**Typical Applications**

Active Multiplier for X Band Applications:

- Fiber Optic
- Point-to-Point Radios
- Military Radar

**Features**

- Output Power: +6 dBm
- Sub-Harmonic Suppression: >25 dBc
- SSB Phase Noise: -136 dBc/Hz
- Single Supply: +5V @ 68 mA
- 24 Lead 4x4 mm SMT Package: 16 mm²

**General Description**

The HMC444LP4 & HMC444LP4E are active miniature x8 frequency multipliers utilizing InGaP GaAs HBT technology in 4x4 mm leadless surface mount packages. Power output is +6 dBm typical from a 5V supply voltage and varies little vs. input power, temperature and supply voltage. Suppression of undesired fundamental and sub-harmonics is >25 dBc typical with respect to output signal level. The low additive SSB phase noise of -136 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance. The HMC444LP4 & HMC444LP4E are ideal for use in LO multiplier chains allowing reduced parts count vs. traditional approaches.

**Parameter** | **Min.** | **Typ.** | **Max.** | **Units**
--- | --- | --- | --- | ---
Frequency Range, Input | 1.2375 - 1.40 | | | GHz
Frequency Range, Output | 9.9 - 11.2 | | | GHz
Input Power Range | -15 dBm | | | dBm
Output Power | 3 | 6 | +5 | dBm
Sub-Harmonic Suppression | 25 dBc | | | dBc
Input Return Loss | 22 dB | | | dB
Output Return Loss | 7 dB | | | dB
SSB Phase Noise (100 kHz Offset) | Pin= 0 dBm | -136 | | dBc/Hz
Supply Current (Icc) | 68 mA | 81 | | mA
## HMC444* PRODUCT PAGE QUICK LINKS

### Last Content Update: 02/23/2017

### COMPARABLE PARTS
View a parametric search of comparable parts.

### EVALUATION KITS
- HMC444LP4 Evaluation Board

### DOCUMENTATION
**Data Sheet**
- HMC444 Data Sheet

### TOOLS AND SIMULATIONS
- HMC444 S-Parameter

### REFERENCE MATERIALS
**Quality Documentation**
- Package/Assembly Qualification Test Report: LP4, LP4B, LP4C, LP4K (QTR: 2013-00487 REV: 04)
- Package/Assembly Qualification Test Report: Plastic Encapsulated QFN (QTR: 05006 REV: 02)
- Semiconductor Qualification Test Report: GaAs HBT-A (QTR: 2013-00228)

**Technical Articles**
- Active Multipliers & Dividers to Simplify Synthesizers

### DESIGN RESOURCES
- HMC444 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

### DISCUSSIONS
View all HMC444 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.

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HMC444LP4 / 444LP4E

SMT GaAs HBT MMIC x8 ACTIVE
FREQUENCY MULTIPLIER, 9.9 - 11.2 GHz OUTPUT

Output Power vs. Temperature @ -10 dBm Drive Level

Output Power vs. Drive Level

Output Power vs. Supply Voltage @ -10 dBm Drive Level

Input Return Loss vs. Temperature

Output Return Loss vs. Temperature

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HMC444LP4 / 444LP4E

SMT GaAs HBT MMIC x8 ACTIVE FREQUENCY MULTIPLIER, 9.9 - 11.2 GHz OUTPUT

**Output Spectrum**

**SSB Phase Noise**
Performance, Fout= 10.5 GHz

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Application Support: Phone: 1-800-ANALOG-D
**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Input (Vcc = +5V)</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>Vcc</td>
<td>+5.5V</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>135 °C</td>
</tr>
<tr>
<td>Continuous $P_diss$ (T=85 °C)</td>
<td>650 mW</td>
</tr>
<tr>
<td>(derate 10 mW/°C above 85 °C)</td>
<td></td>
</tr>
<tr>
<td>Thermal Resistance ($R_{th}$)</td>
<td>100 °C/W</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40 to +85 °C</td>
</tr>
</tbody>
</table>

**Typical Supply Current vs. Vcc**

<table>
<thead>
<tr>
<th>Vcc (V)</th>
<th>$I_{cc}$ (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>66</td>
</tr>
<tr>
<td>5.0</td>
<td>68</td>
</tr>
<tr>
<td>5.5</td>
<td>70</td>
</tr>
</tbody>
</table>

Note: Multiplier will operate over full voltage range shown above.

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**Outline Drawing**

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**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 [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC444LP4</td>
<td>Low Stress Injection Molded Plastic</td>
<td>Sn/Pb Solder</td>
<td>MSL1 [1]</td>
<td>H444 XXXX</td>
</tr>
<tr>
<td>HMC444LP4E</td>
<td>RoHS-compliant Low Stress Injection Molded Plastic</td>
<td>100% matte Sn</td>
<td>MSL1 [2]</td>
<td>H444 XXXX</td>
</tr>
</tbody>
</table>

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

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**Pin Description**

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Function</th>
<th>Description</th>
<th>Interface Schematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 5 - 14, 17, 18, 20 - 24</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>3</td>
<td>RFIN</td>
<td>RF input needs to be DC blocked only if there is an external DC voltage applied to RF IN.</td>
<td><img src="image" alt="RFIN Interface" /></td>
</tr>
<tr>
<td>4, 15</td>
<td>GND</td>
<td>All ground leads and ground paddle must be soldered to PCB RF/DC ground.</td>
<td><img src="image" alt="GND Interface" /></td>
</tr>
<tr>
<td>16</td>
<td>RFOUT</td>
<td>Multiplied Output. AC coupled. No external DC blocks necessary.</td>
<td><img src="image" alt="RFOUT Interface" /></td>
</tr>
<tr>
<td>19</td>
<td>Vcc</td>
<td>Supply voltage 5V ± 0.5V.</td>
<td></td>
</tr>
</tbody>
</table>
Evaluation PCB

List of Materials for Evaluation PCB 106137 [1]

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1 - J3</td>
<td>PCB Mount SMA Connector</td>
</tr>
<tr>
<td>C1</td>
<td>1,000 pF Capacitor, 0603 Pkg.</td>
</tr>
<tr>
<td>U1</td>
<td>HMC444LP4(E) x8 Active Multiplier</td>
</tr>
<tr>
<td>PCB [2]</td>
<td>104610 Eval Board</td>
</tr>
</tbody>
</table>

[1] Reference this number when ordering complete evaluation PCB


The circuit board used in the final application should be generated with proper 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. The evaluation circuit board shown is available from Hittite upon request.