

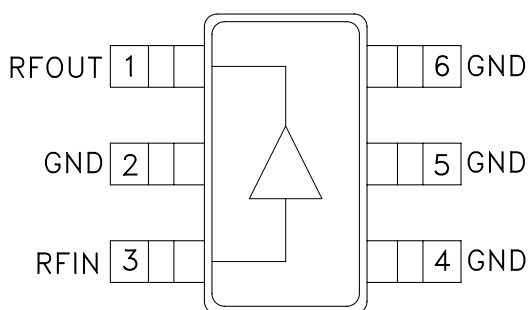
**GaAs InGaP HBT MMIC BROADBAND  
AMPLIFIER GAIN BLOCK, DC - 6 GHz**
**Typical Applications**

Ideal as a Driver & Amplifier for:

- 2.2 - 2.7 GHz MMDS
- 3.5 GHz Wireless Local Loop
- 5 - 6 GHz UNII & HiperLAN

**Features**

P1dB Output Power: +14 dBm  
 Output IP3: +27 dBm  
 Gain: 17 dB  
 Single Supply: +5V  
 High Reliability GaAs HBT Process  
 Ultra Small Package: SOT26  
 Included in the HMC-DK001 Designer's Kit

**Functional Diagram**

**General Description**

The HMC313 & HMC313E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC amplifiers that operate from a single Vcc supply. The surface mount SOT26 amplifier can be used as a broadband gain stage or used with external matching for optimized narrow band applications. With Vcc biased at +5V, the HMC313(E) offers 17 dB of gain and +15 dBm of saturated power while only requiring 50 mA of current.

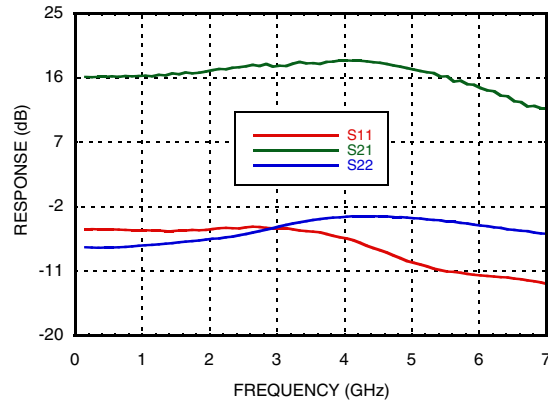
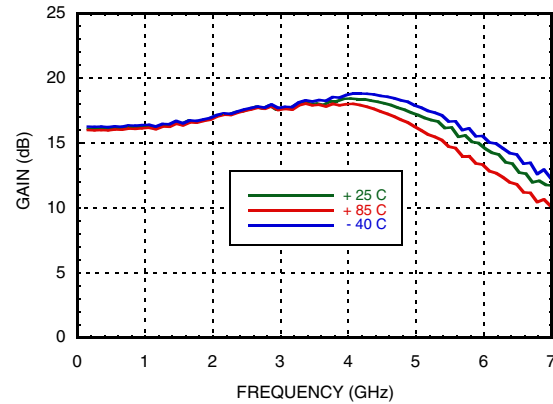
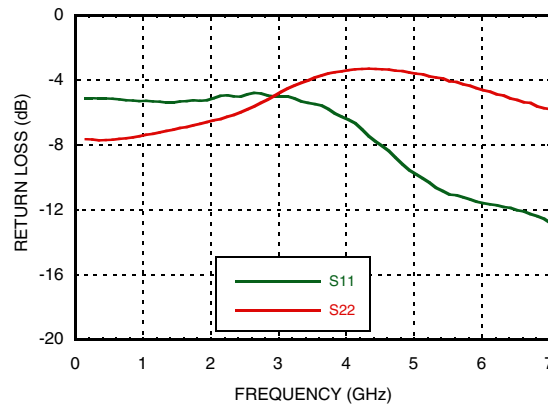
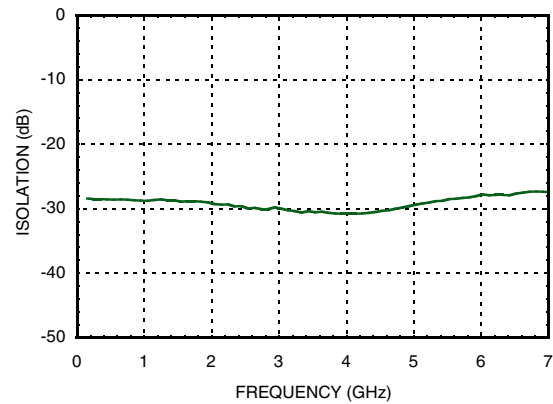
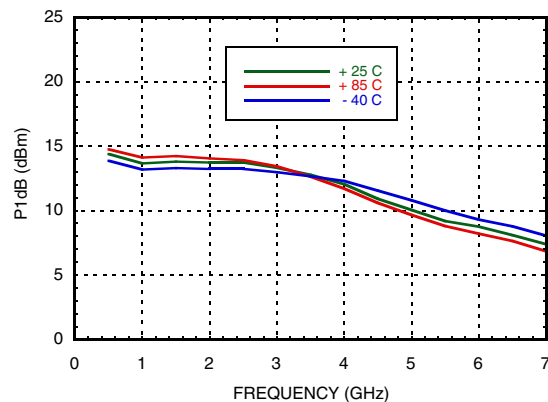
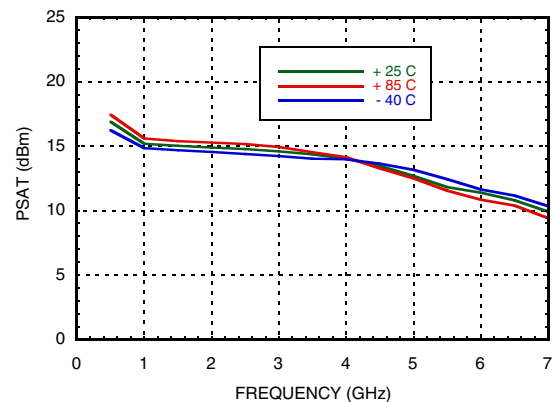
**Electrical Specifications,  $T_A = +25^\circ\text{C}$ ,  $V_{CC} = +5.0\text{V}$** 

| Parameter                                          | Vcc = +5V |      |      | Units |
|----------------------------------------------------|-----------|------|------|-------|
|                                                    | Min.      | Typ. | Max. |       |
| Frequency Range                                    | DC - 6    |      |      | GHz   |
| Gain                                               | 14        | 17   | 20   | dB    |
| Gain Variation Over Temperature                    |           | 0.02 | 0.03 | dB/°C |
| Input Return Loss                                  |           | 7    |      | dB    |
| Output Return Loss                                 |           | 6    |      | dB    |
| Reverse Isolation                                  |           | 30   |      | dB    |
| Output Power for 1 dB Compression (P1dB) @ 1.0 GHz | 11        | 14   |      | dBm   |
| Saturated Output Power (Psat) @ 1.0 GHz            |           | 15   |      | dBm   |
| Output Third Order Intercept (IP3) @ 1.0 GHz       | 24        | 27   |      | dBm   |
| Noise Figure                                       |           | 6.5  |      | dB    |
| Supply Current (Icc)                               |           | 50   |      | mA    |

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

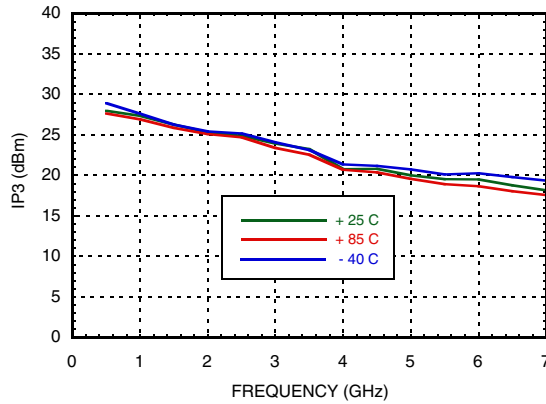
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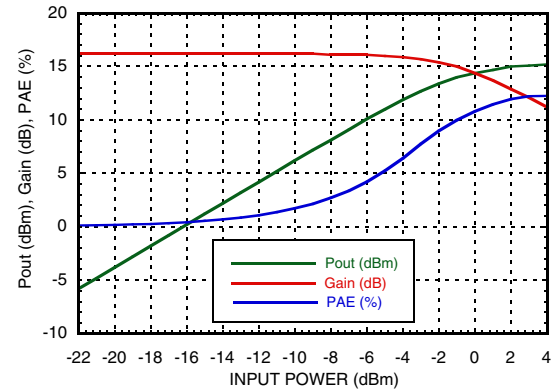
**GaAs InGaP HBT MMIC BROADBAND  
AMPLIFIER GAIN BLOCK, DC - 6 GHz**
**Gain & Return Loss**

**Gain vs. Temperature**

**Input & Output Return Loss**

**Reverse Isolation**

**P1dB vs. Temperature**

**Psat vs. Temperature**


**GaAs InGaP HBT MMIC BROADBAND  
AMPLIFIER GAIN BLOCK, DC - 6 GHz**

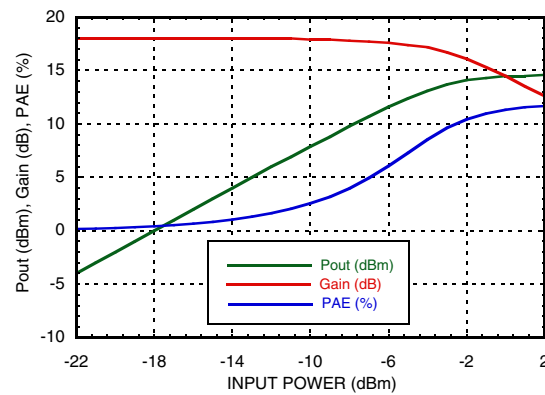
**Output IP3 vs. Temperature**



**Power Compression @ 1 GHz**



**Power Compression @ 3 GHz**



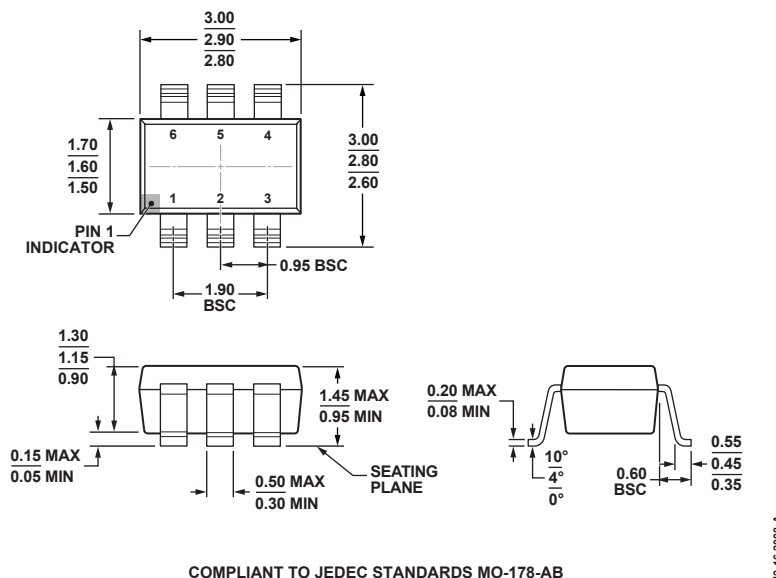
**GaAs InGaP HBT MMIC BROADBAND  
AMPLIFIER GAIN BLOCK, DC - 6 GHz**
**Absolute Maximum Ratings**

|                                                                             |                |
|-----------------------------------------------------------------------------|----------------|
| Collector Bias Voltage (Vcc)                                                | +5.5 Vdc       |
| RF Input Power (RFIN)(Vcc = +5Vdc)                                          | +20 dBm        |
| Junction Temperature                                                        | 150 °C         |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 3.99 mW/°C above 85 °C) | 0.259 W        |
| Thermal Resistance<br>(junction to pin 2 lead) <sup>[1]</sup>               | 251 °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**

[1] Pin 2 REQUIRES good thermal attachment to the PCB

**Outline Drawing**


**6-Lead Small Outline Transistor Package [SOT-23]  
(RJ-6)**

Dimensions shown in millimeters.

**Package Information**

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC313      | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H313<br>XXXX                   |
| HMC313TR    | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 313<br>XXXX                    |
| HMC313E     | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 313E<br>XXXX                   |
| HMC313ETR   | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 313E<br>XXXX                   |

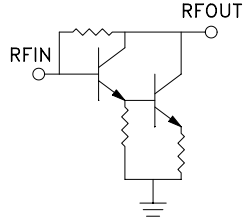
[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

## GaAs InGaP HBT MMIC BROADBAND AMPLIFIER GAIN BLOCK, DC - 6 GHz

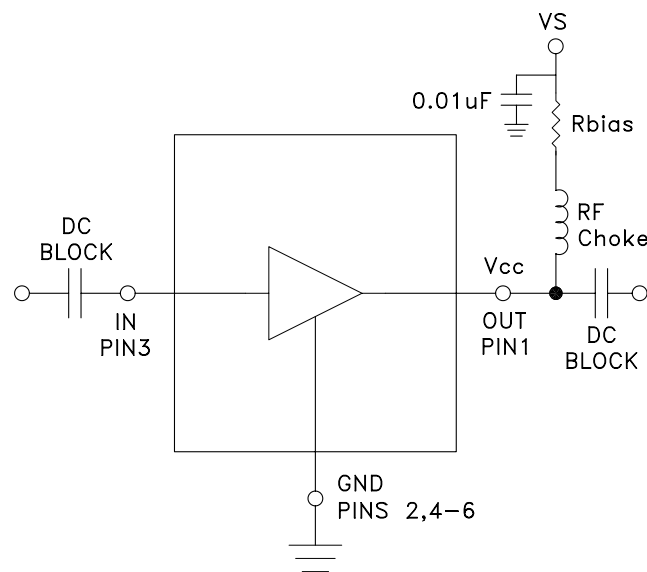
### Pin Descriptions

| Pin Number | Function | Description                                                            | Interface Schematic                                                                 |
|------------|----------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1          | RFOUT    | This pin is DC coupled. An off chip DC blocking capacitor is required. |  |
| 3          | RFIN     | This pin is DC coupled. An off chip DC blocking capacitor is required. |                                                                                     |
| 2, 4-6     | GND      | These pins must be connected to RF/DC ground.                          |  |

### Application Circuit

#### Recommended Bias Resistor Values for $I_{CC} = 50 \text{ mA}$ , $R_{bias} = (V_s - 5.0) / I_{CC}$

| Supply Voltage ( $V_s$ ) | 5V         | 6V          | 8V          |
|--------------------------|------------|-------------|-------------|
| $R_{BIAS}$ VALUE         | 0 $\Omega$ | 20 $\Omega$ | 62 $\Omega$ |
| $R_{BIAS}$ POWER RATING  |            | ¼ W         | ½ W         |

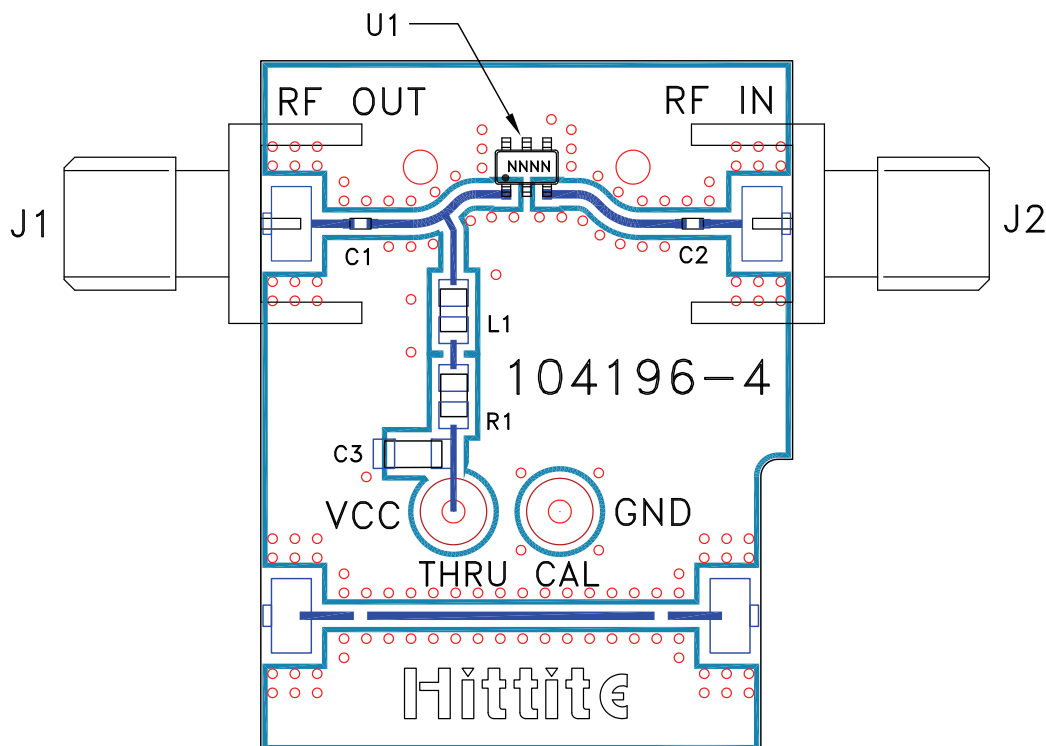


Note:

1. Select  $R_{bias}$  to achieve desired  $V_{cc}$  voltage on Pin 1.
2. External Blocking Capacitors are required on Pins 1 & 3.

**GaAs InGaP HBT MMIC BROADBAND  
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**Evaluation PCB**



**List of Materials for Evaluation PCB 104217 [1]**

| Item    | Description                     |
|---------|---------------------------------|
| J1 - J2 | PCB Mount SMA Connector         |
| C1 - C2 | 100 pF Capacitor, 0402 Pkg.     |
| C3      | 100 pF Capacitor, 0805 Pkg.     |
| L1      | 22 nH Inductor, 0805 Pkg.       |
| R1      | 22 $\Omega$ Resistor, 0805 Pkg. |
| U1      | HMC313 / HMC313E                |
| PCB [2] | 104196 Evaluation PCB           |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR or Roger 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 circuit board shown is available from Analog Devices, upon request.

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