ANALOG DEVICES

HMC471MS8G / 471MS8GE

v01.0605

SiGe HBT DUAL CHANNEL GAIN BLOCK MMIC AMPLIFIER, DC - 5 GHz

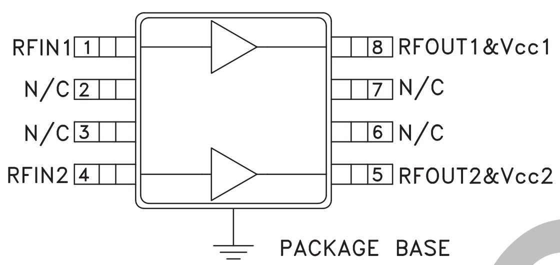
RoHS✓ EARTH FRIENDLY

Typical Applications

The HMC471MS8G / HMC471MS8GE is a dual RF/IF gain block & LO or PA driver:

- Cellular / PCS / 3G
- Fixed Wireless & WLAN
- CATV, Cable Modem & DBS
- Microwave Radio & Test Equipment

Functional Diagram



Features

P1dB Output Power: +20 dBm

Gain: 20 dB

Output IP3: +34 dBm

Supply (Vs): +6V to +12V

14.9 mm^2 Ultra Small 8 Lead MSOP

General Description

The HMC471MS8G & HMC471MS8GE are SiGe HBT Dual Channel Gain Block MMIC SMT amplifiers covering DC to 5 GHz. These versatile products contain two gain blocks, packaged in a single 8 lead plastic MSOP, for use as either separate cascadable 50 Ohm RF/IF gain stages, LO or PA drivers or with both amplifiers combined utilizing external 90° hybrids to create a high linearity driver amplifier. Each amplifier in the HMC471MS8G(E) offers 20 dB of gain, +20 dBm P1dB with a +34 dBm output IP3 at 850 MHz while requiring only 80 mA from a single positive supply. The combined dual amplifier circuit delivers up to +21 dBm P1dB with +36 dBm OIP3 for specific application bands through 4 GHz.

Electrical Specifications, Vs= 8.0 V, Rbias= 39 Ohm, T_A = +25° C

Parameter		Min.	Typ.	Max.	Units
Gain	DC - 1.0 GHz 1.0 - 2.0 GHz 2.0 - 3.0 GHz 3.0 - 4.0 GHz 4.0 - 5.0 GHz	18.5 15.5 13 10.5 8	21 17.5 15 12.5 10		dB dB dB dB dB
Gain Variation Over Temperature	DC - 5 GHz		0.008	0.012	dB/ °C
Input Return Loss	DC - 2.0 GHz 2.0 - 4.0 GHz 4.0 - 5.0 GHz		12 14 8		dB dB dB
Output Return Loss	DC - 1.0 GHz 1.0 - 2.0 GHz 2.0 - 4.0 GHz 4.0 - 5.0 GHz		13 9 7 5		dB dB dB dB
Reverse Isolation	DC - 5 GHz		20		dB
Output Power for 1 dB Compression (P1dB)	0.5 - 1.0 GHz 1.0 - 2.0 GHz 2.0 - 3.0 GHz 3.0 - 4.0 GHz 4.0 - 5.0 GHz	16 14 11 9 7	19 17 14 12 10		dBm dBm dBm dBm
Output Third Order Intercept (IP3) (Pout= 0 dBm per tone, 1 MHz spacing)	0.5 - 1.0 GHz 1.0 - 2.0 GHz 2.0 - 3.0 GHz 3.0 - 4.0 GHz 4.0 - 5.0 GHz		34 32 27 25 22		dBm dBm dBm dBm dBm
Noise Figure	DC - 4 GHz 4.0 - 5.0 GHz		3.25 4.0		dB dB
Supply Current (Icq)			80		mA

Note: Data taken with broadband bias tee on device output. All specifications refer to a single amplifier.

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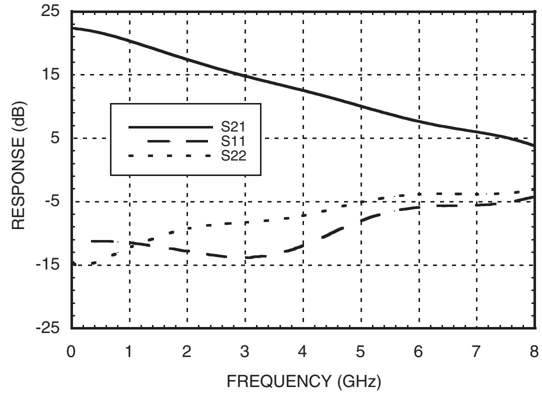
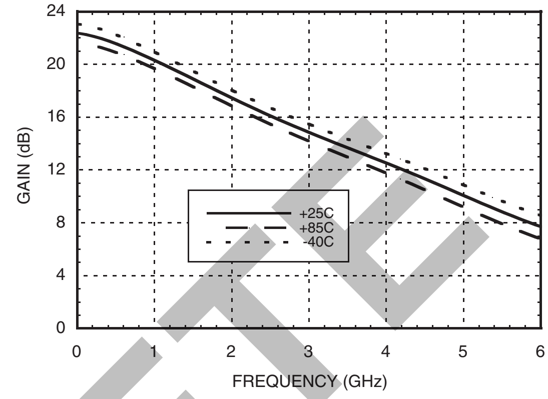
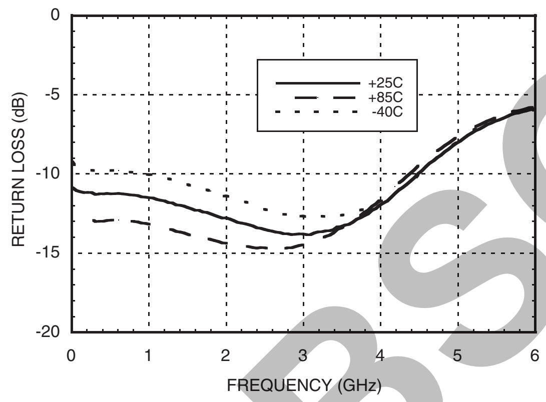
Broadband Gain & Return Loss



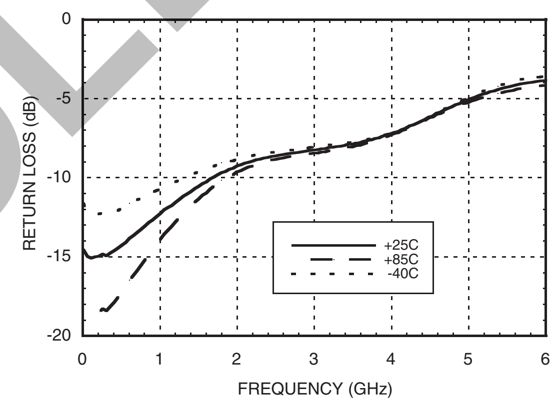
Gain vs. Temperature



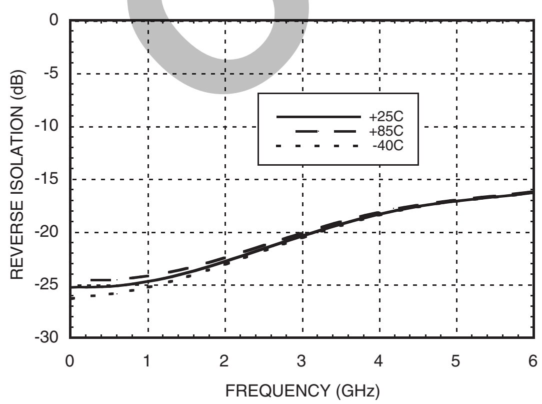
Input Return Loss vs. Temperature



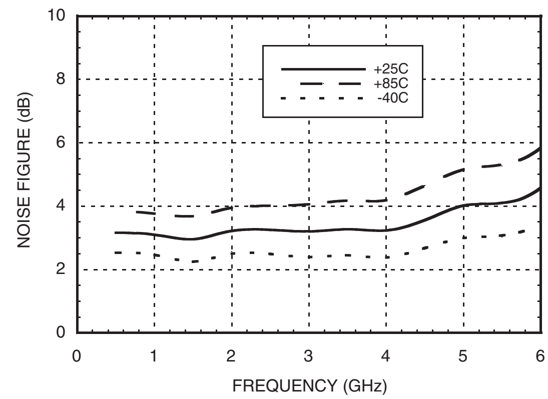
Output Return Loss vs. Temperature



Reverse Isolation vs. Temperature



Noise Figure vs. Temperature



Data shown is of a single amplifier.

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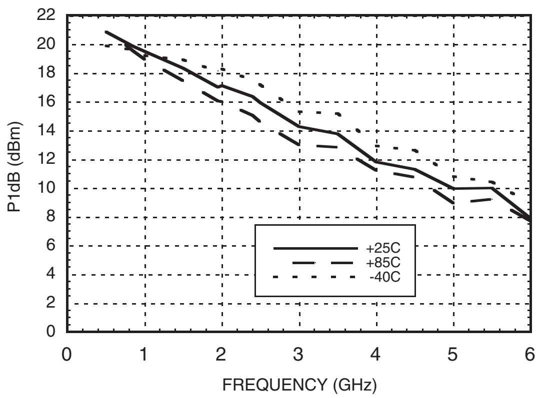
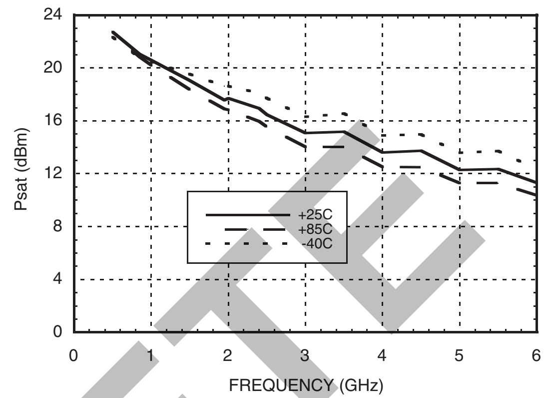
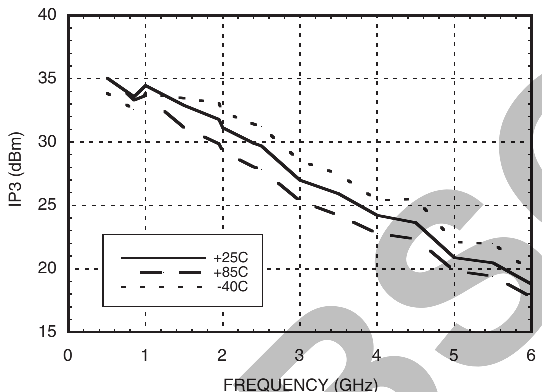
P1dB vs. Temperature



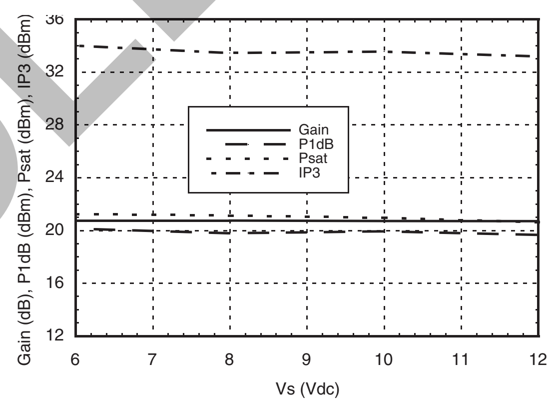
Psat vs. Temperature



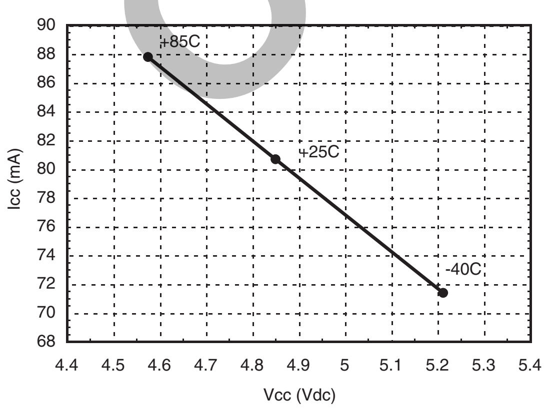
Output IP3 vs. Temperature



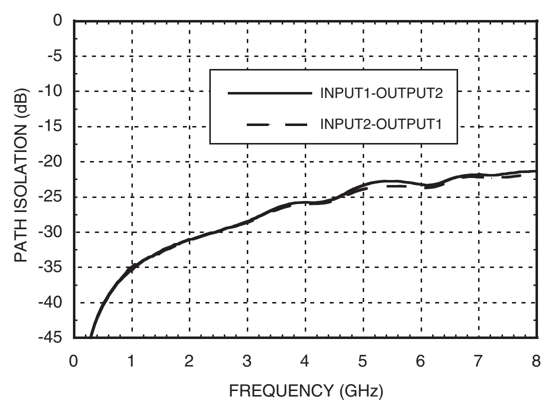
Gain, Power & OIP3 vs. Supply Voltage for Constant Icc= 80 mA @ 850 MHz



Vcc vs. Icc Over Temperature for Fixed Vs= 8V, R_{BIAS}= 51 Ohms

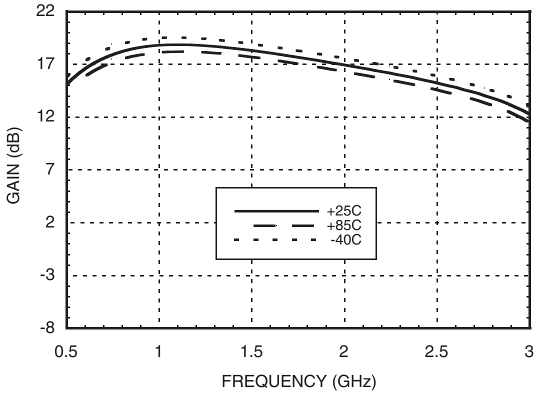


Cross Channel Isolation

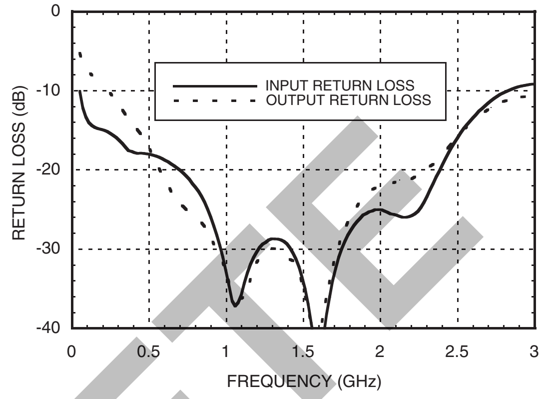


Data shown is of a single amplifier.

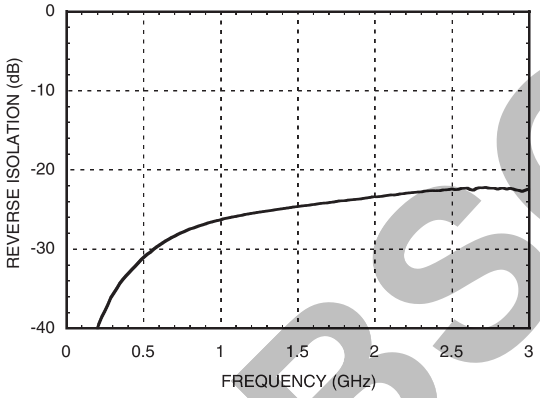
*Gain**



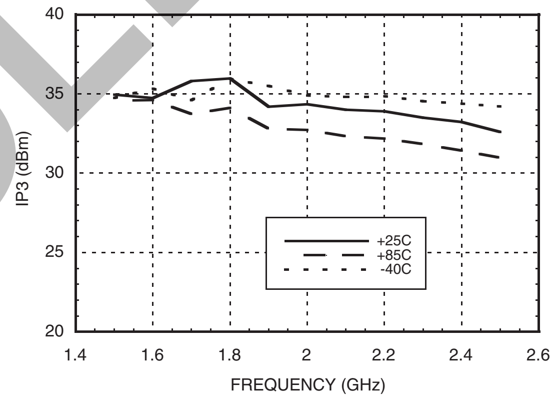
*Input & Output Return Loss **



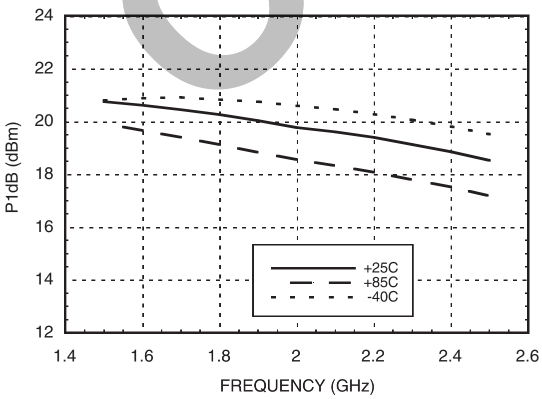
*Reverse Isolation**



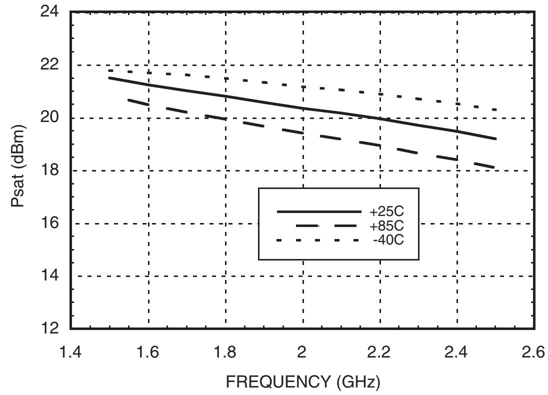
*Output IP3**



*Output P1dB**



*Output Psat**



** Measurements shown are of both channels with 1.5 - 2.5 GHz 90° splitter/combiners on input & output (see application circuit for balanced operation).*

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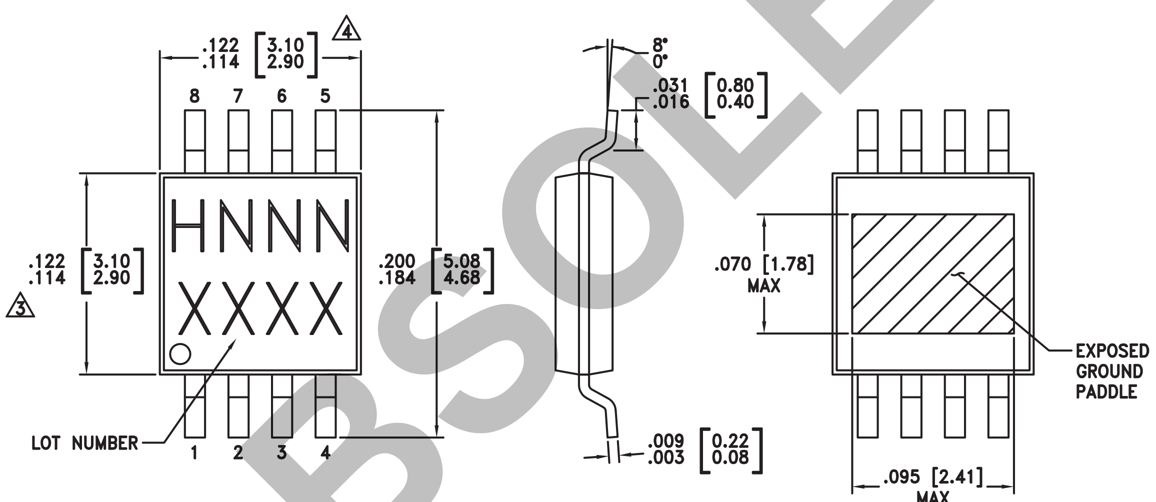
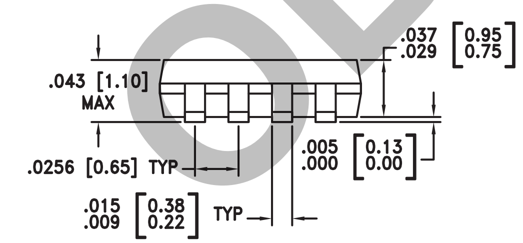
Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+6.0 Vdc
Collector Bias Current (Icc)	100 mA
RF Input Power (RFIN)(Vcc = +4.2 Vdc)	+14 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 32.6 mW/°C above 85 °C)	2.12 W
Thermal Resistance (junction to ground paddle)	30.7 °C/W
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:
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 AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC471MS8G	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H471 XXXX
HMC471MS8GE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H471 XXXX

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

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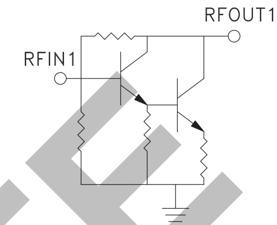
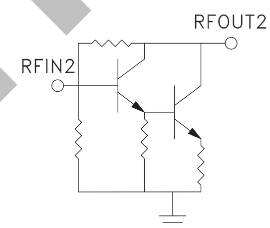
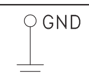
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	RFIN1	This pin is DC coupled. An off chip DC blocking capacitor is required.	
8	RFOUT1	RF output and DC Bias (Vcc1) for the output stage.	
2, 3, 6, 7	N/C	No connection. These pins may be connected to RF ground. Performance will not be affected.	
4	RFIN2	This pin is DC coupled. An off chip DC blocking capacitor is required.	
5	RFOUT2	RF output and DC Bias (Vcc2) for the output stage.	
Ground Paddle	GND	Ground paddle must be connected to RF/DC ground.	

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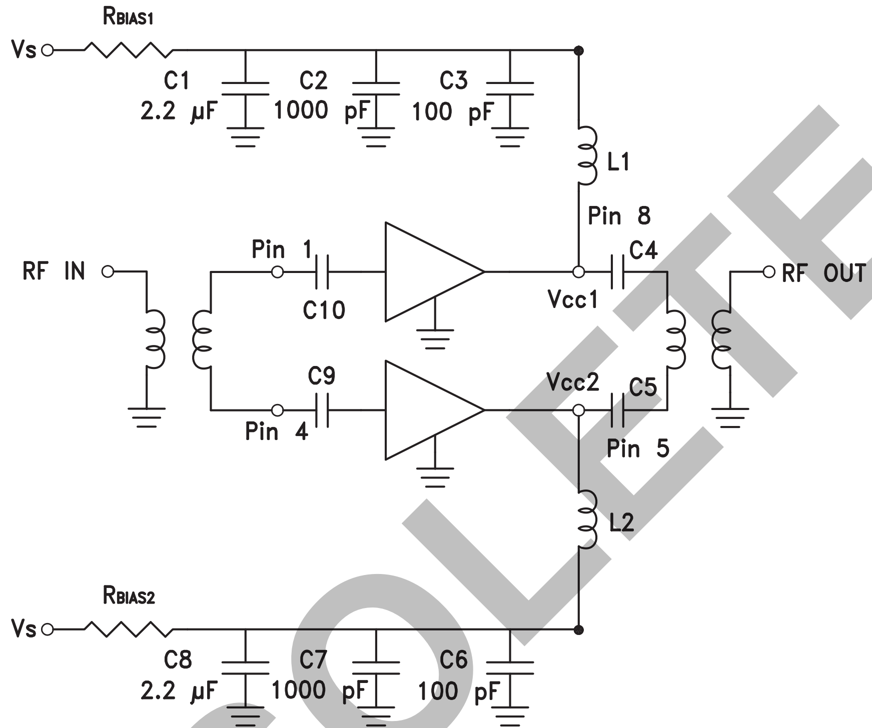
Application Circuit for Balanced Operation



Note:
1. External blocking capacitors are required on RFIN and RFOUT.
2. RBIAS provides DC bias stability over temperature.

Recommended Bias Resistor Values for Icc= 75 mA, Rbias= (Vs - Vcc) / Icc

Supply Voltage (Vs)	6V	8V	10V	12V
RBIAS VALUE	11 Ω	39 Ω	62 Ω	91 Ω
RBIAS POWER RATING	1/4 W	1/2 W	1/2 W	1 W

Recommended Component Values for Key Application Frequencies

Component	Frequency (MHz)						
	50	900	1900	2200	2400	3500	5000
L1, L2	270 nH	56 nH	18 nH	18 nH	15 nH	8.2 nH	6.8 nH
C4, C5, C9, C10	0.01 µF	100 pF	100 pF	100 pF	100 pF	100 pF	100 pF

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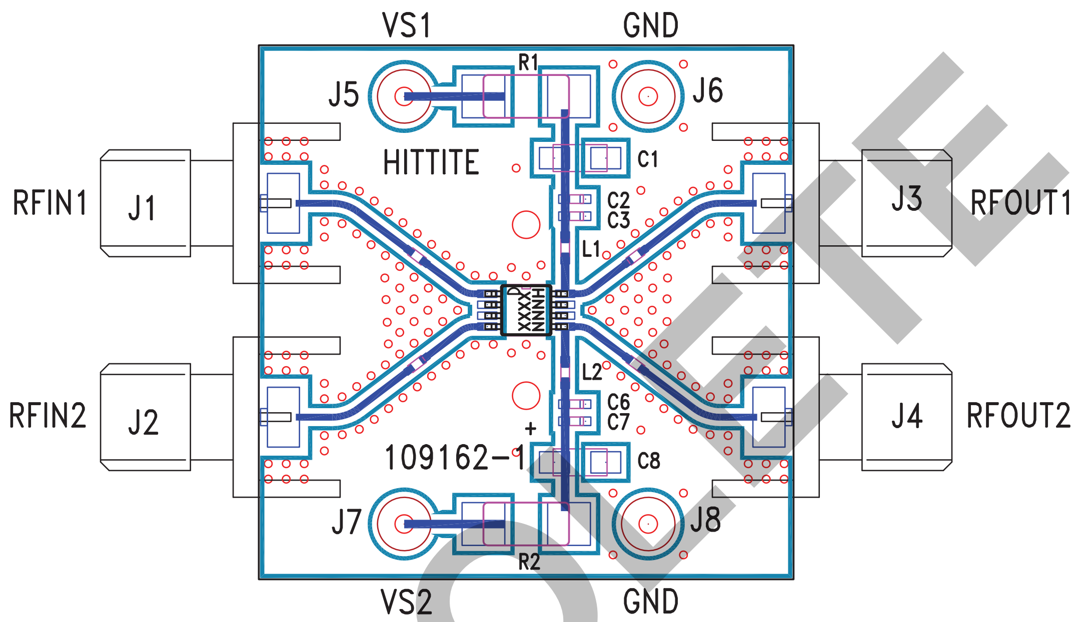
Evaluation PCB



List of Materials for Evaluation PCB 109185 [1]

Item	Description
J1 - J4	PCB Mount SMA Connector
J5 - J8	DC Pins
L1, L2	Inductor, 0402 Pkg.
C1, C8	2.2 µF Capacitor, Tantalum
C2, C7	1000 pF Capacitor, 0402 Pkg.
C3, C6	100 pF Capacitor, 0402 Pkg.
C4, C5, C9, C10	Capacitor, 0402 Pkg.
R1, R2	Resistor, 2010 Pkg.
U1	HMC471MS8G / HMC471MS8GE
PCB [2]	109162 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

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 and package bottom 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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

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