RFUV1703

21GHz TO 26.5GHz GaAs MMIC IQ UPCONVERTER

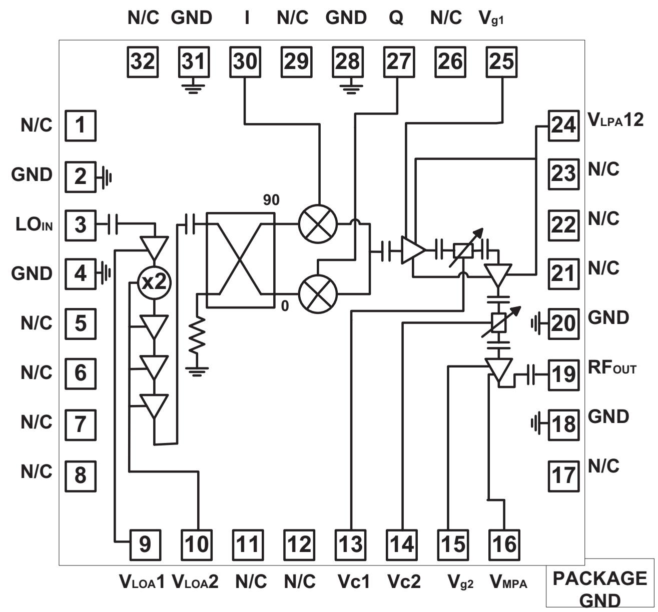
Package: QFN, 32-Pin, 5mm x 5mm x 0.95mm

Features

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

Applications

- Point-to-Point
- VSAT



Functional Block Diagram

Product Description

RFMD's RFUV1703 is a 21GHz to 26.5GHz 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 VSAT applications. RFUV1703 is packaged in a 5mm x 5mm QFN to simplify both system level board design and volume assembly.

Ordering Information

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

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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
T_{OPER}	-55 to +85	°C
T_{STOR}	-65 to +150	°C
ESD Human Body Model	Class 1A	

Caution! ESD sensitive device.

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.

RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000 ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Nominal Operating Parameters

Parameter	Specification			Unit	Condition
	Min.	Typ.	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		4.0	GHz	
LO input Drive		0		dBm	
Conversion Gain (Max.)		21		dB	
Conversion Gain (Min.)		-10		dB	
NF (Max. Gain)		12		dB	
OIP3 (Max. Gain)		27		dBm	
Image Rejection		15		dBc	
LO Leakage at RF-Port (Max. Gain)		-5		dBm	With IQ bias
LO Return Loss		10		dB	
RF Return Loss		10		dB	
V_{LOA}		4		V	
V_{LPA}		3.5		V	
V_{MPA}		4.5		V	
I_{LOA}		205		mA	
I_{LPA12}		120		mA	
I_{MPA}		120		mA	
I_{TOTAL}		445		mA	
V_{C1},V_{C2}	-4		0	V	

Test Conditions and Bias Sequence

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

V_{LOA1} = V_{LOA2} = 4V, $I_{LOA1, 2}$ = 205mA; V_{LPA12} = 3.5V, Adjust V_{G1} around -0.4V to get I_{LPA12} = 120mA; V_{MPA} = 4.5V, Adjust V_{G2} to get I_{MPA} = 120mA; I_{TOTAL} = 445mA, V_{C1} = V_{C2} = -4V

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

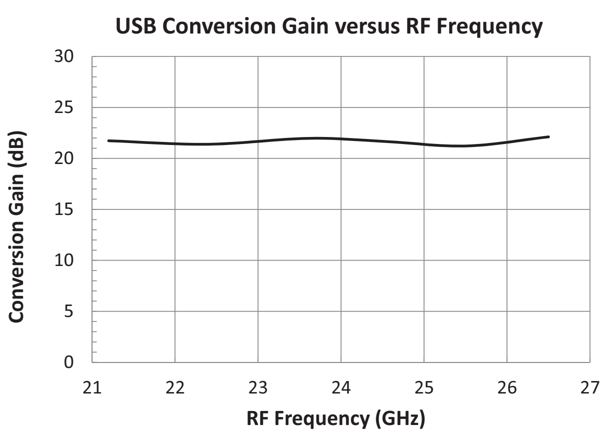
More dynamic range can be achieved using V_{G2} over (-0.4 to -1V) and V_{G1} over (-0.4 to -1V)

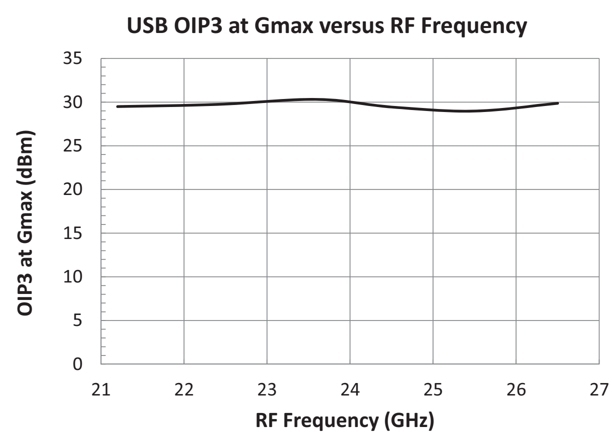
Typical Electrical Performance

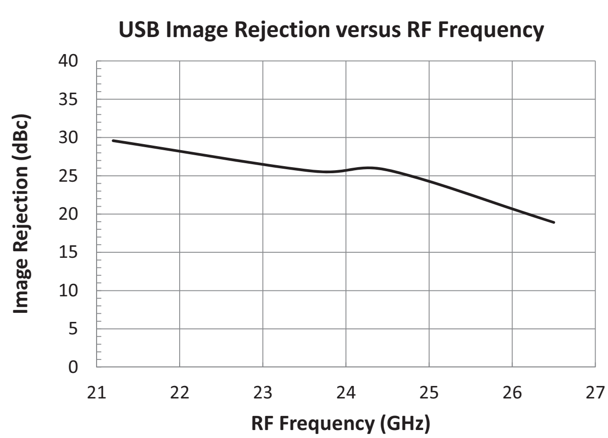
Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid, LO Power = 0dBm and IF = 2.5GHz, -10dBm, unless otherwise stated.

USB Conversion Gain, Image Rejection and OIP3

V_{LOA1} = V_{LOA2} = 4V, $I_{LOA1, 2}$ = 205mA; V_{LPA12} = 3.5V, Adjust V_{G1} around -0.4V to get I_{LPA12} = 120mA; V_{MPA} = 4.5V, Adjust V_{G2} to get I_{MPA} = 120mA; I_{TOTAL} = 445mA, V_{C1} = V_{C2} = -4V







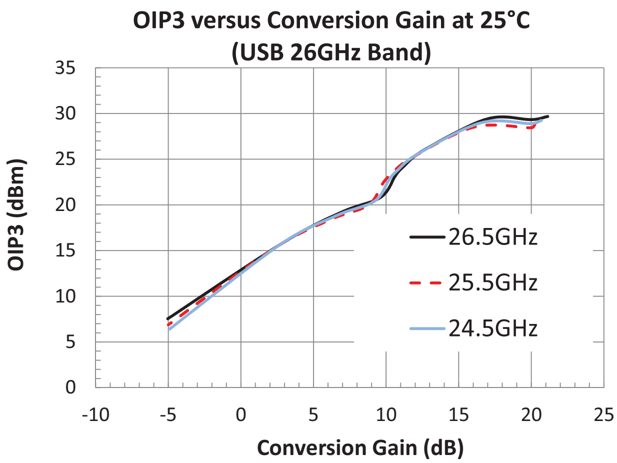
USB OIP3 versus Conversion Gain

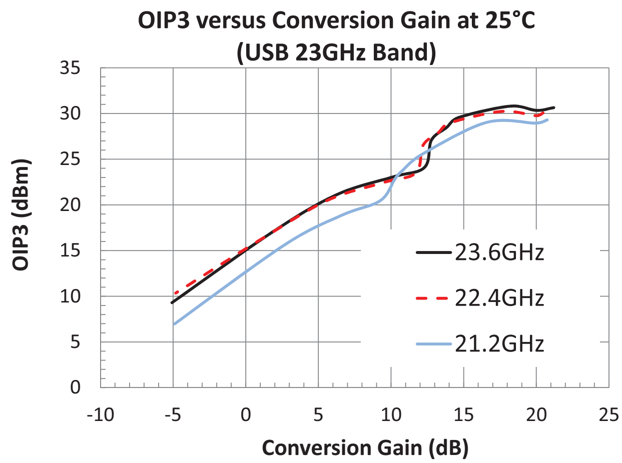
$V_{LOA1} = V_{LOA2}$ = 4V, $I_{LOA1, 2}$ = 205mA; V_{LPA12} = 3.5V, Adjust V_{G1} around -0.4V to get I_{LPA12} = 120mA;
V_{MPA} = 4.5V, Adjust V_{G2} to get I_{MPA} = 120mA; I_{TOTAL} = 445mA, $V_{C1} = V_{C2}$ = -4V

Typical Bias Sequence

	G_{MAX}						G_{MIN}
V_{C1} (V)	-4	-2	-1	0	0	0	0
V_{C2} (V)	-4	-4	-4	-4	-2	-1	0

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





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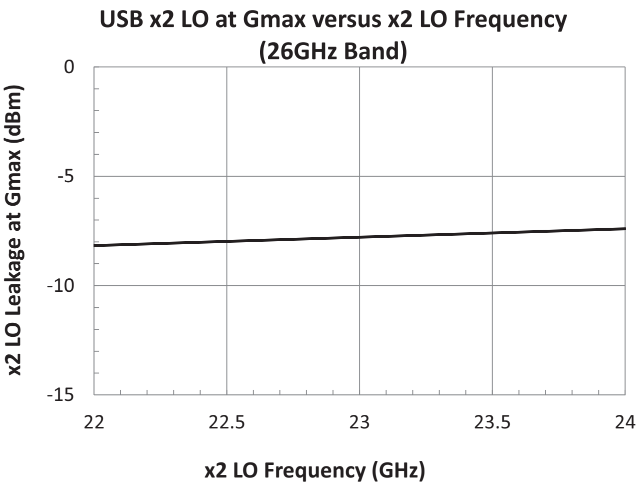
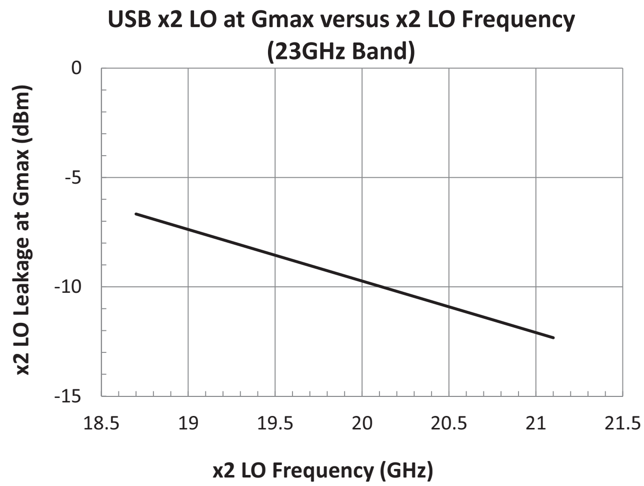
USB LO Leakage

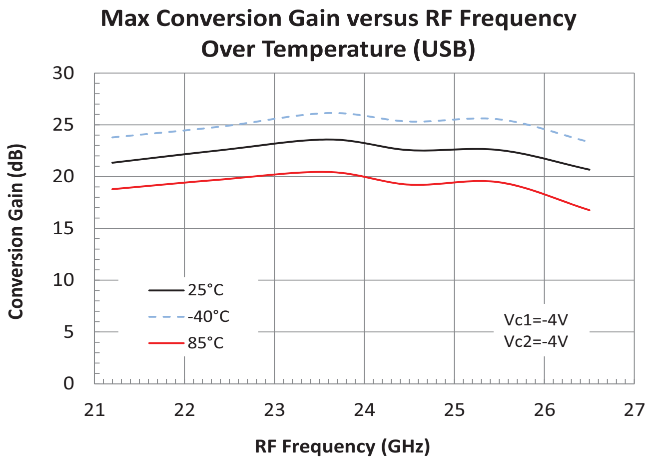
$V_{LOA1} = V_{LOA2} = 4V$, $I_{LOA1,2} = 205mA$; $V_{LPA12} = 3.5V$, Adjust V_{G1} around -0.4V to get $I_{LPA12} = 120mA$;
$V_{MPA} = 4.5V$, Adjust V_{G2} to get $I_{MPA} = 120mA$; $I_{TOTAL} = 445mA$, $V_{C1} = V_{C2} = -4V$

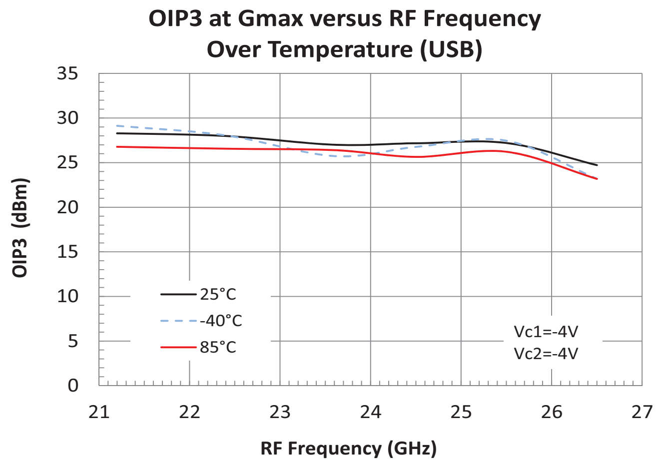


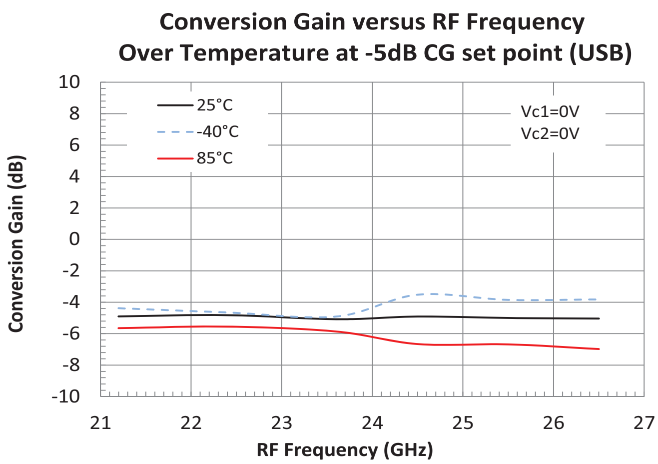


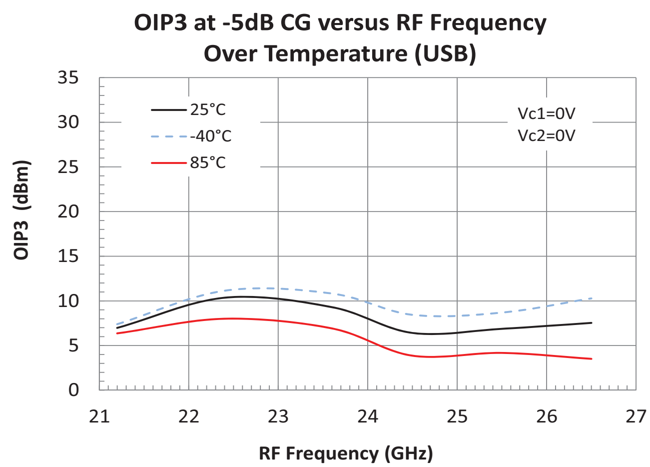
Over Temperature Performance (USB)

V_{LOA1} = V_{LOA2} = 4V, $I_{LOA1,\ 2}$ = 205mA; V_{LPA12} = 3.5V, Adjust V_{G1} around -0.4V to get I_{LPA12} = 120mA; V_{MPA} = 4.5V, Adjust V_{G2} to get I_{MPA} = 120mA; I_{TOTAL} = 445mA



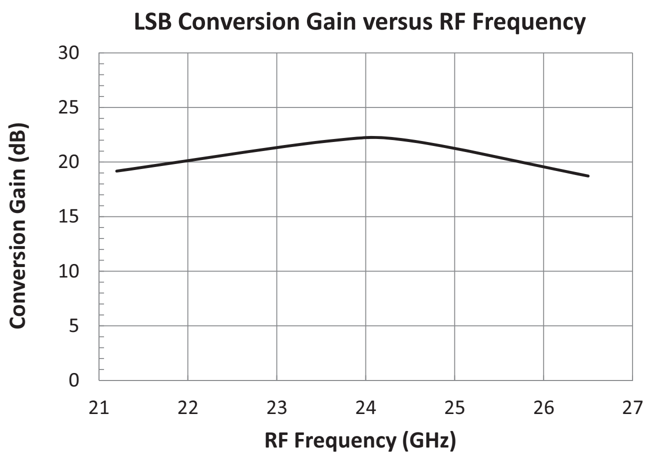


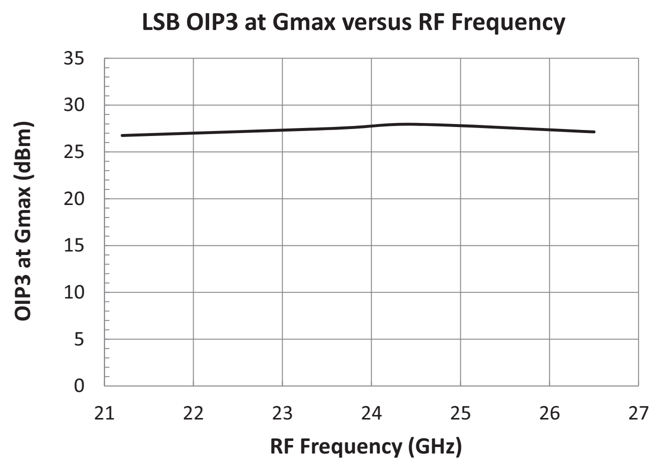


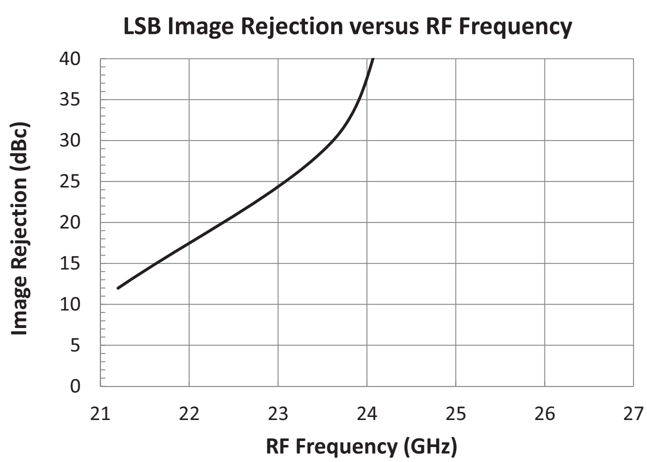


LSB Conversion Gain, Image Rejection, and OIP3

V_{LOA1} = V_{LOA2} = 4V, $I_{LOA1,\ 2}$ = 205mA; V_{LPA12} = 3.5V, Adjust V_{G1} around -0.4V to get I_{LPA12} = 120mA; V_{MPA} = 4.5V, Adjust V_{G2} to get I_{MPA} = 120mA; I_{TOTAL} = 445mA, V_{C1} = V_{C2} = -4V

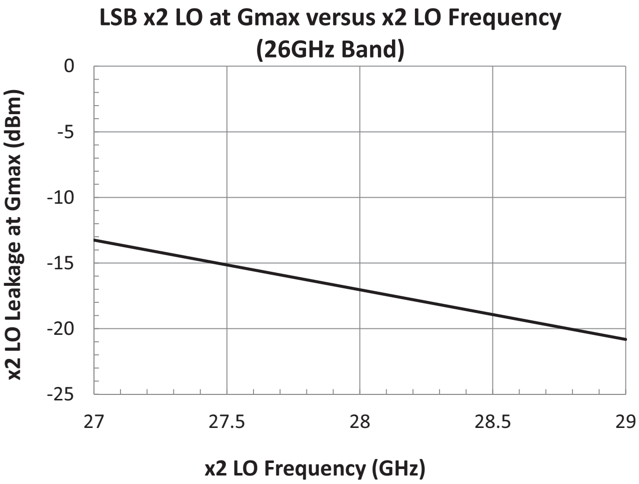




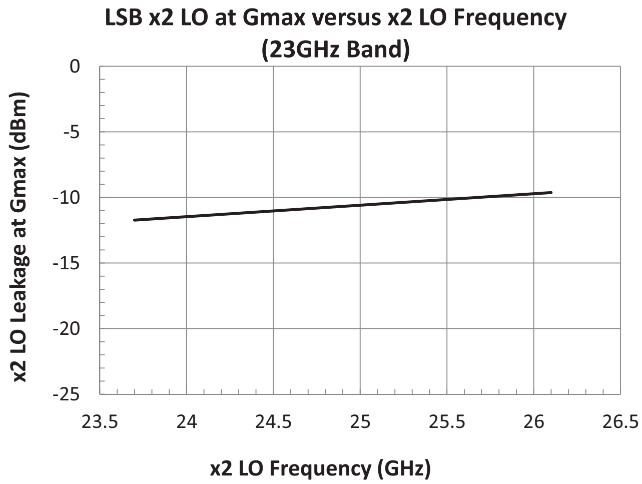


LSB LO Leakage

$V_{LOA1} = V_{LOA2}$ = 4V, $I_{LOA1, 2}$ = 205mA; V_{LPA12} = 3.5V, Adjust V_{G1} around -0.4V to get I_{LPA12} = 120mA;
V_{MPA} = 4.5V, Adjust V_{G2} to get I_{MPA} = 120mA; I_{TOTAL} = 445mA, $V_{C1} = V_{C2}$ = -4V



I_{BIAS} = -42mV Q_{BIAS} = 0mV



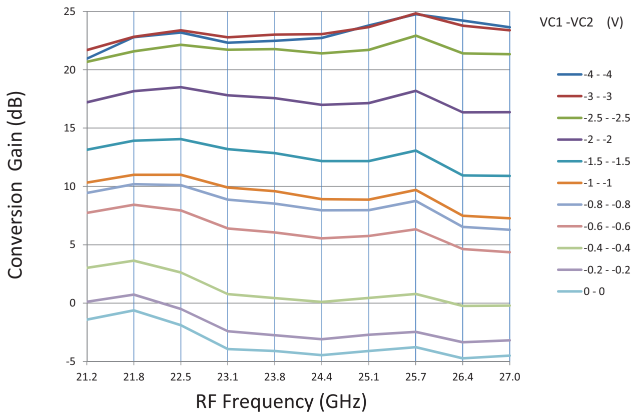
I_{BIAS} = -56mV Q_{BIAS} = 0mV

Performance Using Single Control Line (without IQ bias)_1

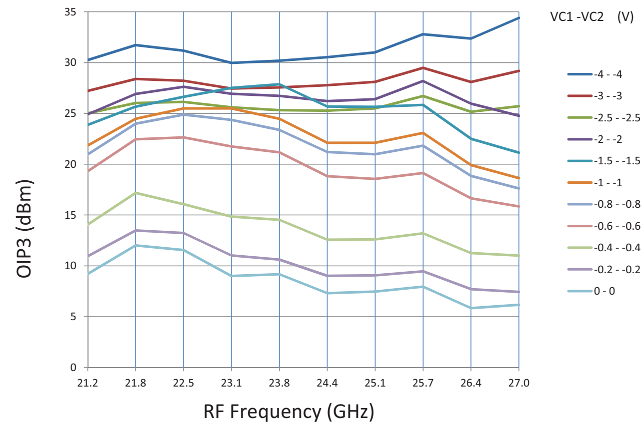
V_{MPA} = 4.5V, V_{LPA12} = 3.5V, V_{LOA1} = V_{LOA2} = 4V, I_{total} = 445mA, V_{G1} = V_{G2} = -0.4V

V_{C1} and V_{C2} are connected together off chip and changes over (-4V to 0V)

USB Conversion Gain versus Frequency



USB OIP3 versus Frequency

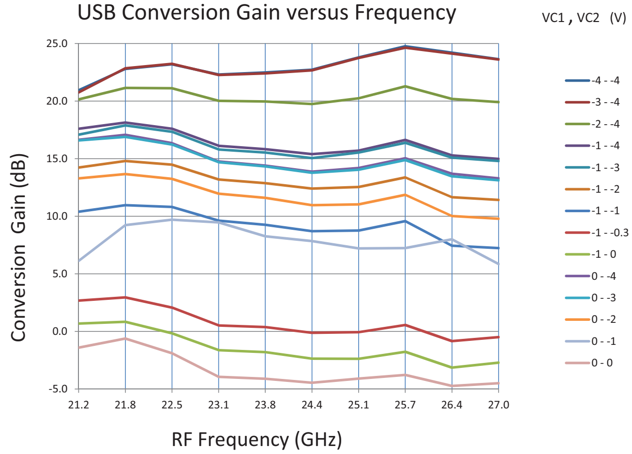


Performance Using Double Control Line (without IQ bias)_2

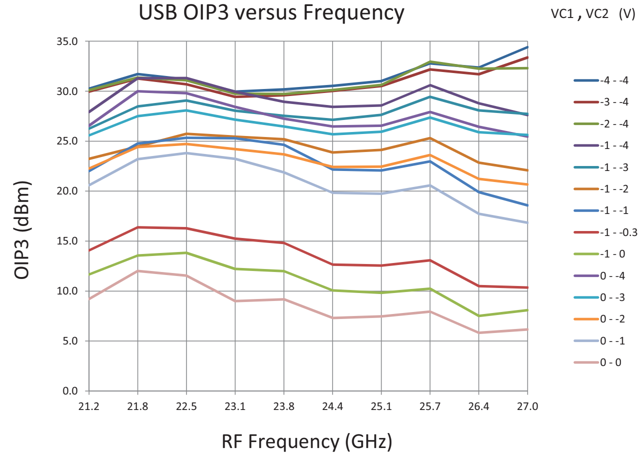
V_{MPA} = 4.5V, V_{LPA12} = 3.5V, V_{LOA1} = V_{LOA2} = 4V, I_{total} = 445mA, V_{G1} = V_{G2} = -0.4V

V_{C1} and V_{C2} are separately controlled and changes over (-4V to 0V)

USB Conversion Gain versus Frequency



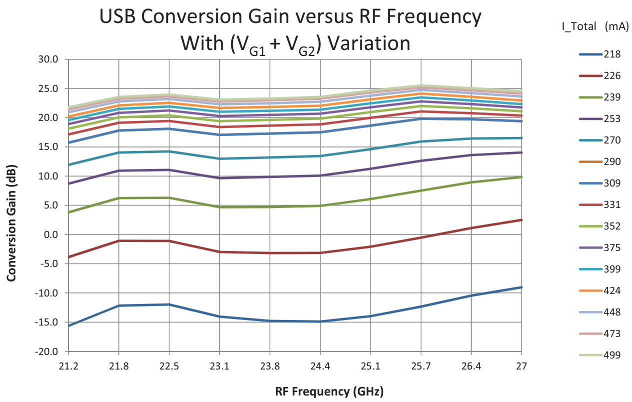
USB OIP3 versus Frequency

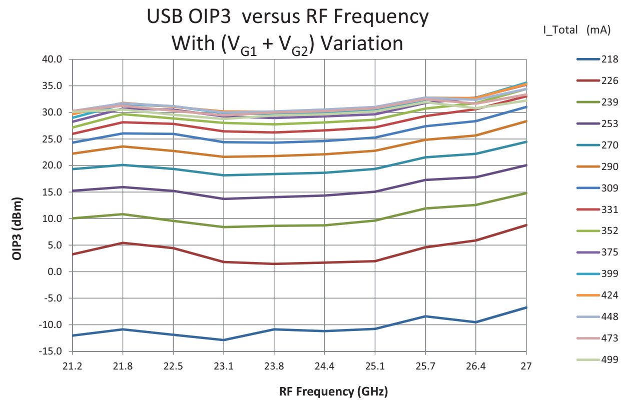


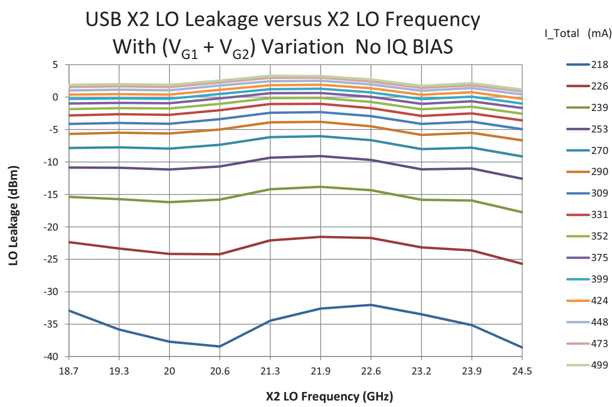
Performance Using Single Control on V_{G1} = V_{G2} (without IQ bias)_3

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

V_{G1} and V_{G2} are connected together off chip and changes over (-0.3V to -1V)

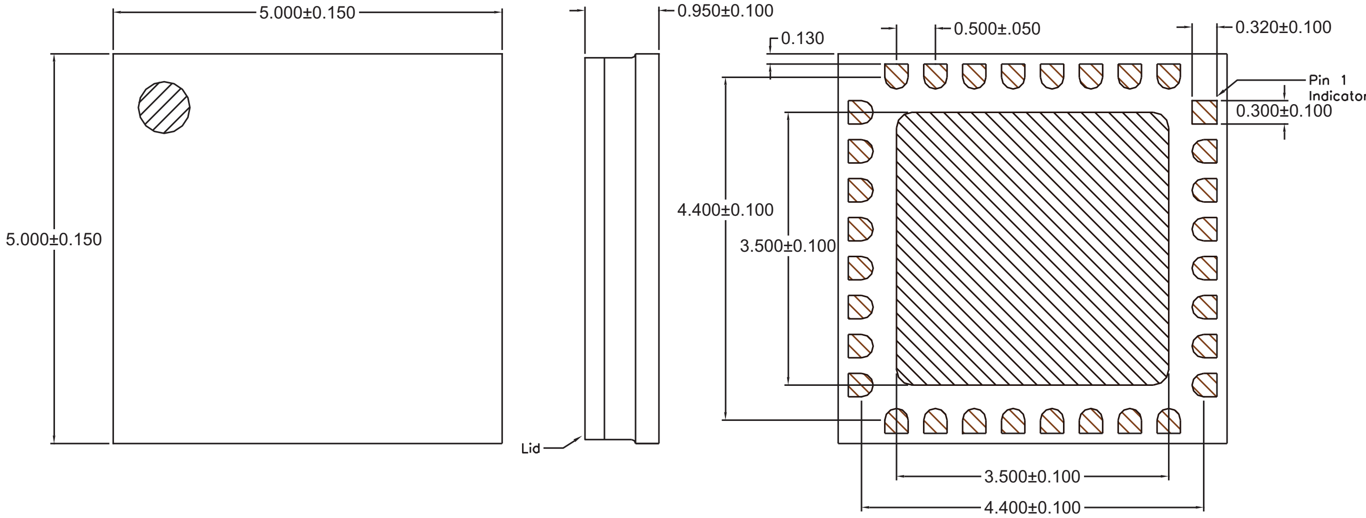






Package Outline Drawing

QFN, 32-Pin, 5mm x 5mm x 0.95mm



Pin Names and Description

Pin	Name	Description
1	N/C	Not Connected
2	GND	Ground
3	LO	Local Oscillator Input. AC Coupled and Matched to 50Ω
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 50Ω
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

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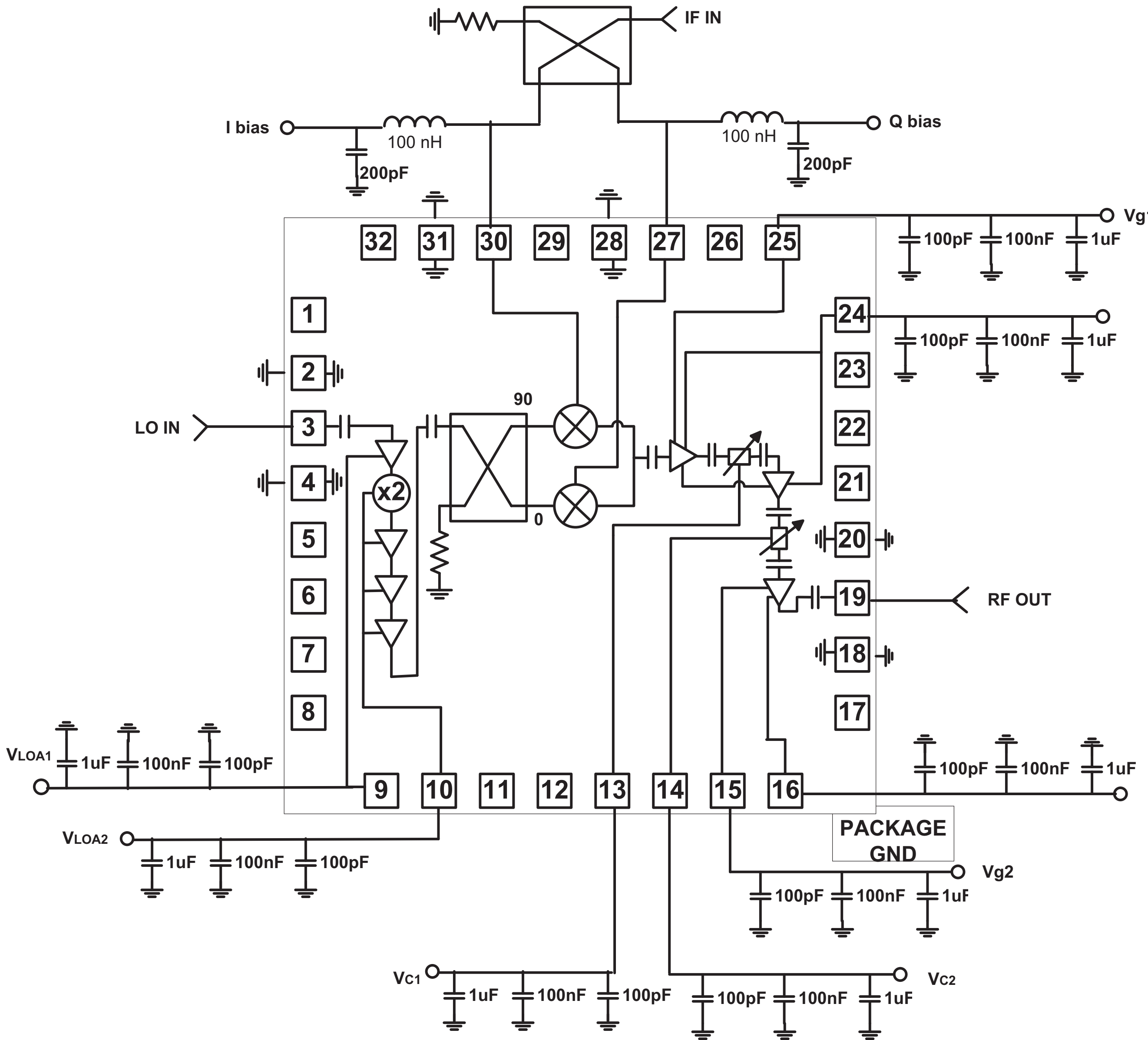
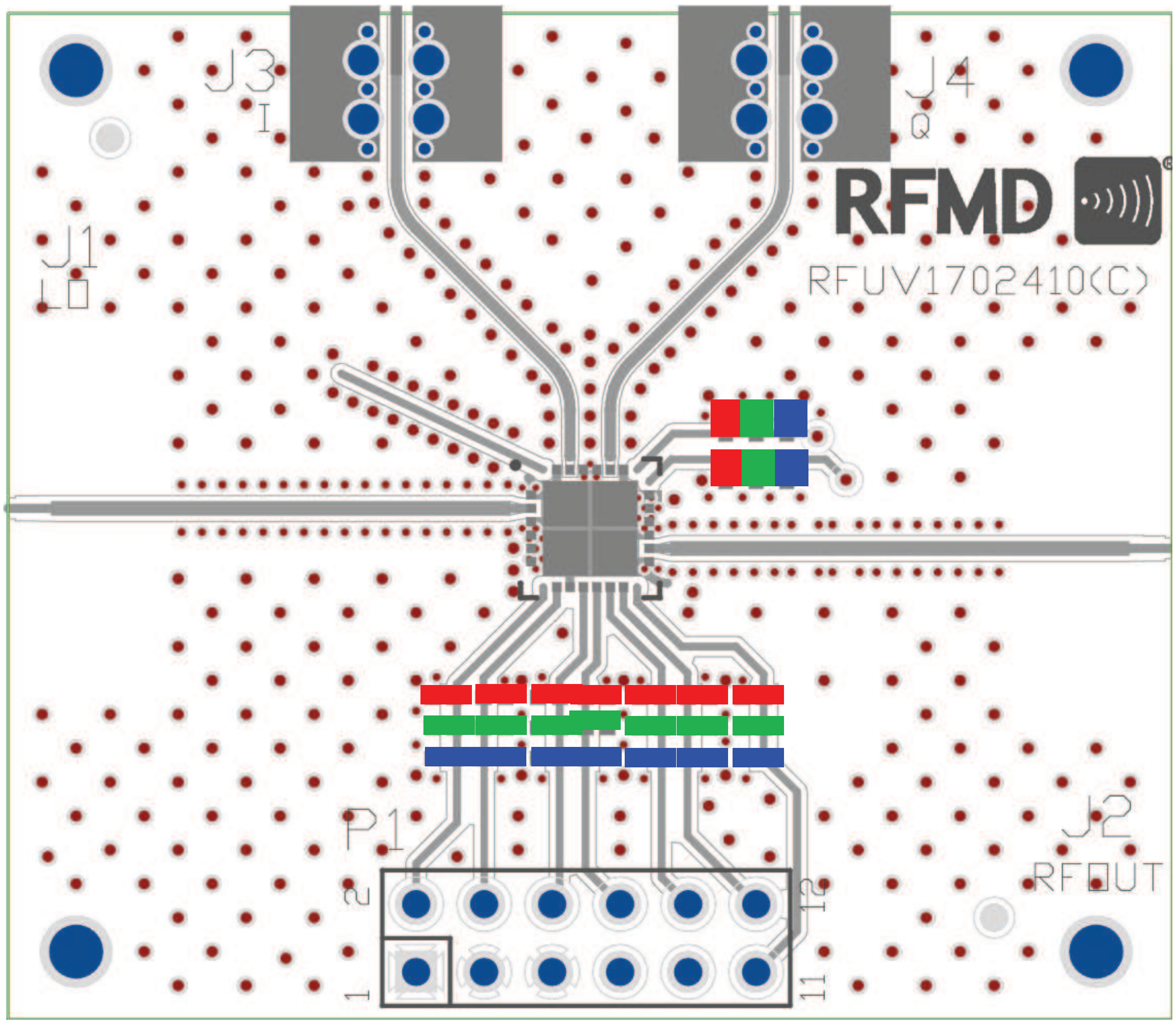
Application Circuit Block Diagram



2*LO - IF = RF (LSB), LO = 10.5 to 15.25GHz
2*LO + IF = RF (USB), LO = 8.5GHz to 13.25GHz

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

Evaluation Board Layout



VLOA1	VLOA2	NC	VC1	VC2	VG2
GND	GND	GND	VG1	VLPA2	VMPA

- 100pF (0402)
- 100nF (0402)
- 1uF (0402)

Sub-Band Frequency Ranges

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

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