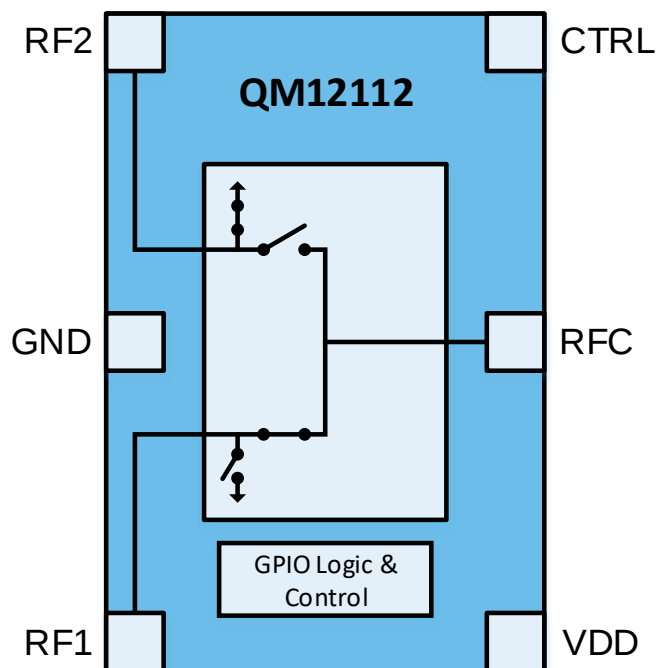


Product Description

The QM12112 is a low loss, high isolation SPDT switch with performance optimized for GSM, CDMA, WCDMA, & LTE applications requiring high linearity and high power handling. The QM12112 is controlled by 1 bit GPIO in a compact 0.7mm x 1.1mm, 6-pin module, which allows for a small solution size with no need for external DC blocking capacitors (when no external DC is applied to the device ports).

Functional Block Diagram



6 Pin 0.7 x 1.1 x 0.44 mm Package

Feature Overview

- <0.4dB typical insertion loss at 2.7GHz
- >30dB typical isolation at 2.7GHz
- One Bit GPIO Control
- Capable of 1.2V and 1.8V operation
- HBM Rating > 1kV on all ports
- Compact size: 0.7mm x 1.1mm x 0.44mm
- DC blocking capacitors are not required in typical applications

Applications

- Cellular Handset Applications
- Cellular Modems and USB Devices
- Multi-Mode GSM, EDGE, WCDMA, and LTE Applications Including NR frequencies N77-N79

Ordering Information

PART NO.	DESCRIPTION
QM12112EVB	Fully Assembled EVB
QM12112SB	5-pc Sample Bag
QM12112SR	100-pc, 7" Reel
QM12112TR13	10000-pc, 13" Reel

Absolute Maximum Ratings

PARAMETER	RATING
Storage Temperature	-40 to +125 °C
Operating Temperature	-30 to +90°C
V _{DD} Supply Voltage	3.5 V
CTRL Voltage	3.0 V
Maximum Peak Input Power	+36dBm, VSWR 1:1, 25 °C +35dBm, VSWR 3:1, 25 °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. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

Recommended Operating Conditions

PARAMETER	MIN.	TYP.	MAX.	UNITS
V _{DD} Supply Voltage	1.62	1.8	3.1	V
V _{DD} Supply Current		38	55	μA
CTRL Logic High Voltage	1.0	1.2/1.8	1.98	V
CTRL Logic Low Voltage	0.00	0.00	0.45	V
CTRL Logic High Current		10.0		nA
Switching Speed – Measured 50% CTRL to 90% RF		3.5	4	μs

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

Electrical Specifications

Test conditions unless otherwise stated: all unused RF ports terminated in 50Ω, Input and Output = 50Ω, T = 25°C.

V_{DD} = 1.8V, CTRL = 1.2V / 0 V, 1.8 V / 0 V

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS
Frequency Range		617		8240				MHz
Insertion Loss		T=25°C			T=-30°C to 90°C			
RFx to RFC	617 MHz to 960 MHz	---	0.2	0.35	---	0.2	0.35	dB
RFx to RFC	960 MHz to 2170 MHz	---	0.25	0.45	---	0.25	0.45	dB
RFx to RFC	2170 MHz to 2700 MHz	---	0.3	0.55	---	0.3	0.55	dB
RFx to RFC	3300 MHz to 3800 MHz	---	0.55	0.65	---	0.55	0.75	dB
RFx to RFC	3800 MHz to 4200 MHz	---	0.6	0.75	---	0.6	0.8	dB
RFx to RFC	4400 MHz to 5000 MHz	---	0.65	0.8	---	0.65	0.85	dB
RFx to RFC	5150 MHz to 5925 MHz	---	0.7	0.9	---	0.7	1.1	dB
With Matching *	5925 MHz to 6425 MHz	---	0.43		---	0.5		dB
Without Matching	5925 MHz to 6425 MHz	---	1.0		---	1.1		dB
With Matching *	6420 MHz to 6920 MHz	---	0.3		---	0.4		dB
Without Matching	6420 MHz to 6920 MHz	---	1.0		---	1.1		dB
With Matching *	7740 MHz to 8240 MHz	---	0.2		---	0.3		dB
Without Matching	7740 MHz to 8240 MHz	---	1.0		---	1.2		dB
* See UWB Matching Schematic for Ch5/9 performance								
Isolation		T=25°C			T=-30°C to 90°C			
RF1 to RF2	617 MHz to 960 MHz	30	50	---	30	50	---	dB
RFx to RFC		30	40	---	30	40	---	dB
RF1 to RF2	960 MHz to 2170 MHz	30	43	---	28	43	---	dB
RFx to RFC		30	34	---	28	34	---	dB
RF1 to RF2	2170 MHz to 2700 MHz	30	37	---	25	37	---	dB
RFx to RFC		25	30	---	25	30	---	dB
RF1 to RF2	3300 MHz to 3800 MHz	25	33	---	23	33	---	dB
RFx to RFC		23	27	---	21	27	---	dB
RF1 to RF2	3800 MHz to 5000 MHz	21	29	---	20	29	---	dB
RFx to RFC		21	24	---	20	24	---	dB
RF1 to RF2	5000 MHz to 6000 MHz	16	25	---	15	25	---	dB
RFx to RFC		16	20	---	15	20	---	dB
RF1 to RF2	5925 MHz to 6425 MHz		18	---		18	---	dB
RFx to RFC			16	---		15	---	dB
RF1 to RF2	6420 MHz to 6920 MHz		18	---		18	---	dB
RFx to RFC			16	---		15	---	dB
RF1 to RF2	7740 MHz to 8240 MHz		19	---		19	---	dB
RFx to RFC			16	---		16	---	dB
Harmonics								
VSWR = 1:1		T=25°C			T=-30°C to 90°C			

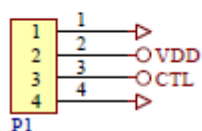
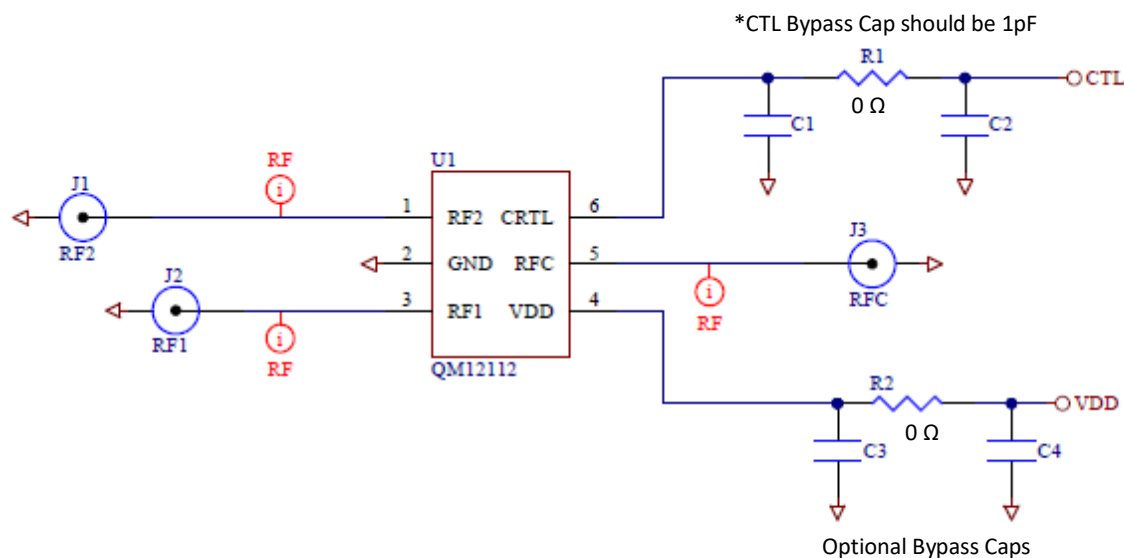
PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS
3Fo (B17)	fo = 704MHz; P _{in} = 26dBm; CW	---	-82	-55	---	-82	-55	dBm
2Fo (B8)	fo = 897.5MHz; P _{in} = 26dBm; CW	---	-88	-55	---	-88	-55	dBm
2Fo (GSM 850/900)	fo = 617 – 960MHz; Pin = 35dBm; CW	---	-70	-55	---	-70	-55	dBm
3Fo (GSM 850/900)	fo = 617 – 960MHz; Pin = 35dBm; CW	---	-61	-55	---	-61	-55	dBm
≥ 4Fo - 12.75GHz (GSM 850/900)	fo = 617 – 960MHz; Pin = 35dBm; CW	---	-84	-55	---	-84	-55	dBm
2Fo (GSM DCS/PCS)	fo = 960 – 2170MHz; Pin = 32dBm; CW	---	-73	-55	---	-73	-55	dBm
3Fo (GSM DCS/PCS)	fo = 960 – 2170MHz; Pin = 32dBm; CW	---	-67	-55	---	-67	-55	dBm
≥ 4Fo - 12.75GHz (GSM DCS/PCS)	fo = 960 – 2170MHz; Pin = 32dBm; CW	---	-87	-55	---	-87	-55	dBm
2Fo (B40/41)	fo = 2170 – 2700MHz; Pin = 26dBm; CW	---	-82	-55	---	-82	-55	dBm
3Fo (B40/41)	fo = 2170 – 2700MHz; Pin = 26dBm; CW	---	-88	-55	---	-88	-55	dBm
≥ 4Fo - 12.75GHz (B40/41)	fo = 2170 – 2700MHz; Pin = 26dBm; CW	---	-70	-55	---	-70	-55	dBm
2Fo (UHB)	fo = 3300 – 3800MHz; Pin = 26dBm; CW	---	-61	-55	---	-61	-55	dBm
3Fo (UHB)	fo = 3300 – 3800MHz; Pin = 26dBm; CW	---	-84	-55	---	-84	-55	dBm
≥ 4Fo - 12.75GHz (UHB)	fo = 3300 – 3800MHz; Pin = 26dBm; CW	---	-73	-55	---	-73	-55	dBm
2Fo (N77)	fo = 3800 – 4200MHz; Pin = 26dBm; CW	---	-67	-55	---	-67	-55	dBm
3Fo (N77)	fo = 3800 – 4200MHz; Pin = 26dBm; CW	---	-87	-55	---	-87	-55	dBm
≥ 4Fo - 12.75GHz (N77)	fo = 3800 – 4200MHz; Pin = 26dBm; CW	---	-82	-55	---	-82	-55	dBm
2Fo (N79)	fo = 4400 – 5000MHz; Pin = 26dBm; CW	---	-88	-55	---	-88	-55	dBm
3Fo (N79)	fo = 4400 – 5000MHz; Pin = 26dBm; CW	---	-70	-55	---	-70	-55	dBm
≥ 4Fo - 12.75GHz (N79)	fo = 4400 – 5000MHz; Pin = 26dBm; CW	---	-61	-55	---	-61	-55	dBm
2Fo (B46)	fo = 5150 – 5925MHz; Pin = 26dBm; CW	---	-84	-50	---	-84	-45	dBm
3Fo (B46)	fo = 5150 – 5925MHz; Pin = 26dBm; CW	---	-73	-55	---	-73	-55	dBm
≥ 4Fo - 12.75GHz (B46)	fo = 5150 – 5925MHz; Pin = 26dBm; CW	---	-67	-55	---	-67	-55	dBm
VSWR = 6:1		T=25°C			T=-30°C to 90°C			
3Fo (B17)	fo = 704MHz; P _{in} = 26dBm; CW	---	-71	-55	---	-71	-55	dBm
2Fo (B8)	fo = 897.5MHz; P _{in} = 26dBm; CW	---	-72	-55	---	-72	-55	dBm

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS
2Fo (GSM 850/900)	fo = 617 – 960MHz; Pin = 35dBm; CW	---	-50	-45	---	-50	-45	dBm
3Fo (GSM 850/900)	fo = 617 – 960MHz; Pin = 35dBm; CW	---	-50	-45	---	-50	-45	dBm
≥ 4Fo - 12.75GHz (GSM 850/900)	fo = 617 – 960MHz; Pin = 35dBm; CW	---	-76	-55	---	-76	-55	dBm
2Fo (GSM DCS/PCS)	fo = 960 – 2170MHz; Pin = 32dBm; CW	---	-58	-50	---	-58	-50	dBm
3Fo (GSM DCS/PCS)	fo = 960 – 2170MHz; Pin = 32dBm; CW	---	-58	-50	---	-58	-50	dBm
≥ 4Fo - 12.75GHz (GSM DCS/PCS)	fo = 960 – 2170MHz; Pin = 32dBm; CW	---	-65	-55	---	-65	-55	dBm
2Fo (B40/41)	fo = 2170 – 2700MHz; Pin = 26dBm; CW	---	-65	-55	---	-65	-55	dBm
2Fo (B40/41)	fo = 2170 – 2700MHz; Pin = 29dBm ; CW	---	-50	-35	---	-50	-32	dBm
3Fo (B40/41)	fo = 2170 – 2700MHz; Pin = 26dBm; CW	---	-67	-55	---	-67	-55	dBm
3Fo (B40/41)	fo = 2170 – 2700MHz; Pin = 29dBm ; CW	---	-60	-40	---	-60	-38	dBm
≥ 4Fo - 12.75GHz (B40/41)	fo = 2170 – 2700MHz; Pin = 26dBm; CW	---	-85	-55	---	-85	-55	dBm
2Fo (UHB)	fo = 3300 – 3800MHz; Pin = 26dBm; CW	---	-61	-55	---	-61	-55	dBm
2Fo (UHB)	fo = 3300 – 3800MHz; Pin = 29dBm ; CW	---	-60	-50	---	-60	-48	dBm
3Fo (UHB)	fo = 3300 – 3800MHz; Pin = 26dBm; CW	---	-84	-55	---	-84	-55	dBm
3Fo (UHB)	fo = 3300 – 3800MHz; Pin = 29dBm ; CW	---	-60	-50	---	-60	-48	dBm
≥ 4Fo - 12.75GHz (UHB)	fo = 3300 – 3800MHz; Pin = 26dBm; CW	---	-73	-55	---	-73	-55	dBm
2Fo (N77)	fo = 3800 – 4200MHz; Pin = 26dBm; CW	---	-63	-50	---	-63	-50	dBm
3Fo (N77)	fo = 3800 – 4200MHz; Pin = 26dBm; CW	---	-63	-50	---	-63	-50	dBm
≥ 4Fo - 12.75GHz (N77)	fo = 3800 – 4200MHz; Pin = 26dBm; CW	---	-84	-50	---	-84	-50	dBm
2Fo (N79)	fo = 4400 – 5000MHz; Pin = 26dBm; CW	---	-59	-50	---	-59	-50	dBm
2Fo (N79)	fo = 4400 – 5000MHz; Pin = 29dBm ; CW	---	-55	-45	---	-55	-42	dBm
3Fo (N79)	fo = 4400 – 5000MHz; Pin = 26dBm; CW	---	-65	-50	---	-65	-50	dBm
3Fo (N79)	fo = 4400 – 5000MHz; Pin = 29dBm ; CW	---	-60	-50	---	-60	-48	dBm
≥ 4Fo - 12.75GHz (N79)	fo = 4400 – 5000MHz; Pin = 26dBm; CW	---	-89	-50	---	-89	-50	dBm
2Fo (B46)	fo = 5150 – 5925MHz; Pin = 26dBm; CW	---	-55	-42	---	-55	-40	dBm

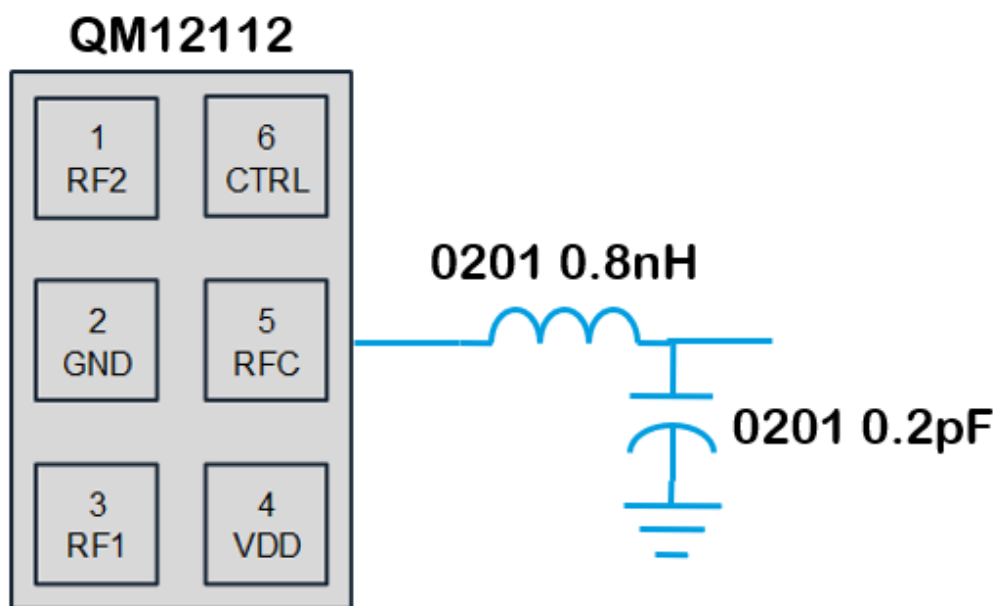
PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS
3Fo (B46)	fo = 5150 – 5925MHz; Pin = 26dBm; CW	---	-70	-50	---	-70	-50	dBm
≥ 4Fo - 12.75GHz (B46)	fo = 5150 – 5925MHz; Pin = 26dBm; CW	---	-92	-50	---	-92	-50	dBm
		T=25°C			T=-30°C to 90°C			
IMD2	Ftx = 20dBm; Fint = -15dBm							
Band VIII	Ftx = 880 MHz, Fint = 1805 MHz, Fmeas = 925 MHz, Measure on all Pins	---	-120	-100	---	-120	-100	dBm
Band II	Ftx = 1880 MHz, Fint = 3840 MHz, Fmeas = 1960 MHz, Measure on all Pins	---	-120	-100	---	-120	-100	dBm
Band VII	Ftx = 2535 MHz, Fint = 5190 MHz, Fmeas = 2655 MHz, Measure on all Pins	---	-120	-100	---	-120	-80	dBm

IMD3	Ftx = 20dBm; Fint = -15dBm							
Band VIII	Ftx = 897.5 MHz, Fint = 852.5 MHz, Fmeas = 942.5 MHz, Measure on all Pins	---	-120	-100	---	-120	-100	dBm
Band II	Ftx = 1880 MHz, Fint = 1800 MHz, Fmeas = 1960 MHz, Measure on all Pins	---	-120	-100	---	-120	-100	dBm
Band VII	Ftx = 2535 MHz, Fint = 2415 MHz, Fmeas = 2655 MHz, Measure on all Pins	---	-120	-100	---	-120	-80	dBm
VSWR		T=25°C			T=-30°C to 90°C			
Any RF Port	600 MHz to 960 MHz	---	1.05	1.5	---	1.05	1.5	:1
Any RF Port	1700 MHz to 2200 MHz	---	1.1	1.5	---	1.1	1.5	:1
Any RF Port	2300 MHz to 2700 MHz	---	1.25	1.5	---	1.25	1.5	:1
Any RF Port	3200 MHz to 4000 MHz	---	1.5	1.8	---	1.5	1.8	:1
Any RF Port	5000 MHz to 6000 MHz	---	1.7	2	---	1.7	2	:1

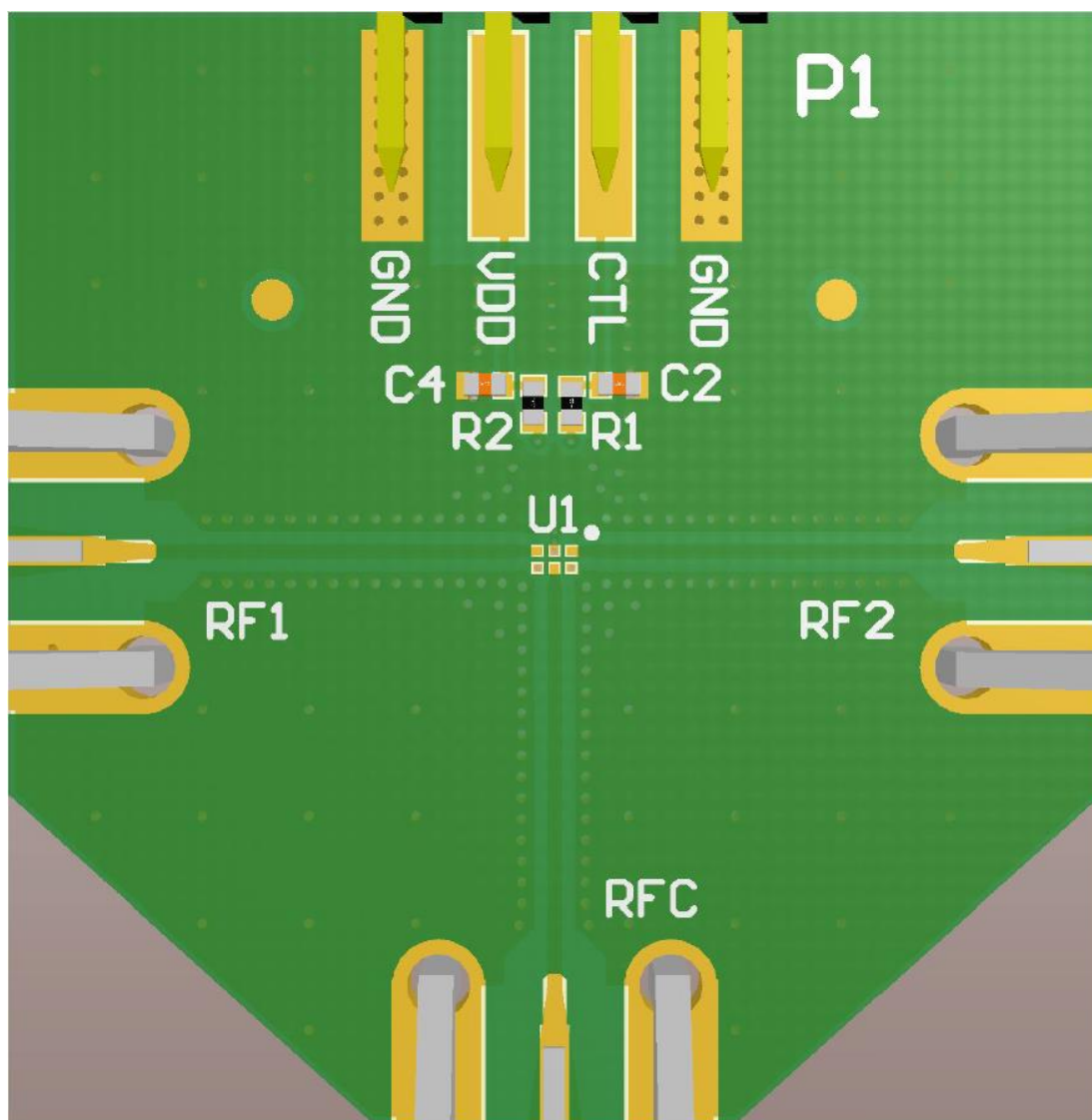
Application Circuit Schematic



UWB Matching Schematic



Evaluation Board Layout



Pin Configuration and Description



Top View

PIN NO.	LABEL	DESCRIPTION
1	RF2	RF Port
2	GND	Ground
3	RF1	RF Port
4	VDD	Power Supply Pin
5	RFC	RF Common Port
6	CTRL	Logic Control Pin

Control Logic

LOGIC STATE	V _{DD}	CTRL	DESCRIPTION
RF1 to RFC	"V _{DD} "	Low	RF1 to RFC active path, RF2 low impedance/reflective
RF2 to RFC	"V _{DD} "	High	RF2 to RFC active path, RF1 low impedance/reflective

Power On and Off Sequence

It is very important that the user adheres to the correct power-on/off sequence in order to avoid damaging the part. First apply V_{DD} before applying a high to CTRL.

Power On –

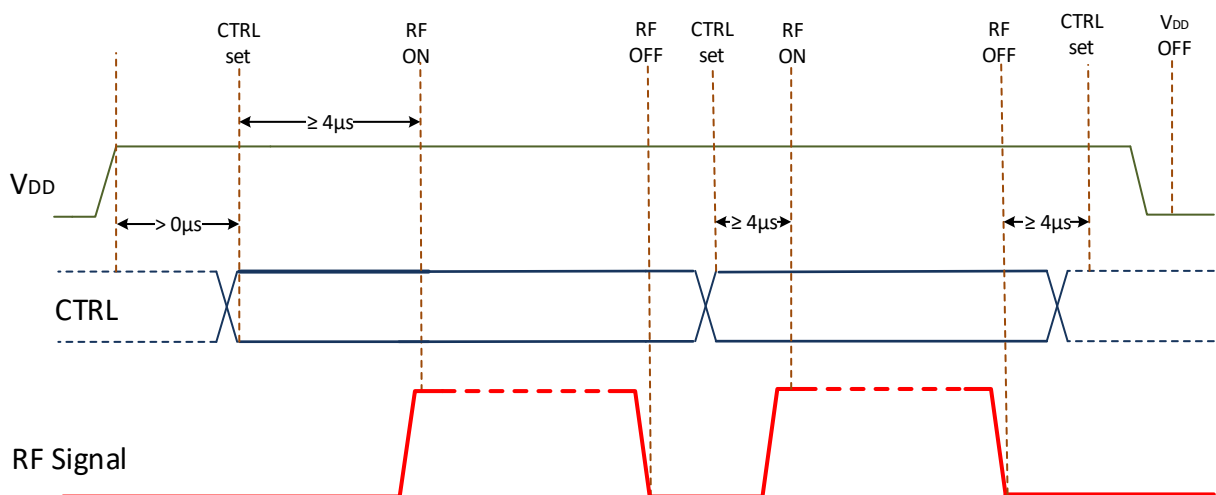
1. Apply voltage supply – V_{DD}
2. Apply logic signal – CTRL
3. Wait $4\mu s$ or greater after CTRL is stable and then apply the RF signal

Switching Ports –

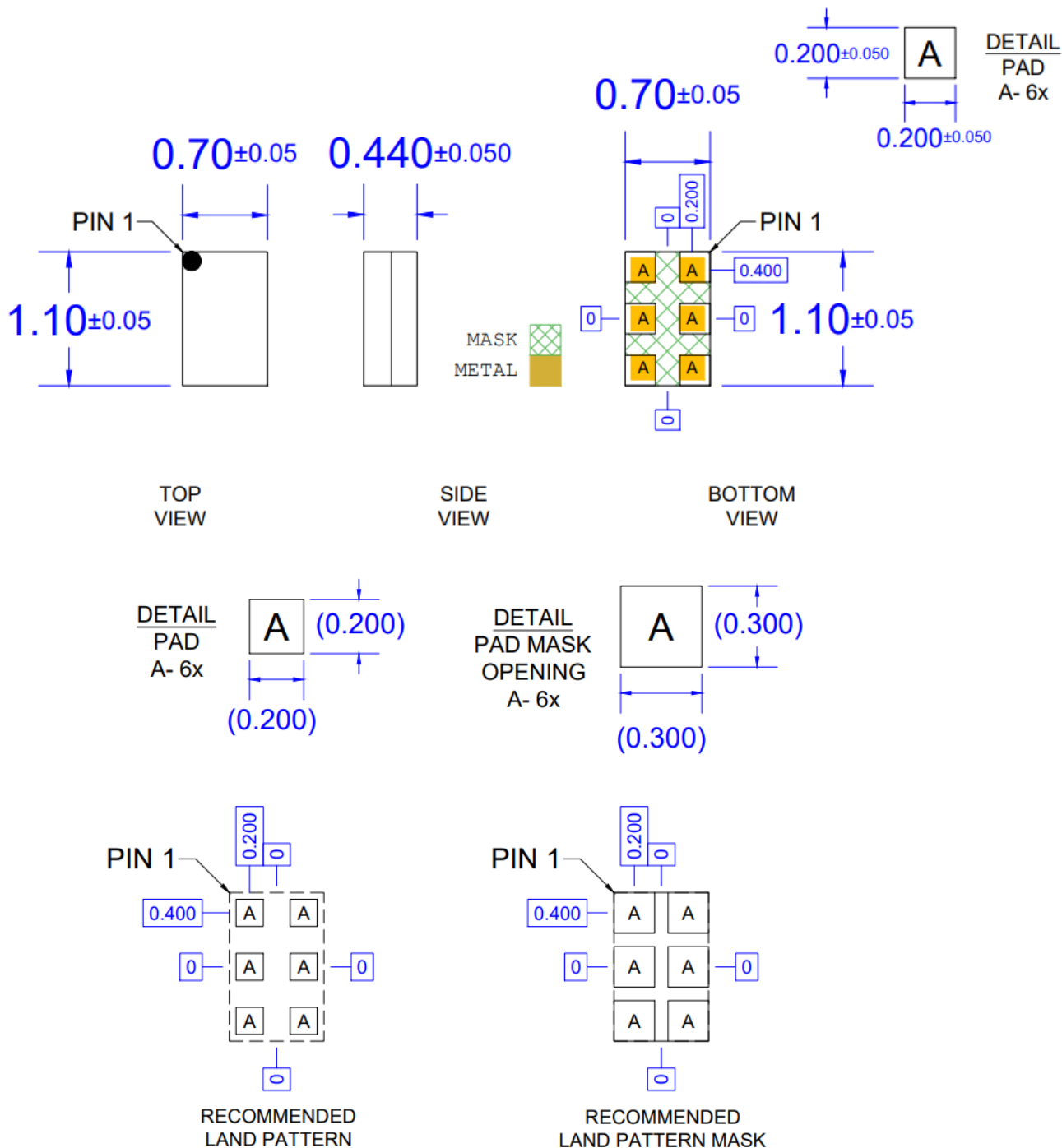
1. Remove the RF Signal
2. Change logic signal – CTRL
3. Wait $4\mu s$ or greater after CTRL is stable and then apply the RF signal

Power Off –

1. Remove the RF signal
2. Wait $4\mu s$ or greater and remove the logic signal – CTRL
3. Remove the voltage supply – V_{DD}



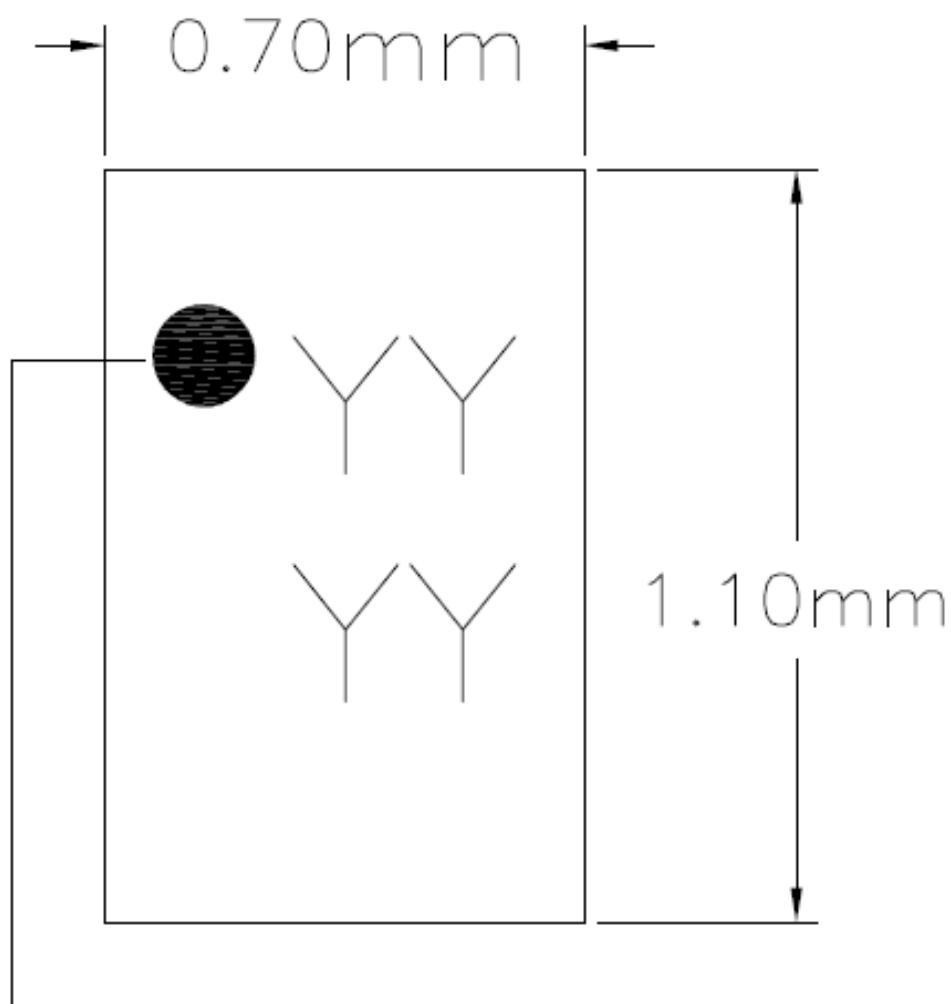
Mechanical Information



Notes:

1. All dimensions are in millimeters. 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.

Branding Diagram



Pin 1 Indicator

Trace Code to be assigned by SubCon

Where:

Y is Product Code

YYY is Trace Code

Tape and Reel Information

Qorvo Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units Per Reel
QM12112TR13	13 (330)	4 (102)	8	4	Single	10000
QM12112SR	7 (178)	2.5 (63)	8	4	Single	100

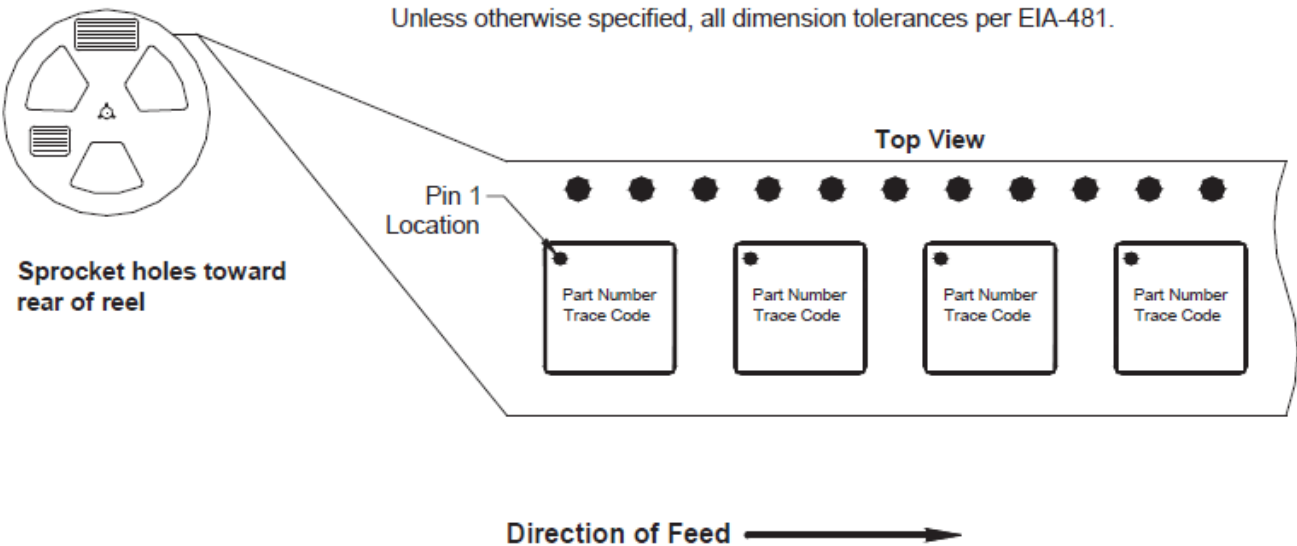


Figure 1. 0.70 mm x 1.10 mm (Carrier Tape Drawing with Part Orientation).

Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 2	ANSI/ESDA/JEDEC JS-001
ESD – Charge Device Model (CDM)	Class C3	ANSI/ESDA/JEDEC JS-002
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020



Caution!

ESD sensitive device

Solderability

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

Package lead plating: Electrolytic plated Au over Ni

RoHS 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
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- SVHC Free



Revision History

Revision Code	Date	Comments
A	12/20/2017	Initial Release
B	9/05/2018	Updated Max Power Handling
C	10/25/2018	Updated Part Ordering Numbers, typical data, and EVB drawings
D	4/10/2019	Updated ISO values
E	06/07/2019	Added NR frequencies to product feature
F	06/25/2019	Updated Part number in Tap and Reel
G	08/13/2019	Updated Switching Speed and Mechanical Drawing, added limits
H	08/30/2019	Updated IL Frequency range and Harmonics data
I	09/10/2019	Updated IL Frequency range and Harmonics data
J	09/17/2019	Updated with data over temp, updated harmonic freq range
K	10/16/2019	Added 29dBm Harmonic data over VSWR
L	2/13/2020	Updated Branding Diagram
M	3/26/2020	Added UWB IL and ISO data
N	6/08/2020	Added UWB Match data and Matching Schematic
O	8/16/2022	Updated Mechanical Drawing Dimensions and Added 1.2V VCTRL Spec
P	4/20/2023	Updated Electrical Specs
Q	6/21/2023	Updated Electrical AMR Spec

Contact Information

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

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