# HMC476SC70 / 476SC70E

v04.0814

## SIGE HBT GAIN BLOCK MMIC AMPLIFIER, DC - 6 GHz

### Typical Applications

The HMC476SC70(E) is ideal for:

- Cellular / PCS / 3G
- WiBro / WiMAX / 4G
- Fixed Wireless & WLAN
- CATV, Cable Modem & DBS
- Microwave Radio & Test Equipment

### Features

P1dB Output Power: +12 dBm

Gain: 20 dB

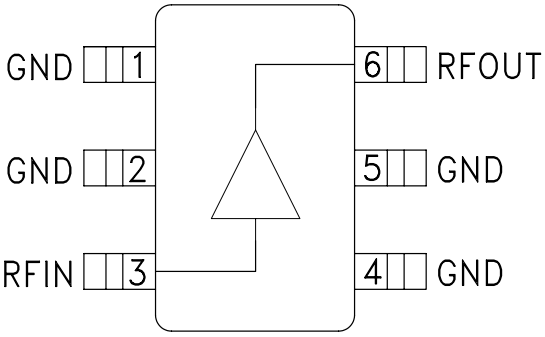
Output IP3: +24 dBm

Cascadable 50 Ohm I/Os

Single Supply: +5V to +12V

Industry Standard SC70 Package

### Functional Diagram




### General Description

The HMC476SC70(E) is a SiGe Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT amplifiers covering DC to 6 GHz. This industry standard SC70 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 +12 dBm output power. The HMC476SC70(E) offers 20 dB of gain with a +24 dBm output IP3 at 850 MHz while requiring only 35 mA from a single positive supply. The Darlington topology 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= 56 Ohm, $T_A$ = +25° C

| Parameter | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Gain | DC - 2.0 GHz<br>2.0 - 4.0 GHz<br>4.0 - 6.0 GHz | 16<br>13<br>9 | 19<br>16<br>12 | | dB<br>dB<br>dB |
| Gain Variation Over Temperature | DC - 6 GHz | | 0.008 | 0.012 | dB/ °C |
| Input Return Loss | DC - 4 GHz<br>4.0 - 6.0 GHz | | 20<br>15 | | dB<br>dB |
| Output Return Loss | DC - 4 GHz<br>4.0 - 6.0 GHz | | 20<br>13 | | dB<br>dB |
| Reverse Isolation | DC - 6 GHz | | 18 | | dB |
| Output Power for 1 dB Compression (P1dB) | 0.5 - 4.0 GHz<br>4.0 - 6.0 GHz | 9.0<br>8.0 | 12.0<br>11.0 | | dBm<br>dBm |
| Output Third Order Intercept (IP3)<br>(Pout= 0 dBm per tone, 1 MHz spacing) | 0.5 - 4.0 GHz<br>4.0 - 6.0 GHz | | 24<br>22 | | dBm<br>dBm |
| Noise Figure | 0.5 - 4.0 GHz<br>4.0 - 6.0 GHz | | 2.5<br>3.0 | | dB<br>dB |
| Supply Current (Icq) | | | 35 | 42 | mA |



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*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

# HMC476SC70* PRODUCT PAGE QUICK LINKS

**Last Content Update: 02/23/2017**

## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- HMC476SC70 Evaluation Board

## TOOLS AND SIMULATIONS

- HMC476SC70 S-Parameters

## REFERENCE MATERIALS

**Quality Documentation**

- Package/Assembly Qualification Test Report: 6 Lead Plastic SC70 Package (QTR: 08002 REV: 01)
- Package/Assembly Qualification Test Report: Plastic Encapsulated 4-LEAD MICRO-P (QTR: 05007 REV: 01)
- Semiconductor Qualification Test Report: SiGe HBT-A (QTR: 2013-00227)

## DESIGN RESOURCES

- HMC476SC70 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all HMC476SC70 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

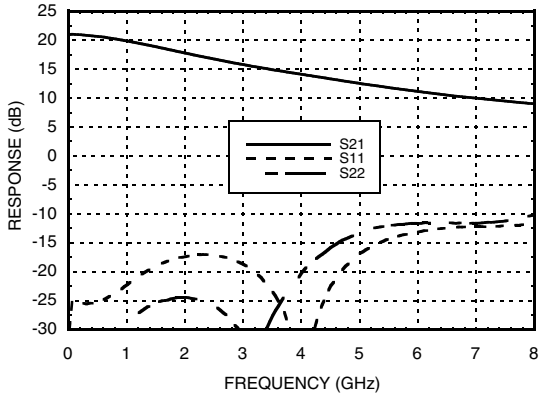
## TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

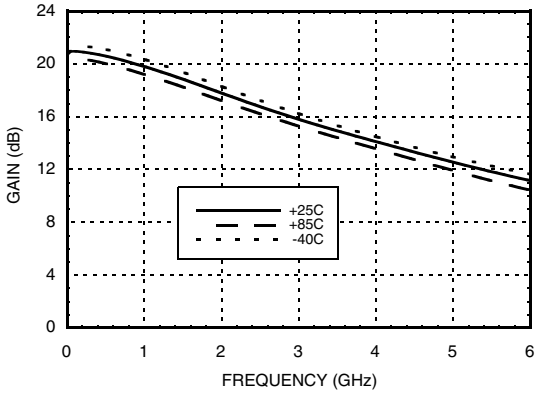
## DOCUMENT FEEDBACK

Submit feedback for this data sheet.

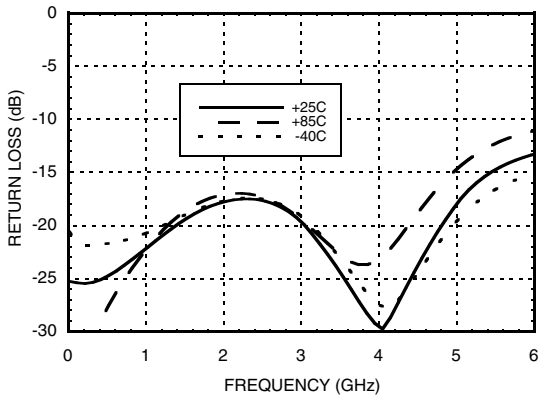
### Broadband Gain & Return Loss



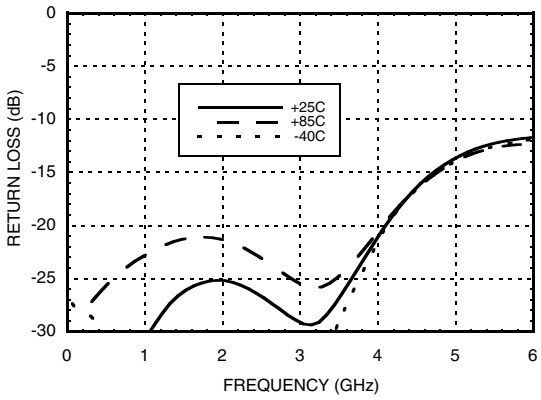

### Gain vs. Temperature



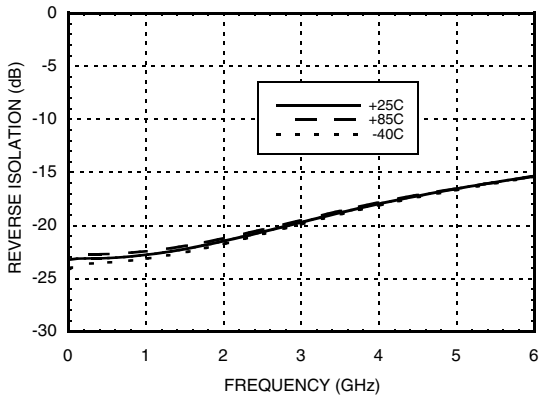

### Input Return Loss vs. Temperature



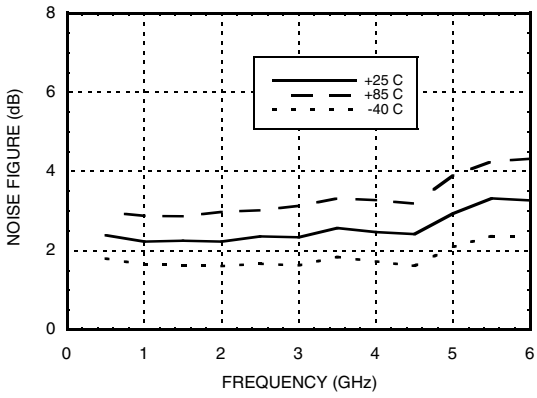

### Output Return Loss vs. Temperature




### Reverse Isolation vs. Temperature




### Noise Figure vs. Temperature



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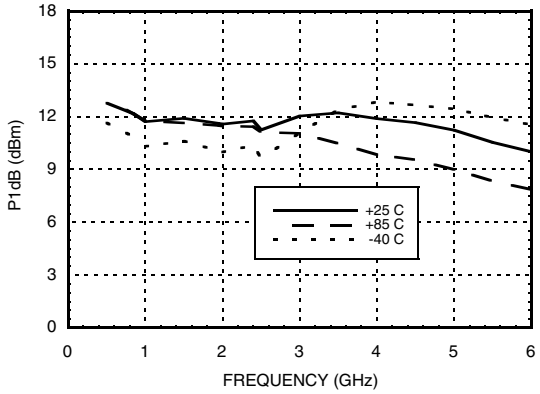
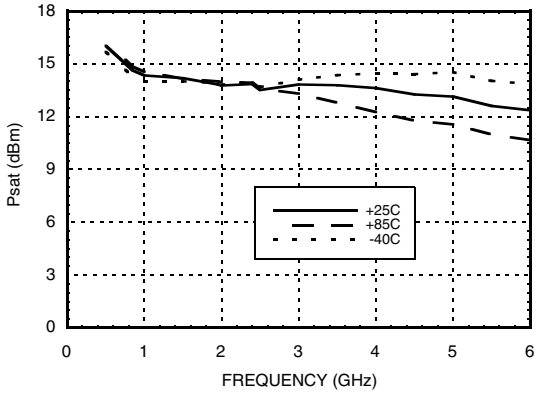
## SIGE HBT GAIN BLOCK MMIC AMPLIFIER, DC - 6 GHz

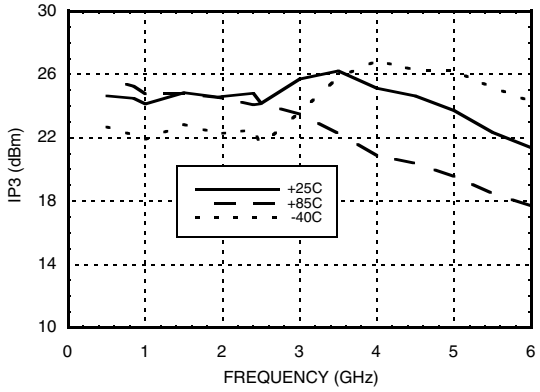
### P1dB vs. Temperature



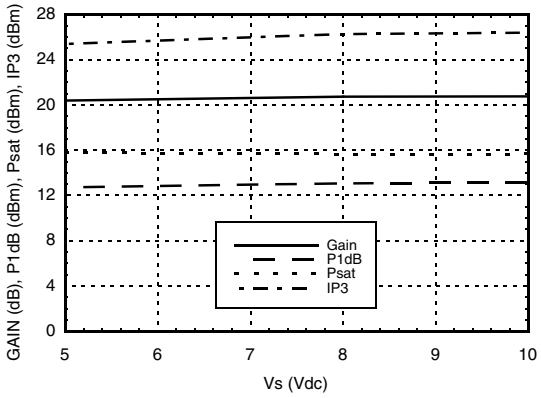

### Psat vs. Temperature



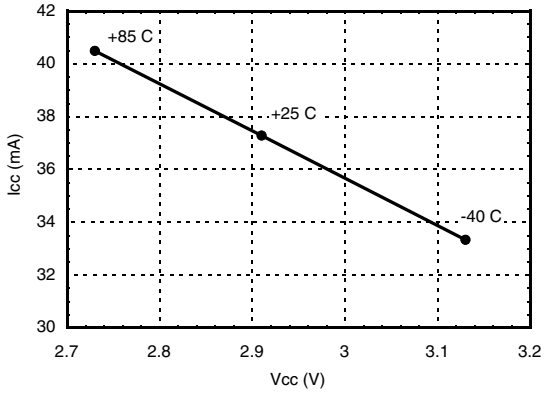

### Output IP3 vs. Temperature




### Gain, Power & OIP3 vs. Supply Voltage for Constant Icc = 35 mA @ 850 MHz




### Icc vs. Vcc Over Temperature for Fixed Vs = 5V, $R_{BIAS}$ = 56 Ohms



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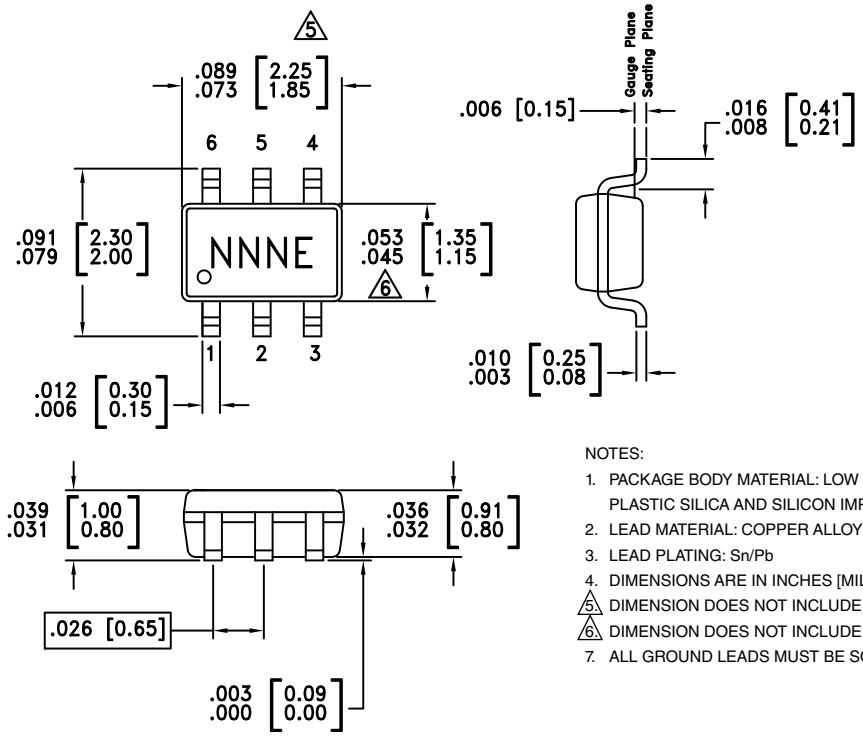
## Absolute Maximum Ratings

| | |
|---|---|
| Collector Bias Voltage (Vcc) | +6V |
| Collector Bias Current (Icc) | 45 mA |
| RF Input Power (RFIN)(Vcc = +2.4V) | +5 dBm |
| Junction Temperature | 150 °C |
| Continuous Pdiss (T = 85 °C) (derate 7.75 mW/°C above 85 °C) | 0.504 W |
| Thermal Resistance (junction to lead) | 129 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |
| ESD Sensitivity (HBM) | Class 1A |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

## Outline Drawing




NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD MATERIAL: COPPER ALLOY
3. LEAD PLATING: Sn/Pb
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 |
|---|---|---|---|---|
| HMC476SC70 | Low Stress Injection Molded Plastic | Sn/Pb | MSL1 [1] | 476E |
| HMC476SC70E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | 476E |

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



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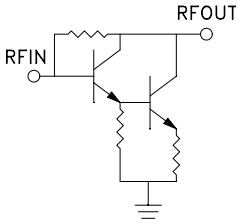
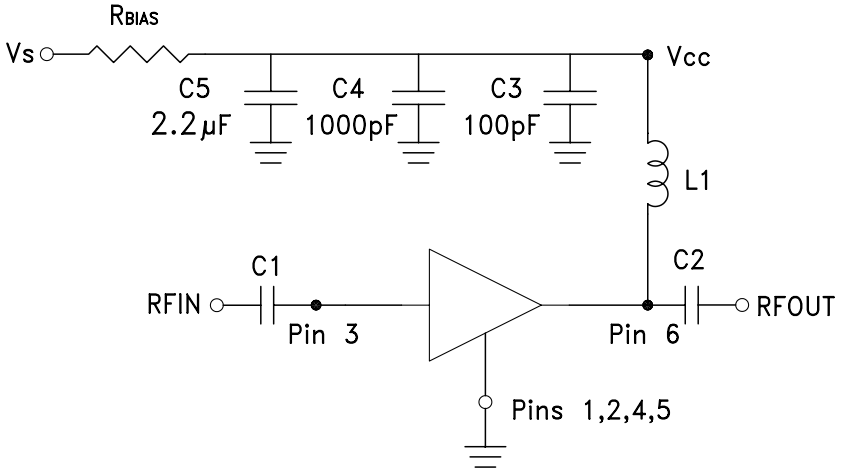
## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 2, 4, 5 | GND | These pins must be connected to RF/DC ground. |   |
| 3 | RFIN | This pin is DC coupled.<br>An off chip DC blocking capacitor is required. |   |
| 6 | RFOUT | RF output and DC Bias (Vcc) for the output stage. | |

## Application Circuit




## Recommended Bias Resistor Values for Icc= 35 mA, Rbias= (Vs - Vcc) / Icc

| Supply Voltage (Vs) | 5V | 8V | 10V | 12V |
|---|---|---|---|---|
| RBIAS VALUE | 56 Ω | 130 Ω | 180 Ω | 240 Ω |
| RBIAS POWER RATING | 1/8 W | 1/4 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 | 5200 | 5800 |
| L1 | 270 nH | 56 nH | 18 nH | 18 nH | 15 nH | 8.2 nH | 6.8 nH | 3.3 nH |
| C1, C2 | 0.01 µF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF |



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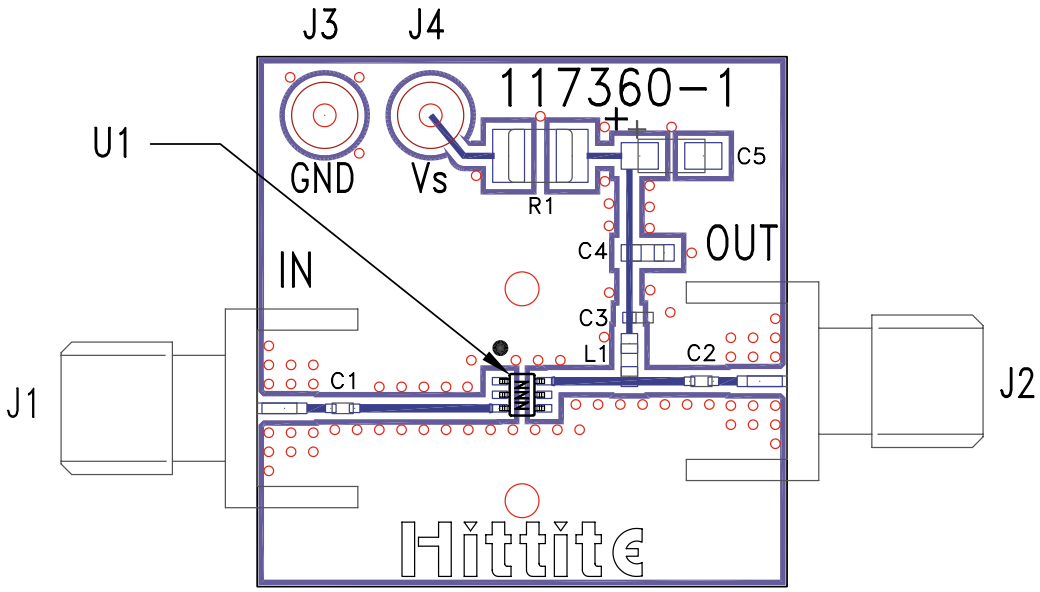
## Evaluation PCB




## List of Materials for Evaluation PCB 118038 [1]

| Item | Description |
|---|---|
| J1 - J2 | PCB Mount SMA Connector |
| J3 - J4 | DC Pin |
| C1 - C3 | 100 pF Capacitor, 0402 Pkg. |
| C4 | 1000 pF Capacitor, 0603 Pkg. |
| C5 | 2.2 µF Capacitor, Tantalum |
| R1 | 50 Ohm Resistor, 1210 Pkg. |
| L1 | 18 nH Inductor, 0603 Pkg. |
| U1 | HMC476SC70(E) |
| PCB [2] | 117360 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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