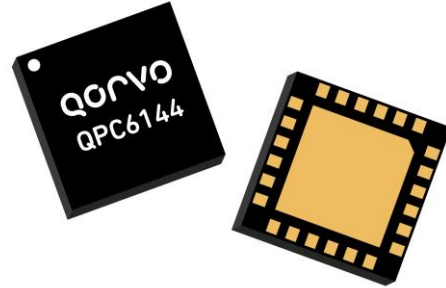


1. Product Overview and Benefits

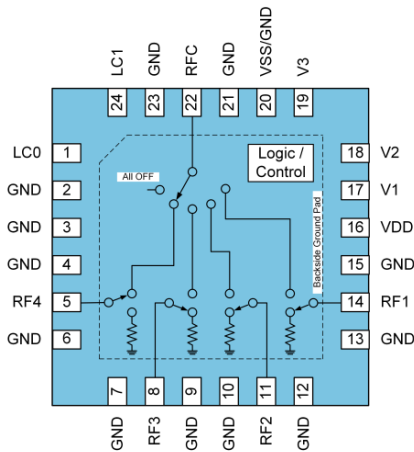
The Qorvo® QPC6144 is a Silicon on Insulator (SOI) Single-Pole 4- Throw (SP4T) switch designed for uses in cellular, 5G, and other high-performance fast switching applications. QPC6144 offers high isolation of 65dB, symmetric throw ports with excellent linearity and power handling capability. The design is non-reflective as such the RF1, RF2, RF3 and RF4 ports are terminated with 50 Ω load(s) in the non-throw or OFF state. QPC6144 is JEDEC standard 1.2V, 1.5V and 1.8V positive control logics selectable. It incorporates a single pin control to disable the internal Negative Voltage Generator (NVG) by applying a negative voltage of an off-chip external source to the same pin.

The QPC6144 is packaged in a RoHS-compliant, compact 4x4mm surface-mount leadless package.



24 Pin 4 x 4 mm leadless SMT Package

2. Functional Block Diagram



Top View

3. Key Features

- 50MHz-10GHz Operational Frequency Range
- Symmetrical SP4T
- High Isolation: >65dB
- High Input IP3: +57dBm Typical
- Non-Reflective RF1, RF2 RF3, and RF4 Ports, Terminated in All-OFF State
- Ideal for DPD Feedback Path Selections and Calibration
- Only Requires a Single DC Supply with Internal NVG
- External Negative DC Supply Optional
- No Blocking Capacitors Required on RF Pins unless ≠0 DC Voltage Present
- 1.2V, 1.5V and 1.8V JEDEC Standard Control Logic Selectable

4. Applications

- Wireless Infrastructure
- High Performance Communication System
- Test Equipment

5. Ordering Information

Part Number	Description
QPC6144TR13	13" T&R with 2500 pieces
QPC6144EVB	50MHz-10GHz Evaluation Board

Electrical Characteristics

5.1. Absolute Maximum Ratings

Parameter	Conditions	Rating
Storage Temperature		-40 to 150 °C
VDD		+6V
Control Voltage		+6V
RF input power	ON state	+33dBm
	OFF state, internal termination	+25.5 dBm

Operation of this device outside the parameter ranges given above may cause permanent damage.

5.2. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
VDD	+3.15	+3.30	+5.50	V
VSS	-5.5	-3.3	-3.15	V
RF Input Power, On State, CW		32		dBm
RFX Input Power, Off State, CW		25		dBm
Hot Switching RF Input Power, CW			25	dBm
T _{CASE}	-40		+115	°C
T _j for >10 ⁵ hours MTTF			+125	°C

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

5.3. Electrical Specifications

Parameter	Conditions ⁽¹⁾	Min.	Typ.	Max.	Units
Operational Frequency Range		0.05		10	GHz
Insertion Loss ⁽²⁾	50-1000MHz		0.85		dB
	1000-3000MHz		1.05		dB
	3000-5000MHz		1.15		dB
	5000-8600MHz		1.40		dB
	8600-10000MHz		1.50		dB
Insertion Loss Ripple	In any 600MHz range		0.5		dB
Return Loss, RFX ⁽²⁾ (ON State)	50-1000MHz		26		dB
	1000-3000MHz		20		dB
	3000-5000MHz		23		dB
	5000-8600MHz		22		dB
	8600-10000MHz		20		dB
Return Loss, RFC ⁽²⁾ (ON State)	50-1000MHz		24		dB
	1000-3000MHz		21		dB
	3000-5000MHz		25		dB
	5000-8600MHz		23		dB
	8600-10000MHz		21		dB



QPC6144

50MHz-12GHz High Isolation SP4T Switch

Parameter	Conditions ⁽¹⁾	Min.	Typ.	Max.	Units
Return Loss, RFX ⁽²⁾ (OFF State)	50-1000MHz		43		dB
	1000-3000MHz		32		dB
	3000-5000MHz		24		dB
	5000-8600MHz		21		dB
	8600-10000MHz		15		dB
Isolation RFC-RFX	50-1000MHz		89		dB
	1000-3000MHz		78		dB
	3000-5000MHz		73		dB
	5000-8600MHz		68		dB
	8600-10000MHz		65		dB
Isolation RFX-RFX	50-1000MHz		84		dB
	1000-3000MHz		74		dB
	3000-5000MHz		69		dB
	5000-8600MHz		66		dB
	8600-10000MHz		63		dB
IP3, +22dBm input power per-tone, 1MHz tone spacing	50MHz		60		dBm
	1000MHz		59		dBm
	2000MHz		58		dBm
	4000MHz		58		dBm
	6000MHz		59		dBm
P0.05dB	50-1000MHz		30		dBm
	1000-3000MHz		30		dBm
	3000-5000MHz		30		dBm
	5000-8600MHz		30		dBm
	8600-10000MHz		30		dBm
VDD Current	VDD 3.3V to 5.5V		91		μA
Control Logic Voltage	1.2V Logic Low	JEDEC Standard Compatible	-0.30	0.46	V
	1.2V Logic High		0.72	VDD	V
	1.5V Logic Low		-0.30	0.56	V
	1.5V Logic High		0.91	VDD	V
	1.8V Logic Low		-0.30	0.68	V
	1.8V Logic High		1.07	VDD	V
Switching Time	Control Threshold to 90/10% RF, 2GHz		176		ns
	Control Threshold to 97% RF, 2GHz		230		ns
	Control Threshold to 99% RF, 2GHz		255		ns
Settling Time	Control Threshold to 0.1dB Steady State Error		255		ns
Thermal Resistance	Case to Termination		31		°C/W
	Case to RF Branch		22		°C/W

Notes:

1. Test conditions unless otherwise noted: VDD +3.3V, VSS 0V internal NVG enabled, Temp +25C, RF ports DC 0V, RFX as Input ports.
2. Reference planes on device pads (EVB connector & PCB loss and mismatch excluded)

6. [Truth | Logic] Table

6.1. Switch Control Truth Table – 3 Pin

Control Input			Mode of Signal Path
V3	V2	V1	
0	0	0	RFC ⇆ RF4, Active ON
0	0	1	RFC ⇆ RF1, Active ON
0	1	0	RFC ⇆ RF2, Active ON
0	1	1	RFC ⇆ RF3, Active ON
1	0	0	RFC ⇆ RF4, Active ON
1	0	1	All OFF, RFC Reflective
1	1	0	
1	1	1	

6.2. Switch Control Truth Table – 2 Pin

Control Input		Mode of Signal Path
V2	V1	
0	0	RFC ⇆ RF4, Active ON
0	1	RFC ⇆ RF1, Active ON
1	0	RFC ⇆ RF2, Active ON
1	1	RFC ⇆ RF3, Active ON

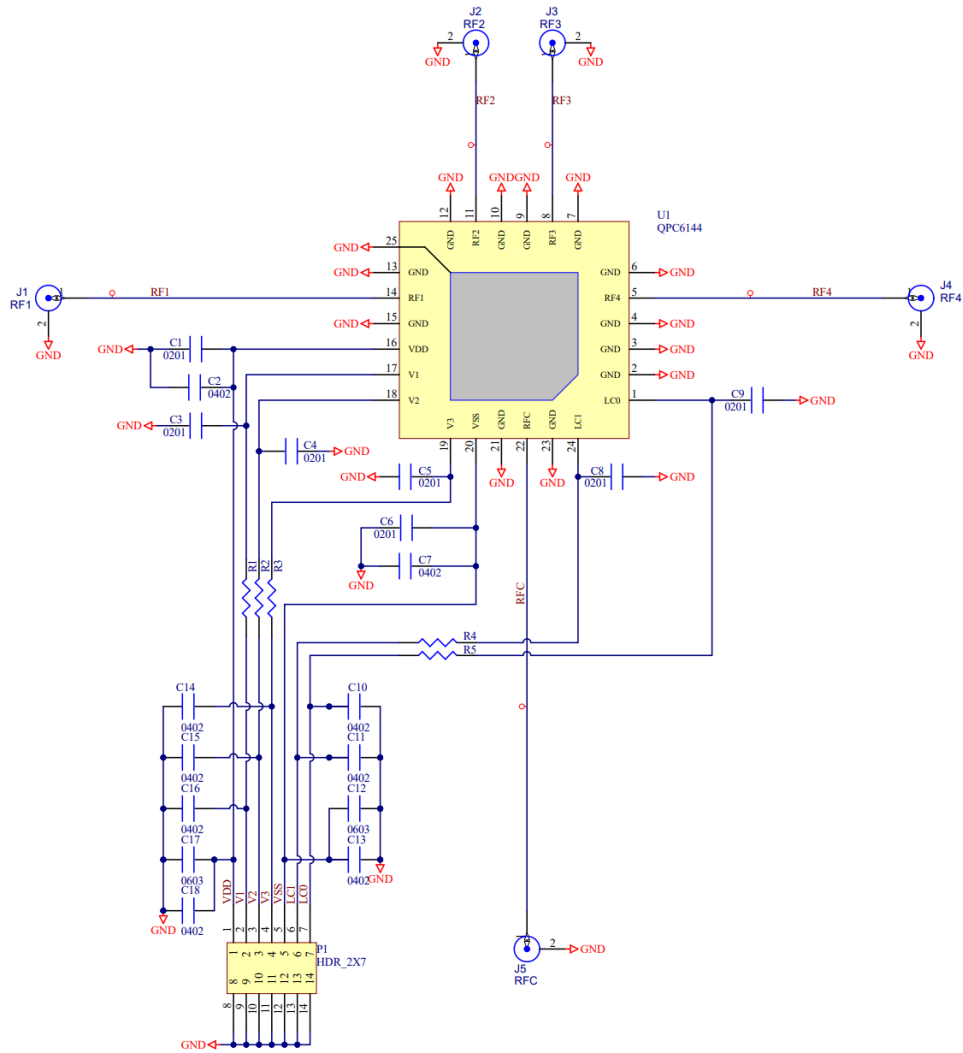
Note: V3 must be grounded

6.3. Control Logic Select Truth Table

Control Input		Control Logic
LC1	LC0	
0	0	+1.8V
0	1	+1.5V
1	0	+1.2V
1	1	+1.5V

7. Application Information

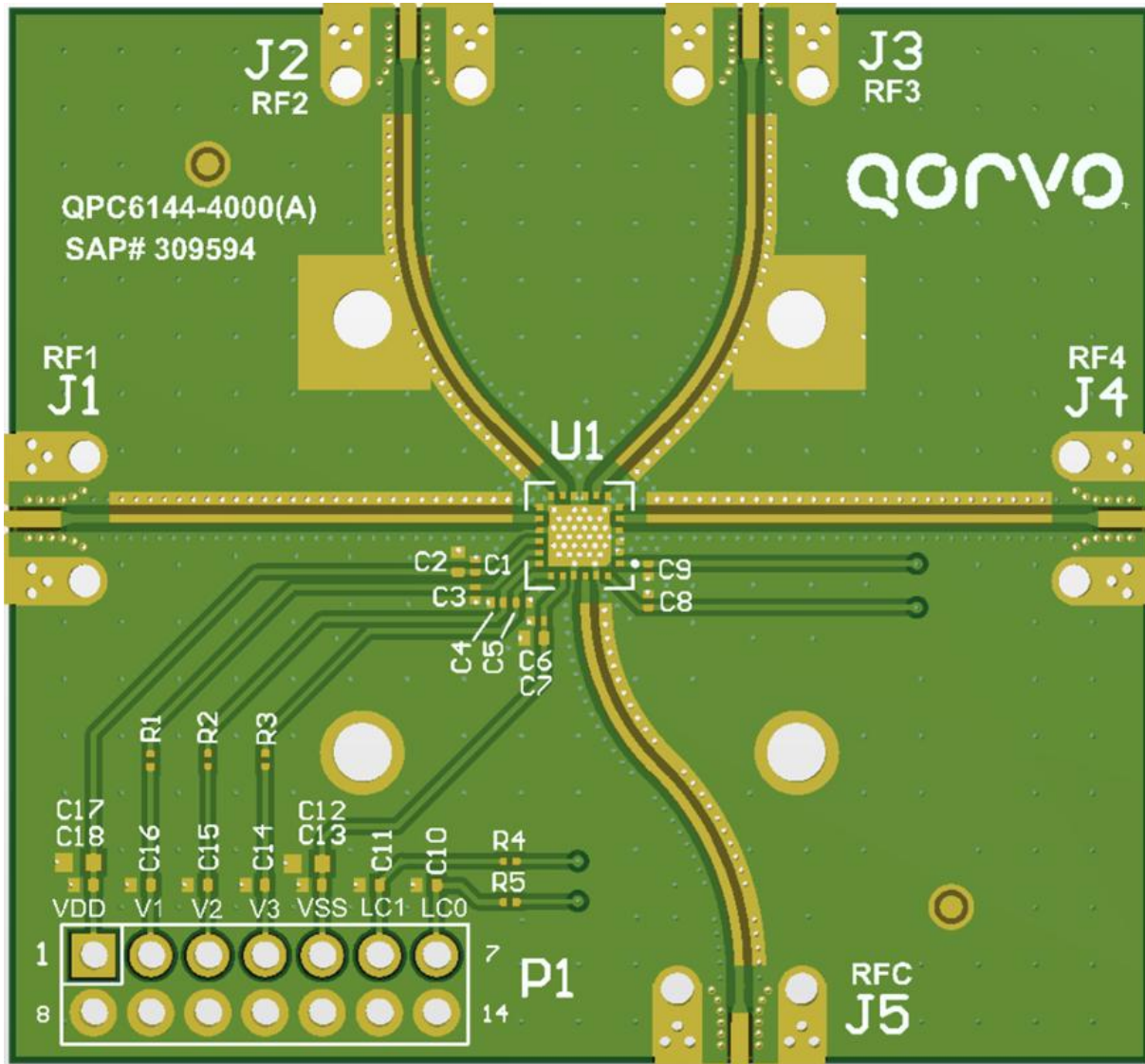
7.1. Application Circuit Schematic



7.2. Bill of Material

Ref. Des.	Value	Description	Manuf.	Part Number
-	-	Printed Circuit Board	-	-
U1	-	0.05-10GHz High Isolation SP4T Switch	Qorvo	QPC6144
C1, C8	100pF	CAP, 100pF,5%, 25V, C0G, 0201	Kamaya	0201N101J250CT
C2, C7	0.1μF	CAP, 0.1μF, 10%, 50V, X7R, 0402	Various	-
R1, R2, R3, R4, R5	0 Ω	RES, 0 OHM, 5%, 1/20W, 0201	Kamaya	RMC1/20JPPA
J1, J2, J3, J4, J5	SMA	CON, SMA, EL FLT VIPER MAT-21-1038	Amphenol	901-10425
P1	-	CON, HDR, 2x7 RT-ANG, 0.100", T/H	SAMTEC	TSW-107-08-G-D-RA

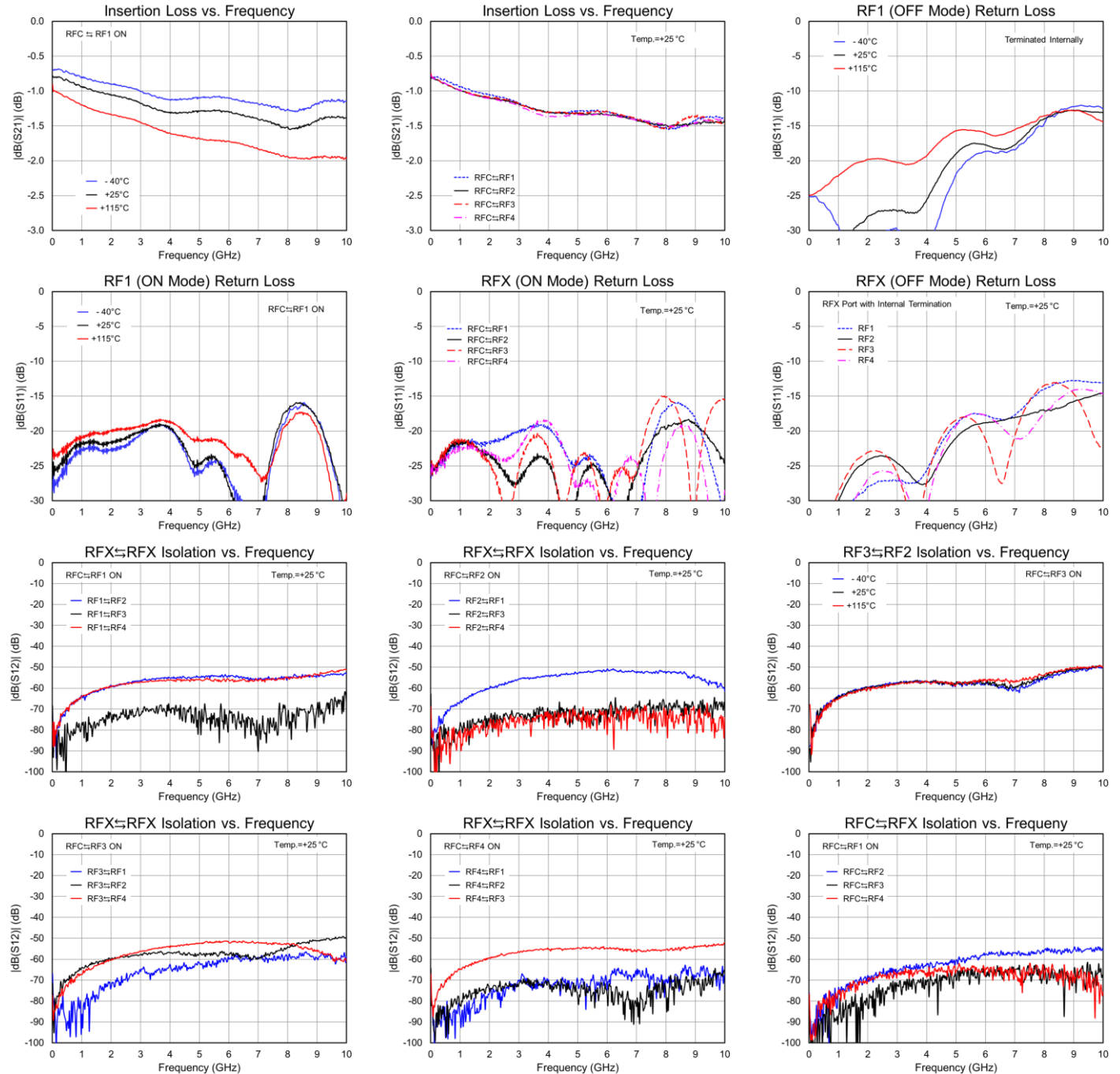
7.3. Application PCB Layout



EVB Layout Top View

8. Performance Plots

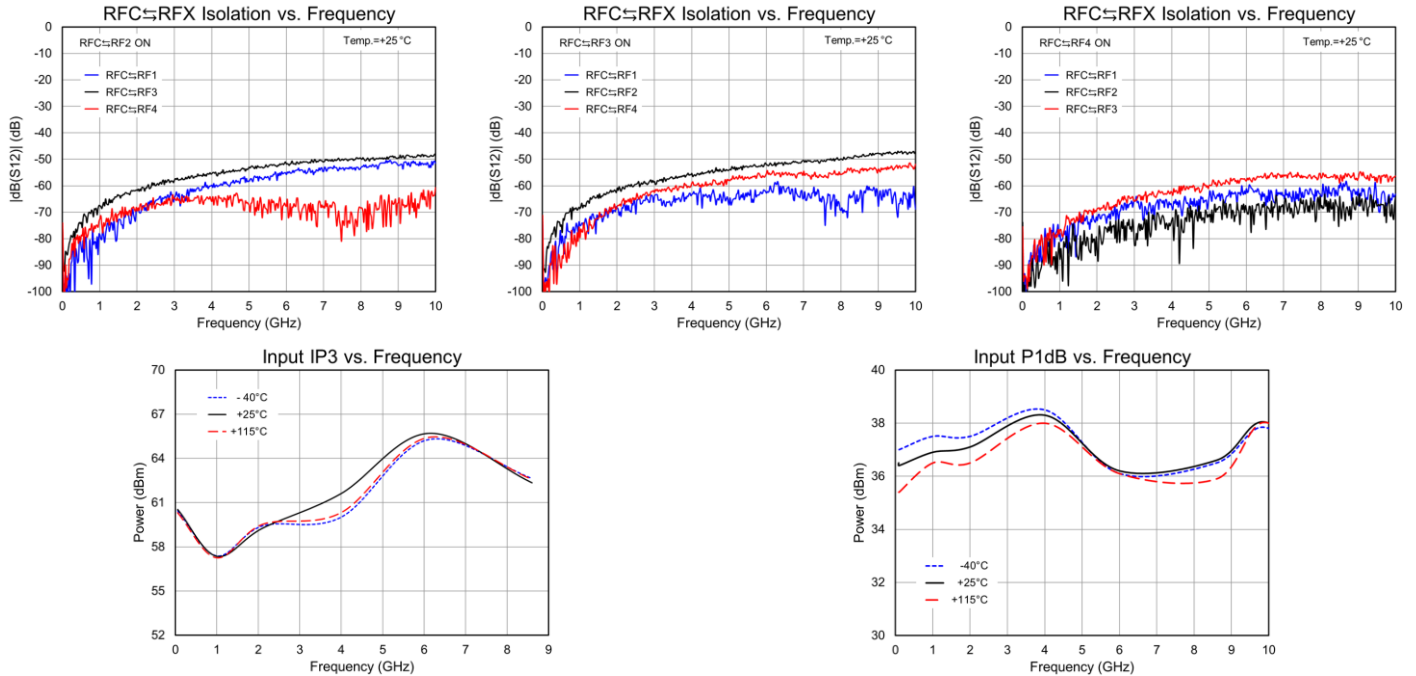
Test conditions unless otherwise noted: VDD +3.3V, Reference on device pads, System impedance 50Ω, Temp +25°C



Note: Isolation performances are highly dependent on careful PCB layout design.

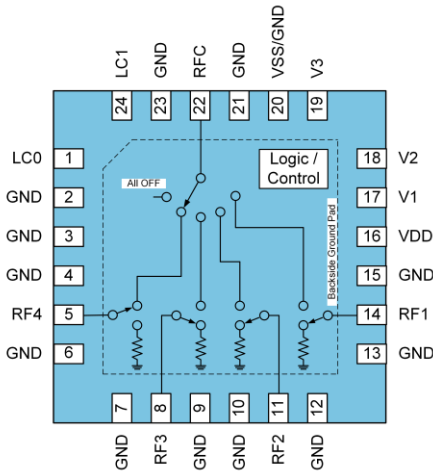
9. Performance Plots (Continued 1)

Test conditions unless otherwise noted: VDD +3.3V, Reference on device pads, System impedance 50Ω, Temp +25°C



Note: Isolation performances are highly dependent on careful PCB layout design.

10. Pin Configuration and Description



Top View

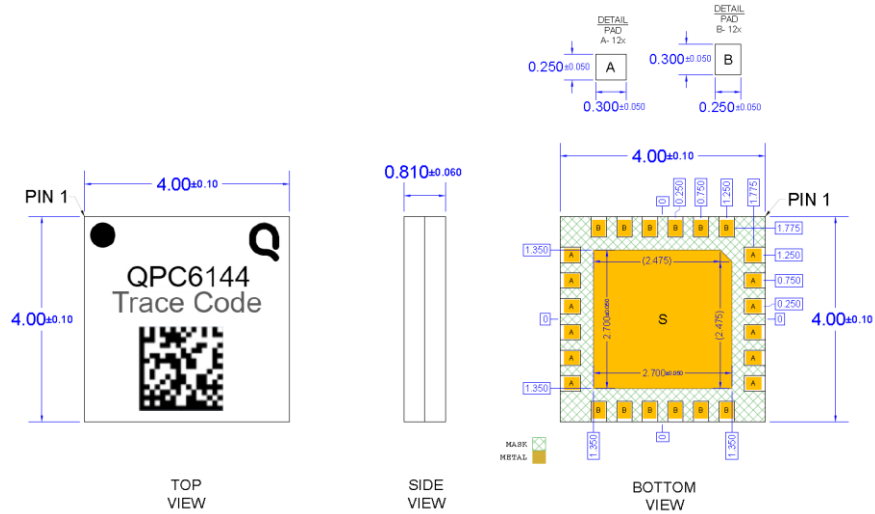
PIN NUMBER	LABEL	DESCRIPTION
1	LC0	Control Logic selection bit 0
2, 3, 4, 6, 7, 9, 10, 12, 13, 15, 21, 23	GND	RF and DC Ground connections
5	RF4	RF input 4, internal matched to 50Ω, No DC blocking required unless external ≠0V DC presents
8	RF3	RF input 3, internal matched to 50Ω, No DC blocking required unless external ≠0V DC presents
11	RF2	RF input 2, internal matched to 50Ω, No DC blocking required unless external ≠0V DC presents
14	RF1	RF input 1, internal matched to 50Ω, No DC blocking required unless external ≠0V DC presents
16	VDD	DC supply input
17	V1	Logic control input 1
18	V2	Logic control input 2
19	V3	Logic control input 3
20	VSS/GND	Negative DC voltage input, Grounded will enable internal NVG (negative voltage generator)
22	RFC	RF common port, internal matched to 50Ω, No DC blocking required unless external ≠0V DC presents
24	LC1	Control Logic selection bit 1
Backside Pad	GND	Ground connection. The back side of the package should be connected to the ground plan though as short of a connection as possible. PCB via holes under the device are required.

11. Packaging and Ordering Information

11.1. Device Marking and Package Dimensions

Marking: Part number – QPC6144

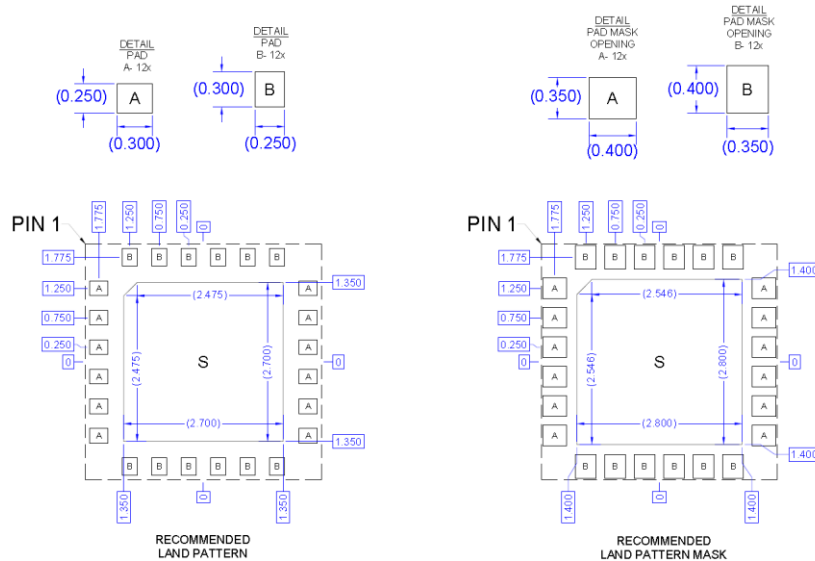
Trace code – assigned by sub-contractor



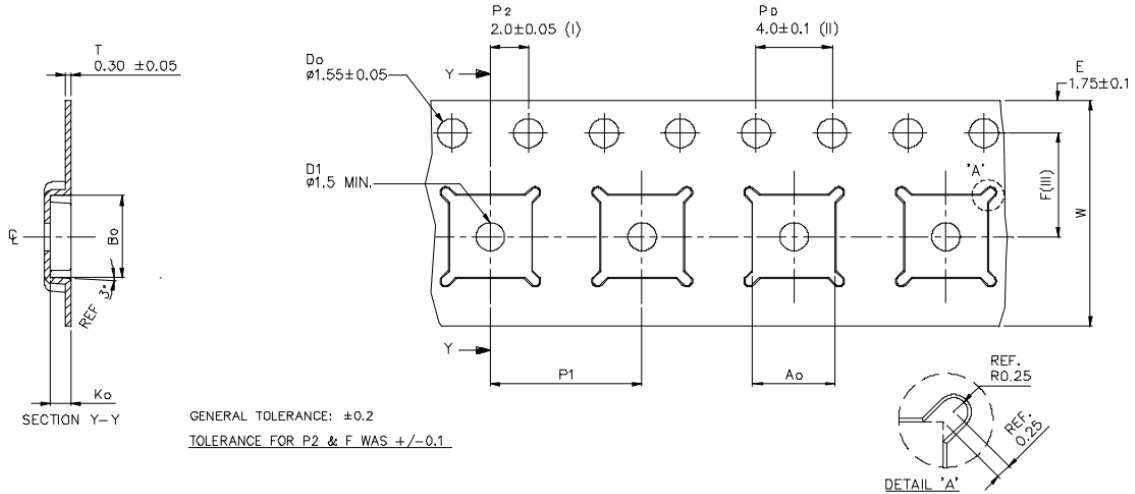
Notes:

1. All dimensions are in mm. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

11.2. PCB Footprint Recommendations



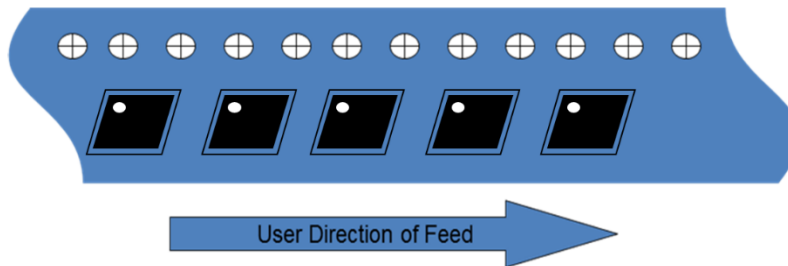
11.3. Tape and Reel Information



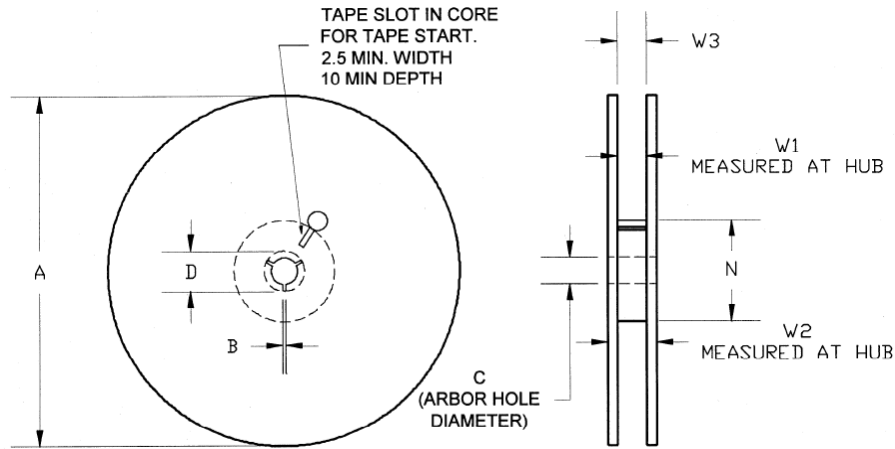
Ao	4.35 +/- 0.1
Bo	4.35 +/- 0.1
Ko	1.10 +/- 0.1
F	5.50 +/- 0.05
P1	8.00 +/- 0.1
W	12.00 +/- 0.3

- (I) Measured from centreline of sprocket hole to centreline of pocket.
 - (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
 - (III) Measured from centreline of sprocket hole to centreline of pocket.
 - (IV) Other material available.
 - (V) Typical SR of form Tape Max 10^9 OHM/SQ
- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

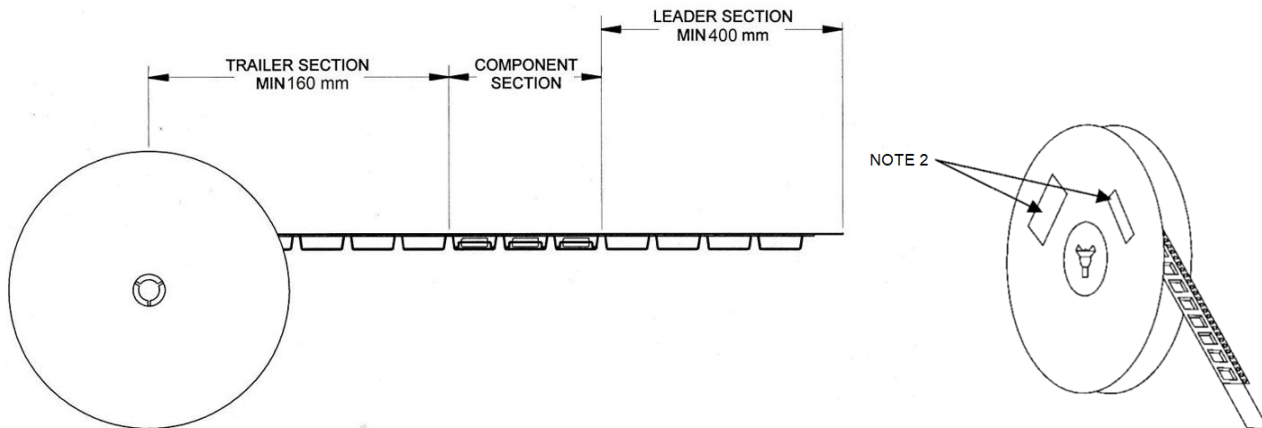
Feature	Measure	Symbol	Size (in)	Size (mm)
Cavity	Length	A0	0.171	4.35
	Width	B0	0.171	4.35
	Depth	K0	0.043	1.10
	Pitch	P1	0.315	8.00
Centerline Distance	Cavity to Perforation - Length Direction	P2	0.079	2.00
	Cavity to Perforation - Width Direction	F	0.217	5.50
Cover Tape	Width (Reference Only)	C	0.362	9.20
Carrier Tape	Width	W	0.472	12.00



Standard T/R size = 2,500 pieces on a 13" reel.



Feature	Measure	Symbol	Size (in)	Size (mm)
Flange	Diameter	A	12.992	330.0
	Thickness	W2	0.717	18.2
	Space Between Flange	W1	0.504	12.8
Hub	Outer Diameter	N	4.016	02.0
	Arbor Hole Diameter	C	0.512	13.0
	Key Slit Width	B	0.079	2.0
	Key Slit Diameter	D	0.787	20.0



Notes:

1. Empty part cavities at the trailing and leading ends are sealed with cover tape. See EIA 481-1-A.
2. Labels are placed on the flange opposite the sprockets in the carrier tape.

12. Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1C	ESDA/JEDEC JS-001-2012
ESD – Charged Device Model (CDM)	Class C3	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020



Caution!

ESD sensitive device

13. Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Thin Ni-ENEPIG (*Plating thickness: Ni 0.40±0.10µm, Pd 0.145±0.035µm, Au 0.095±0.025µm*)

14. Environmental Compliance

This part is compliant with the 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
- SVHC Free
- PFOS Free



Contact Information

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

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