**HMC1082LP4E**

**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 5.5 - 18 GHz**

**Typical Applications**
The HMC1082LP4E is ideal for:
- Point-to-Point Radios
- Point-to-Multi-Point Radios
- VSAT & SATCOM
- Marine Radar
- Military EW & ECM

**Features**
- High Saturated Output Power: 26 dBm @ 26% PAE
- High Output IP3: 35 dBm
- High Gain: 22 dB
- High P1dB Output Power: 24 dBm
- DC Supply: +5V @ 220 mA
- Compact 24 Lead 4x4 mm SMT Package: 16 mm³

**General Description**
The HMC1082LP4E is a GaAs pHEMT MMIC driver amplifier with an integrated temperature compensated on-chip power detector which operates between 5.5 and 18 GHz. The amplifier provides 22 dB of gain, +35 dBm Output IP3, and +24 dBm of output power at 1 dB gain compression, while requiring 220 mA from a +5V supply. The HMC1082LP4E is capable of supplying +26 dBm of saturated output power with 26 % PAE and is housed in a compact leadless 4x4 mm plastic surface mount package.

The HMC1082LP4E is an ideal driver amplifier for a wide range of applications including point-to-point radio from 5.5 to 18 GHz and marine radar at 9 GHz. The HMC1082LP4E may also be used for 6 to 18 GHz EW and ECM applications.

**Functional Diagram**

**Electrical Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>5.5 - 6.5</td>
<td>6.5 - 17</td>
<td>17 - 18</td>
<td>GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>21.5</td>
<td>23.5</td>
<td>20.5</td>
<td>22.5</td>
<td>20</td>
<td>22</td>
<td>dB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain Variation over temperature</td>
<td>0.0121</td>
<td>0.0101</td>
<td>0.015</td>
<td>dB/C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>22</td>
<td>12</td>
<td>7.5</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>10</td>
<td>14</td>
<td>17.5</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Power for 1 dB Compression (P1dB)</td>
<td>21</td>
<td>24</td>
<td>21</td>
<td>24</td>
<td>20.5</td>
<td>23.5</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturated Output Power (Psat)</td>
<td>25.5</td>
<td>26</td>
<td>24.5</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Third Order Intercept (IP3)</td>
<td>36</td>
<td>35</td>
<td>33.5</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Current (Idd)</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[1] Adjust Vgg between -2 to 0V to achieve Idd = 220mA typical
**HMC1082LP4E**

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**Broadband Gain & Return Loss**

- **Gain** vs. **Temperature**
  - Frequency (GHz)
  - Gain (dB)
  - 4V, 4.5V, 5V

- **Input Return Loss vs. Temperature**
  - Frequency (GHz)
  - Return Loss (dB)
  - 25°C, 85°C, -40°C

- **Output Return Loss vs. Temperature**
  - Frequency (GHz)
  - Return Loss (dB)
  - 25°C, 85°C, -40°C

- **P1dB vs. Temperature**
  - Frequency (GHz)
  - P1dB (dBm)
  - 25°C, 85°C, -40°C

- **P1dB vs. Supply Voltage**
  - Frequency (GHz)
  - P1dB (dBm)
  - 4V, 4.5V, 5V

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HMC1082LP4E
v05.1018
GaAs pHEMT MMIC MEDIUM
POWER AMPLIFIER, 5.5 - 18 GHz

Psat vs. Temperature

Psat vs. Supply Voltage

P1dB vs. Supply Current

Psat vs. Supply Current

Output IP3 vs. Temperature

Output IP3 vs. Supply Current

[1] Pout/Tone = +12 dBm
HMC1082LP4E
GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 5.5 - 18 GHz

**Output IP3 vs. Supply Voltage**

- Frequency (GHz): 5.5, 8, 10.5, 13, 15.5, 18
- Supply Voltages: 4V, 4.5V, 5V
- IP3 (dBm): 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

**Output IM3 @ Vdd = +4V**

- Frequency (GHz): 7 GHz, 9 GHz, 12 GHz, 15 GHz, 17 GHz
- IM3 (dBc): 20, 30, 40, 50, 60, 70
- Pout/TONE (dBm): 4, 6, 8, 10, 12, 14, 16

**Output IM3 @ Vdd = +4.5V**

- Frequency (GHz): 7 GHz, 9 GHz, 12 GHz, 15 GHz, 17 GHz
- IM3 (dBc): 20, 30, 40, 50, 60, 70
- Pout/TONE (dBm): 4, 6, 8, 10, 12, 14, 16

**Output IM3 @ Vdd = +5V**

- Frequency (GHz): 7 GHz, 9 GHz, 12 GHz, 15 GHz, 17 GHz
- IM3 (dBc): 20, 30, 40, 50, 60, 70
- Pout/TONE (dBm): 4, 6, 8, 10, 12, 14, 16

**Power Compression @ 12 GHz**

- Gain (dB), P1dB (dBm), PSat (dBm)
- P1dB: 20, 30, 40, 50, 60, 70
- PSat: 4, 6, 8, 10, 12, 14, 16
- Pout/TONE (dBm): 4, 6, 8, 10, 12, 14, 16

**Gain & Power vs. Supply Current**

- Gain (dB), P1dB (dBm), PSat (dBm)
- Gain: 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40
- P1dB: 4, 6, 8, 10, 12, 14, 16
- PSat: 20, 22, 24, 26
- Input Power (dBm): -8, -6, -4, -2, 0, 2, 4, 6, 8, 10, 12, 14, 16
- Idd (mA): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

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[1] Pout/Tone = +12 dBm

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Gain & Power vs. Supply Voltage

Reverse Isolation vs. Temperature

Power Dissipation

Detector Voltage vs. Temperature @ 6 GHz

Detector Voltage vs. Temperature @ 12 GHz

Detector Voltage vs. Temperature @ 18 GHz
**HMC1082LP4E**

**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 5.5 - 18 GHz**

**Notes:**

*Additive Phase Noise Vs Offset Frequency, RF Frequency = 8 GHz, RF Input Power = 3 dBm (P1dB)*

![Graph showing Iddq Vs Vgg](chart1)

![Graph showing Phase Noise Vs Offset Frequency](chart2)
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**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 5.5 - 18 GHz**

### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Bias Voltage (Vdd)</td>
<td>5.5V</td>
</tr>
<tr>
<td>RF Input Power (RFIN)</td>
<td>20 dBm</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>175 °C</td>
</tr>
<tr>
<td>Continuous Pdiss (T=85 °C) (derate 20mW/°C)</td>
<td>1.81W</td>
</tr>
<tr>
<td>Thermal Resistance (RTH) (junction to ground paddle)</td>
<td>49.8 °C/W</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to 150°C</td>
</tr>
<tr>
<td>ESD Sensitivity (HBM)</td>
<td>Class 0, Passed 100V</td>
</tr>
</tbody>
</table>

### Typical Supply Current vs. Vdd

<table>
<thead>
<tr>
<th>Vdd (V)</th>
<th>Idd (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4</td>
<td>220</td>
</tr>
<tr>
<td>+4.5</td>
<td>220</td>
</tr>
<tr>
<td>+5</td>
<td>220</td>
</tr>
</tbody>
</table>

Adjust Vgg1 to achieve Idd = 220mA

**Electrostatic Sensitive Device**

**Observe Handling Precautions**

### Outline Drawing

**Package Information**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC1082LP4E</td>
<td>RoHS-compliant Low Stress Injection Molded Plastic</td>
<td>100% matte Sn</td>
<td>MSL1</td>
<td>H1082 XXXX</td>
</tr>
</tbody>
</table>

[1] 4-Digit lot number XXXX
### Pin Descriptions

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Function</th>
<th>Description</th>
<th>Pin Schematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 5, 6, 7, 8, 10, 13, 14, 17, 18, 19, 21, 23</td>
<td>N/C</td>
<td>These pins are not connected internally, however all data shown herein was measured with these pins connected to RF/DC ground externally.</td>
<td><img src="image1" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>3</td>
<td>RF IN</td>
<td>This pin is DC coupled and matched to 50 Ohms.</td>
<td><img src="image2" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>4, 15</td>
<td>GND</td>
<td>These pins and package bottom must be connected to RF/DC ground.</td>
<td><img src="image3" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>9</td>
<td>Vgg</td>
<td>Gate control for amplifier. External bypass capacitors of 1000pF, 100pF and 2.2uF are required.</td>
<td><img src="image4" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>11</td>
<td>Vref</td>
<td>DC bias of diode biased through external resistor used for temperature compensation of Vdet. See application circuit.</td>
<td><img src="image5" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>12</td>
<td>Vdet</td>
<td>DC voltage representing RF output power rectified by diode which is biased through an external resistor. See application circuit.</td>
<td><img src="image6" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>16</td>
<td>RF OUT</td>
<td>This pin is DC coupled and matched to 50 Ohms.</td>
<td><img src="image7" alt="Pin Schematic" /></td>
</tr>
<tr>
<td>24, 22, 20</td>
<td>Vdd1, Vdd2, Vdd3</td>
<td>Drain bias voltage for amplifier. External bypass capacitors of 1000pF, 100pF and 2.2uF are required.</td>
<td><img src="image8" alt="Pin Schematic" /></td>
</tr>
</tbody>
</table>
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Application Circuit

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The circuit board used in the 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 circuit board shown is available from Analog Devices upon request.

List of Materials for Evaluation PCB EV1HMC1082LP4

<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>J5 - J12</td>
<td>DC Pin</td>
</tr>
<tr>
<td>C1 - C4</td>
<td>100pF Capacitor, 0402 Pkg.</td>
</tr>
<tr>
<td>C5 - C8</td>
<td>1000pF Capacitor, 0402 Pkg</td>
</tr>
<tr>
<td>C9 - C12</td>
<td>2.2uF Capacitor, 0402 Pkg.</td>
</tr>
<tr>
<td>R1, R2</td>
<td>40.2k Ohm Resistor, 0402 Pkg.</td>
</tr>
<tr>
<td>U1</td>
<td>HMC1082LP4E</td>
</tr>
<tr>
<td>PCB [2]</td>
<td>600-00819-00 Evaluation Board</td>
</tr>
</tbody>
</table>

[1] Reference this number when ordering Complete Evaluation PCB