Hittite MICROWAVE CORPORATION

v02.0604

HMC408LP3

GaAs InGaP HBT MMIC 1 WATT POWER AMPLIFIER, 5.1 - 5.9 GHz

Typical Applications

The HMC408LP3 is ideal for:

- 802.11a & HiperLAN WLAN
- UNII & Pt-Pt / Multi-Pt. Radios
- Access Point Radios

Features

Gain: 20 dB

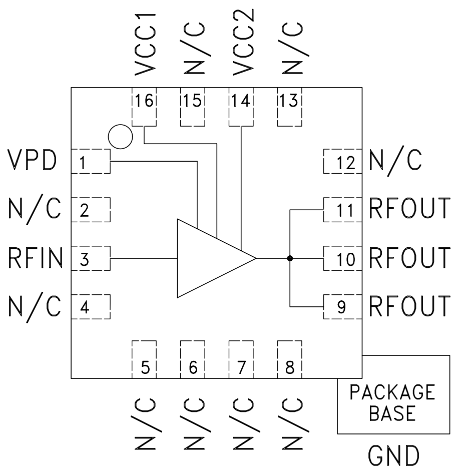
Saturated Power: +32.5 dBm @ 27% PAE

Single Supply Voltage: +5.0 V

Power Down Capability

3x3 mm Leadless SMT Package

Functional Diagram



TOP VIEW

General Description

The HMC408LP3 is a 5.1 - 5.9 GHz high efficiency GaAs InGaP Heterojunction Bipolar Transistor (HBT) Power Amplifier MMIC which offers +30 dBm P1dB. The amplifier provides 20 dB of gain, +32.5 dBm of saturated power, and 27% PAE from a +5.0V supply voltage. The input is internally matched to 50 Ohms while the output requires a minimum of external components. Vpd can be used for full power down or RF output power/current control. The amplifier is packaged in a low cost, 3x3 mm leadless surface mount package with an exposed base for improved RF and thermal performance.

Electrical Specifications, T_A = +25° C, Vs = 5V, Vpd = 5V

Parameter		Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range			5.7 - 5.9			5.1 - 5.9		GHz
Gain		17	20		17	20		dB
Gain Variation Over Temperature			0.045	0.055		0.045	0.055	dB/°C
Input Return Loss			8			8		dB
Output Return Loss*			14			6		dB
Output Power for 1 dB Compression (P1dB)	Icq= 750 mA Icq= 500 mA	27	30 27		24	27 23		dBm
Saturated Output Power (Psat)			32.5			31		dBm
Output Third Order Intercept (IP3)		40	43		36	39		dBm
Harmonics, Pout= 30 dBm, F= 5.8 GHz	2 fo 3 fo		-50 -90			-50 -90		dBc dBc
Noise Figure			6			6		dB
Supply Current (Icq)	Vpd= 0V/5V		0.002 / 750			0.002 / 750		mA
Control Current (Ipd)	Vpd= 5V		14			14		mA
Switching Speed	tOn, tOff		50			50		ns

** Output match optimized for 5.7 - 5.9 GHz operation. See Application Circuit herein.*

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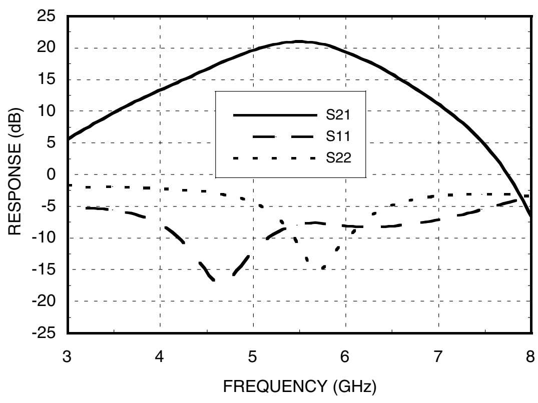
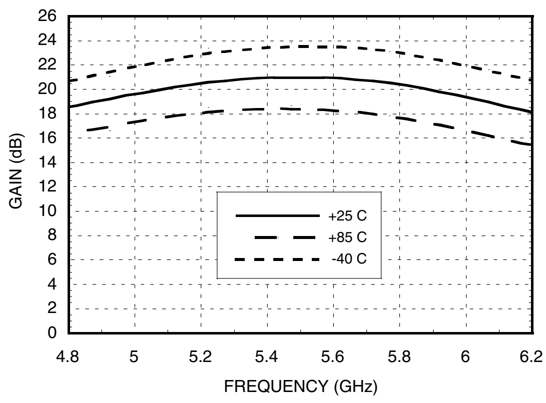
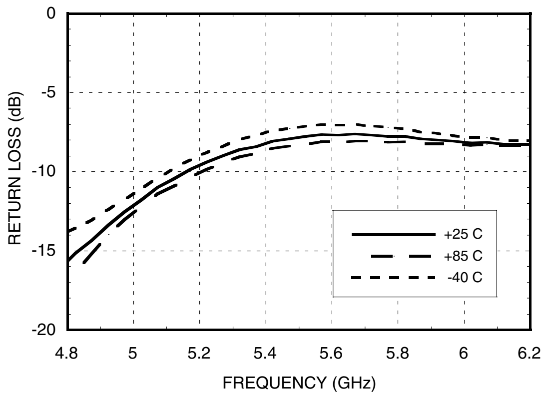
Broadband Gain & Return Loss



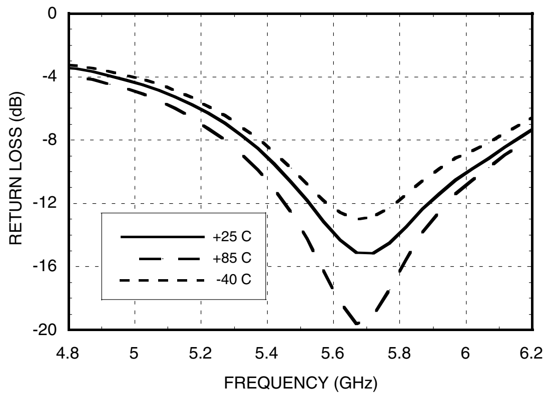
Gain vs. Temperature



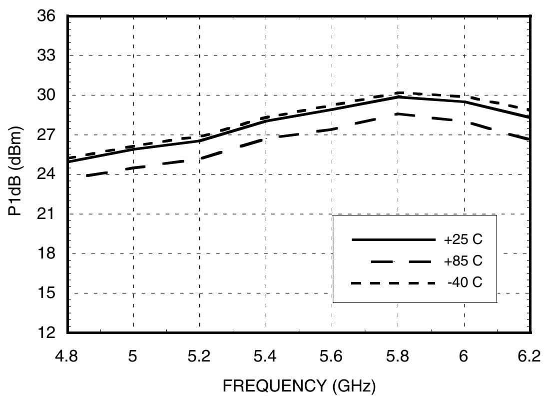
Input Return Loss vs. Temperature



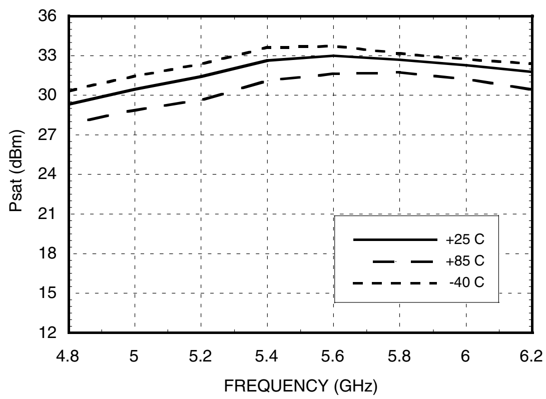
Output Return Loss vs. Temperature*



P1dB vs. Temperature



Psat vs. Temperature



** Output match optimized for 5.7 - 5.9 GHz.*

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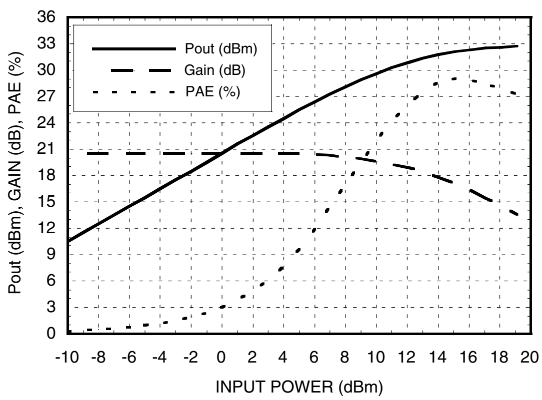
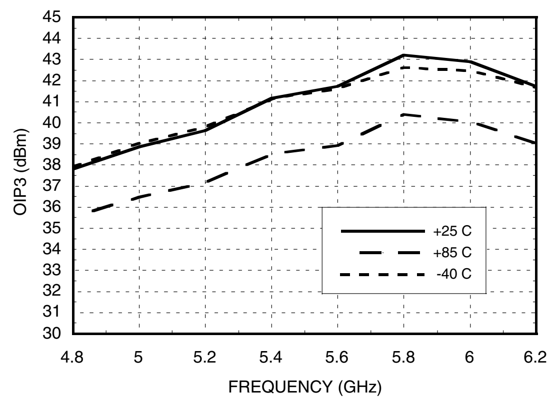
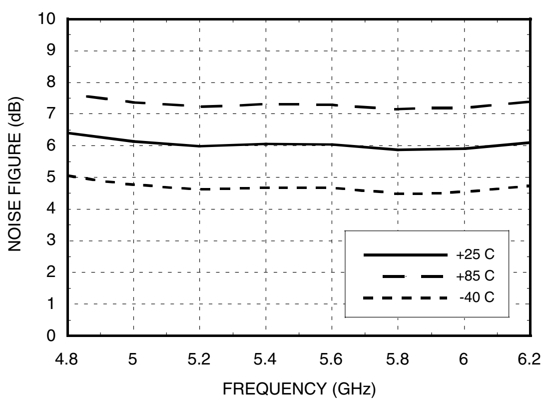
Power Compression @ 5.8 GHz



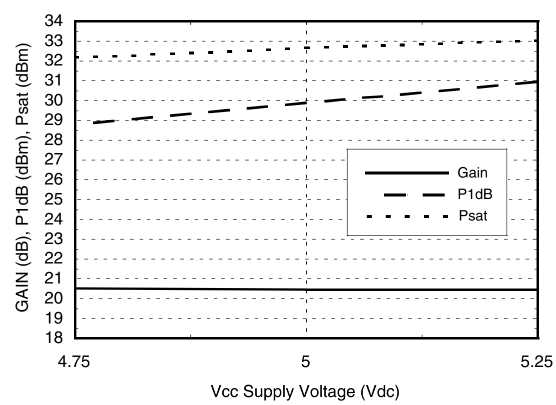
Output IP3 vs. Temperature



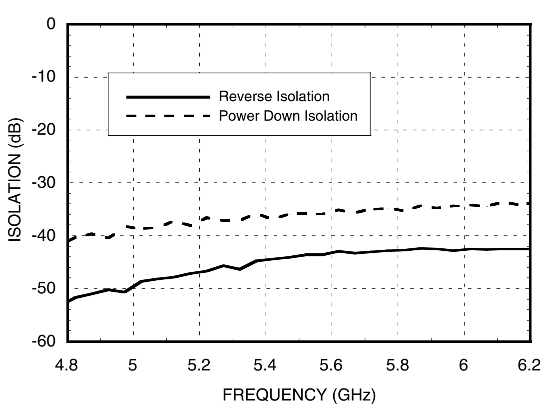
Noise Figure vs. Temperature



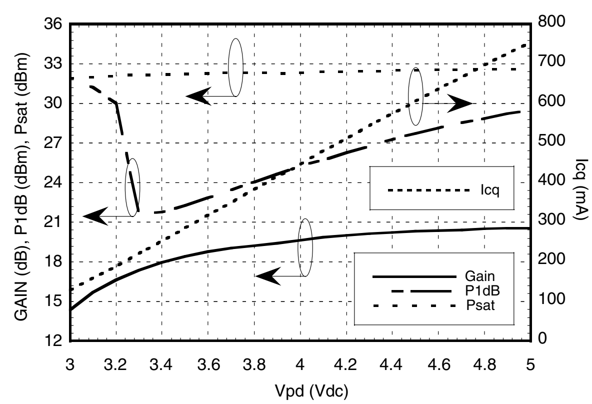
Gain & Power vs. Supply Voltage @ 5.8 GHz



Reverse Isolation vs. Temperature



Gain, Power & Quiescent Supply Current vs. Vpd @ 5.8 GHz



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Absolute Maximum Ratings

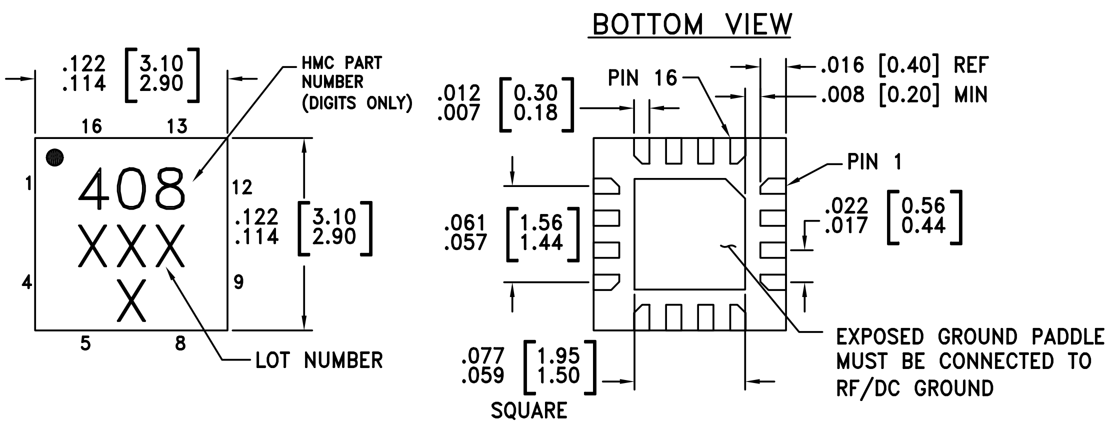
Collector Bias Voltage (Vcc1, Vcc2)	+5.5 Vdc
Control Voltage (Vpd)	+5.5 Vdc
RF Input Power (RFin)(Vs = Vpd = +5.0 Vdc)	+20 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 72.5 mW/°C above 85 °C)	4.71 W
Thermal Resistance (junction to ground paddle)	13.8 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

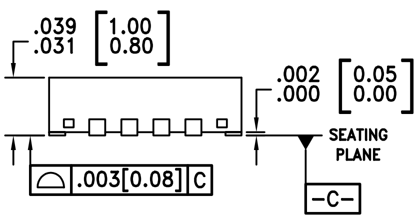
Typical Supply Current vs. Vs= Vcc1 + Vcc2

Vs (V)	Icq (mA)
4.75	725
5.0	750
5.25	780

Note: Amplifier will operate over full voltage range shown above

Outline Drawing





NOTES:
1. MATERIAL PACKAGE BODY: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY
3. LEAD AND GROUND PADDLE PLATING: Sn/Pb SOLDER
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
6. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
7. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
8. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
9. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

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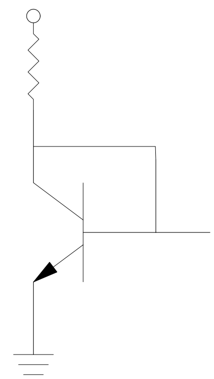
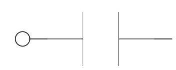
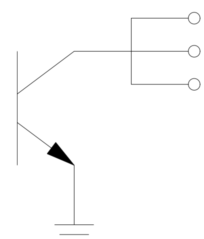
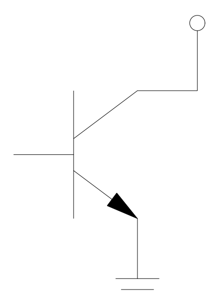
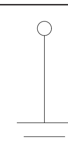
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	Vpd	Power control pin. For maximum power, this pin should be connected to 5.0V. A higher voltage is not recommended. For lower idle current, this voltage can be reduced.	
2, 4, 5 - 8, 12, 13, 15	N/C	No Connection	
3	RF IN	This pin AC coupled and matched to 50 Ohms from 5.1 - 5.9 GHz.	
9, 10, 11	RF OUT	RF output and DC bias for the output stage.	
14	Vcc2	Power supply voltage for the second amplifier stage. External bypass capacitors and pull up choke are required as shown in the application schematic.	
16	Vcc1	Power supply voltage for the first amplifier stage. External bypass capacitors are required as shown in the application schematic.	
	GND	Ground: Backside of package has exposed metal ground slug that must be connected to ground thru a short path. Vias under the device are required.	

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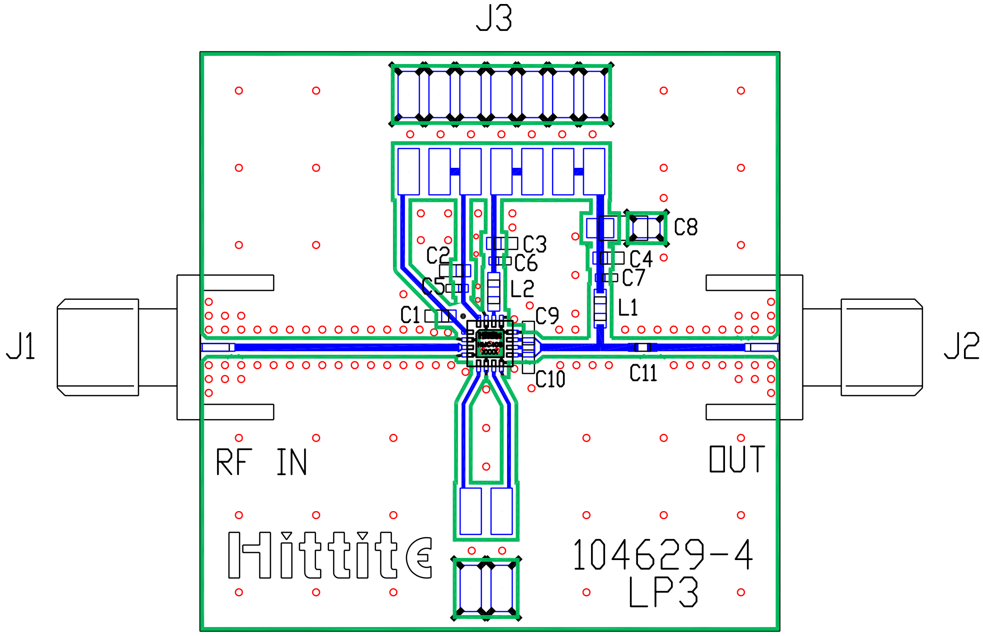
Evaluation PCB



List of Material

Item	Description
J1 - J2	PC Mount SMA RF Connector
J3	2 mm DC Header
C1 - C4	1,000 pF Capacitor, 0603 Pkg.
C5 - C7	100 pF Capacitor, 0402 Pkg.
C8	2.2 μF Tantalum Capacitor
C9 - C10	0.5 pF Capacitor, 0603 Pkg.
C11	10 pF Capacitor, 0402 Pkg.
L1 - L2	1.6 nH Inductor, 0603 Pkg.
U1	HMC408LP3 Amplifier
PCB*	104629 Eval Board
* 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 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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

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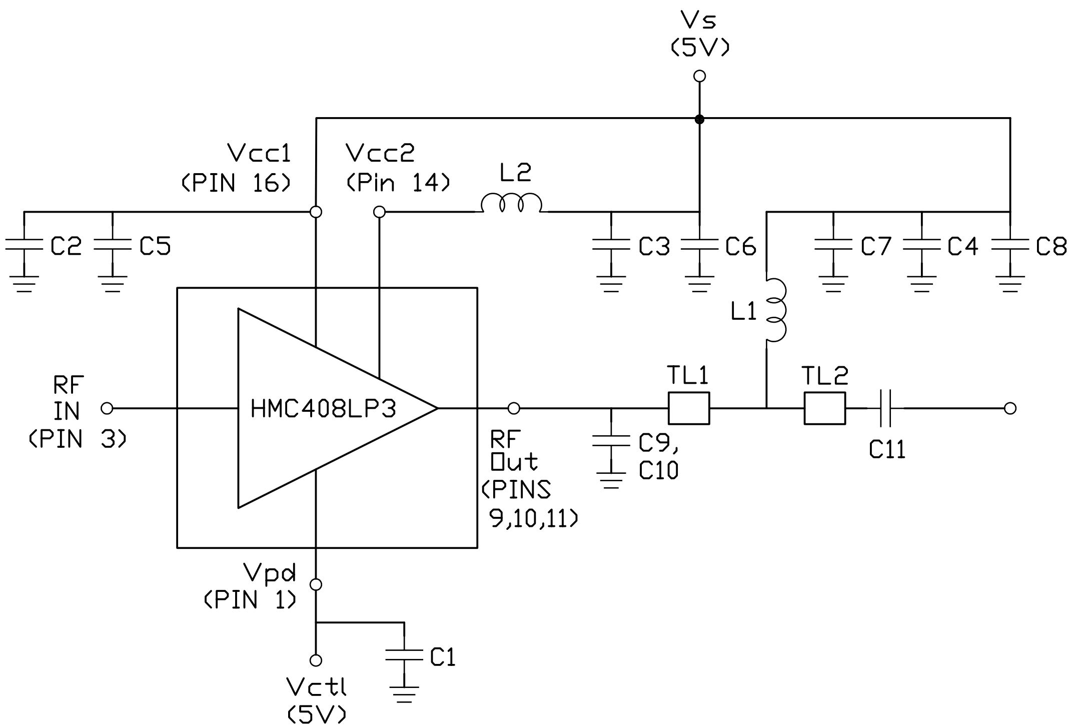
Application Circuit



Recommended Component Values	
L1, L2	1.6 nH
C1 - C4	1,000 pF
C5 - C7	100 pF
C8	2.2 µF
C9 - C10	0.5 pF

	TL1	TL2
Impedance	50 Ohm	50 Ohm
Length	0.200”	0.100”

Note 1: C9, C10 should be located < 0.020” from pins 9, 10, & 11.

Note 2: Application circuit values shown are optimized for 5.7 - 5.9 GHz operation.
Contact our Applications Engineers for optimization of output match for other frequencies.

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