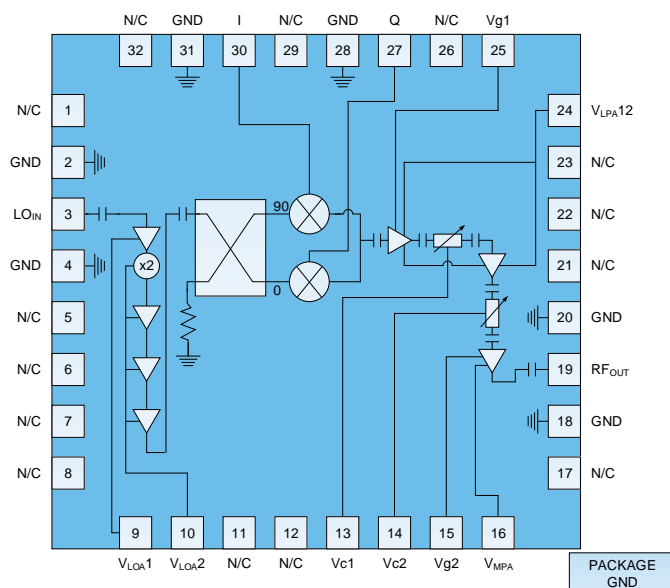


### General Description

Qorvo's RFUV1703 is a 21 GHz to 26.5 GHz GaAs pHEMT upconverter, incorporating an integrated doubler, LO buffer amplifier, a balanced single sideband (image rejection) mixer followed by Variable Gain Amplifier, DC decoupling capacitors. The combination of high performance part and low-cost packaging makes the RFUV1703 a cost effective solution, ideally suited to both current and next generation point-to-point and  $V_{SAT}$  applications. RFUV1703 is packaged in a 5 mm x 5 mm QFN to simplify both system level board design and volume assembly.

Lead-free and RoHS compliant

### Functional Block Diagram



Package: QFN, 32 Pin, 5 mm x 5 mm x 0.95 mm

### Product Features

- RF Frequency: 21 GHz to 26.5 GHz
- LO Frequency (LSB): 10.5 GHz to 15.2 GHz
- LO Frequency (USB): 8.5 GHz to 13.25 GHz
- IF Frequency: DC to 4 GHz
- Conversion Gain (Max): 21 dB
- Conversion Gain (Min): -10 dB
- NF (Max. Gain): 12 dB
- OIP3 (Max. Gain): +27 dBm
- Image Rejection: 15 dBc

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

### Applications

- Point-to-Point
- $V_{SAT}$

### Ordering Information

Part	Description
RFUV1703S2	2-Piece Sample Bag
RFUV1703SB	5-Piece Bag
RFUV1703SQ	25-Piece Bag
RFUV1703SR	100 Pieces on 7" reel
RFUV1703TR7	750 Pieces on 7" reel
RFUV1703PCBA-410	Evaluation Board

## Absolute Maximum Ratings

Parameter	Rating	Unit
LPA Drain Voltage $V_D$	6	V
LOA Drain Voltage	6	V
IF Input Power	15	dBm
LO Input Power	15	dBm
Storage Temperature	-65 to +150	°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.

## Nominal Operating Parameters

Parameter	Specification			Units	Condition
	Min	Typical	Max		
RF Frequency	21		26.5	GHz	
LO Frequency: LSB	10.5		15.25	GHz	
LO Frequency: USB	8.5		13.25	GHz	
IF Frequency	DC	2.5	4.0	GHz	
LO input Drive		0		dBm	
Conversion Gain (Max.) (USB)	19	21		dB	LO = 9.95 GHz & 11.5 GHz
Conversion Gain (Min.) (USB)	-5.5	-5		dB	LO = 9.95 GHz & 11.5 GHz
OIP3 (Max. Gain) (USB)	23.5	29		dBm	LO = 9.95 GHz
OIP3 (-5 dB Gain) (USB)	0.5	6.5		dBm	LO = 9.95 GHz
OIP3 (Max. Gain) (USB)	20.5	27		dBm	LO = 11.5 GHz
OIP3 (-5 dB Gain) (USB)	4	9		dBm	LO = 11.5 GHz
Image Rejection (Max. Gain) (USB)	15	20		dBc	LO = 9.95 GHz
Image Rejection (Max. Gain) (USB)	14	20		dBc	LO = 11.5 GHz
LO Leakage @ RF-Port (Max. Gain) (USB)		-10	5	dBm	LO = 9.95 GHz
LO Leakage @ RF-Port (Max. Gain) (USB)		1	7.5	dBm	LO = 11.5 GHz
NF (Max. Gain)		12		dB	
LO Return Loss		10		dB	
RF Return Loss		10		dB	
$V_{LOA}$		4		V	
$V_{LPA}$		3.5		V	
$V_{MOA}$		4.5		V	
$I_{LOA}$		205		mA	
$I_{LOA1,2}$		120		mA	
$I_{MPA}$		120		mA	
$I_{TOTAL}$		445		mA	
$V_{C1}, V_{C2}$	-4		0	V	
Operating Temperature	-55	25	85	°C	

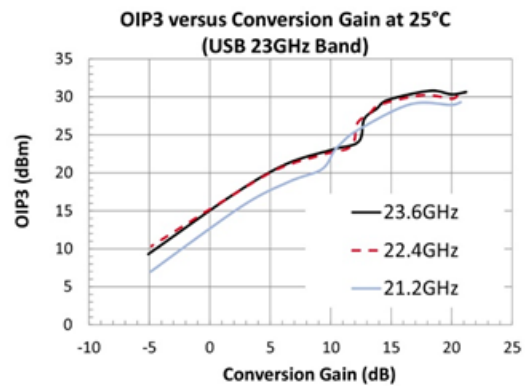
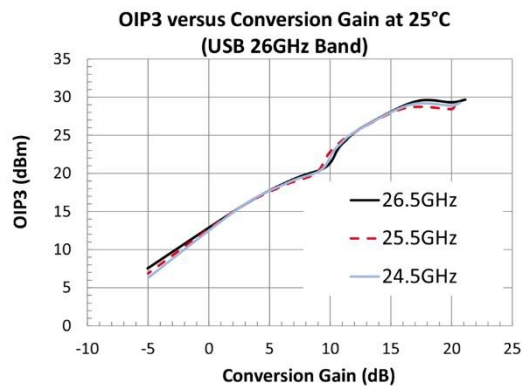
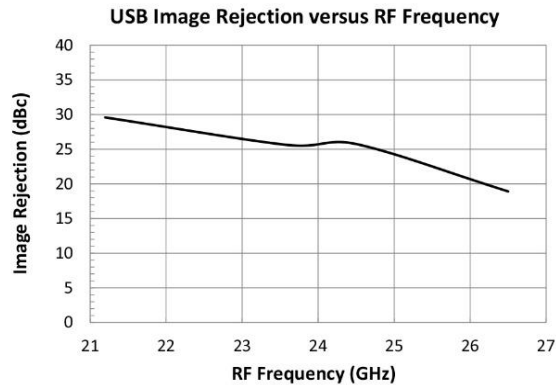
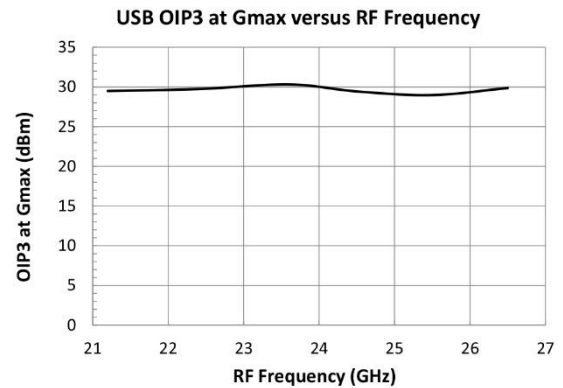
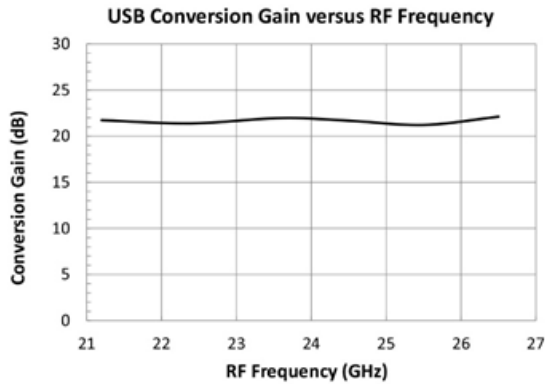
## Performance Plots – USB Conversion

Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid

Test conditions unless otherwise noted: LO Power = 0 dBm and IF = 2.5 GHz, -10 dBm

$V_{LOA1} = V_{LOA2} = 4$  V,  $I_{LOA1,2} = 205$  mA;  $V_{LPA12} = 3.5$  V, Adjust  $V_{G1}$  around -0.4 V to get  $I_{LPA12} = 120$  mA

$V_{MPA} = 4.5$  V, Adjust  $V_{G2}$  to get  $I_{MPA} = 120$  mA,  $I_{TOTAL} = 445$  mA,  $V_{C1} = V_{C2} = -4$  V



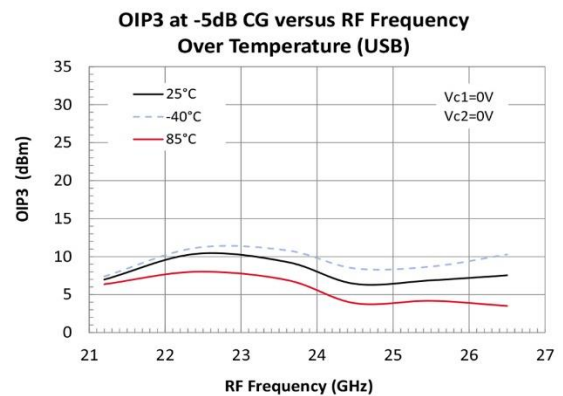
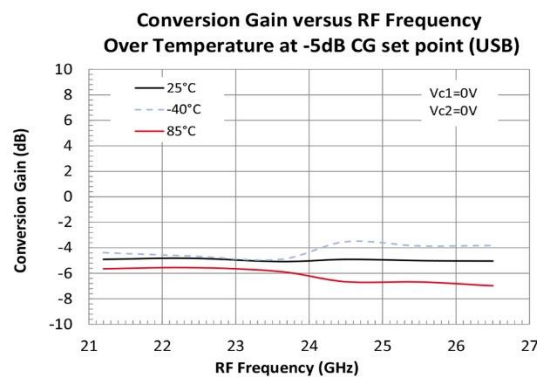
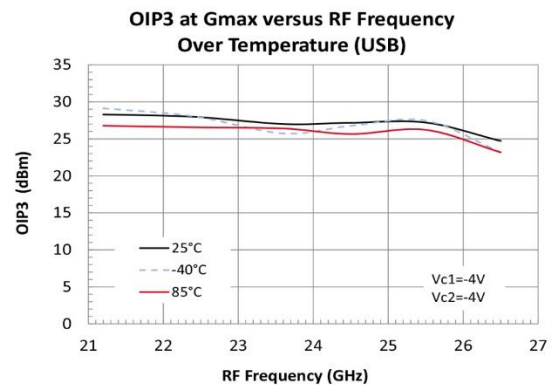
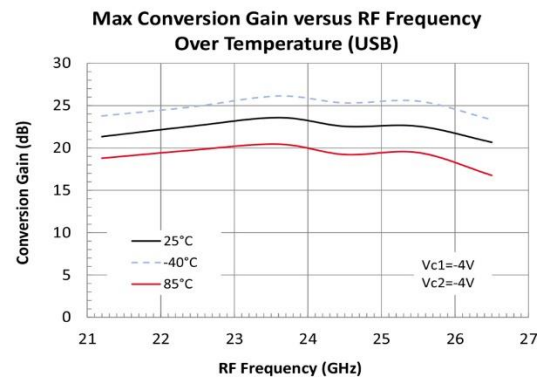
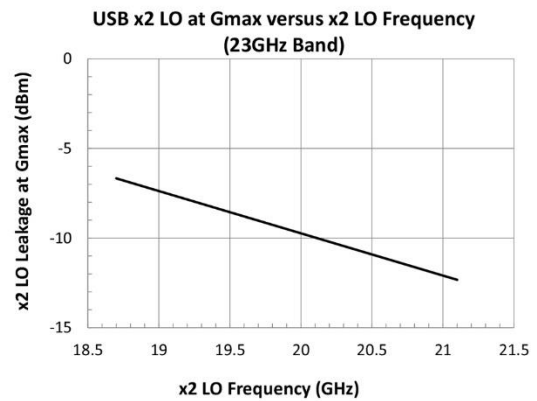
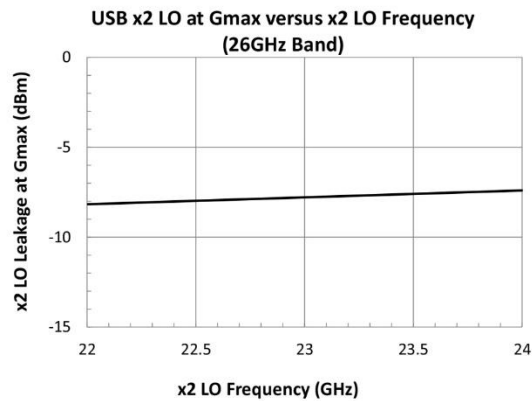
## Performance Plots – USB LO Leakage & Over Temperature

Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid

Test conditions unless otherwise noted: LO Power = 0 dBm and IF = 2.5 GHz, -10 dBm

$V_{LOA1} = V_{LOA2} = 4$  V,  $I_{LOA1,2} = 205$  mA;  $V_{LPA12} = 3.5$  V, Adjust  $V_{G1}$  around -0.4 V to get  $I_{LPA12} = 120$  mA

$V_{MPA} = 4.5$  V, Adjust  $V_{G2}$  to get  $I_{MPA} = 120$  mA,  $I_{TOTAL} = 445$  mA,  $V_{C1} = V_{C2} = -4$  V



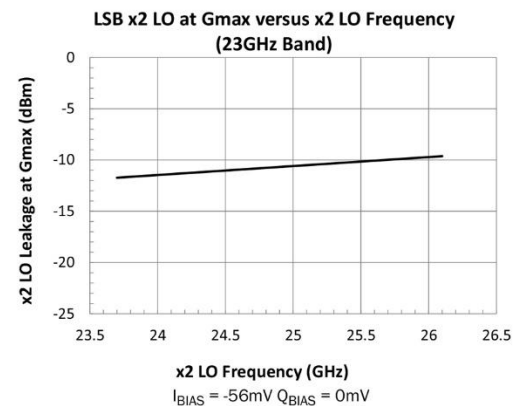
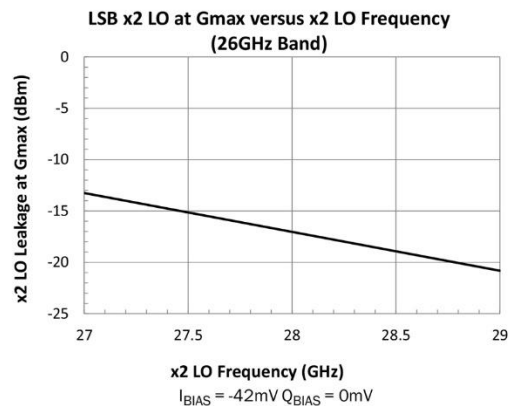
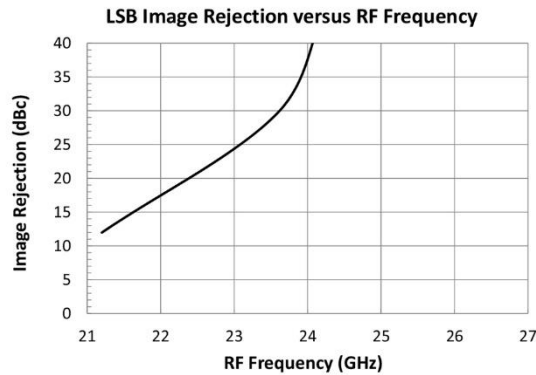
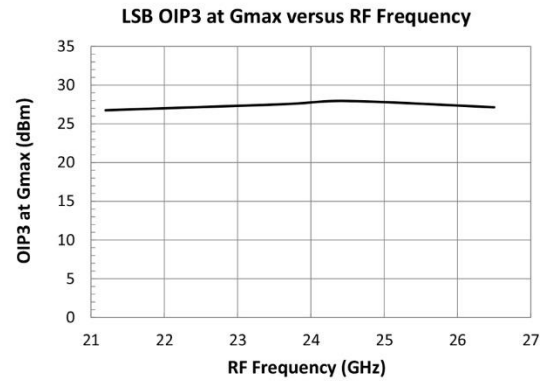
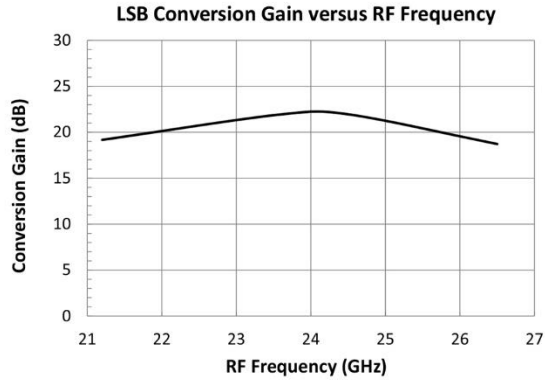
## Performance Plots – LSB Conversion & LO Leakage

Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid

Test conditions unless otherwise noted: LO Power = 0 dBm and IF = 2.5 GHz, -10 dBm

$V_{LOA1} = V_{LOA2} = 4$  V,  $I_{LOA1,2} = 205$  mA;  $V_{LPA12} = 3.5$  V, Adjust  $V_{G1}$  around -0.4 V to get  $I_{LPA12} = 120$  mA

$V_{MPA} = 4.5$  V, Adjust  $V_{G2}$  to get  $I_{MPA} = 120$  mA,  $I_{TOTAL} = 445$  mA,  $V_{C1} = V_{C2} = -4$  V



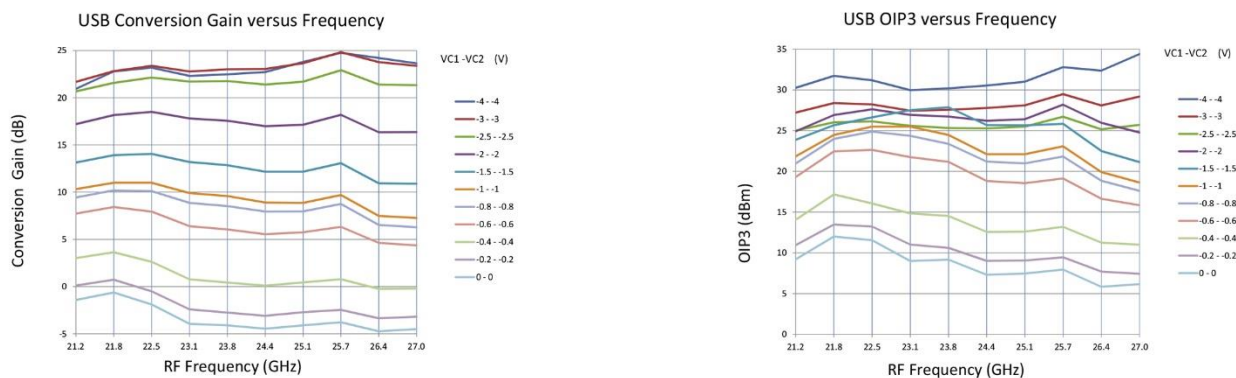
## Performance Plots – USB: Without IQ Bias

Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid

Test conditions unless otherwise noted: LO Power = 0 dBm and IF = 2.5 GHz, -10 dBm

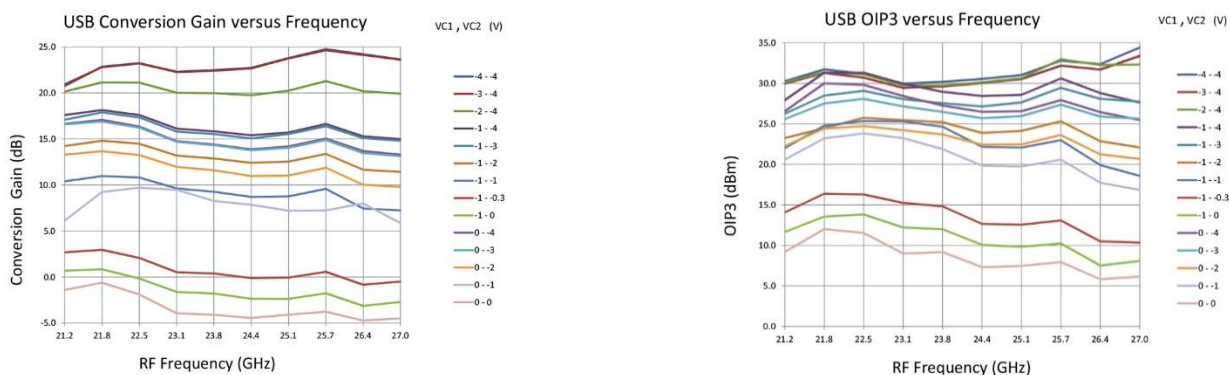
$V_{MPA} = 4.5\text{ V}$ ,  $V_{LPA12} = 3.5\text{ V}$ ,  $V_{LOA1} = V_{LOA2} = 4\text{ V}$ ,  $I_{TOTAL} = 445\text{ mA}$ ,  $V_{G1} = V_{G2} = -0.4\text{ V}$

$V_{C1}$  and  $V_{C2}$  are connected together off chip and changes over (-4 V to 0 V): **Single Control Bias**



$V_{MPA} = 4.5\text{ V}$ ,  $V_{LPA12} = 3.5\text{ V}$ ,  $V_{LOA1} = V_{LOA2} = 4\text{ V}$ ,  $I_{TOTAL} = 445\text{ mA}$ ,  $V_{G1} = V_{G2} = -0.4\text{ V}$

$V_{C1}$  and  $V_{C2}$  are separated controlled and changes over (-4 V to 0 V): **Double Control Bias**



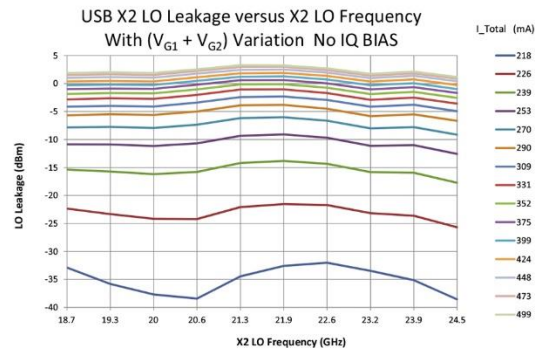
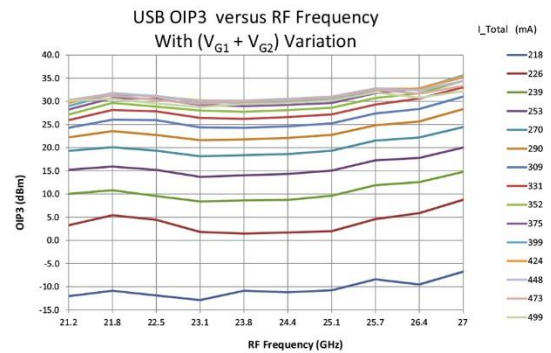
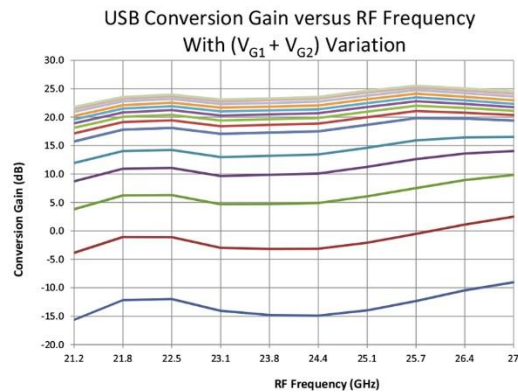
## Performance Plots – USB: Without IQ Bias (continued)

Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid

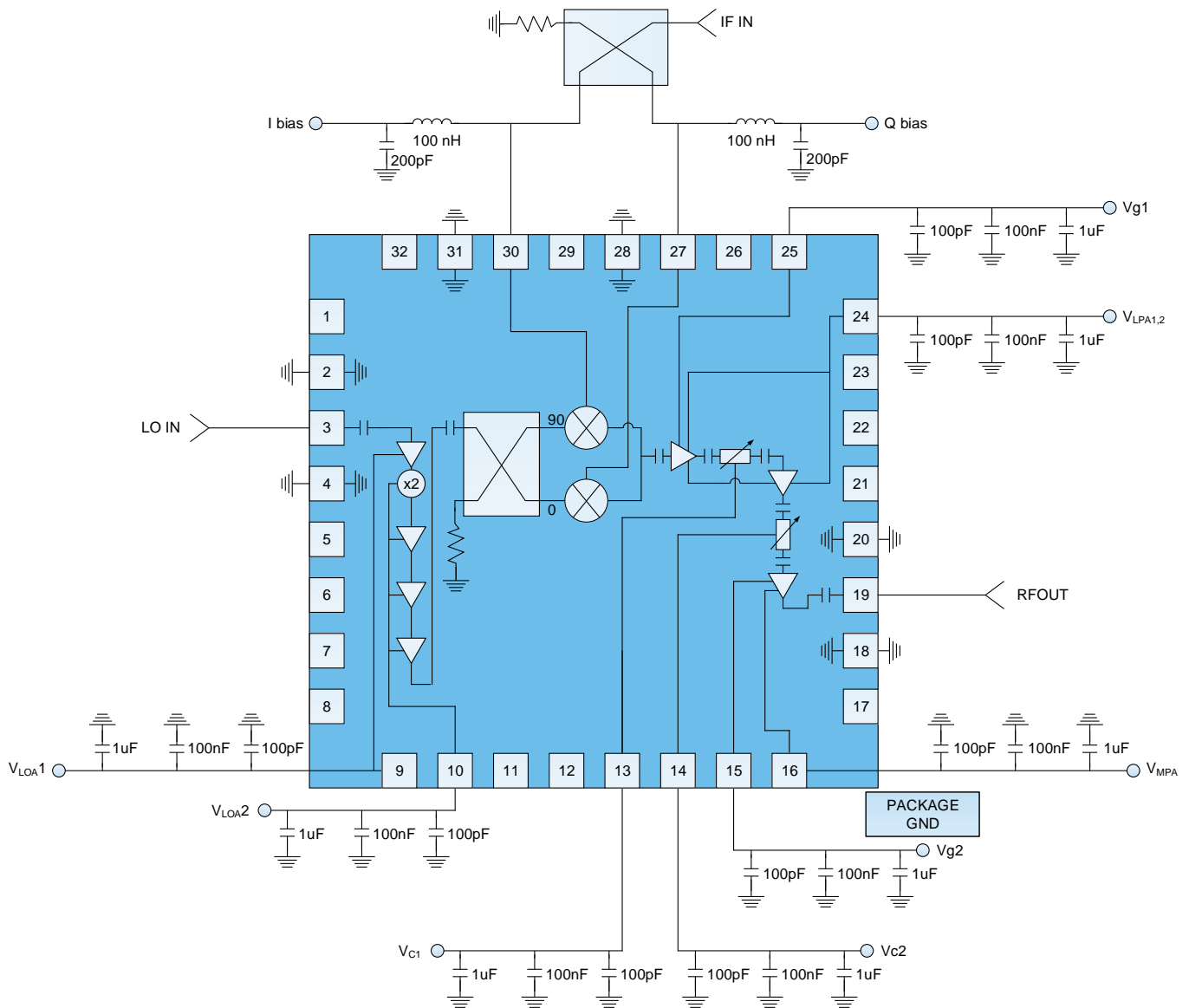
Test conditions unless otherwise noted: LO Power = 0 dBm and IF = 2.5 GHz, -10 dBm

$V_{MPA} = 4.5\text{ V}$ ,  $V_{LPA12} = 3.5\text{ V}$ ,  $V_{LOA1} = V_{LOA2} = 4\text{ V}$ ,  $V_{C1} = V_{C2} = -4\text{ V}$

$V_{G1}$  and  $V_{G2}$  are connected together off chip and changes over (-0.3 V to -1 V): **Single Control on  $V_{G1} = V_{G2}$**



## Application Circuit Block Diagram



$2*LO - IF = RF$  (LSB), LO = 10.5 to 15.25 GHz

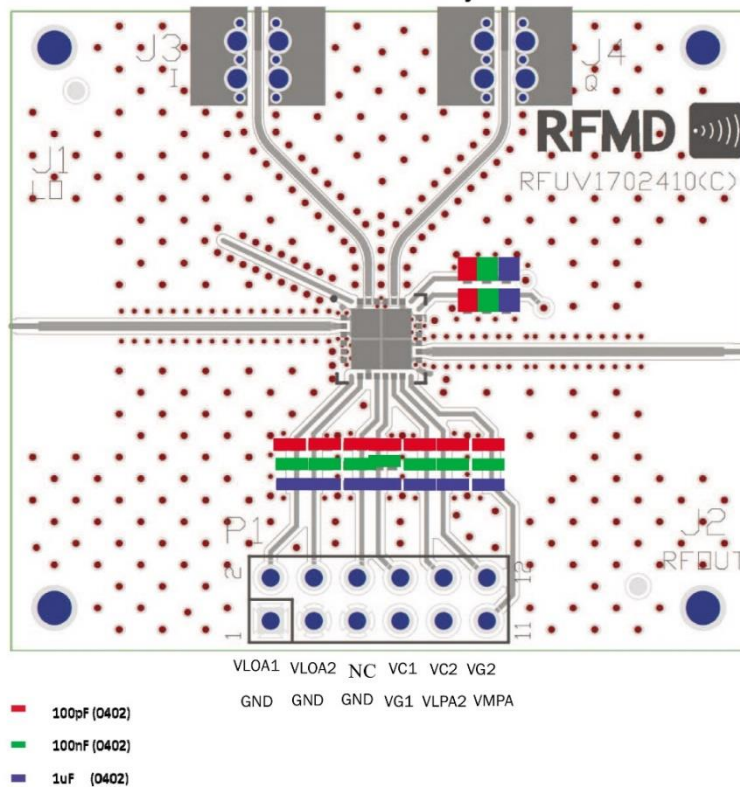
$2*LO + IF = RF$  (USB), LO = 8.5 GHz to 13.25 GHz

### Notes:

1. External components for IQ biases are required.
2. External hybrid coupler is required.



## Evaluation Board Layout



## Sub-Band Frequency Ranges

Band	Frequency Range
23 GHz	21.2 GHz to 23.6 GHz
26 GHz	24.5 GHz to 26.5 GHz

## Test Conditions and Bias Sequence

Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid, LO Power = 0 dBm and IF = 2.5 GHz, -10 dBm, unless otherwise stated.

$V_{LOA1} = V_{LOA2} = 4\text{ V}$ ,  $I_{LOA1,2} = 205\text{ mA}$ ;  $V_{LPA12} = 3.5\text{ V}$ , Adjust  $V_{G1}$  around -0.4 V to get  $I_{LPA12} = 120\text{ mA}$

$V_{MPA} = 4.5\text{ V}$ , Adjust  $V_{G2}$  to get  $I_{MPA} = 120\text{ mA}$ ,  $I_{TOTAL} = 445\text{ mA}$ ,  $V_{C1} = V_{C2} = -4\text{ V}$ .

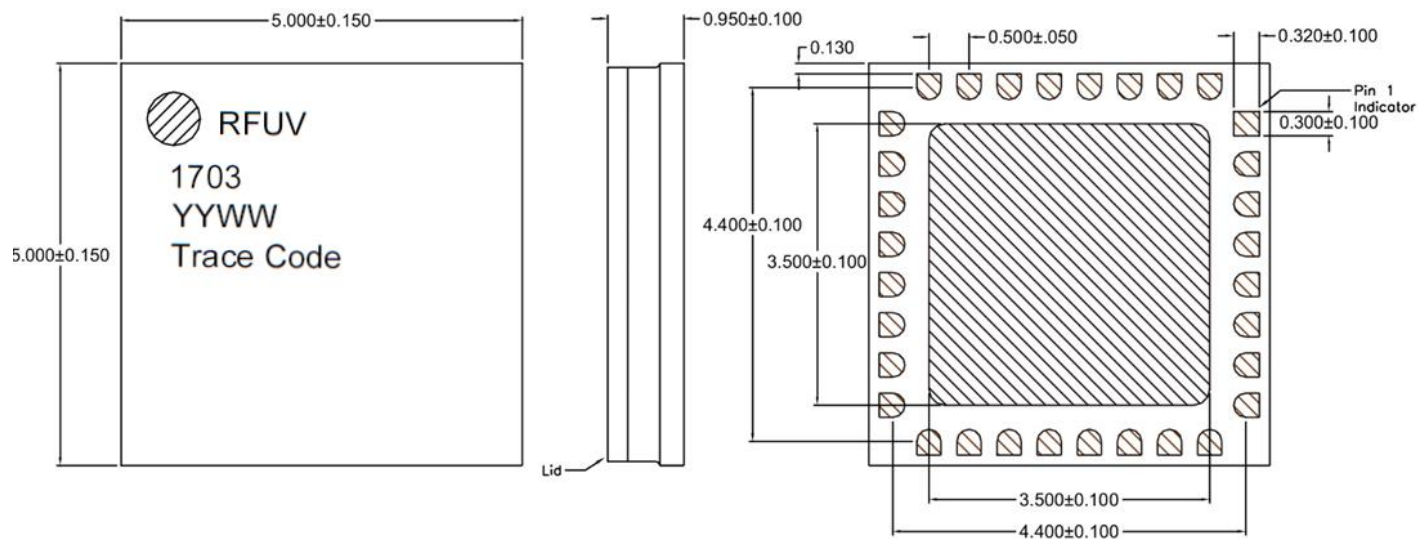
Typical Bias Sequence							
	$G_{MAX}$						$G_{MIN}$
$V_{C1}\text{ (V)}$	-4	-2	-1	0	0	0	0
$V_{C2}\text{ (V)}$	-4	-4	-4	-4	-2	-1	0

More dynamic range can be achieved using  $V_{G2}$  over (-0.4 to -1 V) and  $V_{G1}$  over (-0.4 to -1 V)

## Pin Names and Description

Pin Number	Label	Description
1	N/C	Not Connected
2	GND	Ground
3	LO	Local Oscillator Input. AC Coupled and Matched to 50 $\Omega$
4	GND	Ground
5	N/C	Not Connected
6	N/C	Not Connected
7	N/C	Not Connected
8	N/C	Not Connected
9	VLOA1	LOA Stage1 Drain Bias
10	VLOA2	LOA Stage2 Drain Bias
11	N/C	Not Connected
12	N/C	Not Connected
13	VC1	Control Line Number 1 (See Bias Sequence Description)
14	VC2	Control Line Number 2 (See Bias Sequence Description)
15	VG2	MPA Gate Bias
16	VMPA	MPA Drain Bias
17	N/C	Not Connected
18	GND	Ground
19	RFOUT	RF Output. AC Coupled and Matched to 50 $\Omega$
20	GND	Ground
21	N/C	Not Connected
22	N/C	Not Connected
23	N/C	Not Connected
24	VLPA1, VLPA2	LPA Stage 1, 2 Drain Bias
25	VG1	LPA Stage 1, 2 Gate Bias
26	N/C	Not Connected
27	Q	IF Q Input
28	GND	Ground
29	N/C	Not Connected
30	I	IF I Input
31	GND	Ground
32	N/C	Not Connected

## Package Marking and Dimensions



All dimensions are in millimeters

Marking:

RFUV1703: Part number

YY: Part Assembly year

WW: Part Assembly week

## Assembly Notes

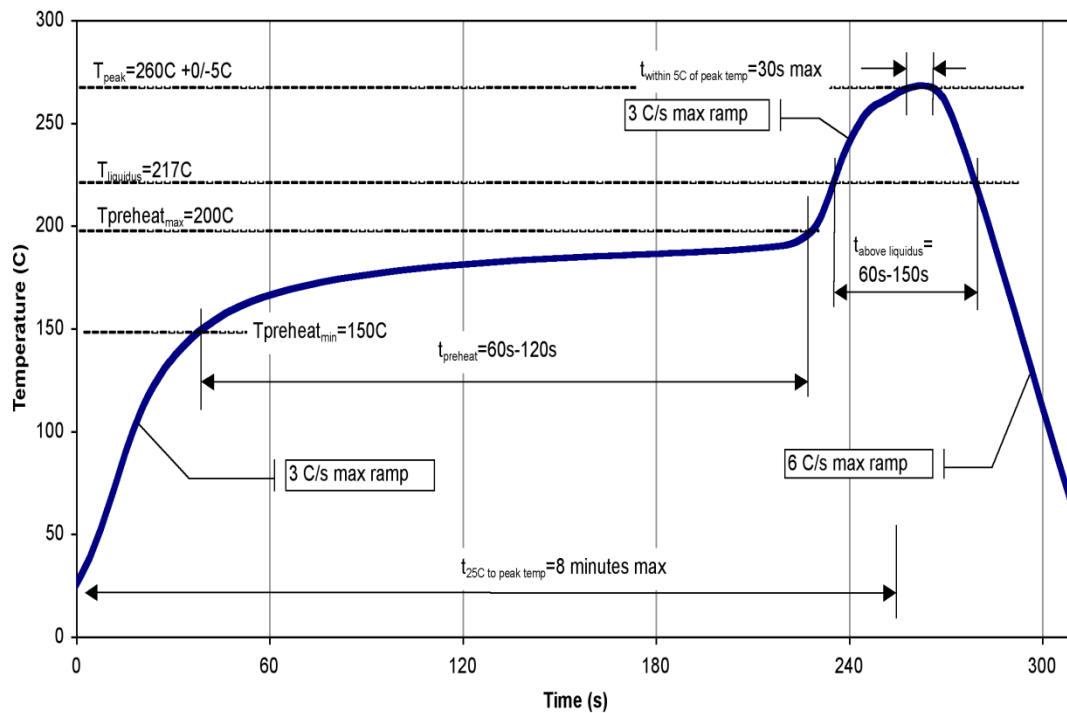
Compatible with lead-free soldering processes with 260°C peak reflow temperature.

This package is air-cavity and non-hermetic, and therefore cannot be subjected to aqueous washing. The use of no-clean solder to avoid washing after soldering is highly recommended.

Contact plating: Ni-Au.

Solder rework not recommended.

## Recommended Soldering Profile



## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1A	JESD22-A114
ESD – Charged Device Model (CDM)	Class C2	JESDE22-C101C
MSL – Convection Reflow 260 °C	Level 2	JEDEC standard IPC/JEDEC J-STD-020



Caution!  
ESD-Sensitive Device

## 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
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free

## Contact Information

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

**Web:** [www.qorvo.com](http://www.qorvo.com)

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

**Email:** [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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