

RFUV1002

GaAs MMIC IQ UpConverter
9GHz to 14GHz

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 5mm x 5mm QFN to simplify both system level board design and volume assembly.



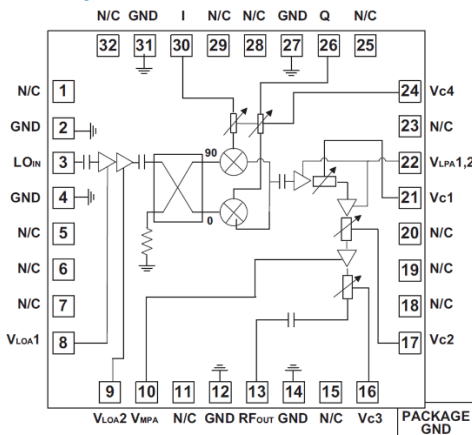
Package: QFN, 32-pin,
5mm x 5mm x 0.95mm

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 Radio
- VSAT



Functional Block Diagram

Ordering Information

RFUV1002S2	Sample bag with 2 pieces
RFUV1002SB	Bag with 5 pieces
RFUV1002SQ	Bag with 25 pieces
RFUV1002SR	7" Reel with 100 pieces
RFUV1002TR7	7" Reel with 750 pieces
RFUV1002TR13	13" Reel with 2500 pieces
RFUV1002PCK-410	Evaluation Board with 2-piece sample bag

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Absolute Maximum Ratings

Parameter	Rating	Unit
LPA Drain Voltage Vd	+6.0	V
LOA Drain Voltage	+6.0	V
RF Input Power	+15	dBm
LO Input Power	+15	dBm
Operating Temperature Range	-40 to +85	°C
Storage Temperature Range	-40 to +150	°C
ESD Rating - Human Body Model (HBM)	Class 1A	V



Caution! ESD sensitive device.



RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), 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.

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.

Electrical Specifications

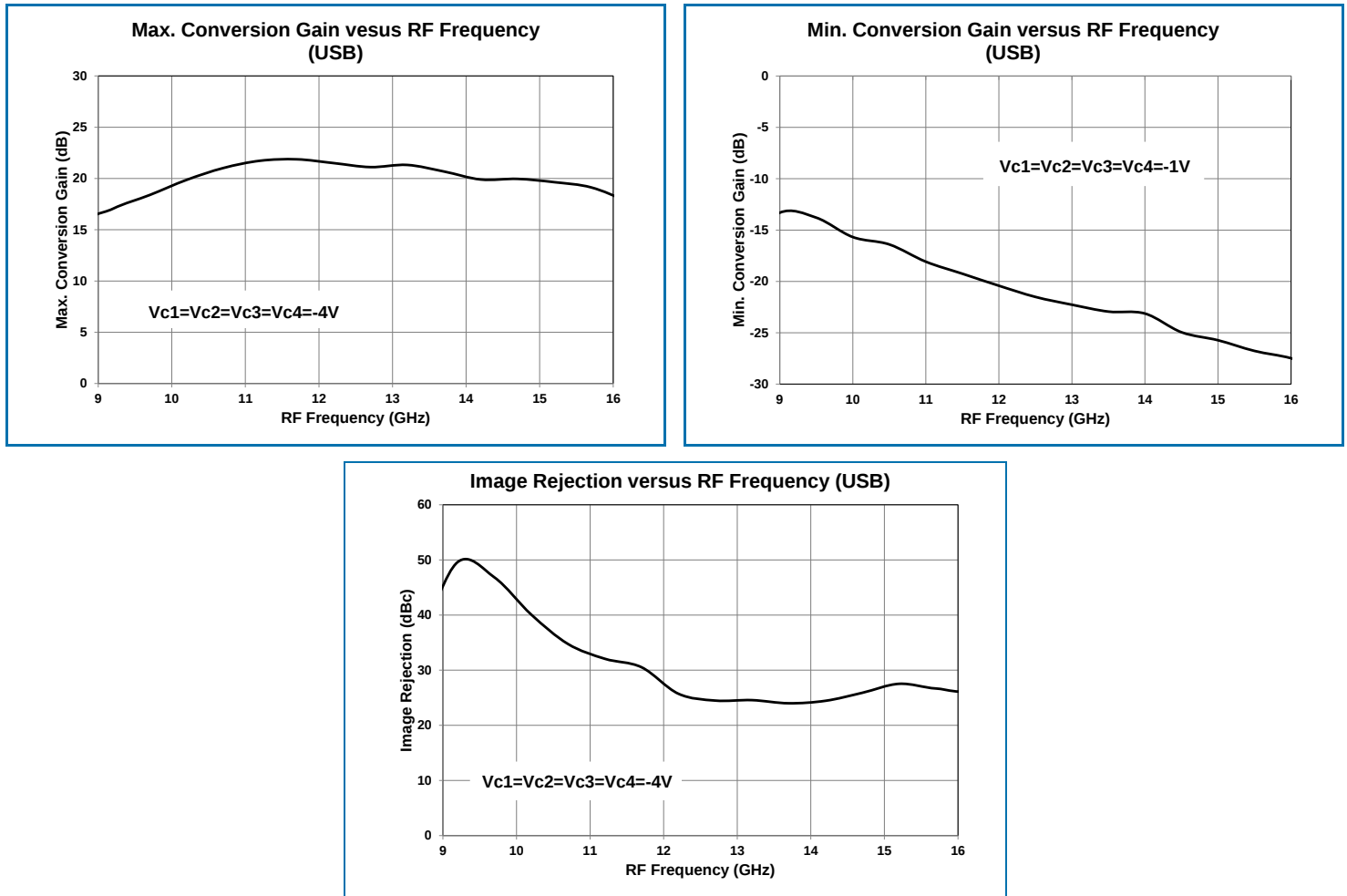
Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Test conditions unless otherwise noted: IF = 2.5GHz, IF Power = -10dBm, LO Power = 0 dBm, IIP3 is measured with a 2-tone input of -13dBm power for each tone and Δf = 10MHz, VLOA1 = VLOA2 = 5V, VLPA1 = VLPA2 = 5V, VMPA = 5V, 50 Ω system					
RF Frequency Range	9		14	GHz	
LO Frequency Range	5		18	GHz	
IF Frequency Range	DC		4.0	GHz	
LO Input Power		0		dBm	
Conversion Gain (Max.) RF Freq = 11 to 13 GHz RF Freq = 9 to 14 GHz	20 15	23 20		dB dB	
Conversion Gain (Min.) RF Freq = 11 to 13 GHz RF Freq = 9 to 14 GHz		-15 -18		dB dB	
NF (max. Gain)		12		dB	
NF (min. Gain)		17		dB	
OIP3 (max. Gain) RF Freq = 11 to 13 GHz RF Freq = 9 to 14 GHz	25 20	28 25		dBm dBm	
OIP3 (min. Gain) RF Freq = 11 to 13 GHz RF Freq = 9 to 14 GHz	9 6	14 11		dBm dBm	
Image Rejection	15	20		dB	
LO-to-RF Leakage (max. 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	-4		0	V	

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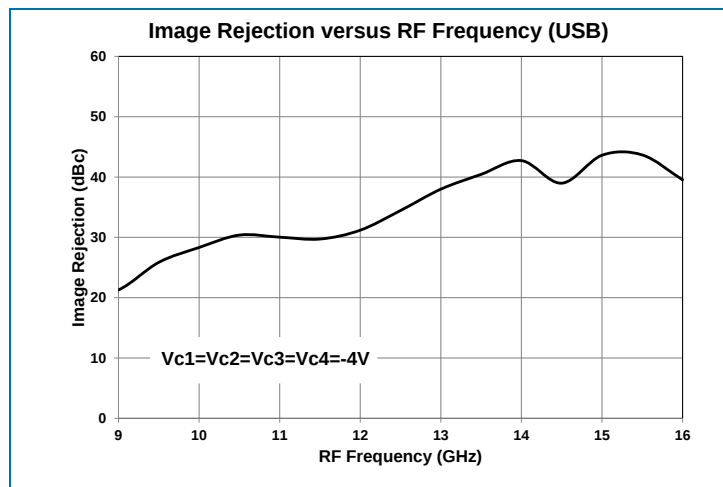
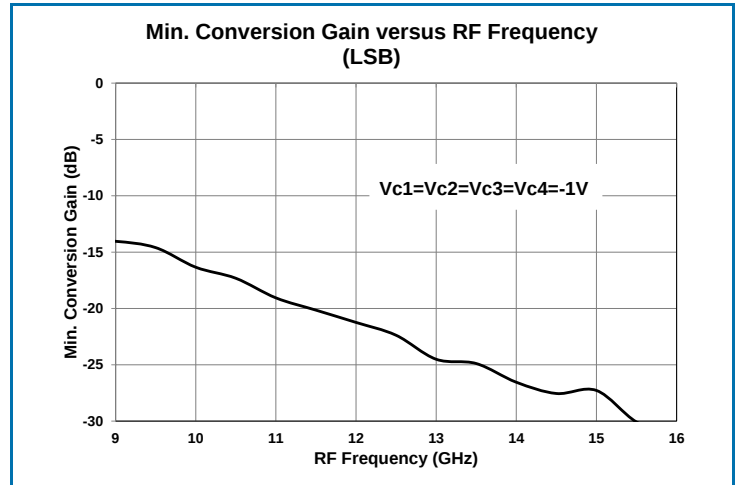
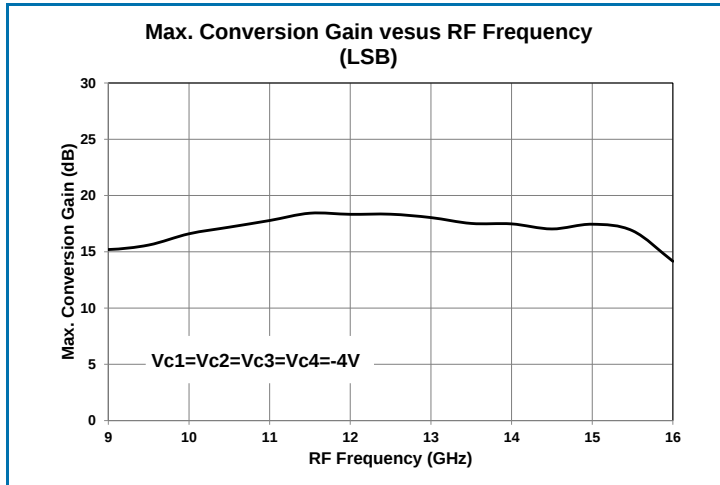
Typical Performance

Measurements performed on part soldered on evaluation board with SMA connectors and IF ports connected to an external 90° Hybrid Combiner and LO Power of 0 dBm and at 25°C, unless otherwise noted.

IF = 2.5GHz, IF Power = -10dBm, LO Power = 0 dBm, IIP3 is measured with a 2-tone input of -13dBm power for each tone and $\Delta f = 10\text{MHz}$, VLOA1 = VLOA2 = 5V, VLPA1 = VLPA2 = 5V, VMPA = 5V, 50 Ω system.

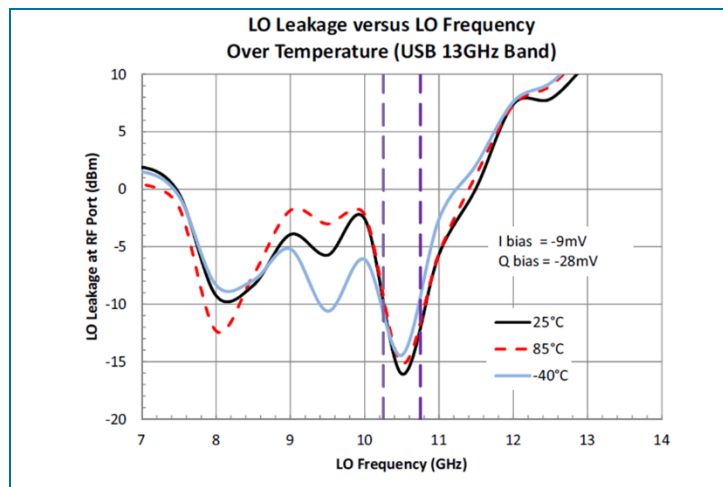
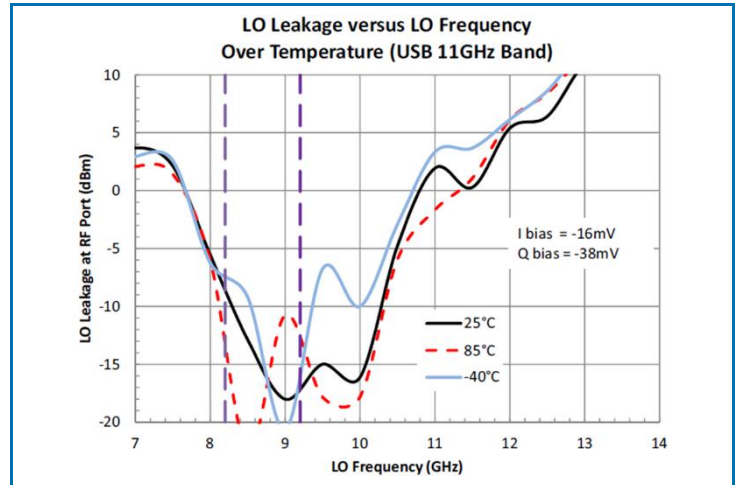
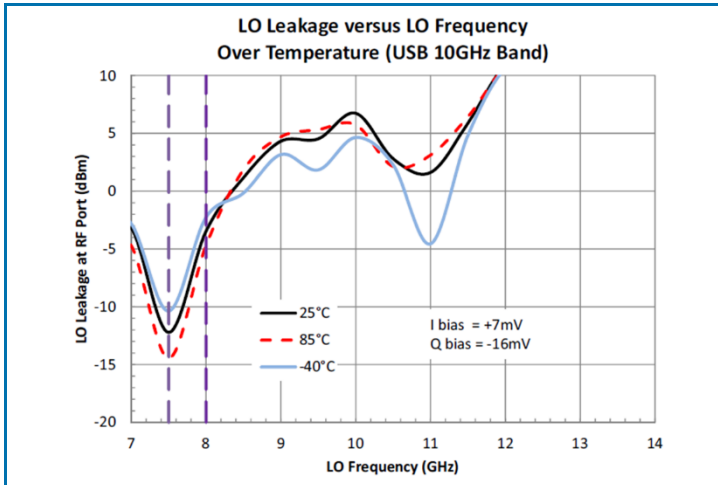


Typical Performance (continued)

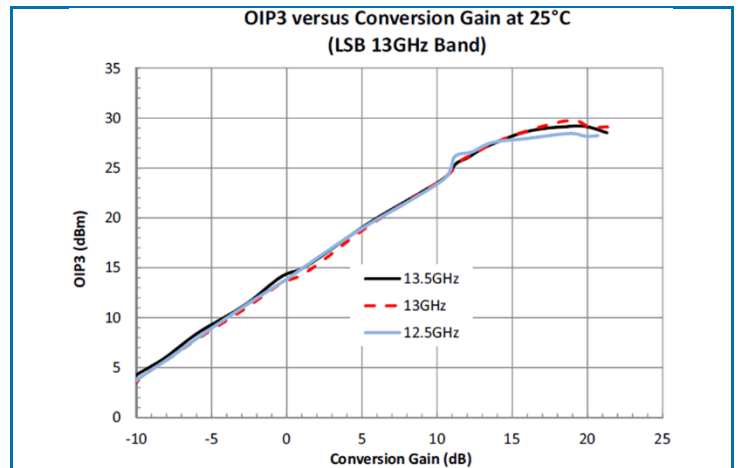
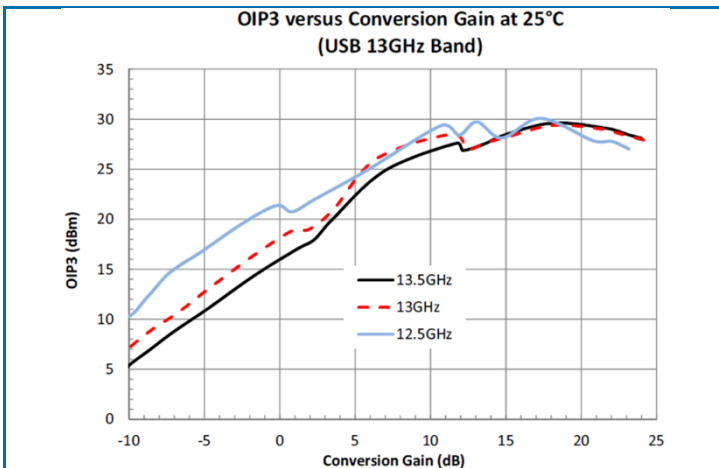
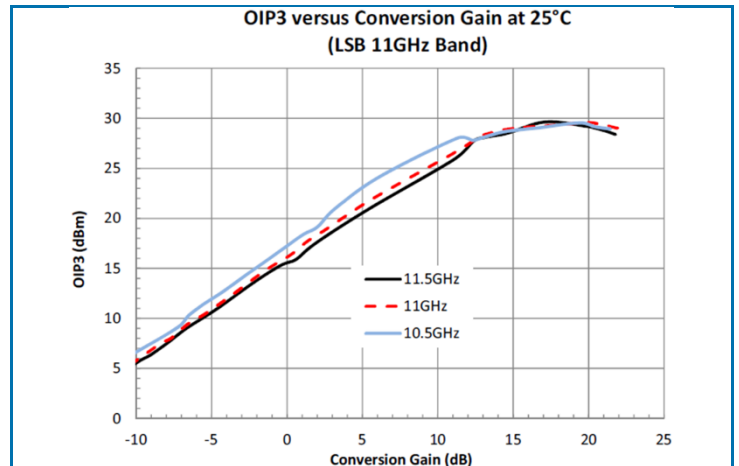
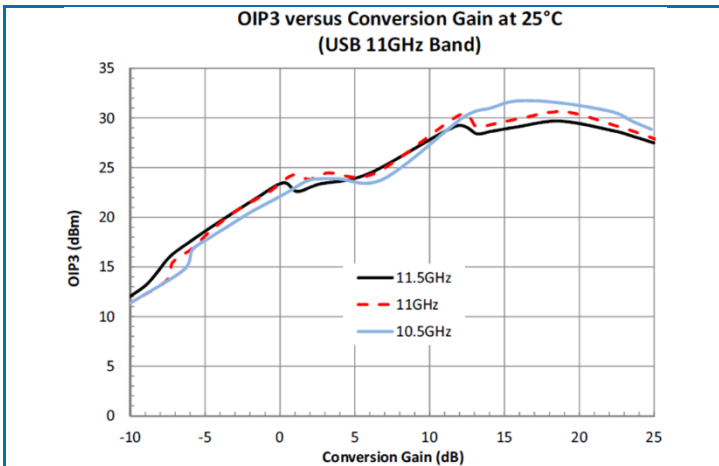
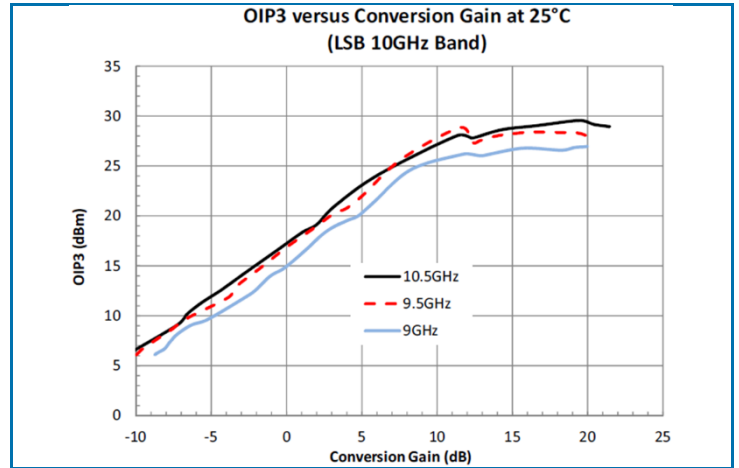
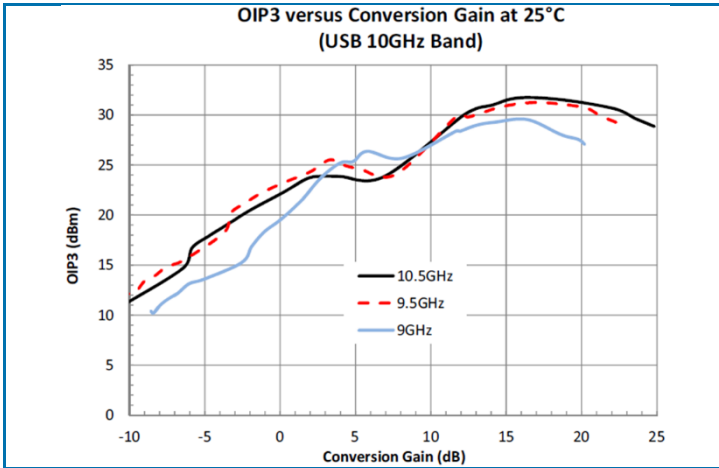


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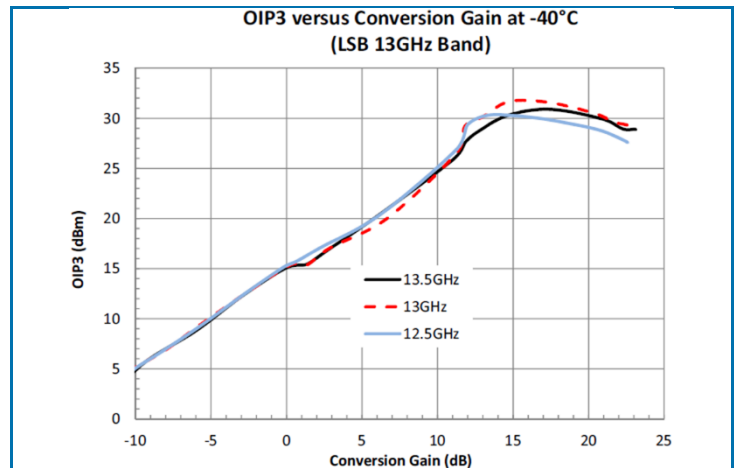
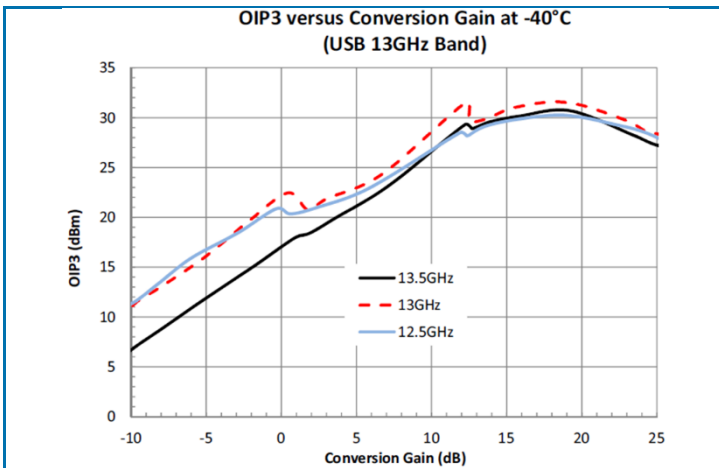
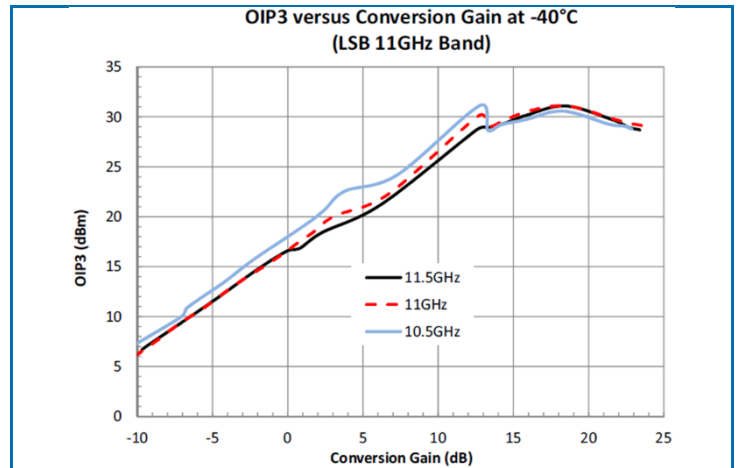
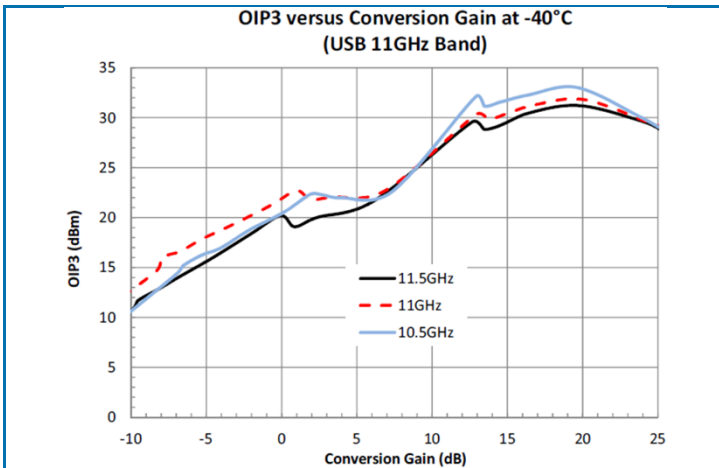
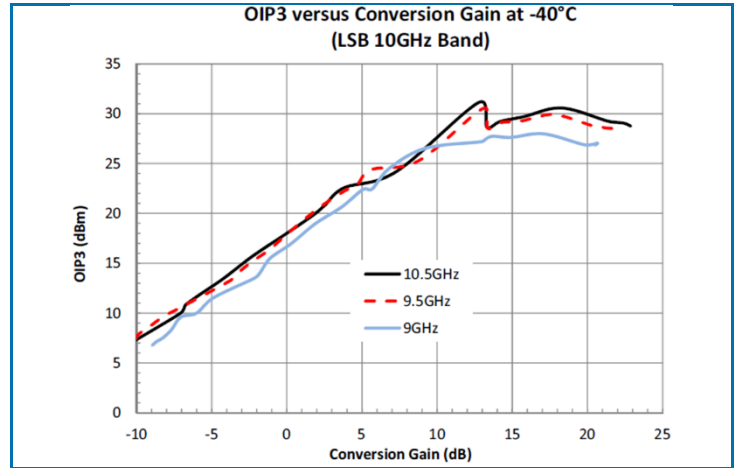
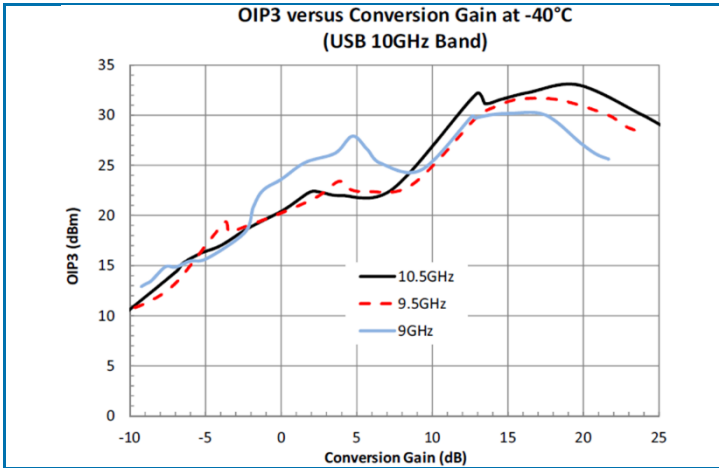
Typical Performance (continued)



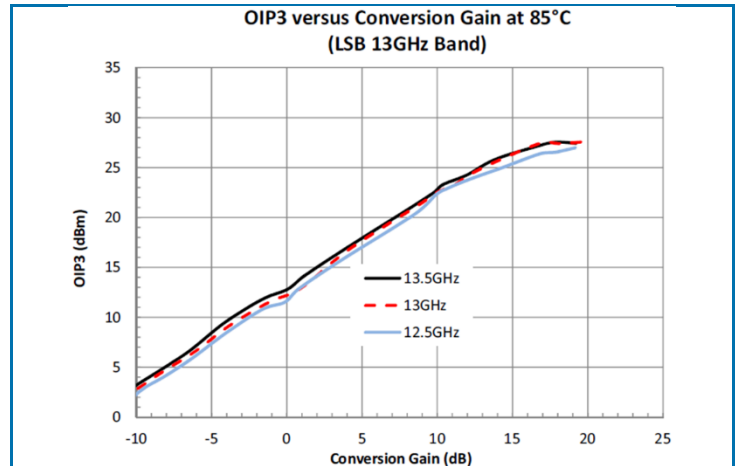
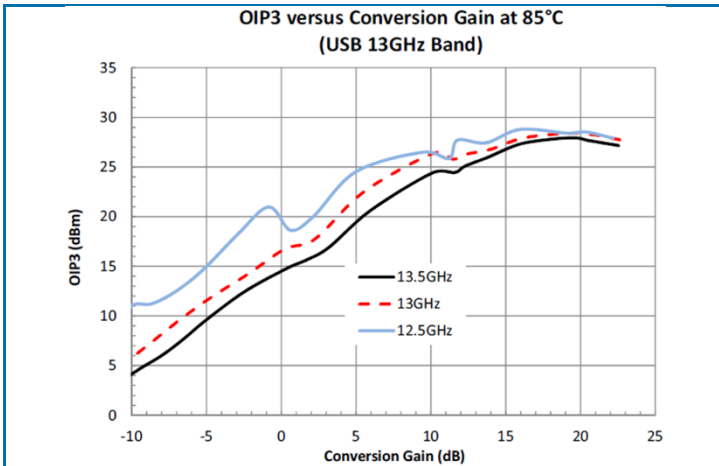
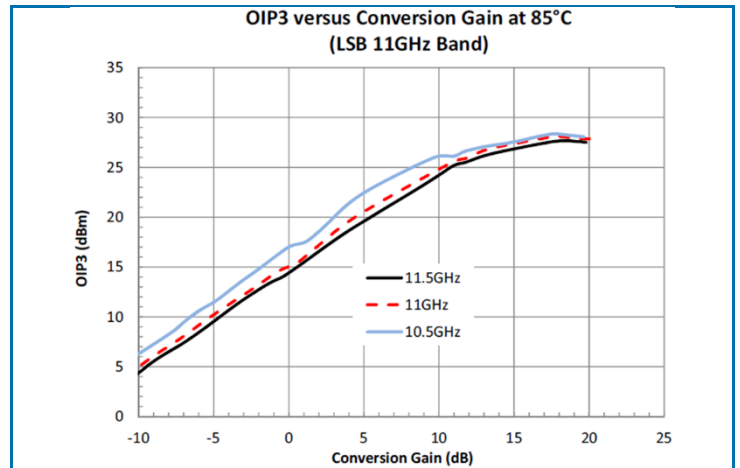
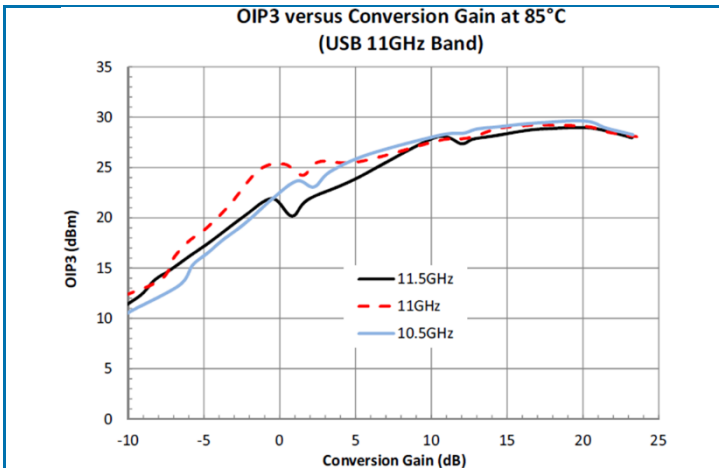
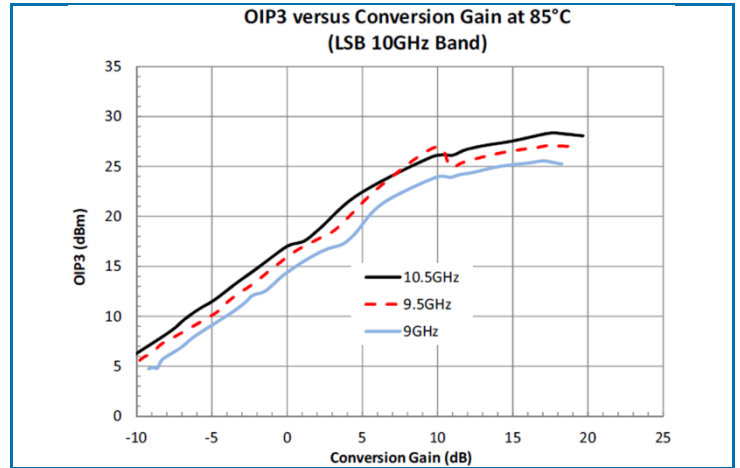
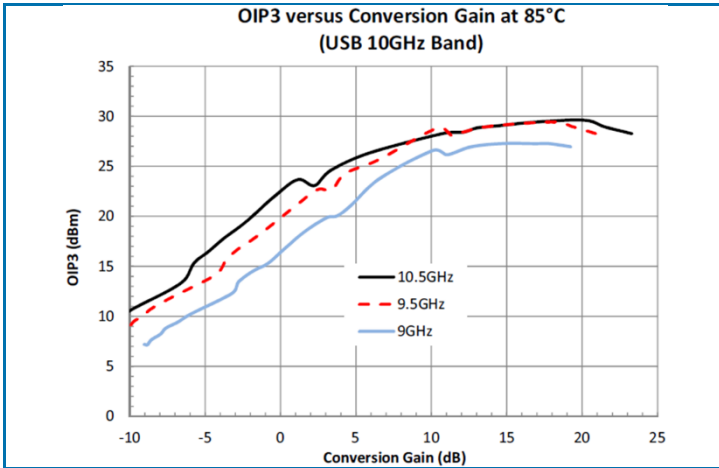
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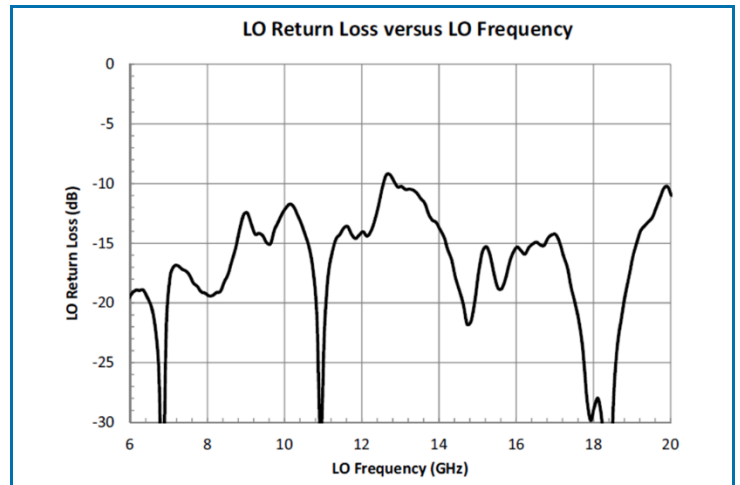
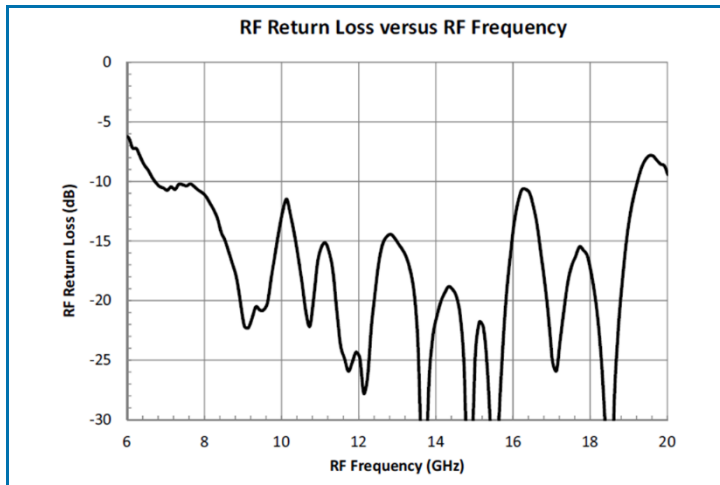
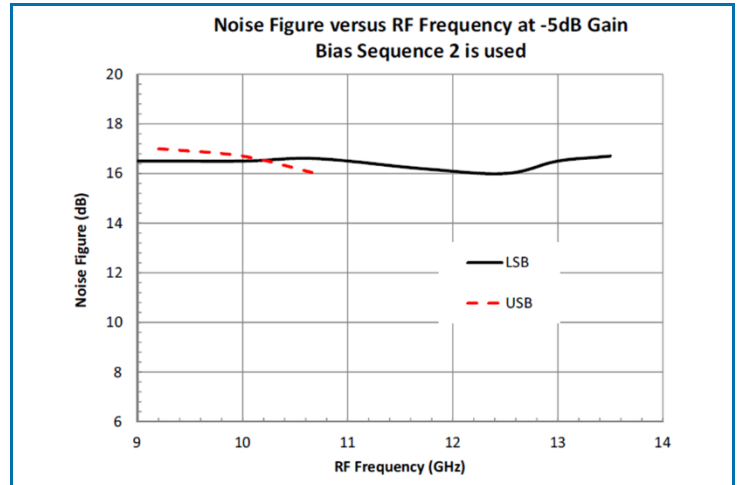
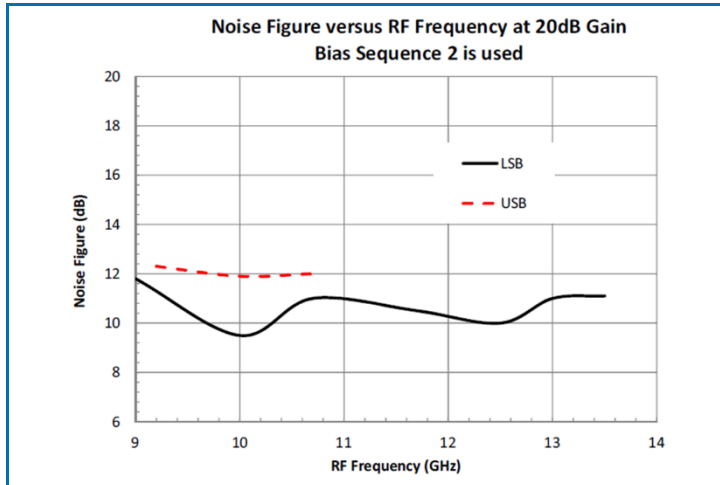
Typical Performance (continued)



Typical Performance (continued)



Typical Performance (continued)



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Typical Performance (continued)

Spur tables are $M \times f_{LO} \pm N \times f_{IF}$ mixer spurious products for -10 dBm IF input power.
All values in dBc below the RF output power level.

M x N Spurious Outputs for LSB,
IF = 3.5 GHz, RF = LO - IF

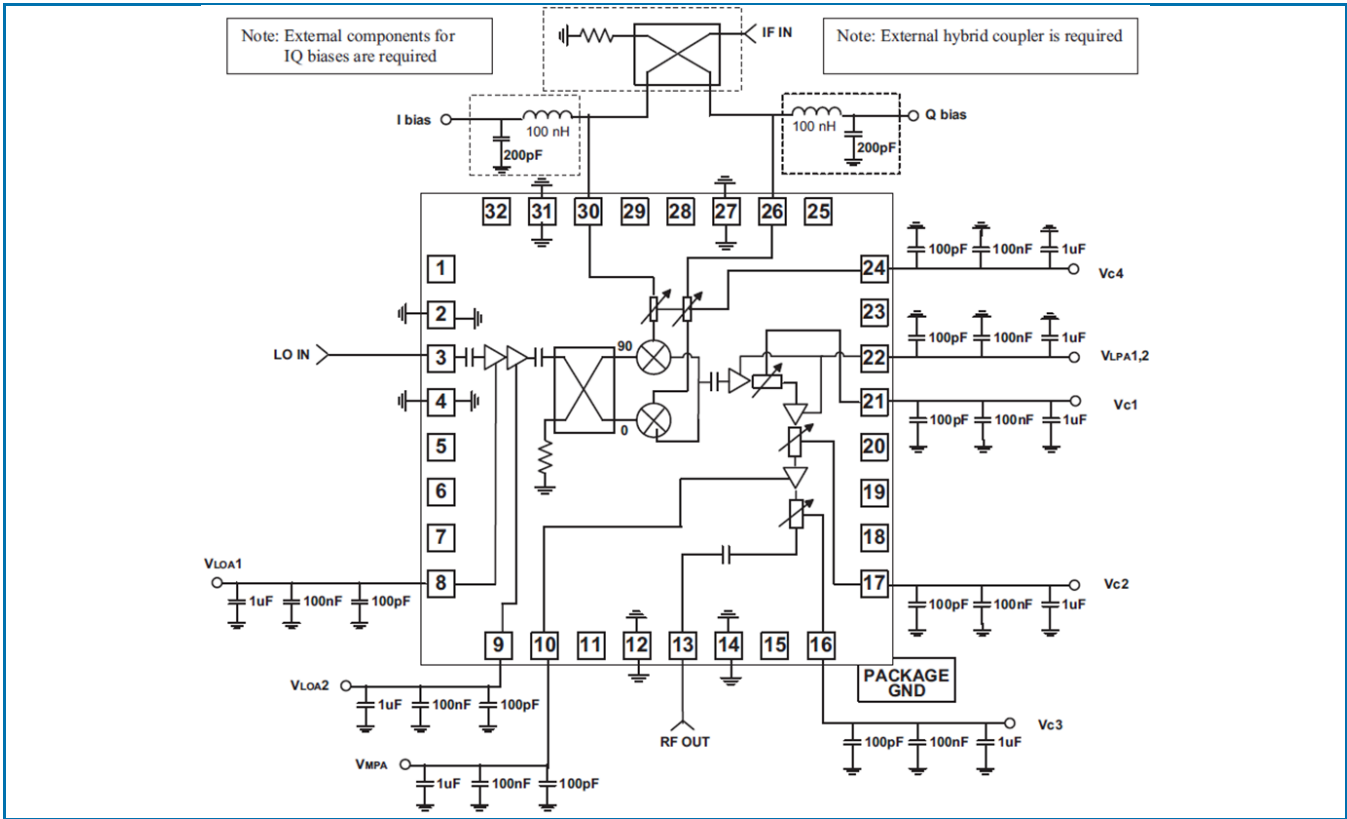
		M				
		1	2	3	4	5
N	-2	55	44	78	--	--
	-1	0	53	74	--	--
	0	27	77	54	--	--
	1	33	80	73	--	--
	2	88	79	--	--	--

M x N Spurious Outputs for USB,
IF = 3.5 GHz, RF = LO + IF

		M				
		1	2	3	4	5
N	-2	73	41	55	76	84
	-1	57	21	25	69	83
	0	33	20	43	65	78
	1	0	37	55	78	78
	2	51	41	75	78	78

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Evaluation Board Schematic



Typical Bias Sequence and Gain Control

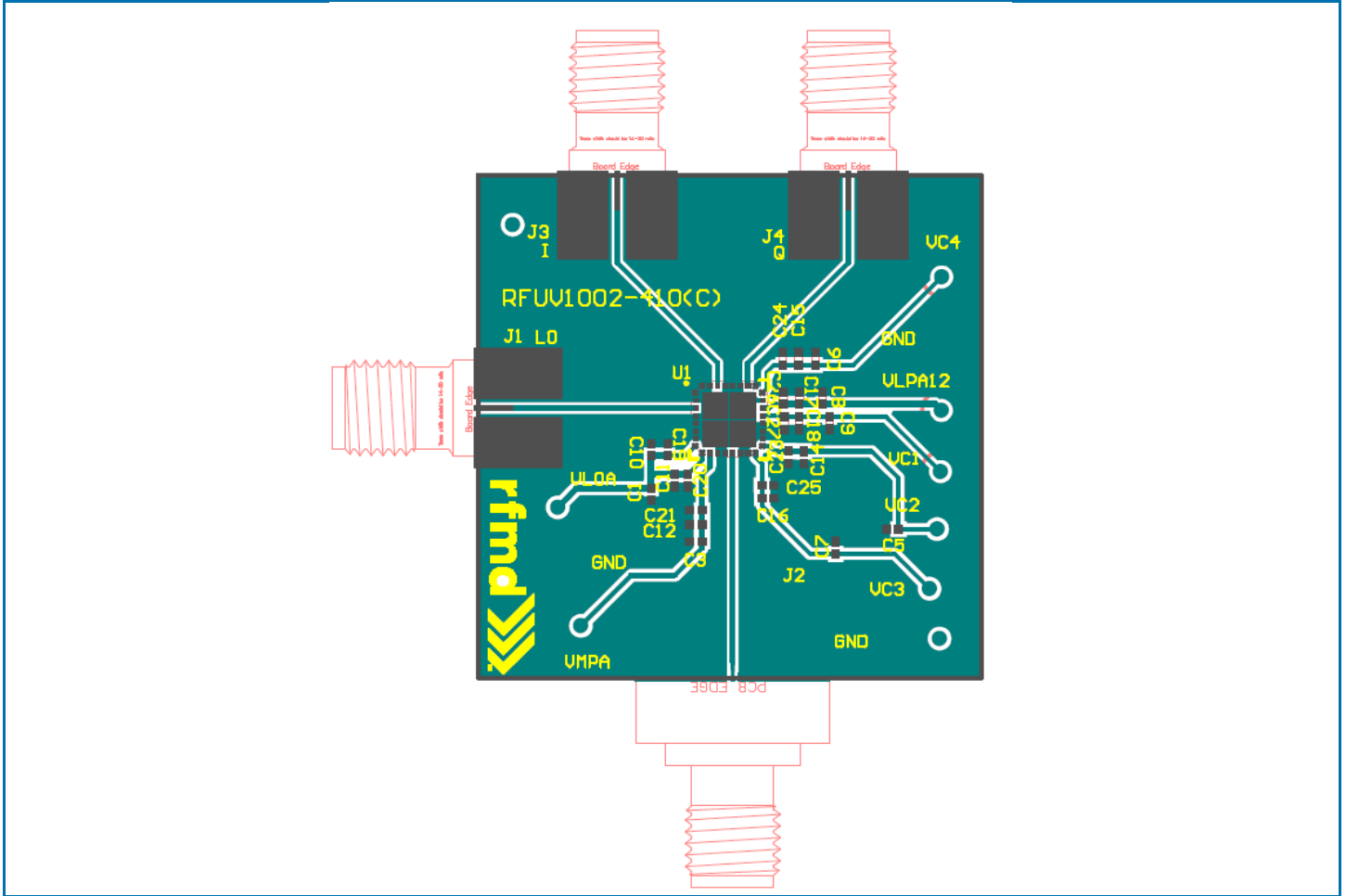
Optimum linearity versus gain is achieved using sequential bias. At maximum gain (V_{c1} , V_{c4}), V_{c2} and V_{c3} are set at -4V. (V_{c1} , V_{c4}), V_{c2} and V_{c3} are biased in sequence. The first dynamic range is achieved by setting V_{c2} and V_{c3} at -4V and varying (V_{c1} , V_{c4}) over the (-4V to -1.25V) range as shown in the table below. Similarly second dynamic range is achieved by setting (V_{c1} , V_{c4}) at -1V, setting V_{c3} to -4V and varying V_{c2} over the (-2.5V to -1.25V) range. Finally third dynamic range is achieved by setting (V_{c1} , V_{c4}) and V_{c2} at -1V, and varying V_{c3} over the (-2.5V to -1V) range.

Bias Sequence 1 (Typical)

	Gmax																		Gmin
VC1, VC4	-4	-2.5	-2.25	-2	-1.75	-1.5	-1.25	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
VC2	-4	-4	-4	-4	-4	-4	-4	-2.5	-2.25	-2	-1.75	-1.5	-1.25	-1	-1	-1	-1	-1	-1
VC3	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-4	-2.5	-2.25	-2	-1.75	-1.5	-1

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Evaluation Board Assembly Drawing



Evaluation Board Bill of Materials (BOM)

Description	Reference Designator	Manufacturer	Manufacturer's P/N
CAP, 1uF, 10%, 6.3V, X5R, 0402	C1, C3, C5, C6, C7, C8, C9	Taiyo Yuden (USA), Inc.	RM JMK105BJ105KVLF
CAP, 0.1uF, 10%, 10V, X5R, 0402	C10, C11, C12, C14, C15, C16, C17, C18	Taiyo Yuden (USA), Inc.	RM LMK105 BJ104KV-F
CAP, 100pF, 5%, 50V, C0G, 0402	C19, C20, C21, C23, C24, C25, C26, C27	Taiyo Yuden (USA), Inc.	RM UMK105 CG101JV-F
CONN, SMA, HI-FREQ END LNCH, SQ 4-HOLE	J1,J3,J4	Emerson Network Power	142-0761-811
CONN, 2.92MM, END LAUNCH, 40GHz, SQ FLG	J2	Southwest Microwave, Inc	1092-01A-5
RFUV1002	U1	Qorvo	

Pin configuration diagram for the ATmega328P in a 28-pin DIP package. The pins are numbered 1 to 28. The top row (pins 1-8) is labeled: N/C, GND, I, N/C, N/C, GND, Q, N/C. The bottom row (pins 9-16) is labeled: VLD A2, VMPA, N/C, GND, RFout, GND, N/C, Vc3. The left side (pins 17-24) is labeled: VLD A1, N/C, N/C, N/C, N/C, N/C, N/C, N/C. The right side (pins 25-28) is labeled: Vc4, N/C, VLD A1,2, Vc1, N/C, N/C, Vc2.

Technical drawing of a rectangular container. The main view shows a rectangle with dimensions 5.000 ± 0.150 (width) and 5.000 ± 0.150 (height). A circular feature is located in the top-left corner. A side view shows the lid, labeled "Lid", with a thickness of 0.950 ± 0.100 . A detailed view of the lid shows a central square area with diagonal hatching, surrounded by a border of circular features. The lid dimensions are 4.400 ± 0.100 (width) and 4.400 ± 0.100 (height). The central square area has dimensions 3.500 ± 0.100 (width) and 3.500 ± 0.100 (height). The border features are spaced at 0.130 intervals. The distance from the edge to the first border feature is 0.320 ± 0.100 . The distance between the first and last border features is 0.500 ± 0.050 . A label "Pin 1 Indicato" points to one of the border features. The distance from the edge to the last border feature is 0.300 ± 0.100 .

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Pin Names and Descriptions

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
5-7	N/C	Not Connected
8	VLOA1	LOA stage 1 drain bias
9	VLOA2	LOA stage 2 drain bias
10	VMPA	MPA drain bias
11	N/C	Not Connected
12	GND	Ground
13	RFOUT	RF output. AC coupled and matched to 50Ω
14	GND	Ground
15	N/C	Not Connected
16	VC3	Control line number 3 (See bias sequence description)
17	VC2	Control line number 2 (See bias sequence description)
18-20	N/C	Not Connected
21	VC1	Control line number 1 (See bias sequence description)
22	VLPA1, VLPA2	LPA stage 1,2 drain bias
23	N/C	Not Connected
24	VC4	Control line number 4 (See bias sequence description)
25	N/C	Not Connected
26	Q	IF Q input
27	GND	Ground
28-29	N/C	Not Connected
30	I	If I input
31	GND	Ground
32	N/C	Not Connected

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Contact Information

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Email: customer.support@qorvo.com

For information about the merger of RFMD and TriQuint as Qorvo:

Web: www.qorvo.com

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