

# Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED



**THIS PAGE INTENTIONALLY LEFT BLANK**

### Typical Applications

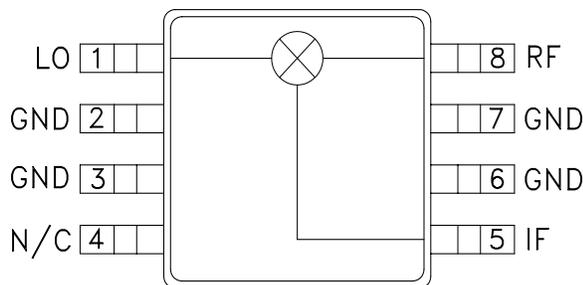
The HMC220MS8(E) is ideal for:

- VSAT & Mobile SatCom Terminals
- Microwave & Military Radio
- Wireless Backhaul Equipment
- Automotive, DSRC and IVHS
- Military RADAR, EW, and ECM Subsystems

### Features

- Wide IF Frequency Range: DC - 4 GHz
- Excellent LO to RF Isolation: 25 dB
- Low Conversion Loss: 7 dB
- No DC Bias & No External Matching Required
- Ideal for Upconversion & Downconversion
- MSOP8 SMT Package, 14.8 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC220MS8(E) is a wideband double-balanced mixer in an 8 lead plastic surface mount package. This fully integrated MMIC mixer is fabricated in a GaAs MESFET process and requires no DC bias and no external matching components. The HMC220MS8(E) mixer integrates Schottky diode mixing elements and on-chip balun transformers to deliver excellent isolation from LO to RF and from LO to IF. The wide IF bandwidth of DC to 4 GHz enables this mixer to be used in a wide range of general purpose applications including upconverters, downconverters, biphase modulators, demodulators, and phase comparators. The HMC220MS8(E) operates with LO drive levels as low as +7 dBm, and exhibits only 7 dB typical conversion loss.

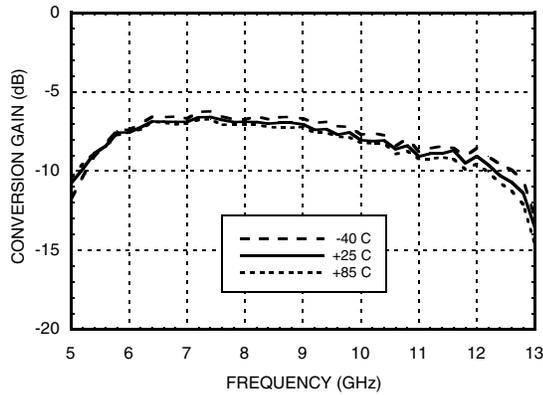
### Electrical Specifications, $T_A = +25^\circ \text{C}$ , As a Function of LO Drive

Parameter	LO = +13 dBm IF = 100 MHz			LO = +13 dBm IF = 100 MHz			LO = +10 dBm IF = 100 MHz			Units
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range, RF & LO	5 - 10			10 - 12			5.9 - 10			GHz
Frequency Range, IF	DC - 4			DC - 4			DC - 3.5			GHz
Conversion Loss		7.0	10		8.5	10.5		7.5	10	dB
Noise Figure (SSB)		7.0	10		8.5	10.5		7.5	10	dB
LO to RF Isolation	17	25		13	18		17	25		dB
LO to IF Isolation	20	28		14	20		20	28		dB
IP3 (Input)	14	17		16	21		13	16		dBm
1 dB Gain Compression (Input)	4	8		4	8		5	8		dBm

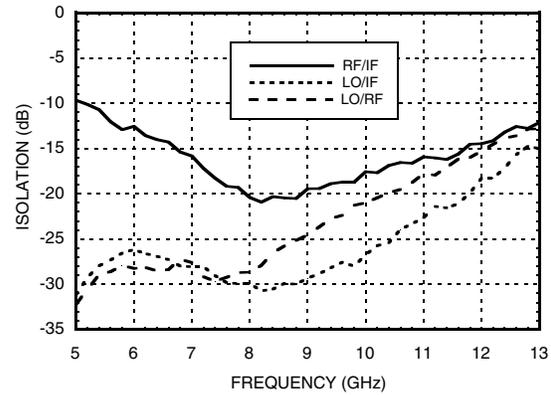


**GaAs MMIC SMT DOUBLE - BALANCED MIXER, 5 - 12 GHz**

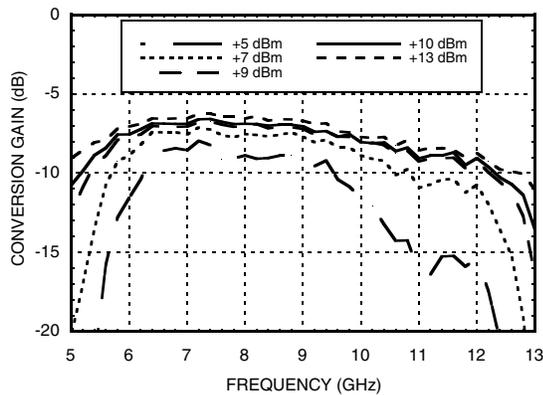
**Conversion Gain vs Temperature @ LO = +10 dBm**



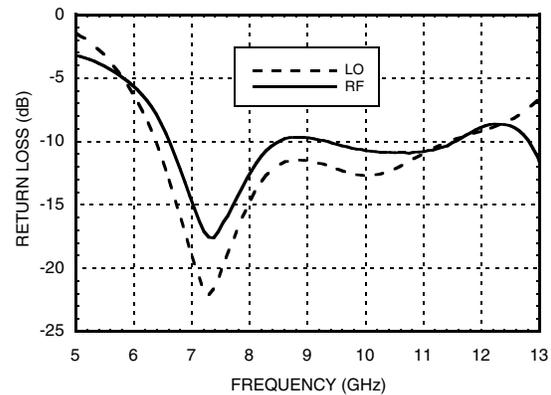
**Isolation @ LO = +10 dBm**



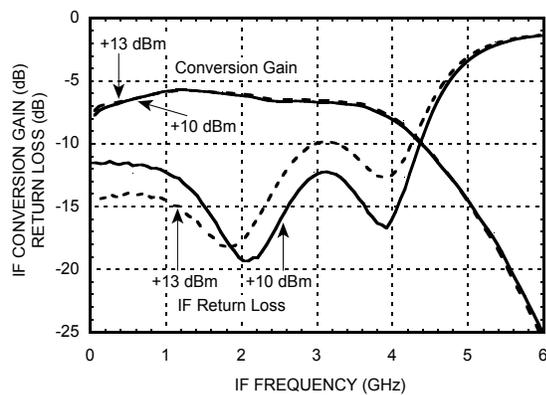
**Conversion Gain vs. LO Drive**



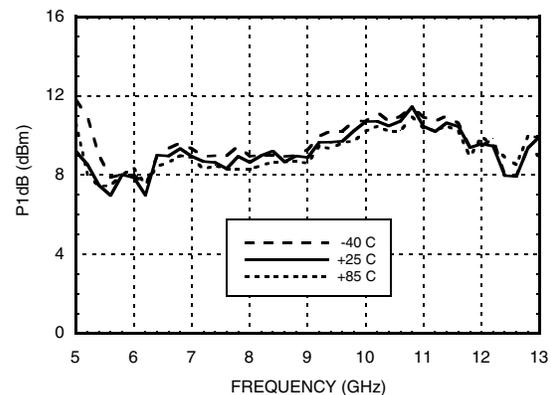
**Return Loss @ LO = +10 dBm**



**IF Bandwidth vs LO Drive Conversion Gain and Return Loss**



**P1dB vs. Temperature LO = +10 dBm**

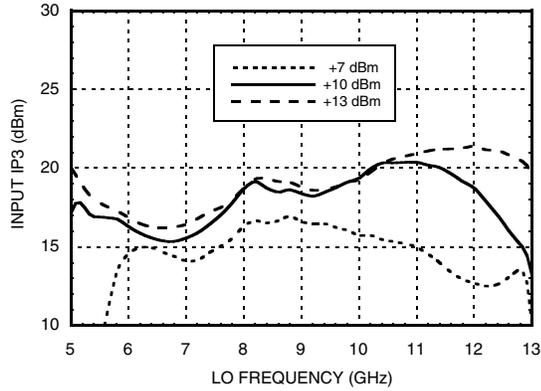




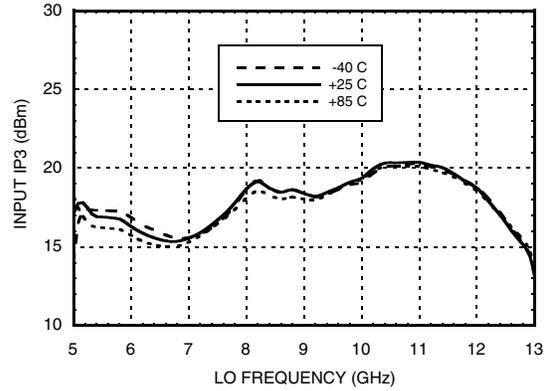
# HMC220MS8 / 220MS8E

## GaAs MMIC SMT DOUBLE - BALANCED MIXER, 5 - 12 GHz

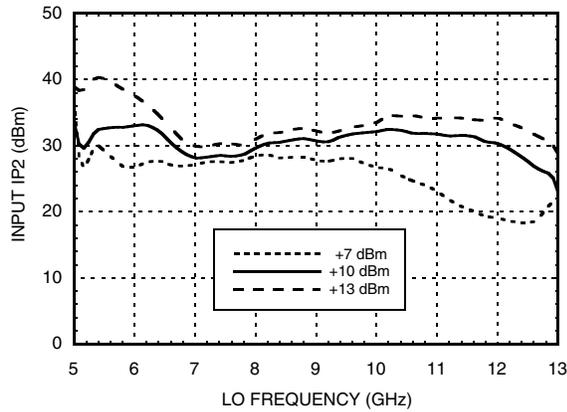
**Input IP3 vs. LO Drive**



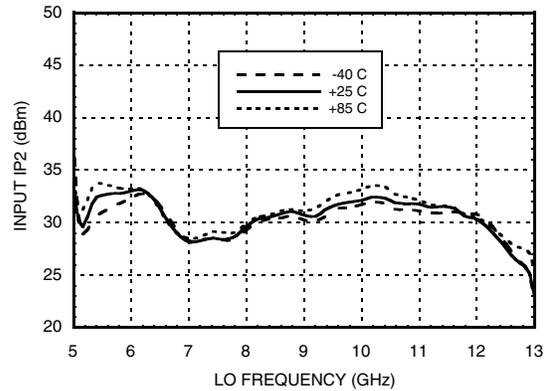
**Input IP3 vs. Temperature @ LO = +10 dBm**



**Input IP2 vs. LO Drive**



**Input IP2 vs. Temperature @ LO = +10 dBm**





## GaAs MMIC SMT DOUBLE - BALANCED MIXER, 5 - 12 GHz

### MxN Spurious Outputs

mRF	nLO				
	0	1	2	3	4
0	xx	4	12	17	36
1	12	0	29	40	34
2	62	58	45	57	62
3	71	78	73	65	75
4	> 85	> 85	> 85	> 85	> 85

RF = 7.5 GHz @ -10 dBm  
LO = 7.6 GHz @ +10 dBm  
All values in dBc below the IF power level (-1RF + 1LO)

### Harmonics of LO

LO Freq. (GHz)	nLO Spur at RF Port			
	1	2	3	4
5.5	28	27	34	67
7	29	25	39	61
8.5	26	30	55	60
10	21	43	59	62
11.5	17	51	50	xx
13	13	48	50	xx

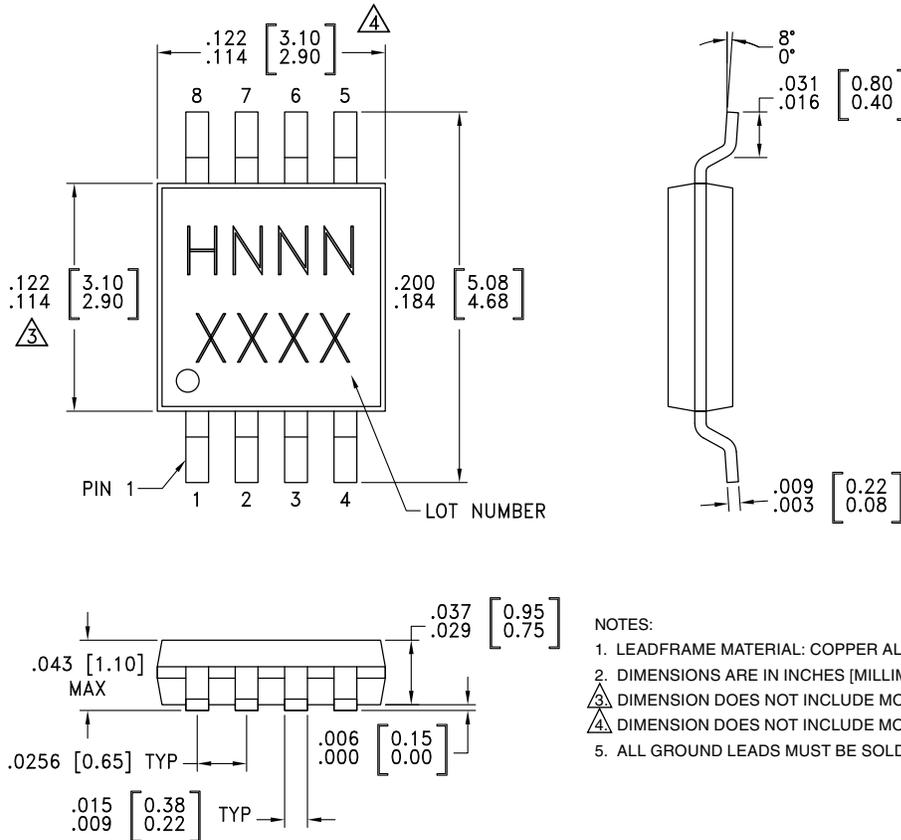
LO = +10 dBm  
Values in dBc below input LO level measured at the RF port.

### Absolute Maximum Ratings

RF / IF Input	+13 dBm
LO Drive	+27 dBm
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

**Outline Drawing**

**NOTES:**

- LEADFRAME MATERIAL: COPPER ALLOY
- DIMENSIONS ARE IN INCHES [MILLIMETERS]
-  DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
-  DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
- ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

**Package Information**

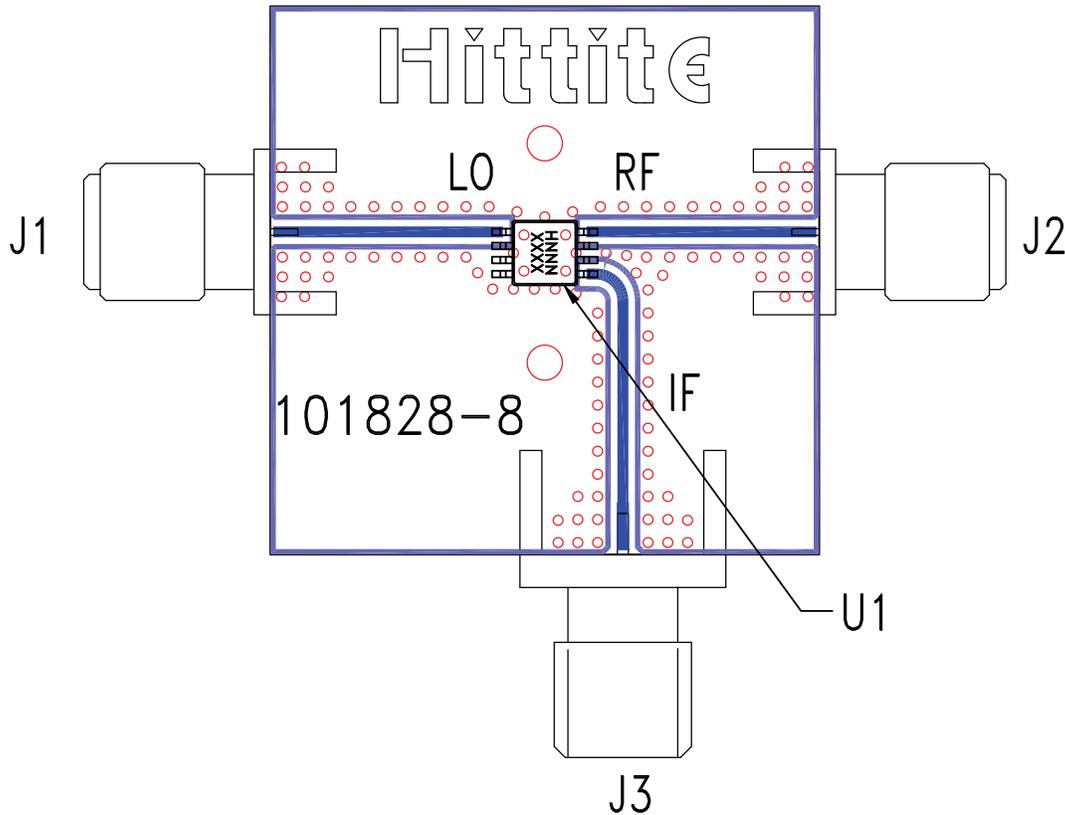
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[3]</sup>
HMC220MS8	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 <sup>[1]</sup>	H220 XXXX
HMC220MS8E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 <sup>[2]</sup>	H220 XXXX

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

**Evaluation Circuit Board**



**List of Materials for Evaluation PCB 101830 [1]**

Item	Description
J1 - J3	PCB Mount SMA RF Connector
U1	HMC220MS8 / HMC220MS8E Mixer
PCB [2]	101828 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 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 Hittite upon request.