RFUV1002

9GHz TO 14GHz GaAs MMIC IQ UP-CONVERTER

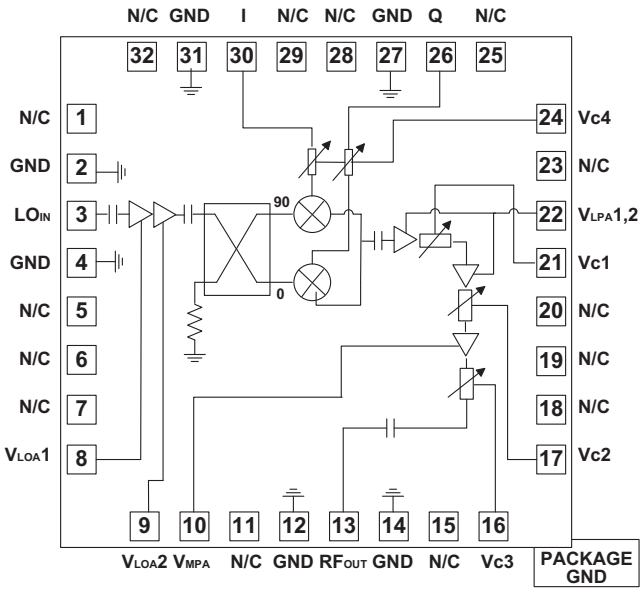
Package: QFN, 32-Pin, 5mm x 5mm x 0.95mm

Features

- RF Frequency, 9GHz to 14GHz
- IF Frequency, DC to 4GHz
- Maximum Conversion Gain, 23dB
- Minimum Conversion Gain, -15dB
- Noise Figure (Maximum Gain), 12dB
- OIP3 (Maximum Gain), +28dBm
- Image Rejection, 20dBc
- LO Leakage at RF Port, -5dBm

Applications

- Point to point
- VSAT



Functional Block Diagram

Product Description

RFMD's RFUV1002 is a 9GHz to 14GHz GaAs pHEMT up-converter, incorporating an integrated LO buffer amplifier, a balanced single-side band (image rejection) mixer followed by a variable gain amplifier and a DC decoupling capacitor. The combination of high performance and low cost packaging makes the RFUV1002 a cost effective solution, ideally suited to both current and next generation Point-to-Point and VSAT applications. RFUV1002 is packaged in a 5mmx5mm QFN to simplify both system level board design and volume assembly.

Ordering Information

RFUV1002S2	2-Piece sample bag
RFUV1002SB	5-Piece bag
RFUV1002SQ	25-Piece bag
RFUV1002SR	100 Pieces on a 7" reel
RFUV1002TR7	750 Pieces on a 7" reel
RFUV1002TR13	2500 Pieces on a 13" reel
RFUV1002PCK-410	Evaluation board with 2-piece sample bag

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☑ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☐ Si CMOS	☐ BiFET HBT
☐ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

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Absolute Maximum Ratings

Parameter	Rating	Unit
LPA Drain Voltage Vd	6	V
LOA Drain Voltage	6	V
RF Input Power	15	dBm
LO Input Power	15	dBm
T_{OPER}	-40 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, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
RF Frequency	9		14	GHz	
LO Frequency	5		18	GHz	
IF Frequency	DC		4.0	GHz	
LO input Drive		0		dBm	
Conversion Gain (Max.)	20	23		dB	
Conversion Gain (Min.)		-15		dB	
NF (max. Gain)		12		dB	
NF (min. Gain)		17		dB	
OIP3 (max. Gain)	25	28		dBm	
OIP3 (min. Gain)	9	14		dBm	
Image Rejection	15	20		dBc	
LO Leakage at RF-Port (Maximum Gain)		-5	5	dBm	With IQ bias
LO Return Loss		10		dB	
RF Return Loss		10		dB	
V_D		5		V	
I_D		380	500	mA	
VVA	-3		0	V	

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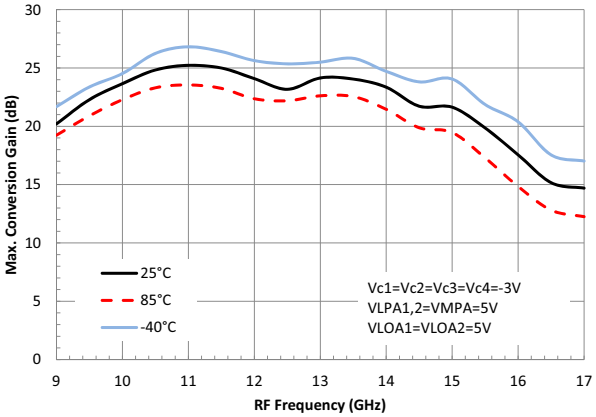
Typical Electrical Performance

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.

Max. Conversion Gain versus RF Frequency Over Temperature (USB)



Min. Conversion Gain versus RF Frequency Over Temperature (USB)

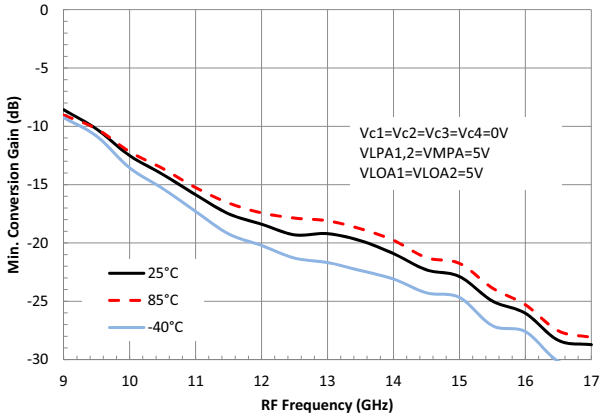
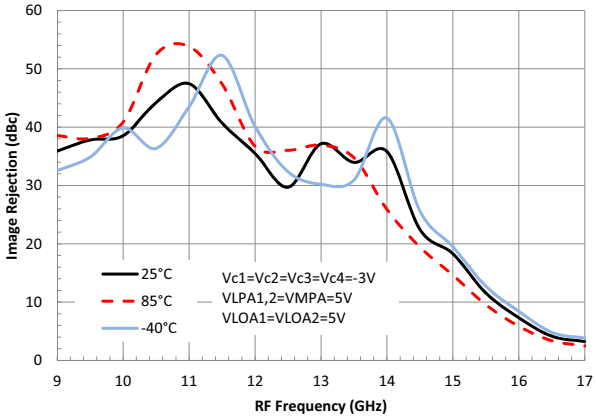
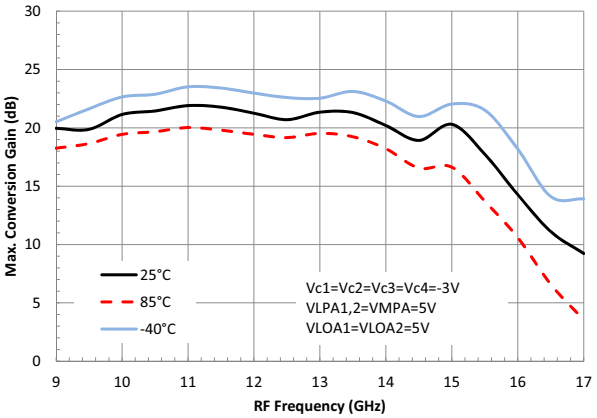


Image Rejection versus RF Frequency Over Temperature (USB)



LSB Conversion Gain and Image Rejection

Max. Conversion Gain versus RF Frequency
Over Temperature (LSB)



Min. Conversion Gain versus RF Frequency
Over Temperature (LSB)

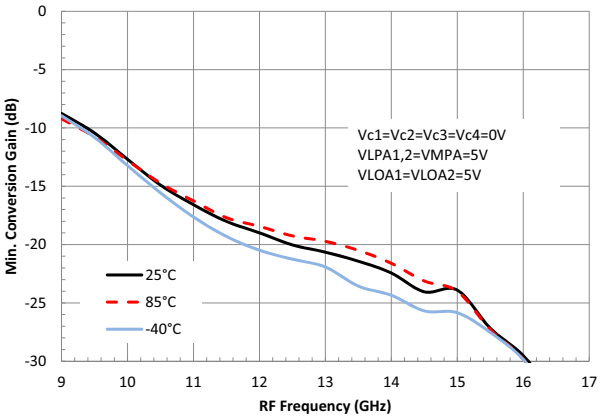
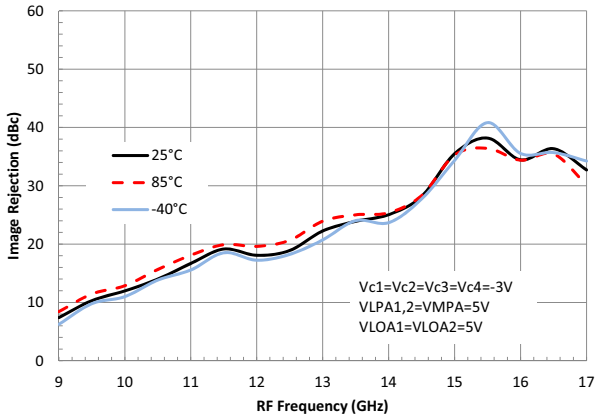


Image Rejection versus RF Frequency
Over Temperature (LSB)



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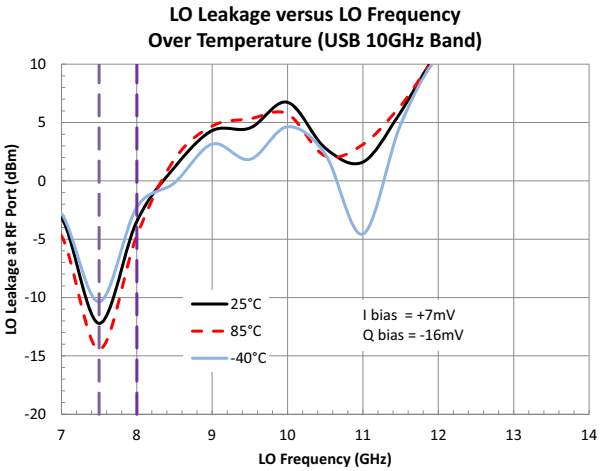
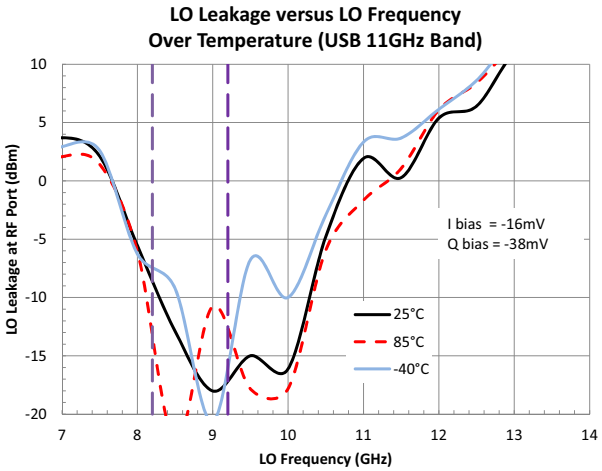
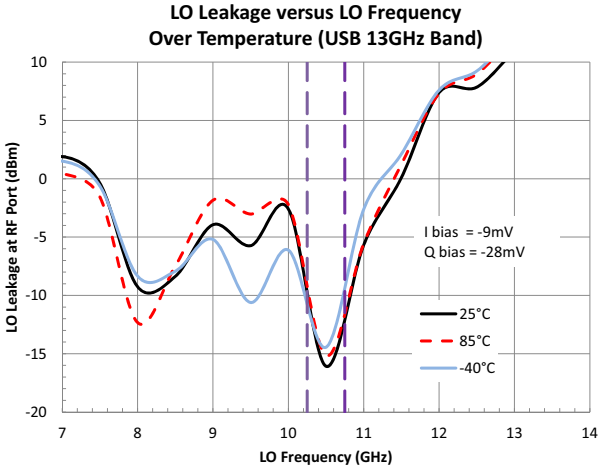
USB LO Leakage

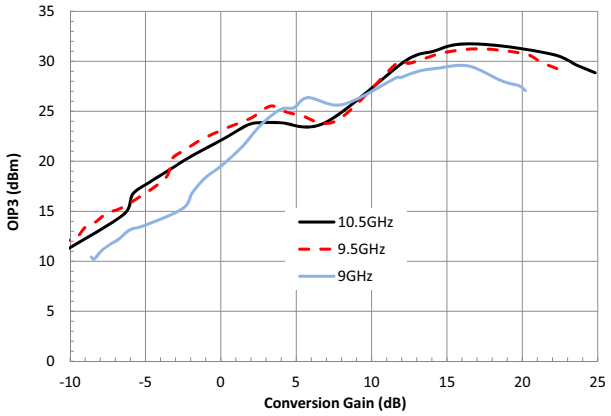




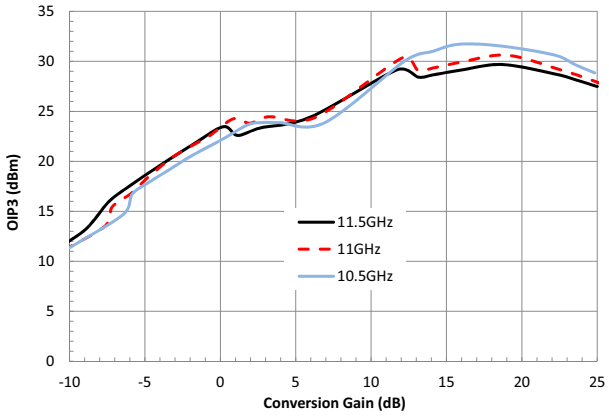


OIP3 (USB) at 25°C

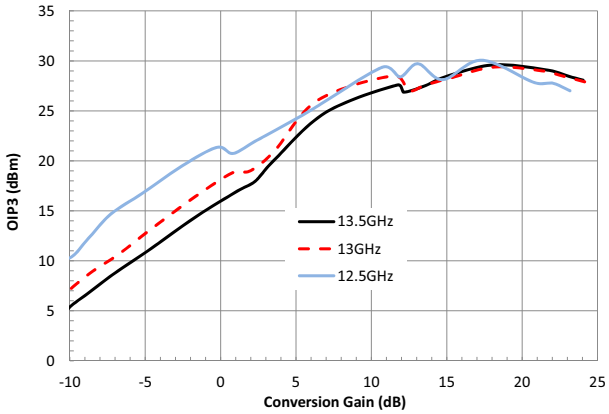
OIP3 versus Conversion Gain at 25°C
(USB 10GHz Band)



OIP3 versus Conversion Gain at 25°C
(USB 11GHz Band)



OIP3 versus Conversion Gain at 25°C
(USB 13GHz Band)



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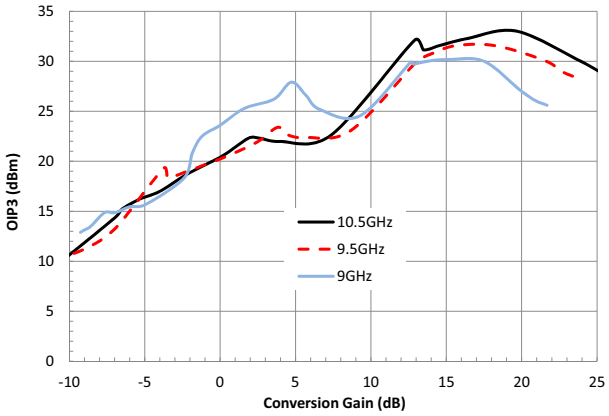
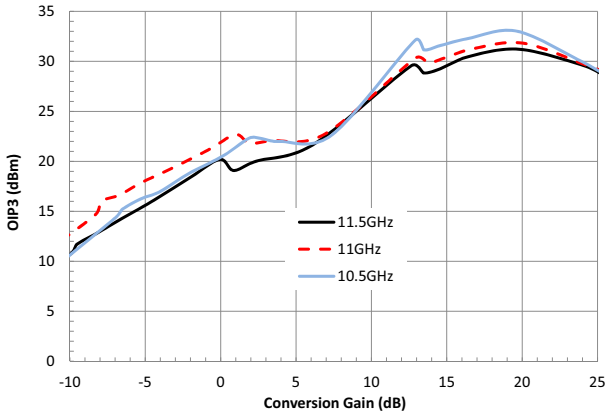
OIP3 (USB) at -40°C

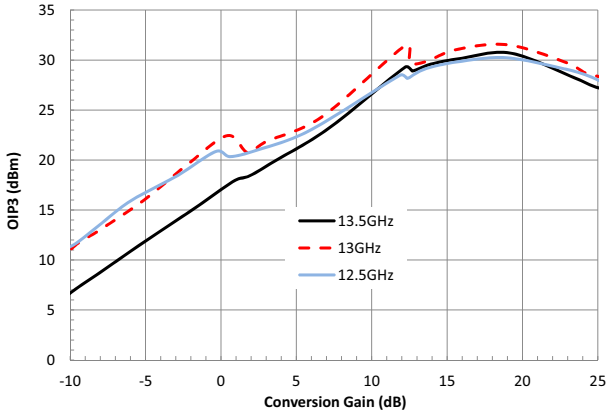
OIP3 versus Conversion Gain at -40°C
(USB 10GHz Band)



OIP3 versus Conversion Gain at -40°C
(USB 11GHz Band)

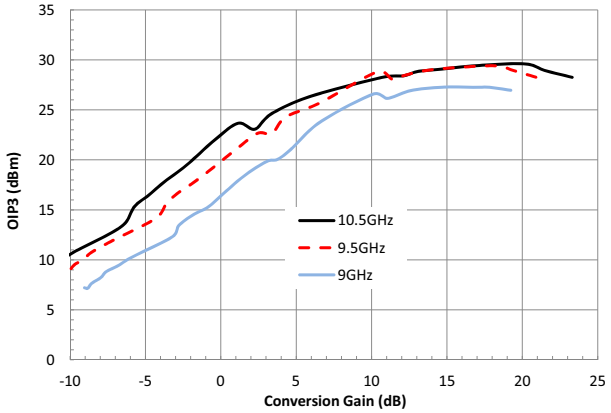


OIP3 versus Conversion Gain at -40°C
(USB 13GHz Band)

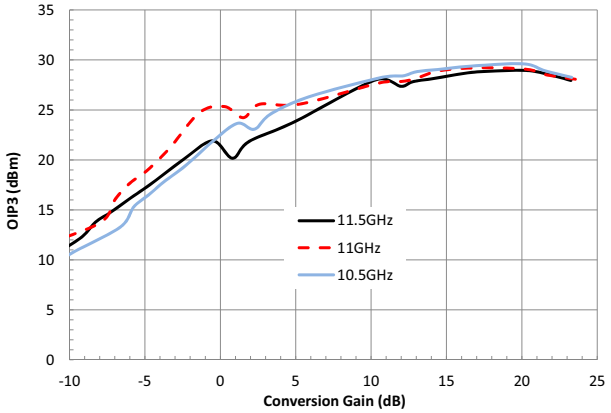


OIP3 (USB) at 85ºC

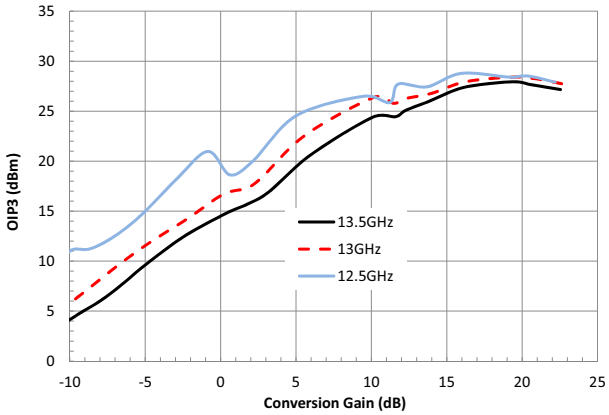
OIP3 versus Conversion Gain at 85°C
(USB 10GHz Band)



OIP3 versus Conversion Gain at 85°C
(USB 11GHz Band)



OIP3 versus Conversion Gain at 85°C
(USB 13GHz Band)



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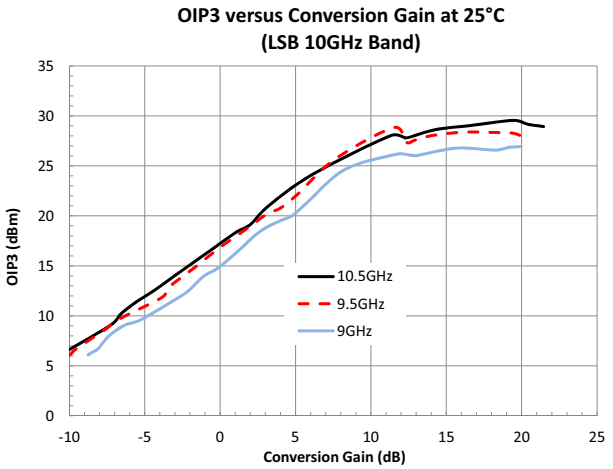
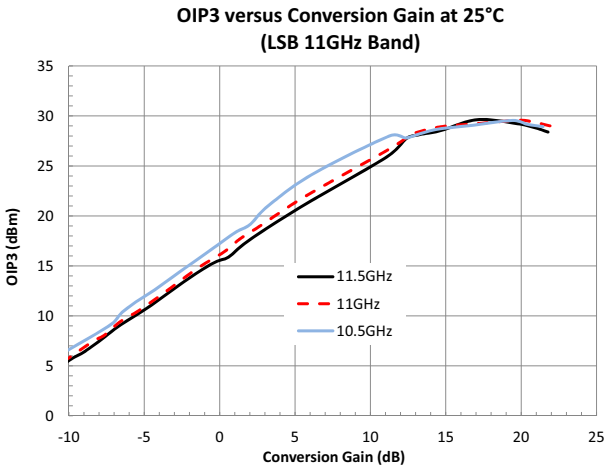
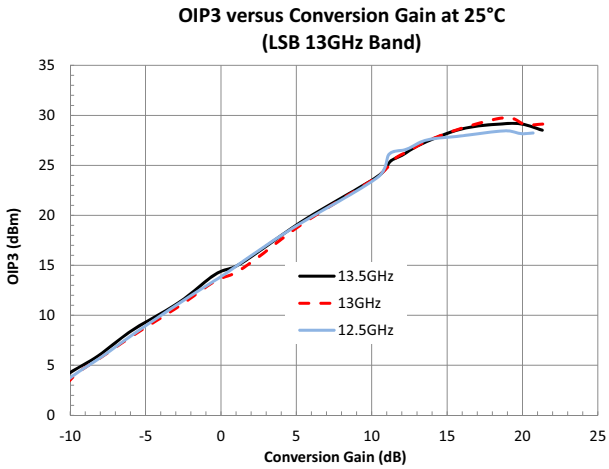
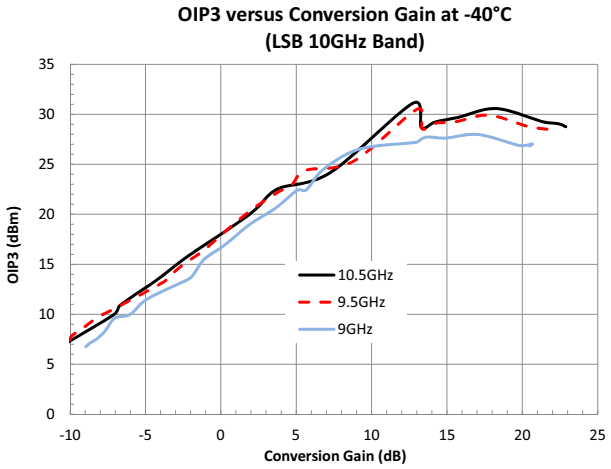
OIP3 (LSB) at 25°C

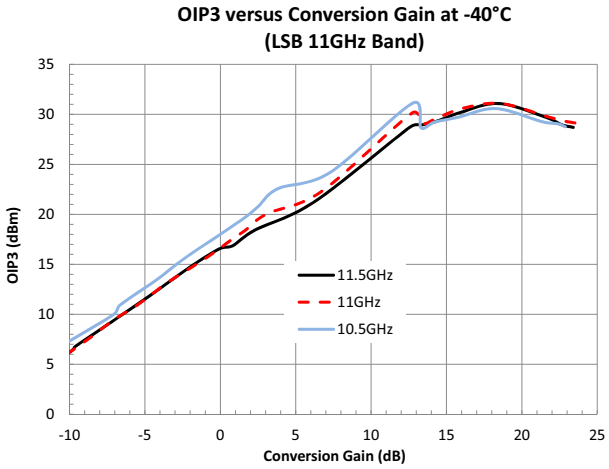


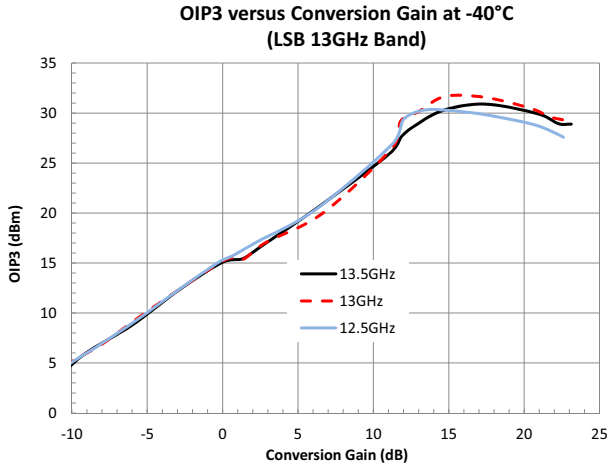




OIP3 (LSB) at -40ºC







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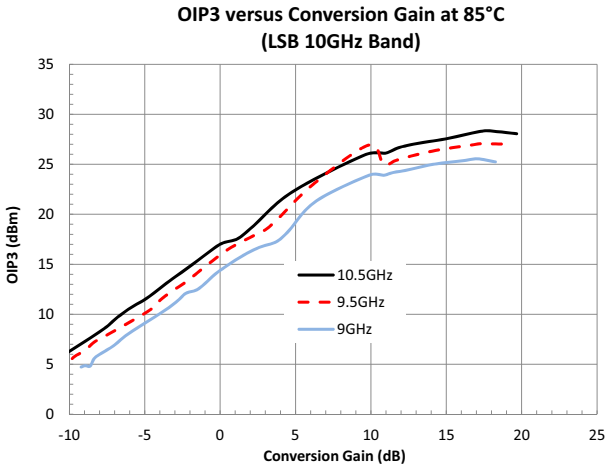
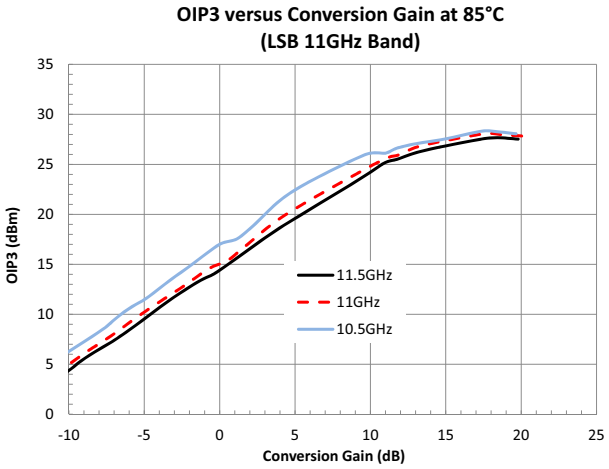
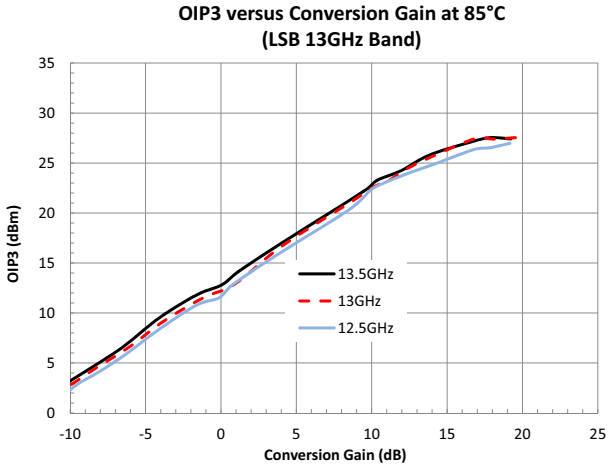
OIP3 (LSB) at 85°C

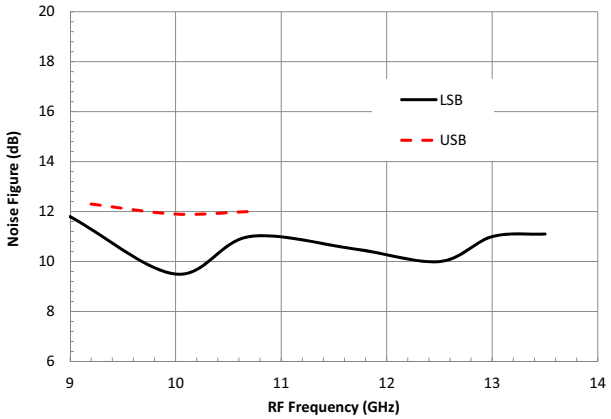




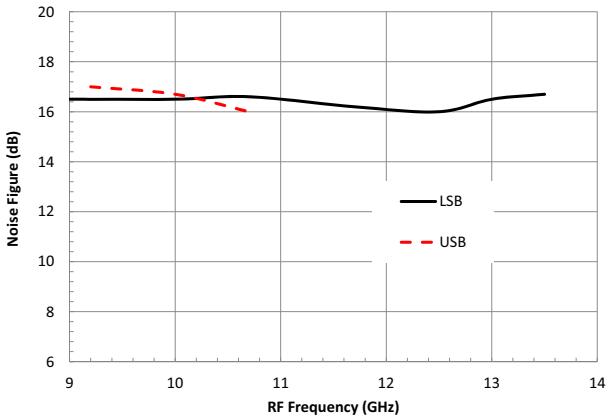


Noise Figure and Return Losses

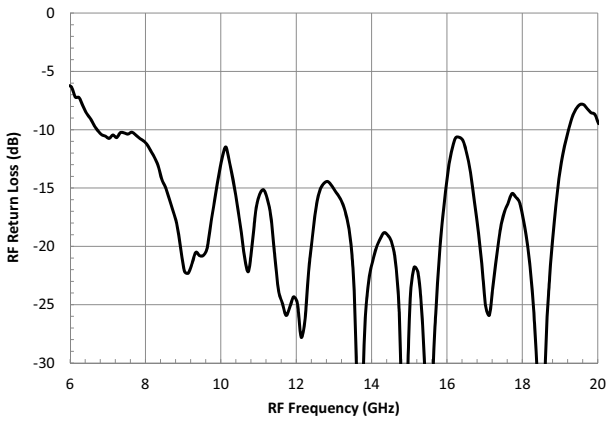
Noise Figure versus RF Frequency at 20dB Gain
Bias Sequence 2 is used



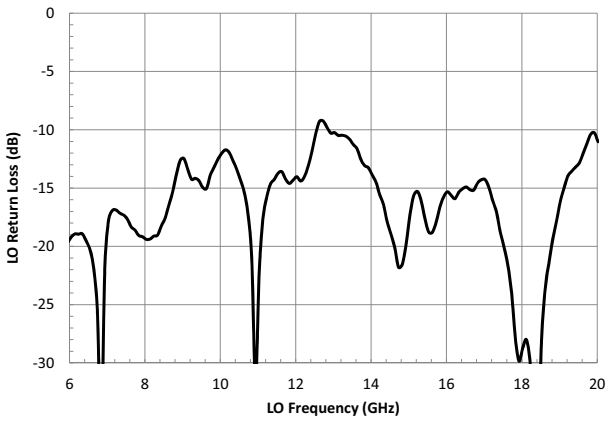
Noise Figure versus RF Frequency at -5dB Gain
Bias Sequence 2 is used



RF Return Loss versus RF Frequency



LO Return Loss versus LO Frequency



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Typical Bias Sequence and Gain Control

Optimum performance is achieved using sequential bias. At maximum gain (VC1 ,VC4), VC2 and VC3 are set at -3V. (VC1 ,VC4), VC2 and VC3 are biased in sequence. The first dynamic range is achieved by setting VC2 and VC3 at -3V and varying (VC1 ,VC4) over the (-3 to 0V) range as shown in the table below. Similarly second dynamic range is achieved by setting (VC1 ,VC4) at 0V, VC3 at -3 and varying VC2 over the (-3 to 0V) range. Finally third dynamic range is achieved by setting (VC1 ,VC4) and VC2 at 0V and varying VC3 over the (-3 to 0V) range.

Bias Sequence 1 (Typical)

	Gmax									Gmin
VC1, VC4	-3	-2	-1	0	0	0	0	0	0	0
VC2	-3	-3	-3	-3	-2	-1	0	0	0	0
VC3	-3	-3	-3	-3	-3	-3	-3	-2	-1	0

Better NF at minimum gain is achieved using bias sequence 2.

Bias Sequence 2

	Gmax															Gmin
VC1, VC4	-3	-2.5	-2	-1.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
VC2	-3	-3	-3	-3	-3	-2.5	-2	-1.5	-1	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
VC3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-2.5	-2	-1.5	-1	-0.5	0

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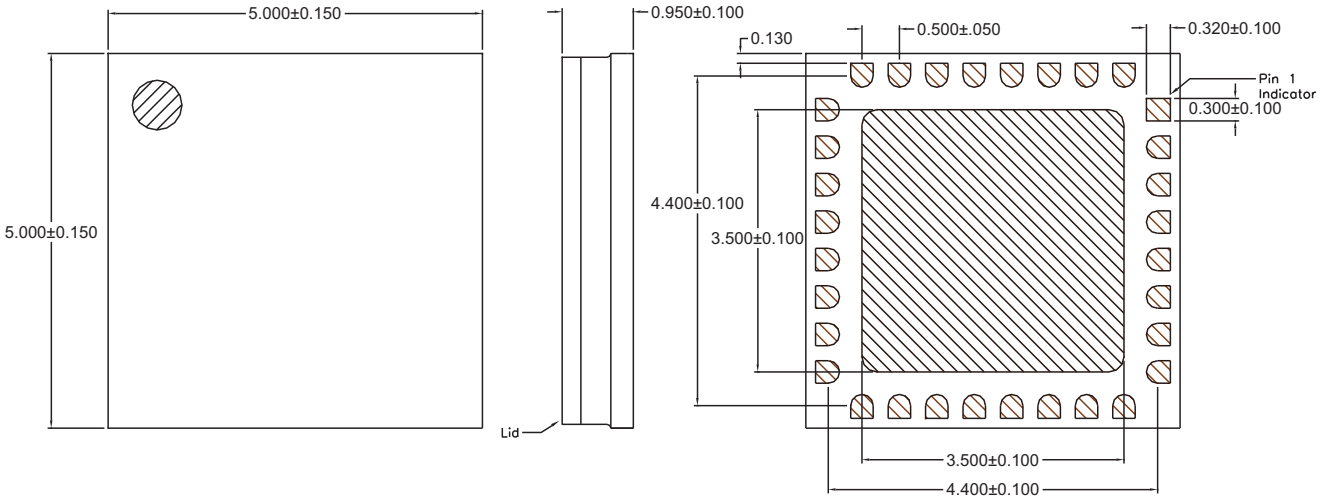
Package Outline Drawing

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



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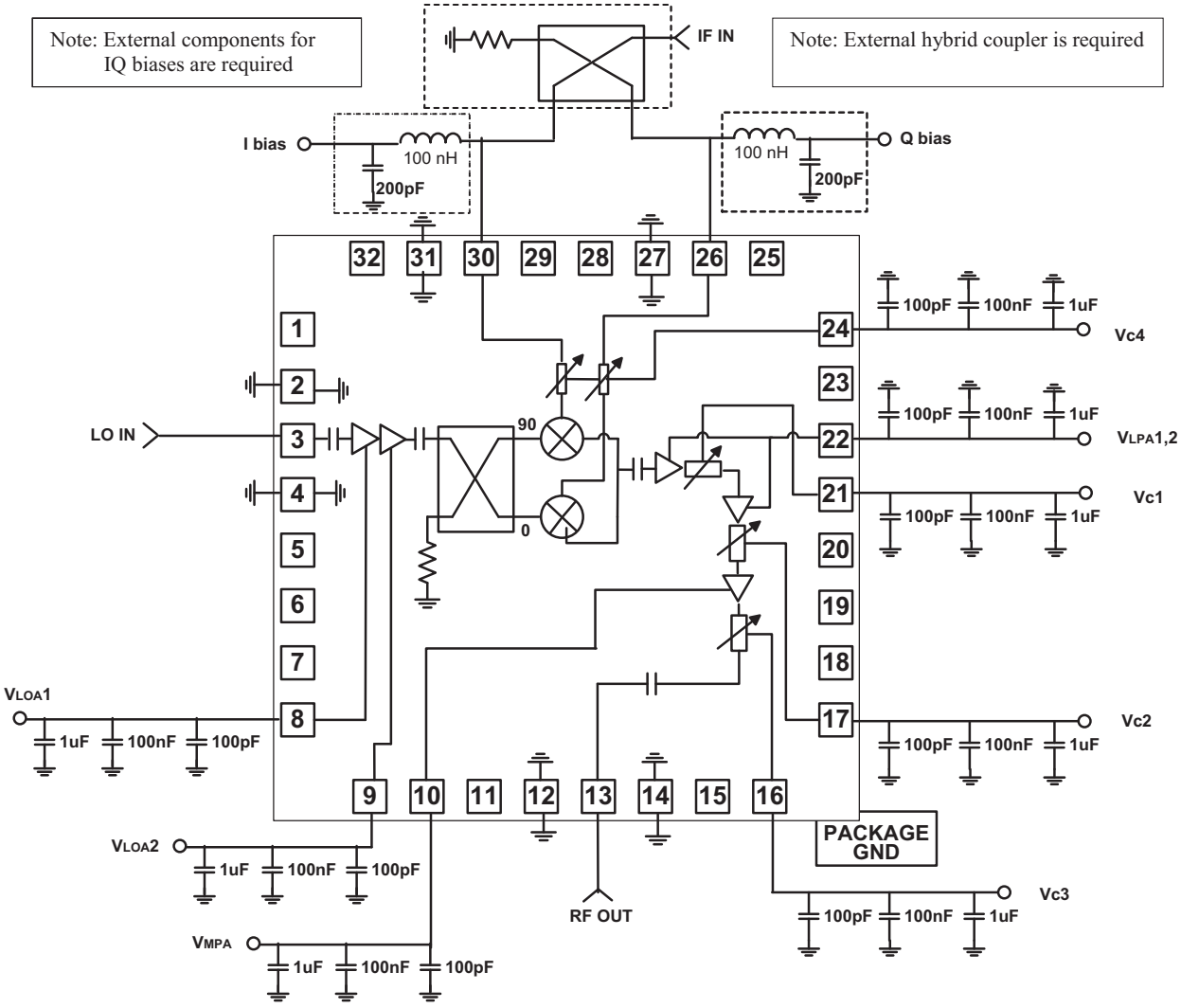
Pin Names and Description

Pin	Function	Description
1	N/C	
2	GND	Ground
3	LO	Local Oscillator Input. AC Coupled and Matched to 50W
4	GND	Ground
5	N/C	
6	N/C	
7	N/C	
8	VLOA1	LOA Stage1 Drain Bias
9	VLOA2	LOA Stage2 Drain Bias
10	VMPA	MPA Drain Bias
11	N/C	
12	GND	Ground
13	RFOUT	RF Output. AC Coupled and Matched to 50W
14	GND	Ground
15	N/C	
16	VC3	Control Line number3 (See Bias Sequence description)
17	VC2	Control Line number2 (See Bias Sequence description)
18	N/C	
19	N/C	
20	N/C	
21	VC1	Control Line number1 (See Bias Sequence description)
22	VLPA1, VLPA2	LPA Stage1,2 Drain Bias
23	N/C	
24	VC4	Control Line number4 (See Bias Sequence description)
25	N/C	
26	Q	IF Q Input
27	GND	Ground
28	N/C	
29	N/C	
30	I	IF I Input
31	GND	Ground
32	N/C	

Application Circuit Block Diagram



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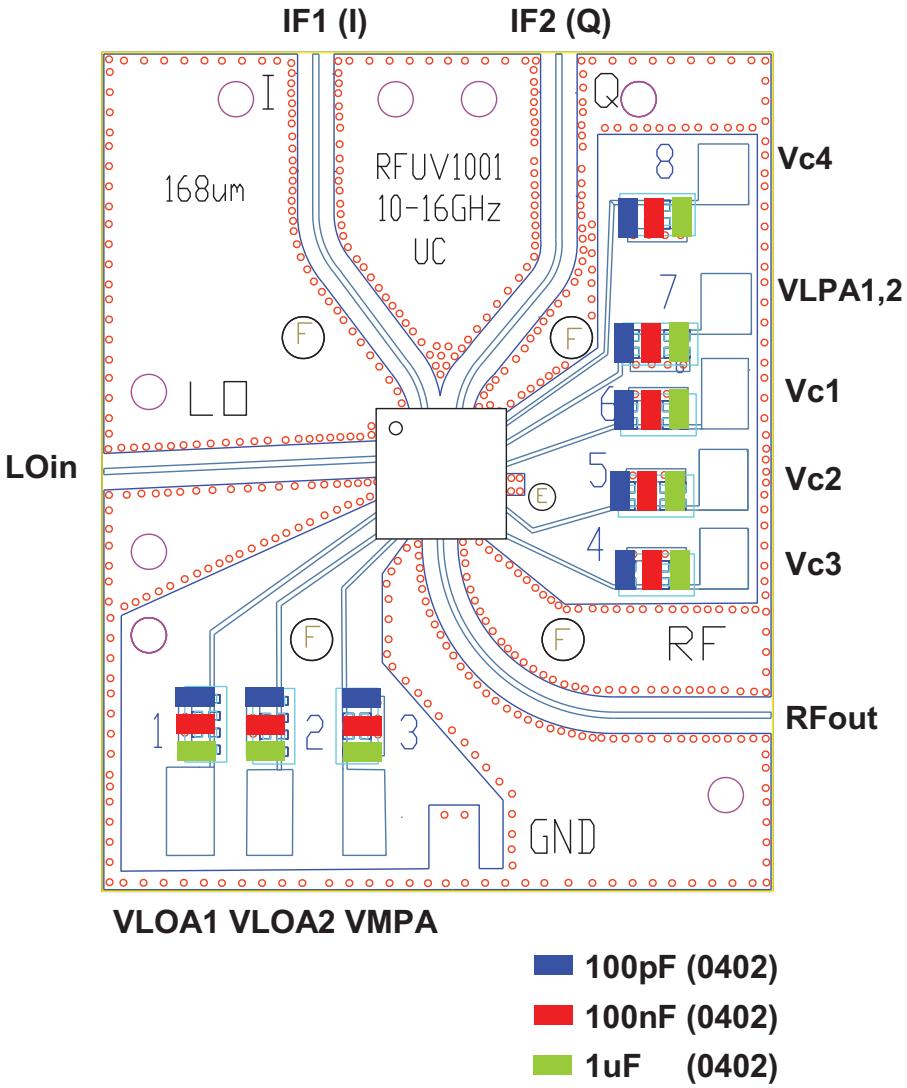
Evaluation Board Layout



Test Condition

LO Power	0dBm
IF Power	-10dBm
VLOA1, VLOA2	5V
VLPA1, VLPA2, VMPA	5V
(VC1, VC4), VC2, VC3	-3V to 0V

Sub-Band Frequency Ranges

Band	Frequency Range
10GHz	10GHz to 10.5GHz
11GHz	10.7GHz to 11.7GHz
13GHz	12.75GHz to 13.25GHz
15GHz	14.4GHz to 15.4GHz