



MICROWAVE CORPORATION v00.1108



# HMC758LP3 / 758LP3E

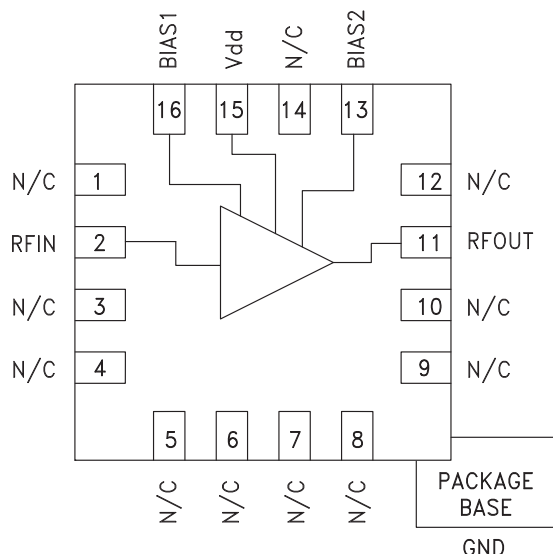
## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 700 - 2200 MHz

### Typical Applications

The HMC758LP3(E) is ideal for:

- Cellular Infrastructure, WiMAX & LTE/4G
- Software Defined Radios
- Repeaters and Femtocells
- Access Points
- Test & Measurement Equipment

### Functional Diagram



### Features

Noise Figure: 1.7 dB

Gain: 22 dB

Output IP3: +37 dBm

Single Supply: +3V to +5V

50 Ohm Matched Input/Output

16 Lead 3x3 mm SMT Package: 9 mm<sup>2</sup>

### General Description

The HMC758LP3(E) is a GaAs pHEMT MMIC Low Noise Amplifier that is ideal for Cellular Infrastructure, WiMAX & LTE/4G basestation front-end receivers operating between 700 and 2200 MHz. The amplifier has been optimized to provide 1.7 dB noise figure, 21 dB gain and +37 dBm output IP3 from a single supply of +5V. Input and output return losses are excellent with minimal external matching and bias decoupling components. The HMC758LP3(E) can be biased with +3V to +5V and features an externally adjustable supply current, which allows the designer to tailor the linearity performance of the LNA for each application.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $R1 = 390\Omega$ , $R2 = 560\Omega^*$

| Parameter                                | Vdd = +3V  |       |      |             |      |      | Vdd = +5V  |       |      |             |      |      | Units |
|------------------------------------------|------------|-------|------|-------------|------|------|------------|-------|------|-------------|------|------|-------|
|                                          | Min.       | Typ.  | Max. | Min.        | Typ. | Max. | Min.       | Typ.  | Max. | Min.        | Typ. | Max. |       |
| Frequency Range                          | 700 - 1700 |       |      | 1700 - 2200 |      |      | 700 - 1700 |       |      | 1700 - 2200 |      |      | MHz   |
| Gain                                     | 19         | 21.8  |      | 16          | 19.4 |      | 20         | 22.7  |      | 18          | 21.3 |      | dB    |
| Gain Variation Over Temperature          |            | 0.005 |      |             | 0.01 |      |            | 0.004 |      |             | 0.01 |      | dB/°C |
| Noise Figure                             |            | 1.6   | 2.5  |             | 1.4  | 1.8  |            | 1.7   | 2.6  |             | 1.6  | 2.0  | dB    |
| Input Return Loss                        |            | 15    |      |             | 13   |      |            | 14    |      |             | 14   |      | dB    |
| Output Return Loss                       |            | 11    |      |             | 15   |      |            | 10    |      |             | 12   |      | dB    |
| Output Power for 1 dB Compression (P1dB) | 16         | 18    |      | 18          | 20   |      | 20.5       | 22.5  |      | 22          | 24   |      | dBm   |
| Saturated Output Power (Psat)            |            | 20    |      |             | 21.5 |      |            | 23.5  |      |             | 25   |      | dBm   |
| Output Third Order Intercept (IP3)       |            | 31    |      |             | 31.5 |      |            | 36    |      |             | 35   |      | dBm   |
| Supply Current (Idd)                     | 80         | 102   | 130  | 80          | 102  | 130  | 190        | 227   | 260  | 190         | 227  | 260  | mA    |

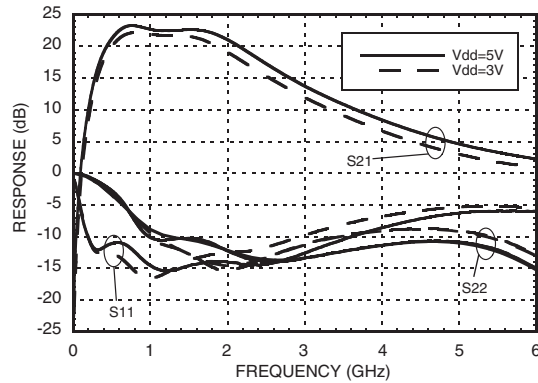
\* R1 & R2 resistors set current, see application circuit herein

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824

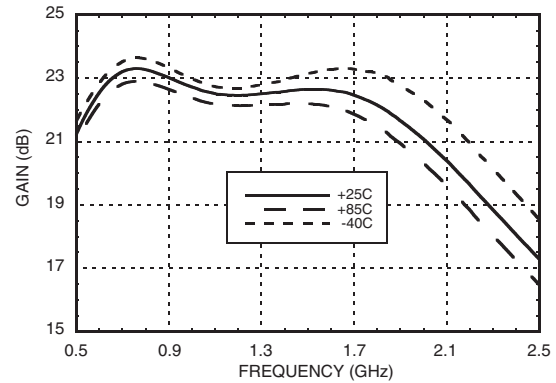
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)

Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

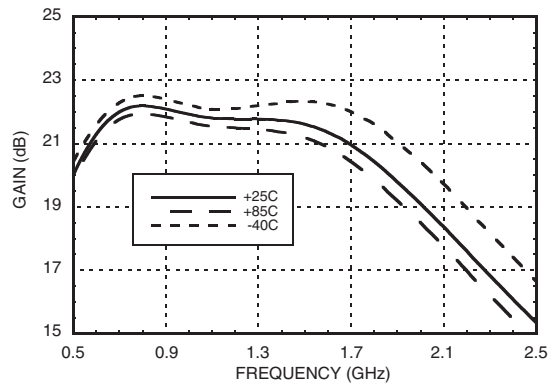
**Broadband Gain & Return Loss**



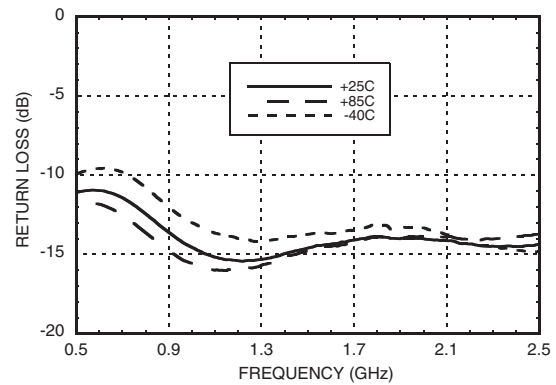
**Gain vs. Temperature, V<sub>dd</sub> = +5V**



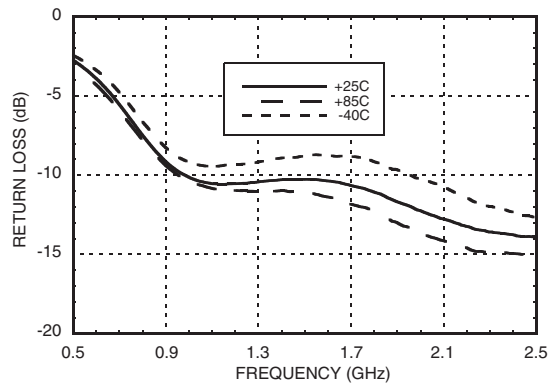
**Gain vs. Temperature, V<sub>dd</sub> = +3V**



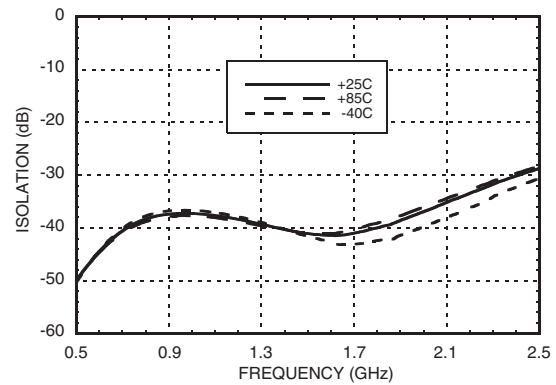
**Input Return Loss vs. Temperature, V<sub>dd</sub> = +5V**



**Output Return Loss vs. Temperature, V<sub>dd</sub> = +5V**



**Reverse Isolation vs. Temperature, V<sub>dd</sub> = +5V**





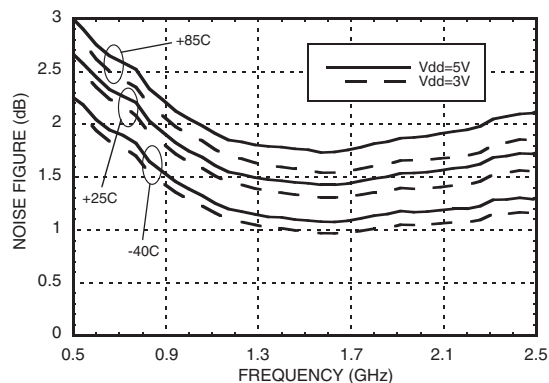
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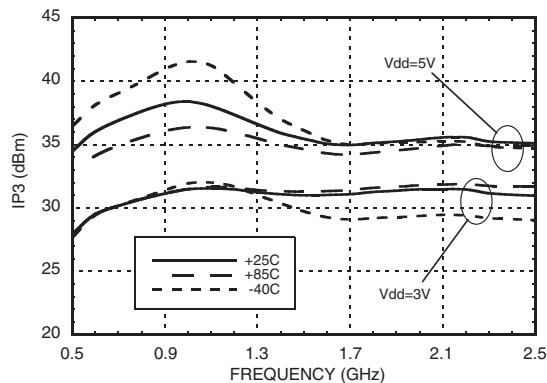
# HMC758LP3 / 758LP3E

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 700 - 2200 MHz

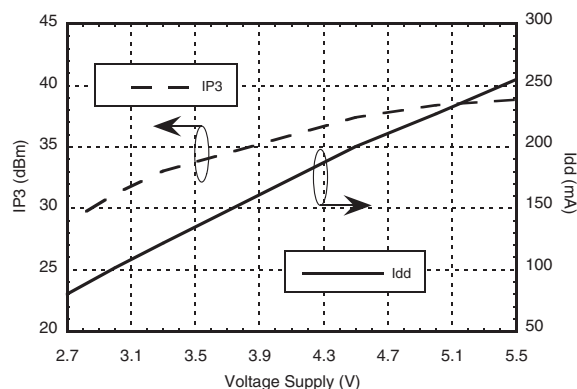
Noise Figure vs. Temperature [1]



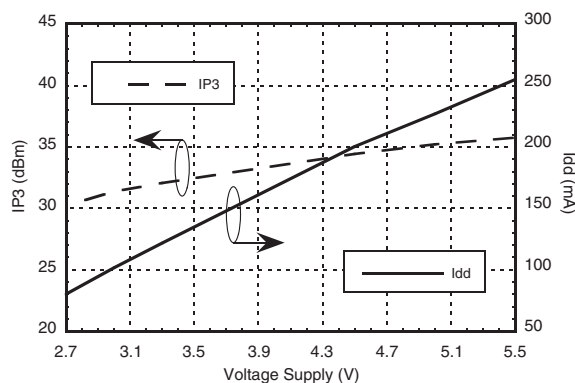
Output IP3 vs. Temperature



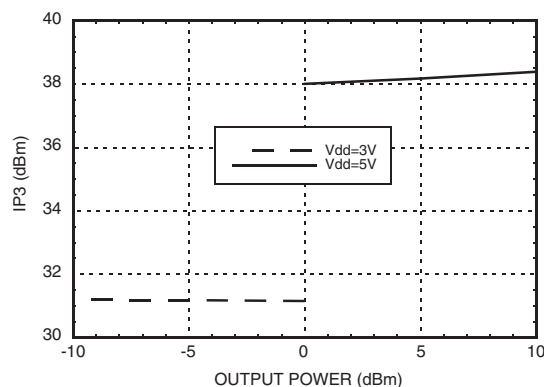
Output IP3 and Supply Current vs. Supply Voltage @ 900 MHz



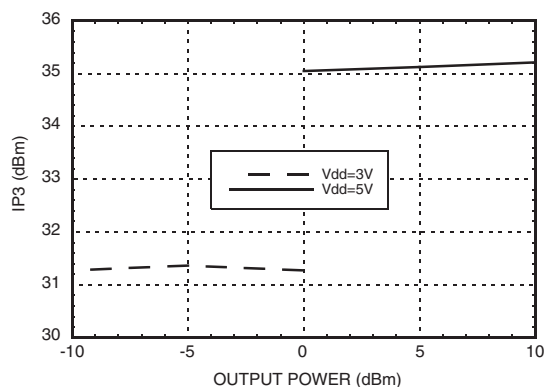
Output IP3 and Supply Current vs. Supply Voltage @ 1900 MHz



Output IP3 vs. Output Power @ 900 MHz



Output IP3 vs. Output Power @ 1900 MHz



[1] Measurement reference plane shown on evaluation PCB drawing.

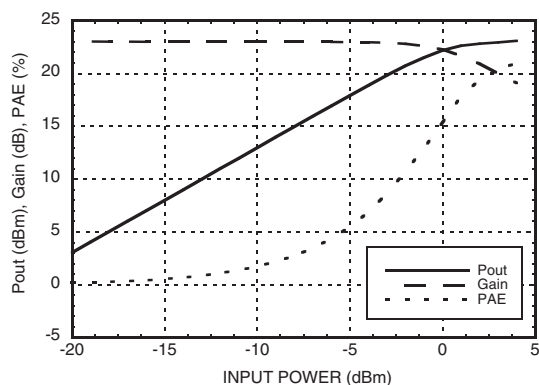
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## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 700 - 2200 MHz

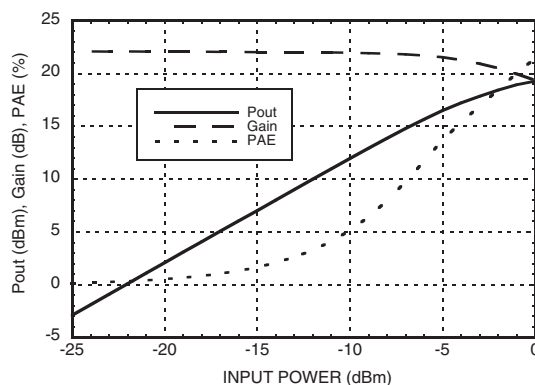
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AMPLIFIERS - LOW NOISE - SMT

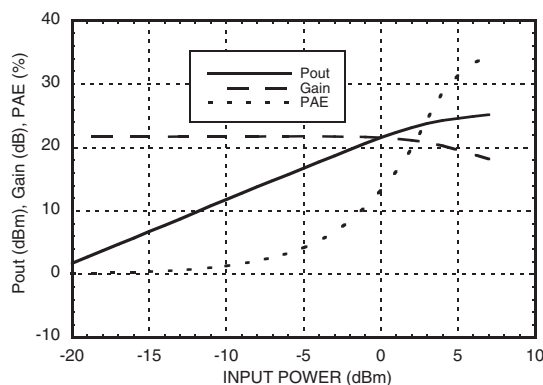
**Power Compression @ 900 MHz [1]**



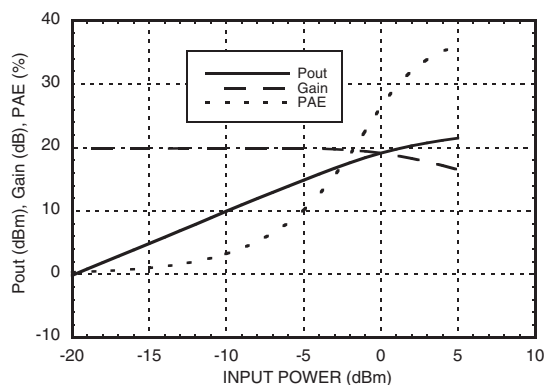
**Power Compression @ 900 MHz [2]**



**Power Compression @ 1900 MHz [1]**



**Power Compression @ 1900 MHz [2]**



### Recommended Bias Resistor Values for Idd

| Vdd (V) | R1 (Ohms) | R2 (Ohms) | Idd (mA) |
|---------|-----------|-----------|----------|
| 3V      | 390       | 560       | 102      |
| 3V      | 1k        | 1.5k      | 85       |
| 3V      | 3.3k      | 4.7k      | 54       |
| 5V      | 390       | 560       | 227      |
| 5V      | 1k        | 1.5k      | 190      |
| 5V      | 3.3k      | 4.7k      | 124      |

### Absolute Min/Max Bias Resistor Range

| Max       |           | Min       |           |
|-----------|-----------|-----------|-----------|
| R1 (Ohms) | R2 (Ohms) | R1 (Ohms) | R2 (Ohms) |
| 3.9k      | 5.6k      | 270       | 470       |

### Typical Supply Current vs. Vdd (R1 = 390Ω, R2 = 560Ω)

| Vdd (V) | Idd (mA) |
|---------|----------|
| 2.7     | 80       |
| 3       | 102      |
| 3.3     | 122      |
| 4.5     | 200      |
| 5       | 227      |
| 5.5     | 255      |

Note: Amplifier will operate over full voltage range shown above.

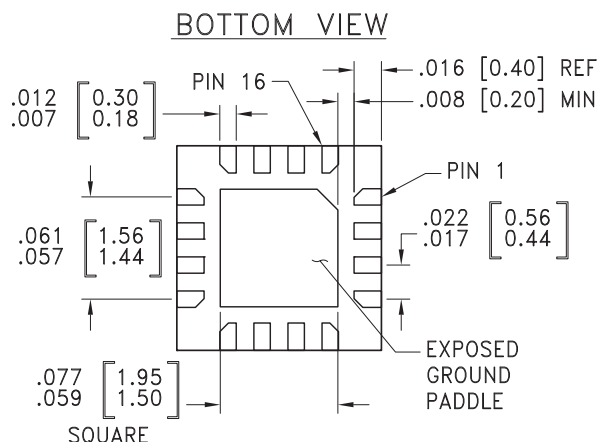
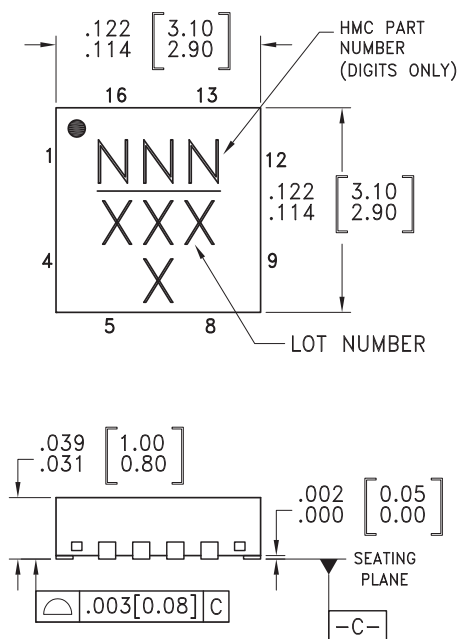
[1] Vdd = 5V [2] Vdd = 3V



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**HMC758LP3 / 758LP3E****GaAs SMT pHEMT LOW NOISE  
AMPLIFIER, 700 - 2200 MHz****Absolute Maximum Ratings**

|                                                                          |                |
|--------------------------------------------------------------------------|----------------|
| Drain Bias Voltage (Vdd)                                                 | +6 V           |
| RF Input Power (RFIN)<br>(Vdd = +5V)                                     | +5 dBm         |
| Channel Temperature                                                      | 150 °C         |
| Continuous P <sub>diss</sub> (T= 85 °C)<br>(derate 20 mW/°C above 85 °C) | 1.3 W          |
| Thermal Resistance<br>(channel to ground paddle)                         | 50 °C/W        |
| Storage Temperature                                                      | -65 to +150 °C |
| Operating Temperature                                                    | -40 to +85 °C  |

**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS****Outline Drawing****NOTES:**

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.  
PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE  
MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR  
SUGGESTED LAND PATTERN.

**Package Information**

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC758LP3   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 758<br>XXXX                    |
| HMC758LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 758<br>XXXX                    |

[1] Max peak reflow temperature of 235 °C

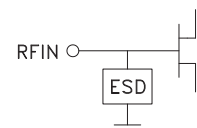
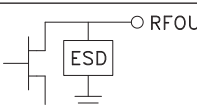
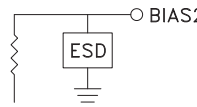
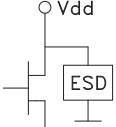
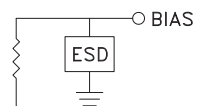
[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824

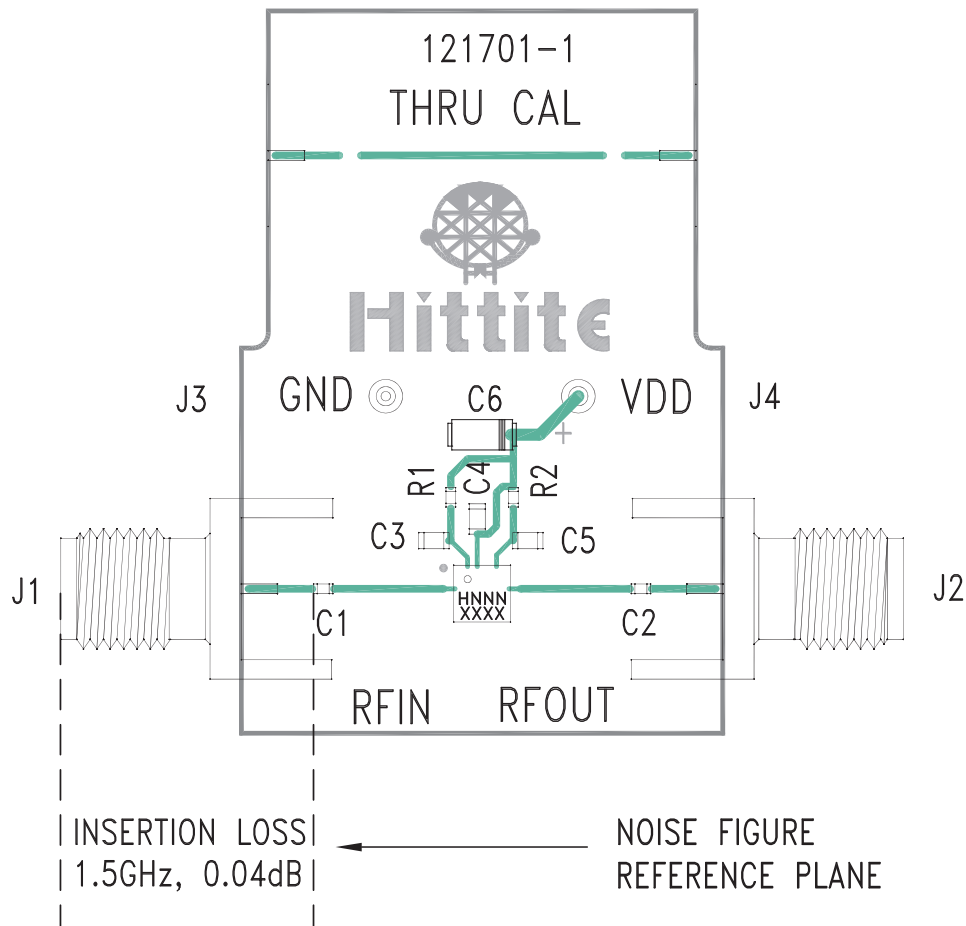
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

### Pin Descriptions

| Pin Number                  | Function | Description                                                                                                                           | Interface Schematic                                                                   |
|-----------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1, 3 - 6,<br>7 - 10, 12, 14 | N/C      | No connection required. These pins may be connected to RF/DC ground without affecting performance.                                    |                                                                                       |
| 2                           | RFIN     | This pin is DC coupled. An off-chip DC blocking capacitor is required.                                                                |    |
| 11                          | RFOUT    | This pin is DC coupled. An off-chip DC blocking capacitor is required.                                                                |    |
| 13                          | BIAS2    | This pin is used to set the DC current of the second stage amplifier by selection of external bias resistor. See application circuit. |    |
| 15                          | Vdd      | Power Supply Voltage for the amplifier. Bypass capacitors are required. See application circuit.                                      |   |
| 16                          | BIAS1    | This pin is used to set the DC current of the first stage amplifier by selection of external bias resistor. See application circuit.  |  |



### Evaluation PCB



### List of Materials for Evaluation PCB 121703 <sup>[1]</sup>

| Item               | Description                    |
|--------------------|--------------------------------|
| J1, J2             | PCB Mount SMA RF Connector     |
| J3, J4             | DC Pin                         |
| C1                 | 220 pF Capacitor, 0402 Pkg.    |
| C2                 | 10 pF Capacitor, 0402 Pkg.     |
| C3 - C5            | 10 nF Capacitor, 0603 Pkg.     |
| C6                 | 2.2 $\mu$ F Tantalum Capacitor |
| R1                 | 390 Ohm Resistor, 0402 Pkg.    |
| R2                 | 560 Ohm Resistor, 0402 Pkg.    |
| U1                 | HMC758LP3(E) Amplifier         |
| PCB <sup>[2]</sup> | 121701 Evaluation PCB          |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25FR.

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.