Hittite MICROWAVE CORPORATION

v00.0404

HMC480ST89

InGaP HBT GAIN BLOCK MMIC AMPLIFIER, DC - 5.0 GHz

Typical Applications

The HMC480ST89 is an ideal RF/IF gain block & LO or PA driver for:

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

Features

P1dB Output Power: +19 dBm to 2.5 GHz

Gain: 19 dB @ 1 GHz

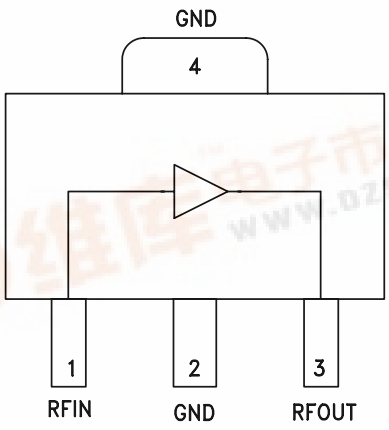
16 dB @ 2 GHz

+34 dBm Output IP3

Single Supply: +6V to +8V

Industry Standard SOT89 Package

Functional Diagram



General Description

The HMC480ST89 is an InGaP HBT Gain Block MMIC SMT amplifier covering DC to 5 GHz and packaged in an industry standard SOT89. The amplifier can be used as a cascadable 50 Ohm RF/IF gain stage as well as a LO or PA driver with up to +20 dBm P1dB output power for cellular/3G, FWA, CATV, microwave radio and test equipment applications. The HMC480ST89 offers 19 dB of gain with a +34 dBm output IP3 at 1 GHz while requiring only 82 mA from a single positive supply. The HMC480ST89 InGaP gain block offers excellent output IP3 and flat +19 to +20dBm output power performance through 5 GHz compared to equivalent SiGe based products.

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

Parameter		Min.	Typ.	Max.	Units
Gain	DC - 1.0 GHz	17	19		dB
	1.0 - 2.0 GHz	14	17		dB
	2.0 - 3.0 GHz	12	15		dB
	3.0 - 4.0 GHz	10	13		dB
	4.0 - 5.0 GHz	8	11		dB
Gain Variation Over Temperature	DC - 5.0 GHz		0.008	0.016	dB/ °C
Input Return Loss	DC - 1.0 GHz		17		dB
	1.0 - 5.0 GHz		10		dB
Output Return Loss	DC - 1.0 GHz		17		dB
	1.0 - 5.0 GHz		10		dB
Reverse Isolation	DC - 5.0 GHz		20		dB
Output Power for 1 dB Compression (P1dB)	0.5 - 1.0 GHz	16	20		dBm
	1.0 - 2.0 GHz	15.5	18.5		dBm
	2.0 - 3.5 GHz	14.5	17.5		dBm
	3.5 - 5.0 GHz	13	16		dBm
Output Third Order Intercept (IP3) (Pout= 0 dBm per tone, 1 MHz spacing)	0.5 - 1.0 GHz		34		dBm
	1.0 - 2.0 GHz		33		dBm
	2.0 - 3.5 GHz		32		dBm
	3.5 - 5.0 GHz		30		dBm
Noise Figure	DC - 4.0 GHz		3.25		dB
	4.0 - 5.0 GHz		4.0		dB
Supply Current (Icq)			82		mA

Note: Data taken with broadband bias tee on device output.

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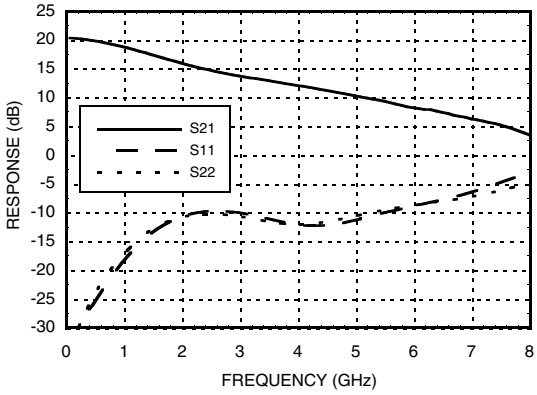
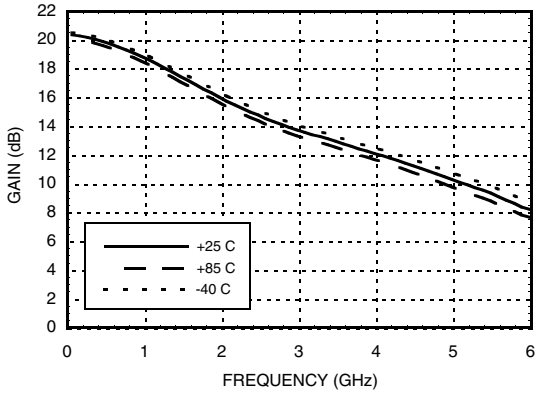
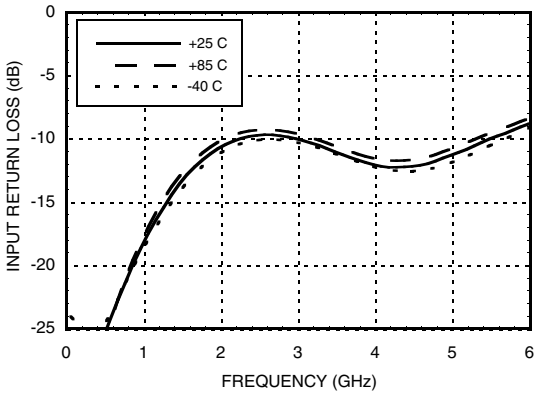
Broadband Gain & Return Loss



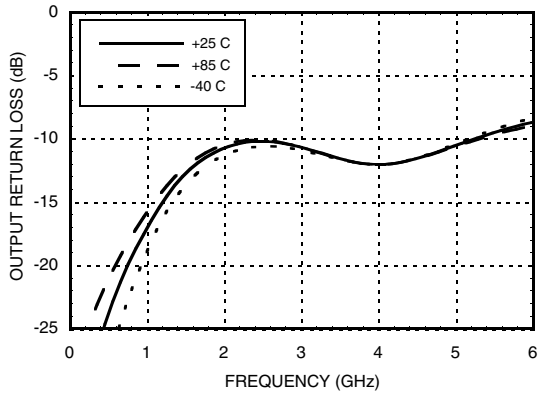
Gain vs. Temperature



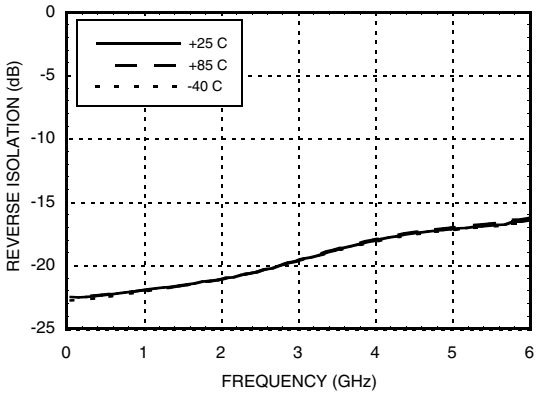
Input Return Loss vs. Temperature



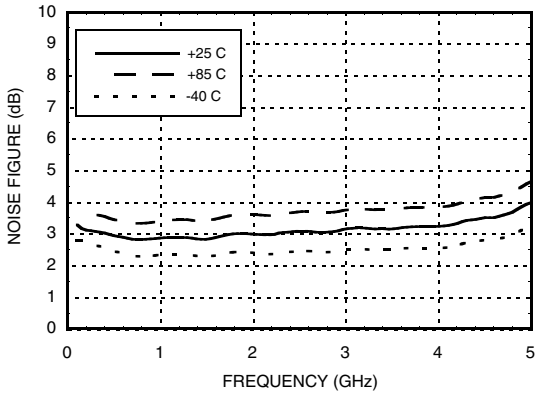
Output Return Loss vs. Temperature



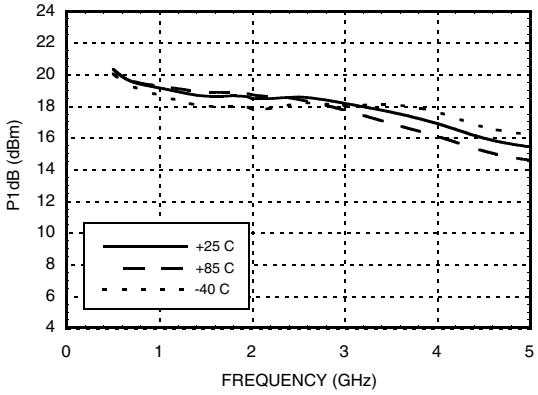
Reverse Isolation vs. Temperature



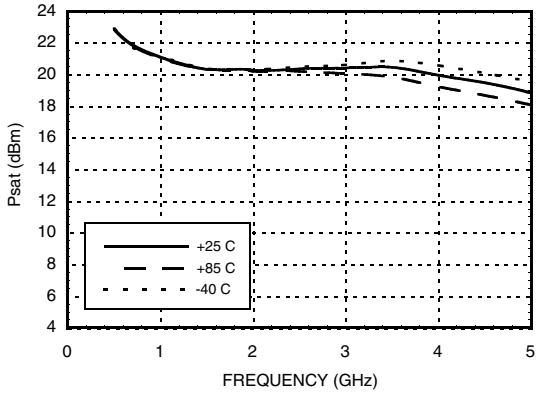
Noise Figure vs. Temperature



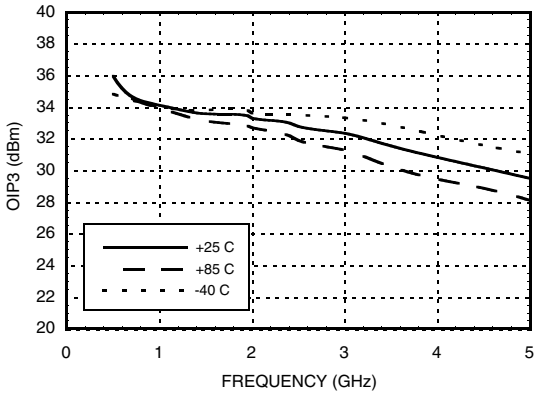
P1dB vs. Temperature



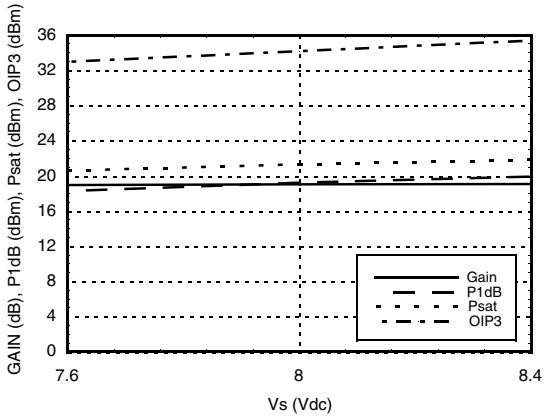
Psat vs. Temperature



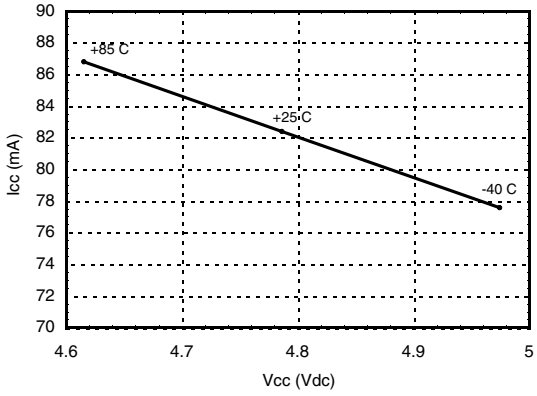
Output IP3 vs. Temperature



Gain, Power & OIP3 vs. Supply Voltage @ 850 MHz, Rbias= 39 Ohms



Vcc vs. Icc Over Temperature for Fixed Vs= 8V, RBIAS= 39 Ohms



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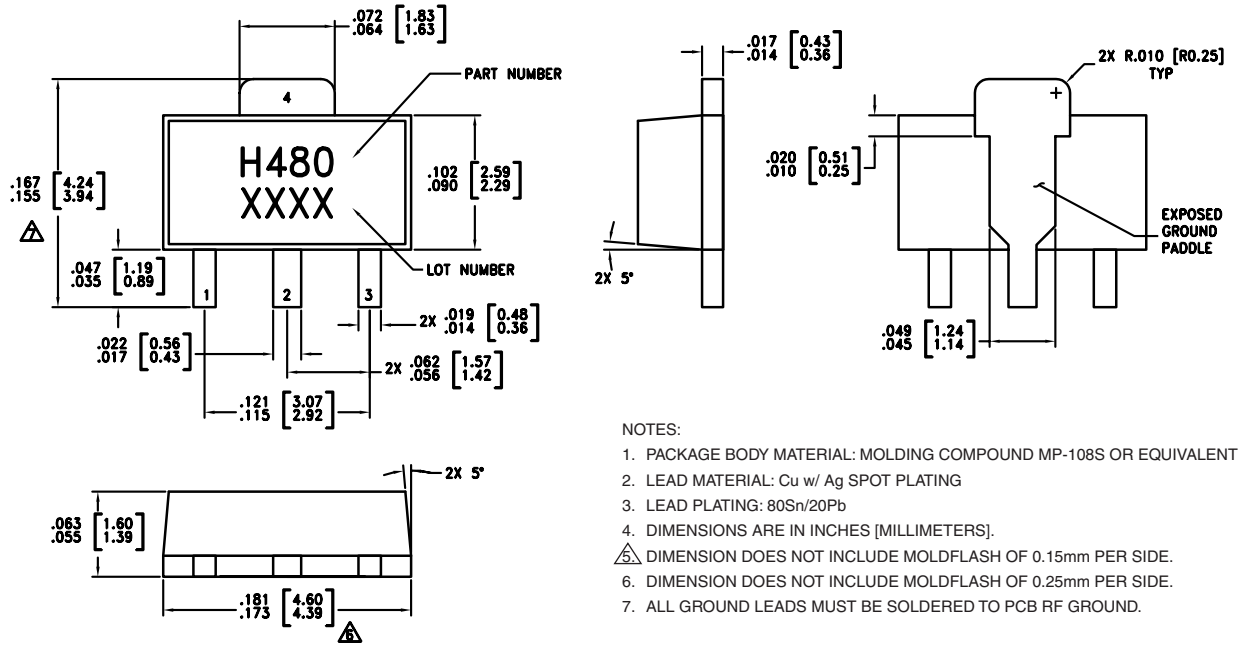
Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+6.0 Vdc
RF Input Power (RFin)(Vcc = +5 Vdc)	+15 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 8.25 mW/°C above 85 °C)	0.536 W
Thermal Resistance (junction to ground paddle)	122 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

Outline Drawing



NOTES:

1. PACKAGE BODY MATERIAL: MOLDING COMPOUND MP-108S OR EQUIVALENT
2. LEAD MATERIAL: Cu w/ Ag SPOT PLATING
3. LEAD PLATING: 80Sn/20Pb
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
6. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
7. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

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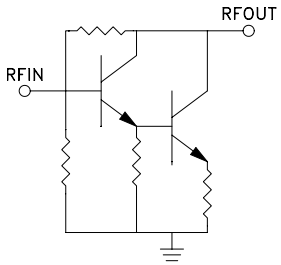
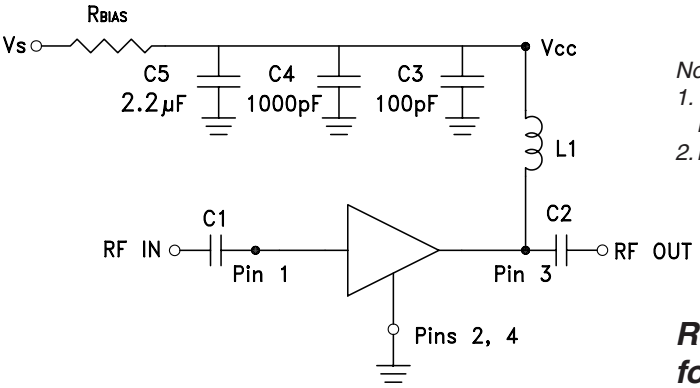
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	RFIN	This pin is DC coupled. An off chip DC blocking capacitor is required.	
3	RFOUT	RF output and DC Bias (Vcc) for the output stage.	
2, 4	GND	These pins and package bottom must be connected to RF/DC ground.	

Application Circuit



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

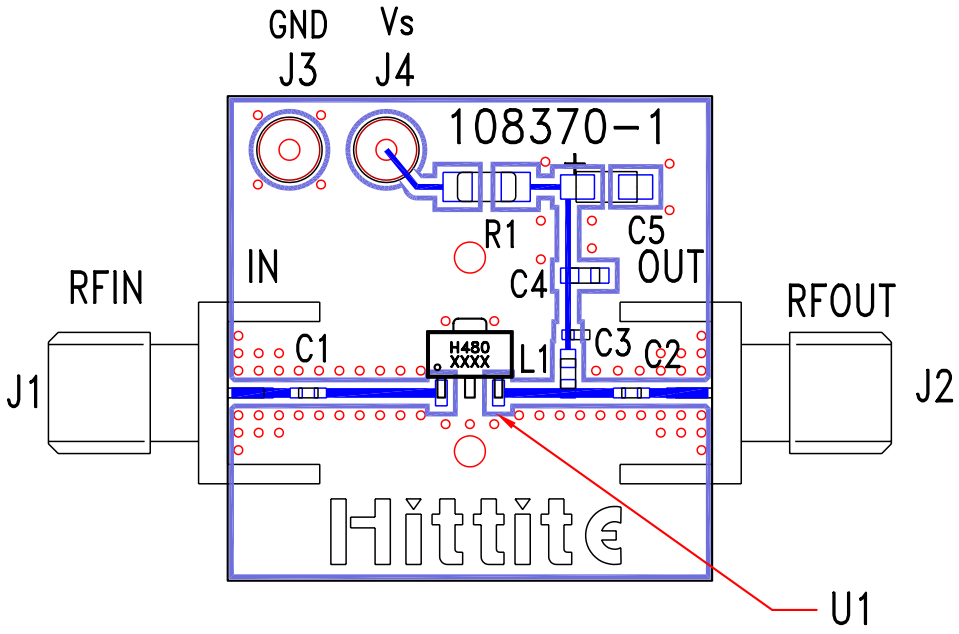
Recommended Bias Resistor Values for Icc= 82 mA, Rbias= (Vs - Vcc) / Icc

Supply Voltage (Vs)	6V	8V
RBIAS VALUE	12 Ω	39 Ω
RBIAS POWER RATING	1/8 W	1/4 W

Recommended Component Values for Key Application Frequencies

Component	Frequency (MHz)						
	50	900	1900	2200	2400	3500	5000
L1	270 nH	56 nH	18 nH	18 nH	15 nH	8.2 nH	6.8 nH
C1, C2	0.01 µF	100 pF	100 pF	100 pF	100 pF	100 pF	100 pF

Evaluation PCB



List of Materials for Evaluation PCB 108371*

Item	Description
J1 - J2	PC Mount SMA Connector
J3 - J4	DC Pin
C1, C2	Capacitor, 0402 Pkg.
C3	100 pF Capacitor, 0402 Pkg.
C4	1000 pF Capacitor, 0603 Pkg.
C5	2.2 µF Capacitor, Tantalum
R1	Resistor, 1210 Pkg.
L1	Inductor, 0603 Pkg.
U1	HMC480ST89
PCB**	108370 Evaluation PCB
** Circuit Board Material: Rogers 4350	

* Reference this number when ordering complete evaluation PCB.

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.