**FREQUENCY MULTIPLIER - ACTIVE - SMT**

**HMC695LP4 / HMC695LP4E**

**SMT GaAs HBT MMIC x4 ACTIVE FREQUENCY MULTIPLIER**

**11.4 - 13.2 GHz OUTPUT**

**Typical Applications**

The HMC695LP4(E) is ideal for:

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

**Features**

Output Power: +7 dBm

Sub-Harmonic Suppression: >25 dBc

SSB Phase Noise: -140 dBc/Hz

Single Supply: +5V @ 60 mA

24 Lead 4x4 mm SMT Package: 16 mm²

**General Description**

The HMC695LP4(E) are active miniature x4 frequency multipliers utilizing InGaP GaAs HBT technology in 4x4 mm leadless surface mount packages. Power output is +7 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 -140 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance. The HMC695LP4(E) are ideal for use in LO multiplier chains allowing reduced parts count vs. traditional approaches.

**Functional Diagram**

![Functional Diagram](image)

**Electrical Specifications, T_A = +25°C, Vcc= 5V**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range, Input</td>
<td>2.85 - 3.3 GHz</td>
<td></td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>Frequency Range, Output</td>
<td>11.4 - 13.2 GHz</td>
<td></td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>Input Power Range</td>
<td>-15 dBm</td>
<td>7 dBm</td>
<td>5 dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Output Power</td>
<td>2 dBm</td>
<td>7 dBm</td>
<td>5 dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Sub-Harmonic Suppression</td>
<td>25 dBc</td>
<td></td>
<td></td>
<td>dBc</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>15 dB</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>8 dB</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>SSB Phase Noise (100 kHz Offset)</td>
<td>Pin= 0 dBm</td>
<td></td>
<td></td>
<td>dBc/Hz</td>
</tr>
<tr>
<td>Supply Current (Icc)</td>
<td>60 mA</td>
<td>75 mA</td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

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HMC695* PRODUCT PAGE QUICK LINKS

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COMPARABLE PARTS
View a parametric search of comparable parts.

EVALUATION KITS
• HMC695LP4 Evaluation Board

DOCUMENTATION
Data Sheet
• HMC695 Data Sheet

TOOLS AND SIMULATIONS
• HMC695 S-Parameter

REFERENCE MATERIALS
Quality Documentation
• Package/Assembly Qualification Test Report: LP4, LP4B, LP4C, LP4K (QTR: 2013-00487 REV: 04)
• Semiconductor Qualification Test Report: GaAs HBT-A (QTR: 2013-00228)

DESIGN RESOURCES
• HMC695 Material Declaration
• PCN-PDN Information
• Quality And Reliability
• Symbols and Footprints

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**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**

**Harmonics @ -10 dBm Drive Level**

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**11.4 - 13.2 GHz OUTPUT**

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**SSB Phase Noise**

**@ Pin = 0 dBm @ 12.5 GHz**

![SSB Phase Noise Graph](image)

**SSB Phase Noise**

**@ Pin = -10 dBm @ 12.5 GHz**

![SSB Phase Noise Graph](image)

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**Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</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 Pdiss (T=85 °C)</td>
<td>538 mW</td>
</tr>
<tr>
<td>(derate 10.8 mW/°C above 85 °C)</td>
<td></td>
</tr>
<tr>
<td>Thermal Resistance (Rth)</td>
<td>93 °C/W</td>
</tr>
<tr>
<td>(junction to ground paddle)</td>
<td></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>
<tr>
<td>ESD Sensitivity (HBM)</td>
<td>Class 1B</td>
</tr>
</tbody>
</table>

**Typical Supply Current vs. Vcc**

<table>
<thead>
<tr>
<th>Vcc (V)</th>
<th>Icc (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75</td>
<td>59</td>
</tr>
<tr>
<td>5.00</td>
<td>60</td>
</tr>
<tr>
<td>5.25</td>
<td>61</td>
</tr>
</tbody>
</table>

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

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**ELECTROSTATIC SENSITIVE DEVICE**

**OBSEERVE HANDLING PRECAUTIONS**

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Outline Drawing

NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.
   PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE
   SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED
   LAND PATTERN.

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>HMC695LP4</td>
<td>Low Stress Injection Molded Plastic</td>
<td>Sn/Pb Solder</td>
<td>MSL1 [1]</td>
<td>H695 XXXX</td>
</tr>
<tr>
<td>HMC695LP4E</td>
<td>RoHS-compliant Low Stress Injection Molded Plastic</td>
<td>100% matte Sn</td>
<td>MSL1 [2]</td>
<td>H695 XXXX</td>
</tr>
</tbody>
</table>

[1] Max peak reflow temperature of 235 °C
[3] 4-Digit lot number XXXX
HMC695LP4 / HMC695LP4E

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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 RFIN.</td>
<td></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></td>
</tr>
<tr>
<td>16</td>
<td>RFOUT</td>
<td>Multiplied Output. AC coupled. No external DC blocks necessary.</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Vcc</td>
<td>Supply voltage 5V</td>
<td></td>
</tr>
</tbody>
</table>
Evaluation PCB

List of Materials for Evaluation PCB 106137

<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>HMC695LP4(E) x4 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 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.