



InGaP HBT 1/2 WATT HIGH IP3 AMPLIFIER, 0.4 - 2.5 GHz

Typical Applications

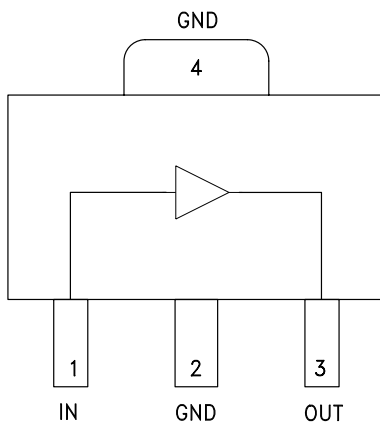
The HMC454ST89 / HMC454ST89E is ideal for applications requiring a high dynamic range amplifier:

- GSM, GPRS & EDGE
- CDMA & W-CDMA
- CATV/Cable Modem
- Fixed Wireless & WLL

Features

- Output IP3: +40 to +42 dBm
- Gain: 12.5 dB @ 2150 MHz
- 50% PAE @ +28 dBm Pout
- +17.5 dBm W-CDMA Channel Power @ -45 dBc ACP
- Single +5V Supply
- Industry Standard SOT89 Package
- Included in the HMC-DK002 Designer's Kit

Functional Diagram



General Description

The HMC454ST89 & HMC454ST89E are high dynamic range GaAs InGaP Heterojunction Bipolar Transistor (HBT) 1/2 watt MMIC amplifiers operating between 0.4 and 2.5 GHz. Packaged in a low cost industry standard SOT89, the amplifier gain is typically 17.8 dB from 0.8 to 1.0 GHz and 12.5 dB from 1.8 to 2.2 GHz. Utilizing a minimum number of external components and a single +5V supply, the amplifier output IP3 can be optimized to +40 dBm at 0.9 GHz or +42 dBm at 2.0 GHz. The high output IP3 and PAE makes the HMC454ST89 an ideal driver amplifier for Cellular/PCS/3G, WLL, ISM and Fixed Wireless applications.

Electrical Specifications, $T_A = +25^\circ\text{C}$, $V_S = +5\text{V}$ [1]

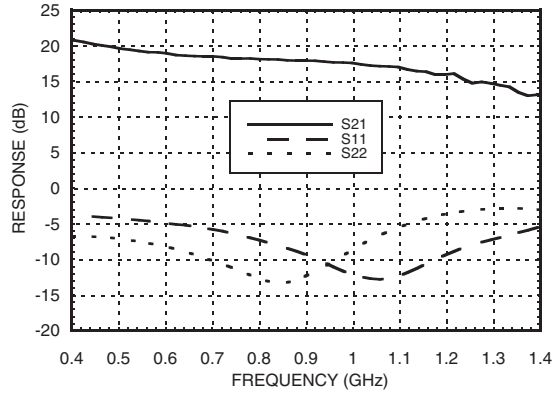
| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|---|-----------|-------|-------|-------------|-------|-------|-------------|-------|-------|---------|
| Frequency Range | 824 - 960 | | | 1800 - 2000 | | | 2000 - 2200 | | | MHz |
| Gain | 16 | 17.8 | | 11 | 12.5 | | 11 | 12.5 | | dB |
| Gain Variation Over Temperature | | 0.008 | 0.016 | | 0.008 | 0.016 | | 0.008 | 0.016 | dB / °C |
| Input Return Loss | | 9 | | | 7 | | | 12 | | dB |
| Output Return Loss | | 13 | | | 21 | | | 19 | | dB |
| Output Power for 1dB Compression (P1dB) | 22 | 24.5 | | 24 | 27 | | 24 | 27.5 | | dBm |
| Saturated Output Power (Psat) | | 25.5 | | | 28.5 | | | 28.5 | | dBm |
| Output Third Order Intercept (IP3) [2] | 37 | 40 | | 38 | 41 | | 38 | 42 | | dBm |
| Noise Figure | | 8 | | | 6.5 | | | 5.2 | | dB |
| Supply Current (Icq) | | 150 | 175 | | 150 | 175 | | 150 | 175 | mA |

[1] Specifications and data reflect HMC454ST89 measured using the respective application circuits for each designated frequency band found herein. Contact the HMC Applications Group for assistance in optimizing performance for your application.

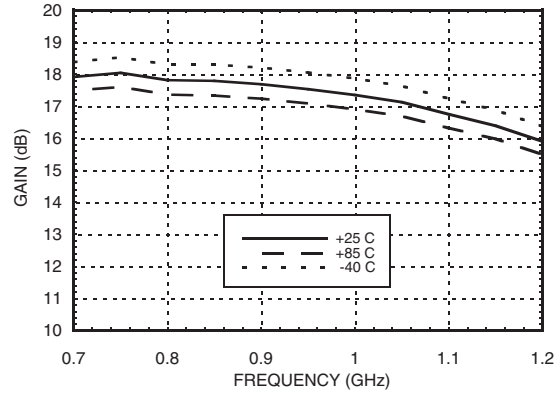
[2] Two-tone input power of 0 dBm per tone, 1 MHz spacing.



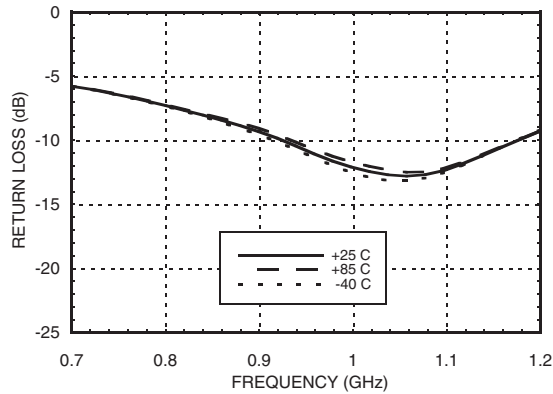
**Broadband Gain
& Return Loss @ 900 MHz**



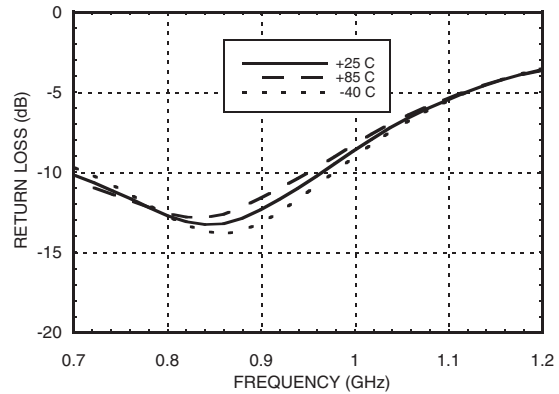
Gain vs. Temperature @ 900 MHz



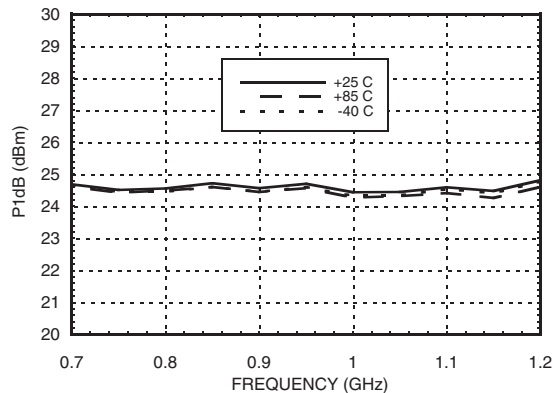
**Input Return Loss
vs. Temperature @ 900 MHz**



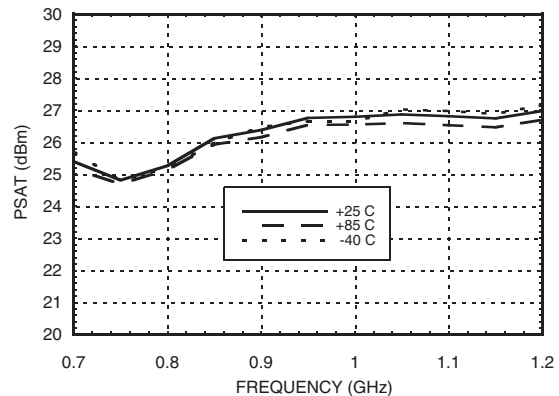
**Output Return Loss
vs. Temperature @ 900 MHz**



P1dB vs. Temperature @ 900 MHz



Psat vs. Temperature @ 900 MHz



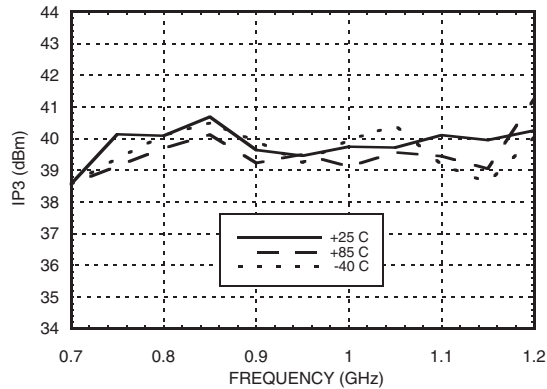
Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at www.analog.com Application Support: Phone: 1-800-ANALOG-D

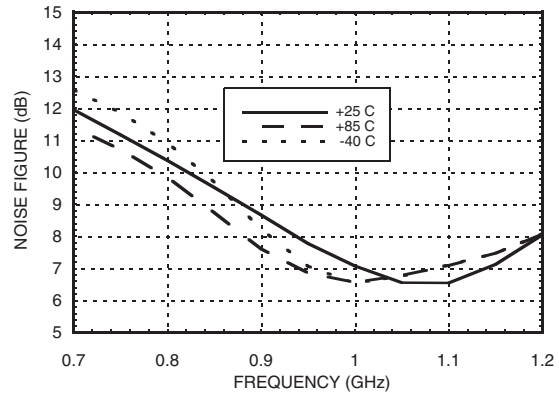
**InGaP HBT 1/2 WATT HIGH IP3
AMPLIFIER, 0.4 - 2.5 GHz**



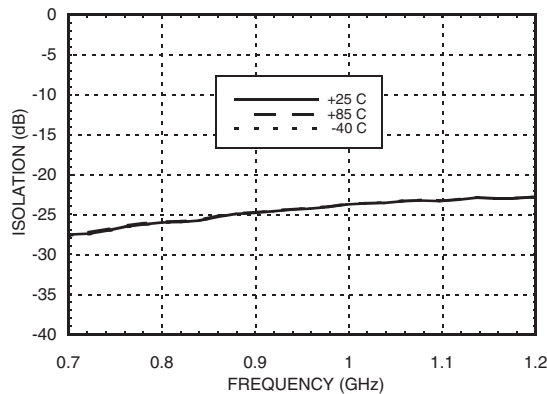
Output IP3 vs. Temperature @ 900 MHz



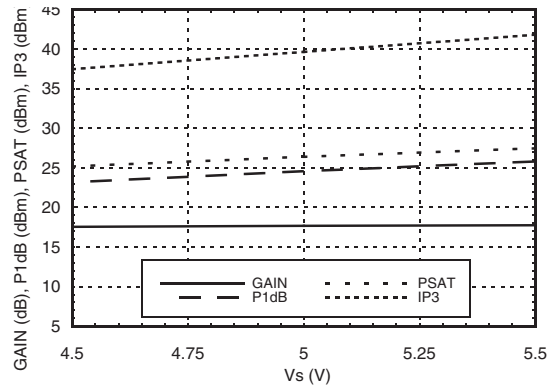
Noise Figure vs. Temperature @ 900 MHz



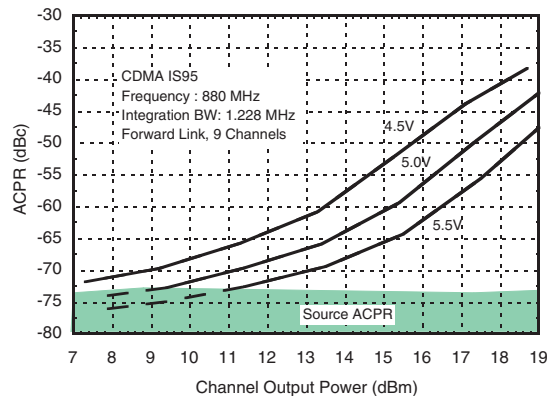
Reverse Isolation vs. Temperature @ 900 MHz



Gain, Power & Output IP3 vs. Supply Voltage @ 900 MHz

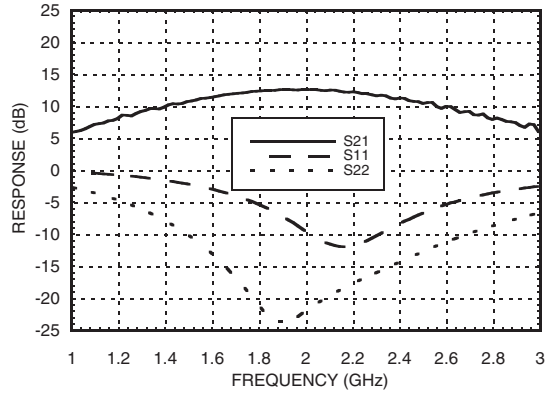


**ACPR vs. Supply Voltage @ 880 MHz
CDMA IS95, 9 Channels Forward**

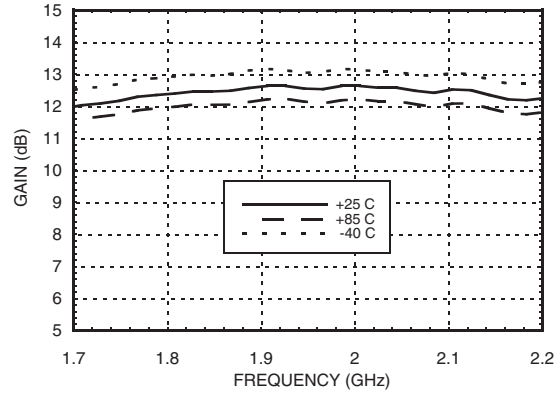




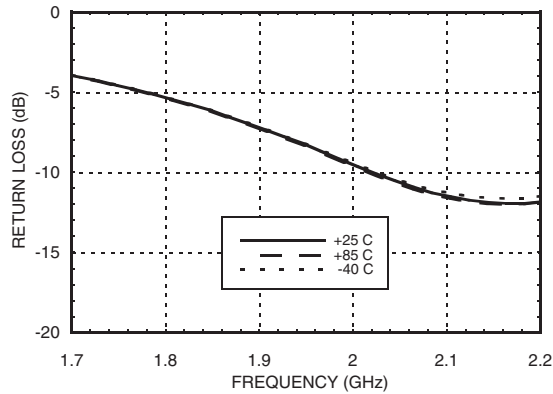
**Broadband Gain
& Return Loss @ 1960 MHz**



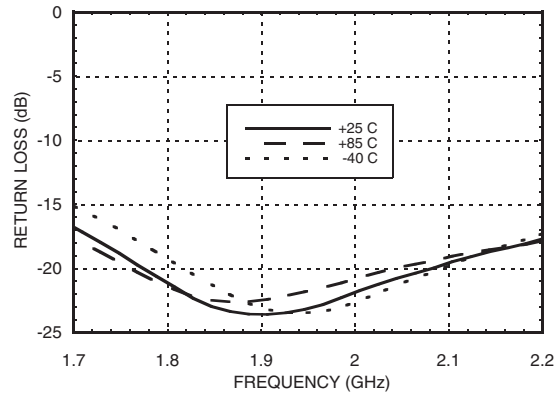
Gain vs. Temperature @ 1960 MHz



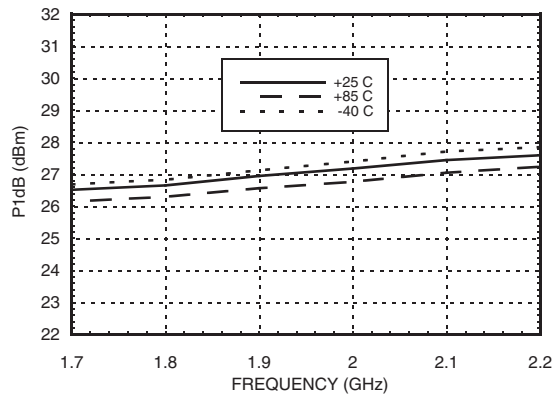
**Input Return Loss
vs. Temperature @ 1960 MHz**



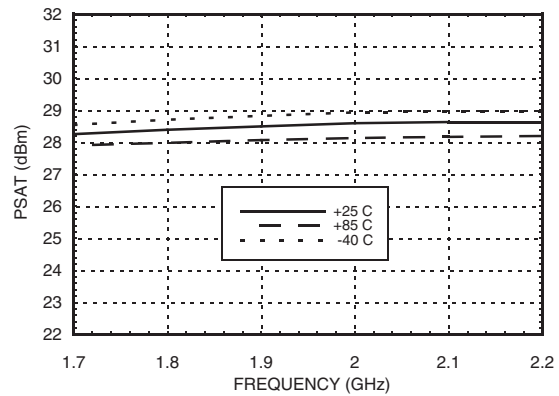
**Output Return Loss
vs. Temperature @ 1960 MHz**



P1dB vs. Temperature @ 1960 MHz



Psat vs. Temperature @ 1960 MHz

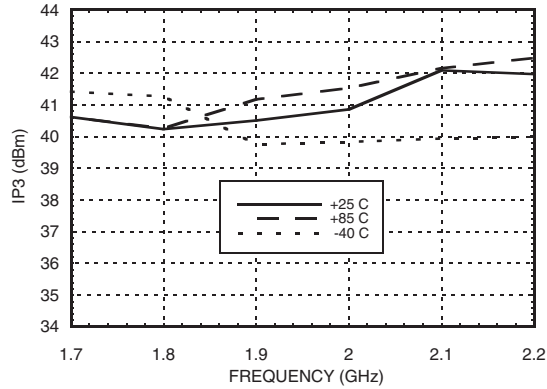


Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

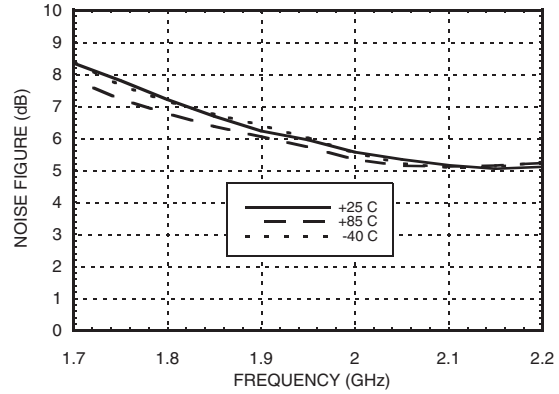
For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at www.analog.com Application Support: Phone: 1-800-ANALOG-D



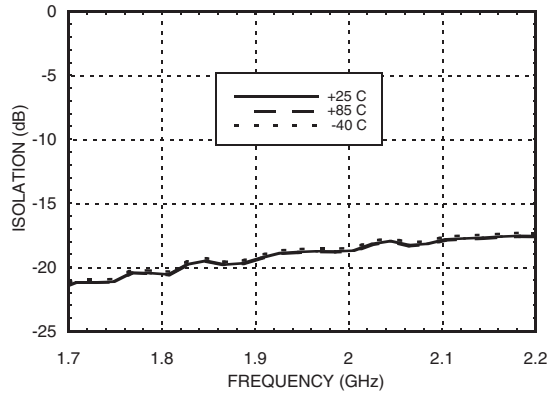
Output IP3 vs. Temperature @ 1960 MHz



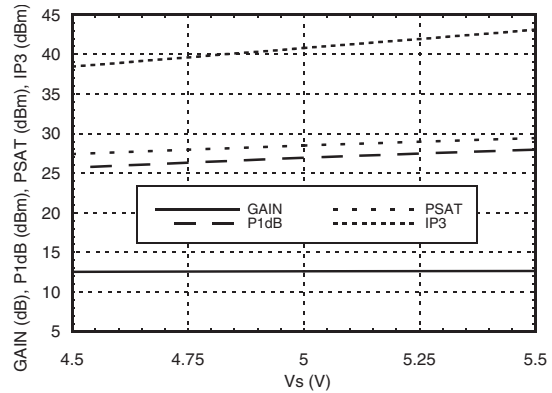
Noise Figure vs. Temperature @ 1960 MHz



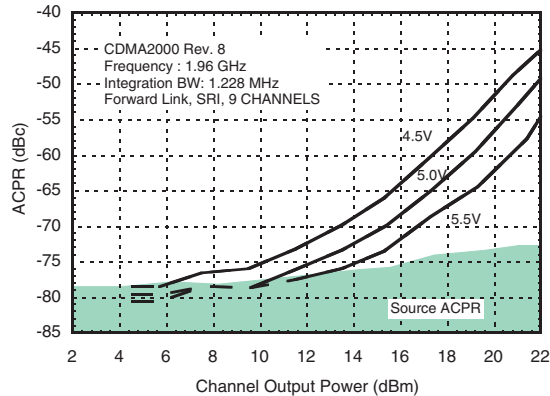
Reverse Isolation vs. Temperature @ 1960 MHz



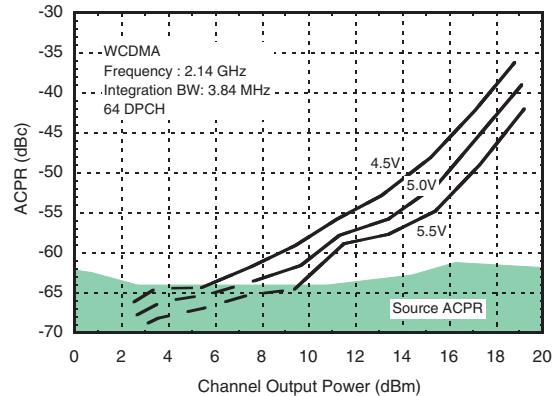
Gain, Power & Output IP3 vs. Supply Voltage @ 1960 MHz



**ACPR vs. Supply Voltage @ 1.96 GHz
CDMA 2000, 9 Channels Forward**



**ACPR vs. Supply Voltage @ 2.14 GHz
W-CDMA, 64 DPCH**





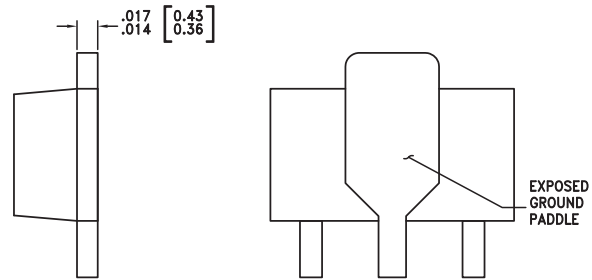
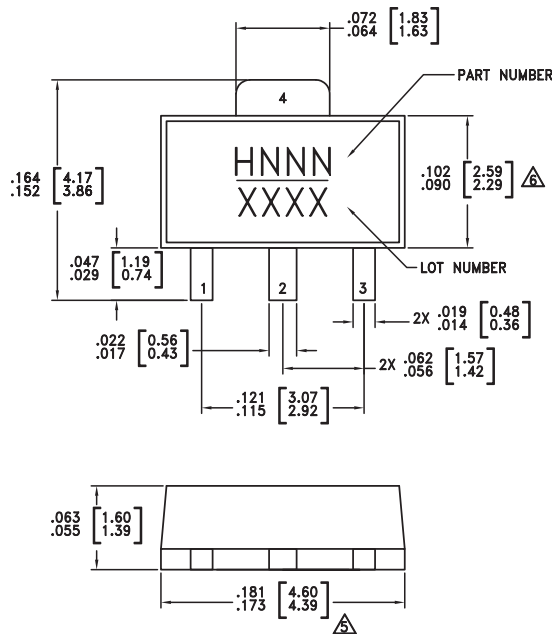
Absolute Maximum Ratings

| | |
|---|----------------|
| Collector Bias Voltage (Vcc) | +6.0 Vdc |
| RF Input Power (RFIN)(Vs = +5Vdc) | +25 dBm |
| Junction Temperature | 150 °C |
| Continuous P _{diss} (T = 85 °C) (derate 13.6 mW/°C above 85 °C) | 0.890 W |
| Thermal Resistance (junction to ground paddle) | 73 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

- LEADFRAME MATERIAL: COPPER ALLOY
- DIMENSIONS ARE IN INCHES [MILLIMETERS].
- DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
- DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
- ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC454ST89 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | H454 XXXX |
| HMC454ST89E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | H454 XXXX |

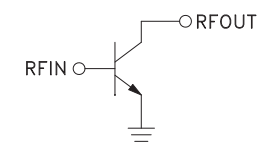

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

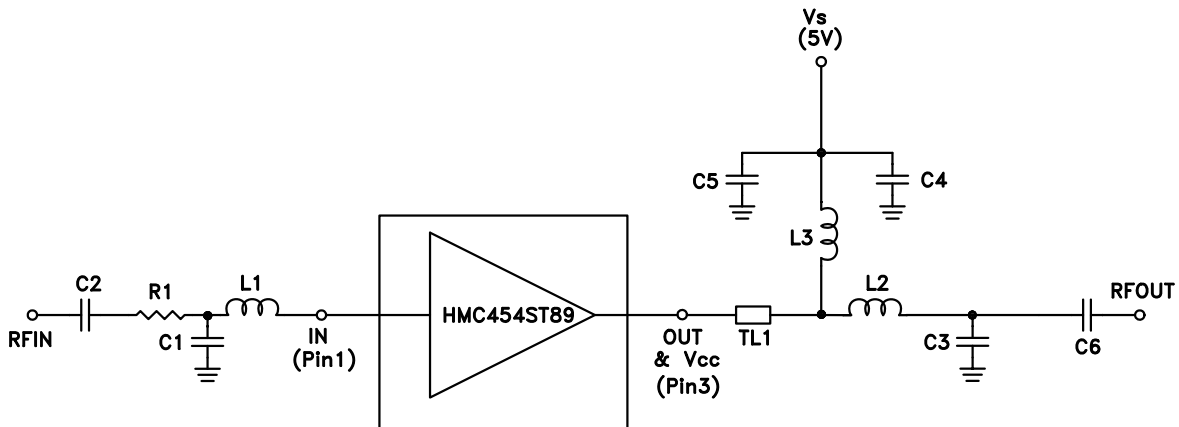


Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|------------|----------|--|---|
| 1 | RFIN | This pin is AC coupled. Off chip matching components are required. See Application Circuit herein. |  |
| 3 | RFOUT | RF output and DC Bias input for the output amplifier stage. Off chip matching components are required. See Application Circuit herein. | |
| 2,4 | GND | These pins & package bottom must be connected to RF/DC ground. |  |

900 MHz Application Circuit, Compact Layout

This circuit was used to specify the performance for 894-960 MHz operation. This circuit will satisfy many applications from 700 to 1200 MHz. Contact the HMC Applications Group for assistance in optimizing performance for your application.



| | TL1 |
|--|--------|
| Impedance | 50 Ohm |
| Physical Length | 0.050" |
| Electrical Length | 2.5° |
| PCB Material: 10 mil Rogers 4350, Er = 3.48 | |

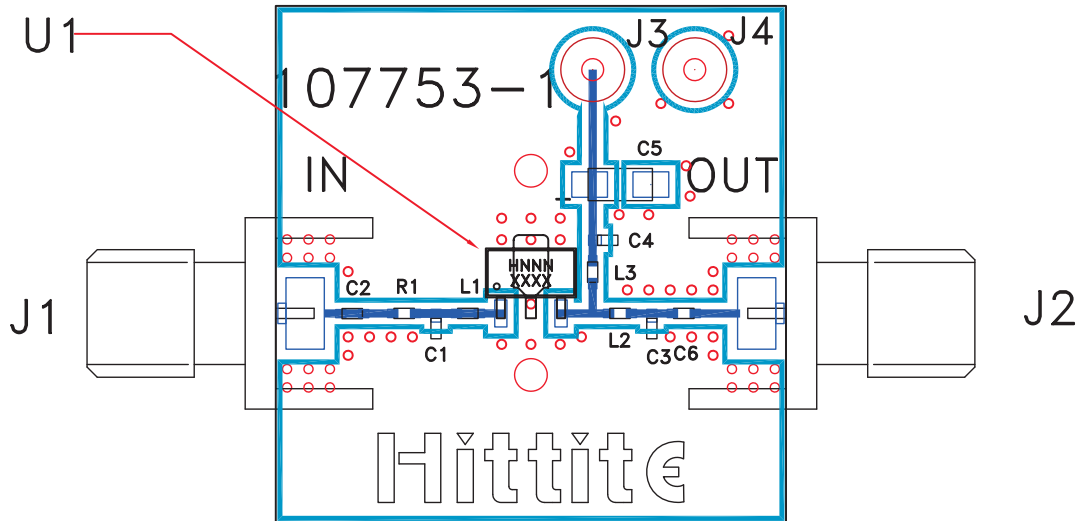
| Recommended Component Values | |
|------------------------------|----------|
| L1, L2 | 1 nH |
| L3 | 36 nH |
| R1 | 5.1 Ohms |
| C1 | 8 pF |
| C2 | 22 pF |
| C3 | 2.7 pF |
| C4, C6 | 100 pF |
| C5 | 2.2 μF |

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D



900 MHz Evaluation PCB



List of Materials for Evaluation PCB 107755 [1]

| Item | Description |
|---------|--|
| J1 - J2 | PCB Mount SMA Connector |
| J3 -J4 | DC Pins |
| C1 | 8 pF Capacitor, 0402 Pkg. |
| C2 | 22 pF Capacitor, 0402 Pkg. |
| C3 | 2.7 pF Capacitor, 0402 Pkg. |
| C4, C6 | 100 pF Capacitor, 0402 Pkg. |
| C5 | 2.2 μF Capacitor, Tantalum |
| L1, L2 | 1 nH Inductor, 0402 Pkg. |
| L3 | 36 nH Inductor, 0402 Pkg. |
| R1 | 5.1 Ohms |
| U1 | HMC454ST89 / HMC454ST89E Linear Amp |
| PCB [2] | 107753 Evaluation PCB, 10 mils |

The circuit board used in this 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.

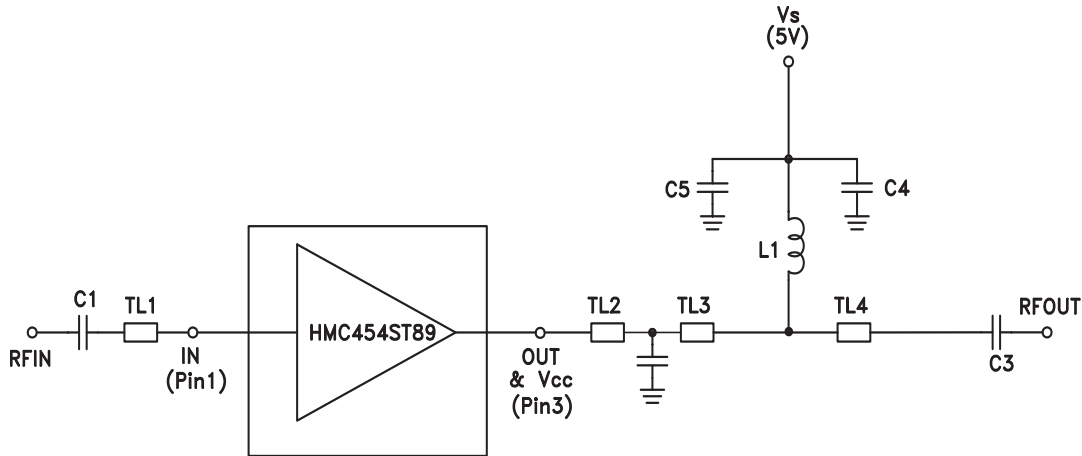
[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350, Er = 3.48



1960 & 2140 MHz Application Circuit

This circuit was used to specify the performance for 1800-2000 and 2000-2200 MHz operation. This circuit will satisfy many applications from 1700 to 2500 MHz. Contact the HMC Applications Group for assistance in optimizing performance for your application.

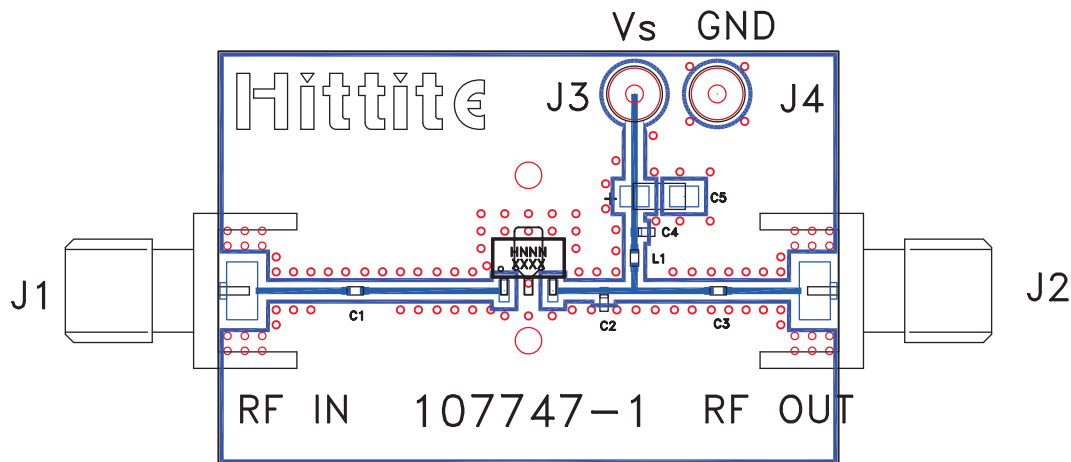


| | TL1 | TL2 | T3 | TL4 |
|---|--------|--------|--------|--------|
| Impedance | 50 Ohm | 50 Ohm | 50 Ohm | 50 Ohm |
| Physical Length | 0.32" | 0.10" | 0.07" | 0.17" |
| Electrical Length | 34° | 11° | 8° | 18.5° |
| PCB Material: 10 mil Rogers 4350, Er = 3.48 | | | | |

| Recommended Component Values | |
|------------------------------|--------|
| L1 | 8.2 nH |
| C1 | 1 pF |
| C2 | 1.2 pF |
| C3 | 3 pF |
| C4 | 100 pF |
| C5 | 2.2 μF |



1960 & 2140 MHz Evaluation PCB



List of Materials for Evaluation PCB 107749 [1]

| Item | Description |
|---------|--------------------------------|
| J1 - J2 | PCB Mount SMA Connector |
| J3 - J4 | DC Pins |
| C1 | 1.0 pF Capacitor, 0402 Pkg. |
| C2 | 1.2 pF Capacitor, 0402 Pkg. |
| C3 | 3.0 pF Capacitor, 0402 Pkg. |
| C4 | 100 pF Capacitor, 0402 Pkg. |
| C5 | 2.2 μF Capacitor, Tantalum |
| L1 | 8.2 nH Inductor, 0402 Pkg. |
| U1 | HMC454ST89 / HMC454ST89E |
| PCB [2] | 107747 Evaluation PCB, 10 mils |

[1] Reference this number when ordering complete evaluation PCB

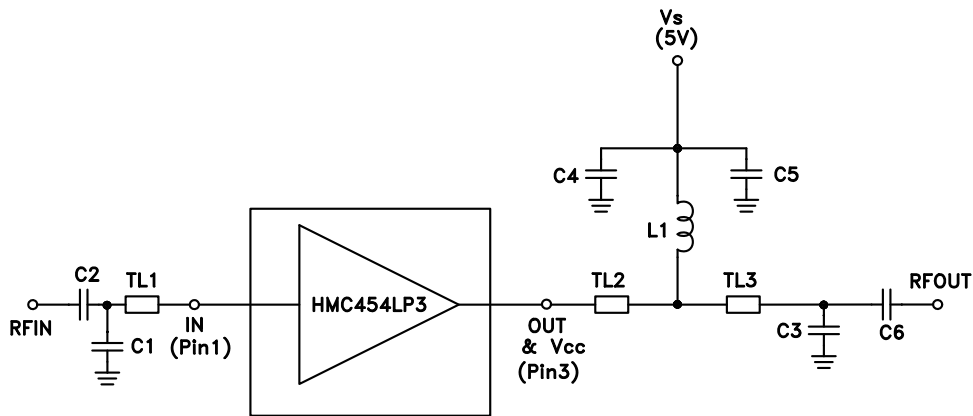
[2] Circuit Board Material: Rogers 4350, Er = 3.48

The circuit board used in this 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.



Alternative 900 MHz Application Circuit, Optimal OIP3 Layout

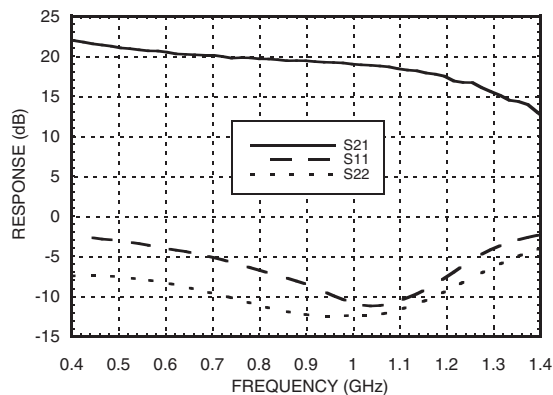
This alternate application circuit for 900 MHz applications features a resonating I/O structure on the PCB that, while using more PCB area, will improve output IP3 from +40 dBm to +42 dBm. This circuit will satisfy many applications from 700 to 1200 MHz as the typical performance below demonstrates. Contact the HMC Applications Group for assistance in optimizing performance for your application.



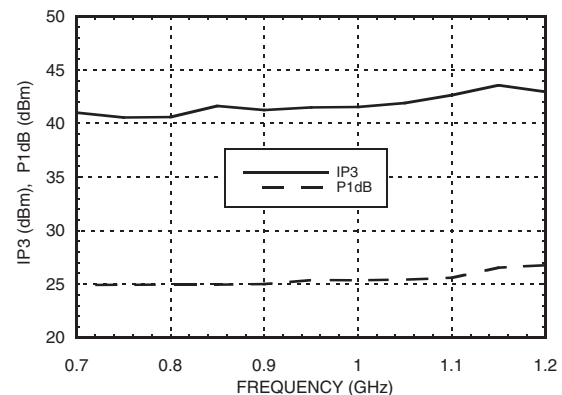
| | TL1 | TL2 | TL3 |
|---|--------|--------|--------|
| Impedance | 50 Ohm | 50 Ohm | 50 Ohm |
| Physical Length | 0.35" | 0.05" | 0.53" |
| Electrical Length | 18° | 2.5° | 27° |
| PCB Material: 10 mil Rogers 4350, Er = 3.48 | | | |

| Recommended Component Values | |
|------------------------------|--------|
| L1 | 18 nH |
| C1 | 4 pF |
| C2, C6 | 10 pF |
| C3 | 3 pF |
| C4 | 100 pF |
| C5 | 2.2 μF |

Broadband Gain & Return Loss



Output IP3 & P1dB

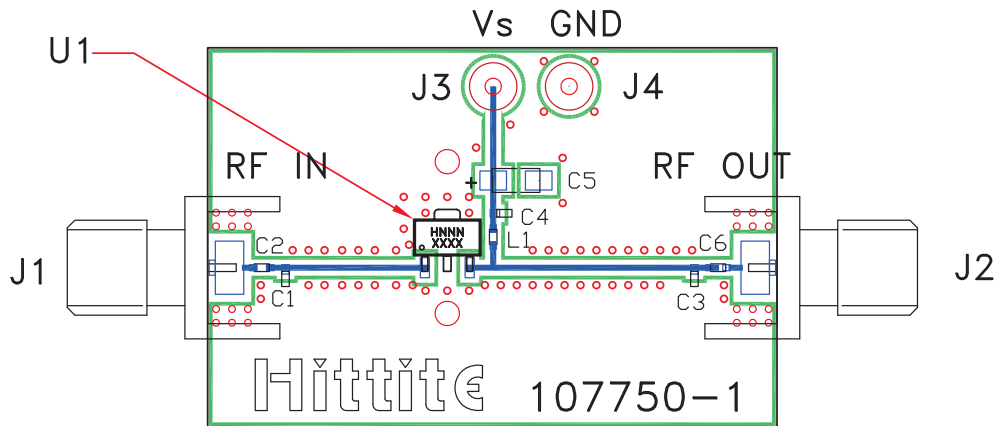


Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at www.analog.com Application Support: Phone: 1-800-ANALOG-D



Alternate 900 MHz Evaluation PCB



List of Materials

| Item | Description |
|---------|--------------------------------|
| J1 - J2 | PCB Mount SMA Connector |
| J3 - J4 | DC Pins |
| C1 | 4 pF Capacitor, 0402 Pkg. |
| C2, C6 | 10 pF Capacitor, 0402 Pkg. |
| C3 | 3.0 pF Capacitor, 0402 Pkg. |
| C4 | 100 pF Capacitor, 0402 Pkg. |
| L1 | 18 nH Inductor, 0402 Pkg. |
| U1 | HMC454ST89 / HMC454ST89E |
| PCB* | 107750 Evaluation PCB, 10 mils |

* Circuit Board Material: Rogers 4350, Er = 3.48

The circuit board used in this 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.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.