WINSOURCE ELECTRONICS

THE DATASHEET OF

QPC2110SR

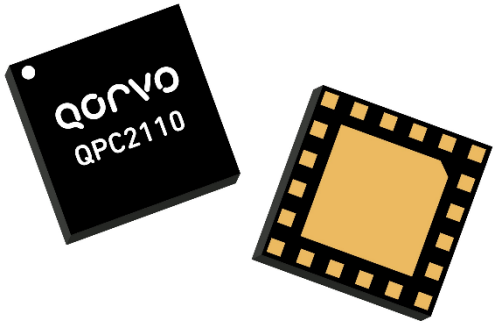
QPC2110

X-Band SOI 6-Bit Phase Shifter

Product Description

The Qorvo QPC2110 is a packaged SOI 6-bit phase shifter. It operates over 8 – 11.5 GHz while providing 360° of phase coverage with a LSB of 5.625. The QPC2110 offers an exceptional RMS phase error of <3 degrees and amplitude error of <0.4 dB over most of the operational band. With other equally impressive small signal and linearity characteristics, the QPC2110 delivers superior performance for your X-band phased array applications.

Housed in a small 2 x 2 mm plastic overmold QFN package, DC blocked on both ports with bi-directional operation and the use of positive only control logic, the QPC2110 supports ease of use and simply system integration. Low DC power consumption also provides the system designer more flexibility in the overall power management of the system.



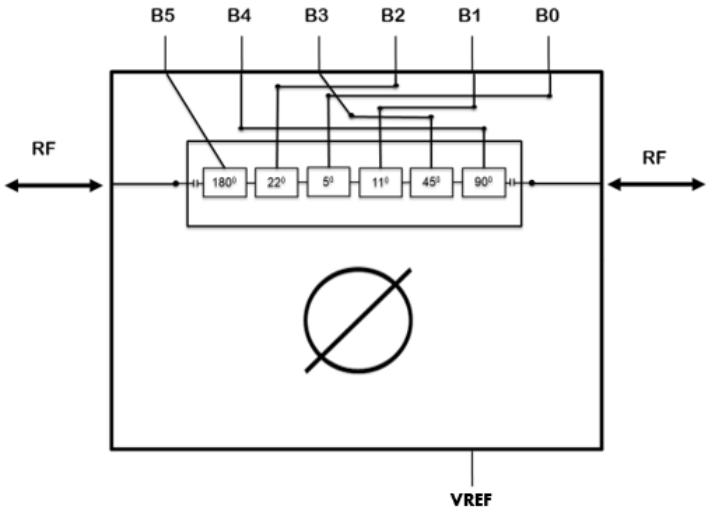
20 Pad 2.0 x 2.0 QFN Package

Product Features

- Frequency Range: 8 to 11.5 GHz
- 6-Bit Phase Shifter
- Bi-Directional
- 360° Coverage, LSB = 5.625°
- RMS Phase Error: 3° @ 10GHz
- RMS Amplitude Error: 0.2 dB @ 10GHz
- Average Insertion Loss: 5.5 dB
- Return Loss: 10 dB
- Input P_{1dB}: >30 dBm
- Input IP3: > 40 dBm
- Switching Speed: < 91 ns
- Control Voltage: 0 /+3.3 V
- QFN Package Dimensions: 2.0 x 2.0 x 0.94 mm

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

Block Diagram



Applications

- X-Band Radar

Ordering Information

Part No.	Description
QPC2110TR7	X-Band SOI 6-Bit Phase Shifter 750 Piece 7” Reel
QPC2110SR	100 pcs T/R
QPC2110EVB	Evaluation Board

Absolute Maximum Ratings

Parameter	Value
Drain Voltage (V_{REF})	+6 V
Drain Current (I_{REF})	7 mA
Control Voltage (V_{CTRL})	+6 V
Control Current (I_{CTRL})	± 0.5 mA
Power Dissipation	1 W
Input Power, CW, 50 Ω, 85°C (HOT SWITCHING)	23 dBm
Input Power, CW, 50 Ω, 85°C	30 dBm
Channel Temperature: Tj for ≥10^5 hours MTTF	125 °C
Mounting Temperature (30 Seconds)	260 °C
Storage Temperature	-55 to 150 °C

Operation of this device outside the parameter ranges given above may cause permanent damage. These are stress ratings only, and functional operation of the device at these conditions is not implied.

Recommended Operating Conditions

Parameter	Value
Control Voltage (V_{CTRL})	0/+3.3 V
Control Current (I_{CTRL})	50 nA typical
Reference / Supply Voltage (V_{REF} / VDD)	+3.3 V
Supply Current (I_{REF})	21 µA typical
Temperature Range	-40 to +85 ^{0}C
Max Input Power (Hot Switching)	20 dBm

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

Thermal and Reliability Information

Parameter	Test Conditions	Value	Units
Channel Temperature (T_{CH})	T_{BASE} = 85°C; Freq = 10GHz; CW, Hot Switching	88	°C
Thermal Resistance, θ_{jc}	Pin = 20 dBm; Pdiss = 0.065 W	45.14	°C/W
Channel Temperature (T_{CH})	T_{BASE} = 85°C; Freq = 10GHz; CW	108	°C
Thermal Resistance, θ_{jc}	Pin = 30 dBm; Pdiss = 0.827 W	27.81	°C/W

Electrical Specifications

Test conditions unless otherwise noted: 25°C. Control Voltage (REF, 5^0, 11^0, 22^0, 45^0, 90^0, 180^0) = 0/+3.3 V; See Bias Truth Table.

Parameter	Min	Typical	Max	Units
Operational Frequency Range	8		11.5	GHz
Insertion Loss		5.5		dB
Input Return Loss		>10		dB
Output Return Loss		>10		dB
RMS Phase Error		3		deg
RMS Amplitude Error		0.3		dB
Input P1dB		>30		dBm
Input IP3 (Tone Spacing = 10 MHz, Pin/Tone = 15 dBm)		50		dBm
Switching Speed		< 91		nS
Insertion Loss Temperature Coefficient		0.008		dB/°C

Bias Truth Table

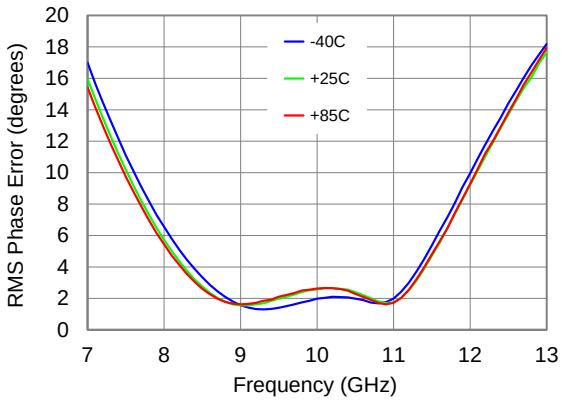
Logic “0” = 0 V, Logic “1” = +3.3 V

Phase Shifter	B0	B1	B2	B3	B4	B5	V_{REF}
0° (Reference)	0	0	0	0	0	0	1
5.625°	1	0	0	0	0	0	1
11.25°	0	1	0	0	0	0	1
22.5°	0	0	1	0	0	0	1
45°	0	0	0	1	0	0	1
90°	0	0	0	0	1	0	1
180°	0	0	0	0	0	1	1

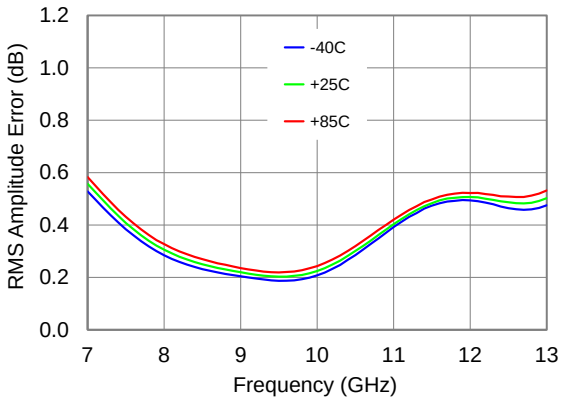
Performance Plots – Small Signal

Test conditions unless otherwise noted: V_{REF} = +3.3 V, V_{CTRL} = 0/+3.3 V, +25 °C

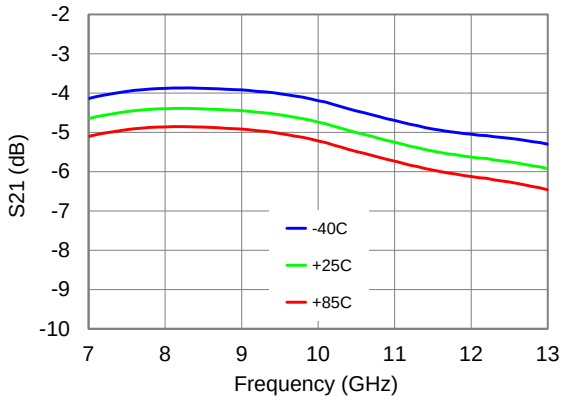
RMS Phase Error vs. Freq. vs. Temp
V_{REF} = 3.3 V, All Phase States



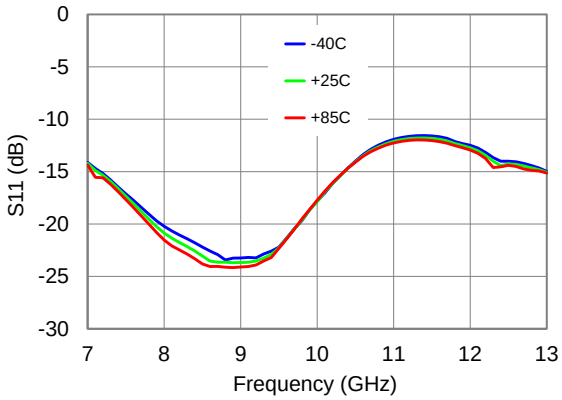
RMS Amplitude Error vs. Freq vs. Temp.
V_{REF} = 3.3 V, All Phase States



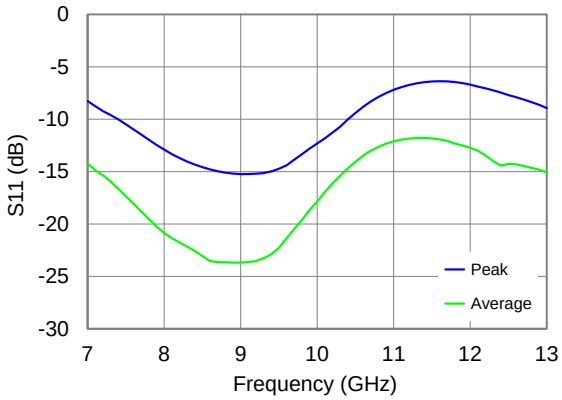
Avg. Insertion Loss vs. Freq. vs. Temp.
V_{REF} = 3.3 V, All Phase States



Avg. IRL vs. Freq. vs.Temp.
V_{REF} = 3.3 V, All Phase States

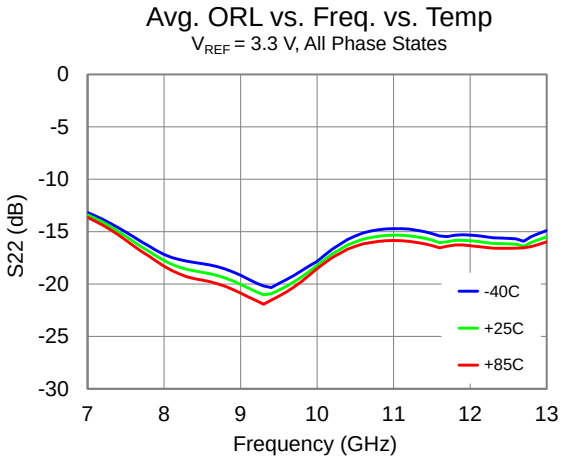


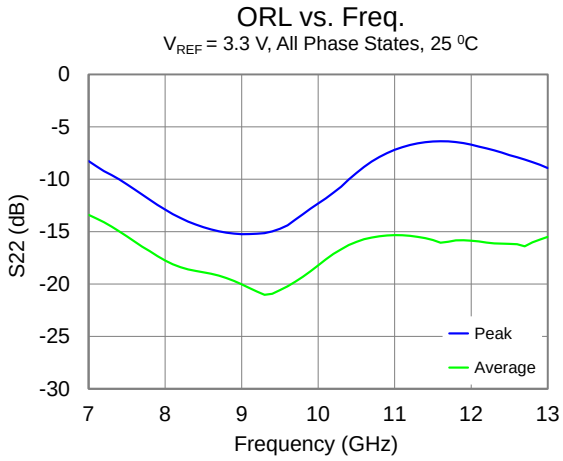
IRL vs. Freq.
V_{REF} = 3.3 V, All Phase States, 25 °C

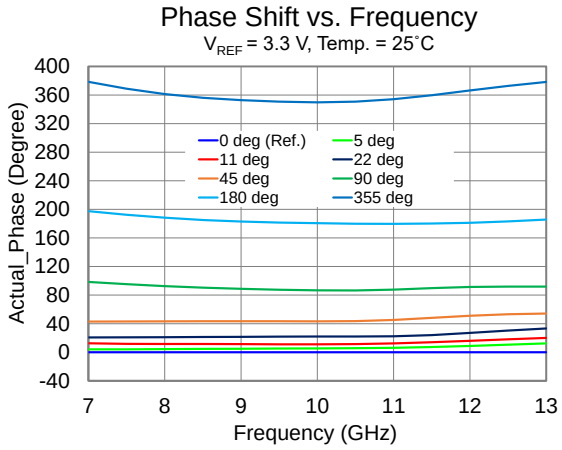


Performance Plots – Small Signal (Cont.)

Test conditions unless otherwise noted: V_{REF} = +3.3 V, V_{CTRL} = 0/+3.3 V, +25 °C





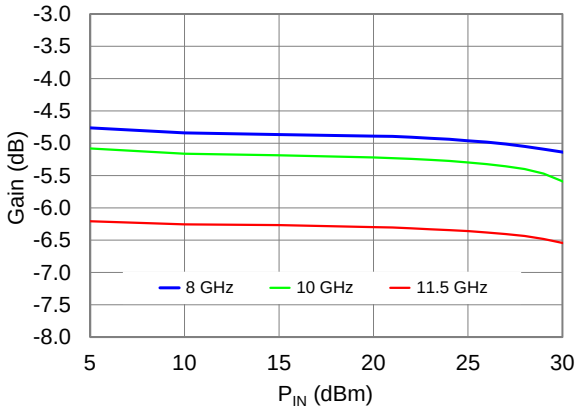


Performance Plots – Large Signal & Linearity

Test conditions unless otherwise noted: V_{REF} = +3.3 V, V_{CTRL} = 0/+3.3 V, +25 °C

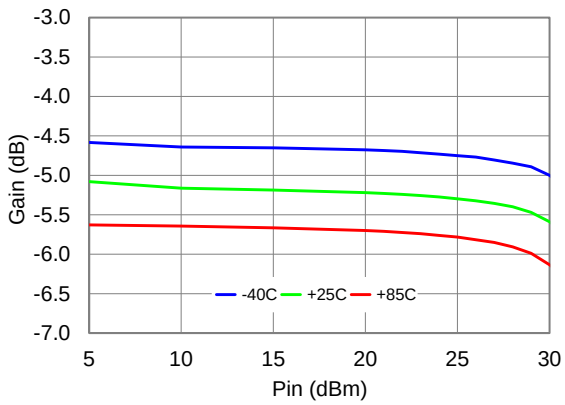
Gain vs. P_{IN} vs. Frequency

V_{REF} = 3.3 V, 25 °C, Phase State = 0 deg



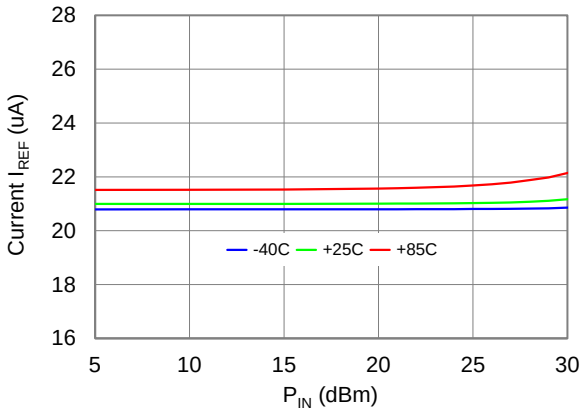
Gain vs. Pin vs. Temperature

V_{REF} = 3.3 V, Freq. = 10 GHz, Phase State = 0 deg



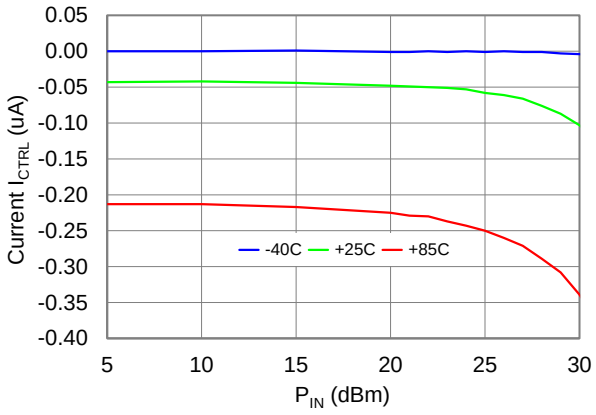
Current I_{REF} vs. P_{IN} vs. Temperature

V_{REF} = 3.3 V, Freq. = 10 GHz, Phase State = 0 deg



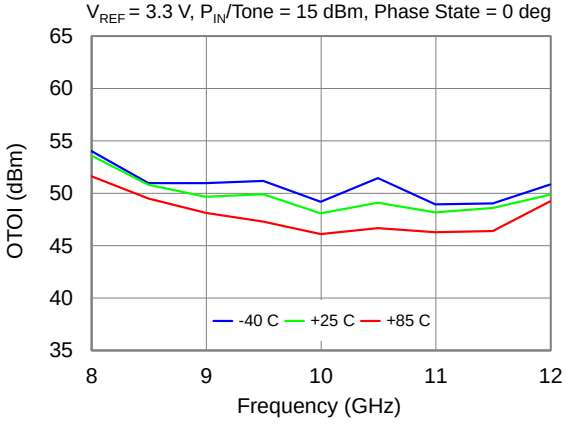
Current I_{CTRL} vs. P_{IN} vs. Temperature

V_{REF} = 3.3 V, Freq. = 10 GHz, Phase State = 0 deg



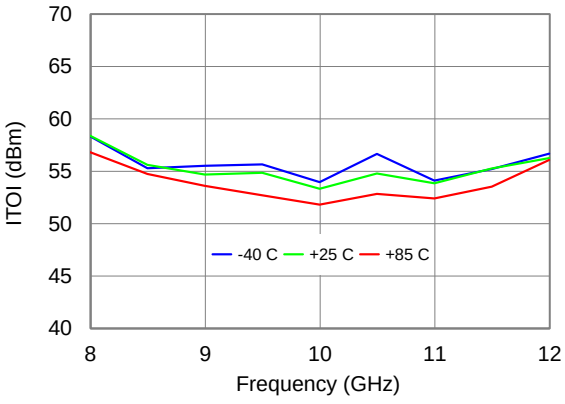
OTOI vs. Freq. vs. Temperature

V_{REF} = 3.3 V, P_{IN}/Tone = 15 dBm, Phase State = 0 deg

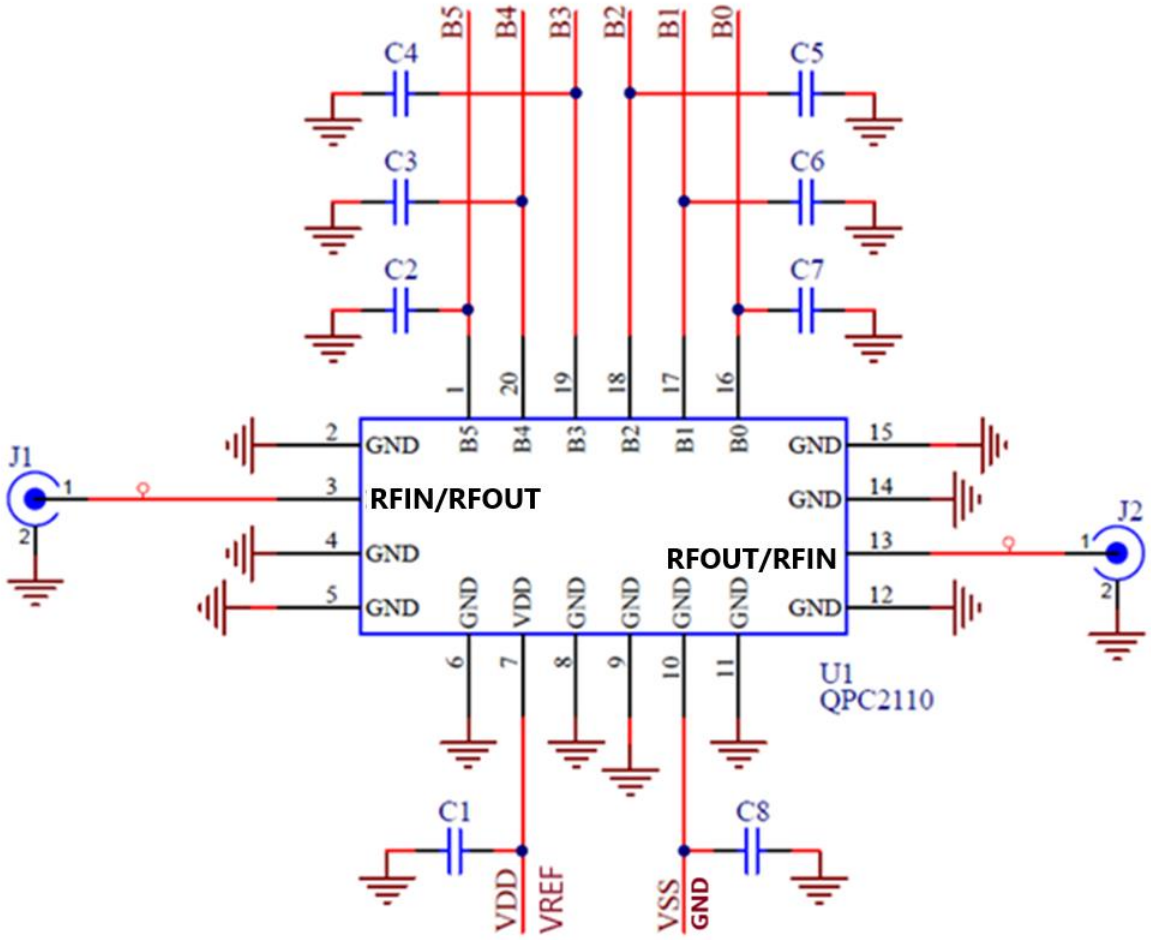


ITOI vs. Freq. vs. Temperature

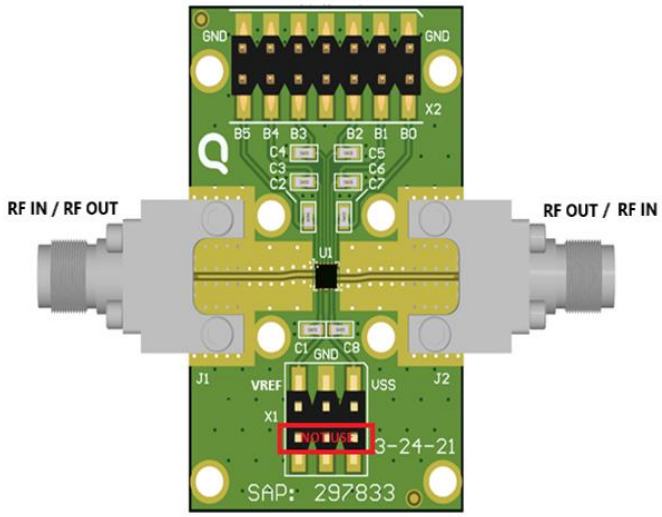
V_{REF} = 3.3 V, P_{IN}/Tone = 15 dBm, Phase State = 0 deg

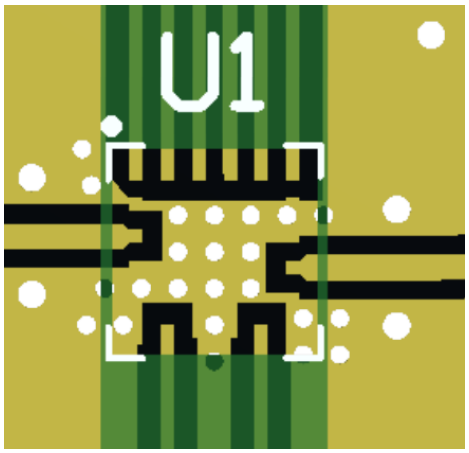


Applications Circuit



Evaluation Board (EVB) Layout Assembly





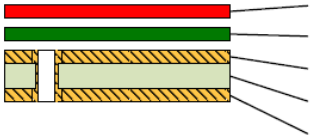
MOUNTING DETAIL

RF IN and RF OUT are interchangeable.

EVB Bill of Materials – QPC2110

Reference Des.	Value	Description	Manuf.	Part Number
C1	0.1 µF	Cap, 0603, 16 V, 10%, X7R	Various	–
C2 – C8	N/A	Not Populated	Various	

Evaluation Board PCB Information



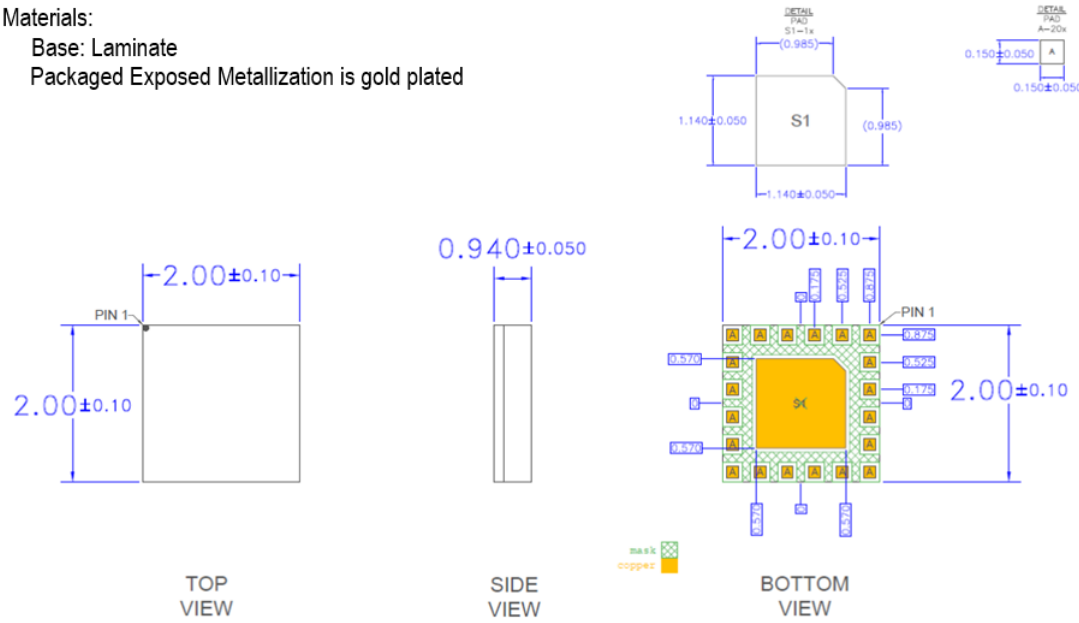
(COPPER THICKNESS IS @ FINISHED THICKNESS)

Material	Layer	Thickness	Dielectric Material	Type	Gerber
	SILKSCREEN_TOP			Legend	GTO
Surface Material	SOLDERMASK_TOP	0.0004in	Solder Resist	Solder Mask	GTS
Copper	**METAL1_TOP**	**0.0018in**		**Signal**	**GTL**
Core		*0.0050in*	*TACONICS TSM-DS3B*	*Dielectric*	
Copper	**METAL2_BOT**	**0.0018in**		**Signal**	**GBL**

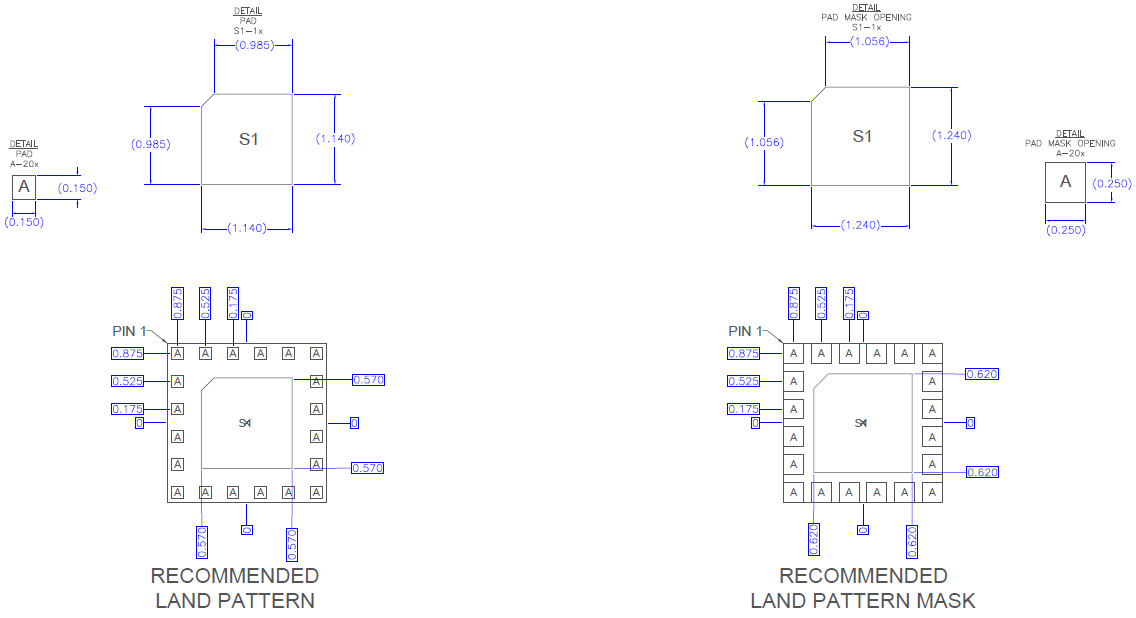
Total thickness: 0.0090in

Mechanical Information

Units: millimeters
Materials:
Base: Laminate
Packaged Exposed Metallization is gold plated



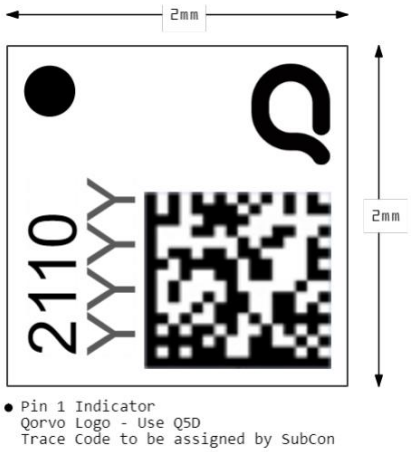
PCB Mounting Pattern



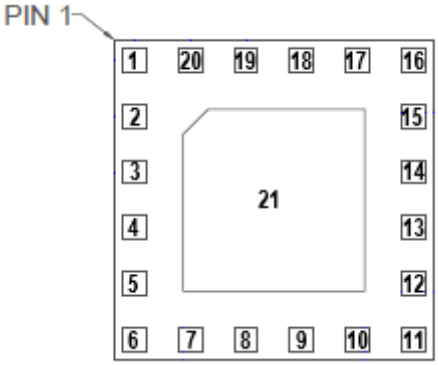
Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. This drawing specifies the mounting pattern used on the Qorvo evaluation board for this product. Some modification may be necessary to suit end user assembly materials and processes.

Package Marking



Package Information



Pin Description

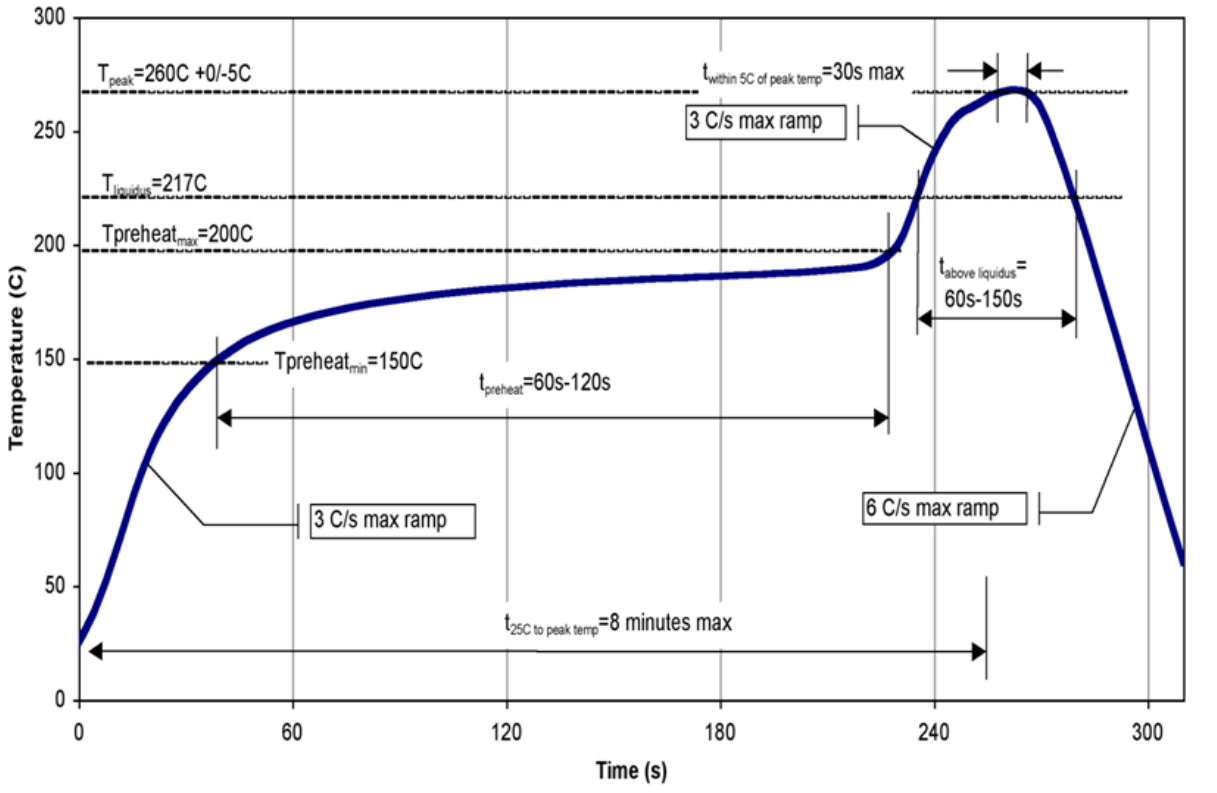
Pin No.	Symbol	Description
1	B5	180° Control
2, 4 - 6, 8 – 12, 14, 15	GND	Ground
3	RF IN / RF OUT	Input/Output; matched to 50 Ohms; DC blocked; interchangeable to RF Output
7	V_{REF} / V_{DD}	Reference voltage (Also supply voltage for internal bias circuit)
10	GND	Ground, Required
13	RF OUT / RF IN	Output/Input; matched to 50 Ohms; DC blocked; interchangeable to RF Input
16	B0	5.625° Control
17	B1	11.25° Control
18	B2	22.5° Control
19	B3	45° Control
20	B4	90° Control
21	GND	Package Base Ground

Solderability

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

Contact plating: ENEPIG

Recommended Soldering Temperature Profile



Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	1C	ANSI/ESDA/JEDEC JS-001
ESD – Charge Device Model (CDM)	C3	ANSI/ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

RoHS Compliance

This product 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
- 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:

Tel: **1-844-890-8163**

Web: **www.qorvo.com**

Email: customer.support@qorvo.com

Important Notice

The information contained herein is believed to be reliable; however, Qorvo makes no warranties regarding the information contained herein and assumes no responsibility or liability whatsoever for the use of the information contained herein. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for Qorvo products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information. **THIS INFORMATION DOES NOT CONSTITUTE A WARRANTY WITH RESPECT TO THE PRODUCTS DESCRIBED HEREIN, AND QORVO HEREBY DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO SUCH PRODUCTS WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

Without limiting the generality of the foregoing, Qorvo products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.

Copyright 2024 © Qorvo, Inc. | Qorvo is a registered trademark of Qorvo, Inc.

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- View QPC2110SR on WIN SOURCE
- Qorvo US Inc. Information

Optimize Your Supply Chain with WIN SOURCE Solutions

- Global Sourcing Solution
- Obsolete Management
- Cost Control Management
- Shortage Management
- Alternative Solution
- Excess Inventory Management