**HMC1040LP3CE**

**GaAs pHEMT MMIC LOW NOISE AMPLIFIER, 24 - 43.5 GHz**

### Typical Applications
This HMC1040LP3BE is ideal for:
- Point-to-Point Radios
- Test Instrumentation
- SatCom Transponders & VSAT
- Industrial Sensors
- EW & ECM Subsystems

### Features
- Low Noise Figure: 2.2 dB
- High Gain: 23 dB
- P1dB Output Power: +12 dBm
- Single Supply: +2.5V @ 70 mA
- Output IP3: +22 dBm
- 50 Ohm Matched Input/Output
- 16 Lead 3x3 mm SMT Package: 16mm²

### General Description
The HMC1040LP3CE is a self-biased GaAs MMIC Low Noise Amplifier housed in a leadless 3x3 mm plastic surface mount package. The amplifier operates between 24 and 43.5 GHz, delivering 23 dB of small signal gain, 2.2 dB noise figure, and output IP3 of +22 dBm, while requiring only 70 mA from a +2.5 V supply. The P1dB output power of +12 dBm enables the LNA to function as a LO driver for many of Hittite's balanced, I/Q and image reject mixers. The HMC1040LP3CE features I/Os that are DC blocked and internally matched to 50 Ohms, and is ideal for high capacity microwave radios and VSAT applications.

### Functional Diagram

![Functional Diagram](image)

### Electrical Specifications, $T_A = +25^\circ\text{C}$, $Vdd1 = Vdd2 = Vdd3 = +2.5\text{V}$, $Idd = 70\text{ mA}$

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>24 - 27.5</td>
<td>27.5 - 33.5</td>
<td>33.5 - 43.5</td>
<td>GHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gain [1]</td>
<td>22</td>
<td>25</td>
<td>20</td>
<td>23</td>
<td>17</td>
<td>20</td>
<td>dB</td>
<td></td>
<td></td>
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<tr>
<td>Gain Variation over Temperature</td>
<td>0.022</td>
<td>0.021</td>
<td>0.021</td>
<td>dB /°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Noise Figure [1]</td>
<td>2.7</td>
<td>3.2</td>
<td>2.2</td>
<td>2.7</td>
<td>2.7</td>
<td>3.2</td>
<td>dB</td>
<td></td>
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<tr>
<td>Input Return Loss</td>
<td>11</td>
<td>12</td>
<td>10</td>
<td>dB</td>
<td></td>
<td></td>
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<tr>
<td>Output Return Loss</td>
<td>16</td>
<td>13</td>
<td>10</td>
<td>dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Output Power for 1 dB Compression</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>dBm</td>
<td></td>
<td></td>
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<tr>
<td>Saturated Output Power ($P_{sat}$)</td>
<td>14</td>
<td>14</td>
<td>14</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>22</td>
<td>22</td>
<td>24</td>
<td>dBm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Current (Idd)</td>
<td>70</td>
<td>85</td>
<td>70</td>
<td>85</td>
<td>70</td>
<td>85</td>
<td>mA</td>
<td></td>
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</table>

COMPARABLE PARTS
View a parametric search of comparable parts.

EVALUATION KITS
• HMC1040LP3C Evaluation Board

DOCUMENTATION
Application Notes
• AN-1363: Meeting Biasing Requirements of Externally Biased RF/Microwave Amplifiers with Active Bias Controllers
• Broadband Biasing of Amplifiers General Application Note
• MMIC Amplifier Biasing Procedure Application Note
• Thermal Management for Surface Mount Components General Application Note

Data Sheet
• HMC1040 Data Sheet

TOOLS AND SIMULATIONS
• HMC1040 S-Parameters

REFERENCE MATERIALS
Quality Documentation
• Package/Assembly Qualification Test Report: LP3, LP4, LP5 & LP5G (QTR: 2014-00145)
• Semiconductor Qualification Test Report: PHEMT-L (QTR: 2013-00266)

DESIGN RESOURCES
• HMC1040 Material Declaration
• PCN-PDN Information
• Quality And Reliability
• Symbols and Footprints

DISCUSSIONS
View all HMC1040 EngineerZone Discussions.

SAMPLE AND BUY
Visit the product page to see pricing options.

TECHNICAL SUPPORT
Submit a technical question or find your regional support number.

DOCUMENT FEEDBACK
Submit feedback for this data sheet.
**HMC1040LP3CE**

GaAs pHEMT MMIC LOW NOISE AMPLIFIER, 24 - 43.5 GHz

**Broadband Gain & Return Loss**

- Gain vs. Temperature
- Input Return Loss vs. Temperature
- Output Return Loss vs. Temperature
- Noise Figure vs. Temperature
- Output IP3 vs. Temperature

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[1] Board loss subtracted out, gain only.
HMC1040LP3CE

GaAs pHEMT MMIC LOW NOISE AMPLIFIER, 24 - 43.5 GHz

P1dB vs. Temperature

Psat vs. Temperature

Reverse Isolation vs. Temperature

Power Compression @ 25 GHz

Power Compression @ 33 GHz

Power Compression @ 42 GHz

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Current vs. Input Power @ 33 GHz

Absolute Maximum Ratings

- Drain Bias Voltage: +4V
- RF Input Power: +5 dBm
- Channel Temperature: 175 °C
- Continuous Pdiss (T = 85 °C) (derate 5.46 mW/°C above 85 °C): 0.49 W
- Thermal Resistance (Channel to ground paddle): 183 °C/W
- Storage Temperature: -65 to +150 °C
- Operating Temperature: -40 to +85 °C
- ESD Sensitivity (HBM): Class 0, 100 V

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

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>HMC1040LP3CE</td>
<td>RoHS-compliant Low Stress Injection Molded Plastic</td>
<td>100% matte Sn</td>
<td>MSL1 [1]</td>
<td>H1040 XXXX</td>
</tr>
</tbody>
</table>

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

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**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, 2, 4, 9, 11, 12</td>
<td>GND</td>
<td>These pins and package bottom must be connected to RF/DC ground.</td>
<td>![Interface Schematic for GND]</td>
</tr>
<tr>
<td>3</td>
<td>RFIN</td>
<td>This pin AC coupled and matched to 50 Ohms</td>
<td>![Interface Schematic for RFIN]</td>
</tr>
<tr>
<td>5-8, 14</td>
<td>N/C</td>
<td>The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>RFOUT</td>
<td>This pin AC coupled and matched to 50 Ohms</td>
<td>![Interface Schematic for RFOUT]</td>
</tr>
<tr>
<td>13, 15, 16</td>
<td>Vdd3, Vdd2, Vdd1</td>
<td>Drain bias voltages for the amplifier. See Application Circuit for required external components.</td>
<td></td>
</tr>
</tbody>
</table>

**Application Circuit**

- Capacitor Table:
<table>
<thead>
<tr>
<th>Capacitor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 - C3</td>
<td>100 pF</td>
</tr>
<tr>
<td>C4 - C6</td>
<td>10 nF</td>
</tr>
<tr>
<td>C7 - C9</td>
<td>4.7 µF</td>
</tr>
</tbody>
</table>

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**Evaluation PCB**

![HMC1040LP3CE diagram]

**List of Material for Evaluation PCB EVAL01-HMC1040LP3CE [1]**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-J4</td>
<td>2.92 mm Connectors</td>
</tr>
<tr>
<td>TP5-TP8</td>
<td>Test Points DC Pin</td>
</tr>
<tr>
<td>C1 - C3</td>
<td>100 pF Capacitor, 0402 Pkg.</td>
</tr>
<tr>
<td>C4 - C6</td>
<td>10 nF Capacitor, 0402 Pkg.</td>
</tr>
<tr>
<td>C7 - C9</td>
<td>4.7 µF Capacitor, Tantalum</td>
</tr>
<tr>
<td>U1</td>
<td>HMC1040LP3CE Amplifier</td>
</tr>
<tr>
<td>PCB [2]</td>
<td>600-00271-00-2 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 Hittite upon request.

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