

Typical Applications

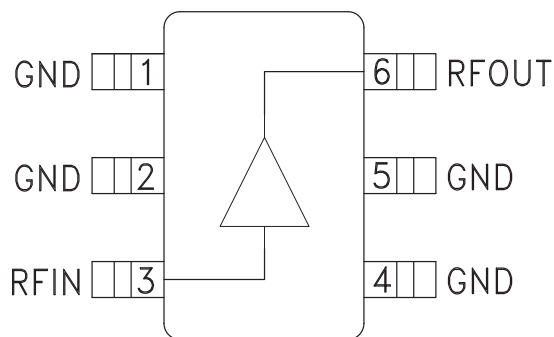
The HMC311SC70(E) is ideal for:

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

Features

- P1dB Output Power: +15 dBm
- Output IP3: +30 dBm
- Gain: 15 dB
- Cascadable, 50 Ohm I/O's
- Single Supply: +5V
- Industry Standard SC70 Package

Functional Diagram



General Description

The HMC311SC70(E) is a GaAs InGaP Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT DC to 8 GHz amplifier. Packaged in an industry standard SC70, the amplifier can be used as either a cascadable 50 Ohm gain stage or to drive the LO port of HMC mixers with up to +15 dBm output power. The HMC311SC70(E) offers 15 dB of gain and an output IP3 of +30 dBm while requiring only 54 mA from a +5V supply. The Darlington topology results in reduced sensitivity to normal process variations, and yields excellent gain stability over temperature while requiring a minimal number of external bias components.

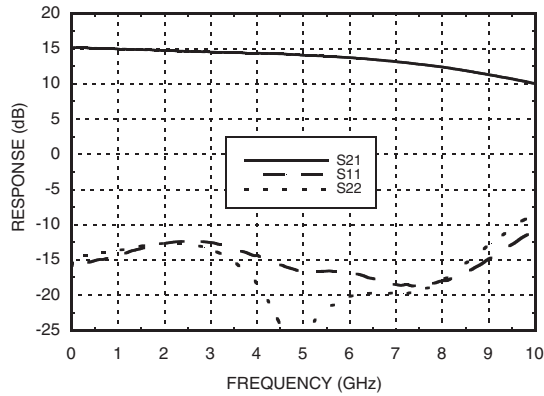
Electrical Specifications, $V_s = 5V$, $R_{bias} = 22 \text{ Ohm}$, $T_A = +25^\circ \text{ C}$

| Parameter | | Min. | Typ. | Max. | Units |
|--|---------------|------|-------|-------|--------|
| Gain | DC - 1.0 GHz | 14.0 | 15.0 | | dB |
| | 1.0 - 4.0 GHz | 13.0 | 15.0 | | dB |
| | 4.0 - 6.0 GHz | 12.5 | 14.5 | | dB |
| | 6.0 - 8.0 GHz | 11.0 | 13.0 | | dB |
| Gain Variation Over Temperature | DC - 1.0 GHz | | 0.004 | 0.007 | dB/ °C |
| | 1.0 - 4.0 GHz | | 0.007 | 0.012 | dB/ °C |
| | 4.0 - 6.0 GHz | | 0.012 | 0.016 | dB/ °C |
| | 6.0 - 8.0 GHz | | 0.018 | 0.022 | dB/ °C |
| Return Loss Input / Output | DC - 8.0 GHz | | 15 | | dB |
| Reverse Isolation | DC - 8.0 GHz | | 18 | | dB |
| Output Power for 1 dB Compression (P1dB) | DC - 2.0 GHz | 13.5 | 15.5 | | dBm |
| | 2.0 - 4.0 GHz | 12.0 | 15.0 | | dBm |
| | 4.0 - 6.0 GHz | 10.0 | 13.0 | | dBm |
| | 6.0 - 8.0 GHz | 8.0 | 11.0 | | dBm |
| Output Third Order Intercept (IP3) | DC - 2.0 GHz | | 30 | | dBm |
| | 2.0 - 6.0 GHz | | 27 | | dBm |
| | 6.0 - 8.0 GHz | | 24 | | dBm |
| Noise Figure | DC - 8.0 GHz | | 5 | | dB |
| Supply Current (Icq) | | | 55 | 74 | mA |

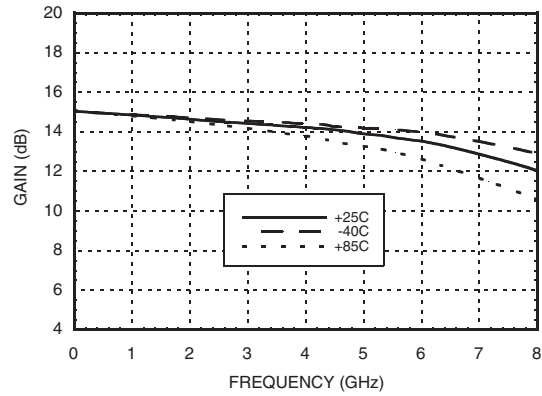
Note: Data taken with broadband bias tee on device output.



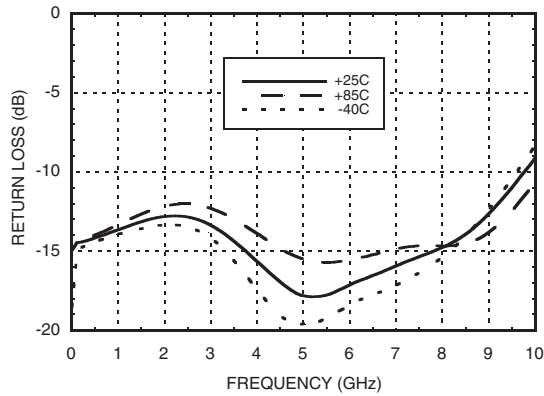
Broadband Gain & Return Loss



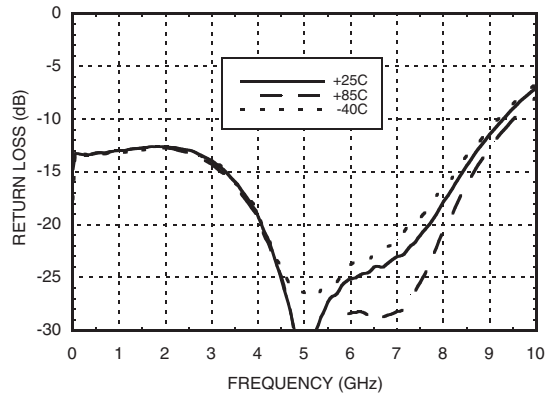
Gain vs. Temperature



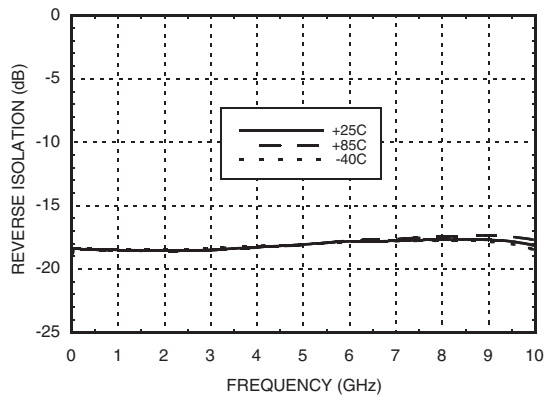
Input Return Loss vs. Temperature



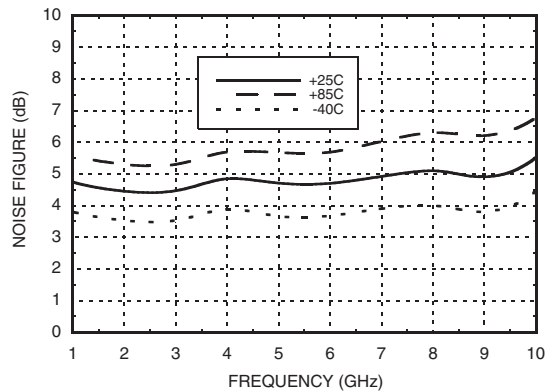
Output Return Loss vs. Temperature



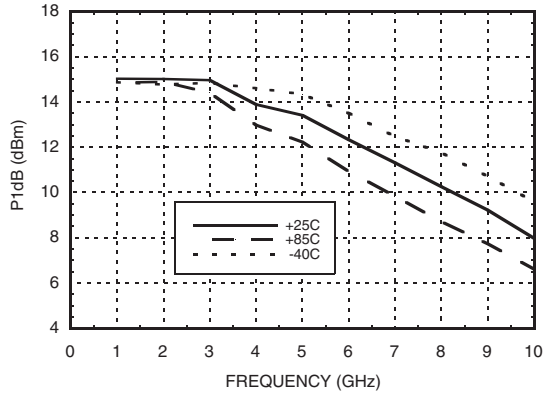
Reverse Isolation vs. Temperature



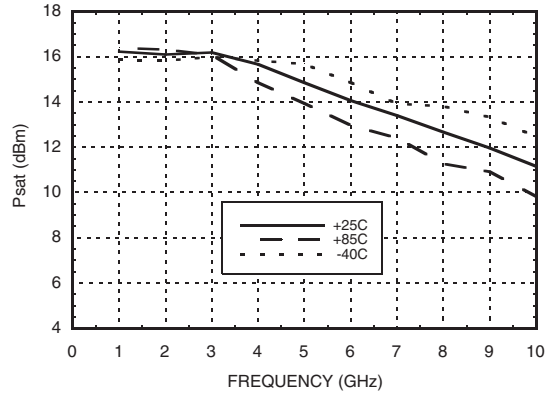
Noise Figure vs. Temperature



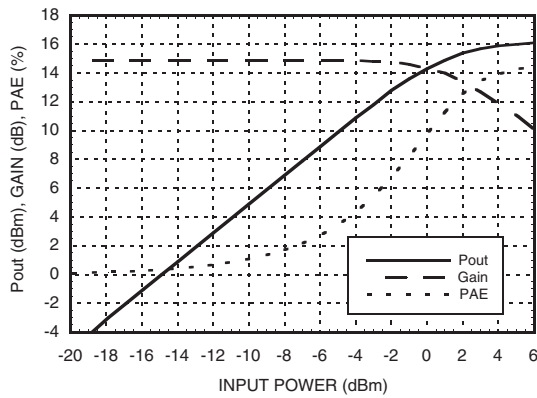
P1dB vs. Temperature



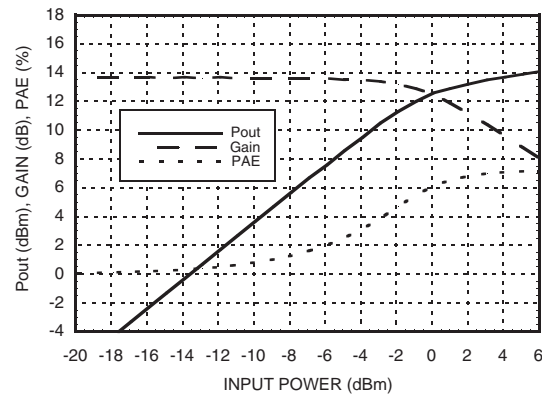
Psat vs. Temperature



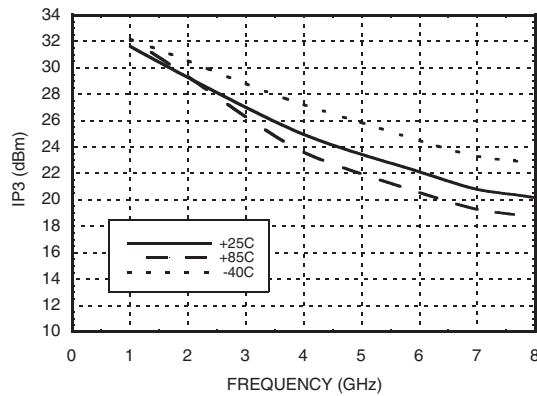
Power Compression @ 1 GHz



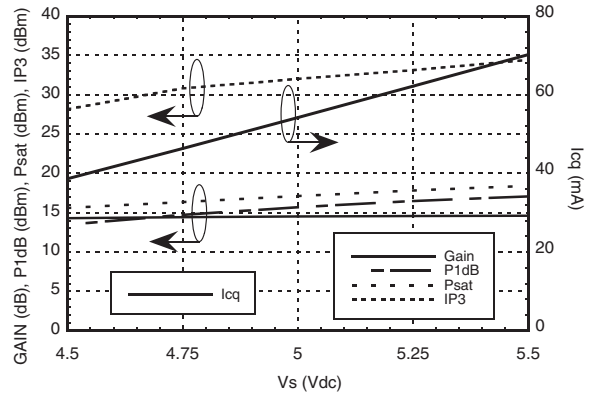
Power Compression @ 6 GHz



Output IP3 vs. Temperature



Gain, Power, IP3 & Supply Current vs. Supply Voltage @ 1 GHz



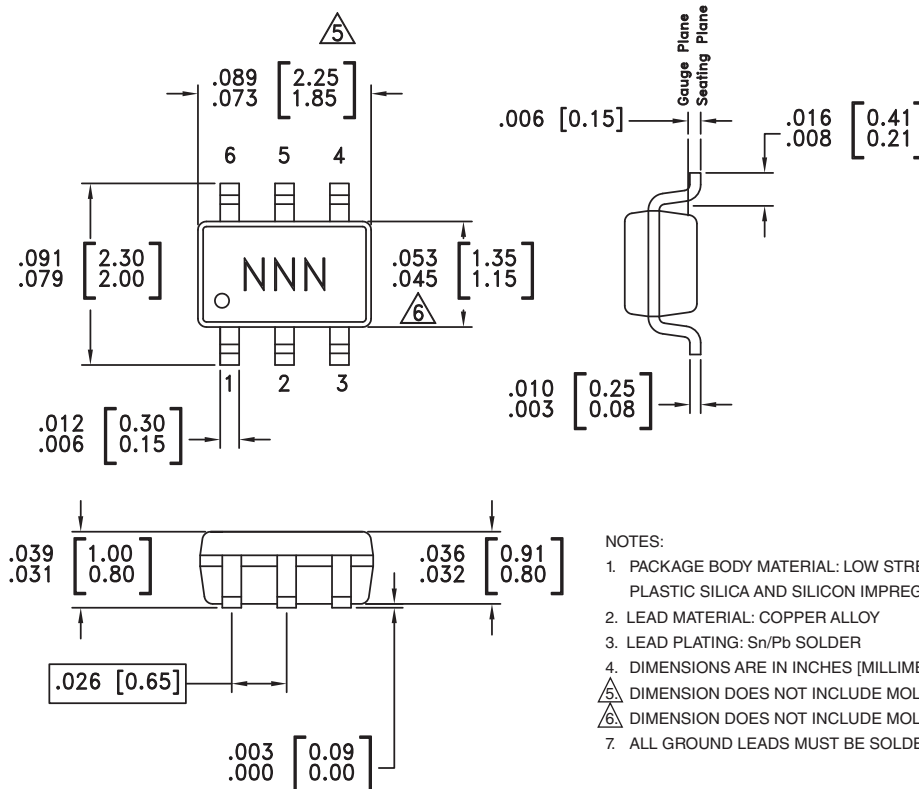
Absolute Maximum Ratings

| | |
|---|----------------|
| Collector Bias Voltage (Vcc) | +7V |
| RF Input Power (RFIN)(Vcc = +3.9V) | +10 dBm |
| Junction Temperature | 150 °C |
| Continuous P _{diss} (T = 85 °C) (derate 5.21 mW/°C above 85 °C) | 0.34 W |
| Thermal Resistance (junction to lead) | 191 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



Package Information


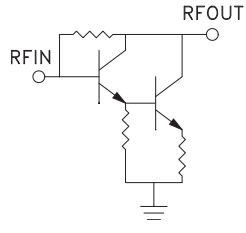
| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking |
|-------------|--|---------------|---------------------|-----------------|
| HMC311SC70 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | 311 |
| HMC311SC70E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | <u>311</u> |

[1] Max peak reflow temperature of 235 °C

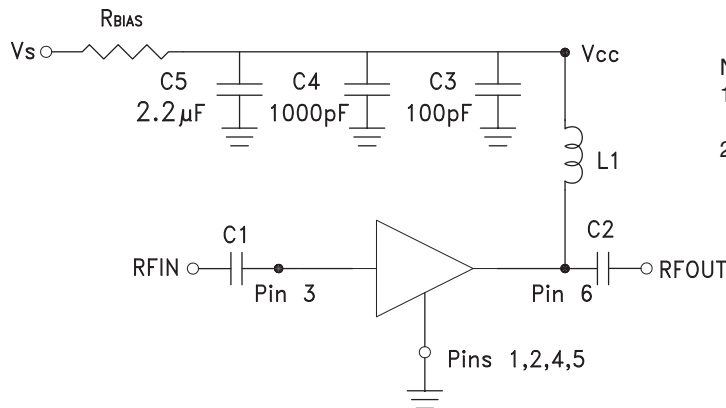
[2] Max peak reflow temperature of 260 °C



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. An off chip DC blocking capacitor is required. |  |
| 6 | RFOUT | RF output and DC Bias for the output stage. | |

Application Circuit



Note:

1. Select Rbias to achieve Icq using equation below, Rbias ≥ 22 Ohm.
2. External blocking capacitors are required on RFIN and RFOUT.

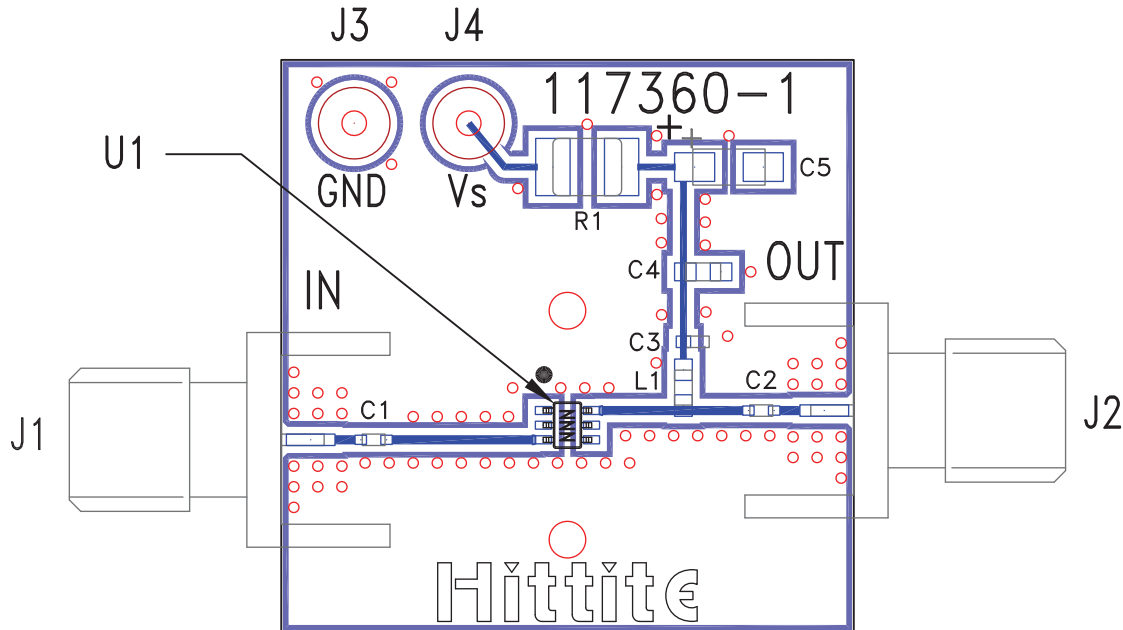
$$I_{cq} = \frac{V_s - 3.8}{R_{bias}}$$

Recommended Component Values

| Component | Frequency (MHz) | | | | | | | |
|-----------|-----------------|--------|--------|--------|--------|--------|--------|--------|
| | 50 | 900 | 1900 | 2200 | 2400 | 3500 | 5200 | 5800 |
| L1 | 270 nH | 56 nH | 22 nH | 22 nH | 15 nH | 8.2 nH | 3.3 nH | 3.3 nH |
| C1, C2 | 0.01 μF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF |

For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
Order On-line at www.hittite.com

Evaluation PCB



List of Materials for Evaluation PCB 118040 [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 μ F Capacitor, Tantalum |
| R1 | 22 Ohm Resistor, 1210 Pkg. |
| L1 | 22 nH Inductor, 0603 Pkg. |
| U1 | HMC311SC70 / HMC311SC70E |
| 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 final 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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