MICROWAVE CORPORATION v00.0910

HMC951LP4E

GaAs MMIC I/Q DOWNCONVERTER 5.6 - 8.6 GHz

Typical Applications

The HMC951LP4E is ideal for:

• Point-to-Point and Point-to-Multi-Point Radio

• Military Radar, EW & ELINT

• Satellite Communications

Features

Conversion Gain: 13 dB

Image Rejection: 20 dB

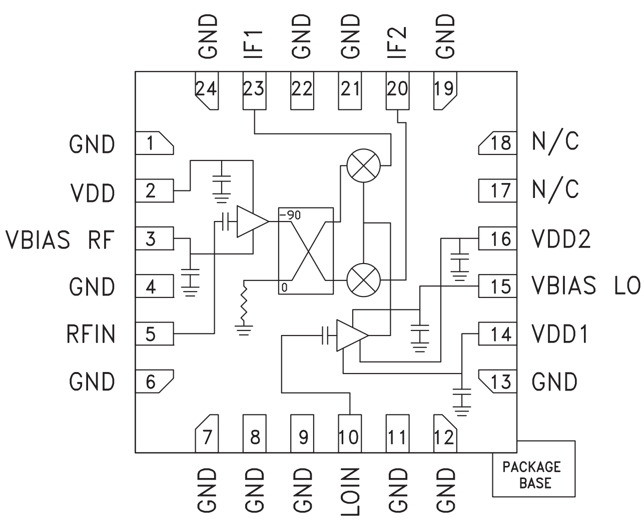
LO to RF Isolation: 48 dB

Noise Figure: 2.3 dB

Input IP3: 3 dBm

24 Lead 4x4 mm SMT Package: 16 mm²

Functional Diagram



General Description

The HMC951LP4E is a compact GaAs MMIC I/Q downconverter in a leadless RoHS compliant SMT package. This device provides a small signal conversion gain of 13 dB with a noise figure of 2 dB and 25 dB of image rejection across the frequency band. The HMC951LP4E utilizes an LNA followed by an image reject mixer which is driven by an LO buffer amplifier. The image reject mixer eliminates the need for a filter following the LNA, and removes thermal noise at the image frequency. I and Q mixer outputs are provided and an external 90° hybrid is needed to select the required sideband. The HMC951LP4E is a much smaller alternative to hybrid style image reject mixer downconverter assemblies, and is compatible with surface mount manufacturing techniques.

Electrical Specifications, T_A = +25 °C, IF = 1000 MHz, LO = 0 dBm, Vdd = 5 Vdc LSB [1]

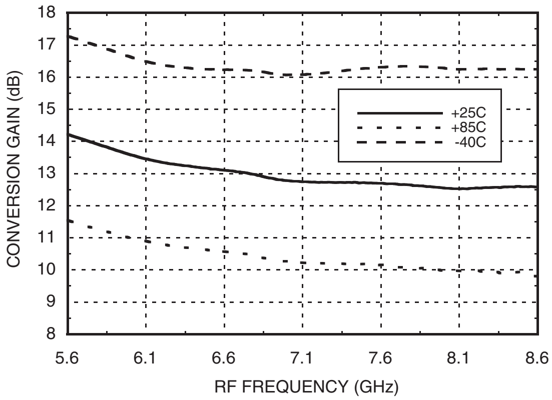
Parameter	Min.	Typ.	Max.	Units
Frequency Range, RF		5.6 - 8.6		GHz
Frequency Range, LO		3 - 12.1		GHz
Frequency Range, IF		DC - 3.5		GHz
Conversion Gain (As IRM)	10	13		dB
Noise Figure		2		dB
Image Rejection	13	25		dB
1 dB Compression (Input)		-3		dBm
LO to RF Isolation	40	48		dB
LO to IF Isolation	20	30		dB
IP3 (Input)		3		dBm
Amplitude Balance [2]		1		dB
Phase Balance [2]		-7		deg
Total Supply Current (Idd1 + Idd2)		220	250	mA

[1] Data taken as IRM with external IF 90° Hybrid

[2] Data taken without external 90° hybrid, IF = 1000 MHz

Data Taken As IRM With External IF 90° Hybrid, IF = 1000 MHz

Conversion Gain LSB vs. Temperature



Conversion Gain LSB vs. LO Drive

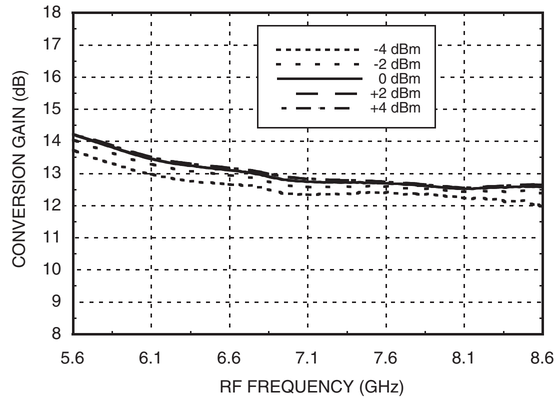
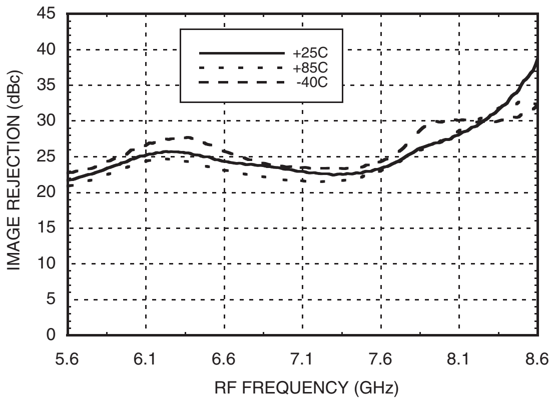
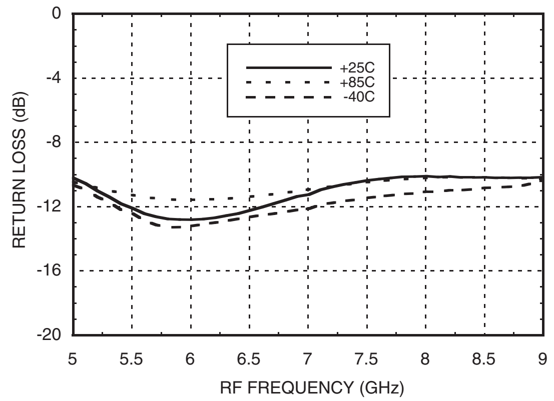


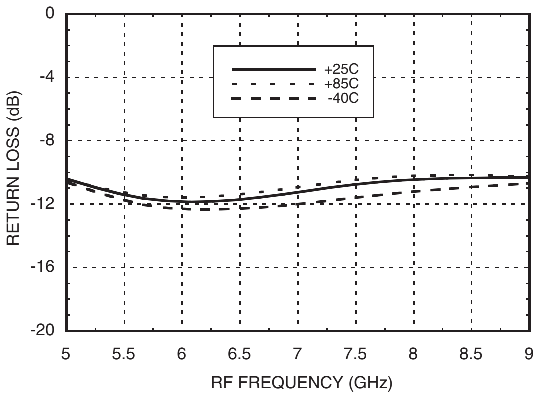
Image Rejection LSB vs. Temperature



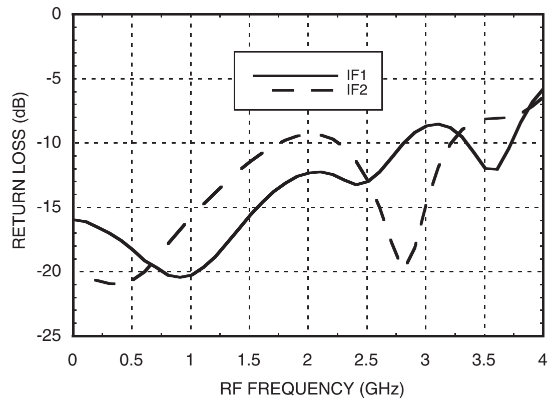
RF Return Loss vs. Temperature



LO Return Loss vs. Temperature



IF Return Loss [1]



[1] Data taken without external 90° hybrid.

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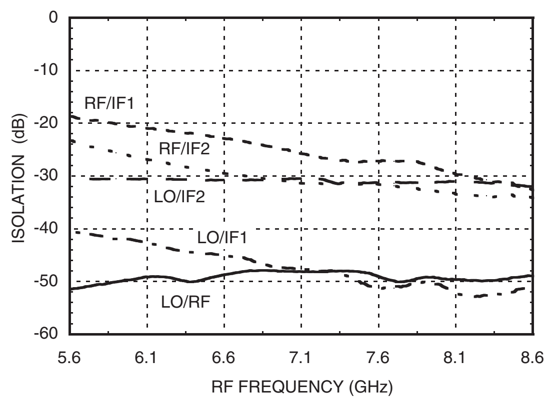
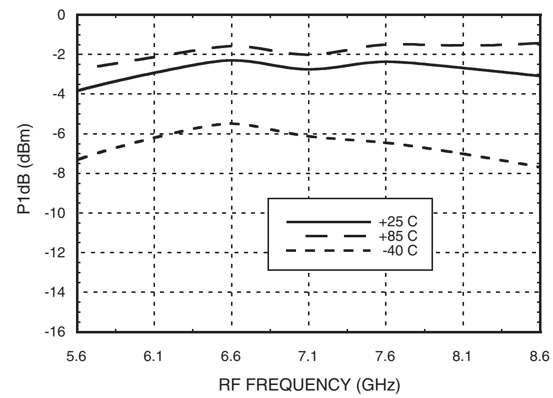
Data Taken as IRM With External IF 90° Hybrid, IF = 1000 MHz

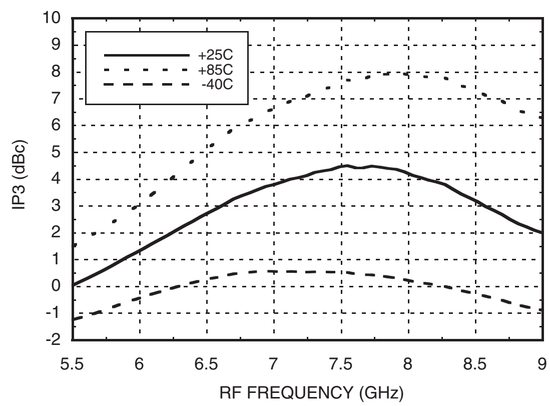
Isolations



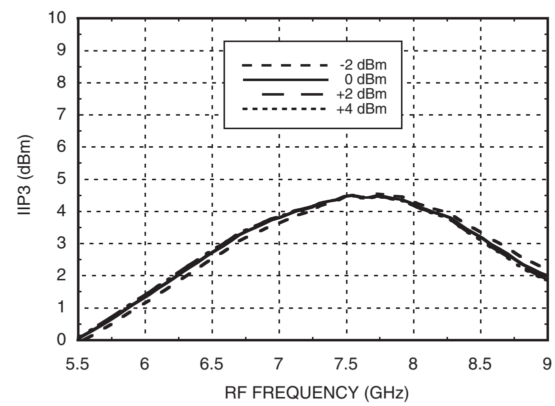
Input P1dB LSB vs. Temperature



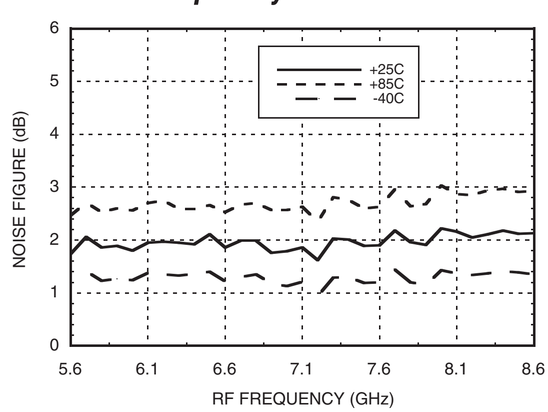
Input IP3, LSB vs. Temperature



Input IP3, LSB vs. LO Drive



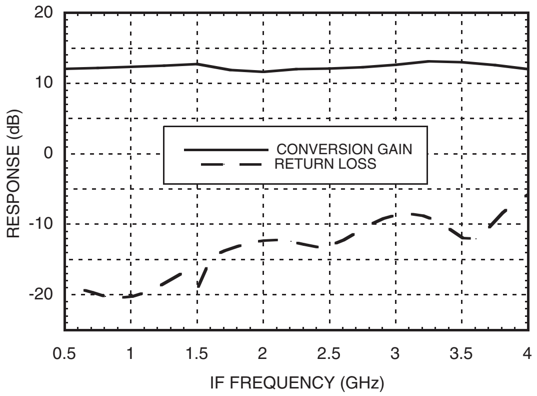
Noise Figure vs. Temperature, IF Frequency = 1000 MHz



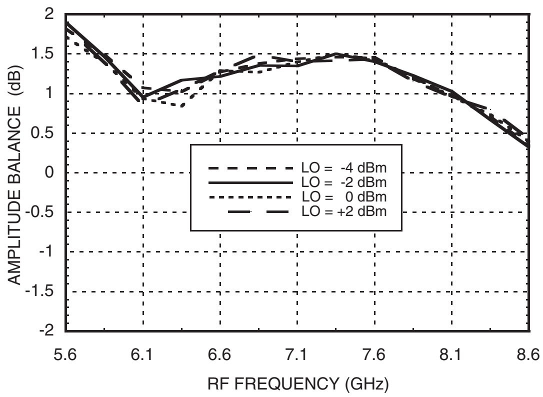
* Conversion gain data taken with external IF 90° IF hybrid, LO frequency fixed at 8.5 GHz and RF varied

Quadrature Channel Data Taken Without IF 90° Hybrid, IF = 1000 MHz

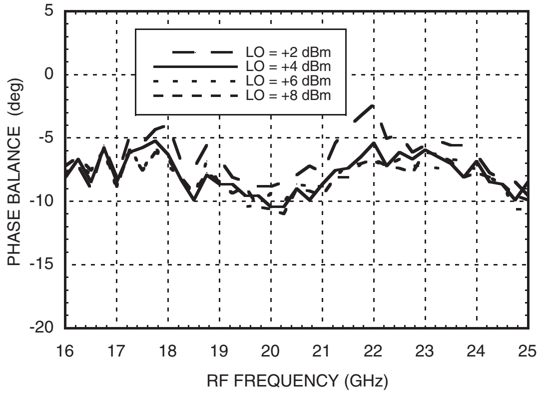
IF Bandwidth



Amplitude Balance vs. LO Drive [1]



Phase Balance vs. LO Drive [1]



[1] Data taken with IF = 1000 MHz

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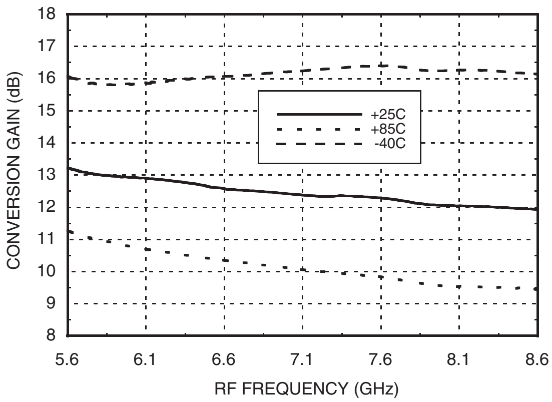
Data Taken as IRM With External IF 90° Hybrid, IF = 1000 MHz

Conversion Gain, USB vs. Temperature



Conversion Gain, USB vs. LO Drive

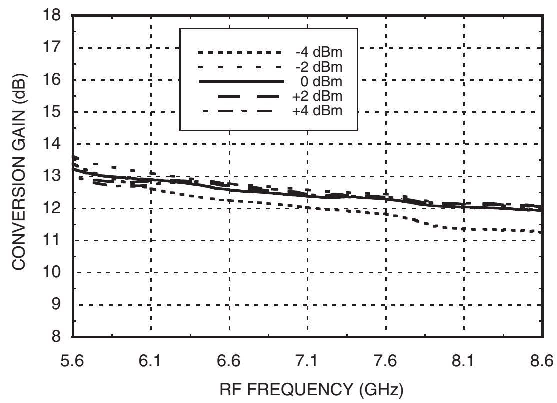
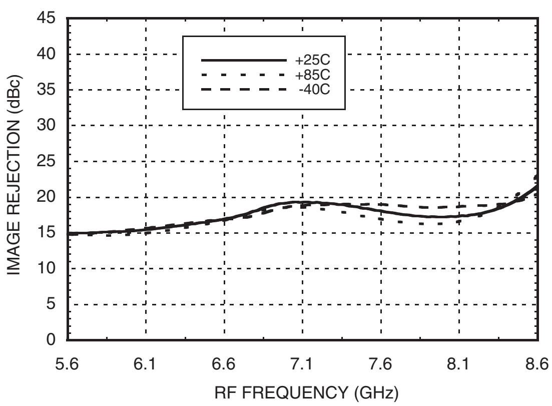
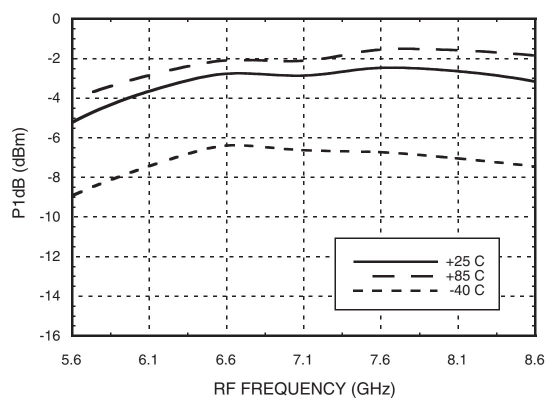


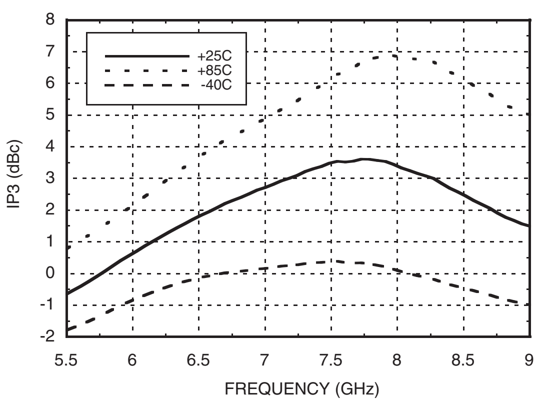
Image Rejection USB vs. Temperature



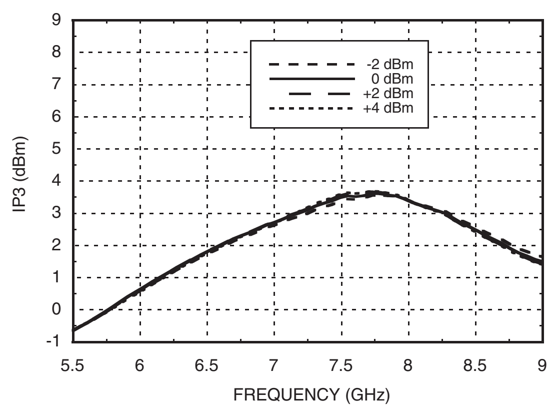
Input P1dB, USB vs. Temperature



Input IP3, USB vs. Temperature



Input IP3, USB vs. LO Drive



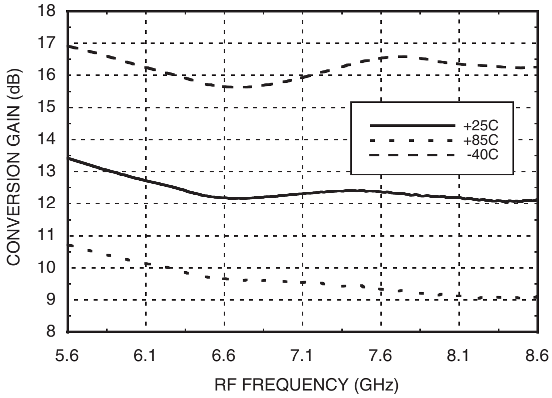
* Conversion gain data taken with external IF 90° IF hybrid, LO frequency fixed at 8.5 GHz and RF varied

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at www.hittite.com
Application Support: Phone: 978-250-3343 or apps@hittite.com

RoHS✓ EARTH FRIENDLY

Data Taken as IRM With External IF 90° Hybrid, IF = 2000 MHz

Conversion Gain, LSB vs. Temperature



Conversion Gain, LSB vs. LO Drive

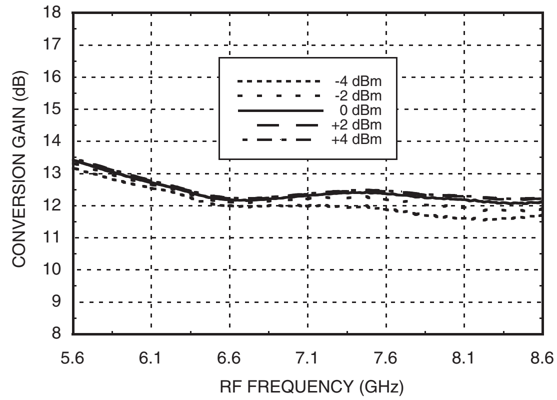
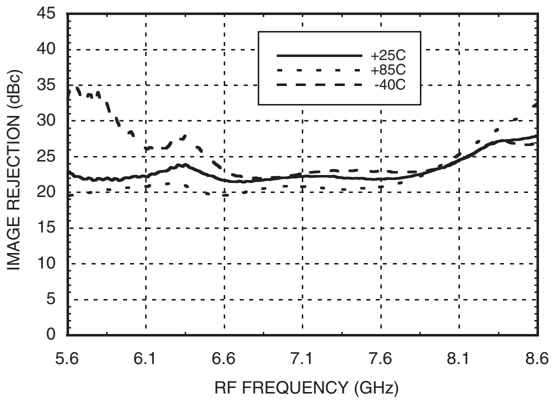
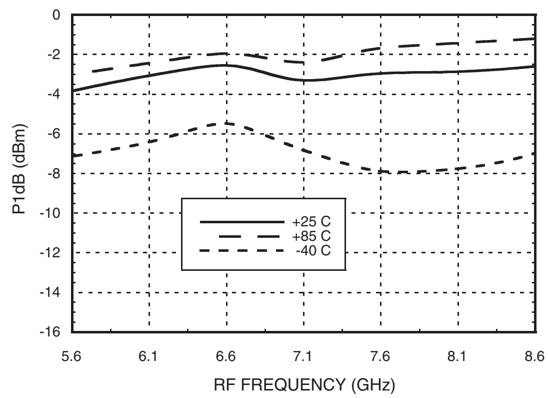


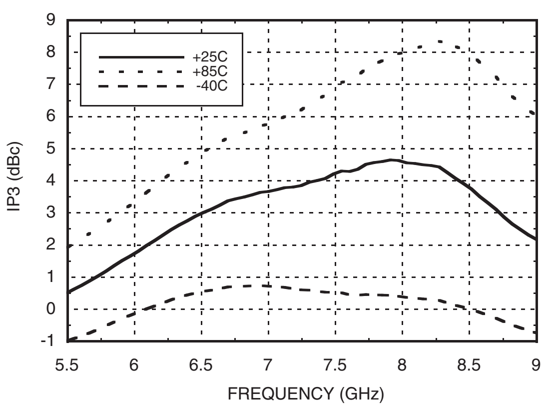
Image Rejection LSB vs. Temperature



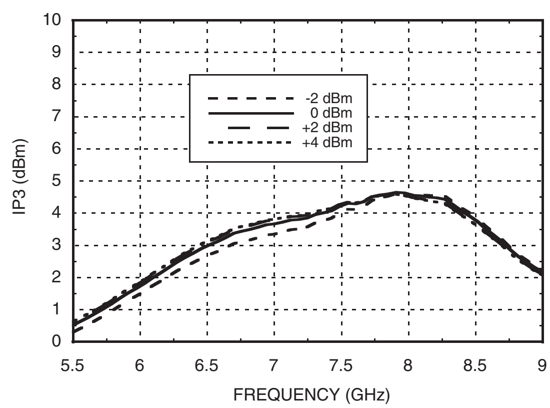
Input P1dB, LSB vs. Temperature



Input IP3, LSB vs. Temperature



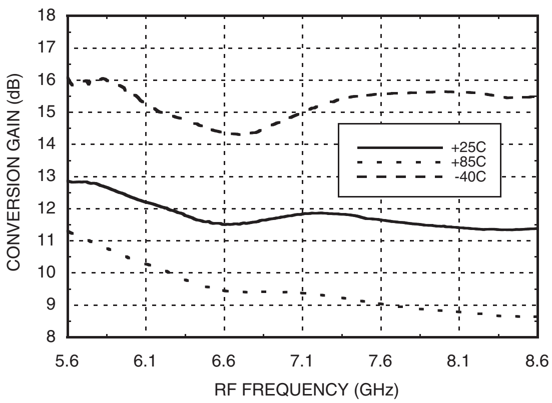
Input IP3, LSB vs. LO Drive



* Conversion gain data taken with external IF 90° IF hybrid, LO frequency fixed at 8.5 GHz and RF varied

Data Taken as IRM With External IF 90° Hybrid, IF = 2000 MHz

Conversion Gain, USB vs. Temperature



Conversion Gain, USB vs. LO Drive

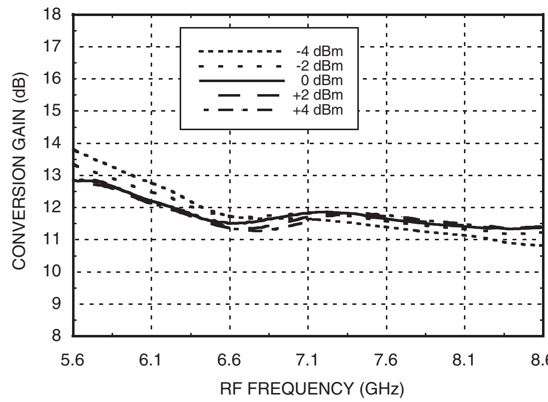
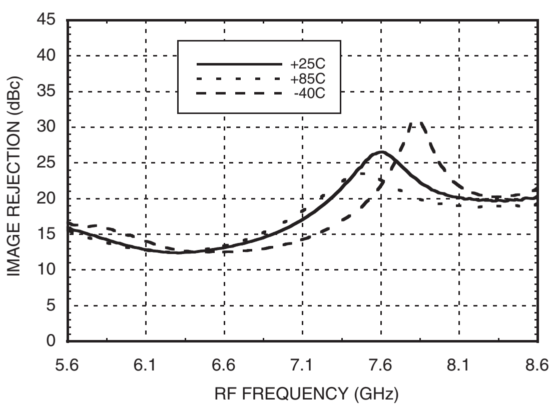
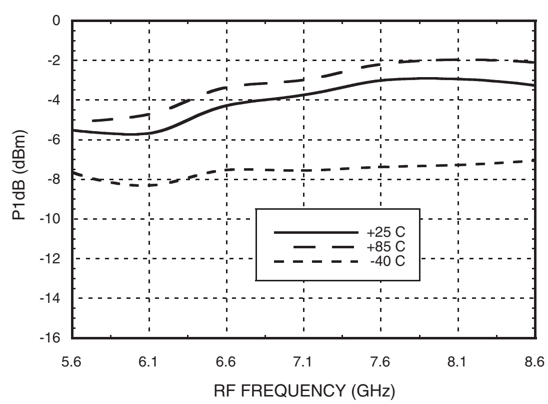


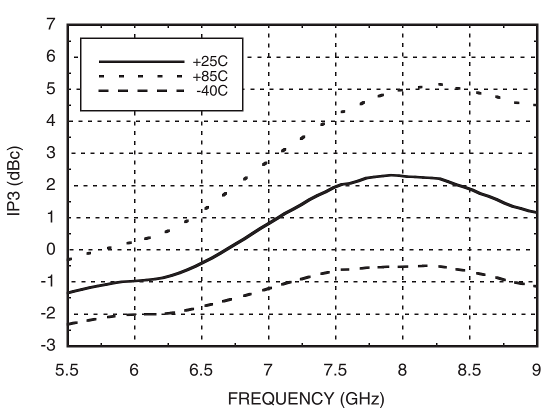
Image Rejection USB vs. Temperature



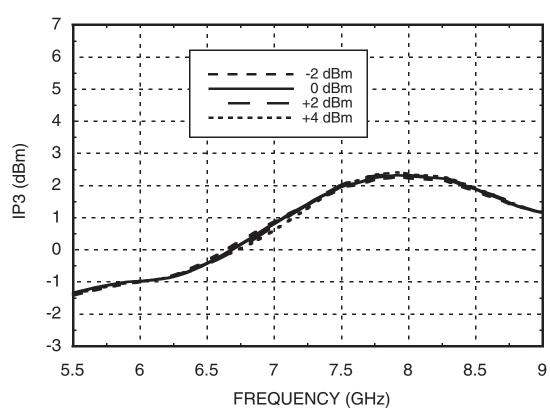
Input P1dB, USB vs. Temperature



Input IP3, USB vs. Temperature



Input IP3, USB vs. LO Drive



MxN Spurious Outputs

	nLO				
mRF	0	1	2	3	4
0	x	34	59	67	56
1	23	0	52	71	80
2	64	50	56	91	95
3	92	93	53	45	90
4	90	115	102	67	64

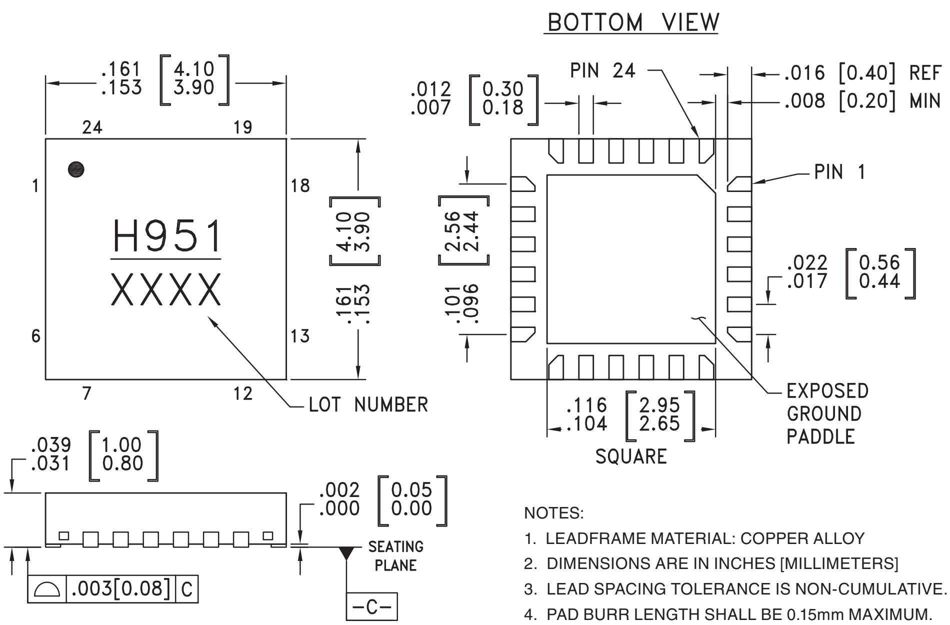
RF = 6.1 GHz @ -20 dBm
LO = 7.1 GHz @ 0 dBm
Data taken without IF hybrid
All values in dBc below IF power level (LO - RF = 1 GHz)

Absolute Maximum Ratings

RF	+15 dBm
LO Drive	+20 dBm
Vdd	+5.5V
Channel Temperature	150 °C
Continuous Pdiss (T=85°C) (derate 17.76 mW/°C above 85°C)	1.15 W
Thermal Resistance (R_{TH}) (channel to package bottom)	56.31 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +85 °C
ESD Sensitivity (HBM)	Class 1A

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



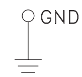
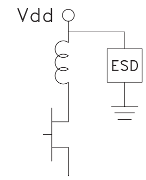
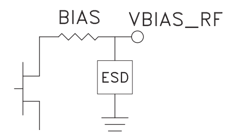
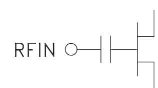
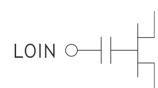
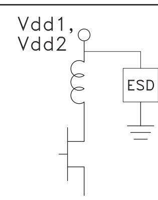
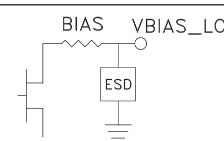
NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC951LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H951 XXXX

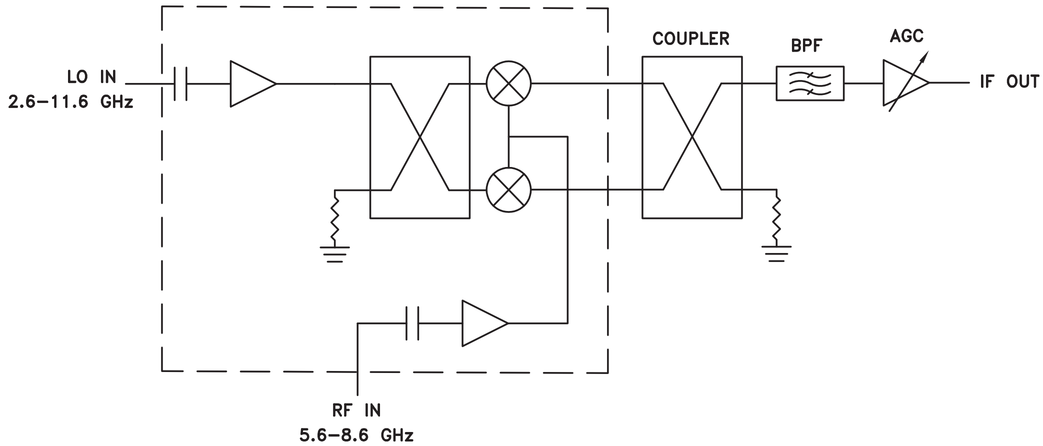
[1] 4-Digit lot number XXXX
[2] Max peak reflow temperature of 260 °C

Pin Descriptions

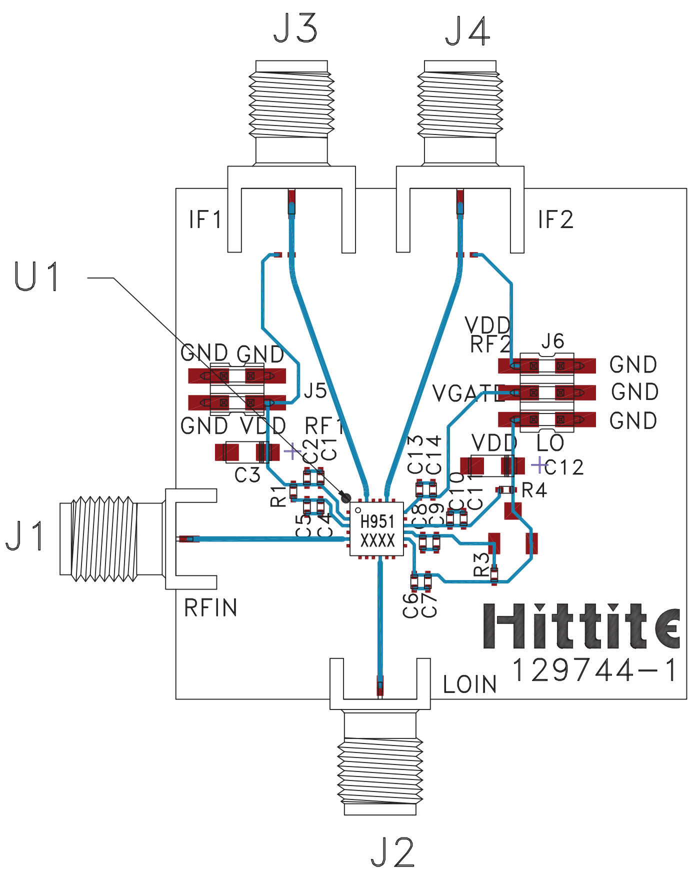
Pin Number	Function	Description	Interface Schematic
1, 4, 6, 7, 8, 9, 11, 12, 13, 19, 21, 22, 24	GND	These pins and package bottom must be connected to RF/DC ground	
2	VDD	Power supply voltage for RF Amplifier. Bypass capacitors are required. See application circuit	
3	VBIAS_RF	This pin is used to set the DC current of the RF amplifier by selection of the external bias resistor. See application circuit.	
5	RFIN	This pin is the RF input pin. It is AC coupled and matched to 50 Ohms	
10	LOIN	This pin is the LO input pin. It is AC coupled and matched to 50 Ohms	
14, 16	VDD1, VDD2	Power supply voltages for LO Amplifier. Bypass capacitors are required. See application circuit	
15	VBIAS_LO	This pin is used to set the DC current of the LO amplifier by selection of the external bias resistor. See application circuit.	
17, 18	N/C	No connection necessary. These pins may be connected to RF/DC ground. Performance will not be affected	

GaAs MMIC I/Q DOWNCONVERTER 5.6 - 8.6 GHz

Typical Application Circuit



Evaluation PCB



List of Materials for Evaluation PCB 131372 [1]

Item	Description
J1, J2	PCB Mount SMA RF Connector, SRI
J3, J4	PCB Mount SMA Connector, Johnson
J5, J6	DC Pin
C1, C4, C6, C8, C10, C13	100 pF Capacitor, 0402 Pkg.
C2, C5, C7, C9, C11, C14	1000 pF Capacitor, 0402 Pkg.
C3, C12	4.7 µF Capacitor, ? Pkg.
R1	390 Ohm Resistor, 0402 Pkg.
R3	1 kOhm Resistor, 0402 Pkg.
R4	0 Ohm Resistor, 0402 Pkg.
U1	HMC951LP4E
PCB [2]	129744 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 Hittite upon request.

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at www.hittite.com
Application Support: Phone: 978-250-3343 or apps@hittite.com