



RF1630

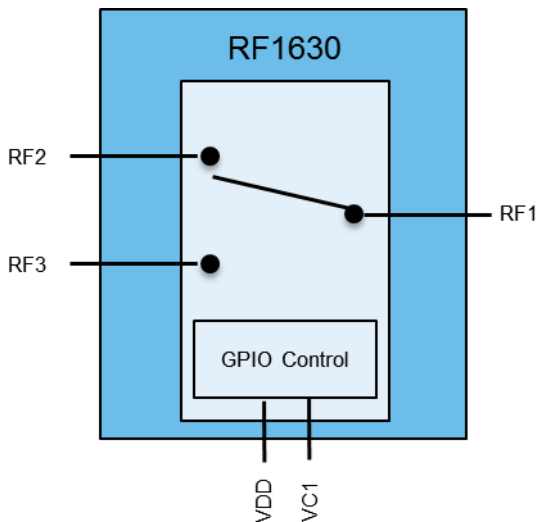
High Linearity SPDT Switch

Product Overview

The RF1630 is a single-pole, dual-throw (SPDT) switch which offers very low insertion loss along with excellent linearity performance. The RF1630 is ideal for UMTS and LTE handset applications. The RF1630 is controlled by a GPIO interface and resides in a compact 1.1 mm x 0.7 mm, 6-bump WLCSP, which allows for a small solution size with no need for external DC blocking capacitors in typical applications.



Functional Block Diagram



6 Bump WLCSP 1.1 x 0.7 x 0.55 mm

Key Features

- Excellent insertion loss and isolation performance
- Exceptional linearity and harmonic performance
- Ideal for LTE applications
- Very compact 1.1 mm x 0.7 mm x 0.55 mm WLCSP
- Very low current consumption
- Broadband performance suitable for all cellular modulation schemes up to 6GHz
- DC blocking capacitors are not required in typical applications

Applications

- Cellular Handsets
- Cellular Modems and USB Devices
- LTE, WCDMA, CDMA, and TD-SCDMA, Including NR frequencies N77-N79

Ordering Information

Part Number	Description
RF1630	Broadband SPDT Switch
RF1630SR	Broadband SPDT Switch 100-pc Sample Bag
RF1630TR7	Standard 7' Reel with 2500 pcs
RF1630TR13	Standard 13' Reel with 5000 pcs
RF1630PCBA-410	Fully Assembled Evaluation Board

Absolute Maximum Ratings

Parameter	Conditions	Rating
Storage Temperature		-55 to +125 °C
Operating Temperature		-35 to +90 °C
Power Supply (V _{DD})		3.5 V
Control Voltage (V _{c1})		3.5 V
Maximum Input Power		
Momentary Infrequent Occurrence	Temp = +85°C; CW; 6:1 VSWR	+33dBm
	Temp = +85°C; CW; 50Ω	+37dBm
Continuous Operation	Temp = +85°C; CW; 6:1 VSWR	+32dBm
	Temp = +85°C; CW; 50Ω	+35dBm

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

DC Control and Electrical Specifications

Parameter	Min.	Typ.	Max.	Units
V _{DD}	2.25	2.65	3.3	V
V _{DD} Supply Current (Active Mode)		59	90	μA
Control Voltage High	1.3	1.8	2.8	V
Control Voltage Low	0	0	0.45	V
Control Current		8	1000	nA
Switching Speed *		1.5	3	μs

* IL Based Switching speed measured from 10% to 90% RF after end of control message

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

Nominal Operating Parameters

Nominal conditions unless otherwise stated. $V_{DD} = 2.65V$, $V_{c1_{High}} = 1.8V$, $V_{c1_{Low}} = 0V$, Temp = 25°C, 50Ω. Unused ports terminated in 50Ω.

Parameter	Conditions	Min.	Typ.	Max.	Units
Broadband Performance		100		6000	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 100MHz to 1000MHz		0.18	0.33	dB
	Pin = 0dBm; 1001MHz to 1600MHz		0.20	0.38	dB
	Pin = 0dBm; 1601MHz to 2200MHz		0.22	0.45	dB
	Pin = 0dBm; 2201MHz to 3000MHz		0.26	0.52	dB
	Pin = 0dBm; 3001MHz to 4500MHz		0.30	0.65	dB
	Pin = 0dBm; 4501MHz to 6000MHz; RF2 – RF1		0.45	0.90	dB
	Pin = 0dBm; 4501MHz to 6000MHz; RF3 – RF1		0.54	1.00	dB
Isolation					
Inactive Port to RF1	Pin = 0dBm; 100 MHz to 1000 MHz	32	42		dB
	Pin = 0dBm; 1001 MHz to 1600 MHz	30	37		dB
	Pin = 0dBm; 1601 MHz to 2200 MHz	27	33		dB
	Pin = 0dBm; 2201 MHz to 3000 MHz	25	30		dB
	Pin = 0dBm; 3001 MHz to 4500 MHz	20	26		dB
	Pin = 0dBm; 4501 MHz to 6000 MHz	15	22		dB
VSWR					
Common Port (RF1)	Pin = 0dBm; 100 MHz to 1000 MHz		1.11	1.3	:1
	Pin = 0dBm; 1001 MHz to 1600 MHz		1.17	1.3	:1
	Pin = 0dBm; 1601 MHz to 2200 MHz		1.19	1.4	:1
	Pin = 0dBm; 2201 MHz to 3000 MHz		1.20	1.5	:1
	Pin = 0dBm; 3001 MHz to 4500 MHz		1.35		:1
	Pin = 0dBm; 4501 MHz to 6000 MHz		1.68		:1
Active Port (RF2 or RF3)	Pin = 0dBm; 100 MHz to 1000 MHz		1.11	1.3	:1
	Pin = 0dBm; 1001 MHz to 1600 MHz		1.17	1.3	:1
	Pin = 0dBm; 1601 MHz to 2200 MHz		1.19	1.4	:1
	Pin = 0dBm; 2201 MHz to 3000 MHz		1.20	1.5	:1
	Pin = 0dBm; 3001 MHz to 4500 MHz		1.35		:1
	Pin = 0dBm; 4501 MHz to 6000 MHz		1.68		:1
Inactive Switched Port (RF2 or RF3)	Pin = 0dBm; 100 MHz to 1000 MHz		8.1		:1
	Pin = 0dBm; 1001 MHz to 1600 MHz		7.8		:1
	Pin = 0dBm; 1601 MHz to 2200 MHz		7.9		:1
	Pin = 0dBm; 2201 MHz to 3000 MHz		7.8		:1
	Pin = 0dBm; 3001 MHz to 4500 MHz		7.4		:1
	Pin = 0dBm; 4501 MHz to 6000 MHz		7.0		:1
Low Band		698		787	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 698MHz to 787MHz		0.18	0.32	dB



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Parameter	Conditions	Min.	Typ.	Max.	Units
Low Band (Continued)		698		787	MHz
Isolation					
Inactive Port to RF1	Pin = 0dBm; 1710MHz to 2170MHz	32	40		dB
Harmonics					
RF2 or RF3 to RF1, 2fo	Pin = 26dBm, CW; fo = 698MHz to 787MHz		-90	-65	dBm
RF2 or RF3 to RF1, 3fo	Pin = 26dBm, CW; fo = 698MHz to 787MHz		-84	-60	dBm
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 26dBm, CW; fo = 698MHz to 787MHz		-90	-65	dBm
VSWR					
Active Switched Port (RF2 or RF3)	698MHz to 787MHz		1.1	1.3	:1
RF1	698MHz to 787MHz		1.1	1.3	:1
Low Band		824		960	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 824MHz to 960MHz		0.18	0.33	dB
	Pin = 0dBm; 824MHz		0.18	0.32	dB
Isolation					
Inactive Port to RF1	Pin = 0dBm; 824MHz to 960MHz	32	40		dB
Harmonics					
RF2 or RF3 to RF1, 2fo	Pin = 26dBm, CW; fo = 824MHz to 915MHz		-90	-65	dBm
	Pin = 26dBm, CW; fo = 824MHz		-90	-65	dBm
RF2 or RF3 to RF1, 3fo	Pin = 26dBm, CW; fo = 824MHz to 915MHz		-84	-60	dBm
	Pin = 26dBm, CW; fo = 824MHz		-84	-60	dBm
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 26dBm, CW; fo = 824MHz to 915MHz		-75	-65	dBm
RF2 or RF3 to RF1, 2fo	Pin = 35dBm, CW; fo = 824MHz to 915MHz		-72		dBm
RF2 or RF3 to RF1, 3fo	Pin = 35dBm, CW; fo = 824MHz to 915MHz		-55		
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 35dBm, CW; fo = 824MHz to 915MHz			-80	
VSWR					
Active Switched Port (RF2 or RF3)	824MHz to 960MHz		1.1	1.3	:1
RF1	824MHz to 960MHz		1.1	1.3	:1
Mid Band		1710		2170	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 1710MHz to 2170MHz		0.23	0.45	dB
Isolation					
Inactive Port to RF1	Pin = 0dBm; 1710MHz to 2170MHz	27	33		dB
Harmonics					
RF2 or RF3 to RF1, 2fo	Pin = 26dBm, CW; fo = 1710MHz to 1910MHz		-81	-55	dBm
RF2 or RF3 to RF1, 3fo	Pin = 26dBm, CW; fo = 1710MHz to 1910MHz		-79	-55	dBm
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 26dBm, CW; fo = 1710MHz to 1910MHz		-90	-55	dBm
RF2 or RF3 to RF1, 2fo	Pin = 33dBm, CW; fo = 1710MHz to 1910MHz		-68		dBm
RF2 or RF3 to RF1, 3fo	Pin = 33dBm, CW; fo = 1710MHz to 1910MHz		-56		

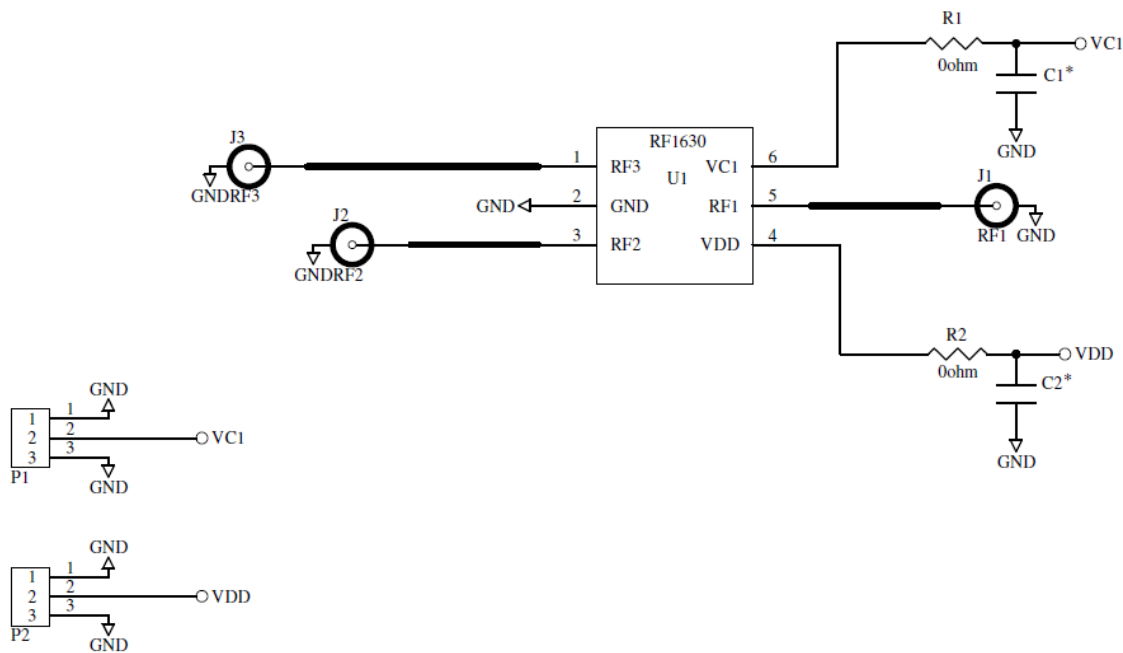


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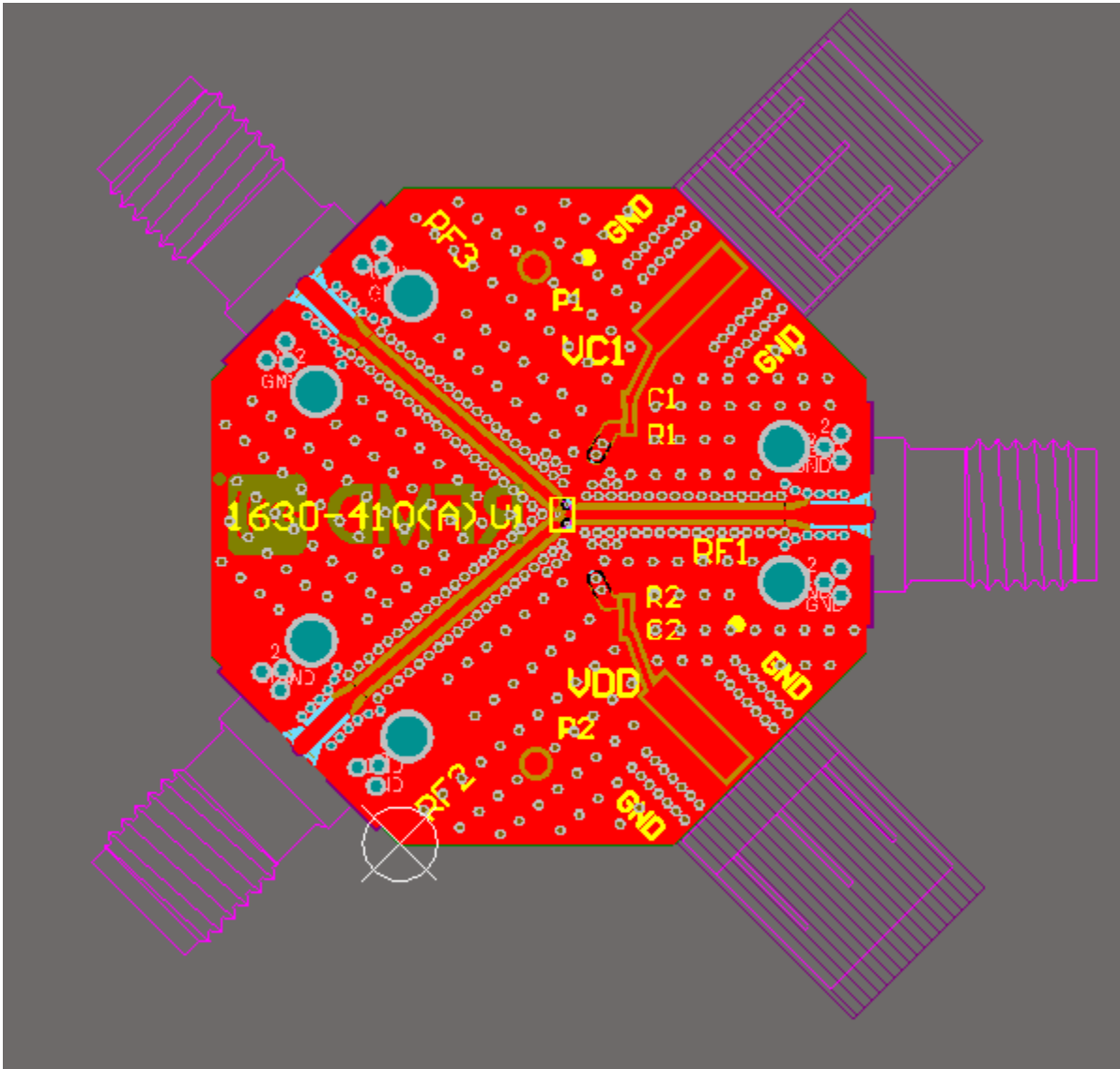
Parameter	Conditions	Min.	Typ.	Max.	Units
Mid Band (Continued)		1710		2170	MHz
Harmonics (Continued)					
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 33dBm, CW; fo = 1710MHz to 1910MHz			-80	
VSWR					
Active Switched Port (RF2 or RF3)	1710MHz to 2170MHz		1.2	1.4	:1
RF1	1710MHz to 2170MHz		1.2	1.4	:1
High Band		2500		2690	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 2500MHz to 2690MHz		0.26	0.51	dB
	Pin = 0dBm; 2570MHz		0.23	0.48	dB
Isolation					
Inactive Port to RF1	Pin = 0dBm; 2500MHz to 2690MHz	25	30		dB
Harmonics					
RF2 or RF3 to RF1, 2fo	Pin = 26dBm, CW; fo = 2500MHz to 2570MHz		-78	-50	dBm
	Pin = 26dBm; 2570MHz		-72	-50	dBm
RF2 or RF3 to RF1, 3fo	Pin = 26dBm, CW; fo = 2500MHz to 2570MHz		-76	-50	dBm
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 26dBm, CW; fo = 2500MHz to 2570MHz		-90	-50	dBm
Harmonics Into Mismatch					
RF2 or RF3 to RF1, 2fo	Pin = 26dBm, CW; fo = 2500MHz to 2570MHz; VSWR = 2.5:1		-77	-50	dBm
RF2 or RF3 to RF1, 3fo	Pin = 26dBm, CW; fo = 2500MHz to 2570MHz; VSWR = 2.5:1		-78	-50	dBm
RF2 or RF3 to RF1, up to 12.75GHz	Pin = 26dBm, CW; fo = 2500MHz to 2570MHz; VSWR = 2.5:1		-90	-50	dBm
VSWR					
Active Switched Port (RF2 or RF3)	2500MHz to 2690MHz		1.25	1.5	:1
RF1	2500MHz to 2690MHz		1.25	1.5	:1
Ultra High Band		3400		3800	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 3400MHz to 3800MHz		0.45	0.65	dB
Isolation					
Inactive Port to RF1	Pin = 0dBm; 3400MHz to 3800MHz	22	28		dB
Harmonics					
RF2 or RF3 to RF1, 2fo	Pin = 26dBm, CW; fo = 3400MHz to 3800MHz		-79		dBm
	Pin = 26dBm; 3600MHz		-80		dBm
RF2 or RF3 to RF1, 3fo	Pin = 26dBm, CW; fo = 3400MHz to 3800MHz		-76		dBm
VSWR					
Active Switched Port (RF2 or RF3)	3400MHz to 3800MHz		1.50		:1
RF1	3400MHz to 3800MHz		1.50		:1

Parameter	Conditions	Min.	Typ.	Max.	Units
LTE-U		5000		6000	MHz
Insertion Loss					
Active Port to RF1	Pin = 0dBm; 5000MHz to 5800MHz		0.53	1.00	dB
Isolation					
Inactive Port to RF1	Pin = 0dBm; 5000MHz to 5800MHz	15	21		dB
VSWR					
Active Switched Port (RF2 or RF3)	5000MHz to 5800MHz		1.69		:1
RF1	5000MHz to 5800MHz		1.69		:1

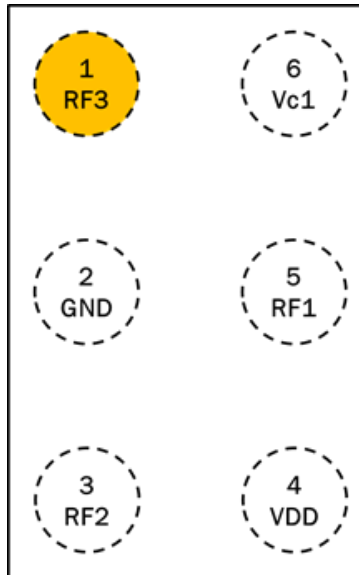
Application Circuit Schematic and Layout



Note: C1 and C2 are not required for switch operation



Pin Configuration and Description



Bumps Down

Pin Number	Label	Description
1	RF3	RF Port
2	GND	Ground
3	RF2	RF Port
4	VDD	Supply Voltage
5	RF1	RF Common Port
6	VC1	Control

Control Logic

The Switch is controlled by V_{DD} , and $Vc1$.

LOGIC STATE	V_{DD}	$VC1$	DESCRIPTION
RF1 – RF2	“ V_{DD} ”	Low	Active path is RF1 to RF2. RF3 is low impedance/reflective
RF1 – RF3	“ V_{DD} ”	High	Active path is RF1 to RF3. RF3 is low impedance/reflective

Power On and Off Sequence

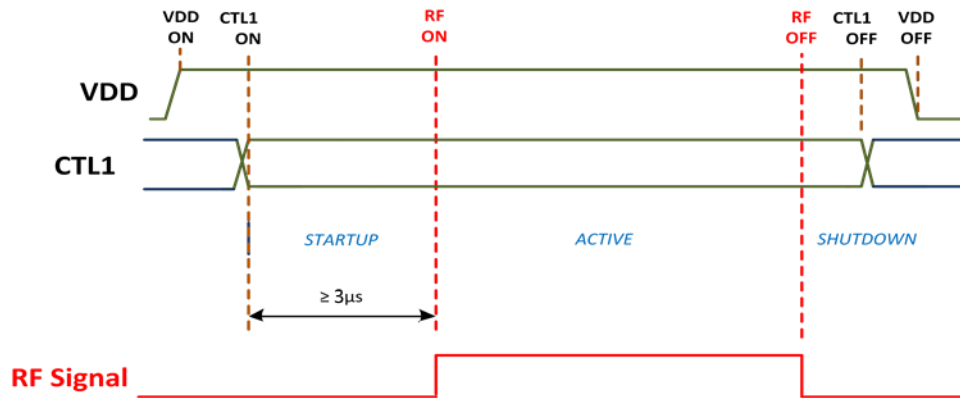
It is very important that the user adheres to the correct power-on/off sequence in order to avoid damaging the part. First apply V_{DD} before applying a high to CTL .

Power On –

1. Apply voltage supply – V_{DD}
2. Apply Logic signal – V_{c1}
3. Wait 5 μ s or greater and then apply the RF signal

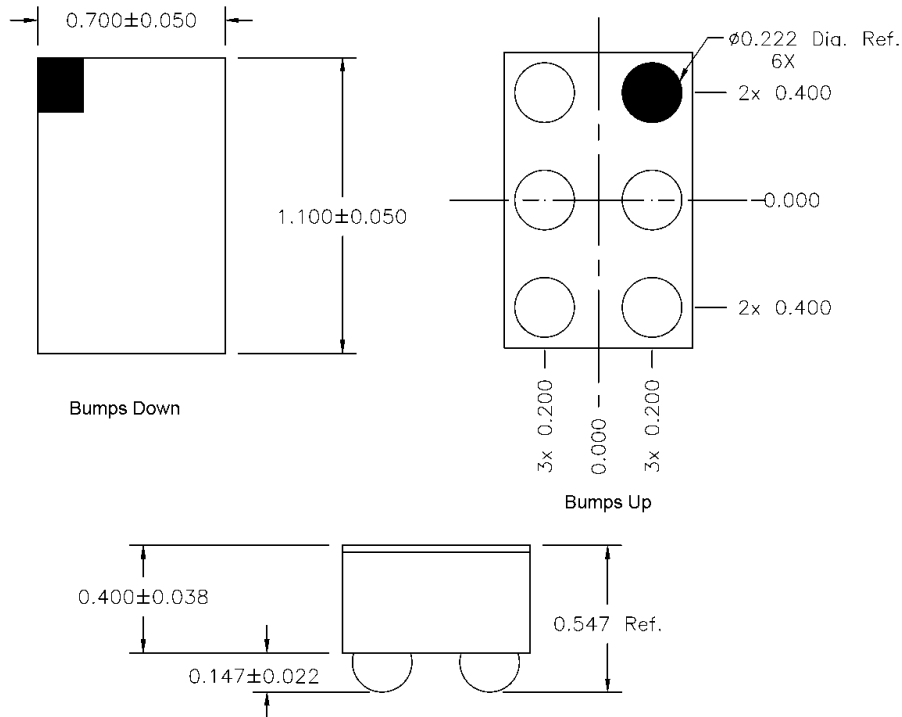
Power Off –

1. Remove the RF signal
2. Remove the logic signal – V_{c1}
3. Remove the voltage supply – V_{DD}

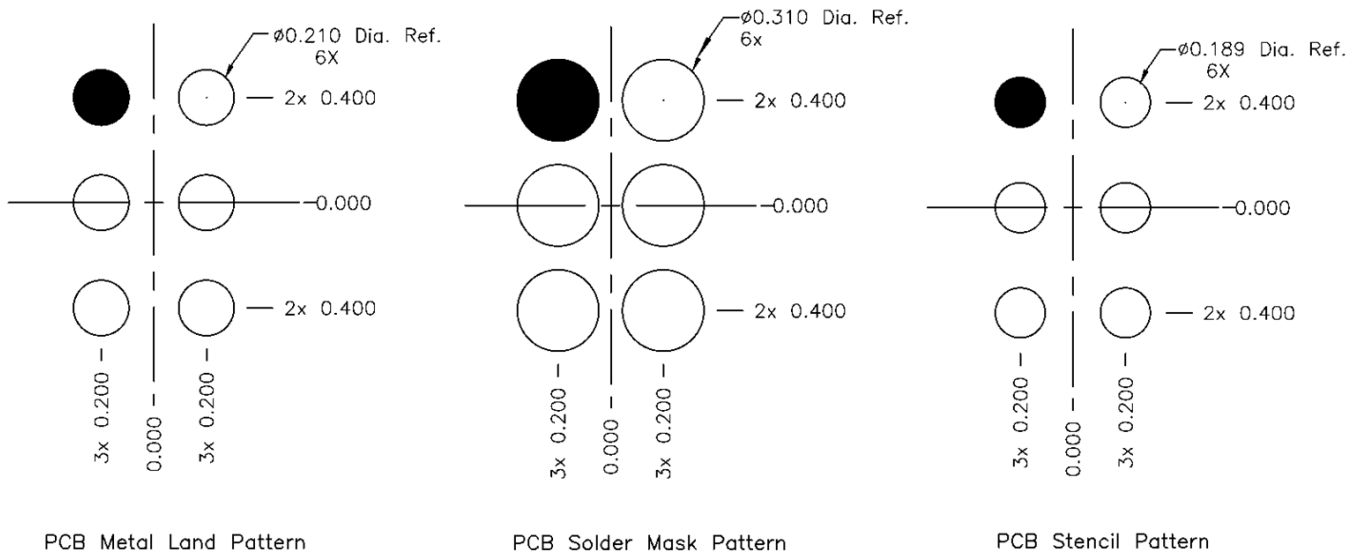


Mechanical Information

Package Outline



PCB Pattern



Notes:

1. All dimensions are in microns. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. Shaded area represents Pin 1 location.
4. UBM dimension is 0.210um

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 2	ESDA/JEDEC JS-001-2012
MSL – Moisture Sensitivity Level	Level 1	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: Sn/Ag/Cu Solder ball

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	2/20/2013	Initial Release
B	9/24/2013	Include evb schematic & layout
E	9/03/2014	Add timing diagram, harmonics under higher power, Clarify Max power handling in AMR table
G	5/13/2016	Added TR7 option in Ordering Information section on first page.
H	7/11/2016	Update IL limits for 6GHz
I	7/19/2016	Add B42 detailed electrical parameters
J	9/06/2016	Updated to Qorvo Template and added UBM dimension
K	8/28/2017	Added data for LTE-U (5.0 – 6.0GHz)
L	4/12/2019	Updated Switching Speed and Timing Diagram
M	6/07/2019	Update Product Feature with NR frequencies

Contact Information

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

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