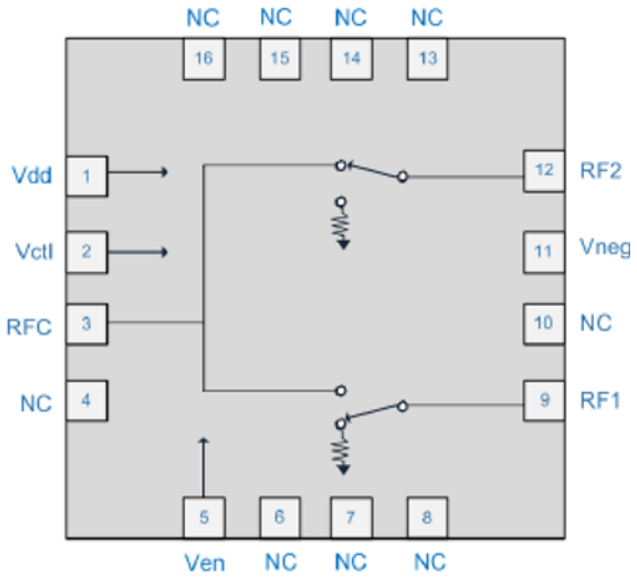
QPC3024

75Ω Absorptive High Isolation SPDT Switch

Product Overview

The QPC3024 is a 75Ω Silicon on Insulator (SOI) single-pole, double throw (SPDT) switch designed for use in CATV, satellite set top, and other high performance communications systems. It offers a high isolation symmetric topology with excellent linearity and power handling capability. No blocking caps are necessary on the RF ports. The design is non-reflective such that RF ports 1 and 2 are terminated in in the off-state. The V_{EN} pin allows for a terminated “all-off state”. Applying a negative voltage to the V_{NEG} pin will turn the negative voltage generator off and allow for external supply input.

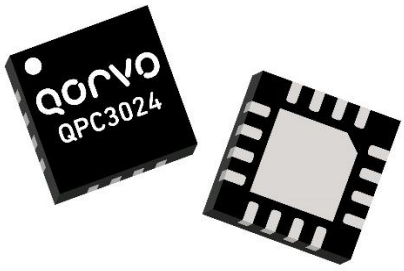
Functional Block Diagram



Top View

Ordering Information

Part No.	Description
QPC3024SQ	Sample bag with 25 pieces
QPC3024SR	7" Reel with 100 pieces
QPC3024TR13	13" Reel with 2500 pieces
QPC3024PCK	5 – 2000 MHz PCBA with 5 pc. sample bag



16 Pad 4 x 4 mm QFN Package

Key Features

- 5 MHz to 2000 MHz Operation
- Symmetric SPDT
- Non-Reflective (RF1, RF2)
- Terminated All-Off State
- No Blocking Caps Required Unless Voltage on RF Line
- High Isolation: >65 dB at 1.2 GHz
- High Input IP3: >60 dBm
- Option to Turn Off Negative Voltage Generator and Supply V_{NEG} Externally
- 2 kV ESD
- +1.8 V Logic Compatible

Applications

- MDU Amplifiers
- Point To Point
- Optical Nodes
- Set Top Box
- PCTV
- Multi-tuner DVR

Table of Contents

Absolute Maximum Ratings

Parameter	Rating
Control Voltage (V_{CTL}, V_{EN})	+6.0 V
Supply Voltage (V_{DD})	+6.0 V
External Negative Supply (V_{NEG})	−6.0 V
Maximum CW Input Power at 25°C	+36 dBm
Maximum CW Input Power, Terminated Port	+28 dBm
Junction Temperature	+125°C
Storage Temperature Range	−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
Supply Voltage, V_{DD}	+2.7	+3	+5.5	V
Supply Voltage, V_{NEG}	−5.5	−5	−3	V
Temperature Range	−40		+105	°C

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

Electrical Specifications

Parameter	Conditions (1)	Min	Typ	Max	Units
Frequency Range		5		2000	MHz
Insertion Loss	5 MHz		0.40		dB
	50 MHz		0.42		
	1.2 GHz		0.55		
	2 GHz		0.61		
Isolation; RFC to RFx	5 MHz		75		dB
	50 MHz		69		
	1.2 GHz		68		
	2 GHz		62		
Isolation; RF1 to RF2	5 MHz		73		dB
	50 MHz		69		
	1.2 GHz		55		
	2 GHz		51		
Return Loss; RFC On State	5 MHz		33		dB
	50 MHz		33		
	1.2 GHz		22		
	2 GHz		30		
Return Loss; RFx On State	5 MHz		33		dB
	50 MHz		33		
	1.2 GHz		26		
	2 GHz		27		
Return Loss; RFx Terminated/ Off State	5 MHz		38		dB
	50 MHz		41		
	1.2 GHz		34		
	2 GHz		21		

Notes:
1. Test Conditions Unless Otherwise Specified: T_A = +25 °C, V_{CTL} = 0/+5 V, V_{DD} = +5 V, V_{NEG} = 0 V, 75 Ω system.

Electrical Specifications (cont'd.)

Parameter	Conditions (1)	Min	Typ	Max	Units
Input IP3(2)	1 GHz +12 dBm input power per tone, 1 MHz tone spacing		61		dBm
Input 1dB Compression Point(2)	1 GHz		36		
Input 0.1dB Compression Point(2)	1 GHz		36		
CSO	130 Channel, Flat Tilt, +42 dBmV/ch		>100		dBc
CTB	130 Channel, Flat Tilt, +42 dBmV/ch		>90		
Turn On Time	90% VDD to steady state harmonics		7.4		µs
Settling Time	50% control to steady state harmonics		3.8		
Switching Speed	50% control to 10/90% RF		1.5		
NVG Spurs	Internal NVG on (F<10MHz)		-113		dBm
Harmonics-2nd	5 MHz		-77		dBc
	17 MHz		-82		
	170 MHz		-95		
	800 MHz		-106		
Harmonics-3rd	5 MHz		-93		dBc
	17 MHz		-115		
	170 MHz		-119		
	800 MHz		-121		

Notes:

1. Test Conditions Unless Otherwise Specified: T_A = +25 °C, V_{CTL} = 0/+5 V, V_{DD} = +5 V, V_{NEG} = 0 V, 75 Ω system. Drive RFC, RFx output.
2. Tested at 50Ω.

Electrical Specifications - Power Supply

Parameter	Conditions (1)	Min	Typ	Max	Units
Supply Current (I_{DD})	V_{DD} = +5.0V		130	200	µA
Control Current (I_{CTL}, I_{EN})	V_{CTL} = +5.0V		0.5	5	µA
Low Control Voltage (V_{CTL}, V_{EN})	+1.8V Logic compatible	0		0.63	V
High Control Voltage (V_{CTL}, V_{EN})		1.1		VDD	V

Maximum Operating Power

Input	State	VEN	Power at 85C (dBm)	Power at 105C (dBm)	Theta-J (°C/W)
RFC, RF1/2	On	Low	34 (1)	31 (1)	125
RFC	Both Off	High	30	27	N/A
RF1/2	Off	Low or High	27	24	77
RF1/2 (Simultaneous)	Both Off	High	29 (2)	26 (2)	50

Notes:
1. Assuming load VSWR <3:1, for high VSWR loads, this value reduces by 3dB.
2. Total power in both loads being driven simultaneously.

Power Supply Sequencing Requirements

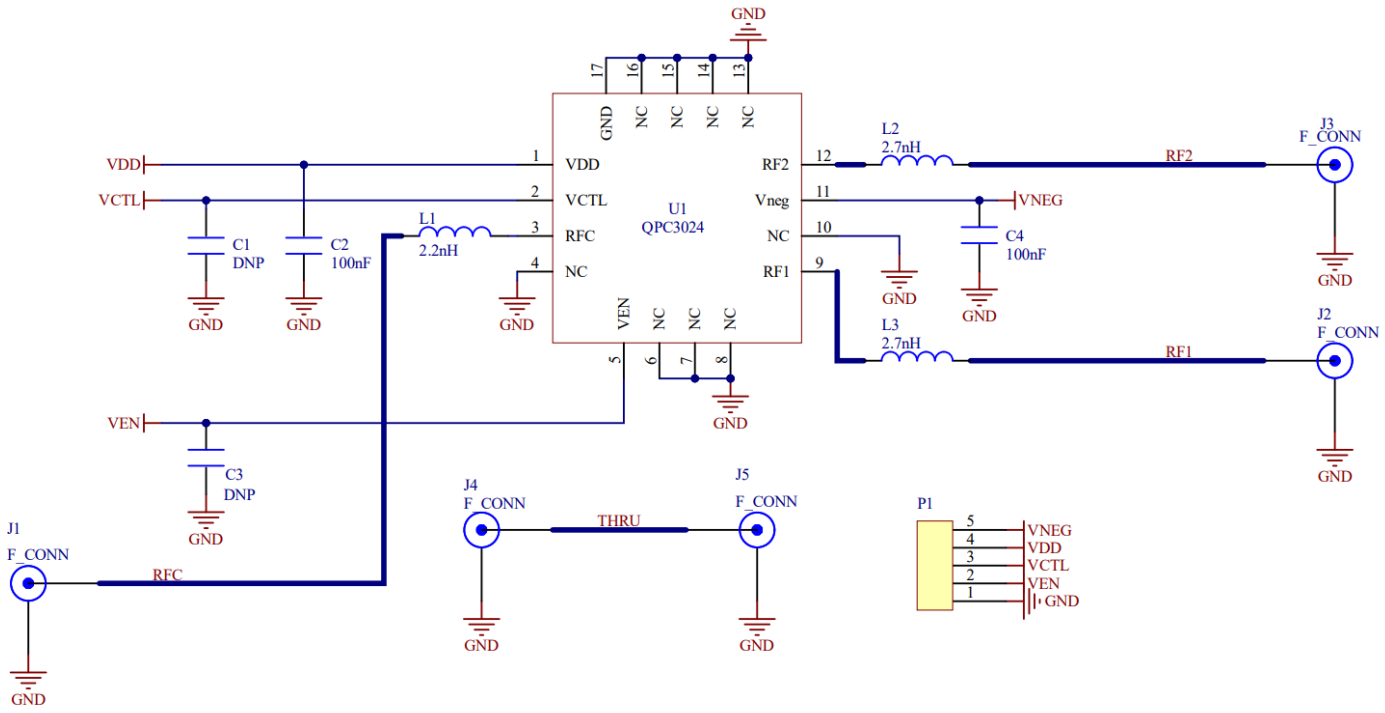
No power supply sequencing is required if VCTL or VEN are less than 4.1V. When VCTL and VEN are greater than 4.1V, for best reliability, apply V_{DD} before applying control voltage.

If the internal Negative Voltage Generator (NVG) is disabled by applying a negative voltage on V_{NEG} , V_{DD} must be power cycled after changing V_{NEG} to 0V to enable it again.

Truth Table

Control Input		Signal Path State	
V_{CTL}	V_{EN}	RFC-RF1	RFC-RF2
0	0	On	Off
1	0	Off	On
0	1	Off	Off
1	1	Off	Off

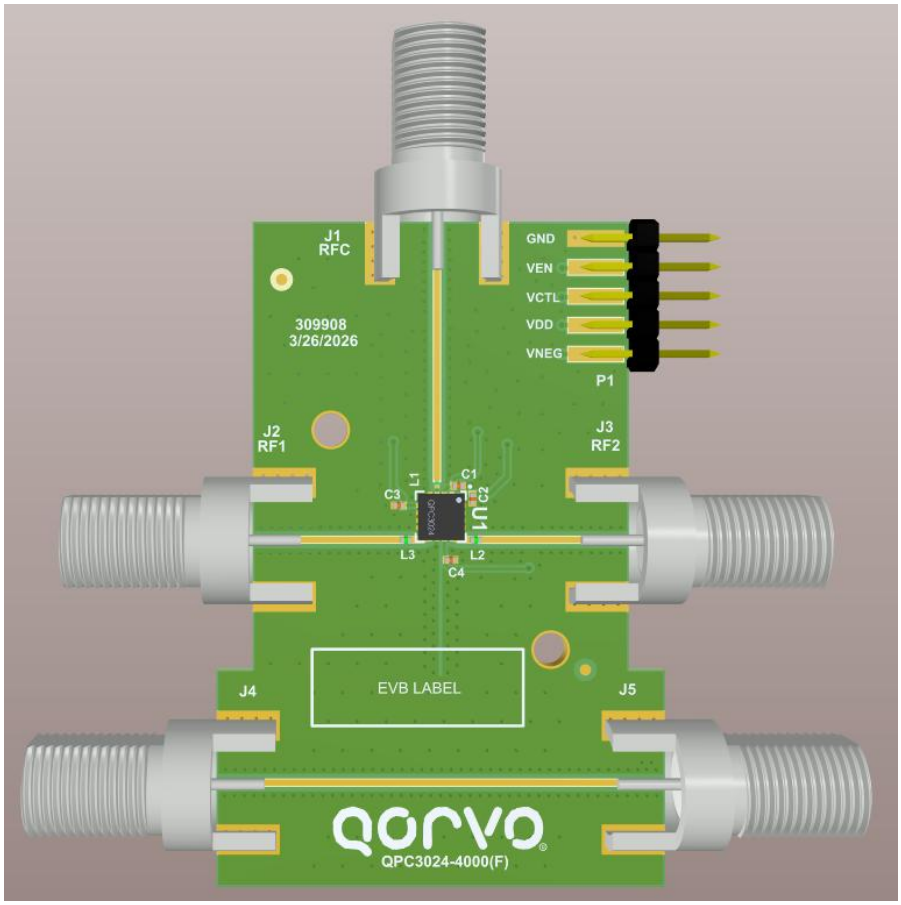
Evaluation Board Schematic



Evaluation Board Bill of Materials

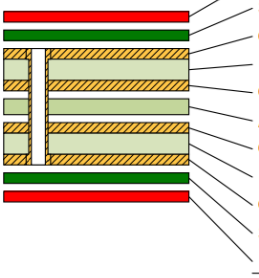
Ref. Designator	Qty	Description	Manufacturer	Manufacturer Part #
PCB	1	Evaluation Board PCB	TTM Technologies, Inc.	QPC3024-4000(F)
U1	1	75ohm High Isolation Switch	Qorvo	QPC3024SB
J1, J2, J3, J4, J5	5	Conn,Type F, Edge Mount, 75Ω, 0.065"	Millimeter Wave Technologies	MW-846-C-DD-75
P1	1	Conn, HDR, ST, 5-Pin, T/H	Molex	22-28-4053
C2, C4	2	100nF 10% X7R 16V CAP, 0402	Murata	GJM1555C1HR20RB12D
L1	1	IND, 2.2nH, +/-0.2nH, T/F, HI-Q, 0201	Murata	LQP03TN2N2C02D
L2, L3	2	IND, 2.7nH, ±0.1nH, 800mA, M/L, 0402	Murata	LQG15HS2N7B02D
C1, C3		DNP	N/A	N/A

Evaluation Board Assembly Drawing



Evaluation Board Stackup

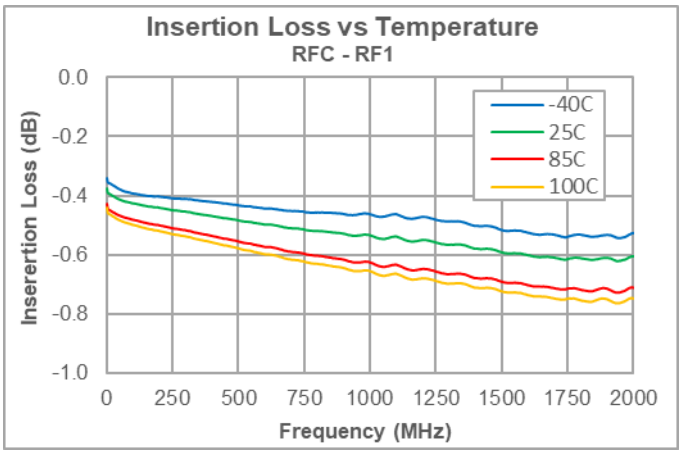
Layer Stack Legend

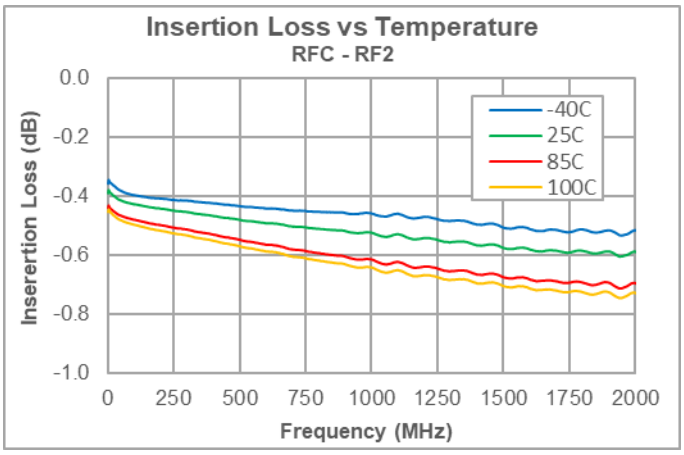


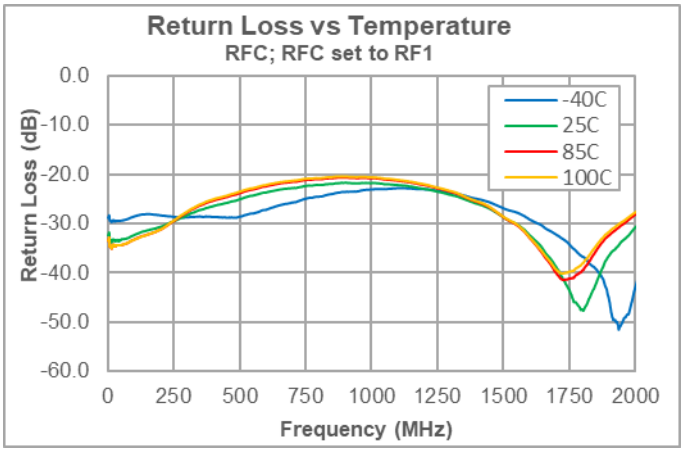
Material	Layer	Thickness	Dielectric Material
	Top Overlay		
Surface Material	Top Solder	0.50mil	Solder Resist
Copper	**Top Layer**	**0.69mil**	
Core		*28.00mil*	*RO4003C*
Copper	**Signal Layer 1**	**0.70mil**	
Prepreg		*25.00mil*	*370H*
Copper	**Signal Layer 2**	**0.70mil**	
Core		*8.00mil*	*370H*
Copper	**Bottom Layer**	**0.70mil**	
Surface Material	Bottom Solder	0.40mil	Solder Resist
	Bottom Overlay		

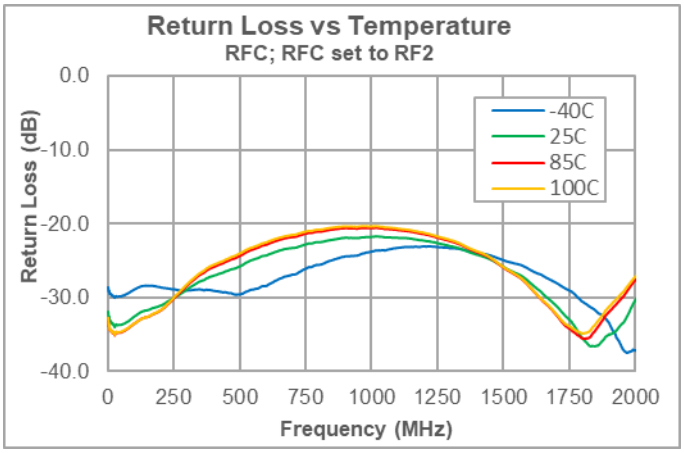
Total thickness: 64.69mil

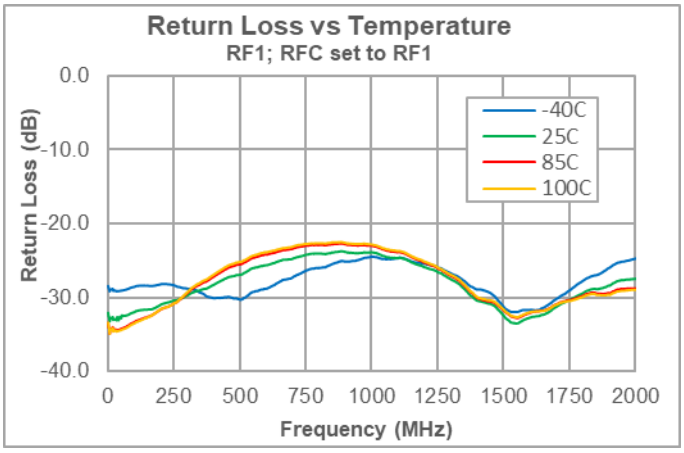
Performance Plots

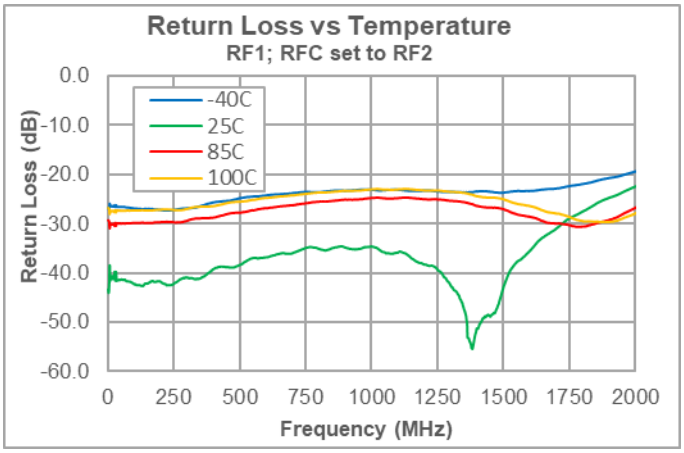








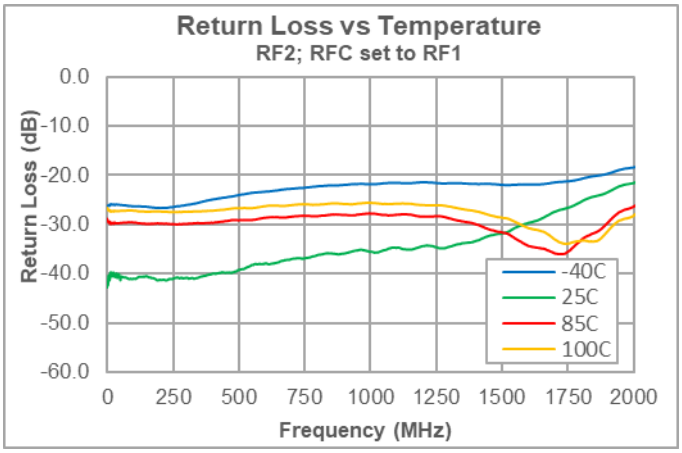


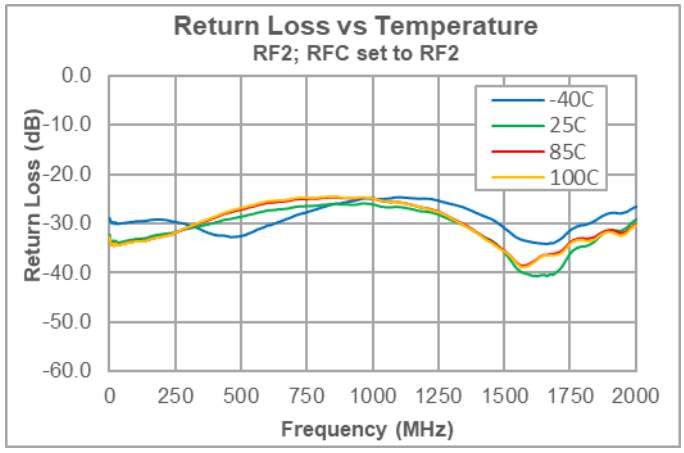


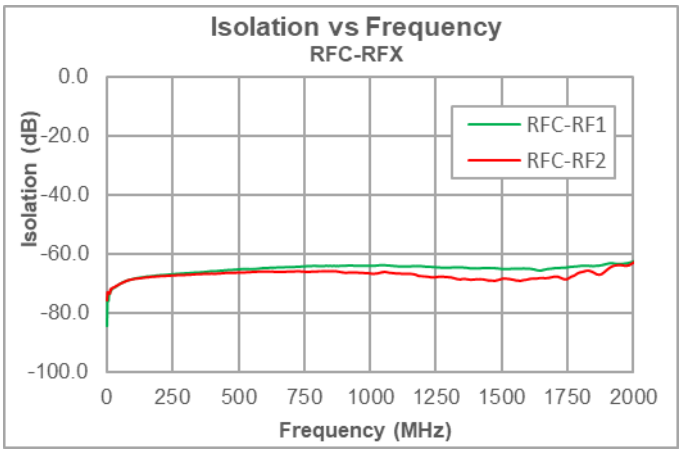
Notes:

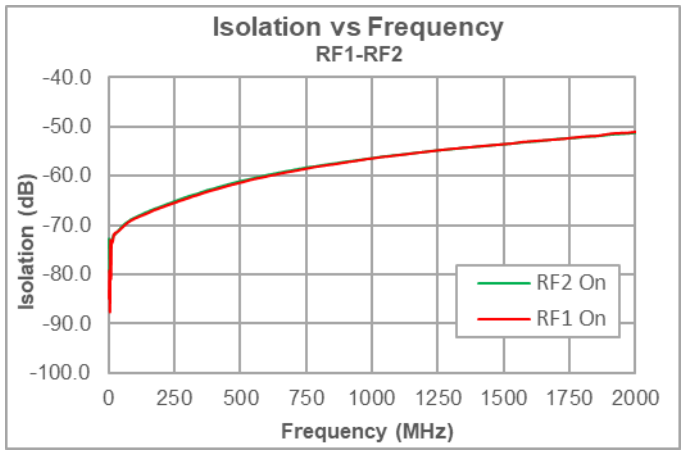
1. Test conditions unless otherwise noted: V_{DD} =+5 V, VNEG= 0V Temp= +25 °C, Z_o = 75Ω

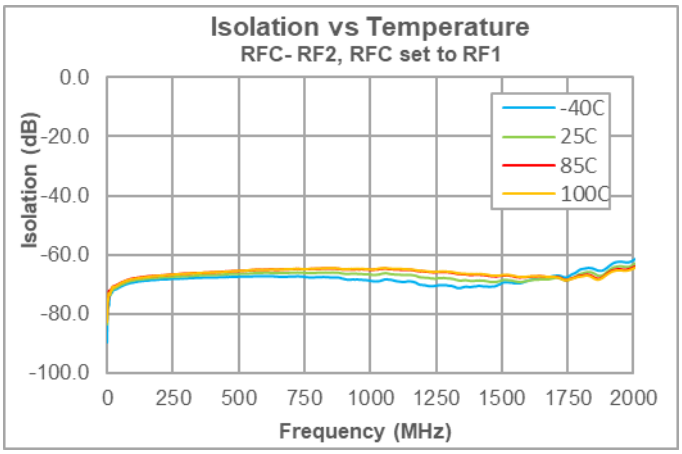
Performance Plots (cont'd.)

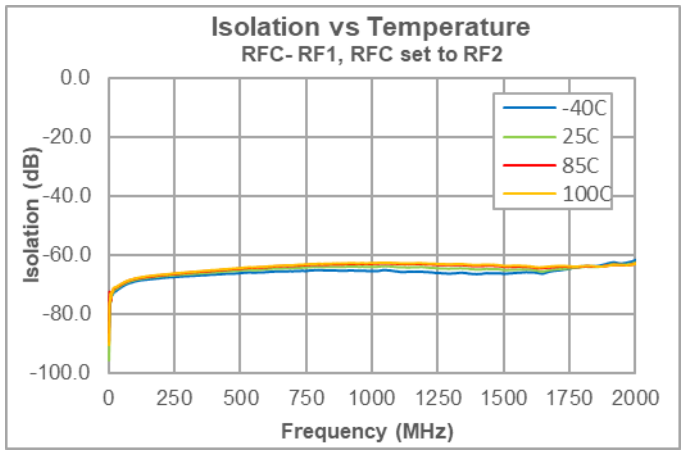












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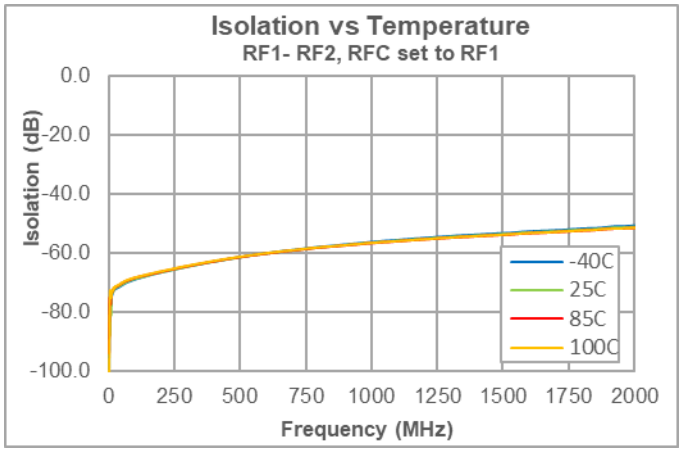
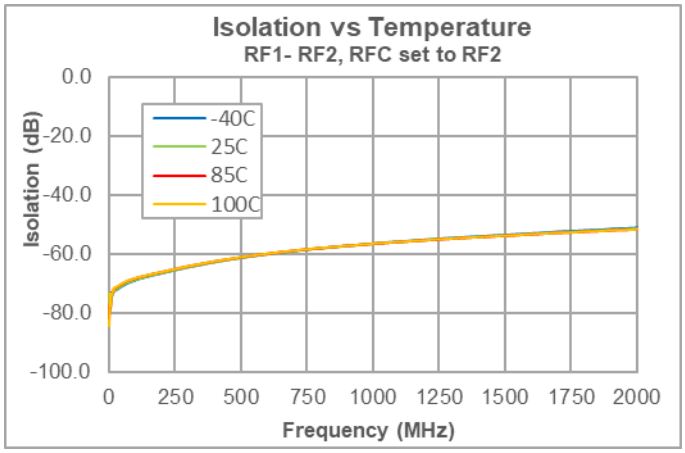
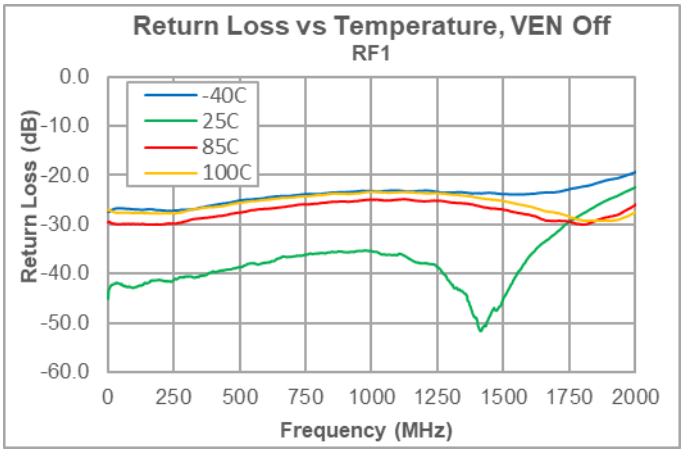
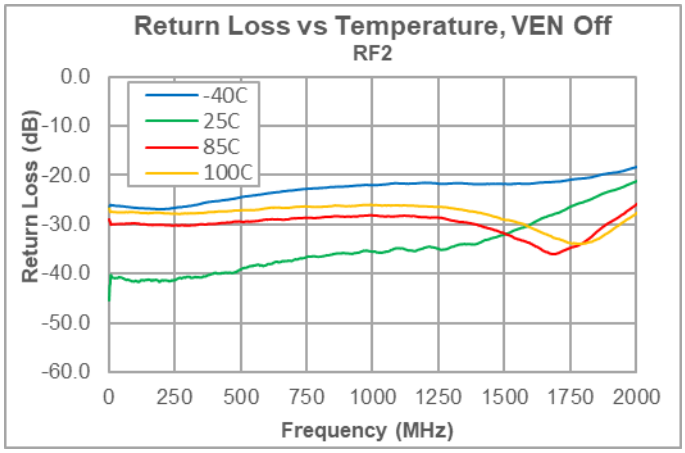
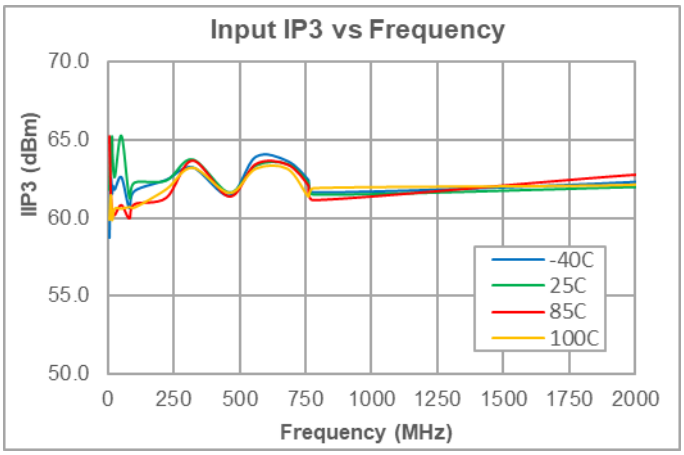
Performance Plots (cont'd.)

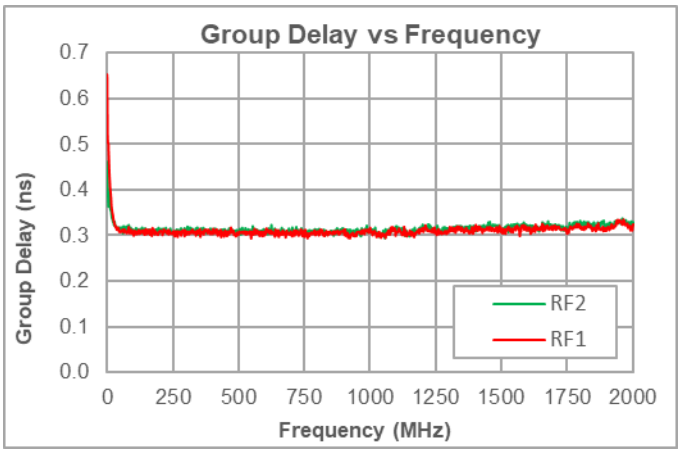












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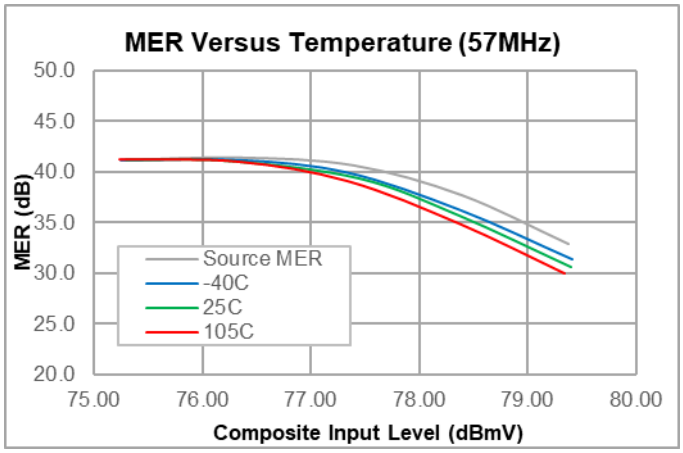
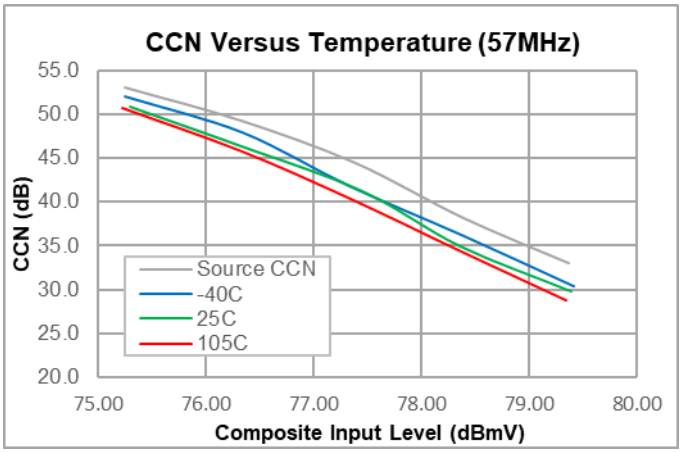
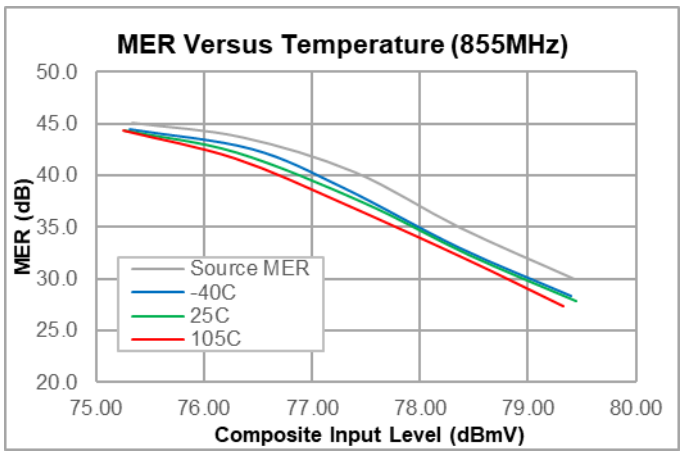
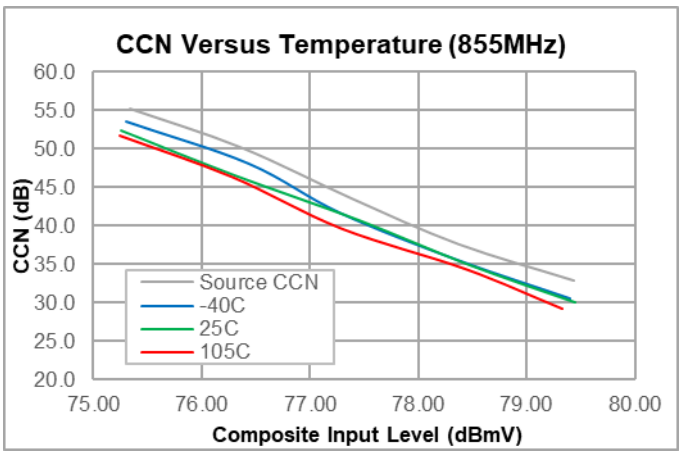
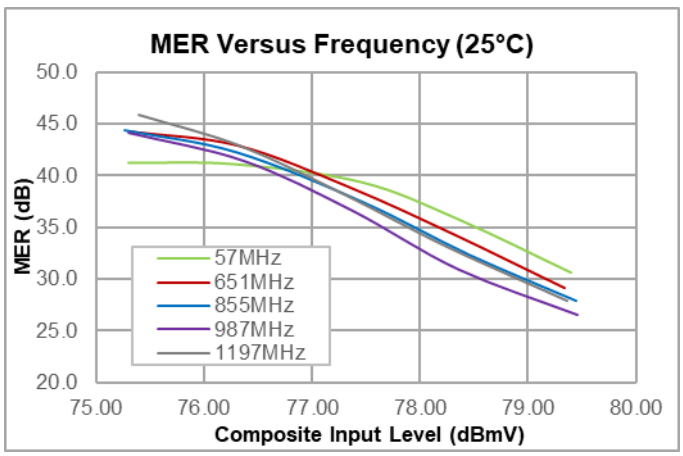
Performance Plots (cont'd.)

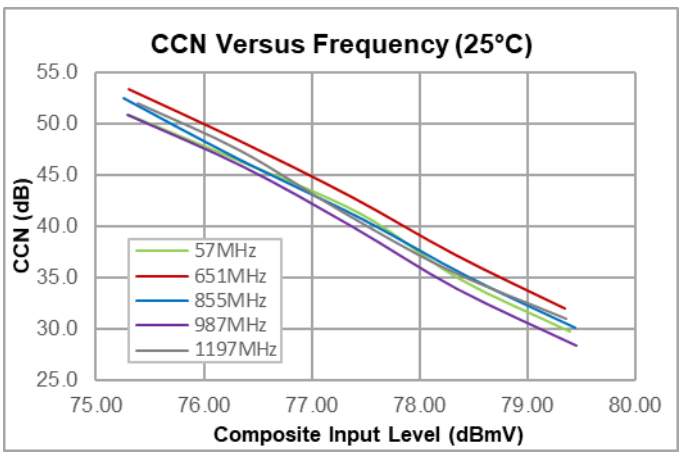








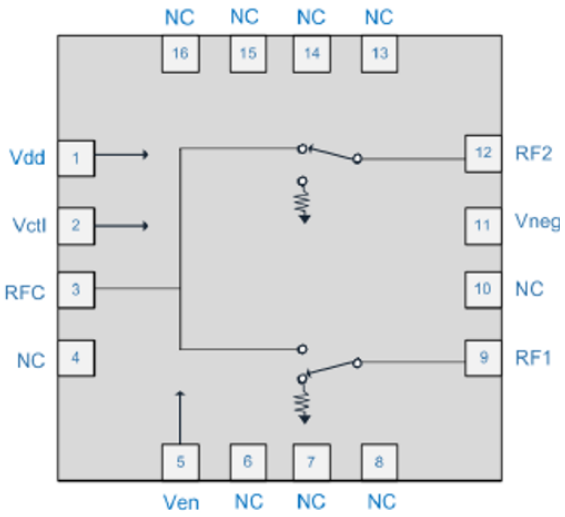




Notes:

2. Test conditions unless otherwise noted: V_{DD} =+5 V, VNEG= 0V Temp= +25 °C, Z_o = 75Ω
3. 190 QAM256 Channels, 57-1215MHz, ITU-T J.83, Annex B
4. CCN test procedure according to ANSI/SCTE 17. System BW 5.36MHz.

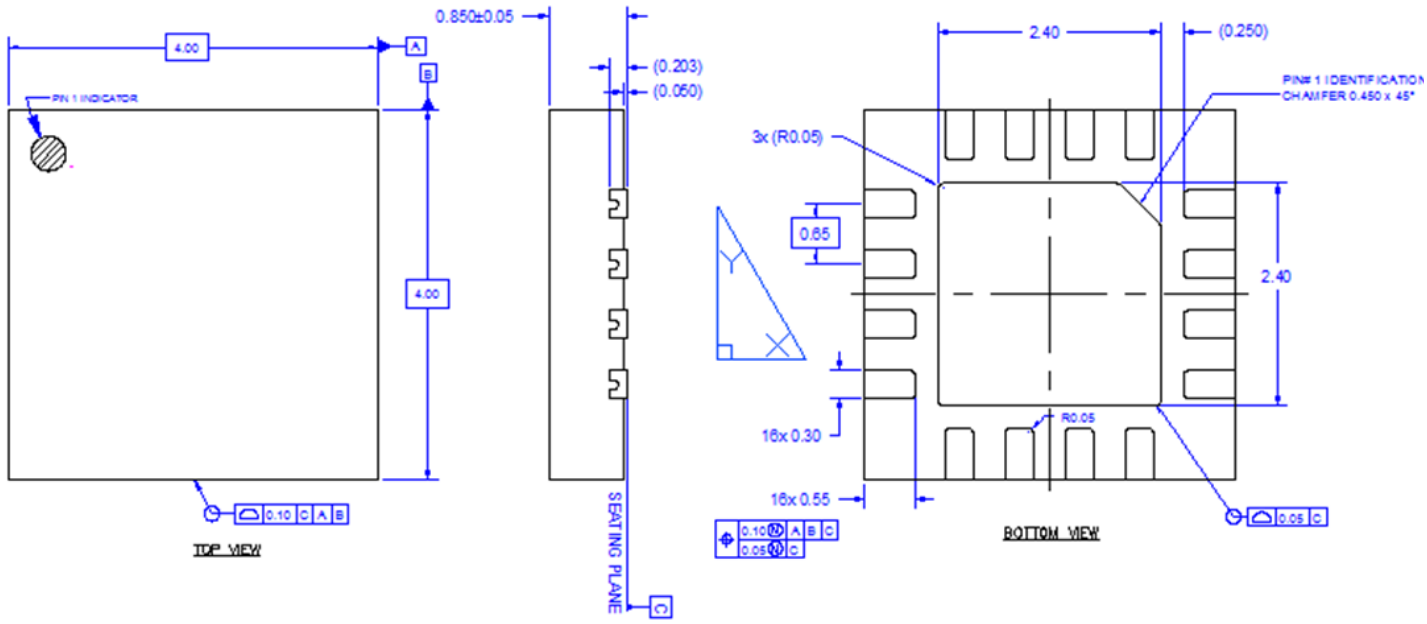
Pad Configuration and Description



Top View

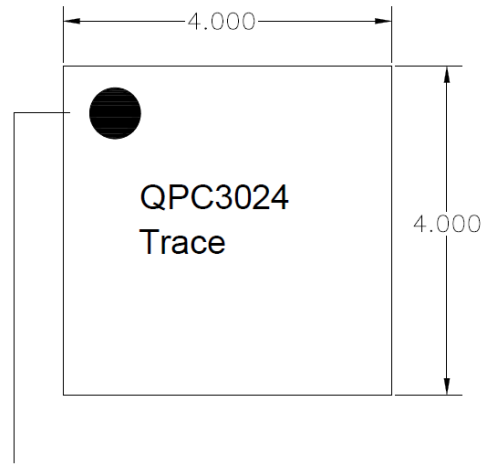
Pad No.	Label	Description
1	VDD	Supply Voltage
2	VCTL	Logic Control Input
3	RFC	RF Common Port
4	NC	Grounding this pin is recommended for performance
5	VEN	Logic input for putting switch in “all-off state”. Logic high for “all-off state”.
6, 7, 8, 13, 14, 15, 16	NC	Grounding this pin is recommended to maximize isolation
9	RF1	RF Port 1
10	NC	Grounding this pin is recommended for performance
11	VNEG	Negative Voltage Generator (NVG) control pin. Supply GND (Low inductive path to ground) to enable internal NVG or supply −2.7 V to −5 V to disable internal NVG. Once disabled, internal NVG cannot be enabled without cycling V_{DD}.
12	RF2	RF Port 2
EPAD	GND	RF and DC Ground: Must be soldered to EVB ground plane.

Package Dimensions



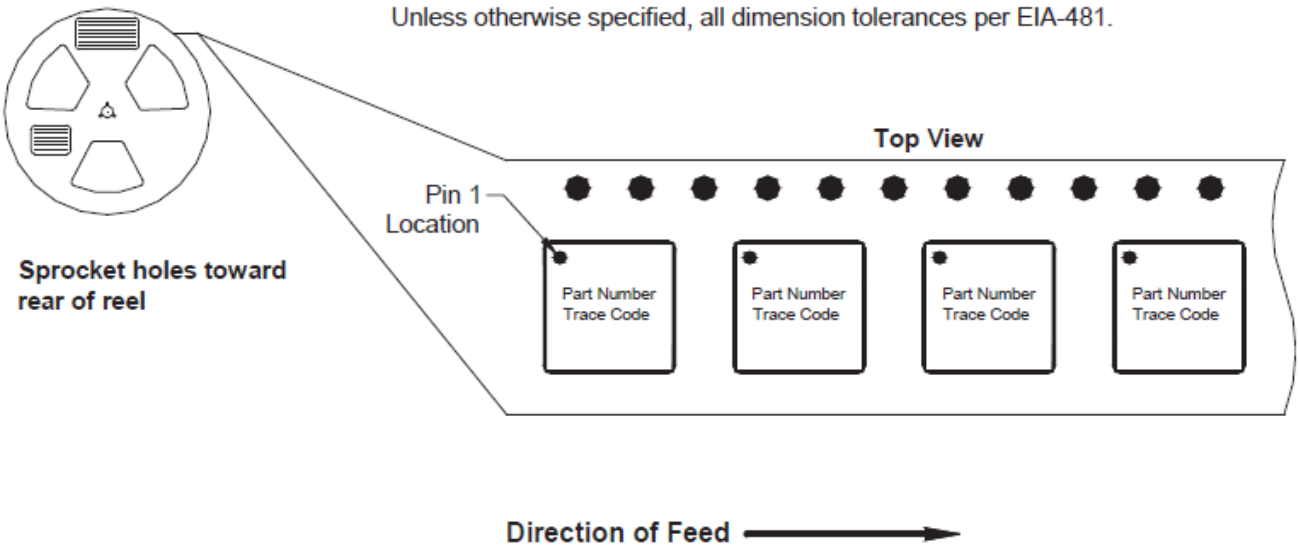
Notes:
1. All dimensions are in millimeters. Angles are in degrees.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
3. Contact plating: NiPdAu

Package Marking



Tape and Reel Information

Qorvo Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units Per Reel
QPC3024TR13	13 (330)	4 (102)	12	8	Single	2500



4.0mm x 4.0mm Carrier Tape Drawing with Part Orientation

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1000V, Class C3	ANSI/ESDA/JEDEC JS-002-2014
ESD – Charged Device Model (CDM)	2000V, Class 2	ANSI/ESDA/JEDEC JS-002-2014
MSL – Moisture Sensitivity Level	Level 2	IPC/JEDEC J-STD-020

Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes.
Solder profiles available upon request.

Contact plating: NiPdAu

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:
Web: www.qorvo.com
Tel: +1 844-890-8163
Email: customer.support@qorvo.com

Important Notices

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