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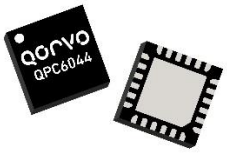
QPC6044

Absorptive High Isolation SP4T Switch
5 MHz to 6000 MHz



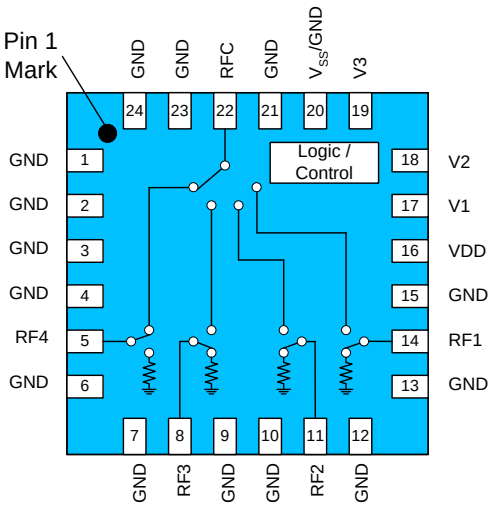
Package: QFN, 24-pin,
4.0 mm x 4.0 mm

The QPC6044 is a Silicon on Insulator (SOI) single-pole, 4-throw (SP4T) switch, designed for use in cellular, 3G, LTE, and other high performance communications systems. It offers high isolation symmetric topology with excellent linearity and power handling capability. No blocking capacitors are necessary on the RF ports. The design is non-reflective such that the RFX ports are terminated into 50 Ω in the off state. QPC6044 is +1.8 V logic compatible, and incorporates a single pin to disable the internal Negative Voltage Generator (NVG) and supply a negative voltage from off-chip, if necessary.

Features

- 5 MHz to 6000 MHz Operation
- Symmetrical SP4T.
- Non-Reflective (RFX ports)
- Terminated All-Off State mode
- No Blocking Caps Necessary unless voltage is on RF Line
- High Isolation: 54 dB at 2 GHz
- High Input IP3: +61 dBm
- 2 kV ESD
- +1.8 V Logic Compatible

Functional Block Diagram



Applications

- Cellular, 3G, LTE Infrastructure
- WiBro, WiMAX, LTE
- High Performance Communications Systems
- Test Equipment

Ordering Information

QPC6044SQ	Sample bag with 25 pieces
QPC6044SR	7" Reel with 100 pieces
QPC6044TR13	13” Reel with 2500 pieces
QPC6044PCK401	5 MHz to 6000 MHz PCBA with 5-piece sample bag

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Absolute Maximum Ratings

Parameter		Rating	Units
Supply Voltage		+6	V
Control Voltage		-0.2 to +6	V
V_{SS} Supply		−6	V
Max RF Input Power, RFC/RFX non-terminated		+37.5	dBm
Max RF Input Power, RFX terminated		+29	dBm
Operating Temperature		−40 to +105	°C
Storage Temperature		−40 to +150	°C
Maximum Junction Temperature		+125	°C
ESD Rating	Human Body Model (HBM)	2000	V
	Charge Device Model (CDM)	1000	
Moisture Sensitivity Level		2	–

Caution! ESD sensitive device.

RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

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. Specified typical performance or functional - operation of the device under Absolute Maximum Rating conditions is not implied.

Recommended Operating Conditions

Parameter	Specifications			Units
	Min	Typ	Max	
Operating Temperature Range	−40	+25	+105	°C
Operating Junction Temperature			+125	°C
Supply Voltage	+2.7	+5	+5.5	V
V_{SS} Supply (Applicable for off-chip negative supply, otherwise 0V (zero) for internal NVG operation)	−5.5	−5	−2.7	V

Electrical Specifications

Parameter	Specification			Units	Conditions
	Min	Typ	Max		
Test conditions unless otherwise noted: T_A = +25 °C, V_{CTRL} = 0/+5 V, V_{DD} = +3V to +5 V, 50 Ω system					
Operating Frequency Range	5		6000	MHz	
Insertion Loss		0.87		dB	450 MHz
		0.91		dB	900 MHz
		0.98	1.25	dB	2100 MHz
		1.00		dB	2600 MHz
		1.05		dB	4000 MHz
		1.20		dB	6000 MHz
Isolation (RFC – RFX)		66		dB	450 MHz
		61		dB	900 MHz
	50	54		dB	2100 MHz
		52		dB	2600 MHz
		48.5		dB	4000 MHz
		45.5		dB	6000 MHz

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Electrical Specifications (contd.)

Parameter	Specification			Units	Conditions
	Min	Typ	Max		
Test conditions unless otherwise noted: T_A = +25 °C, V_{CTRL} = 0/+5 V, V_{DD} = +3V to +5 V, 50 Ω system					
Isolation (RFX – RFX)		62		dB	450 MHz
		57		dB	900 MHz
		50		dB	2100 MHz
		48		dB	2600 MHz
		45		dB	4000 MHz
		42		dB	6000 MHz
Return Loss (RFX On-State)		26		dB	450 MHz
		25		dB	900 MHz
		26		dB	2100 MHz
		27		dB	2600 MHz
		30		dB	4000 MHz
		20		dB	6000 MHz
Return Loss (RFX Off-State)		32		dB	450 MHz
		28		dB	900 MHz
		23		dB	2100 MHz
		22		dB	2600 MHz
		20		dB	4000 MHz
		15		dB	6000 MHz
Input IP2		TBD		dBm	
Input IP3	+55	+61		dBm	1 GHz, 17 dBm/tone, 1 MHz tone spacing
Input P1dB		+37		dBm	
Settling Time		1	4	µs	50% V_{CTRL} to optimum functionality
Start-up Time		5	25	µs	90% V_{DD} to full functionality
Switching Speed		150	500	ns	50 % control to 10/90 % RF
NVG Spur		-104		dBm	Internal NVG on.

Electrical Specifications – Power Supply

Parameter	Specification			Units	Conditions
	Min	Typ	Max		
Test conditions unless otherwise noted: T_A = +25 °C, V_{DD} = +3V to +5.0 V, Standard Application Circuit					
Supply Current (I_{DD})		100		µA	V_{DD} = +5 V
Control Current (V1, V2, V3)		2		µA	V_{CTRL} = +5 V
V_{SS} Current		100		µA	V_{SS} = −5 V, NVG is shut down.
Low Control Voltage (V1, V2, V3)	0		+0.63	V	+1.8 V Logic Compatible
High Control Voltage (V1, V2, V3)	+1.1		V_{DD}	V	+1.8 V Logic Compatible

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Maximum Operating Power at High Temperature, CW, ≥50 MHz, 50 Ω System

Input	Power (dBm) at each port		Theta-J (°C/W)
	85°C	105°C	
RFC/ RFX – Active [1]	35.4	32.2	56
RFX – Terminated (1 path)	27.8	24.8	66
RFX – Terminated (2 adjacent paths)	26.7	23.7	85
RFX – Terminated (all paths)	26.6	23.6	86

Notes:

1. For frequencies <50 MHz, maximum operating power at all temperatures should be at least 2 dB less than P1dB compression from plot.

Truth Table – 3 Pin Control

MODE	V1	V2	V3
Unsupported	0	0	0
RFC-RF1 active	1	0	0
RFC-RF2 active	0	1	0
RFC-RF3 active	1	1	0
RFC-RF4 active	0	0	1
All off	1	0	1
All off	0	1	1
All off	1	1	1

Truth Table – 2 Pin Control (V3 must be grounded)

MODE	V1	V2
RFC-RF1 active	1	0
RFC-RF2 active	0	1
RFC-RF3 active	1	1
RFC-RF4 active	0	0

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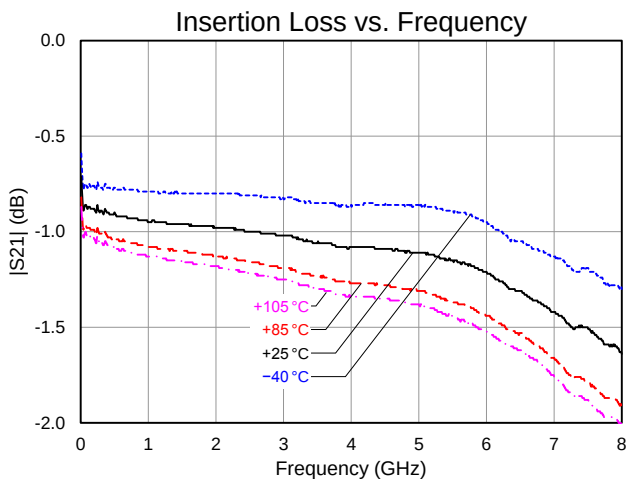
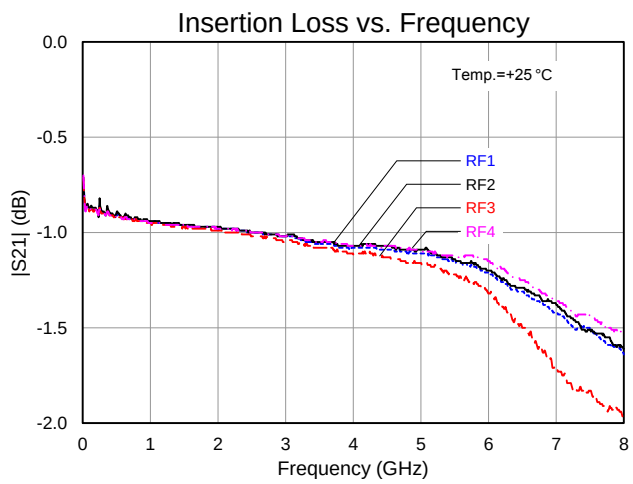
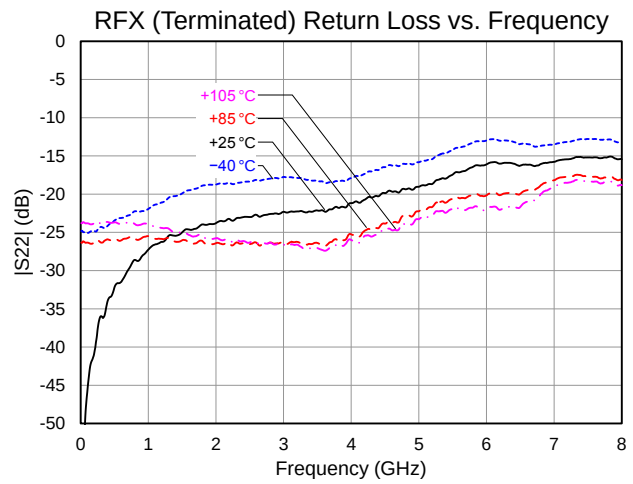
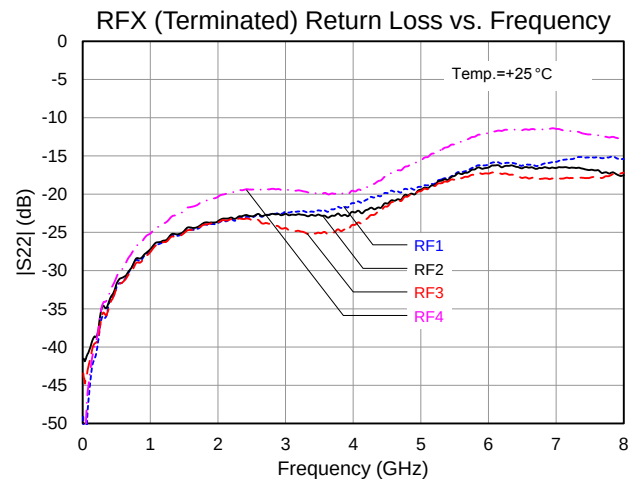
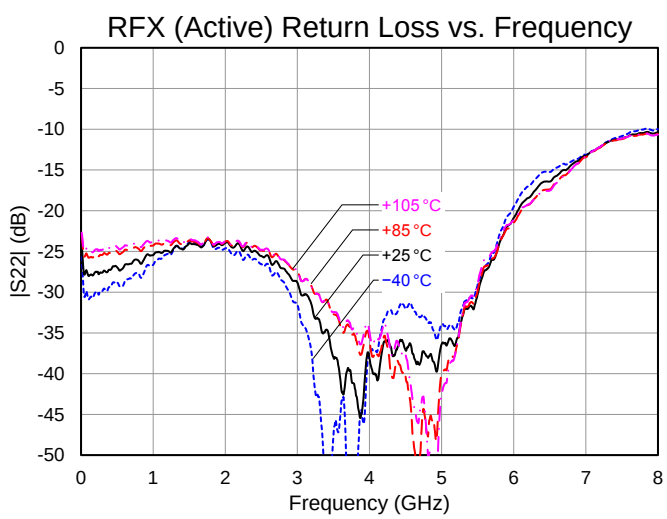
Typical Performance

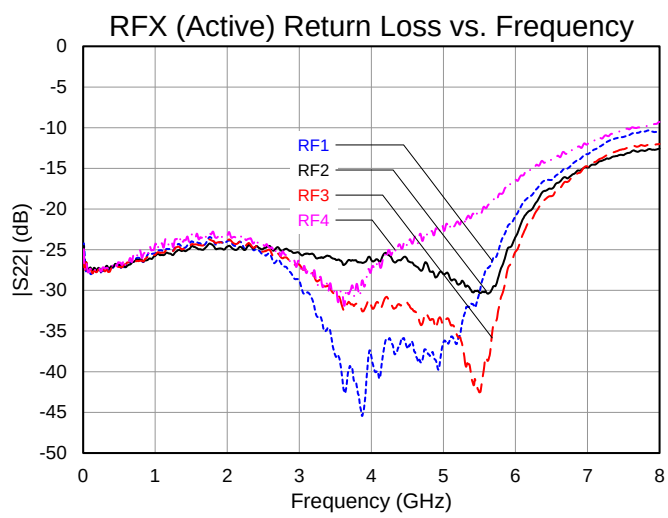












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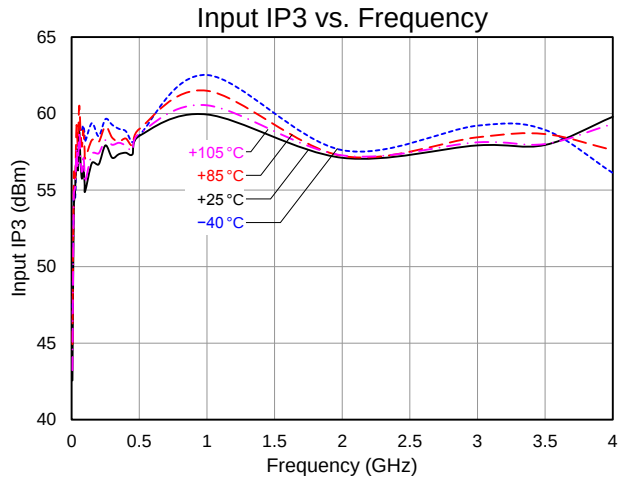
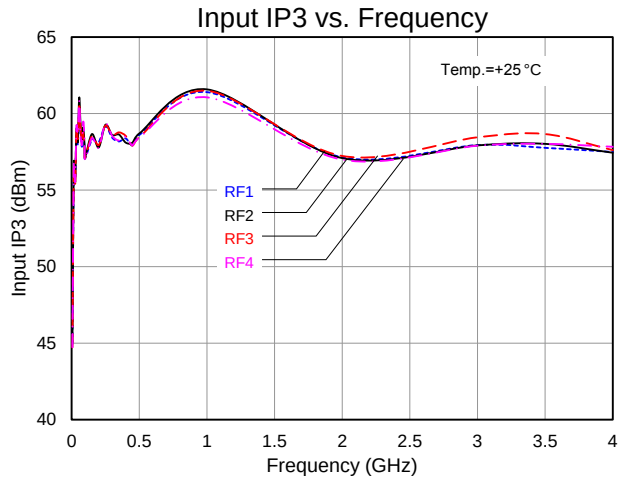
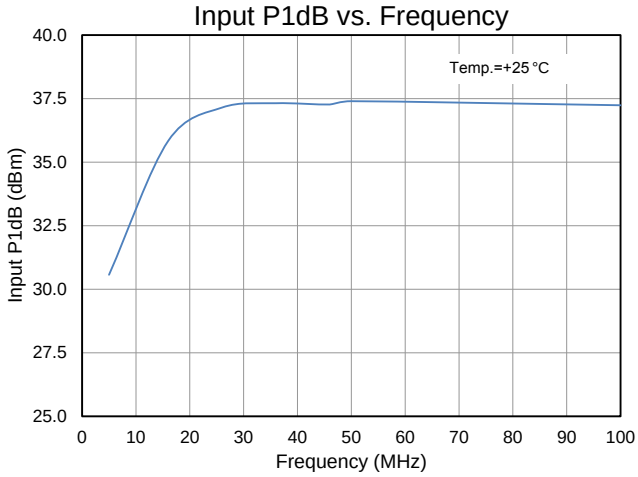
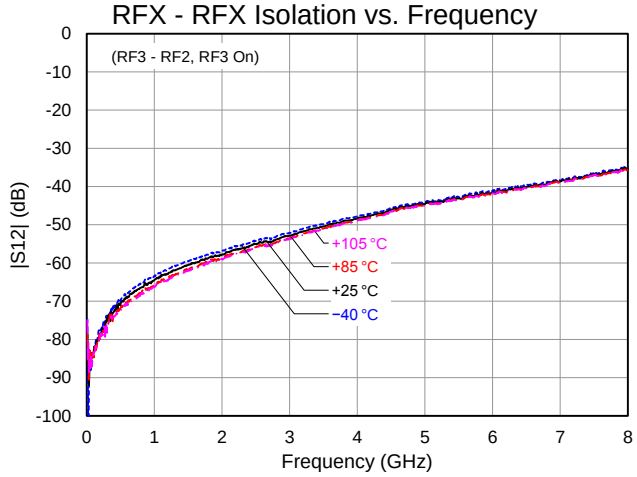
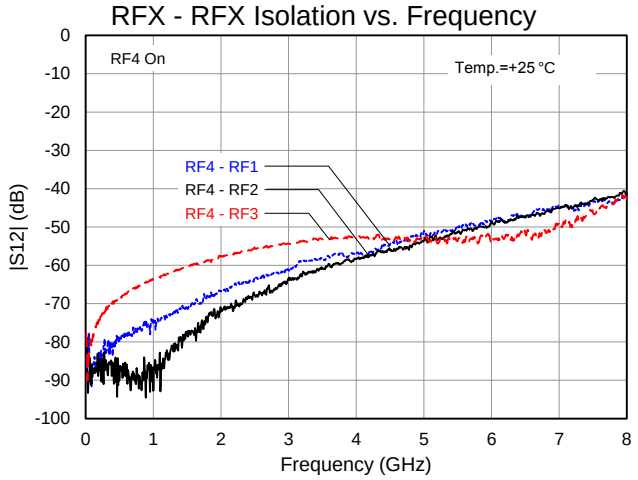
Typical Performance (continued)

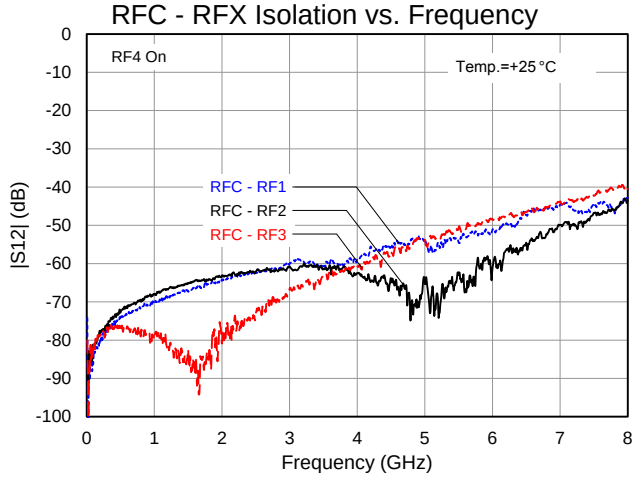












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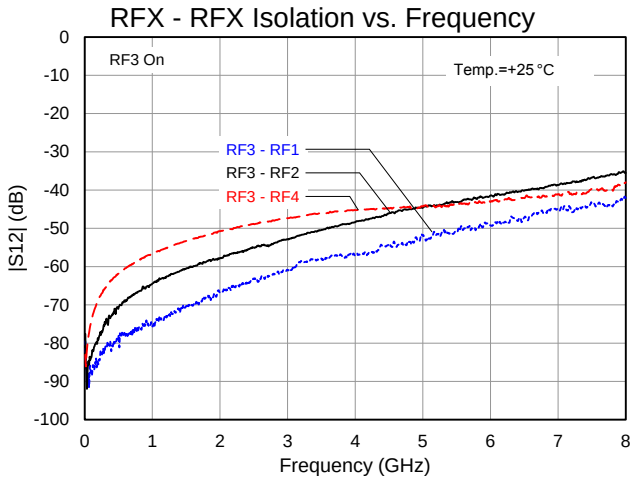
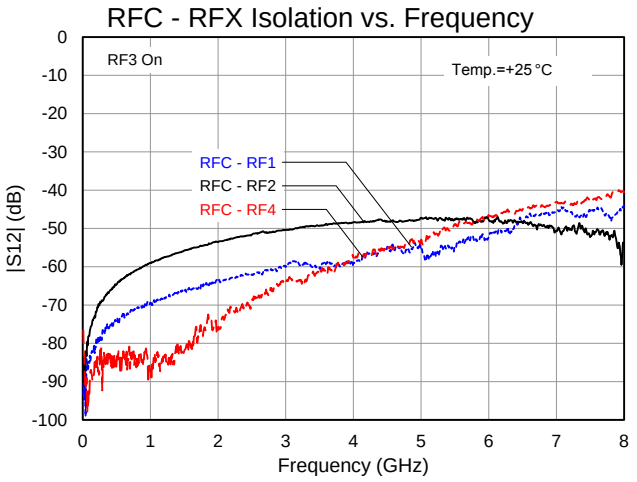
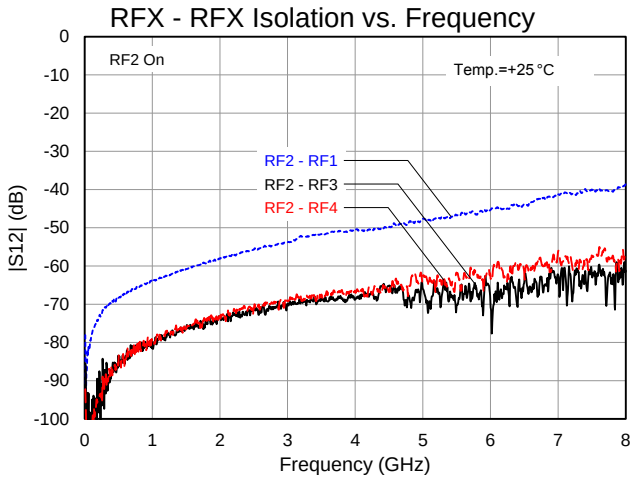
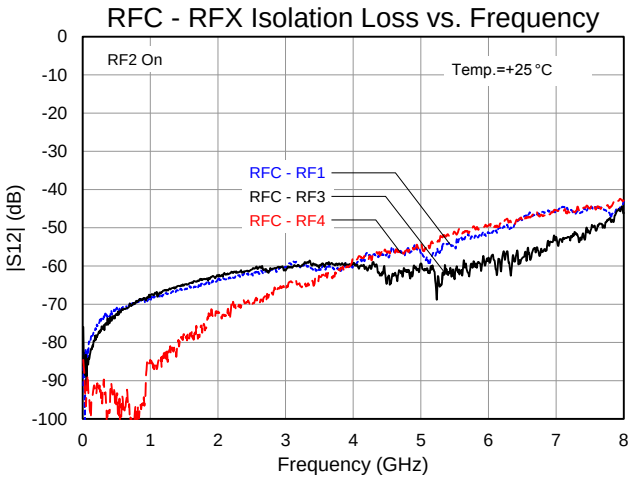
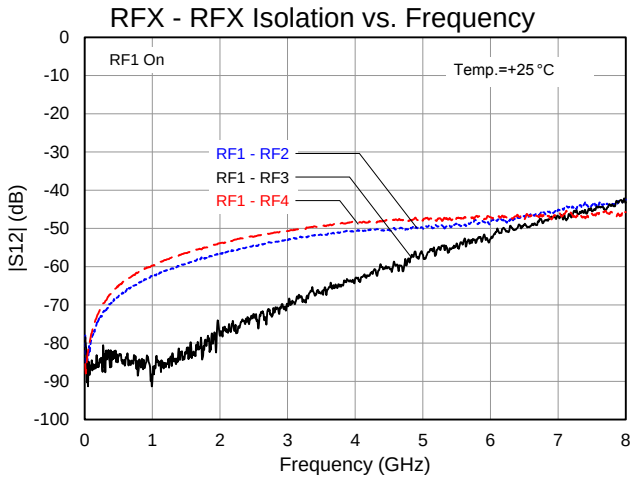
Typical Performance (continued)

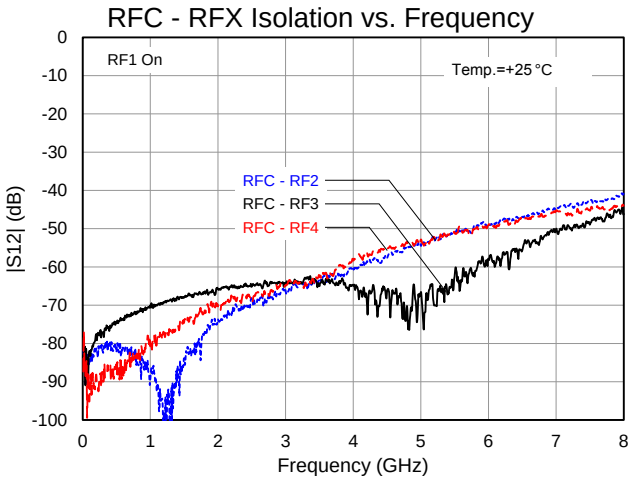












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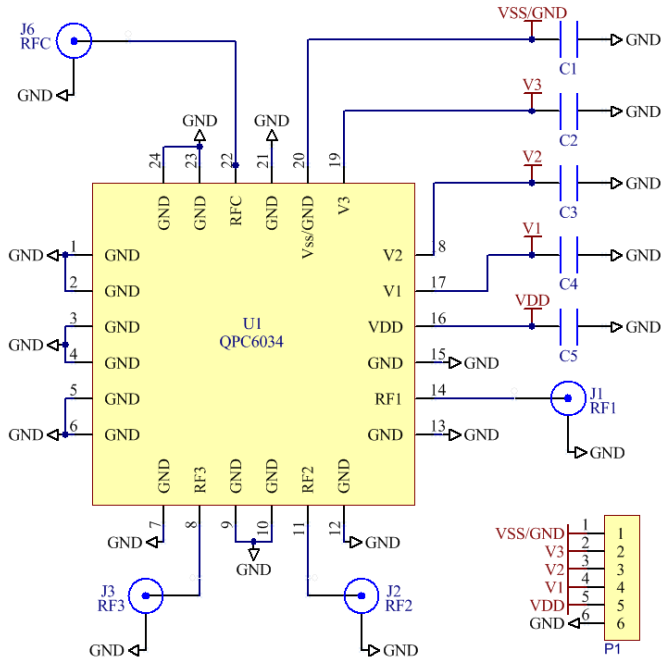
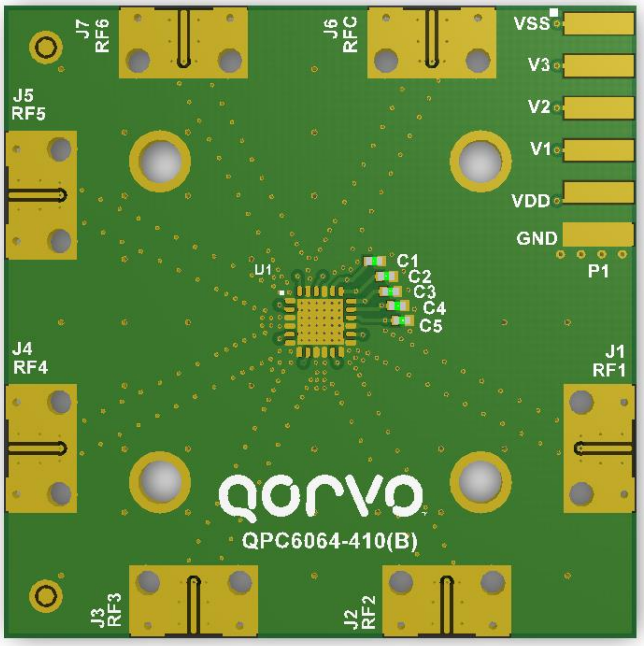
Evaluation Board Schematic and PCB – 5MHz to 6000 MHz Application Circuit





Note:
The QPC6064-410 PCB is used within the family of QPC60x4 products based on the individual BOM per product.

Evaluation Board Bill of Materials (BOM) - 5 MHz to 6000 MHz Application Circuit

Description	Reference Designator	Manufacturer	Manufacturer's P/N
Evaluation Board	–	Viasystems Technologies Corp.	QPC6064-410(B)
CAP, 100 pF, 5 %, 50 V, COG, 0402	C1-C5	Taiyo Yuden	RM UMK105CG101JV-F
CONN, SMA EL FLT VIPER, MAT-21-1038	J1 – J4, J6	Amphenol RF Asia Corp	901-10425
CONN, HDR, ST, PLRZD, 6-PIN	P1	AMP	640454-6
QPC6044	U1	RFMD / Qorvo	QPC6044

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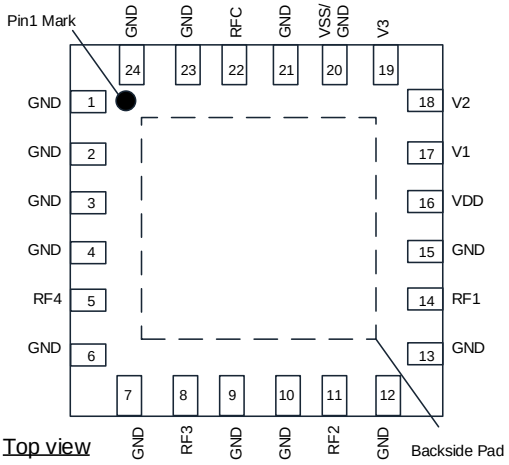
Pin Configuration and Description



Pin	Label	Description
1 – 4, 6, 7, 9, 10, 12, 13, 15, 21, 23, 24	GND	Connect to Low inductive Path to Ground
5	RF4	RF Port 4
8	RF3	RF Port 3
11	RF2	RF Port 2
14	RF1	RF Port 1
16	V_{DD}	Supply Voltage
17	V1	Control Pin
18	V2	Control Pin
19	V3	Control Pin
20	V_{SS}/GND	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 VDD.
22	RFC	RF common Port
Backside Pad	GND	Connect to Low inductive Path to Ground

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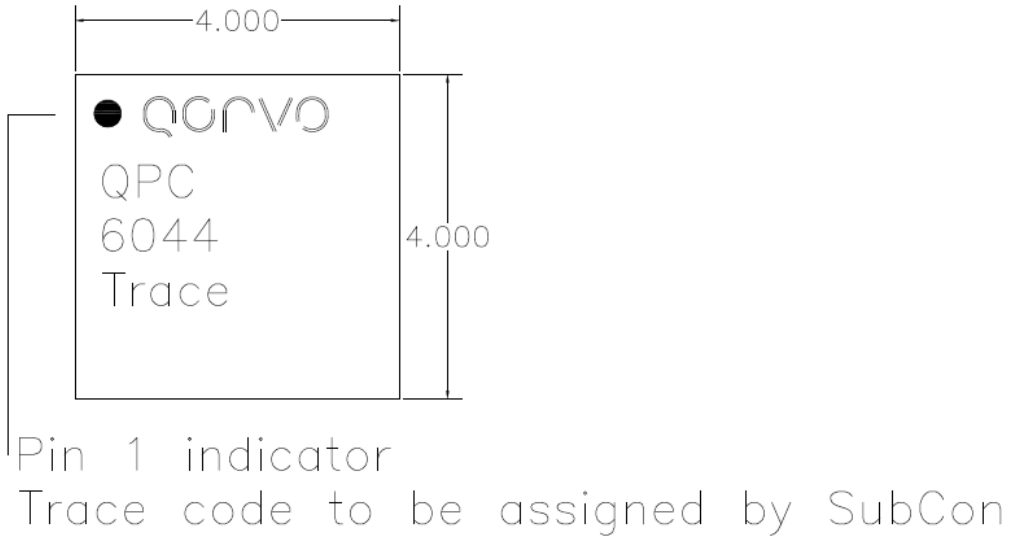
Package Marking



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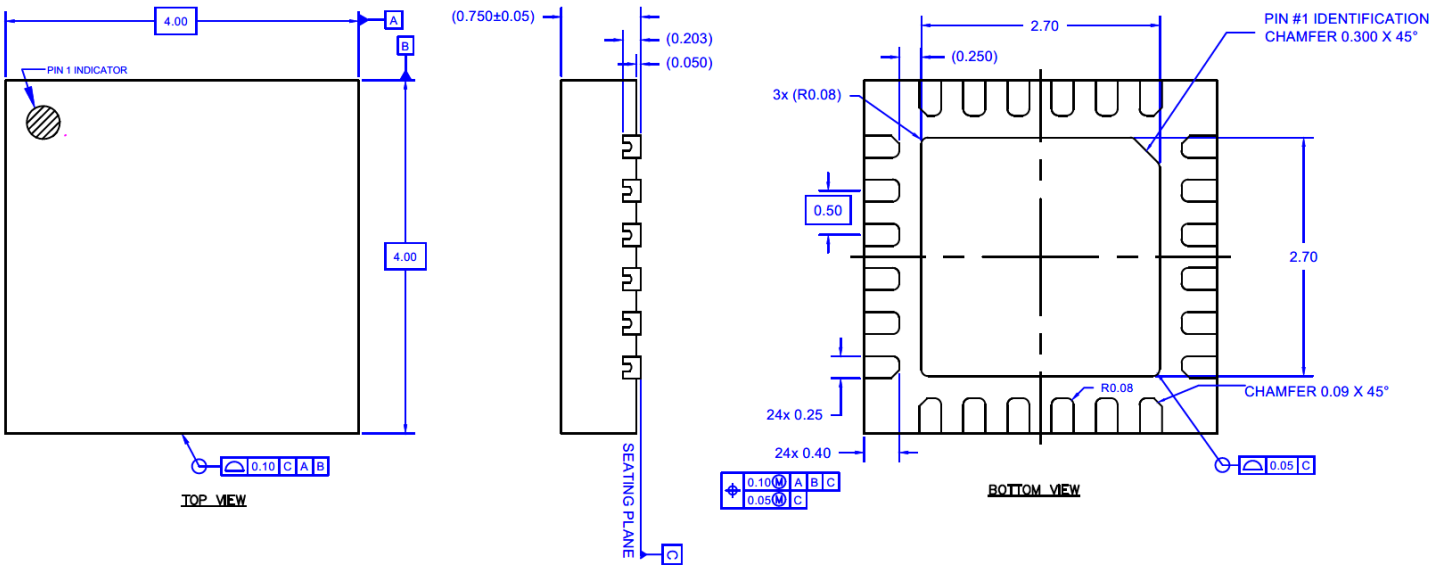
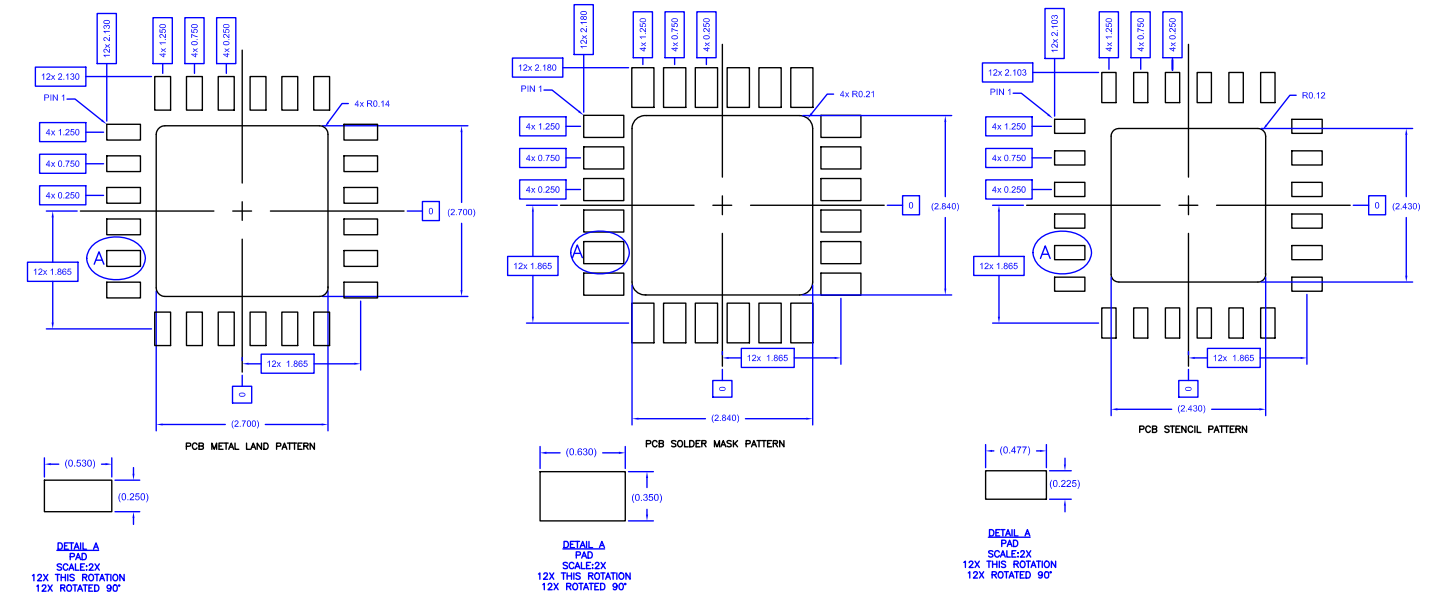
Package Outline (Dimensions in millimeters)



PCB/ PCB Soldermask/ PCB Stencil Drawing (Dimensions in millimeters)



Thermal vias for center slug should be incorporated into the PCB design. The number and size of thermal vias will depend on the application, the power dissipation, and the electrical requirements. Example of the number and size of vias can be found on the RFMD evaluation board layout.

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Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: **www.rfmd.com** **Tel: 1-844-890-8163**
Email: **customer.support@qorvo.com**

For information about the merger of RFMD and TriQuint as Qorvo:

Web: **www.qorvo.com**

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