HMC387MS8 / 387MS8E

v02.0705

HIGH IP3 GaAs MMIC MIXER, 450 - 500 MHz

Designer's Kit Available

Typical Applications

High Dynamic Range Infrastructure:

- GSM 450 & GSM 480
- CDMA 450
- Private Land Mobile Radio

Features

+32 dBm Input IP3

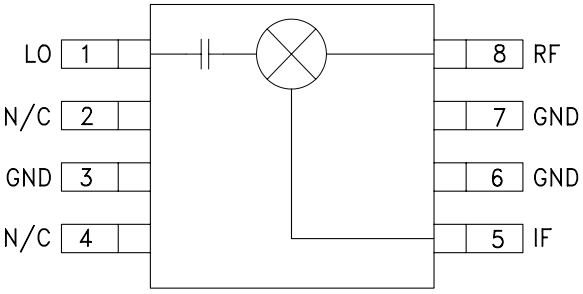
Conversion Loss: 9.5 dB

Low External Part Count

Ultra Small MSOP8 Package: 14.8 mm^2

Included in the HMC-DK003 Designer's Kit

Functional Diagram



General Description

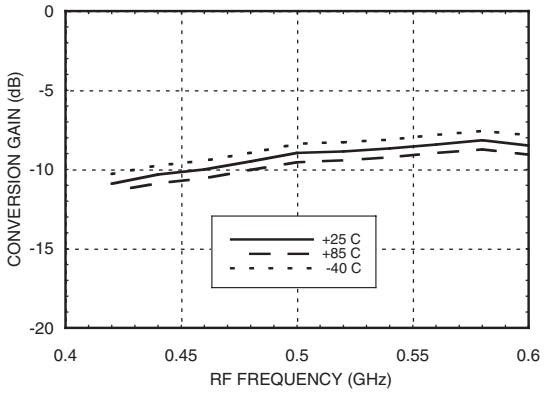
The HMC387MS8 & HMC387MS8E are high dynamic range passive MMIC mixers in plastic surface mount 8 lead Mini Small Outline Packages (MSOP) covering 450 to 500 MHz. Excellent input IP3 performance of +32 dBm for down conversion and +29 dBm for up conversion is provided for both GSM/CDMA based cellular and Private Land Mobile Radio applications at an LO drive of +17dBm. The mixer also has excellent performance with as little as +13 dBm LO drive yielding a +30 dBm input IP3. With a 1 dB compression of +22 dBm, the RF port will accept a wide range of input signal levels. Conversion loss is 9.5 dB typical. The DC to 150 MHz IF frequency response will satisfy many cellular transmit or receive frequency plans. The HMC387MS8 & HMC387MS8E input IP3 performance coupled with its high P1dB rivals traditional active FET mixers while offering a much smaller 14.8mm^2 standard IC footprint and no DC bias.

Electrical Specifications, T_A = +25°C, LO = +17 dBm, IF = 70 MHz [1]

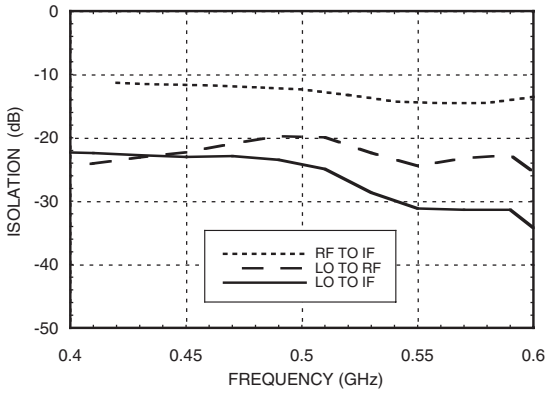
Parameter	Min.	Typ.	Max.	Units
Frequency Range, RF		450 - 500		MHz
Frequency Range, LO [2]		300 - 500		MHz
Frequency Range, IF		DC - 150		MHz
Conversion Loss		9.5	11	dB
Noise Figure (SSB)		9.5	11	dB
LO to RF Isolation	17	20		dB
LO to IF Isolation	20	23		dB
IP3 (Input)	29	32		dBm
1 dB Gain Compression (Input)	19	22		dBm
LO Input Drive Level (Typical)		+13 to +19		dBm

[1] Unless otherwise noted, all measurements performed as a downconverter with low side LO & IF = 70 MHz
[2] LO Frequency optimized. See application circuit herein.

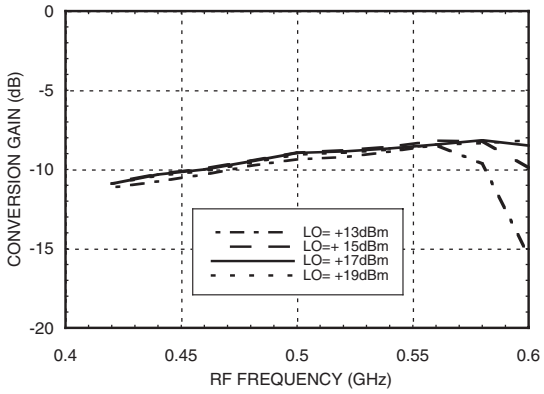
Conversion Gain vs. Temperature @ LO = +17 dBm



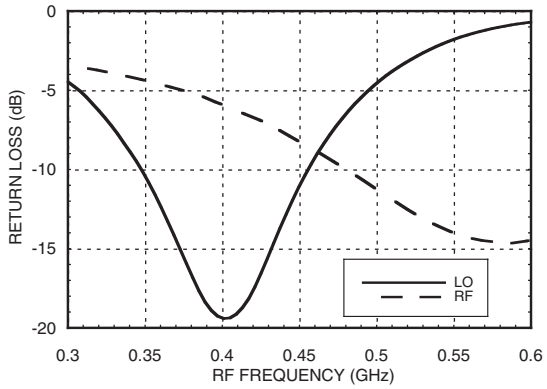
Isolation @ LO = +17 dBm



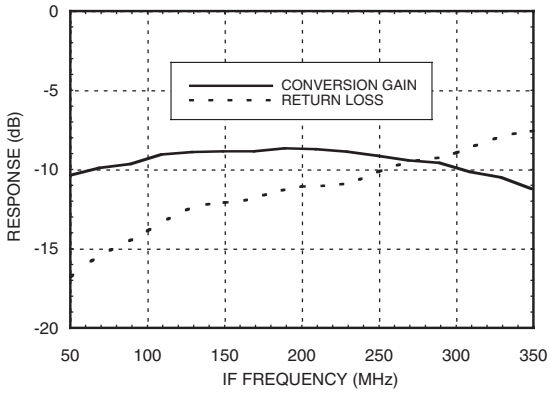
Conversion Gain vs. LO Drive



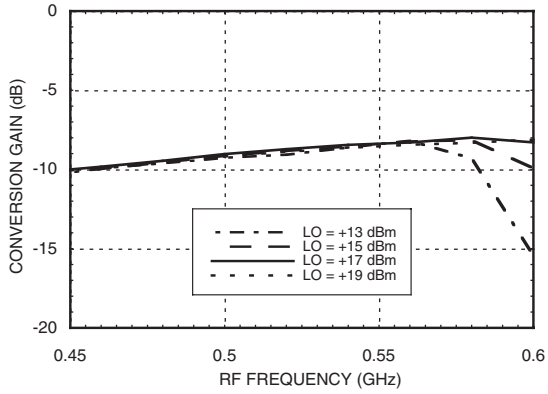
Return Loss @ LO = +17 dBm



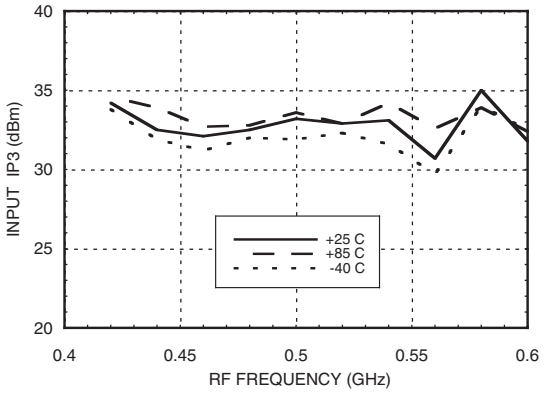
IF Bandwidth @ LO = +17 dBm



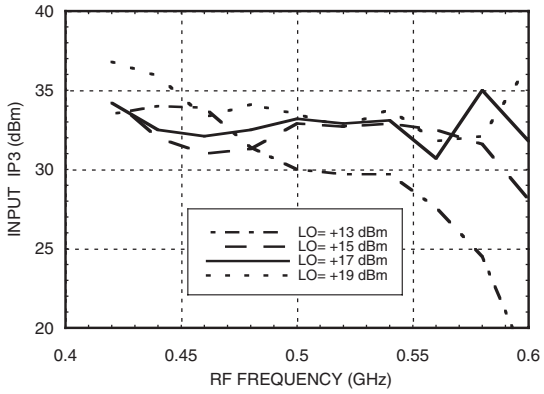
Upconverter Conversion Gain vs. LO Drive



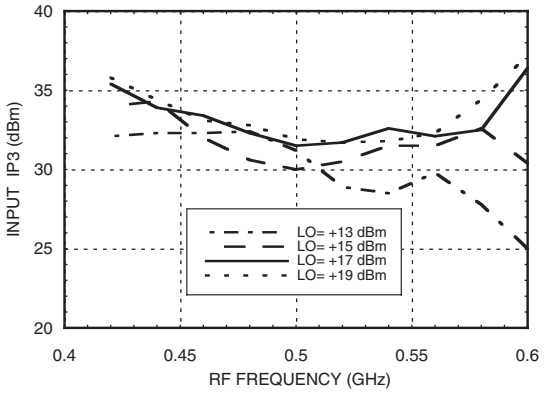
Input IP3 vs. Temperature
IF = 70 MHz, LO = +17 dBm



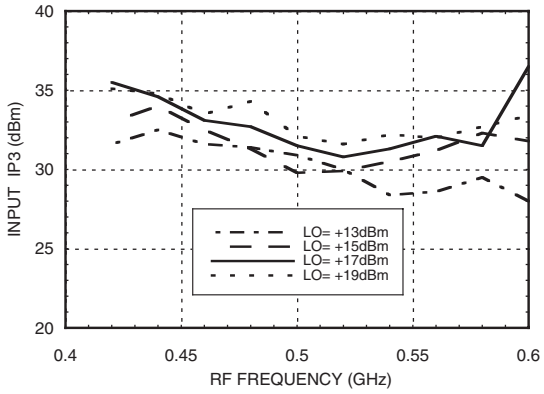
Input IP3 vs. LO Drive
IF = 70 MHz



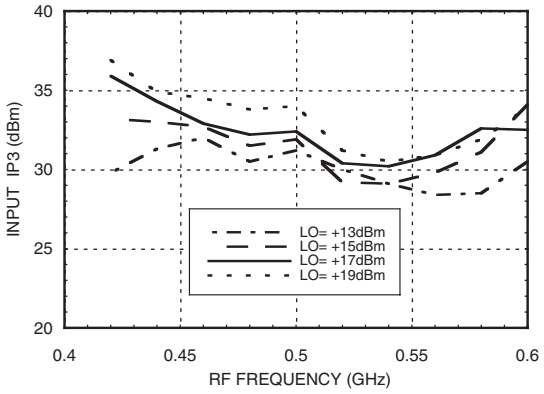
Input IP3 vs. LO Drive
IF = 97 MHz



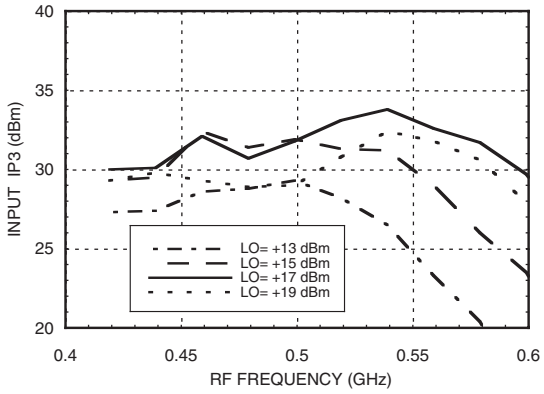
Input IP3 vs. LO Drive
IF = 117 MHz



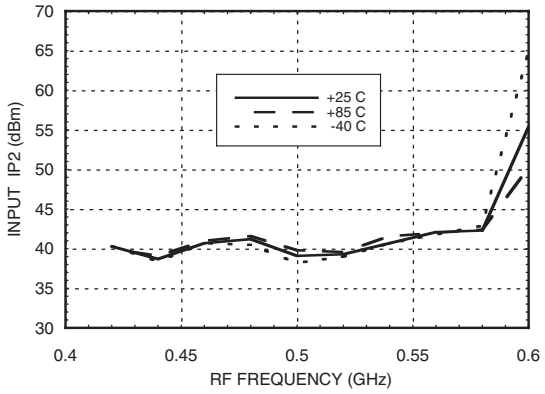
Input IP3 vs. LO Drive
IF = 137 MHz



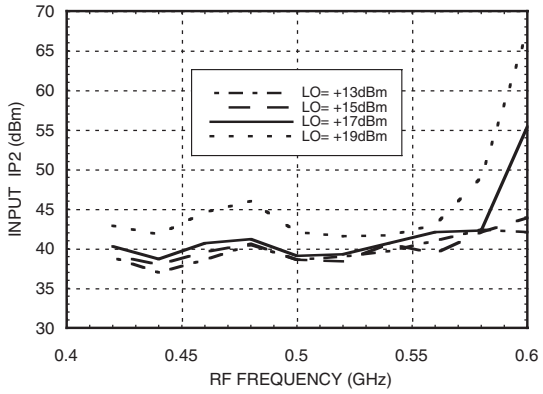
Upconverter Input IP3 vs. LO Drive
IF = 70 MHz



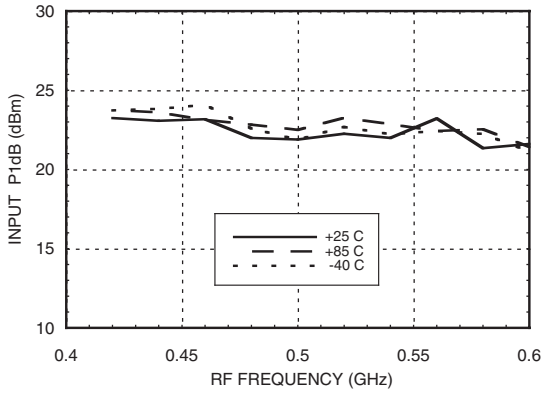
Input IP2 vs. Temperature @ LO = +17 dBm



Input IP2 vs. LO Drive



Input P1dB vs. Temperature IF = 70 MHz



MxN Spurious Outputs

	nLO				
mRF	0	1	2	3	4
0	xx	-5	13	13	6
1	1.5	0	27	25	42
2	54	65	47	53	61
3	83	77	85	74	70
4	85	85	85	85	85

RF Freq = 0.45 GHz @ 0 dBm
LO Freq = 0.38 GHz @ +17 dBm
All values in dBc relative to the IF output power.

Harmonics of LO

	nLO Spur @ RF Port			
LO Freq (GHz)	1	2	3	4
0.35	27	37	38	39
0.37	26	35	43	39
0.39	25	34	44	41
0.41	24	33	41	43
0.43	23	32	38	44
0.45	22	31	37	45

LO = +17 dBm
All values are in dBc below input LO level @ RF port.

HMC387MS8 / 387MS8E

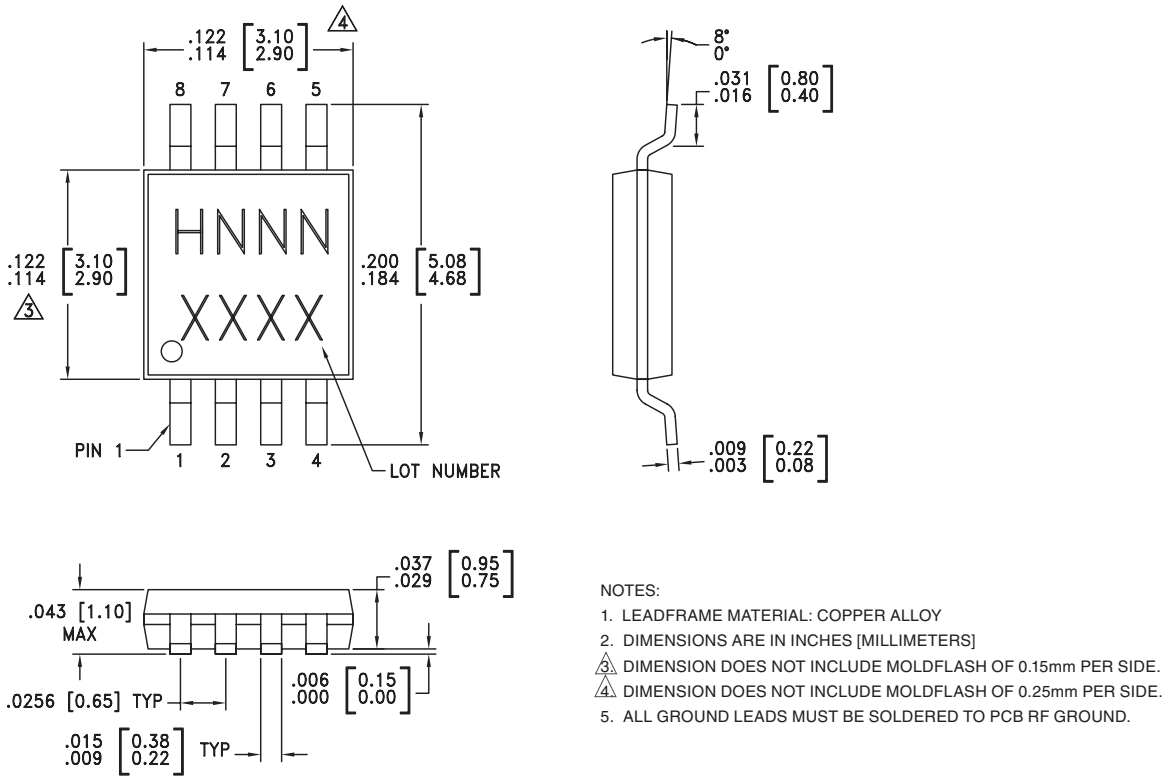
HIGH IP3 GaAs MMIC MIXER, 450 - 500 MHz

Absolute Maximum Ratings

RF/IF Input	+25 dBm
LO Drive	+27 dBm
Channel Temperature (Tc)	150 °C
Thermal Resistance	175 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
IF DC Current	±40 mA
ESD Sensitivity (HBM)	Class 1A

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

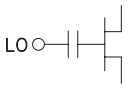
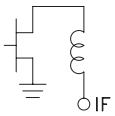
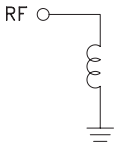
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

Package Information

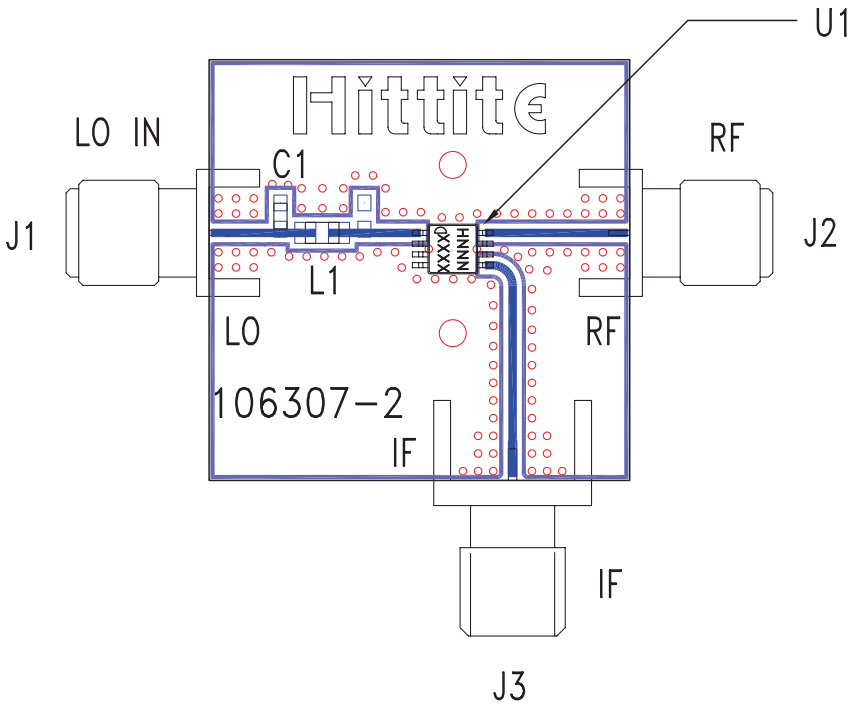
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC387MS8	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H387 XXXX
HMC387MS8E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H387 XXXX

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	LO	This pin is AC coupled & matched to 50 Ohms when an external series inductor (L1) and shunt capacitor (C1) is connected to the LO. Choose values of L1 and C1 to optimize LO frequency response. See Application Circuit herein.	
2, 4	N/C	Not connected.	
3, 6, 7	GND	This pin must be connected to RF ground.	
5	IF	This pin is DC coupled. For applications not requiring operation to DC this port should be DC blocked externally using a series capacitor. Choose value of C1 to pass IF frequency desired. For operation to DC, this pin must not sink/source more than 40 mA of current or failure may result.	
8	RF	This pin is DC coupled & matched to 50 Ohms from 450 - 500 MHz	

Evaluation PCB



List of Materials for Evaluation PCB 107334 [1]

Item	Description
J1 - J3	PCB Mount SMA RF Connector
C1	4 pF Chip Capacitor, 0603 Pkg
L1	47 nH Chip Inductor, 0805 Pkg
U1	HMC387MS8 / HMC387MS8E Mixer
PCB [2]	106307 Eval Board

[1] Reference this number when ordering complete evaluation PCB

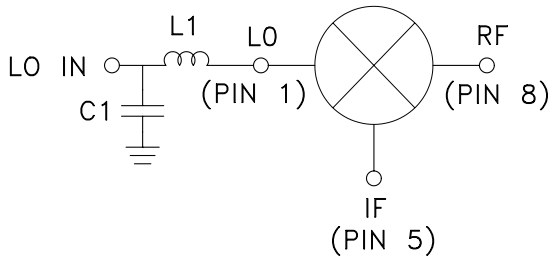
[2] Circuit Board Material: Rogers 4350

[3] Unless otherwise noted, all measurements performed as a downconverter with low side LO & IF = 200 MHz

[4] LO Frequency optimized. See application circuit herein.

The circuit board used in the final 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.

Application Circuit



Selection of L1 & C1 for Optimal LO Frequency ±10%

Choose value of L1 & C1 to optimize LO Frequency response. For best results use an 0805 size RF inductor or smaller.

LO Frequency (MHz)	L1 (nH)	C1 (pF)
400	47	4

Note: Position L1 and C1 as close to Pin 1 as possible.