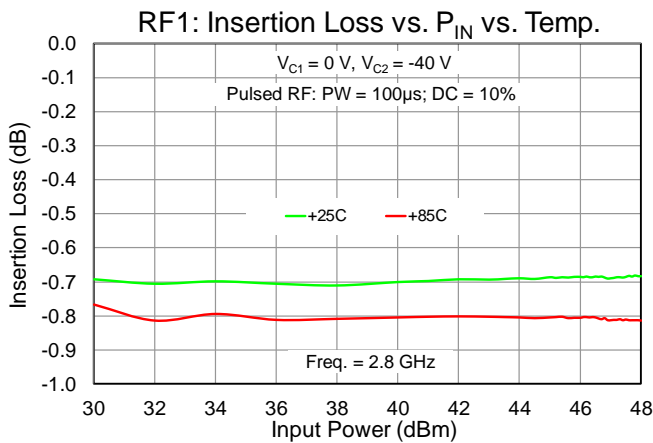
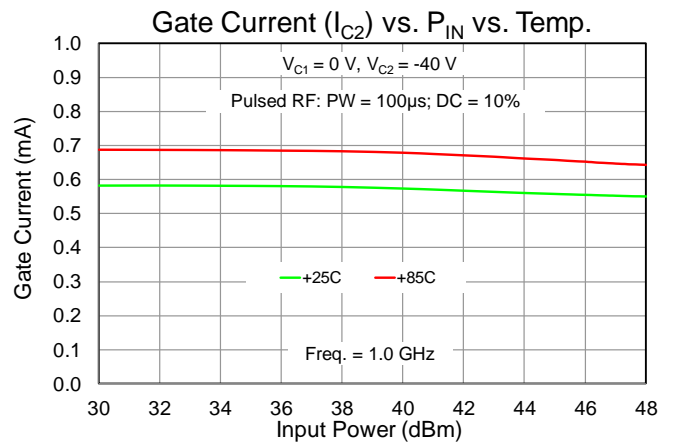
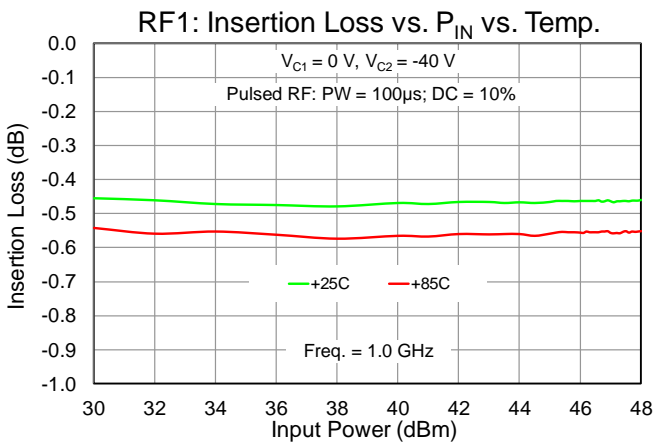
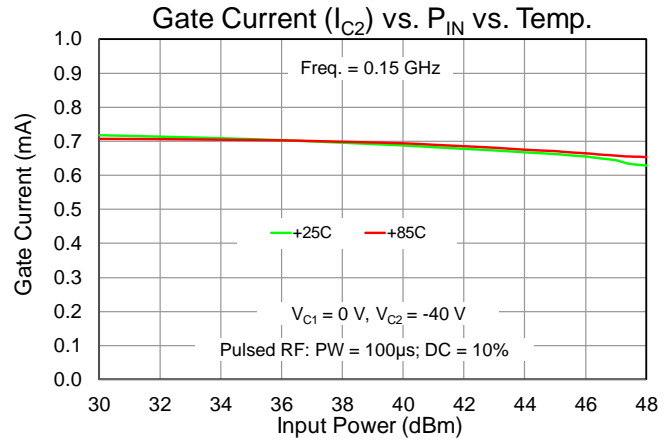
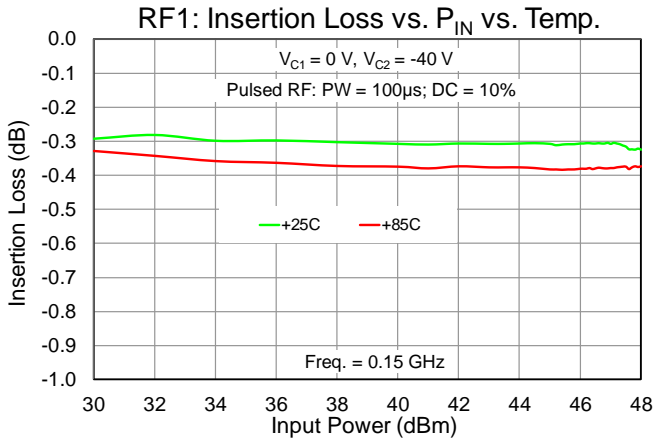
Notes: RFC = Port1; RF1 = Port 2; RF2 = Port 3



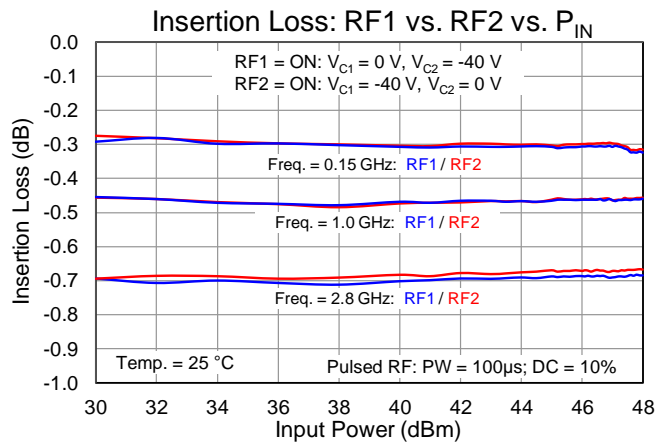
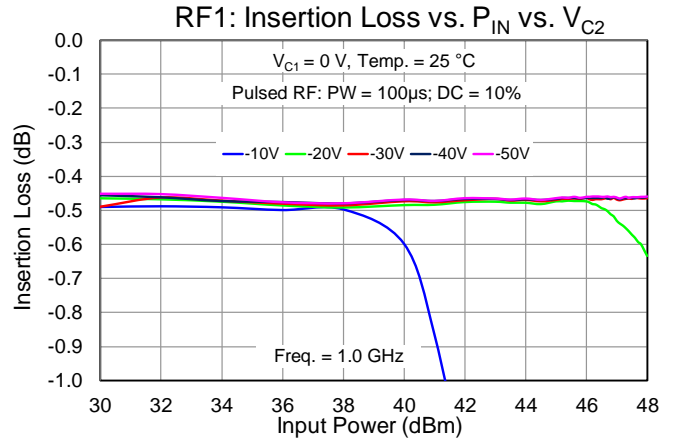
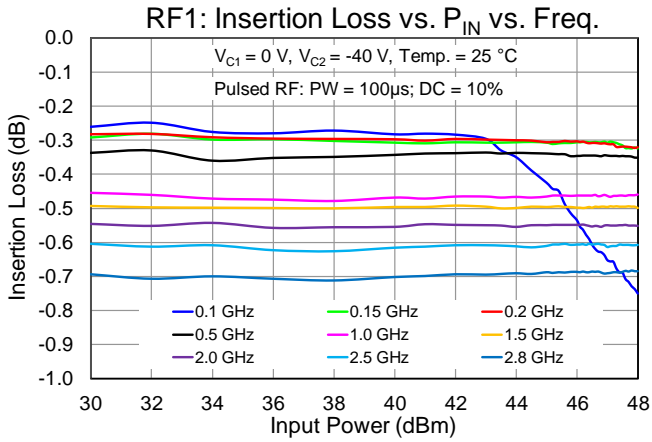
Performance Plots – Small Signal



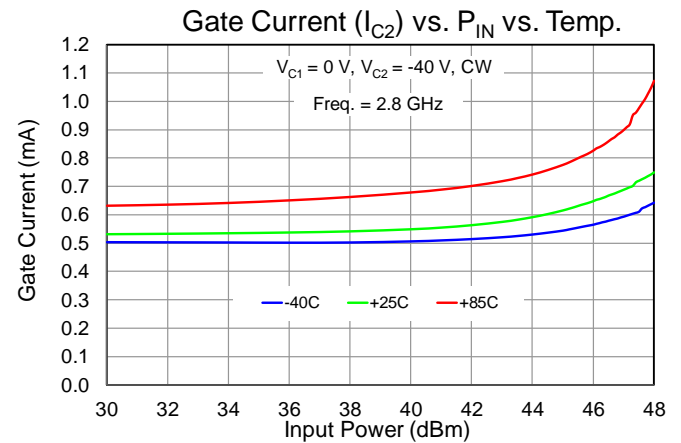
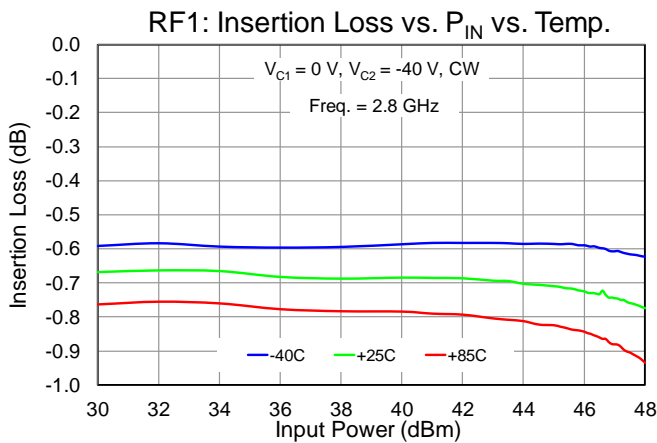
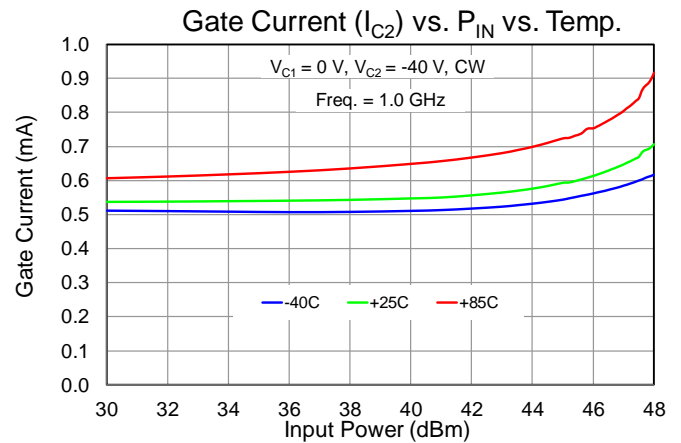
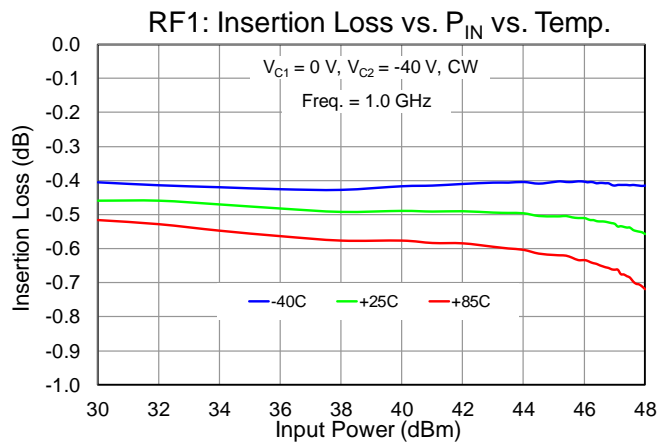
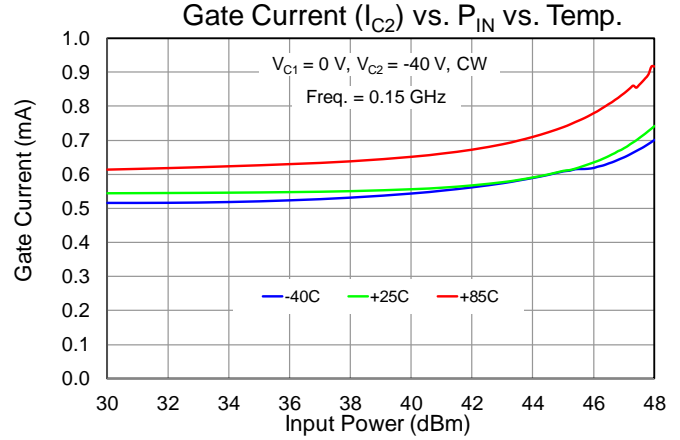
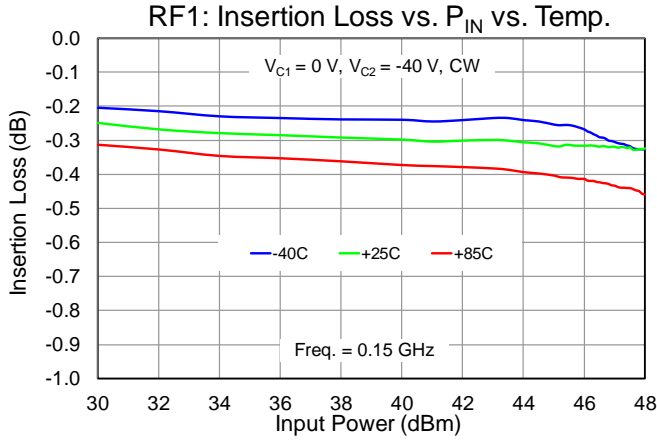
Performance Plots – Compression (Pulsed)



Performance Plots – Compression (Pulsed)

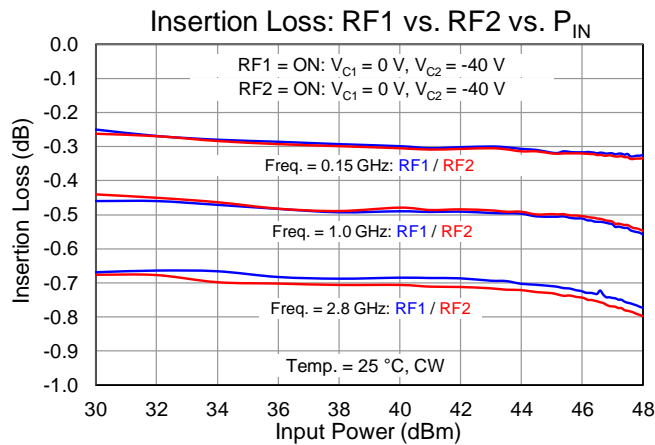
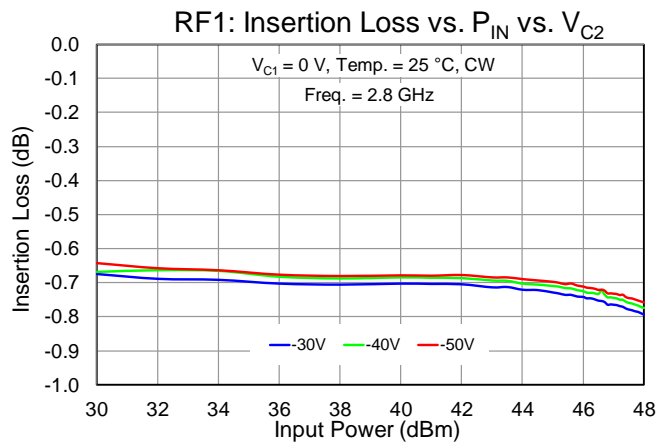
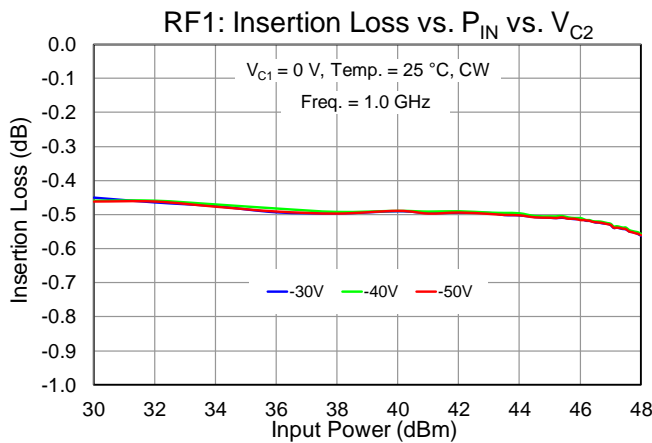
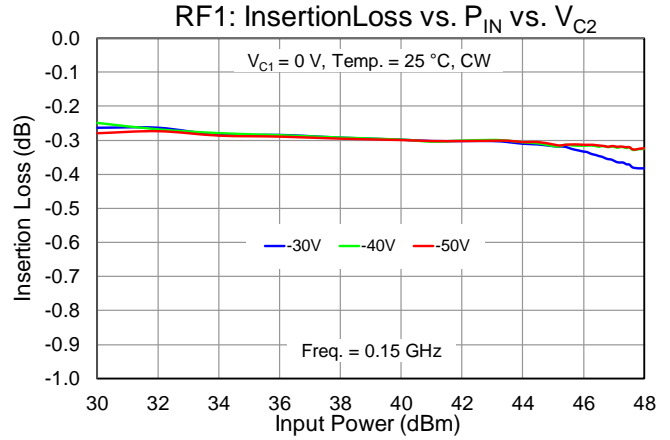
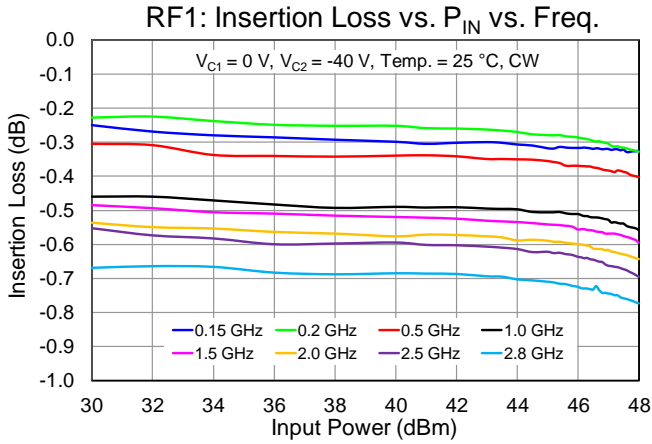


Performance Plots – Compression (CW)

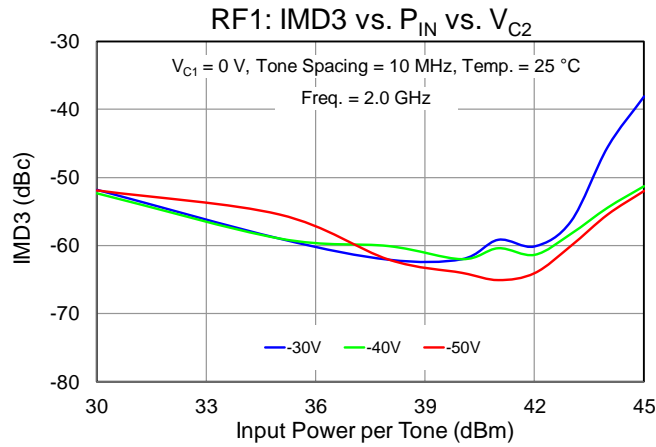
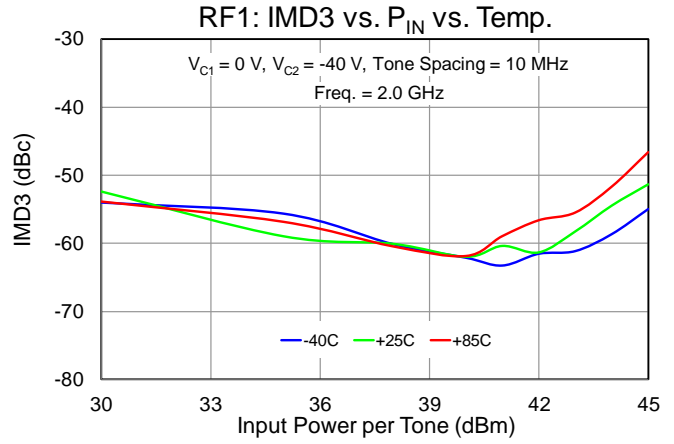
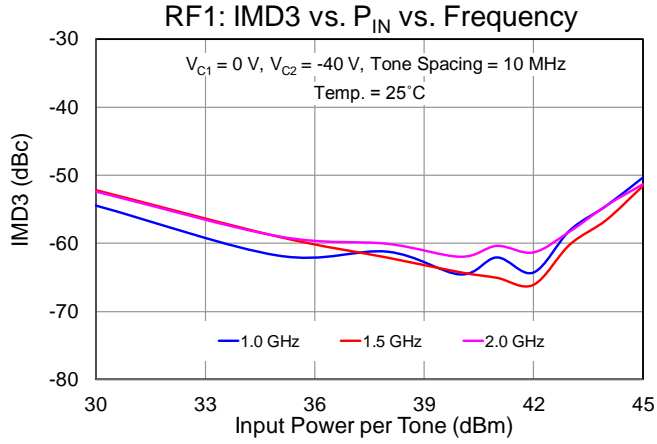




Performance Plots – Compression (CW)



Performance Plots – Linearity



## Thermal and Reliability Information

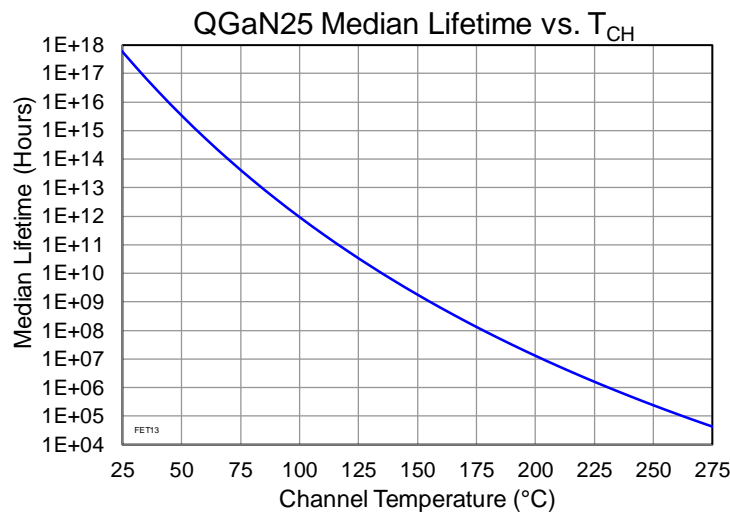
Parameter	Test Conditions	Value	Units
Thermal Resistance ( $\theta_{JC}$ ) <sup>(1)</sup>	T <sub>BASE</sub> = 85 °C, V <sub>C1</sub> = 0 V, V <sub>C2</sub> = -40 V, Freq. = 2.8 GHz P <sub>IN</sub> = 60 W (CW), P <sub>DISS</sub> <sup>(2)</sup> = 6.5 W, CW	7.69	°C/W
Channel Temperature (T <sub>CH</sub> ) <sup>(1)</sup>		135	°C
Median Lifetime (T <sub>M</sub> )		9.75 x 10 <sup>9</sup>	Hrs

Notes:

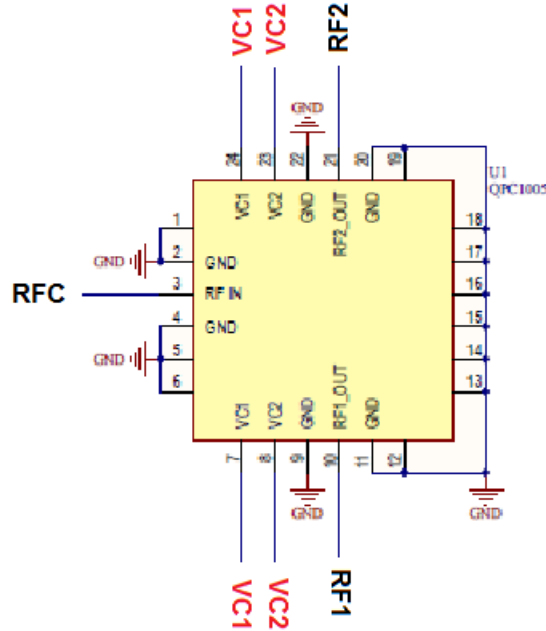
1. Measured to the back of the package.
2. This is a total P<sub>DISS</sub> in the FETs.

## Median Lifetime and Channel Temperature

Test Conditions: V<sub>D</sub> = +40 V; Failure Criteria = 10% reduction in I<sub>D,MAX</sub> during DC Life Testing



Application Circuit



Notes:

1. This switch can be configured as a Single Pole, Single Throw (SPST) by terminating one unused RF switched port with a 50 Ohm load.
2.  $V_{C1}$  can be biased from either pin 7 or 24 and the non-biased pin can be left open.
3.  $V_{C2}$  can be biased from either pin 8 or 23 and the non-biased pin can be left open.
4. External components are not required

Bias Up Procedure

1.  $V_{C1}$  or  $V_{C2}$  set to 0 V (see Function Table for RF Path)
2.  $V_{C2}$  or  $V_{C1}$  set to -40 V (see Function Table for RF Path)
3. Apply RF signal to RF Input

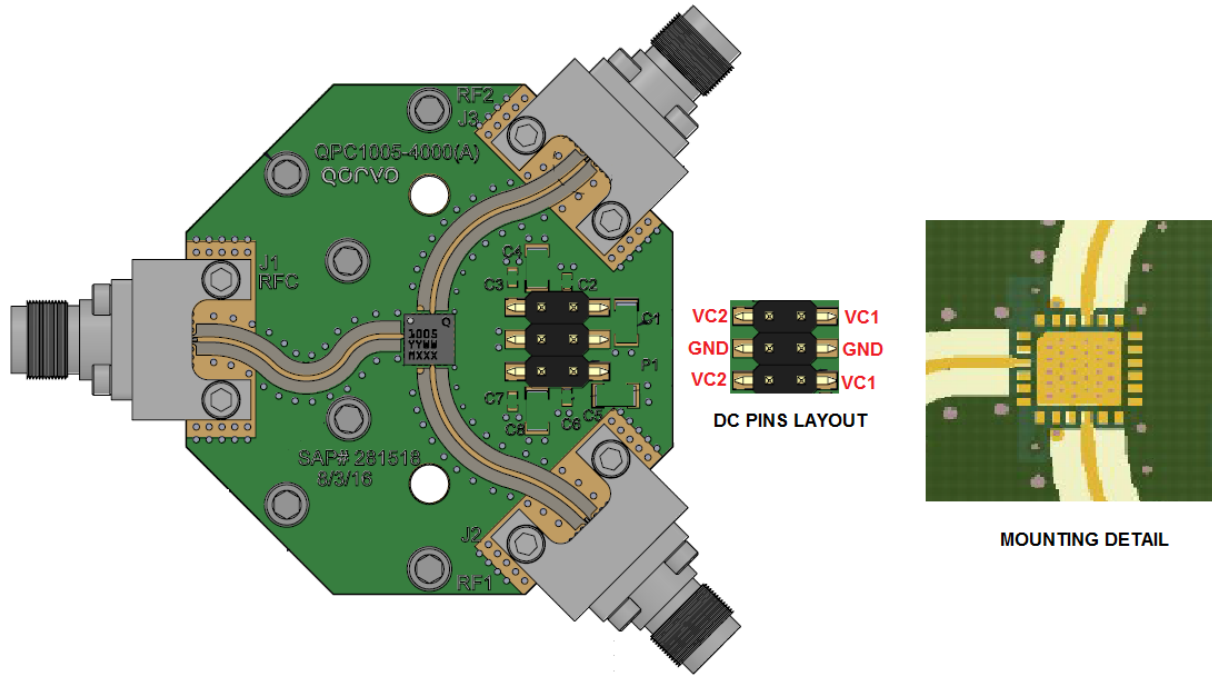
Bias Up Down

1. Turn off RF supply
2. Turn  $V_{C2}$  or  $V_{C1}$  to 0 V
3. Turn  $V_{C1}$  or  $V_{C2}$  to 0 V

Function Table

RF Path	State	$V_{C1}$	$V_{C2}$
RFC to RF1 ON	On-State (Insertion Loss)	0 V	-40 V
	Off-State (Isolation)	-40 V	0 V
RFC to RF2 ON	On-State (Insertion Loss)	-40 V	0 V
	Off-State (Isolation)	0 V	-40 V

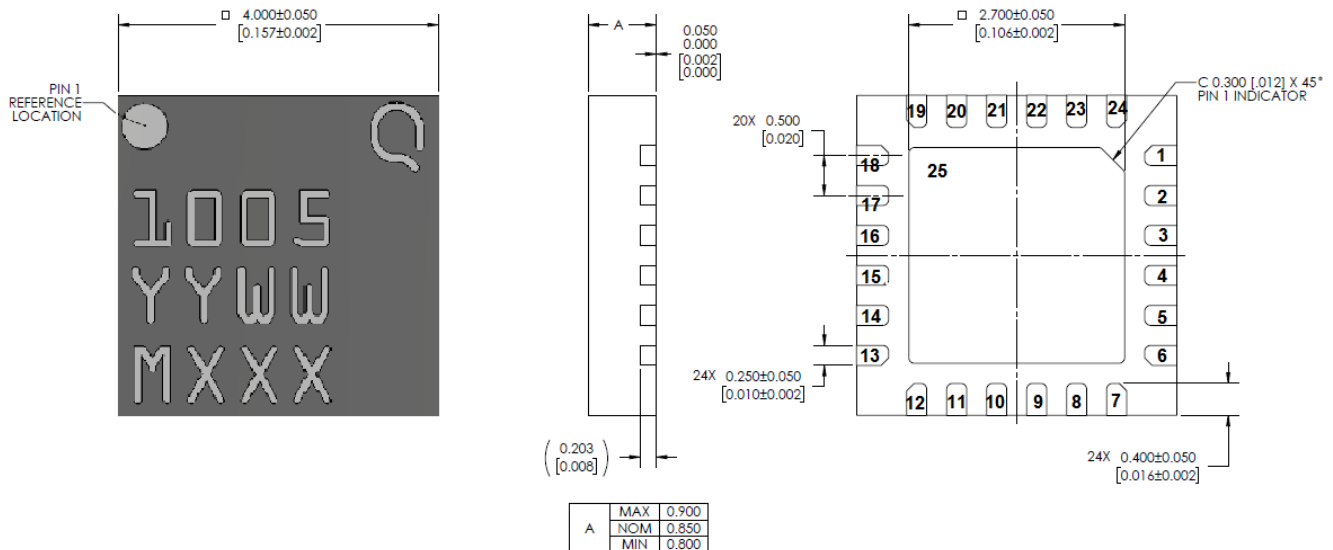
Evaluation Board (EVB) Assembly Layout.



Notes:

1. This switch can be configured as a Single Pole, Single Throw (SPST) by terminating one unused RF switched port with a 50 Ohm load.
2.  $V_{C1}$  can be biased from either pin and the non-biased pin can be left open.
3.  $V_{C2}$  can be biased from either pin and the non-biased pin can be left open.
4. External components are not required

## Mechanical Information



Units: millimeters  
Tolerances: unless specified  
x.xx = ± 0.25  
x.xxx = ± 0.100  
Materials:  
Base: Cu Alloy  
Packaged Exposed Metallization is gold plated  
Marking:  
QPC1005: Part number  
YY: Part Assembly year  
WW: Part Assembly week  
MXXX: Batch ID

## Pin Description

Pad No.	Symbol	Description
1, 5, 6, 11-20,	N/C	Not connected internally. Recommended to be grounded at EVB level
2, 4, 9, 22	GND	Ground. Connected to GND paddle (pin 25); should be grounded on PCB to improve isolation
3	RFC	RF common port; matched to 50 Ω; DC coupled
7, 24	V <sub>C1</sub>	Control voltage #1; External components are not required
8, 23	V <sub>C2</sub>	Control voltage #2; External components are not required
10	RF1	RF switched port 1; matched to 50 Ω; DC coupled
21	RF2	RF switched port 2; matched to 50 Ω; DC coupled
25	GND	Backside Paddle. Multiple vias should be employed to minimize inductance and thermal resistance.

Recommended Soldering Profile

