



# THE DATASHEET OF HMC481ST89ETR





## SiGe HBT GAIN BLOCK MMIC AMPLIFIER, DC - 5 GHz

### Typical Applications

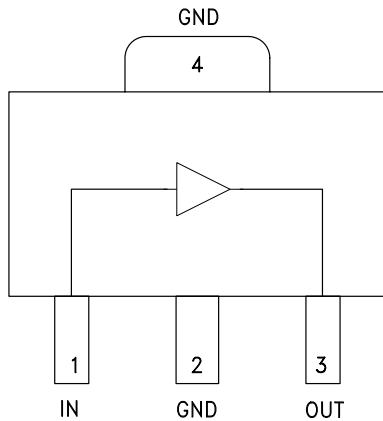
The HMC481ST89 / HMC481ST89E is an ideal RF/IF gain block & LO or PA driver for:

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

### Features

- P1dB Output Power: +19 dBm
- Gain: 20 dB
- Output IP3: +33 dBm
- Cascadable 50 Ohm I/Os
- Single Supply: +6V to +12V
- Industry Standard SOT89 Package
- Included in the HMC-DK001 Designer's Kits

### Functional Diagram



### General Description

The HMC481ST89 & HMC481ST89E are SiGe Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT amplifiers covering DC to 5 GHz. 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 +21 dBm output power. The HMC481ST89(E) offer 20 dB of gain with a +33 dBm output IP3 at 1 GHz while requiring only 79 mA from a single positive supply. The Darlington feedback pair used results in reduced sensitivity to normal process variations and excellent gain stability over temperature while requiring a minimal number of external bias components.

### Electrical Specifications, $V_s = 8.0\text{ V}$ , $R_{bias} = 39\text{ Ohm}$ , $T_A = +25^\circ\text{ C}$

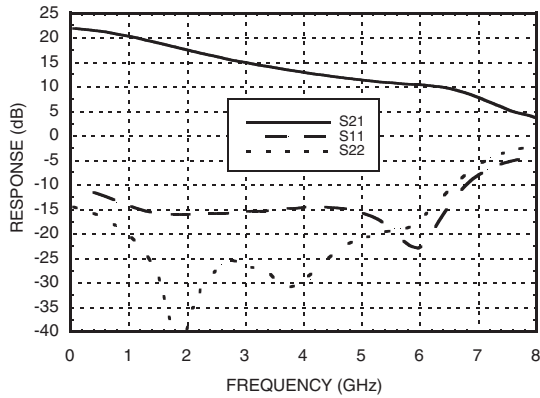
Parameter	Min.	Typ.	Max.	Units	
Gain	DC - 1.0 GHz	18	20	dB	
	1.0 - 2.0 GHz	15.5	17.5	dB	
	2.0 - 3.0 GHz	13	15	dB	
	3.0 - 4.0 GHz	11	13	dB	
	4.0 - 5.0 GHz	9	11	dB	
Gain Variation Over Temperature	DC - 5 GHz		0.008	0.016	dB/ °C
Input Return Loss	DC - 1.0 GHz		12	dB	
	1.0 - 5.0 GHz		15	dB	
Output Return Loss	DC - 1.0 GHz		17	dB	
	1.0 - 4.0 GHz		27	dB	
	4.0 - 5.0 GHz		23	dB	
Reverse Isolation	DC - 5 GHz		18	dB	
Output Power for 1 dB Compression (P1dB)	0.5 - 1.0 GHz	16	19	dBm	
	1.0 - 2.0 GHz	15	18	dBm	
	2.0 - 3.0 GHz	13	16	dBm	
	3.0 - 4.0 GHz	11	14	dBm	
	4.0 - 5.0 GHz	9	12	dBm	
Output Third Order Intercept (IP3) (Pout= 0 dBm per tone, 1 MHz spacing)	0.5 - 2.0 GHz		33	dBm	
	2.0 - 3.0 GHz		30	dBm	
	3.0 - 4.0 GHz		27	dBm	
	4.0 - 5.0 GHz		25	dBm	
Noise Figure	DC - 4 GHz		3.5	dB	
	4.0 - 5.0 GHz		4.0	dB	
Supply Current (Icq)			79	mA	

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

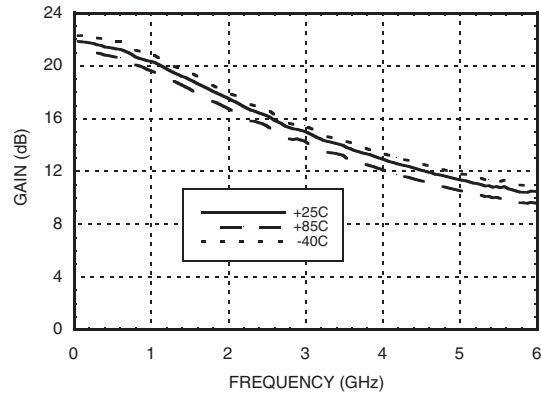


**SiGe HBT GAIN BLOCK  
MMIC AMPLIFIER, DC - 5 GHz**

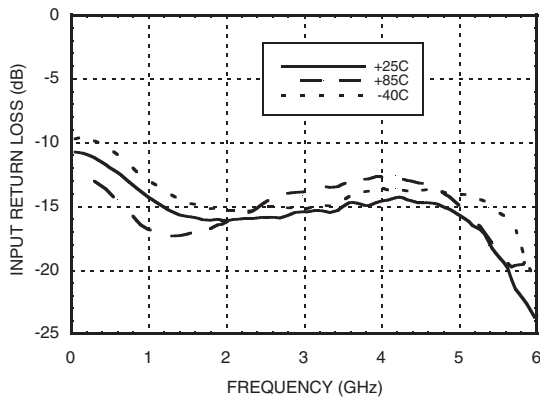
**Broadband Gain & Return Loss**



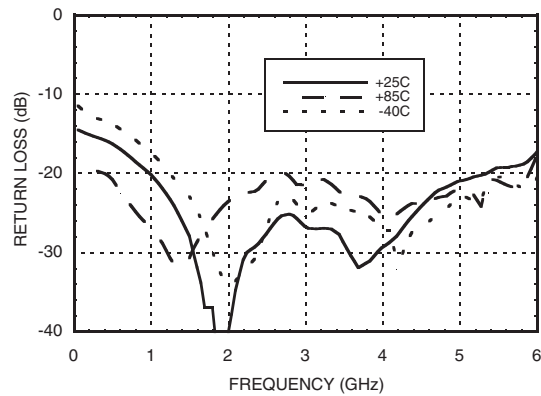
**Gain vs. Temperature**



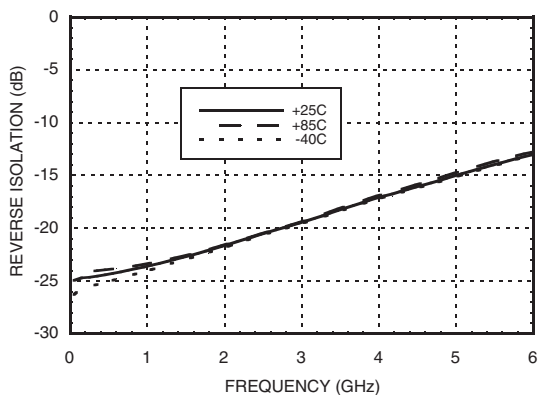
**Input Return Loss vs. Temperature**



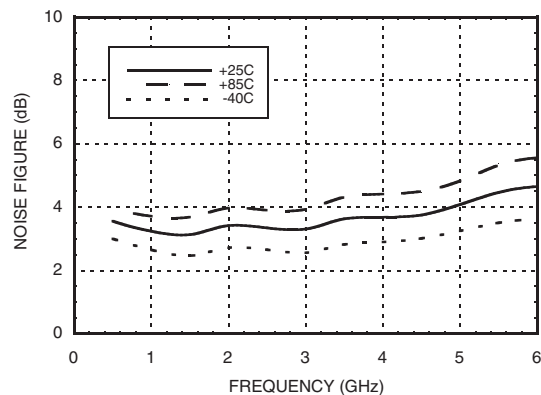
**Output Return Loss vs. Temperature**



**Reverse Isolation vs. Temperature**



**Noise Figure vs. Temperature**



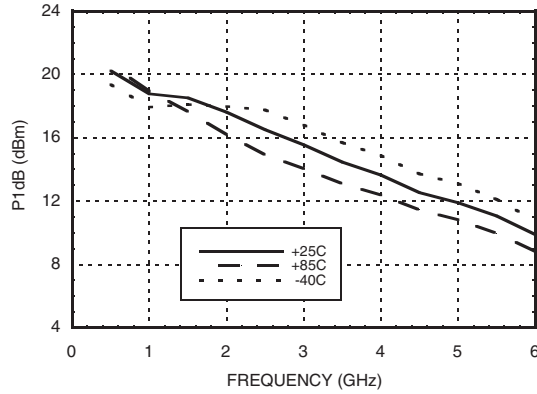
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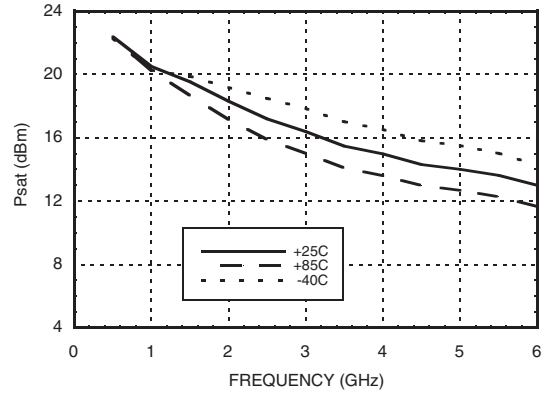


**SiGe HBT GAIN BLOCK  
MMIC AMPLIFIER, DC - 5 GHz**

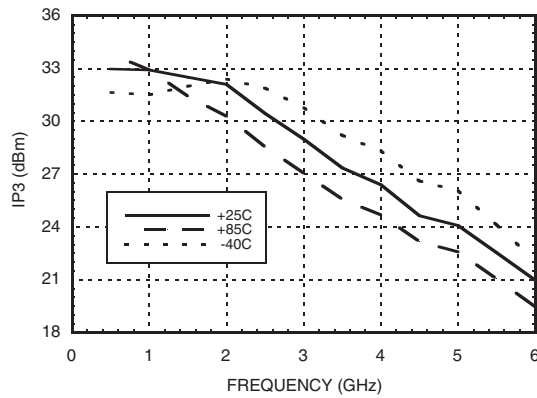
**P1dB vs. Temperature**



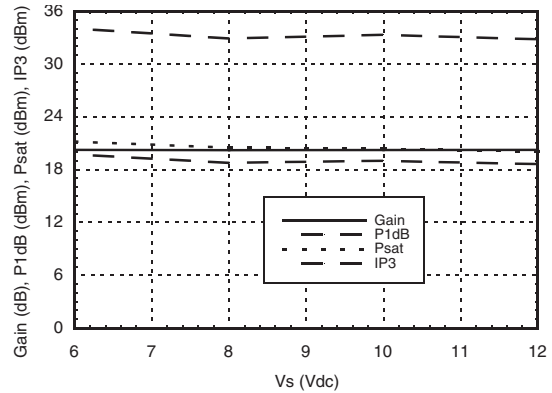
**Psat vs. Temperature**



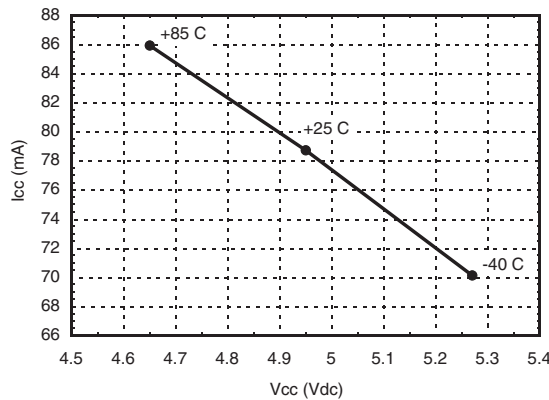
**Output IP3 vs. Temperature**



**Gain, Power & OIP3 vs. Supply Voltage  
for Constant Icc= 79 mA @ 850 MHz**



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





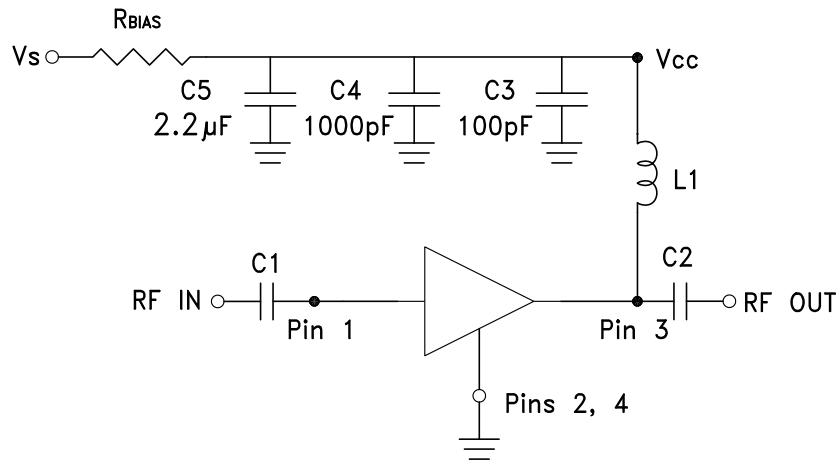


## SiGe HBT GAIN BLOCK MMIC AMPLIFIER, DC - 5 GHz

### 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



### Recommended Bias Resistor Values for $I_{cc} = 79 \text{ mA}$ , $R_{bias} = (V_s - V_{cc}) / I_{cc}$

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

Note:

- External blocking capacitors are required on RFIN and RFOUT.
- RBIAS provides DC bias stability over temperature.

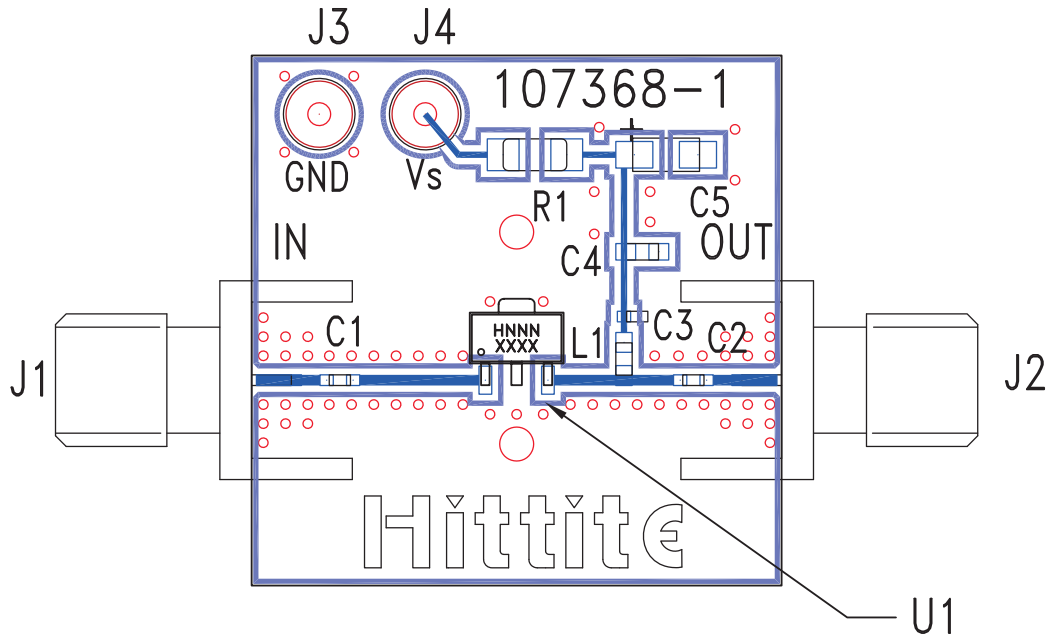
### Recommended Component Values for Key Application Frequencies

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 $\mu\text{F}$	100 pF	100 pF	100 pF	100 pF	100 pF	100 pF



**SiGe HBT GAIN BLOCK  
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**Evaluation PCB**



**List of Materials for Evaluation PCB 108324 [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 $\mu$ F Capacitor, Tantalum
R1	Resistor, 1210 Pkg.
L1	Inductor, 0603 Pkg.
U1	HMC481ST89 / HMC481ST89E
PCB [2]	107368 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.

## Looking for pricing, stock, or lifecycle information?

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