**Typical Applications**

The HMC618ALP3E 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 mm²

**General Description**

The HMC618ALP3E 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 HMC618ALP3E shares the same package and pinout with the HMC617LP3E 0.55 - 1.2 GHz LNA. The HMC618ALP3E 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 HMC618ALP3E offers improved noise figure versus the previously released HMC375LP3(E) and the HMC382LP3(E).

**Functional Diagram**

![Functional Diagram of HMC618ALP3E](image)

**Electrical Specifications**

\[ T_a = +25^\circ C, \text{Rbias} = 470 \text{ Ohm for Vdd1 = Vdd2 = 5V} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Vdd = 5 Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>1200 - 1700 MHz, 1700 - 2000 MHz, 2000 - 2200 MHz</td>
</tr>
<tr>
<td>Gain</td>
<td>19, 23, 16, 19, 13.5, 17 dB</td>
</tr>
<tr>
<td>Gain Variation Over Temperature</td>
<td>0.012, 0.008, 0.008 dB/°C</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>0.65, 0.85, 0.75, 1.1 dB</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>22.5, 18, 19.5 dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>13, 12.5, 10 dB</td>
</tr>
<tr>
<td>Output Power for 1 dB Compression (P1dB)</td>
<td>19, 16.5, 20 dB</td>
</tr>
<tr>
<td>Saturated Output Power (Psat)</td>
<td>20.5, 20.5 dB</td>
</tr>
<tr>
<td>Output Third Order Intercept (IP3)</td>
<td>29.4, 33.5, 30.4 dB</td>
</tr>
<tr>
<td>Supply Current (Idd)</td>
<td>89 mA, 118 mA</td>
</tr>
</tbody>
</table>

* Rbias resistor sets current, see application circuit herein
HMC618ALP3E
GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

Electrical Specifications

\[ T_a = +25^\circ C, \text{Rbias} = 10 \text{K Ohm for Vdd1} = \text{Vdd2} = 3 \text{V} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Vdd = 3 Vdc</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>1200 - 1700</td>
<td>1700 - 2000</td>
</tr>
<tr>
<td>Gain</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Gain Variation Over Temperature</td>
<td>0.009</td>
<td>0.009</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Output Power for 1 dB Compression (P1dB)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Saturated Output Power (Psat)</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Output Third Order Intercept (IP3)</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Supply Current (Idd)</td>
<td>47</td>
<td>65</td>
</tr>
</tbody>
</table>

* Rbias resistor sets current, see application circuit herein

1700 to 2200 MHz Tune

Broadband Gain & Return Loss

Gain vs. Temperature

Input Return Loss vs. Temperature

[1] Vdd = 5V, Rbias = 470 Ohm
[2] Vdd = 3V, Rbias = 10K Ohm
HMC618ALP3E
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 \[1\] \[2\]


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GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

1700 to 2200 MHz Tune

Output IP3 and Idd vs. Supply Voltage @ 1700 MHz [1]

Output IP3 and Idd vs. Supply Voltage @ 1700 MHz [2]

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

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

Power Compression @ 1700 MHz [1]

Power Compression @ 1700 MHz [2]

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GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

1700 to 2200 MHz Tune

Power Compression @ 2100 MHz

Gain, Power & Noise Figure vs. Supply Voltage @ 1700 MHz

Gain, Power & Noise Figure vs. Supply Voltage @ 2100 MHz

[1] Vdd = 5V, Rbias = 470 Ohm
[2] Vdd = 3V, Rbias = 10K Ohm
GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

1700 to 2200 MHz Tune

Output IP3 vs. Rbias @ 1700 MHz

Gain, Noise Figure vs. Rbias @ 1700 MHz

Output IP3 vs. Rbias @ 2100 MHz

Gain, Noise Figure vs. Rbias @ 2100 MHz


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1200 to 1700 MHz Tune

Gain vs. Temperature \(^{(1)}\)

[Graph showing Gain vs. Temperature with different temperatures and frequency ranges.]

Gain vs. Temperature \(^{(2)}\)

[Graph showing Gain vs. Temperature with different temperatures and frequency ranges.]

Input Return Loss vs. Temperature \(^{(1)}\)

[Graph showing Input Return Loss vs. Temperature with different temperatures and frequency ranges.]

Input Return Loss vs. Temperature \(^{(2)}\)

[Graph showing Input Return Loss vs. Temperature with different temperatures and frequency ranges.]

Output Return Loss vs. Temperature \(^{(1)}\)

[Graph showing Output Return Loss vs. Temperature with different temperatures and frequency ranges.]

Output Return Loss vs. Temperature \(^{(2)}\)

[Graph showing Output Return Loss vs. Temperature with different temperatures and frequency ranges.]


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1200 to 1700 MHz Tune

Reverse Isolation vs. Temperature [1]

Noise Figure vs. Temperature [1]

Output P1dB vs. Temperature [1]

Reverse Isolation vs. Temperature [2]

Noise Figure vs. Temperature [2]

Output P1dB vs. Temperature [2]


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GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

1200 to 1700 MHz Tune

Psat vs. Temperature [1]

Output IP3 vs. Temperature [1]

Psat vs. Temperature [2]

Output IP3 vs. Temperature [2]

Absolute Bias Resistor
Range & Recommended Bias Resistor Values for Idd

<table>
<thead>
<tr>
<th>Vdd1 = Vdd2 (V)</th>
<th>Rbias</th>
<th>R1 (Ohms)</th>
<th>Idd1 + Idd2 (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3V</td>
<td>1K [3]</td>
<td>Open Circuit</td>
<td>1k</td>
</tr>
<tr>
<td></td>
<td>1.5k</td>
<td></td>
<td>1.5k</td>
</tr>
<tr>
<td></td>
<td>10k</td>
<td></td>
<td>10k</td>
</tr>
<tr>
<td>5V</td>
<td>0</td>
<td>Open Circuit</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>270</td>
<td></td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>470</td>
<td></td>
<td>470</td>
</tr>
</tbody>
</table>

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

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HMC618ALP3E

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
- ESD Sensitivity (HBM): Class 1A, Passed 250V

Typical Supply Current vs. Vdd

Rbias = 10 KOhm for 3V
Rbias = 470 Ohm for 5V

<table>
<thead>
<tr>
<th>Vdd (Vdc)</th>
<th>Idd (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7</td>
<td>35</td>
</tr>
<tr>
<td>3.0</td>
<td>47</td>
</tr>
<tr>
<td>3.3</td>
<td>58</td>
</tr>
<tr>
<td>4.5</td>
<td>72</td>
</tr>
<tr>
<td>5.0</td>
<td>89</td>
</tr>
<tr>
<td>5.5</td>
<td>106</td>
</tr>
</tbody>
</table>

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

Electrostatic Sensitive Device
Observe Handling Precautions

Outline Drawing

Package Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package Body Material</th>
<th>Lead Finish</th>
<th>MSL Rating</th>
<th>Package Marking [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC618ALP3E</td>
<td>Alumina White</td>
<td>Gold over Nickel</td>
<td>MSL3 [1]</td>
<td>618A XXXX</td>
</tr>
</tbody>
</table>

[1] Max peak reflow temperature of 260 °C
[2] 4-Digit lot number XXXX
### Pin Description

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

### Application Circuit, 1700 to 2200 MHz Tune

![Application Circuit Diagram](image)

[1] Vdd = 5V, Rbias = 470 Ohm  

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**HMC618ALP3E**

GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

**Evaluation PCB, 1700 to 2200 MHz Tune**

**Evaluation PCB Ordering Information**

<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation PCB</td>
<td>HMC618ALP3E Evaluation PCB</td>
<td>EV2HMC618ALP3</td>
</tr>
</tbody>
</table>

**List of Materials for Evaluation PCB**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1, J2</td>
<td>PCB Mount SMA RF Connector</td>
</tr>
<tr>
<td>J3 - J5</td>
<td>DC Pin</td>
</tr>
<tr>
<td>C2, C4</td>
<td>1000 pF Capacitor, 0603 Pkg.</td>
</tr>
<tr>
<td>C3, C5</td>
<td>0.47 µF Capacitor, Tantalum</td>
</tr>
<tr>
<td>L1</td>
<td>15 nH, Inductor, 0603 Pkg.</td>
</tr>
<tr>
<td>L3</td>
<td>6.8 nH, Inductor, 0603 Pkg.</td>
</tr>
<tr>
<td>C6</td>
<td>220 pF Capacitor, 0402 Pkg.</td>
</tr>
<tr>
<td>C1</td>
<td>10 nF Capacitor, 0402 Pkg.</td>
</tr>
<tr>
<td>R1</td>
<td>470 Ohm resistor, 0402 Pkg.</td>
</tr>
<tr>
<td>U1</td>
<td>HMC618LP3(E) Amplifier</td>
</tr>
<tr>
<td>PCB [1]</td>
<td>120586 Evaluation PCB</td>
</tr>
</tbody>
</table>

[1] Reference this number when ordering complete evaluation PCB

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 Analog Devices, upon request.
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GaAs SMT pHEMT LOW NOISE AMPLIFIER, 1.2 - 2.2 GHz

Application Circuit, 1200 to 1700 MHz Tune

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Evaluation PCB, 1200 to 1700 MHz Tune

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 Analog Devices, upon request.