HMC478MP86 / 478MP86E

v03.0810

SiGe HBT GAIN BLOCK MMIC AMPLIFIER, DC - 4 GHz

RoHS✓ EARTH FRIENDLY

Designer's Kit Available

Typical Applications

The HMC478MP86 / HMC478MP86E is an ideal RF/ IF gain block & LO or PA driver:

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

Features

P1dB Output Power: +18 dBm

Gain: 22 dB

Output IP3: +32 dBm

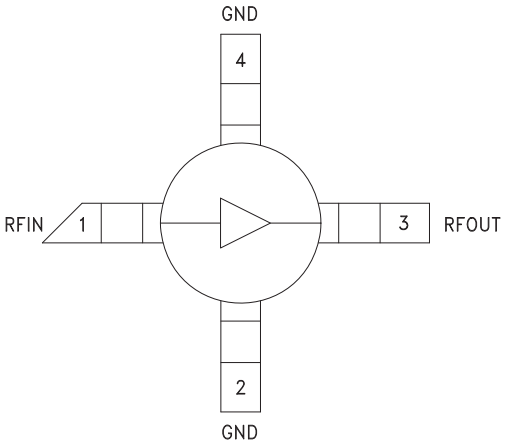
Cascadable 50 Ohm I/Os

Single Supply: +5V to +8V

Robust 1,000V ESD, Class 1C

Included in the HMC-DK001 Designer's Kit

Functional Diagram



General Description

The HMC478MP86 & HMC478MP86E are SiGe Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT amplifiers covering DC to 4 GHz. This Micro-P packaged 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 output power. The HMC478MP86(E) offers 22 dB of gain with a +32 dBm output IP3 at 850 MHz while requiring only 62 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, Vs= 5V, Rbias= 18 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	19 15 13 11	22 18 16 14		dB dB dB dB
Gain Variation Over Temperature	DC - 4 GHz		0.015	0.02	dB/ °C
Input Return Loss	DC - 1.0 GHz 1.0 - 3.0 GHz 3.0 - 4.0 GHz		15 12 13		dB dB dB
Output Return Loss	DC - 1.0 GHz 1.0 - 4.0 GHz		20 17		dB dB
Reverse Isolation	DC - 4 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	15 13 11 9	18 16 14 12		dBm dBm dBm dBm
Output Third Order Intercept (IP3) (Pout= 0 dBm per tone, 1 MHz spacing)	0.5 - 2.0 GHz 2.0 - 3.0 GHz 3.0 - 4.0 GHz		32 29 25		dBm dBm dBm
Noise Figure	DC - 3.0 GHz 3.0 - 4.0 GHz		2.5 3.5		dB dB
Supply Current (Icq)			62		mA

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

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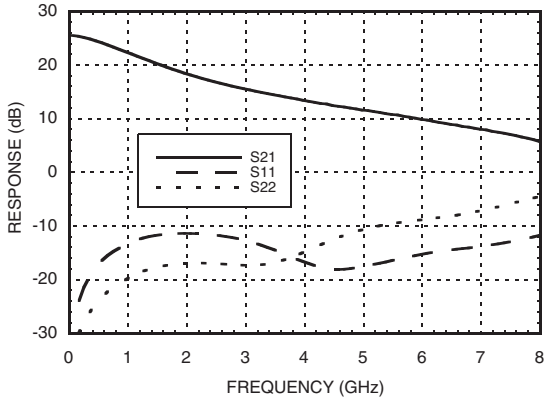
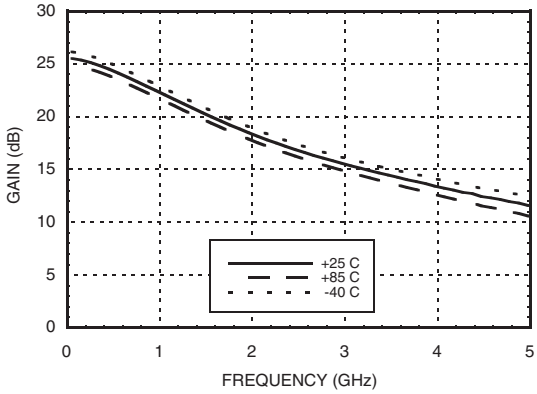
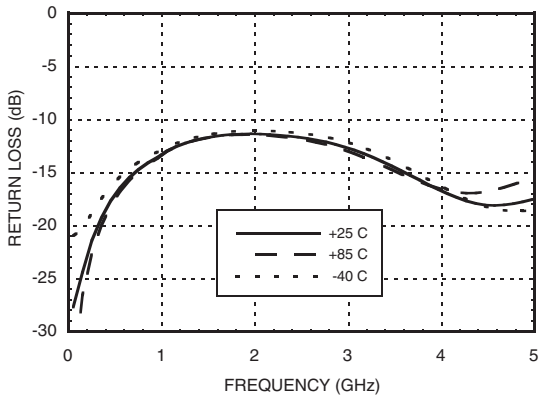
Broadband Gain & Return Loss



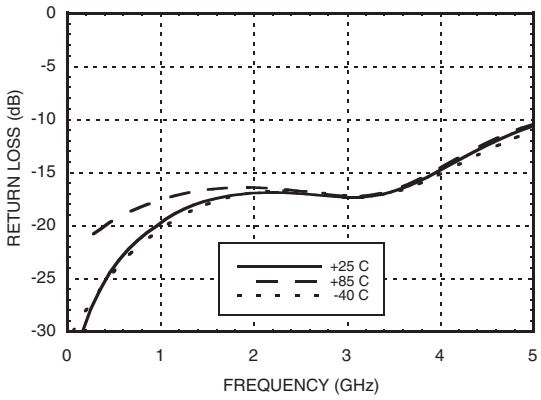
Gain vs. Temperature



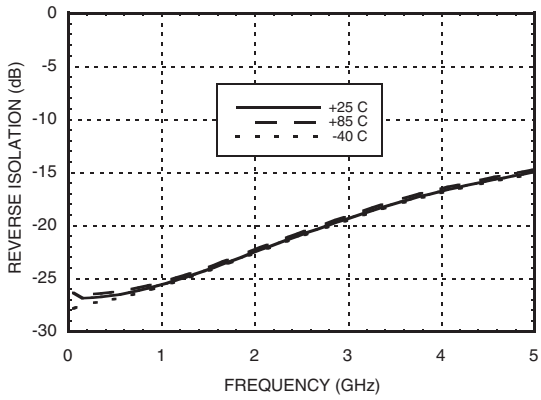
Input Return Loss vs. Temperature



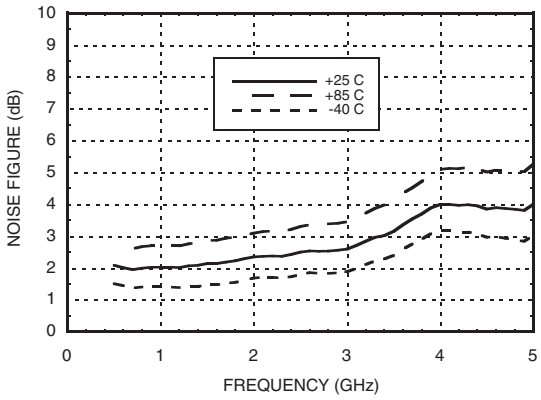
Output Return Loss vs. Temperature



Reverse Isolation vs. Temperature



Noise Figure vs. Temperature



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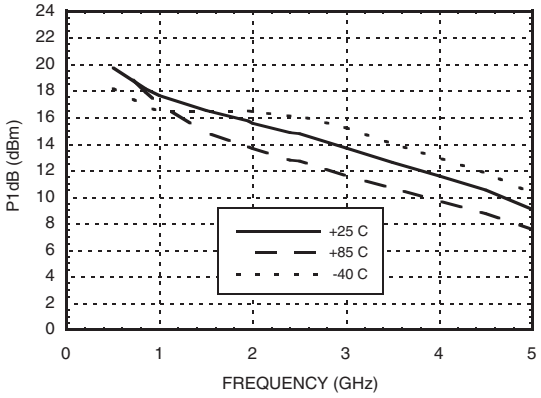
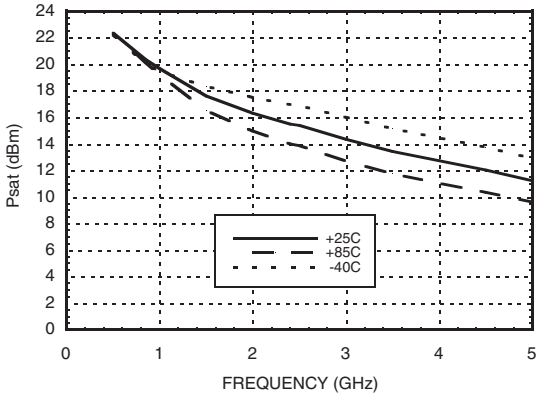
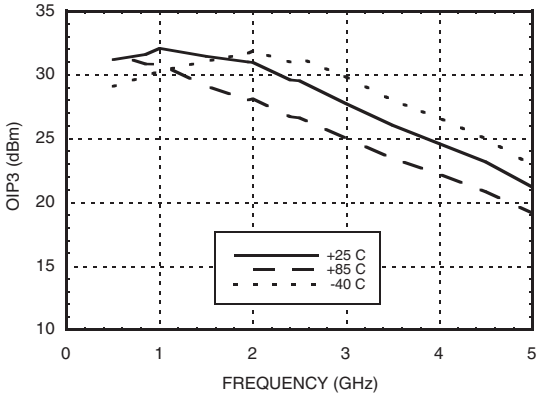
P1dB vs. Temperature



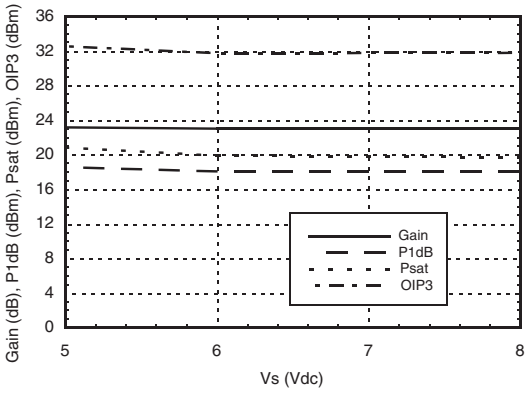
Psat vs. Temperature



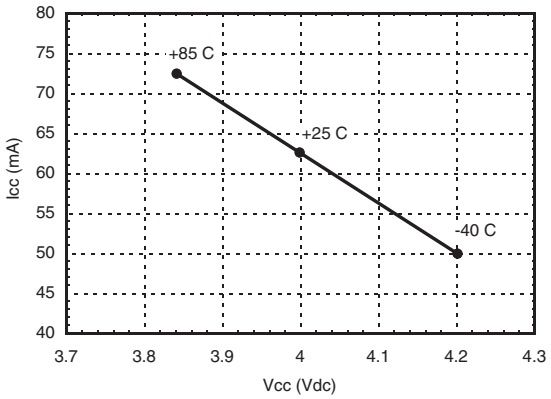
Output IP3 vs. Temperature



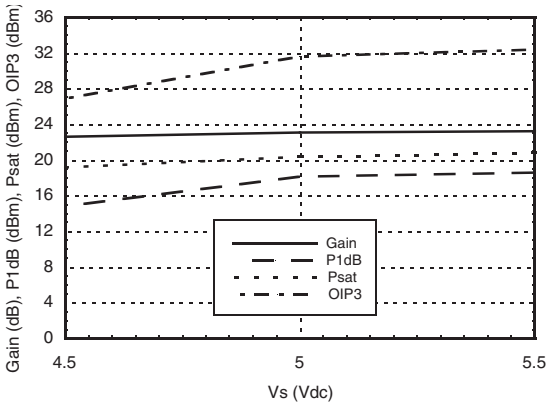
Gain, Power & OIP3 vs. Supply Voltage for Constant Icc= 62 mA @ 850 MHz



Vcc vs. Icc Over Temperature for Fixed Vs= 5V, R_{BIAS}= 18 Ohms



Gain, Power & OIP3 vs. Supply Voltage for Rs = 18 Ohms @ 850 MHz



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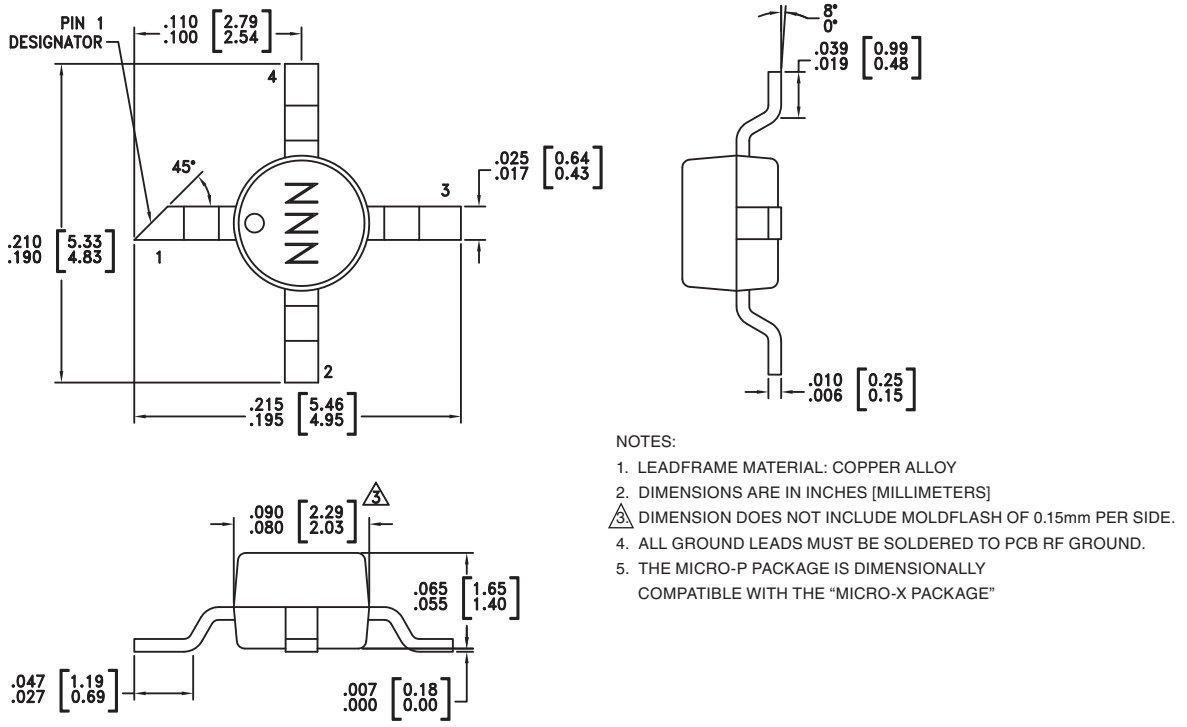
Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+6.0 Vdc
Collector Bias Current (Icc)	100 mA
RF Input Power (RFIN)(Vcc = +4.3 Vdc)	+5 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 9 mW/°C above 85 °C)	0.583 W
Thermal Resistance (junction to lead)	111.5 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1C

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. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.
5. THE MICRO-P PACKAGE IS DIMENSIONALLY COMPATIBLE WITH THE "MICRO-X PACKAGE"

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking
HMC478MP86	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	478
HMC478MP86E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	478

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C

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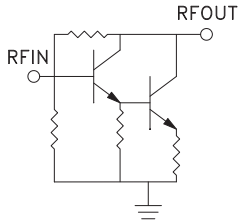
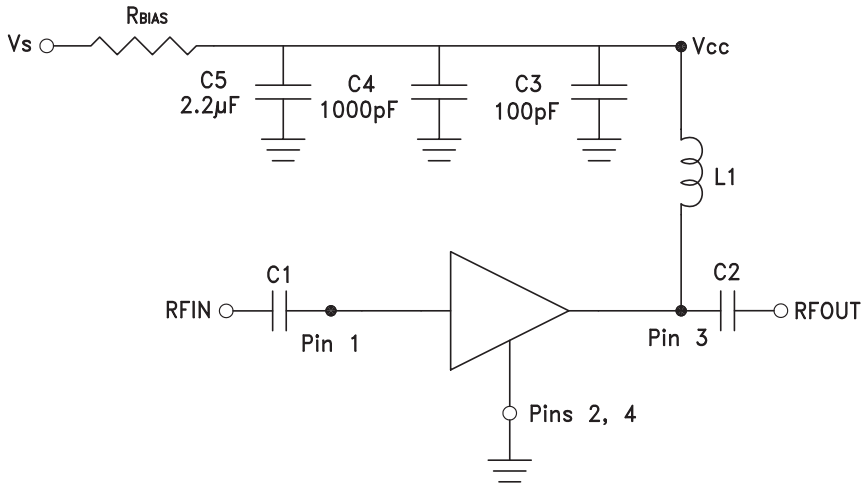
Pin Descriptions

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 must be connected to RF/DC ground.	

Application Circuit



Recommended Bias Resistor Values for Icc= 62 mA, Rbias= (Vs - Vcc) / Icc

Supply Voltage (Vs)	5V	6V	8V
RBIAS VALUE	18 Ω	35 Ω	67 Ω
RBIAS POWER RATING	1/8 W	1/4 W	1/2 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

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

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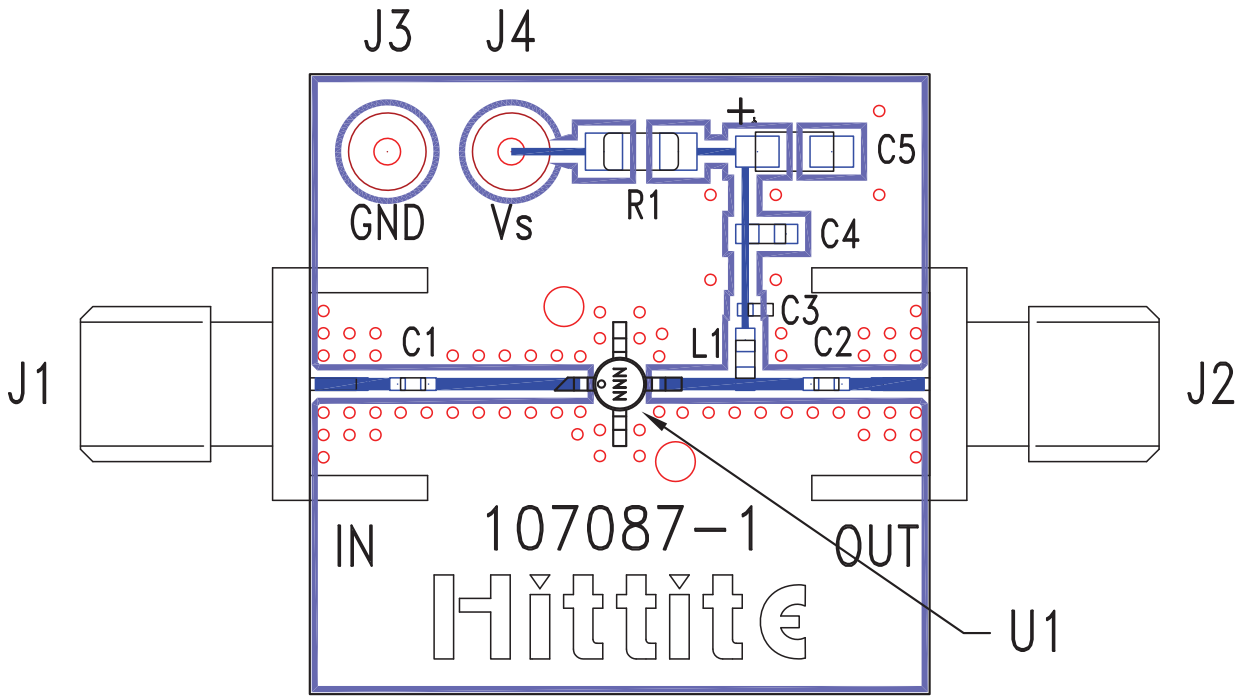
Evaluation PCB



List of Materials for Evaluation PCB 110170 [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, 1210 Pkg.
L1	Inductor, 0603 Pkg.
U1	HMC478MP86 / HMC478MP86E
PCB [2]	107087 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads 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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