# HMC618LP3 / 618LP3E

v08.1210

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

### Typical Applications

The HMC618LP3E is ideal for:

- Cellular/3G and LTE/WiMAX/4G
- BTS & Infrastructure
- Repeaters and Femto Cells
- Public Safety Radios

### Features

Noise Figure: 0.75 dB

Gain: 19 dB

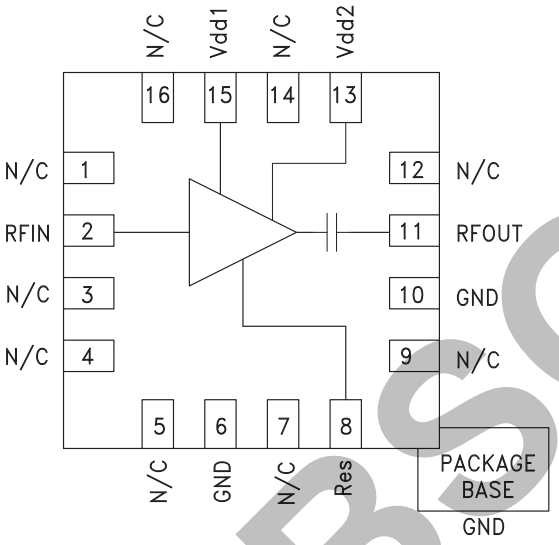
OIP3: 36 dBm

Single Supply: +3V to +5V

50 Ohm Matched Input/Output

16 Lead 3x3mm SMT Package: 9 $mm^2$

### Functional Diagram




### General Description

The HMC618LP3E is a GaAs pHEMT MMIC Low Noise Amplifier that is ideal for Cellular/3G and LTE/WiMAX/4G basestation front-end receivers operating between 1.2 - 2.2 GHz. The amplifier has been optimized to provide 0.75 dB noise figure, 19 dB gain and +36 dBm output IP3 from a single supply of +5V. Input and output return losses are excellent and the LNA requires minimal external matching and bias decoupling components. The HMC618LP3E shares the same package and pinout with the HMC617LP3E 0.55 - 1.2 GHz LNA. The HMC618LP3E 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. The HMC618LP3(E) offers improved noise figure versus the previously released HMC375LP3(E) and the HMC382LP3(E).

OBSOLETE

### Electrical Specifications

**$T_A$ = +25° C, Rbias = 470 Ohm for Vdd1 = Vdd2 = 5V**

| Parameter | Vdd = 5 Vdc | | | | | | | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Frequency Range | 1200 - 1700 | | | 1700 - 2000 | | | 2000 - 2200 | | | MHz |
| Gain | 19 | 23 | | 16 | 19 | | 13.5 | 17 | | dB |
| Gain Variation Over Temperature | | 0.012 | | | 0.008 | | | 0.008 | | dB/°C |
| Noise Figure | | 0.65 | 0.85 | | 0.75 | 1.1 | | 0.85 | 1.15 | dB |
| Input Return Loss | | 22.5 | | | 18 | | | 19.5 | | dB |
| Output Return Loss | | 13 | | | 12.5 | | | 10 | | dB |
| Output Power for 1 dB Compression (P1dB) | 14.5 | 19 | | 16.5 | 20 | | 18 | 20 | | dBm |
| Saturated Output Power (Psat) | | 20.5 | | | 20.5 | | | 20.5 | | dBm |
| Output Third Order Intercept (IP3) | | 33.5 | | | 35 | | | 35.5 | | dBm |
| Supply Current (Idd) | | 89 | 118 | | 89 | 118 | | 89 | 118 | mA |

* Rbias resistor sets current, see application circuit herein

# HMC618LP3 / 618LP3E

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz



## Electrical Specifications

### $T_A$ = +25° C, Rbias = 10K Ohm for Vdd1 = Vdd2 = 3V

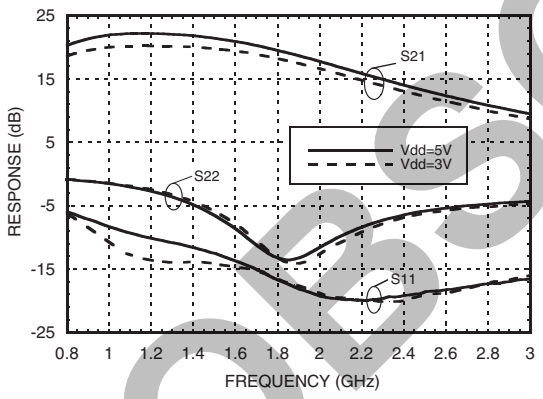
| Parameter | Vdd = 3 Vdc | | | | | | | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Frequency Range | 1200 - 1700 | | | 1700 - 2000 | | | 2000 - 2200 | | | MHz |
| Gain | 18 | 22 | | 15 | 18 | | 12.5 | 15.8 | | dB |
| Gain Variation Over Temperature | | 0.009 | | | 0.009 | | | 0.009 | | dB/°C |
| Noise Figure | | 0.8 | 1.1 | | 0.9 | 1.2 | | 0.9 | 1.2 | dB |
| Input Return Loss | | 26 | | | 17 | | | 19 | | dB |
| Output Return Loss | | 14 | | | 13 | | | 11 | | dB |
| Output Power for 1 dB Compression (P1dB) | 10 | 15 | | 12 | 15 | | 13 | 15 | | dBm |
| Saturated Output Power (Psat) | | 16 | | | 16 | | | 16 | | dBm |
| Output Third Order Intercept (IP3) | | 28 | | | 28 | | | 28 | | dBm |
| Supply Current (Idd) | | 47 | 65 | | 47 | 65 | | 47 | 65 | mA |

* Rbias resistor sets current, see application circuit herein

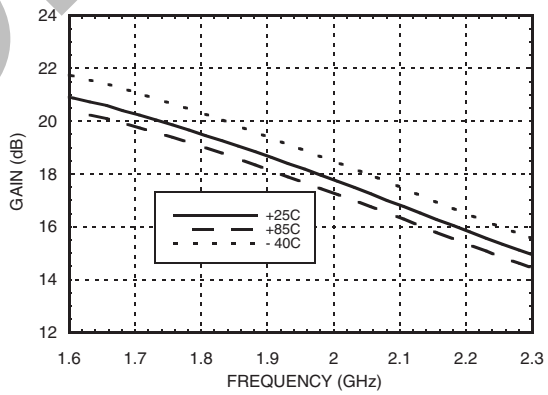
OBSOLETE

### 1700 to 2200 MHz Tune

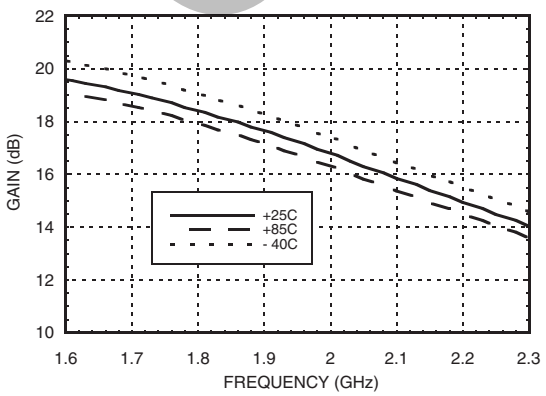
#### Broadband Gain & Return Loss [1] [2]



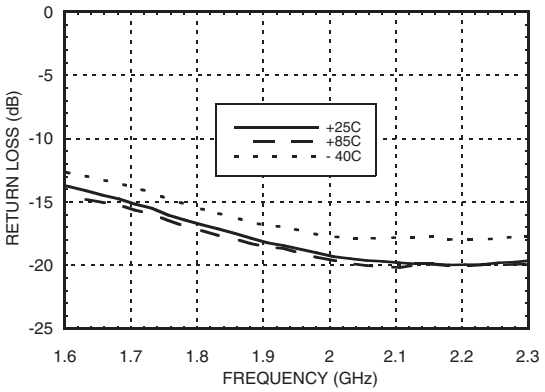

#### Gain vs. Temperature [1]




#### Gain vs. Temperature [2]




#### Input Return Loss vs. Temperature [1]




[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm

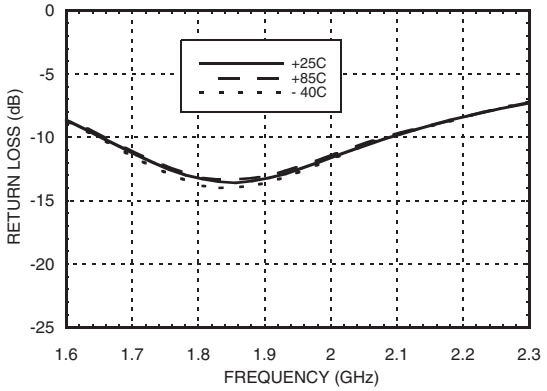
# HMC618LP3 / 618LP3E

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

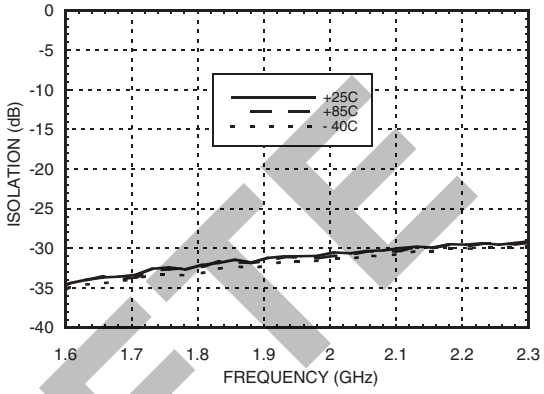
### 1700 to 2200 MHz Tune



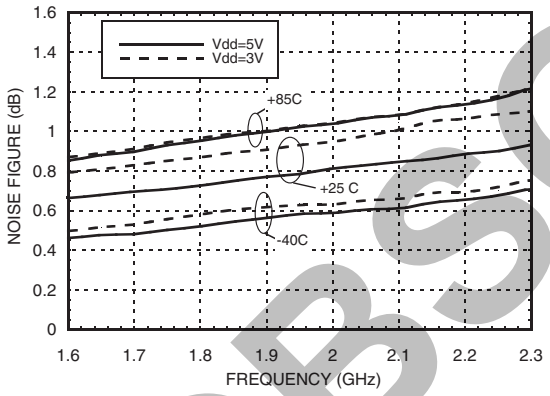
### Output Return Loss vs. Temperature [1]



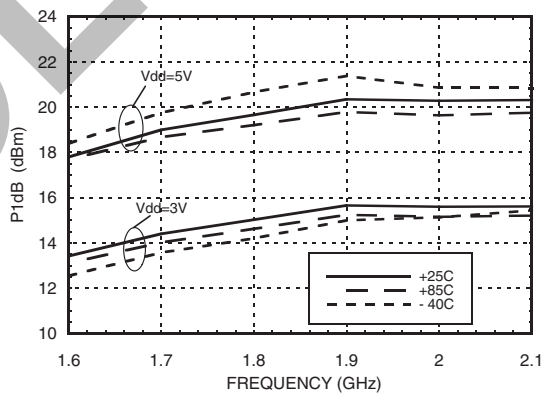

### Reverse Isolation vs. Temperature [1]



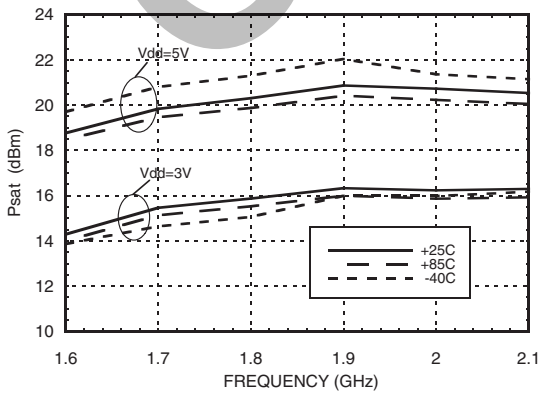

### Noise Figure vs Temperature [1] [2] [3]



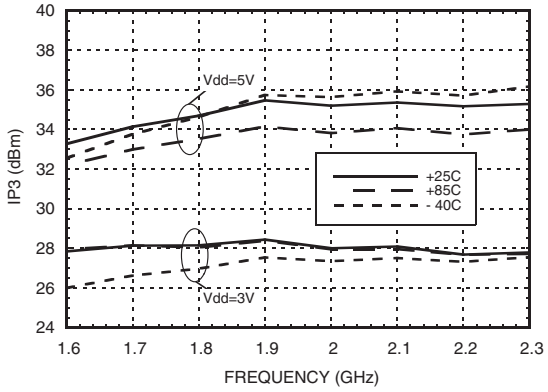

### Output P1dB vs. Temperature [1] [2]




### Psat vs. Temperature [1] [2]




### Output IP3 vs. Temperature [1] [2]

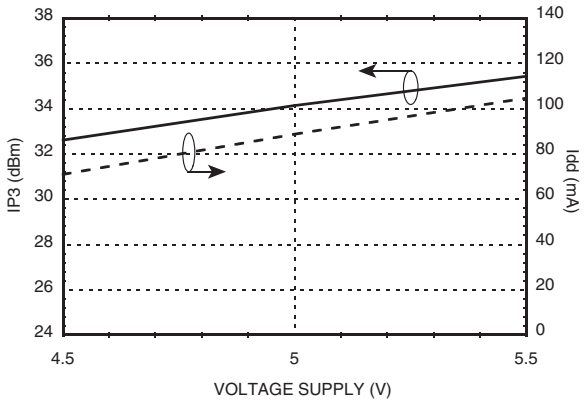



OBSOLETE

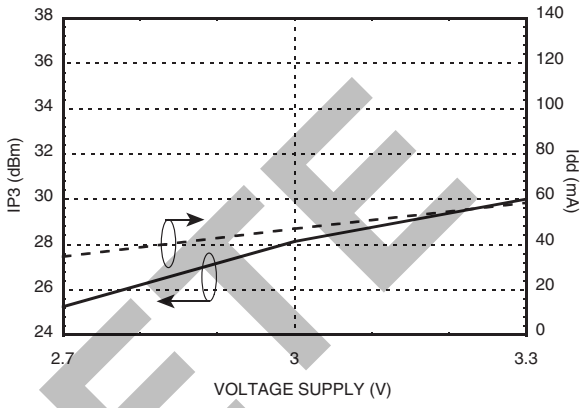
[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm
[3] Measurement reference plane shown on evaluation PCB drawing.

### 1700 to 2200 MHz Tune

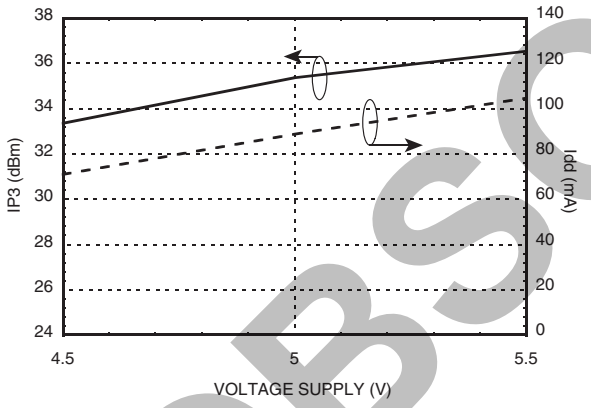
### Output IP3 and Idd vs. Supply Voltage @ 1750 MHz [1]



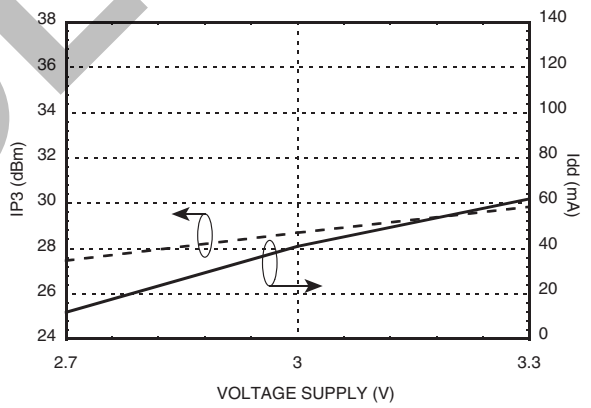

### Output IP3 and Idd vs. Supply Voltage @ 1750 MHz [2]



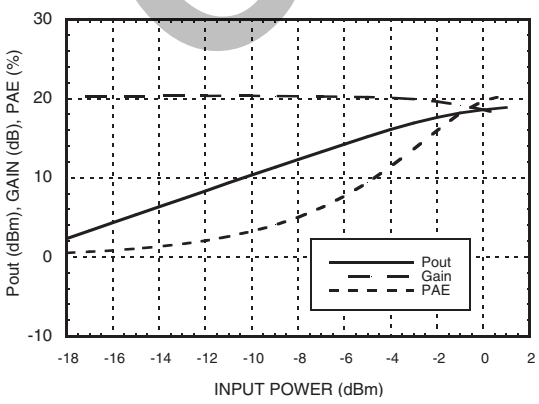

### Output IP3 and Idd vs. Supply Voltage @ 2100 MHz [1]



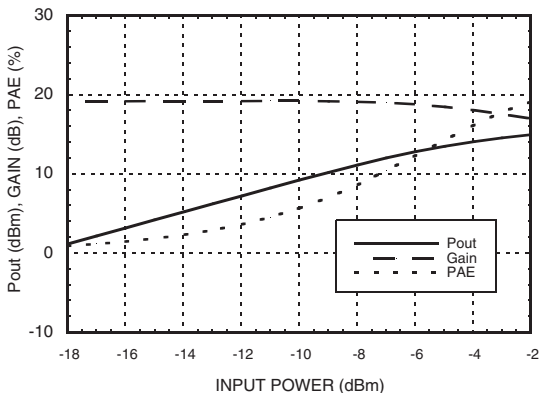

### Output IP3 and Idd vs. Supply Voltage @ 2100 MHz [2]




### Power Compression @ 1750 MHz [1]




### Power Compression @ 1750 MHz [2]




[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm

OBSOLETE

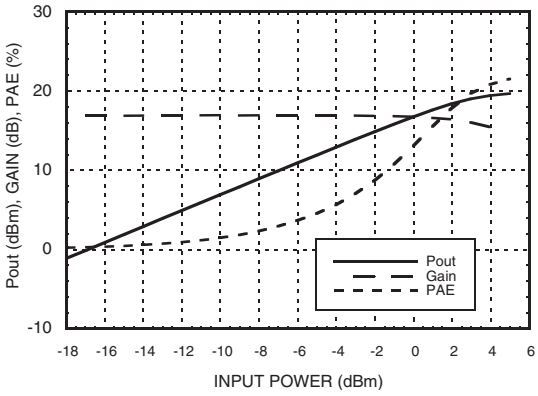
# HMC618LP3 / 618LP3E

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

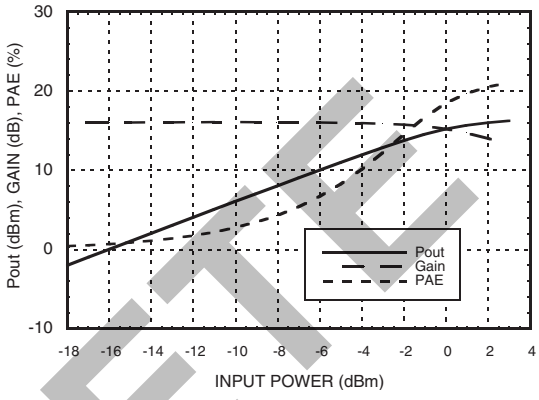
### 1700 to 2200 MHz Tune

OBSOLETE

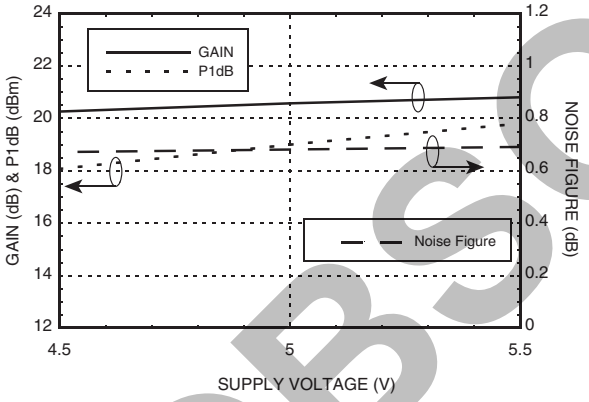
### Power Compression @ 2100 MHz [1]



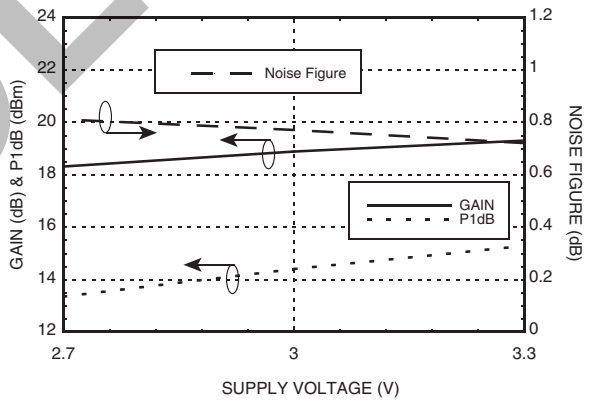

### Power Compression @ 2100 MHz [2]



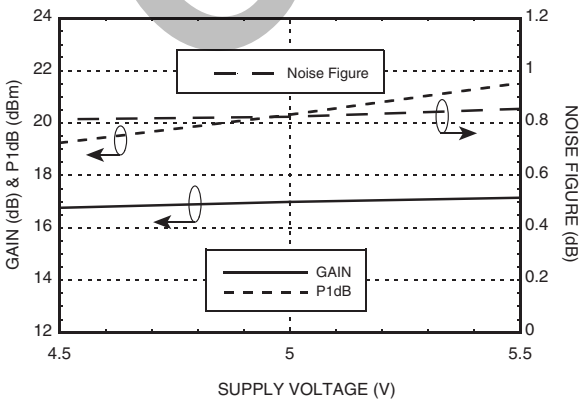

### Gain, Power & Noise Figure vs. Supply Voltage @ 1750 MHz [1]



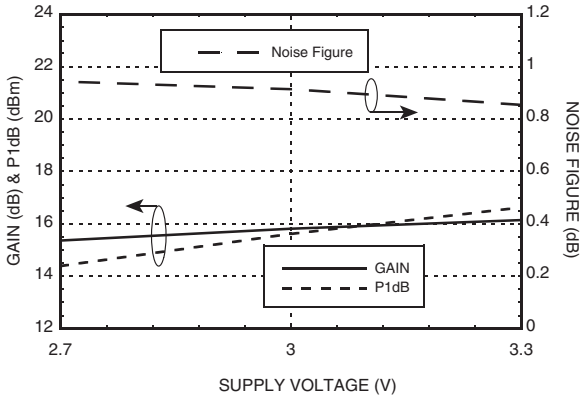

### Gain, Power & Noise Figure vs. Supply Voltage @ 1750 MHz [2]




### Gain, Power & Noise Figure vs. Supply Voltage @ 2100 MHz [1]



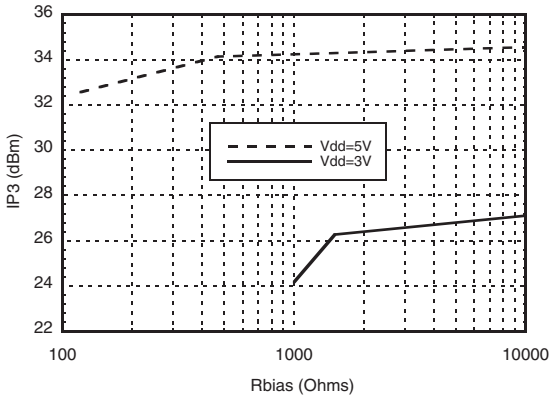

### Gain, Power & Noise Figure vs. Supply Voltage @ 2100 MHz [2]



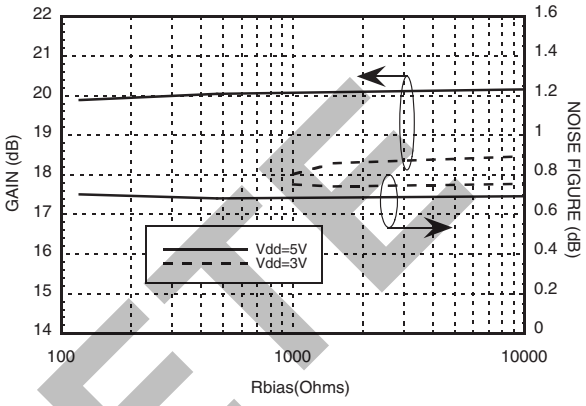

[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm

### 1700 to 2200 MHz Tune

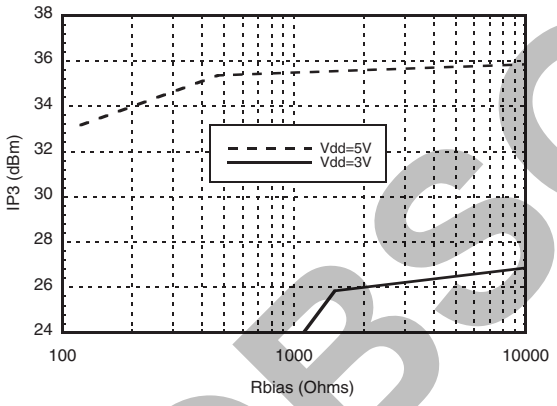
### Output IP3 vs. Rbias @ 1750 MHz



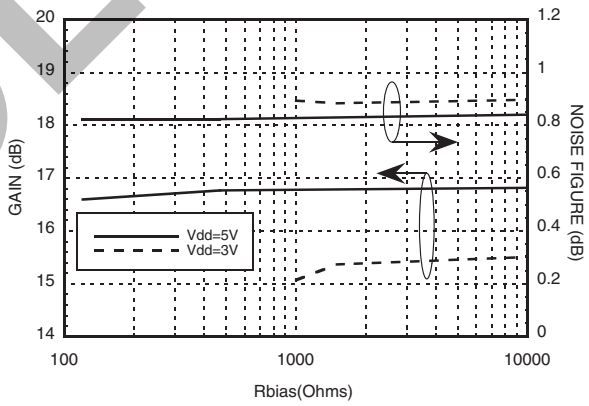

### Gain, Noise Figure vs. Rbias @ 1750 MHz




### Output IP3 vs. Rbias @ 2100 MHz




### Gain, Noise Figure vs. Rbias @ 2100 MHz




OBSOLETE

[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm

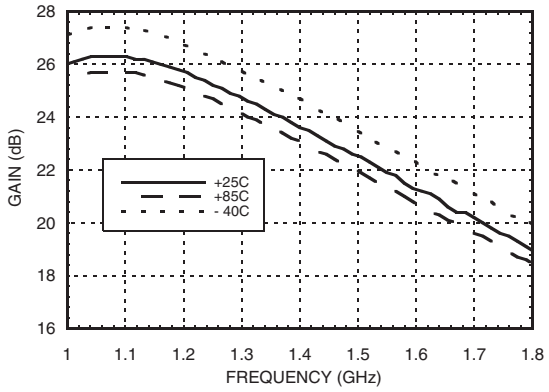
# HMC618LP3 / 618LP3E

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

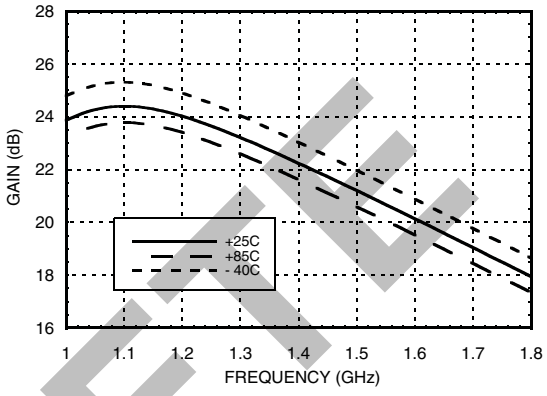
### 1200 to 1700 MHz Tune

OBSOLETE

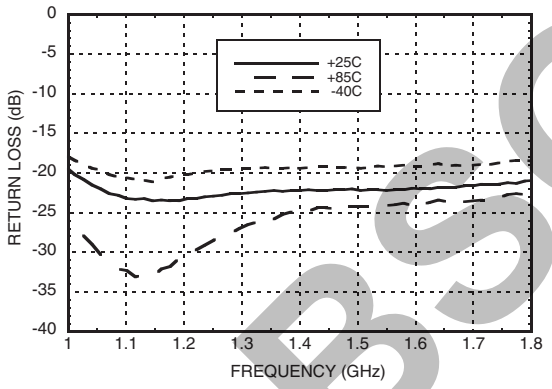
**Gain vs. Temperature [1]**



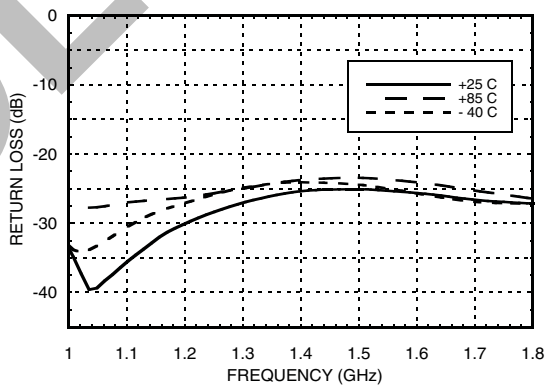

**Gain vs. Temperature [2]**



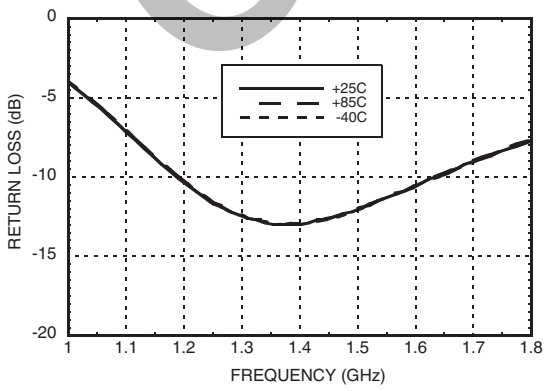

**Input Return Loss vs. Temperature [1]**



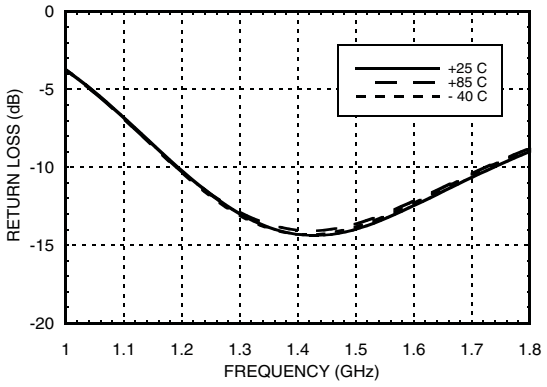

**Input Return Loss vs. Temperature [2]**




**Output Return Loss vs. Temperature [1]**



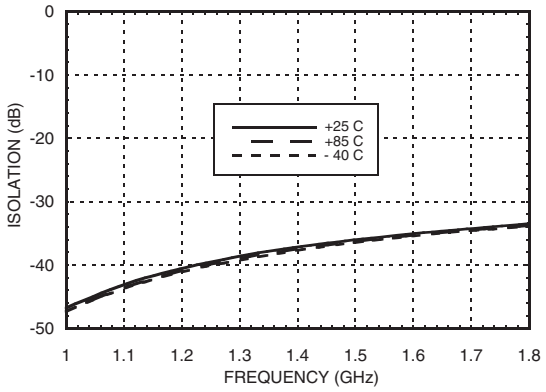

**Output Return Loss vs. Temperature [2]**



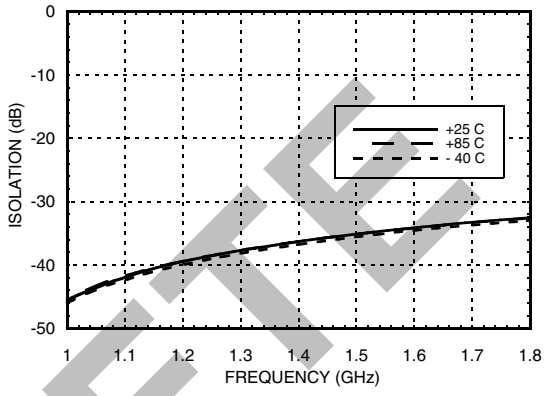

[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm

## 1200 to 1700 MHz Tune

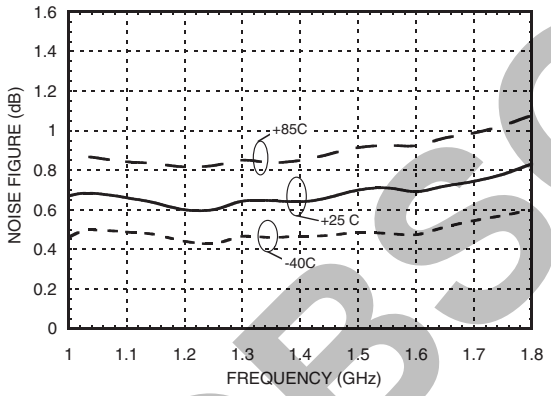
### Reverse Isolation vs. Temperature [1]



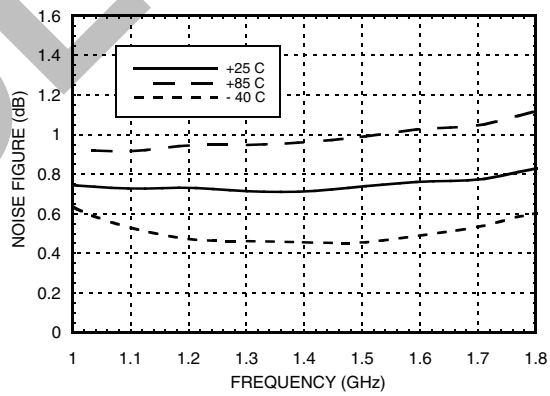

### Reverse Isolation vs. Temperature [2]



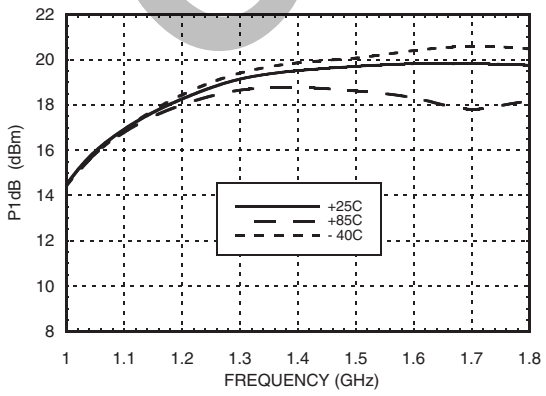

### Noise Figure vs. Temperature [1]



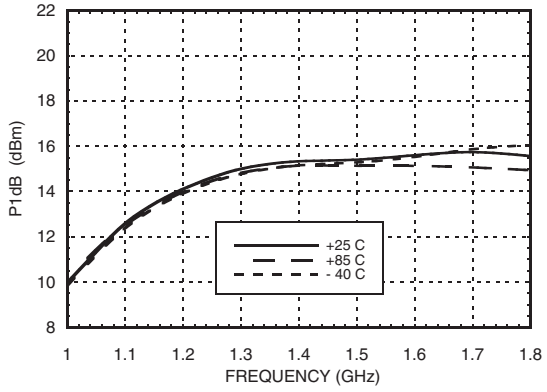

### Noise Figure vs. Temperature [2]




### Output P1dB vs. Temperature [1]




### Output P1dB vs. Temperature [2]




[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm

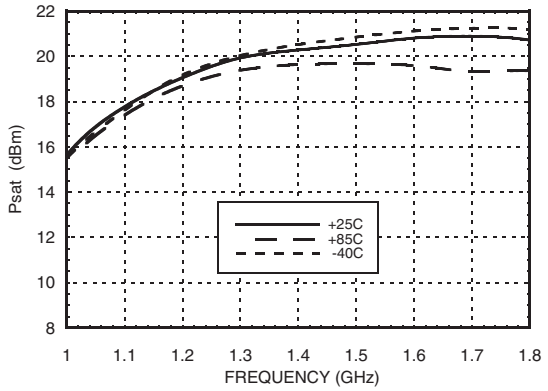
OBSOLETE

# HMC618LP3 / 618LP3E

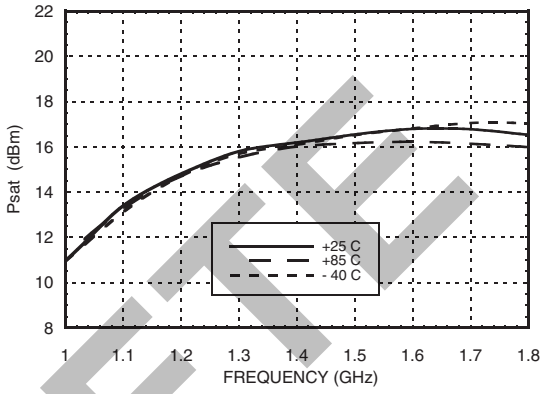
## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

### 1200 to 1700 MHz Tune

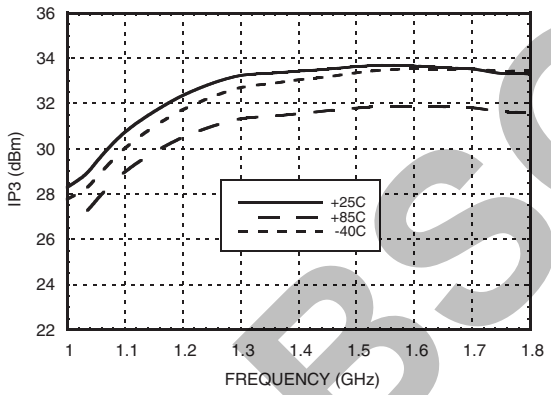
### Psat vs. Temperature [1]



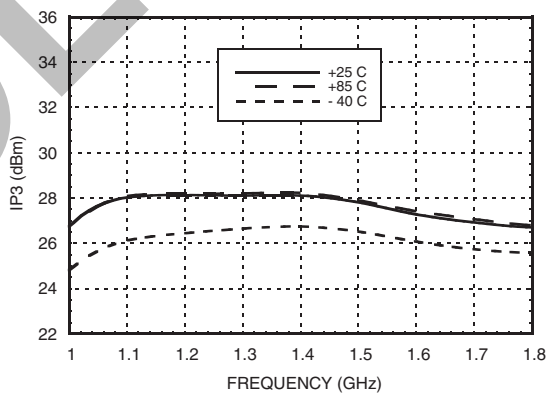

### Psat vs. Temperature [2]




### Output IP3 vs. Temperature [1]




### Output IP3 vs. Temperature [2]




OBSOLETE

### Absolute Bias Resistor Range & Recommended Bias Resistor Values for Idd

| Vdd1 = Vdd2 (V) | Rbias | | | Idd1 + Idd2 (mA) |
|---|---|---|---|---|
| | Min (Ohms) | Max (Ohms) | R1 (Ohms) | |
| 3V | 1K [3] | Open Circuit | 1k | 28 |
| | | | 1.5k | 34 |
| | | | 10k | 47 |
| 5V | 0 | Open Circuit | 120 | 71 |
| | | | 270 | 84 |
| | | | 470 | 89 |

[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K Ohm
[3] With Vdd= 3V and Rbias < 1K Ohm may result in the part becoming conditionally stable which is not recommended.

# HMC618LP3 / 618LP3E

## GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz



### Absolute Maximum Ratings

| | |
|---|---|
| Drain Bias Voltage (Vdd1, Vdd2) | +6V |
| RF Input Power (RFIN) (Vdd = +5 Vdc) | +10 dBm |
| Channel Temperature | 150 °C |
| Continuous Pdiss (T= 85 °C) (derate 9.68 mW/°C above 85 °C) | 0.63 W |
| Thermal Resistance (channel to ground paddle) | 103.4 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

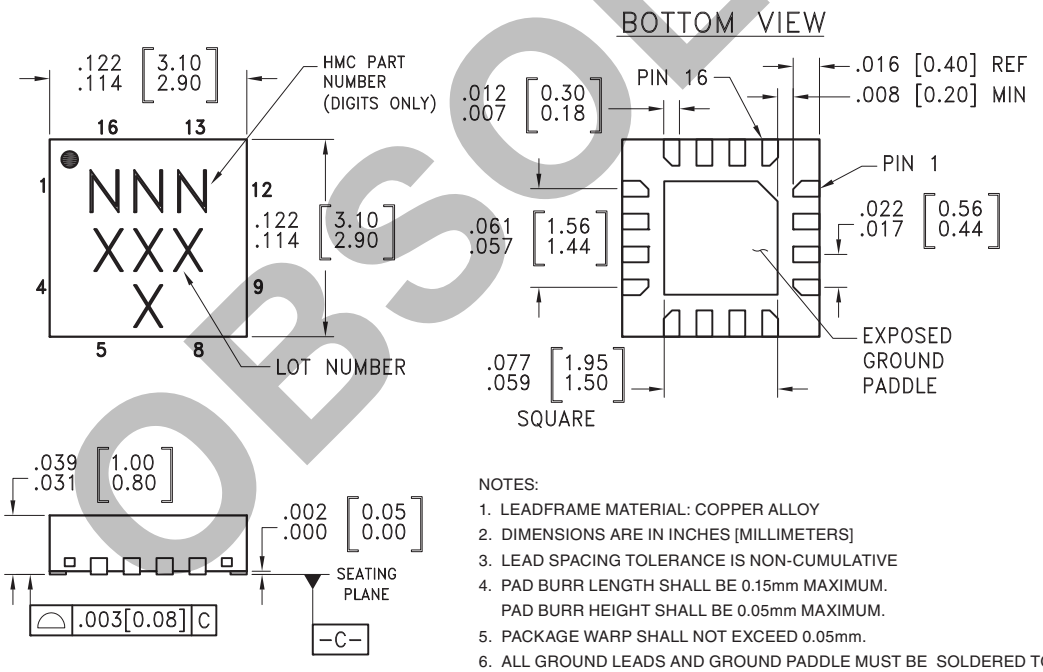
### Typical Supply Current vs. Vdd
### Rbias = 10 KOhm for 3V
### Rbias = 470 Ohm for 5V

| Vdd (Vdc) | Idd (mA) |
|---|---|
| 2.7 | 35 |
| 3.0 | 47 |
| 3.3 | 58 |
| 4.5 | 72 |
| 5.0 | 89 |
| 5.5 | 106 |

*Note: Amplifier will operate over full voltage ranges shown above.*

OBSOLETE

### Outline Drawing



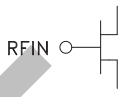
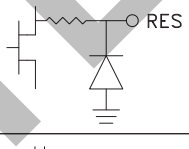
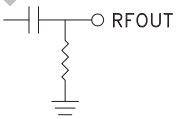
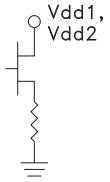

NOTES:

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.

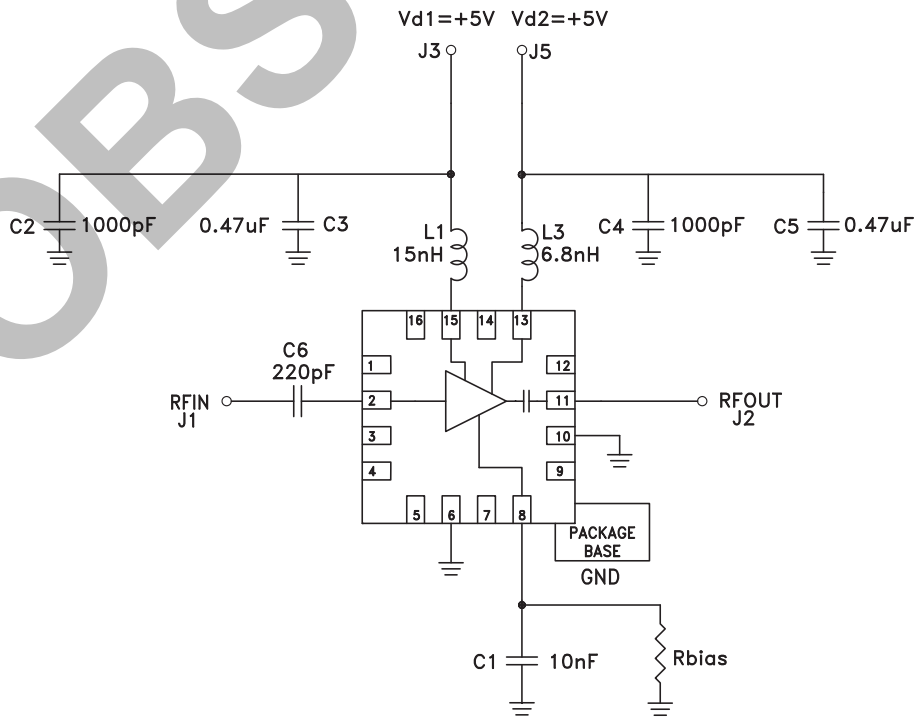
### Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [3] |
|---|---|---|---|---|
| HMC618LP3 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 [1] | 618<br>XXXX |
| HMC618LP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | 618<br>XXXX |

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 3 - 5, 7, 9, 12, 14, 16 | N/C | No connection required. These pins may be connected to RF/DC ground without affecting performance. | |
| 2 | RFIN | This pin is DC coupled and matched to 50 Ohms. |   |
| 6, 10 | GND | This pin and ground paddle must be connected to RC/DC ground. |   |
| 8 | RES | This pin is used to set the DC current of the amplifier by selection of the external bias resistor. See application circuit. |   |
| 11 | RFOUT | This pin is matched to 50 Ohms. |   |
| 13, 15 | Vdd2, Vdd1 | Power Supply Voltage for the amplifier. External bypass capacitors of 1000 pF, and 0.47 µF are required. |   |

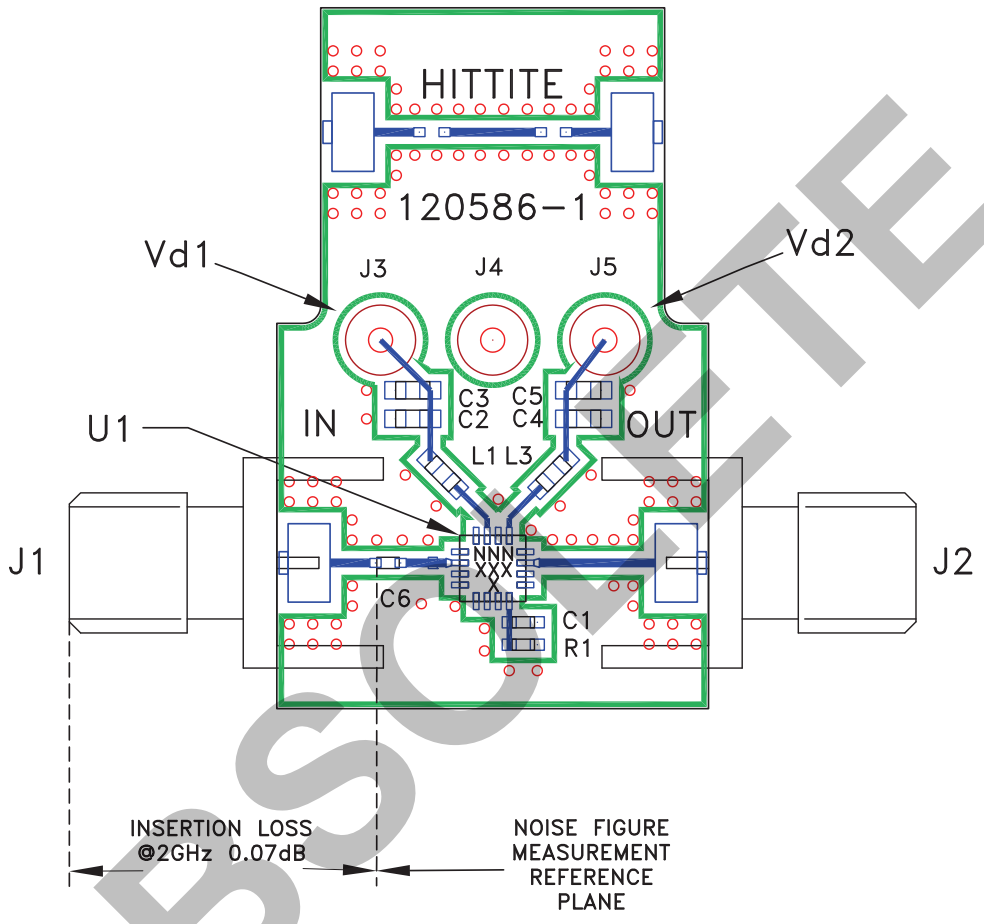
## Application Circuit, 1700 to 2200 MHz Tune




[1] Vdd = 5V, Rbias = 470 Ohm [2] Vdd = 3V, Rbias = 10K

OBSOLETE

### Evaluation PCB, 1700 to 2200 MHz Tune




OBSOLETE

### Evaluation PCB Ordering Information

| Item | Content | Part Number |
|---|---|---|
| Evaluation PCB | HMC618LP3E Evaluation PCB | 117905-HMC618LP3E |

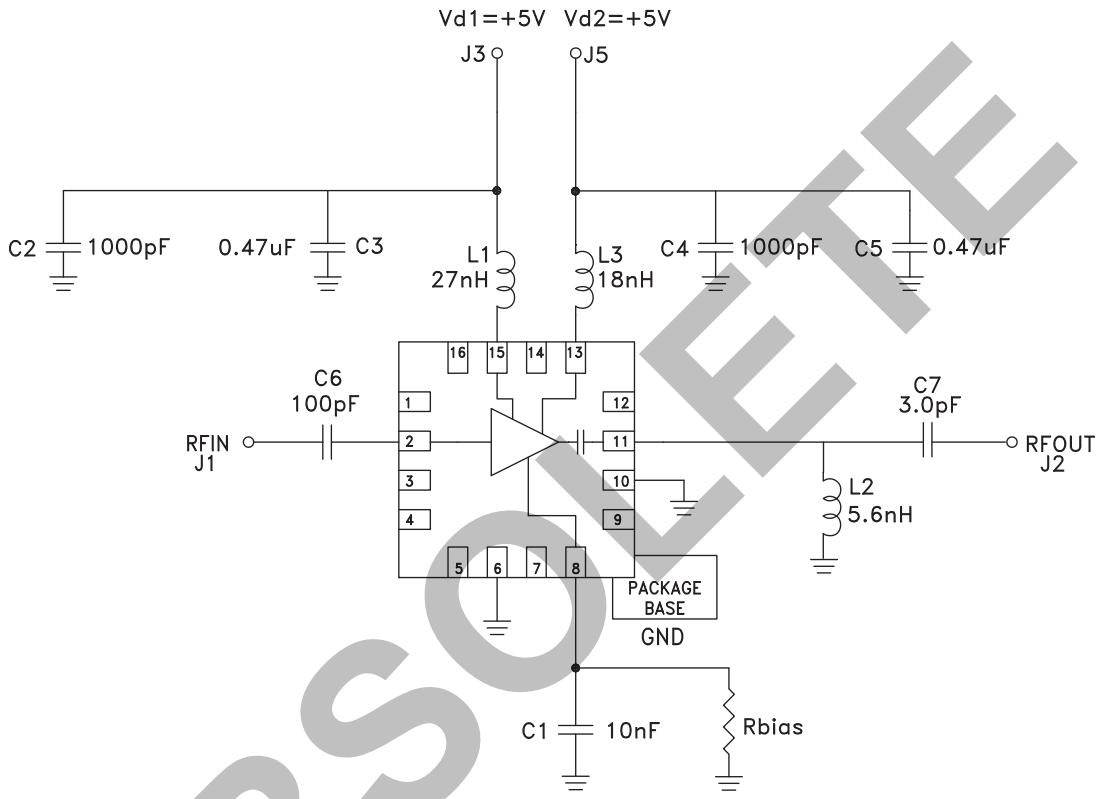
The circuit board used in this application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect 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.

### List of Materials for Evaluation PCB

| Item | Description |
|---|---|
| J1, J2 | PCB Mount SMA RF Connector |
| J3 - J5 | DC Pin |
| C2, C4 | 1000 pF Capacitor, 0603 Pkg.. |
| C3, C5 | 0.47 µF Capacitor, Tantalum |
| L1 | 15 nH, Inductor, 0603 Pkg. |
| L3 | 6.8 nH, Inductor, 0603 Pkg. |
| C6 | 220 pF Capacitor, 0402 Pkg. |
| C1 | 10 nF Capacitor, 0402 Pkg. |
| R1 | 470 Ohm resistor, 0402 Pkg. |
| U1 | HMC618LP3(E) Amplifier |
| PCB [2] | 120586 Evaluation PCB |

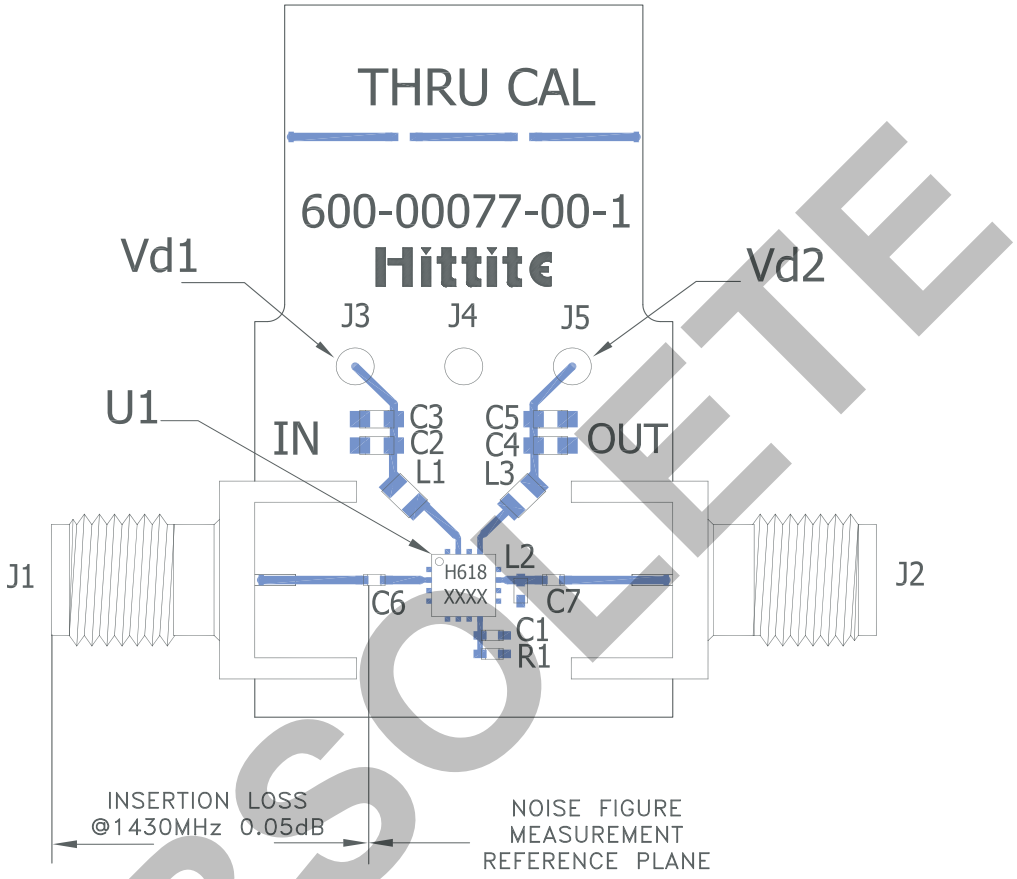
[1] Reference this number when ordering complete evaluation PCB

### Application Circuit, 1200 to 1700 MHz Tune




OBSOLETE

### Evaluation PCB, 1200 to 1700 MHz Tune




OBSOLETE

### Evaluation PCB Ordering Information

| Item | Content | Part Number |
|---|---|---|
| Evaluation PCB | HMC618LP3E Evaluation PCB | EVAL01-HMC618LP3E |

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.

### List of Materials for Evaluation PCB

| Item | Description |
|---|---|
| J1, J2 | PCB Mount SMA RF Connector |
| J3 - J5 | DC Pin |
| C1 | 10 nF Capacitor, 0402 Pkg. |
| C2, C4 | 1000 pF Capacitor, 0603 Pkg.. |
| C3, C5 | 0.47 µF Capacitor, 0603 Pkg. |
| C6 | 100 pF Capacitor, 0402 Pkg. |
| C7 | 3 pF Capacitor, 0402 Pkg. |
| L1 | 27 nH, Inductor, 0603 Pkg. |
| L2 | 5.6 nH, Inductor, 0603 Pkg. |
| L3 | 18 nH, Inductor, 0603 Pkg. |
| R1 | 470 Ohm resistor, 0402 Pkg. |
| U1 | HMC618LP3(E) Amplifier |
| PCB [1] | 120586 Evaluation PCB |

[1] Circuit Board Material: Rogers 4350.