



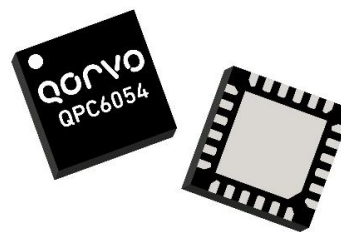
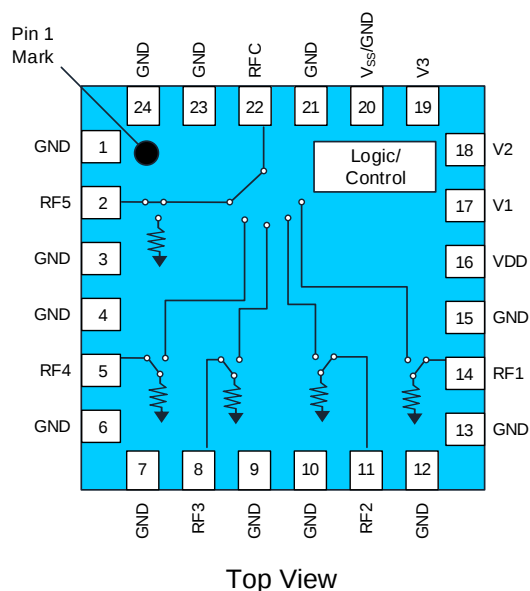
QPC6054

Absorptive High Isolation SP5T Switch 5 MHz to 6000 MHz

Product Description

The QPC6054 is a Silicon on Insulator (SOI) single-pole, 5-throw (SP5T) switch design 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 $50\ \Omega$ in the off state. The QPC6054 is +1.8 V positive logic compatible and has a single pin solution to disable the Negative Voltage Generator (NVG) and supply a negative voltage from off-chip, if necessary.

Functional Block Diagram



24-pin 4.0 mm x 4.0 mm QFN package

Product Features

- Frequency Range 5 MHz to 6000 MHz
- Symmetrical SP5T
- Non-Reflective (RFX ports)
- Terminated All-Off State mode
- No Blocking Caps Necessary unless voltage is on RF Line
- High Isolation: 60 dB @ 2 GHz
- High Input IP3: +59 dBm
- 2 kV ESD
- +1.8 V Logic Compatible

Applications

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

Ordering Information

Part No.	Description
QPC6054SQ	Sample bag with 25 pieces
QPC6054SR	100 pieces on a 7" reel
QPC6054TR13	2500 pieces on a 13" reel
QPC6054PCK401	5 – 6000 MHz PCBA w/5-pc. sample bag

Absolute Maximum Ratings

Parameter	Rating
Supply Voltage (V _{DD})	+6 V
Control Voltage	-0.2 to +6 V
V _{SS} Supply	-6 V
Storage Temperature	-55 to +150 °C
Input Power, non-terminated	+37.5 dBm
Input Power, RFX terminated	+29 dBm

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	+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
Operating Temp. Range	-40	+25	+105	°C
Tj at 10 ⁶ hrs MTTF			+125	°C

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

Electrical Specifications ⁽¹⁾ Power Supply

Parameter	Conditions	Min	Typ	Max	Units
Supply Current (I _{DD})	V _{DD} = +5 V		100		μA
Control Current (V1, V2, V3)	V _{CTRL} = +5 V		2		μA
V _{SS} Current	V _{SS} = -5 V, NVG is shut down		100		μA
Low Control Voltage (V1, V2, V3)	+1.8 V Logic Compatible	0		+0.63	V
High Control Voltage (V1, V2, V3)	+1.8 V Logic Compatible	+1.1		V _{DD}	V

Notes:

1. Test conditions unless otherwise noted: T_A = +25 °C, V_{DD} = +5 V, Standard Application Circuit

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

Input	Power (dBm) @ each port		Theta-J (°C/W)
	+85 °C	+105 °C	
RFC/ RFX – Active ⁽¹⁾	35.5	32.3	53
RFX – Terminated (1 path)	28.1	25.1	61
RFX – Terminated (2 adjacent paths)	26.6	23.6	86
RFX – Terminated (all paths)	26.2	23.1	96

Notes:

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

Truth Table

Mode	V1	V2	V3
All Off	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
RFC – RF5 active	1	0	1
All Off	0	1	1
All Off	1	1	1

Electrical Specifications ⁽¹⁾

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		5		6000	MHz
Insertion Loss	450 MHz		0.95	1.15	dB
	900 MHz		1.00	1.20	dB
	2100 MHz		1.10	1.30	dB
	2600 MHz		1.17	1.40	dB
	4000 MHz		1.40	1.70	dB
	6000 MHz		1.90	2.20	dB
Isolation (RFC – RFX)	450 MHz	Isolation is based on an optimized evaluation board	61	70	dB
	900 MHz		57	63	dB
	2100 MHz		48	56	dB
	2600 MHz		48	54	dB
	4000 MHz		45	50	dB
	5000 MHz		45	50	dB
	6000 MHz		40	50	dB
Isolation (RFX – RFX)	450 MHz	Isolation is based on an optimized evaluation board	61	70	dB
	900 MHz		56	66	dB
	2100 MHz		50	59	dB
	2600 MHz		48	56	dB
	4000 MHz		43	50	dB
	5000 MHz		41	48	dB
	6000 MHz		38	44	dB
Isolation (RF1 – RF4)	3500 MHz		50	56	dB
Isolation (RF2 – RF1, RF2 ON) ⁽²⁾	5000 MHz		41	42.3	dB
Isolation (RF3 – RF2, RF3 ON) ⁽²⁾	5000 MHz		41	42.8	dB
Isolation (RF4 – RF3, RF4 ON) ⁽²⁾	5000 MHz		43	44.8	dB
Isolation (RF5 – RF4, RF5 ON) ⁽²⁾	5000 MHz		40	41.7	dB
Isolation (RF5 – RF1, RF5 ON) ⁽²⁾	5000 MHz		43	45	dB

Notes:

- Test conditions unless otherwise noted: $T_A = +25^\circ\text{C}$, $V_{\text{CTRL}} = 0/+5\text{ V}$, $V_{\text{DD}} = +5\text{ V}$, $50\ \Omega$ system
- Only these RF paths are highlighted as the other ports' isolation performance is better.

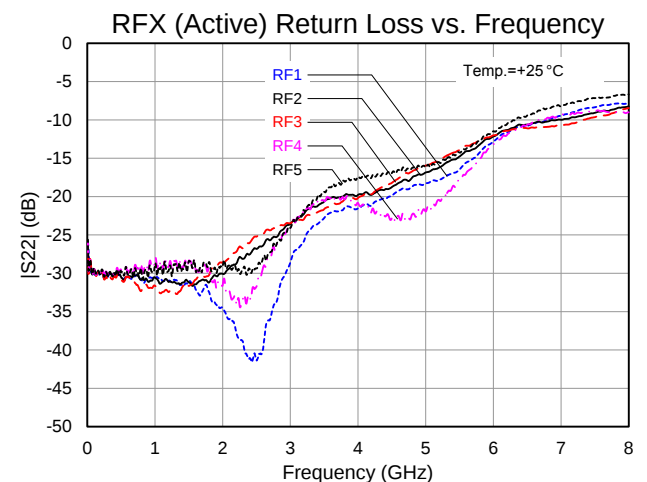
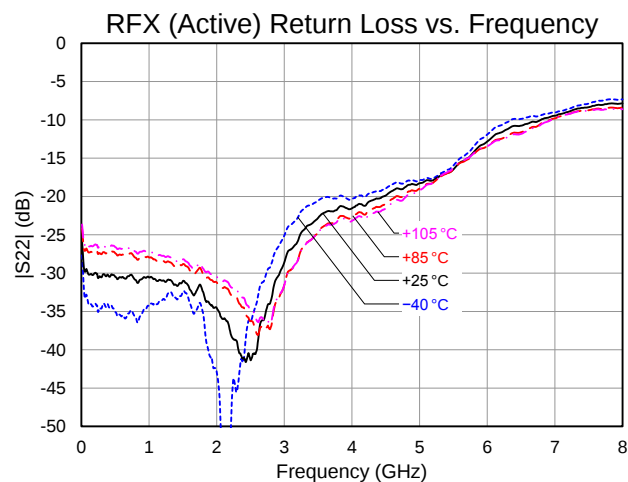
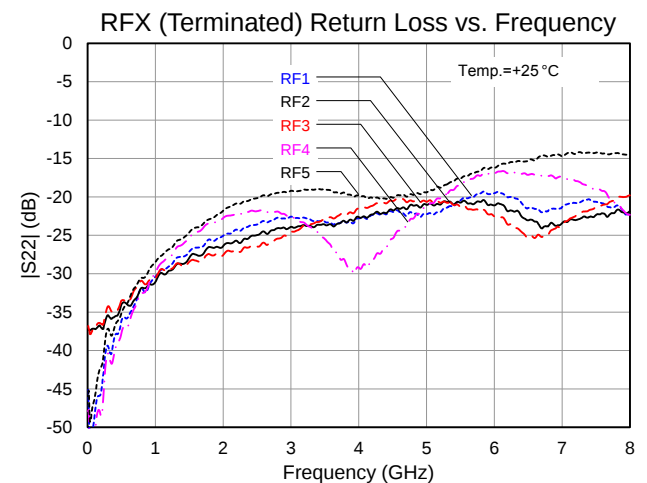
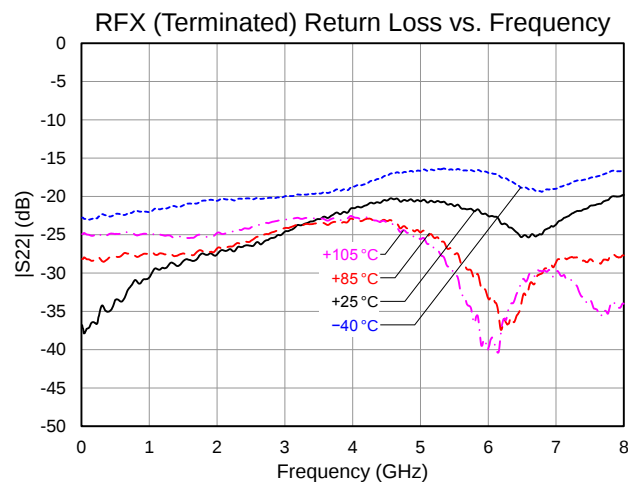
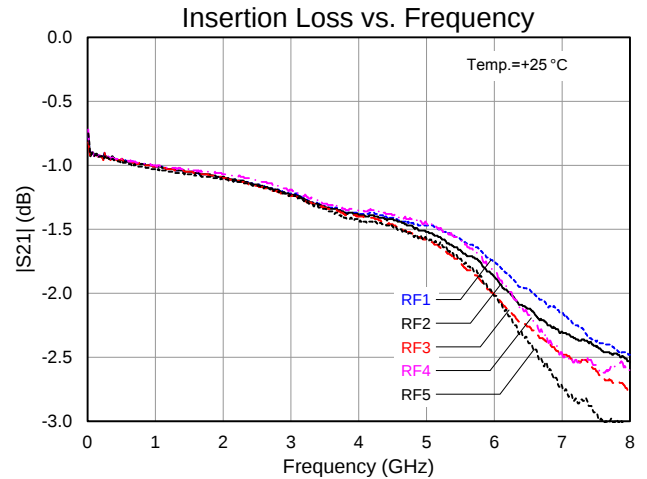
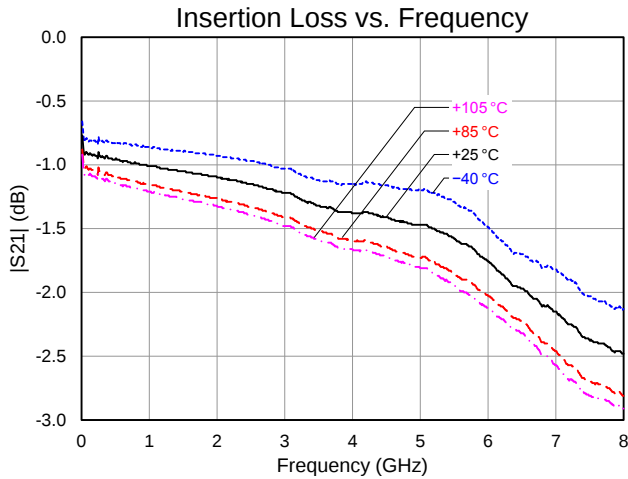
Electrical Specifications Contd. ⁽¹⁾

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		5		6000	MHz
Return Loss (RFX On-State)	450 MHz		30		dB
	900 MHz		31		dB
	2100 MHz		31		dB
	2600 MHz		30		dB
	4000 MHz		20		dB
	5000 MHz		16		dB
	6000 MHz		12		dB
Return Loss (RFX Off-State)	450 MHz		37		dB
	900 MHz		30		dB
	2100 MHz		24		dB
	2600 MHz		23		dB
	4000 MHz		22		dB
	5000 MHz		19		dB
	6000 MHz		14		dB
Input IP2	1000 MHz		117		dBm
Input IP3	1000 MHz, 17 dBm/tone, 1 MHz tone spacing	+55	+59		dBm
Input P1dB		+36			dBm
Settling Time	50% V _{CTRL} to optimum functionality		1	4	μs
Start-up Time	90% V _{DD} to full functionality		5	25	μs
Switching Speed	50 % control to 10/90 % RF		150	350	ns
NVG Spur	Internal NVG ON		-104		dBm
Spurious Signal Level	>100MHz			-120	dBm
Second Harmonic	Pin = +13 dBm, F ₀ = 1GHz		-105	-95	dBc
Third Harmonic	Pin = +13 dBm, F ₀ = 1GHz		-105	-95	dBc
Group Delay	(ON Path)		0.1	0.5	ns

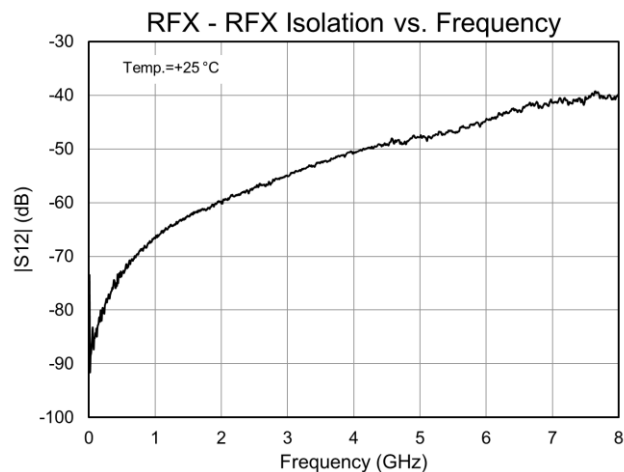
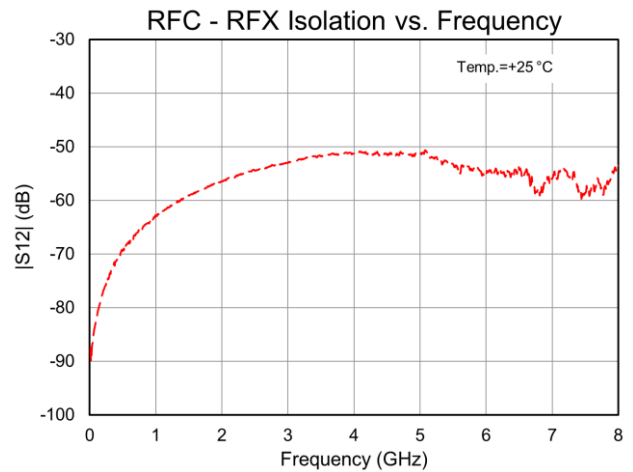
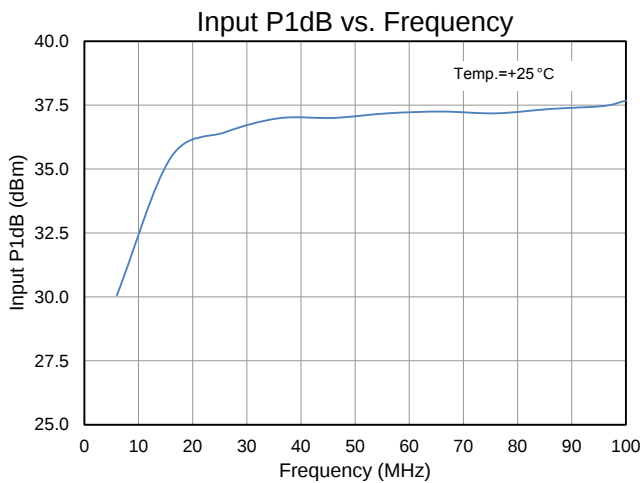
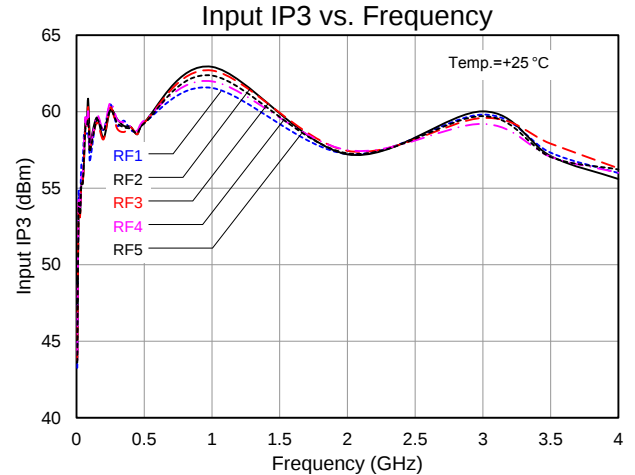
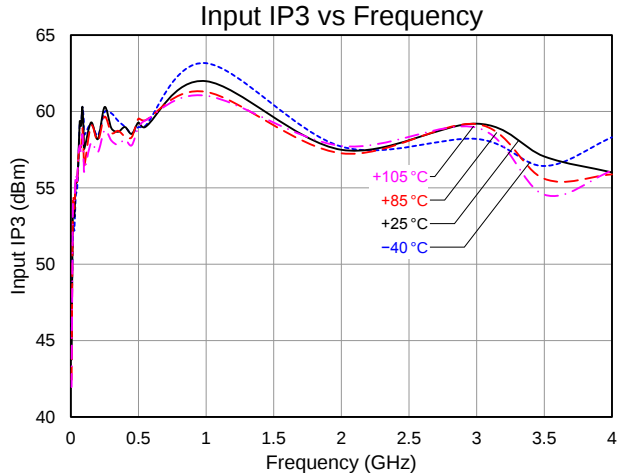
Notes:

- Test conditions unless otherwise noted: T_A = +25 °C, V_{CTRL} = 0/+5 V, V_{DD} = +5 V, 50 Ω system

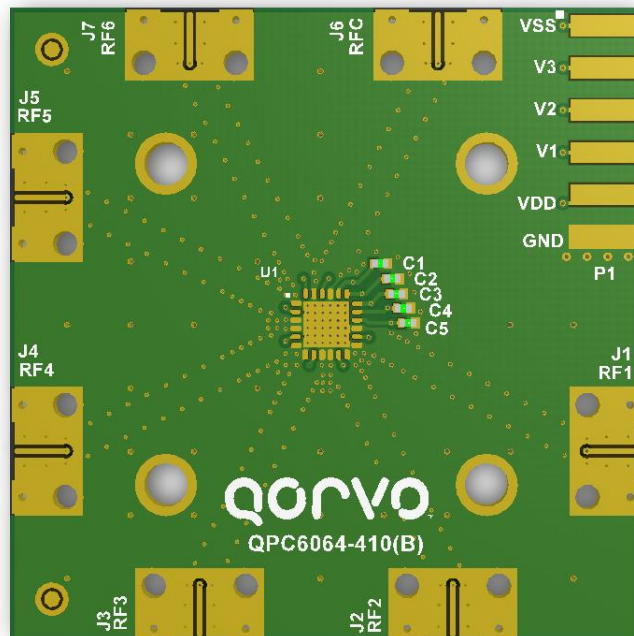
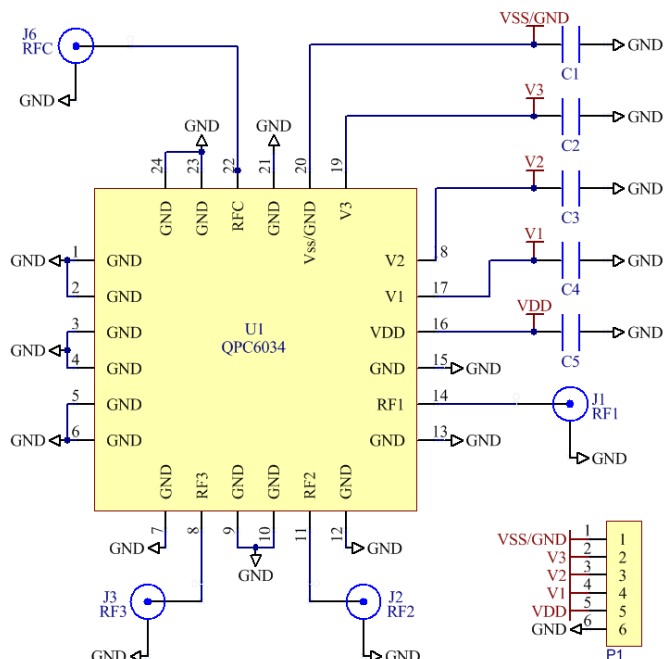
Typical Performance Plots



Typical Performance Plots



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



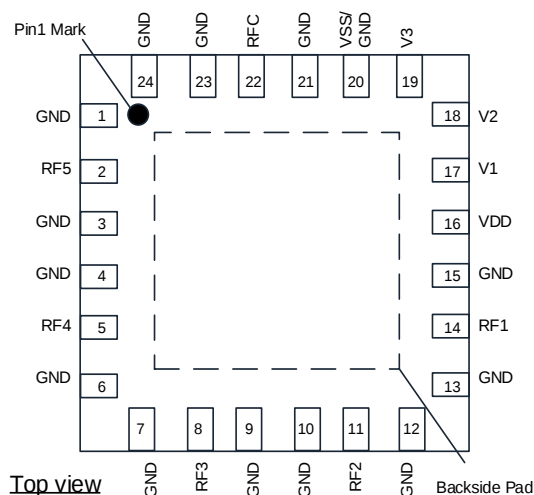
Note:

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

Bill of Material – Evaluation Board– 5 MHz to 6000 MHz Application Circuit

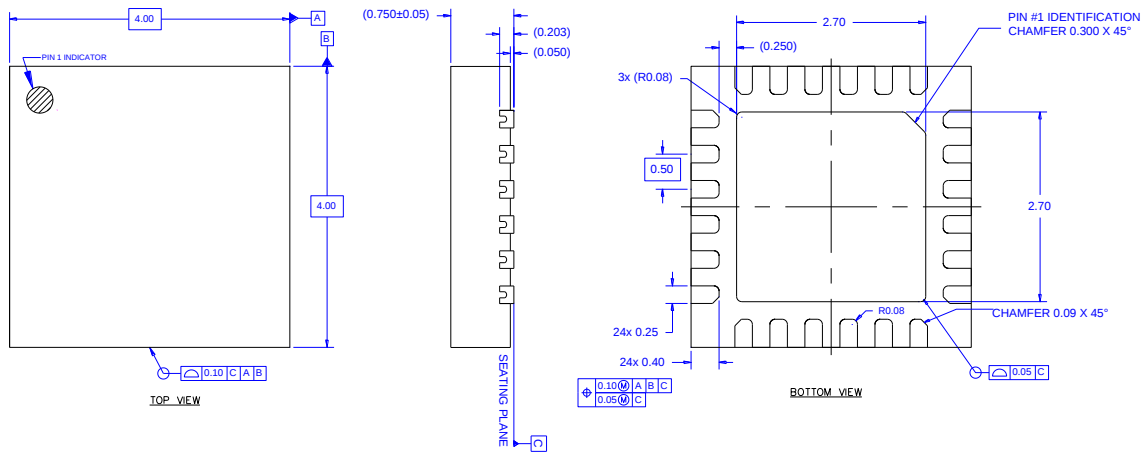
Reference Des.	Value	Description	Manufacturer	Part Number
N/A	N/A	Printed Circuit Board	Viasystems Technologies Corp.	QPC6064-410(B)
U1	N/A	QPC6044	Qorvo	QPC6054
C1-C5	100 pF	CAP, 100 pF, 5%, 50V, COG, 0402	Taiyo Yuden	RM UMK105CG101JV-F
J1-J6	N/A	CONN, SMA, EL FLT WIPER, MAT-21-1038	Amphenol RF Asia Corp	901-10425
P1	N/A	CONN, HDR, ST, PLRZD, 6-PIN	AMP	640454-6

Pad Configuration and Description



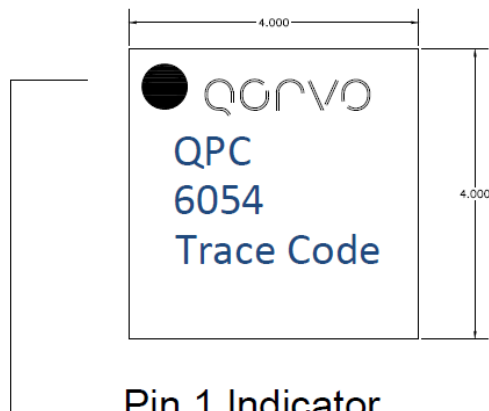
Pad No.	Label	Description
1, 3, 4, 5, 7, 9, 10, 12, 13, 15, 21, 23, 24	GND	Ground Pin; Connect to low inductive path ground
2	RF5	RF Port 5
5	RF4	RF Port 4
8	RF3	RF Port 3
11	RF2	RF Port 2
14	RF1	RF Port 1
16	V _{DD}	Supply Voltage
17	V1	Control Pin
18	V2	Control Pin
19	V3	Control Pin
20	V _{SS} /GND	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 V _{DD} .
22	RFC	RF Common Port

Package Dimensions (1)



Notes:
1. All Dimensions in millimeters

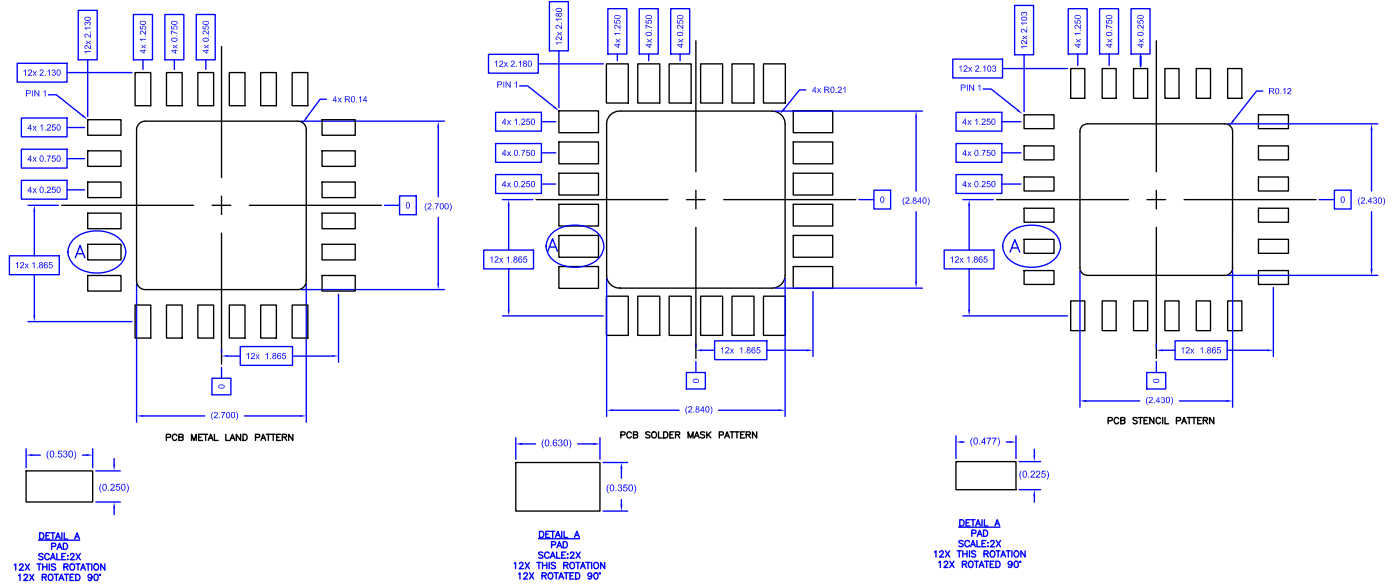
Branding Diagram



Pin 1 Indicator

Trace Code to be assigned by SubCon

PCB / PCB Solder Mask / PCB Stencil Drawing ⁽¹⁾



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.

Notes:

1. All Dimensions in millimeters

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 2	ANSI / ESDA / JEDEC JS-001-2014
ESD – Human Body Model (CDM)	Class C3	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 (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free



Contact Information

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