HMC412BMS8GE

v02.0417

DOUBLE-BALANCED MIXER 8 - 16 GHz

Typical Applications

The HMC412BMS8GE is ideal for:

- Long Haul Radio Platforms
- Microwave Radio
- VSAT

Features

Conversion Loss: 8 dB

Noise Figure: 8 dB

LO to RF Isolation: 44 dB

LO to IF Isolation: 38

RF to IF Isolation: 29 dB

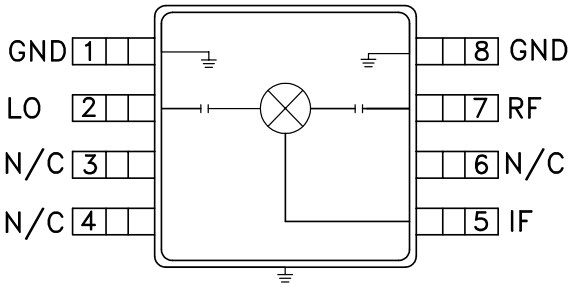
Input Third-Order Intercept: 19 dB

Input Power for 1 dB Compression: 10 dB

No External Components

MSOP8GE SMT Package

Functional Diagram



General Description

The HMC412BMS8GE is a passive double-balanced mixer that operates from 8 to 16 GHz. The HMC412BMS8GE operates with LO drive levels between 9 to 15 dBm and provides 8 dB of conversion loss across the entire specified frequency band. This mixer requires no external components or bias.

Electrical Specifications, T_A = +25 °C, IF = 1.45 GHz, LO Power= +13 dBm, USB [1]

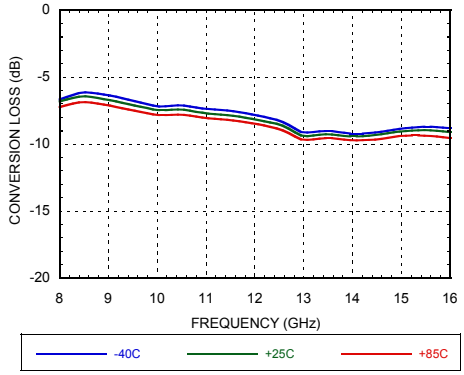
Parameter	Min.	Typ.	Max.	Units
RF Frequency Range	8		16	GHz
LO Frequency Range	8		16	GHz
IF Frequency Range	DC		2.5	GHz
Conversion Loss		8	11	dB
Noise Figure, Single Sideband (SSB)		8		dB
LO to RF Isolation		44		dB
LO to IF Isolation	32	38		dB
RF to IF Isolation		29		dB
Input Third-Order Intercept (IP3)	15	19		dBm
Input Power for 1 dB Compression (P1dB)		10		dBm

[1] Unless otherwise noted all measurements performed as down-converter with upper sideband selected , IF = 1.45 GHz, RFIN = -5dBm

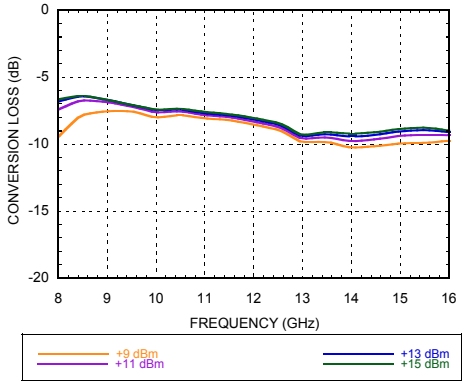
For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

Down-converter Performance, IF = 1450 MHz

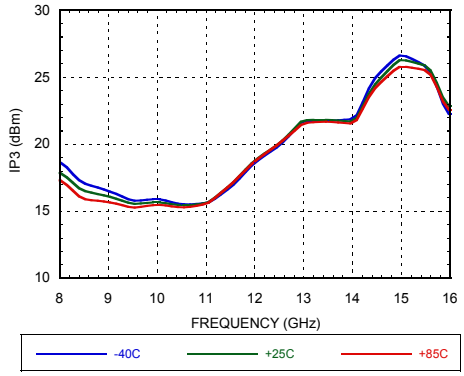
Conversion Loss vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB



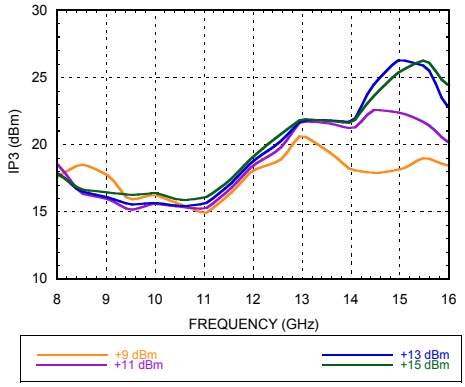
Conversion Loss vs. LO Drive
RFIN = -5 dBm, USB, Ta = +25C



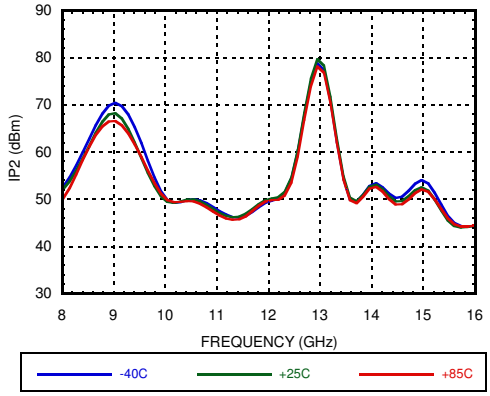
Input IP3 vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB



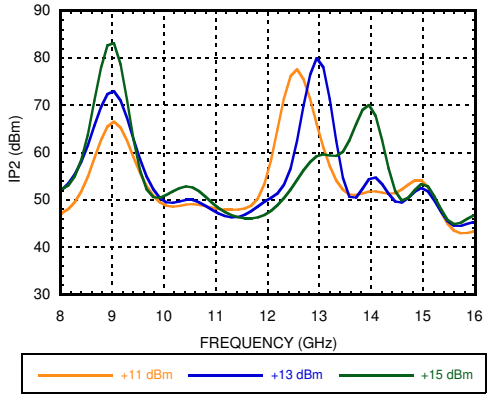
Input IP3 vs. LO Drive
RFIN = -5 dBm, USB, Ta = +25C



Input IP2 vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB

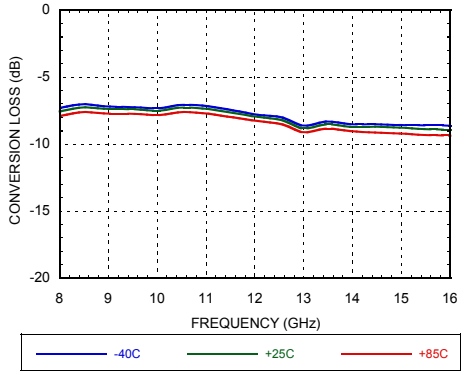


Input IP2 vs. LO Drive
RFIN = -5 dBm, USB, Ta = +25C

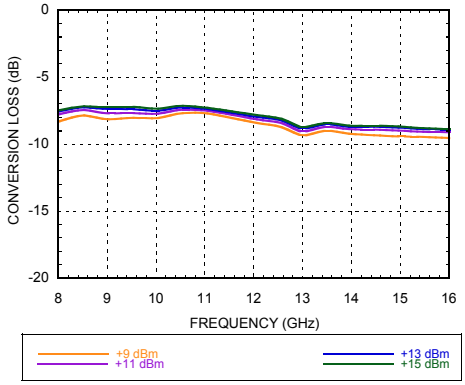


Down-converter Performance, IF = 150 MHz

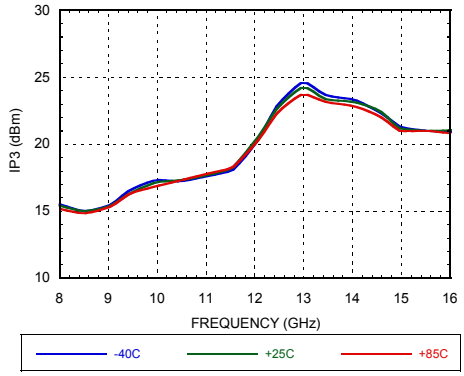
Conversion Loss vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB



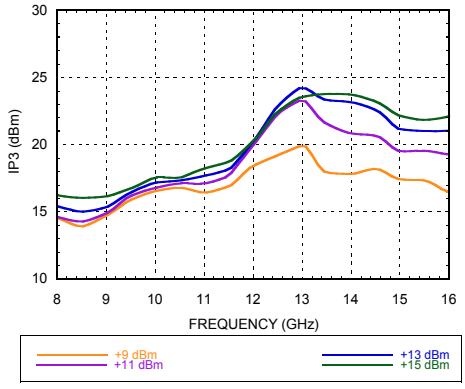
Conversion Loss vs. LO Drive
RFIN = -5 dBm, USB, Ta = +25C



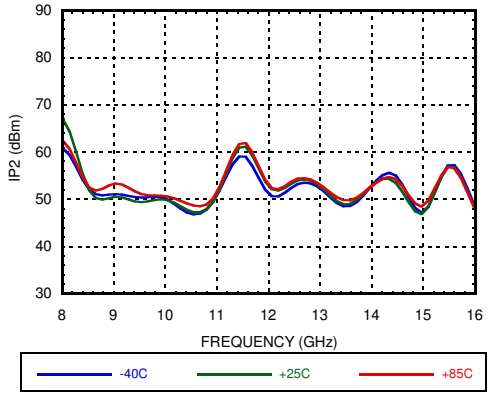
Input IP3 vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB



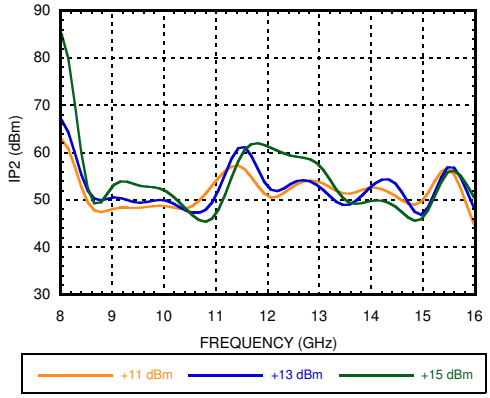
Input IP3 vs. LO Drive
RFIN = -5 dBm, USB, Ta = +25C



Input IP2 vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB

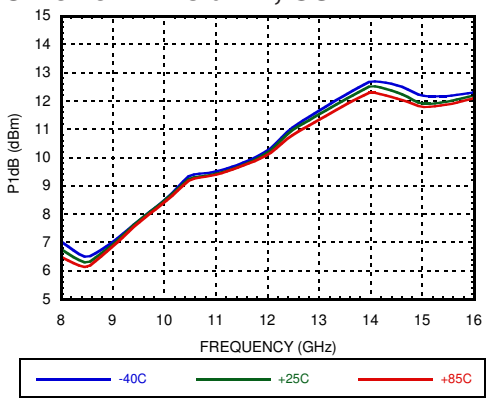


Input IP2 vs. LO Drive
RFIN = -5 dBm, USB, Ta = +25C

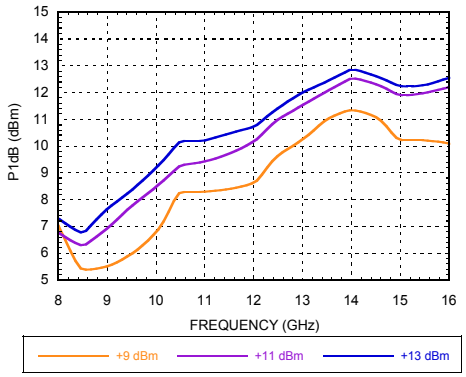


Down-converter Performance, IF = 1450 MHz

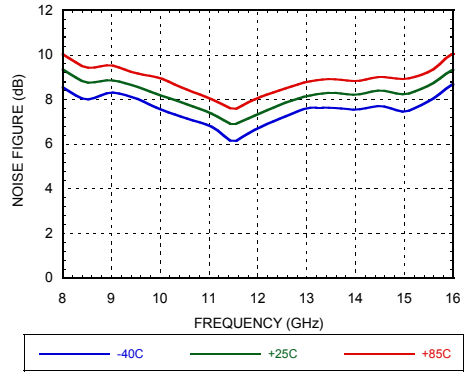
Input P1dB vs. Temperature
LO Power = +13 dBm, USB



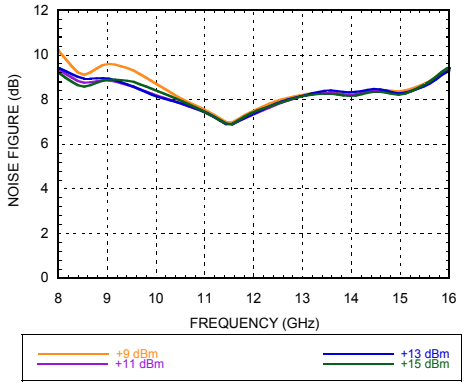
Input P1dB vs. LO Power
USB, Ta = +25C



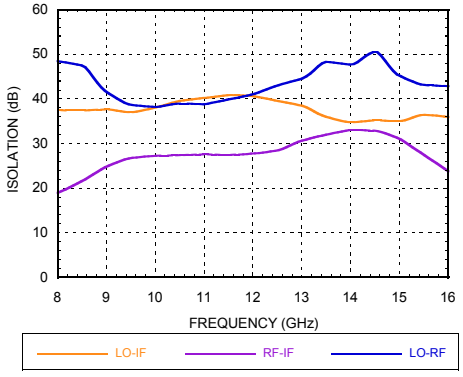
Noise Figure vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB



Noise Figure vs. LO Power
RFIN = -5 dBm, USB, Ta = +25C

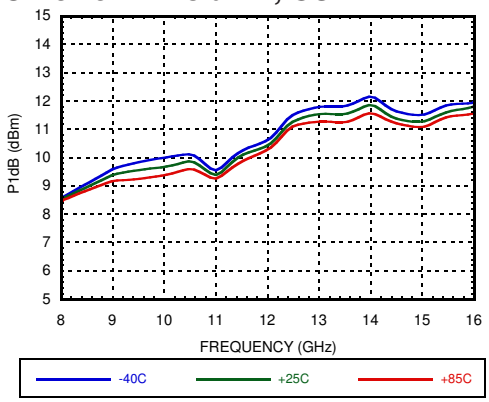


LO to RF, LO to IF, and RF to IF Isolation
LO Power = +13 dBm, USB, Ta = +25C

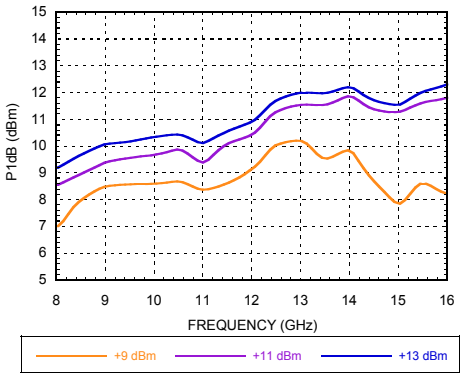


Down-converter Performance, IF = 150 MHz

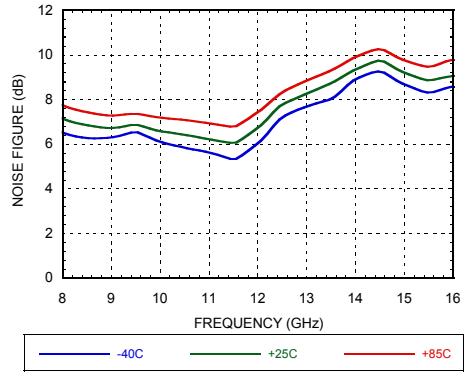
Input P1dB vs. Temperature
LO Power = +13 dBm, USB



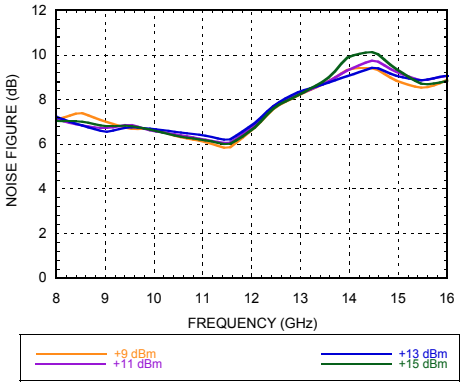
Input P1dB vs. LO Power
USB, Ta = +25C



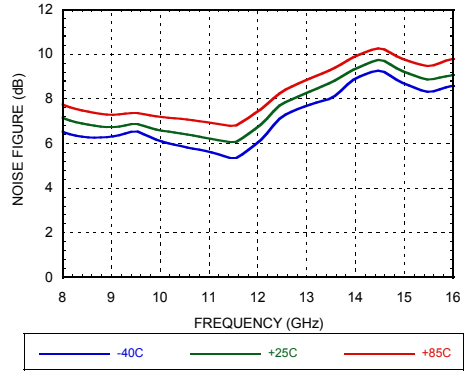
Noise Figure vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB



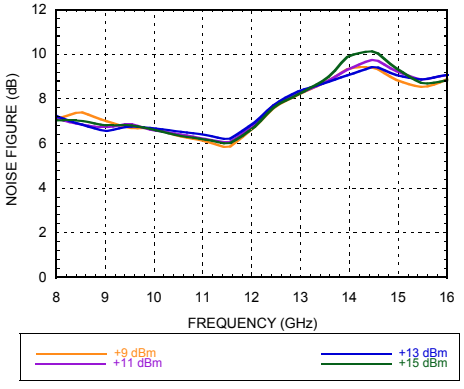
Noise Figure vs. LO Power
RFIN = -5 dBm, USB, Ta = +25C



Noise Figure vs. Temperature
LO = +13 dBm, RFIN = -5 dBm, USB

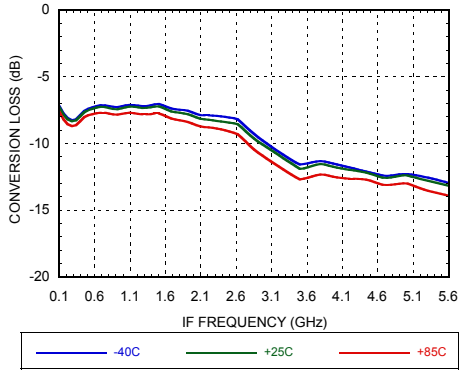


Noise Figure vs. LO Power
RFIN = -5 dBm, USB, Ta = +25C

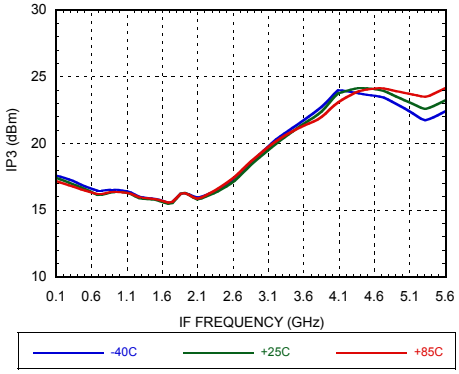


Down-converter Performance

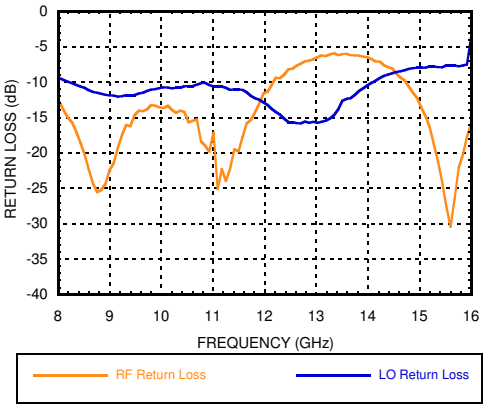
Conversion Loss over IF Bandwidth, USB
RFIN = -5dBm, LO = 9.5 GHz @ +13 dBm



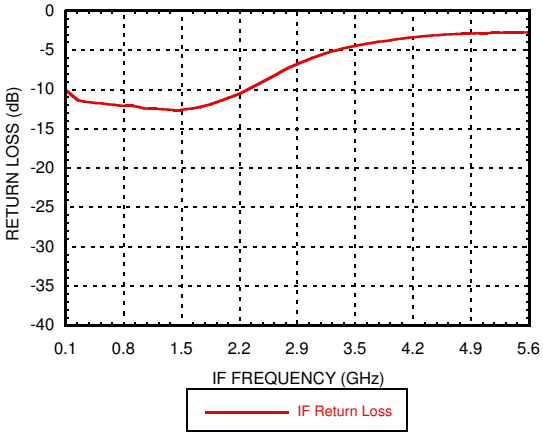
Input IP3 over IF Bandwidth, USB
RFIN = -5dBm, LO = 9.5 GHz @ +13 dBm



RF and LO Return Loss @ LO = 11 GHz,
LO Power = +13 dBm, Ta = +25C

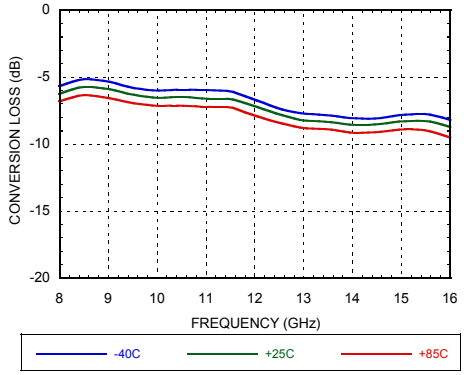


IF Return Loss, Ta = +25C

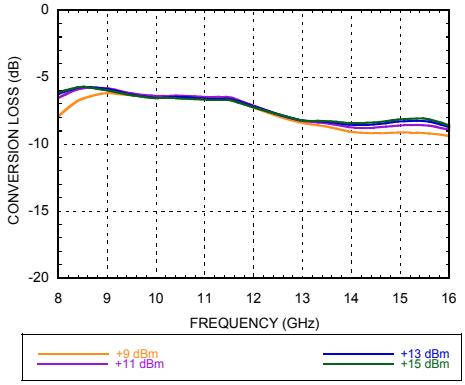


Up-converter Performance, IF = 1450 MHz

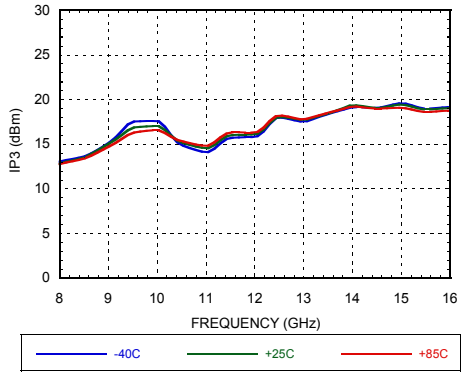
Conversion Loss vs. Temperature
LO = +13 dBm, IFIN = -5 dBm, USB



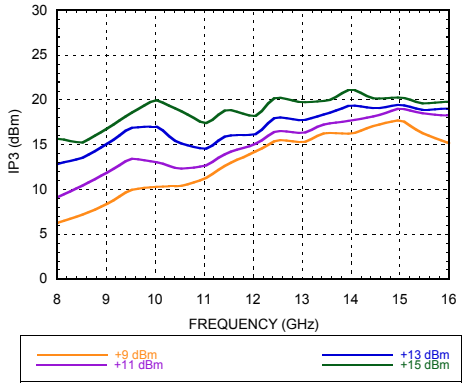
Conversion Loss vs. LO Drive
IFIN = -5 dBm, USB, Ta = +25C



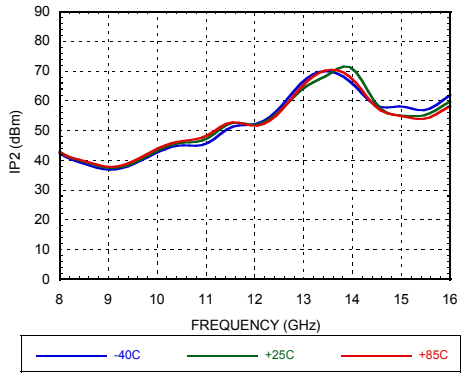
Input IP3 vs. Temperature
LO = +13 dBm, IFIN = -5 dBm, USB



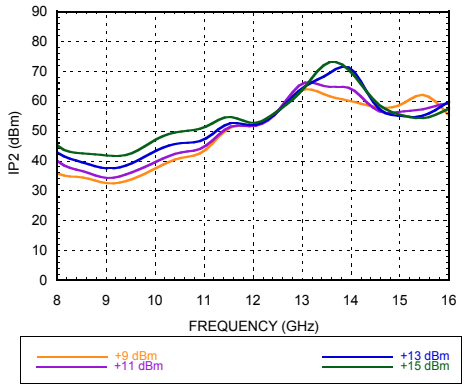
Input IP3 vs. LO Drive
IFIN = -5 dBm, USB, Ta = +25C



Input IP2 vs. Temperature
LO = +13 dBm, IFIN = -5 dBm, USB

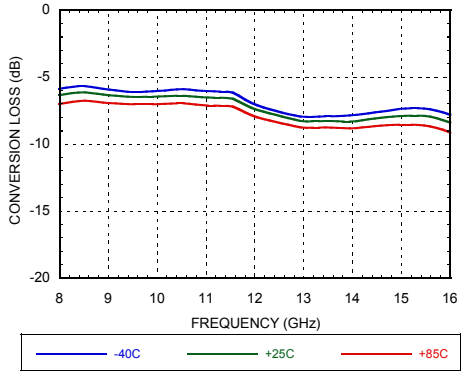


Input IP2 vs. LO Drive
IFIN = -5 dBm, USB, Ta = +25C

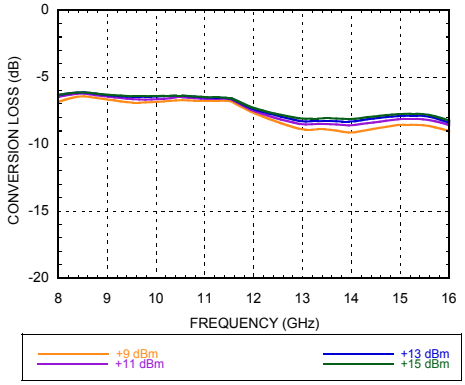


Up-converter Performance, IF = 150 MHz

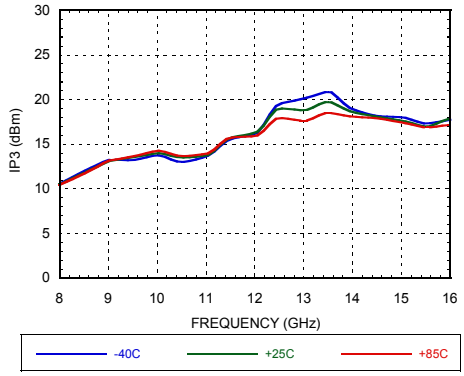
Conversion Loss vs. Temperature
LO = +13 dBm, IFIN = -5 dBm, USB



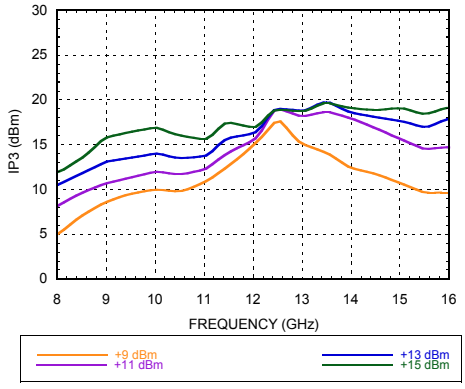
Conversion Loss vs. LO Drive
IFIN = -5 dBm, USB, Ta = +25C



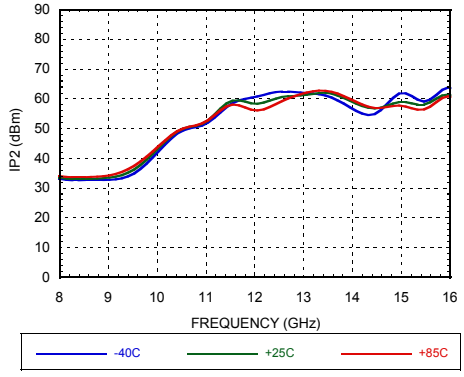
Input IP3 vs. Temperature
LO = +13 dBm, IFIN = -5 dBm, USB



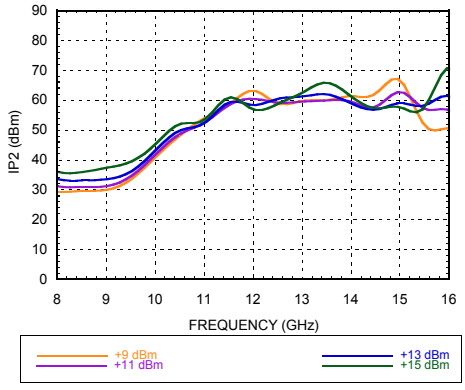
Input IP3 vs. LO Drive
IFIN = -5 dBm, USB, Ta = +25C



Input IP2 vs. Temperature
LO = +13 dBm, IFIN = -5 dBm, USB



Input IP2 vs. LO Drive
IFIN = -5 dBm, USB, Ta = +25C



Harmonics of LO

nLO Spur @ RF port				
LO Freq (GHz)	1	2	3	4
9	39	35	51	63
10.5	40	48	51	62
12	46	53	60	N/A
13.5	49	65	52	N/A
15	40	48	N/A	N/A
16	39	47	N/A	N/A
16.5	35	45	N/A	N/A

LO = +13 dBm
All values in dBc below input LO level @ RF port

MxN Spurious Outputs, IF = 1450 MHz

	nLO					
mRF	0	1	2	3	4	5
0	X	3.3	32	26	N/A	N/A
1	24	N/A	42	34	36	N/A
2	76	67	69	81	75	64
3	941	72	78	81	79.1	78
4	N/A	N/A	68	78	8	82
5	N/A	N/A	N/A	66	75	81

RF = 14.45 GHz @ -10 dBm
LO = 13 GHz @ +13 dBm, USB
All values in dBc relative to the IF. Measured as Down-converter
Spurs values are (m x RF) - (n x LO)

MxN Spurious Output, IF = 150 MHz

	nLO					
mRF	0	1	2	3	4	5
0	X	10.6	24	23	66	N/A
1	19	N/A	36	30	50	113
2	71	61	59	67	67	68
3	79	79	83	66	82	79
4	65	78	80	85	68	82
5	N/A	63	77	79	83	87

RF = 9.5 GHz @ -10 dBm
LO = 9.65 GHz @ +13 dBm, LSB
All values in dBc relative to the IF. Measured as Down-converter
Spurs values are (m x RF) - (n x LO)

MxN Spurious Output, IFin = 1450 MHz

	nLO					
mIF	0	1	2	3	4	5
0	X	8	16	N/A	N/A	N/A
1	26	N/A	34	N/A	N/A	N/A
2	79.3	54.7	71	N/A	N/A	N/A
3	87	78	78	N/A	N/A	N/A
4	84.5	82	70	N/A	N/A	N/A
5	81	81	73	N/A	N/A	N/A

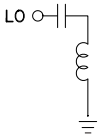
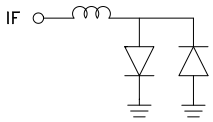
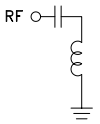
RFout = 14.45 GHz, IF input power = -10 dBm
LO = 15.9 GHz @ +13 dBm, LSB
All values in dBc relative to the RFout. Measured as Up-converter
Spurs values are (m x IF) - (n x LO)

MxN Spurious Output, IFin = 150 MHz

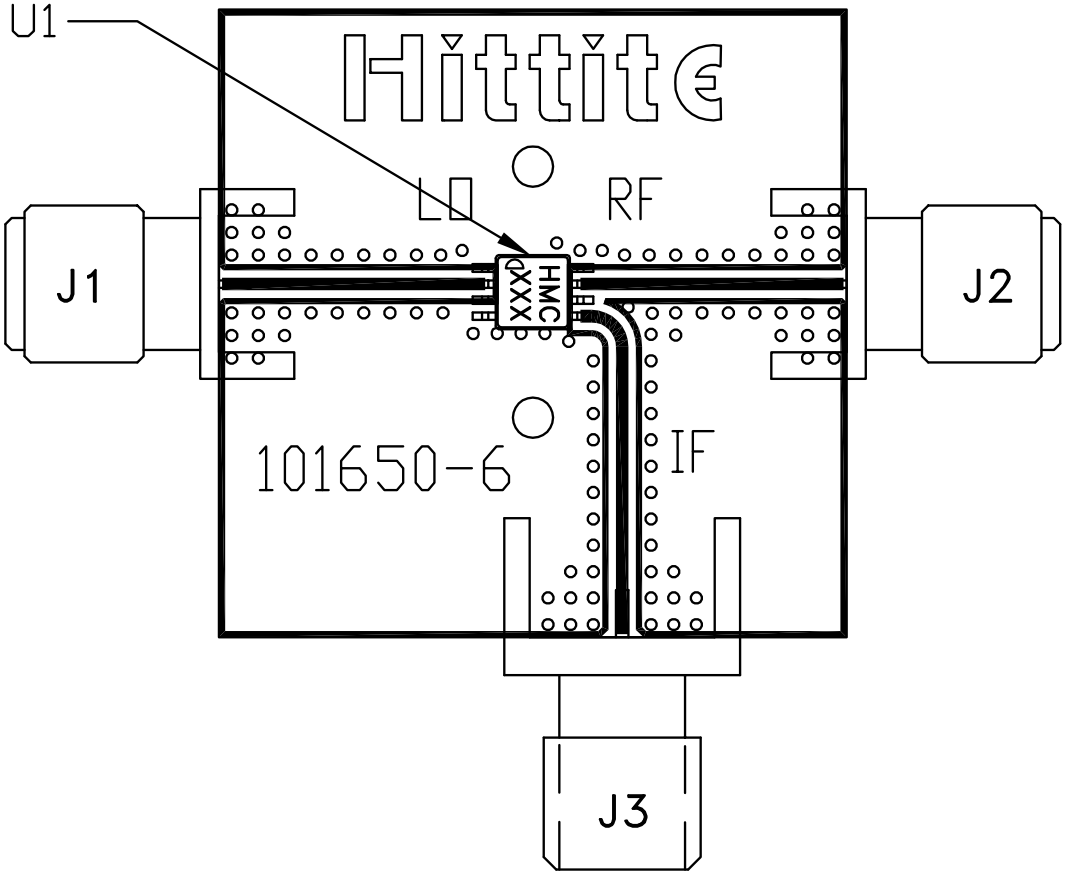
	nLO					
mIF	0	1	2	3	4	5
0	X	9.3	6	21	36.5	N/A
1	45.5	N/A	23	48	64	N/A
2	88	60	50	65	62	N/A
3	89	59	74.5	79	63.5	N/A
4	69	82.5	80.5	78	64	N/A
5	91	82.5	78.6	78	65	N/A

RFout = 9.5 GHz @ -10 dBm
LO = 9.35 GHz @ +13 dBm, USB
All values in dBc relative to the RFout. Measured as Up-converter
Spurs values are (m x IF) - (n x LO)

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 8	GND	These pins and the exposed ground paddle must be connected to RF ground.	
2	LO	This pin is AC coupled and matched to 50 ohms.	
3, 4, 6	N/C	These pins are not connected internally.	
5	IF	This pin is DC coupled. For applications not requiring operation to DC, this port shoud be DC blocked externally using a series capacitor whose values has been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source/sink more than 6 mA of current or die non-funtion and possible die failure will result.	
7	RF	This pin is AC coupled and matched to 50 ohm.	

Evaluation PCB



List of Materials for EV1HMC412BMS8G [1]

Item	Description
J1 - J2	PCB Mount SMA RF Connector, SRI
J3	PCB Mount SMA Connector, Johnson
U1	HMC412BMS8GE MIXER
PCB [2]	101650 Evaluation Board

[1] Reference this number when ordering complete evaluation PCB

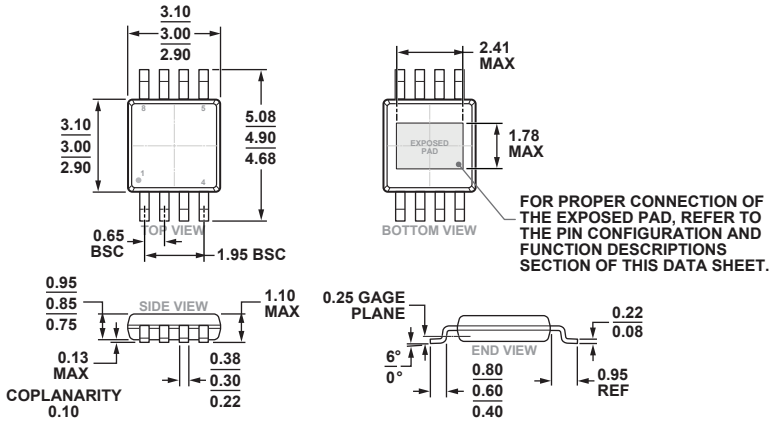
[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Analog Devices upon request.

Absolute Maximum Ratings

LO Input Power	+25 dBm
RF/IF input Power	+25 dBm
IF DC Current	±6 mA
Channel Temperature	150 °C
Continuous Pdiss (T=85 °C) (derate 4.3 mW/°C above 85 °C)	280 mW
Thermal Resistance (R_{TH}) (junction to ground paddle)	180 °C/W
Operating Temperature	-40 to +85 °C
Storage Temperature	-65 to +150 °C
ESD Sensitivity (HBM)	500 V (Class 1B)
ESD Sensitivity (FICDM)	1000 V (Class C3)

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS



COMPLIANT TO JEDEC STANDARDS MO-187-AA-T

8-Lead Mini Small Outline Package with Exposed Pad [MINI_SO_EP]
(RH-8-4)
Dimensions shown in millimeters

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [2]
HMC412BMS8GE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [1]	412B XXXX

[1] Max peak reflow temperature of 260 °C
[2] 4-Digit lot number XXXX