HMC580ST89 / 580ST89E

v04.0710

InGaP HBT GAIN BLOCK MMIC AMPLIFIER, DC - 1 GHz

Typical Applications

The HMC580ST89 / HMC580ST89E is ideal forr:

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

Features

P1dB Output Power: +22 dBm

Gain: 22 dB

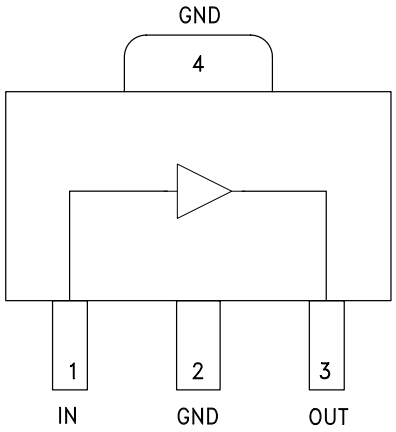
Output IP3: +37 dBm

Cascadable 50 Ohm I/Os

Single Supply: +5V

Industry Standard SOT89 Package

Functional Diagram



General Description

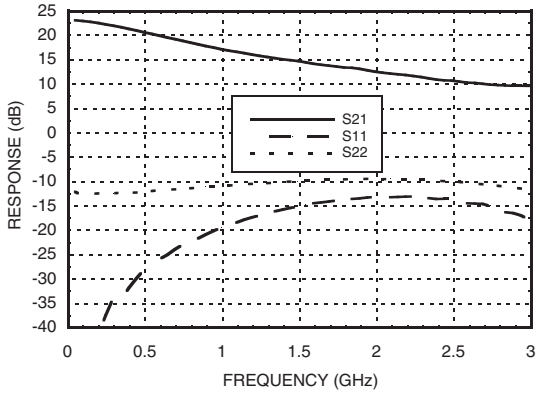
The HMC580ST89 & HMC580ST89E are InGaP Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT amplifiers covering DC to 1 GHz. Packaged in an industry standard SOT89, the amplifier can be used as a cascadable 50 Ohm RF or IF gain stage as well as a PA or LO driver with up to +26 dBm output power. The HMC580ST89(E) offers 22 dB of gain with a +37 dBm output IP3 at 250 MHz, and can operate directly from a +5V supply. The HMC580ST89(E) exhibits excellent gain and output power stability over temperature, while requiring a minimal number of external bias components.

Electrical Specifications, Vs= 5V, Rbias= 1.8 Ohm, T_A = +25° C

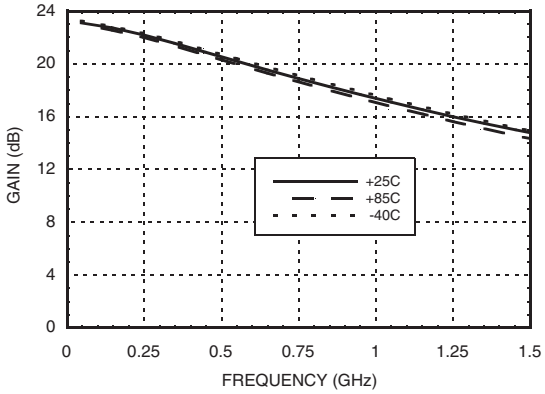
Parameter		Min.	Typ.	Max.	Units
Gain	DC - 0.25 GHz 0.25 - 0.50 GHz 0.50 - 1.00 GHz	19 18.5 15	22 21 17		dB dB dB
Gain Variation Over Temperature	DC - 1.0 GHz		0.005		dB/ °C
Input Return Loss	DC - 0.25 GHz 0.25 - 0.50 GHz 0.50 - 1.00 GHz		35 28 19		dB dB dB
Output Return Loss	DC - 0.50 GHz 0.50 - 1.00 GHz		12 11		dB dB
Reverse Isolation	DC - 1.0 GHz		23		dB
Output Power for 1 dB Compression (P1dB)	DC - 0.25 GHz 0.25 - 0.50 GHz 0.50 - 1.00 GHz	19 17.5 16	22 20.5 19		dBm dBm dBm
Output Third Order Intercept (IP3) (Pout= 0 dBm per tone, 1 MHz spacing)	DC - 0.25 GHz 0.25 - 0.50 GHz 0.50 - 1.00 GHz		37 35 33		dBm dBm dBm
Noise Figure	DC - 1.0 GHz		2.8		dB
Supply Current (Icq)			88	110	mA

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

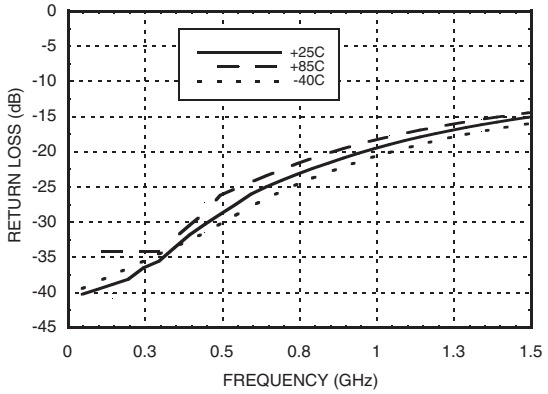
Broadband Gain & Return Loss



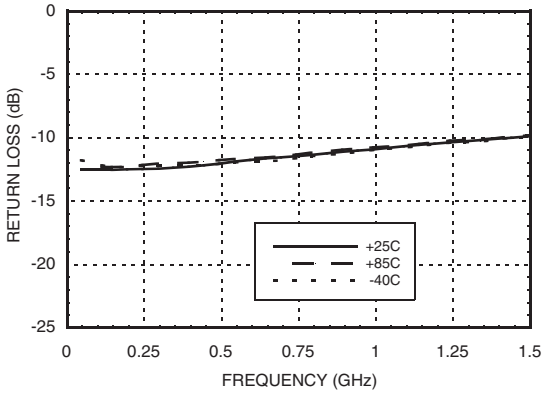
Gain vs. Temperature



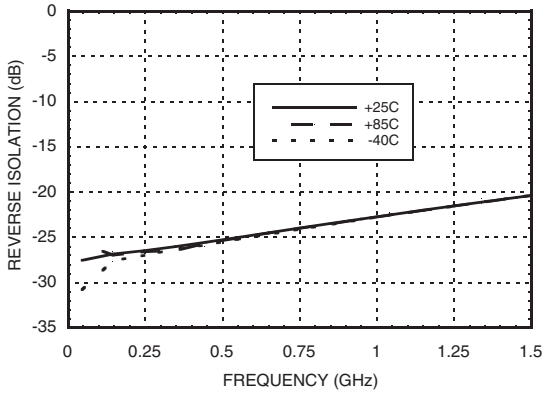
Input Return Loss vs. Temperature



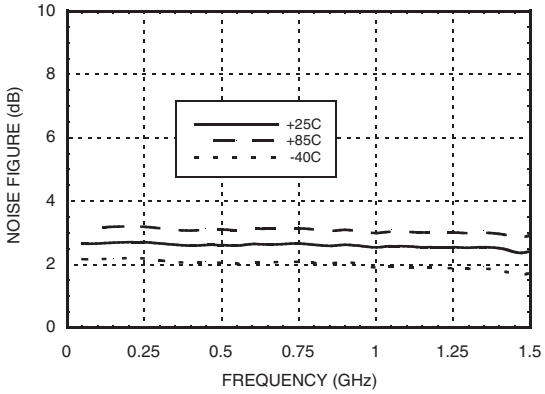
Output Return Loss vs. Temperature



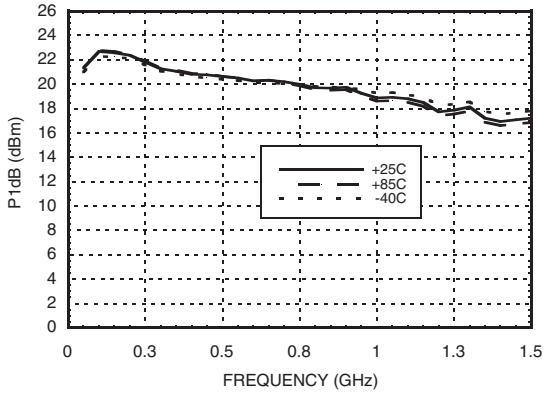
Reverse Isolation vs. Temperature



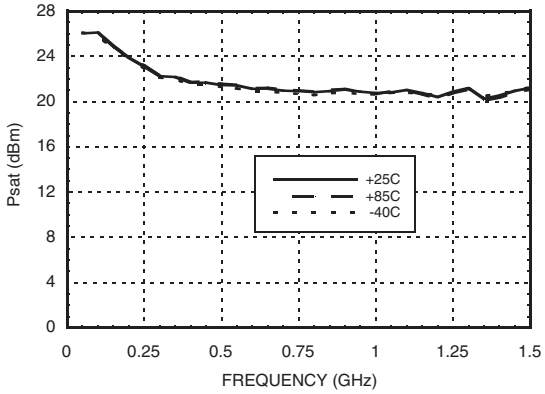
Noise Figure vs. Temperature



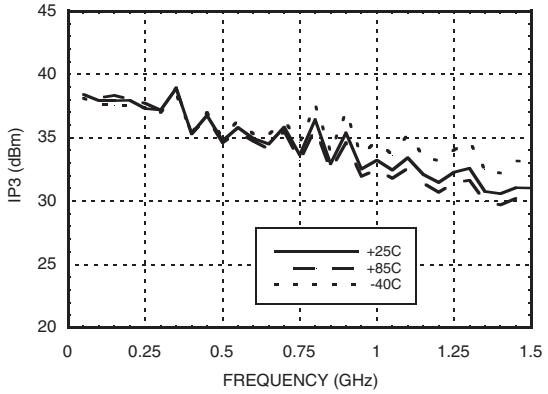
P1dB vs. Temperature



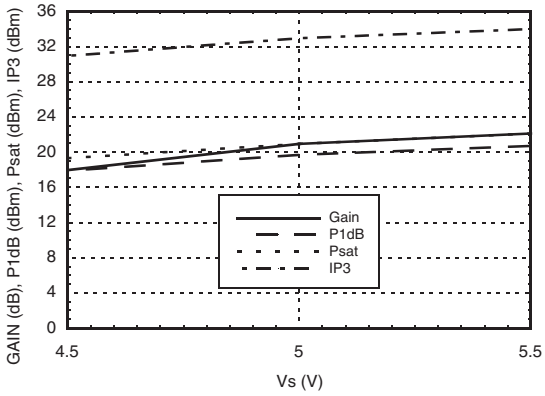
Psat vs. Temperature



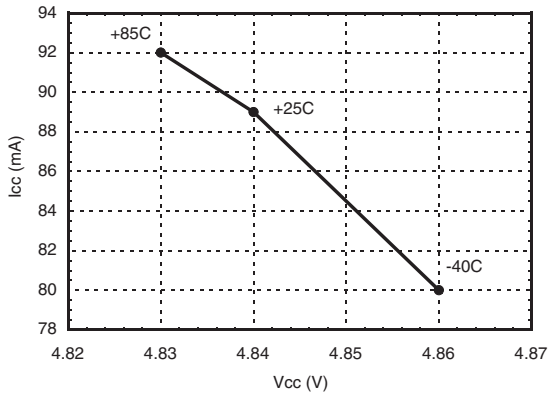
Output IP3 vs. Temperature



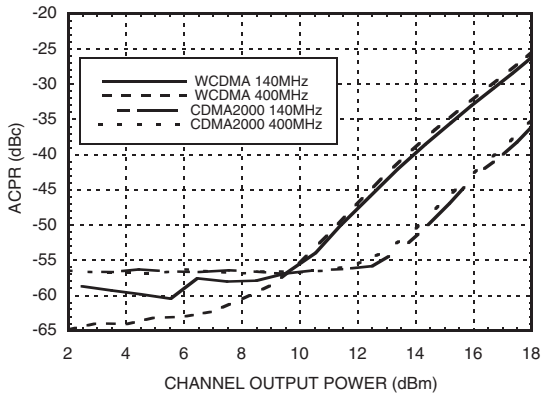
Gain, Power & OIP3 vs. Supply Voltage for Constant Icc = 88 mA @ 850 MHz



Vcc vs. Icc Over Temperature for Fixed Vs= 5V, R_{BIAS}= 1.8 Ohms



ACPR vs. Channel Output Power



HMC580ST89 / 580ST89E

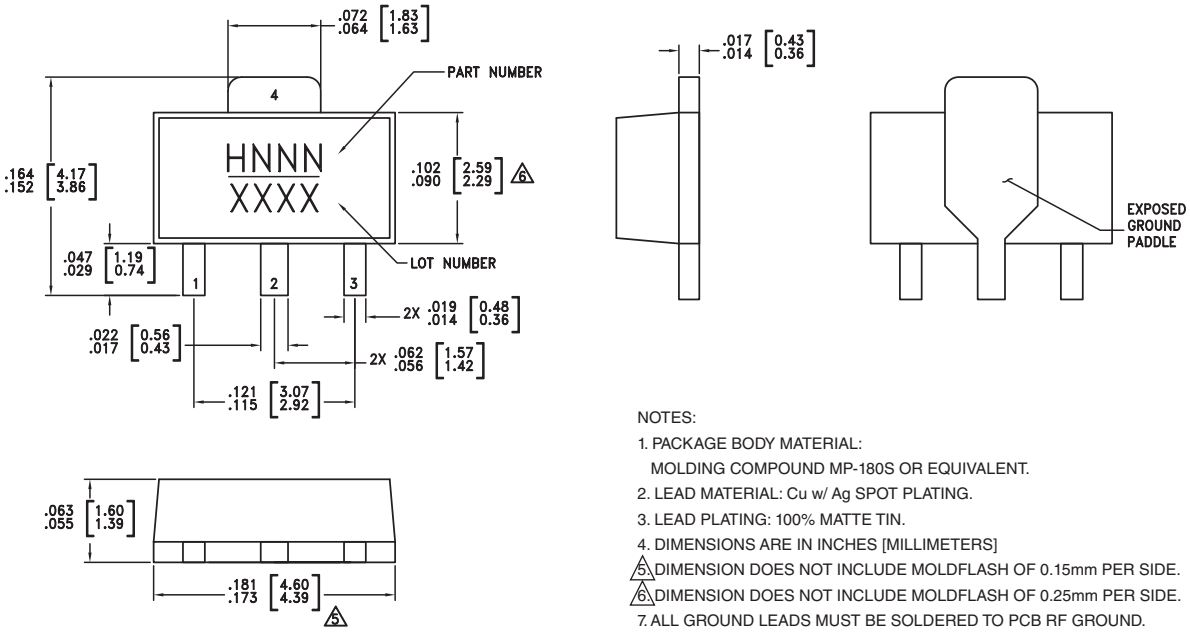
InGaP HBT GAIN BLOCK MMIC AMPLIFIER, DC - 1 GHz

Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+5.5 Vdc
RF Input Power (RFIN)(Vcc = +4.2 Vdc)	+10 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 9 mW/°C above 85 °C)	0.59 W
Thermal Resistance (junction to lead)	110 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HMB)	Class 1C

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

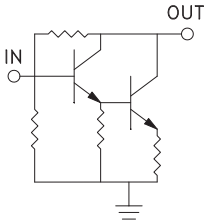
1. PACKAGE BODY MATERIAL:
   MOLDING COMPOUND MP-180S OR EQUIVALENT.
2. LEAD MATERIAL: Cu w/ Ag SPOT PLATING.
3. LEAD PLATING: 100% MATTE TIN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS]
5. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
6. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
7. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

Package Information

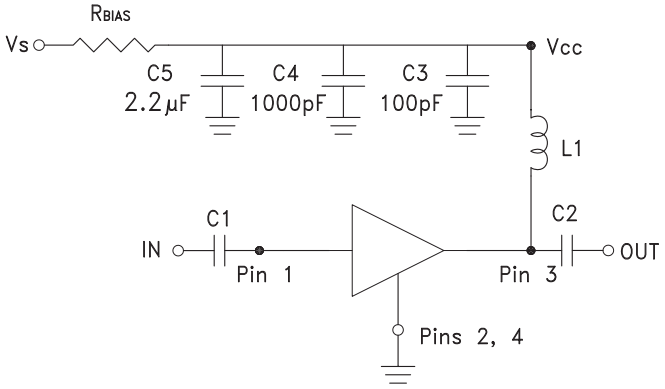
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC580ST89	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H580 XXXX
HMC580ST89E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H580 XXXX

[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	IN	This pin is DC coupled. An off chip DC blocking capacitor is required.	
3	OUT	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



Recommended Bias Resistor Values for Icc = 88 mA, Rbias = (Vs - Vcc) / Icc, Vs > +5V

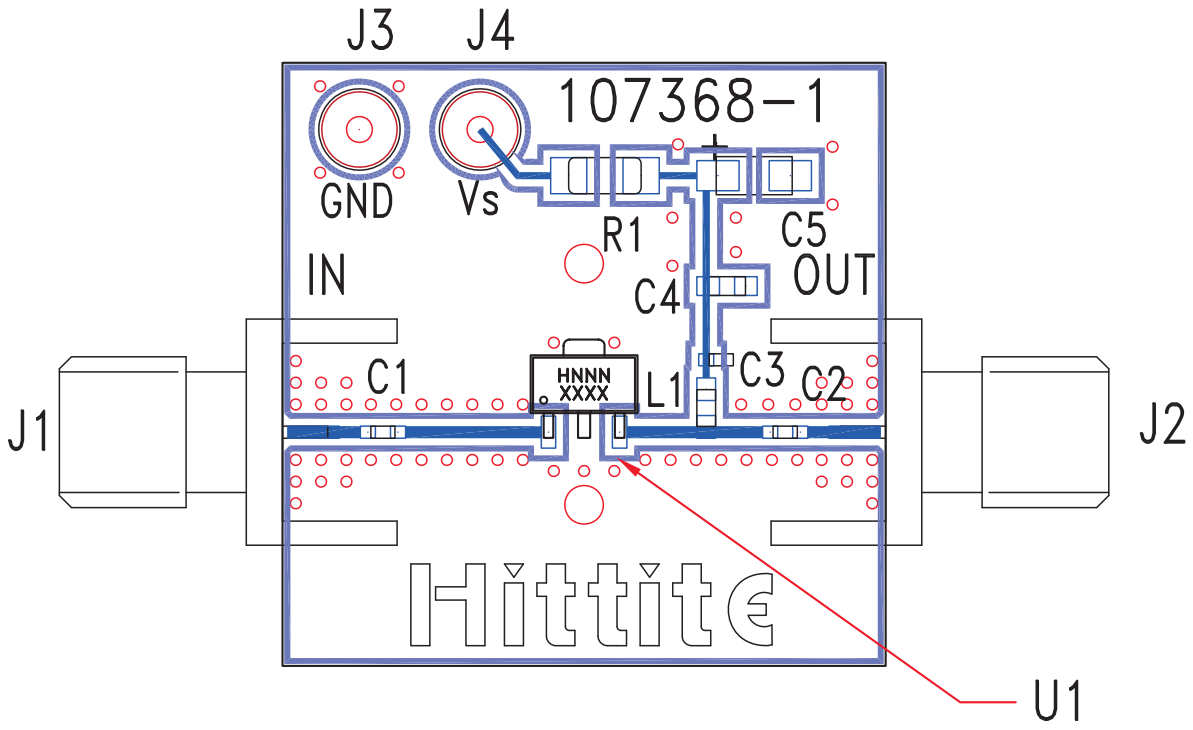
Supply Voltage (Vs)	6V	8V
RBIAS VALUE	13 Ω	36 Ω
RBIAS POWER RATING	¼ W	½ W

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

Recommended Component Values for Key Application Frequencies with Vs = +5V

Component	Frequency (MHz)			
	50	250	400	900
L1	270 nH	110 nH	110 nH	56 nH
C1, C2	0.01 µF	820 pF	820 pF	100 pF
Rbias	0 Ohms	1.5 Ohms	1.5 Ohms	1.8 Ohms

Evaluation PCB



List of Materials for Evaluation PCB 116402 [1]

Item	Description
J1 - J2	PCB 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, 1206 Pkg.
L1	Inductor, 0603 Pkg.
U1	HMC580ST89 / HMC580ST89E
PCB [2]	107368 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

[3] Evaluation board tuned for 900 MHz operation

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.