**Typical Applications**

The HMC907APM5E is ideal for:

- Test Instrumentation
- Military & Space

**Features**

- High P1dB Output Power: +28 dBm
- High Gain: 14 dB
- High Output IP3: +40 dBm
- Single Supply: +10 V @ 350 mA
- 50 Ohm Matched Input/Output
- 32 Lead 5x5 mm SMT Package: 25 mm²

**General Description**

The HMC907APM5E is a GaAs MMIC pHEMT Distributed Power Amplifier which operates between 0.2 and 22 GHz. This self-biased power amplifier provides 14 dB of gain, +40 dBm output IP3 and +28 dBm of output power at 1 dB gain compression while requiring only 350 mA from a +10 V supply. Gain flatness is excellent at ±0.7 dB from 0.2 to 22 GHz making the HMC907APM5E ideal for EW, ECM, Radar and test equipment applications. The HMC907APM5E amplifier I/Os are internally matched to 50 Ohms facilitating integration into Multi-Chip-Modules (MCMs) and is packaged in a leadless QFN 5x5 mm surface mount package, and requires no external matching components.

**Electrical Specifications, $T_A = +25° C$, $Vdd = +10 V$, $Idd = 350 mA$**

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>0.2 - 10</td>
<td>10 - 18</td>
<td>18 - 22</td>
<td>GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>13</td>
<td>12</td>
<td>14</td>
<td>dB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain Flatness</td>
<td>±0.7</td>
<td>±0.6</td>
<td>±0.7</td>
<td>dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gain Variation Over Temperature</td>
<td>0.01</td>
<td>0.013</td>
<td>0.014</td>
<td>dB/°C</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>15</td>
<td>15</td>
<td>18</td>
<td>dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>dB</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>25</td>
<td>27</td>
<td>25.5</td>
<td>28</td>
<td>24.5</td>
<td>27.5</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Saturated Output Power (Psat)</td>
<td>29</td>
<td>28.5</td>
<td>29</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>38.5</td>
<td>40</td>
<td>40</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Figure</td>
<td>6</td>
<td>3</td>
<td>3.5</td>
<td>dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiescent Current (Idq) at (Vdd= 10V)</td>
<td>350</td>
<td>430</td>
<td>350</td>
<td>430</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Voltage (Vdd)</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>8</td>
<td>10</td>
<td>11</td>
<td>V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GaAs pHEMT MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

**Broadband Gain and Return Loss**

**Low Frequency Gain and Return Loss**

**Gain vs. Temperature**

**Gain vs. Vdd**

**Input Return Loss vs. Temperature**

**Input Return Loss vs. Vdd**

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Application Support: Phone: 1-800-ANALOG-D
HMC907APM5E

GaAs pHEMT MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

P1dB vs. Vdd

Low Frequency Psat vs. Temperature

Psat vs. Temperature

Psat vs. Vdd

Power Compression @ 2 GHz

Power Compression @ 6 GHz

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POWER AMPLIFIER, 0.2 - 22 GHz

Power Compression @ 10 GHz

Power Compression @ 14 GHz

Power Compression @ 18 GHz

Power Compression @ 22 GHz

PAE @ Psat vs. Frequency

Power Dissipation @ 85 C
HMC907APM5E

GaAs pHEMT MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

Gain & Power vs. Vdd @ 2 GHz

Gain & Power vs. Vdd @ 6 GHz

Gain & Power vs. Vdd @ 10 GHz

Gain & Power vs. Vdd @ 14 GHz

Gain & Power vs. Vdd @ 18 GHz

Gain & Power vs. Vdd @ 22 GHz

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POWER AMPLIFIER, 0.2 - 22 GHz

Low Frequency OIP3 vs. Temperature
@ Pout / Tone = +16 dBm

OIP3 vs. Temperature
@ Pout / Tone = +16 dBm

OIP3 vs Vdd
@ Pout/Tone = +16 dBm

Output IM3 @ Vdd = +8 V

Output IM3 @ Vdd = +9 V

Output IM3 @ Vdd = +10 V

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**GaAs pHEMT MMIC**

**POWER AMPLIFIER, 0.2 - 22 GHz**

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**Output IM3 @ Vdd = +11 V**

- **Graph showing IM3 (dBc) vs. Pout/TONE (dBm)**
  - Frequency bands: 2GHz, 6GHz, 10GHz, 14GHz, 18GHz, 22GHz
  - Temperature: +25°C, +85°C, -40°C

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**Second Harmonics vs. Temperature**

- **Graph showing Second Harmonic (dBc) vs. Frequency (GHz)**
  - Power level: +16 dBm
  - Temperature: +25°C, +85°C, -40°C

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**Second Harmonics vs. Vdd**

- **Graph showing Second Harmonics vs. Vdd @ Pout = +16 dBm**
  - Frequency bands: 8V, 9V, 10V, 11V

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**Second Harmonics vs. Pout @ Vdd = 10V**

- **Graph showing Second Harmonics vs. Pout @ Vdd = 10V**
  - Frequency bands: +10dBm, +12dBm, +14dBm, +16dBm, +18dBm, +20dBm, +22dBm

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**Low Frequency OIP2 vs. Temperature**

- **Graph showing Low Frequency OIP2 vs. Temperature @ Pout/tone = +16 dBm**
  - Temperature: +25°C, +85°C, -40°C

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**OIP2 vs. Temperature**

- **Graph showing OIP2 vs. Temperature @ Pout/tone = +16 dBm**
  - Temperature: +25°C, +85°C, -40°C
HMC907APM5E

GaAs pHfET MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

OIP2 vs. Vdd
@ Pout/tone = +16 dBm

Supply Current vs. Supply Voltage

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Drain Supply to GND</td>
<td>+12.0 V</td>
</tr>
<tr>
<td>Continuous Pdiss (T= 85 °C) (derate 60 mW/°C above 85 °C)</td>
<td>5.4 W</td>
</tr>
<tr>
<td>RF Input Power</td>
<td>+25 dBm</td>
</tr>
<tr>
<td>Output Load VSWR</td>
<td>7:1</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65 to 150 °C</td>
</tr>
<tr>
<td>Max Peak Reflow Temperature</td>
<td>260 °C</td>
</tr>
<tr>
<td>ESD Sensitivity (HBM)</td>
<td>Class 1A, passed 250V</td>
</tr>
</tbody>
</table>

Reliability Information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction Temperature to Maintain 1 Million Hour MTTF</td>
<td>175 °C</td>
</tr>
<tr>
<td>Nominal Junction Temperature (T=85 °C, Vdd = 10 V)</td>
<td>143.45 °C</td>
</tr>
<tr>
<td>Thermal Resistance (channel to ground paddle)</td>
<td>16.7 °C/W</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40 to +85 °C</td>
</tr>
</tbody>
</table>

Electrostatic Sensitive Device
Observe Handling Precautions

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only, functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.
HMC907APM5E
GaAs pHEMT MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

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</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC907APM5E</td>
<td>RoHS-compliant Low Stress Pre-Molded Plastic</td>
<td>NiPdAu</td>
<td>MSL3 [1]</td>
<td>HMC907A</td>
</tr>
<tr>
<td>HMC907APM5ETR</td>
<td>RoHS-compliant Low Stress Pre-Molded Plastic</td>
<td>NiPdAu</td>
<td>MSL3 [1]</td>
<td>HMC907A</td>
</tr>
</tbody>
</table>

[1] Max peak reflow temperature of 260 °C

Pin Descriptions

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Function</th>
<th>Description</th>
<th>Interface Schematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 4, 6, 8, 9, 16, 17, 20, 22, 24, 25, 32</td>
<td>GND</td>
<td>These pins &amp; exposed ground paddle must be connected to RF/DC ground.</td>
<td><img src="image" alt="Interface Schematic" /></td>
</tr>
<tr>
<td>2 - 3, 7, 10 - 15, 18 - 19, 23, 26 - 31</td>
<td>N/C</td>
<td>No connection required. These pins may be connected to RF/DC ground without affecting performance.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>RFIN</td>
<td>This pad is DC coupled and matched to 50 Ohms.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>RFOUT &amp; VDD</td>
<td>RF output for amplifier. Connect DC bias (Vdd) network to provide drain current (Idd). See application circuit herein.</td>
<td></td>
</tr>
</tbody>
</table>
HMC907APM5E

GaAs pHEMT MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

Evaluation PCB

Evaluation Order Information

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation PCB only</td>
<td>HMC907APM5E Evaluation PCB</td>
<td>EV1HMC907APM5[1]</td>
</tr>
</tbody>
</table>

[1] Reference this number when ordering Evaluation PCB Only

List of Materials for Evaluation Board EV1HMC907APM5

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1, J2</td>
<td>PCB Mount K Connectors</td>
</tr>
<tr>
<td>U1</td>
<td>HMC907APM5E Power Amplifier</td>
</tr>
<tr>
<td>PCB [1]</td>
<td>600-01711-00 Evaluation PCB</td>
</tr>
</tbody>
</table>

[1] Circuit Board Material: Rogers 4350 or Arlon FR4

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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Analog Devices, Inc.
HMC907APM5E
GaAs pHEMT MMIC
POWER AMPLIFIER, 0.2 - 22 GHz

Application Circuit

NOTE 1: Drain Bias (Vdd) must be applied through a broadband bias tee or external bias network.

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