## Technical Chip Distributor for ADI Die Products

### Application Support
- Design Assistance
- Assembly Assistance
- Die handling consultancy
- Hi-Rel die qualification
- Hot & Cold die probing
- Electrical test & trimming

### Distributed Product Support
- Customised Pack Sizes / Qtys
- Support for all industry recognised supply formats:
  - Waffle Pack
  - Gel Pak
  - Tape & Reel
- Onsite storage, stockholding & scheduling

### Product Quality Assurance
- 100% Visual Inspection
  - MIL-STD 883 Condition A
  - MIL-STD 883 Condition A
- On-site failure analysis
- Bespoke 24 Hour monitored storage systems for secure long term product support
- On-site failure analysis

## Contact

[baraedie@micross.com](mailto:baraedie@micross.com)

For price, delivery and to place orders

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**HMC592**

www.analog.com  www.micross.com
Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED

www.analog.com www.hittite.com
HMC592
GaAs PHEMT MMIC 1 WATT POWER AMPLIFIER, 10 - 13 GHz

Typical Applications
The HMC592 is ideal for use as a power amplifier for:
• Point-to-Point Radios
• Point-to-Multi-Point Radios
• Test Equipment & Sensors
• Military End-Use
• Space

Features
- Saturated Output Power: +31 dBm @ 21% PAE
- Output IP3: +38 dBm
- Gain: 19 dB
- DC Supply: +7V @ 750 mA
- 50 Ohm Matched Input/Output
- Die Size: 2.47 x 1.17 x 0.1 mm

Functional Diagram

General Description
The HMC592 is a high dynamic range GaAs PHEMT MMIC 1 Watt Power Amplifier which operates from 10 to 13 GHz. This amplifier die provides 19 dB of gain and +31 dBm of saturated power, at 21% PAE from a +7V supply. The RF I/Os are DC blocked and matched to 50 Ohms for ease of integration into Multi-Chip-Modules (MCMs). All data is taken with the chip in a 50 ohm test fixture connected via 0.025mm (1 mil) diameter wire bonds of length 0.31mm (12 mils). For applications which require optimum OIP3, Idd should be set for 400 mA, to yield +38 dBm OIP3. For applications which require optimum output P1dB, Idd should be set for 750 mA, to yield +31 dBm Output P1dB.

Electrical Specifications, $T_A = +25^\circ C$, $Vdd = +7V$, $Idd = 750 mA^*$

<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</td>
<td>10 - 13</td>
<td></td>
<td></td>
<td>GHz</td>
</tr>
<tr>
<td>Gain</td>
<td>16</td>
<td>19</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Gain Variation Over Temperature</td>
<td>0.05</td>
<td></td>
<td></td>
<td>dB/°C</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>10</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>12</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Output Power for 1 dB Compression (P1dB)</td>
<td>28</td>
<td>31</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Saturated Output Power (Psat)</td>
<td></td>
<td>31.2</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Output Third Order Intercept (IP3)$^{[2]}$</td>
<td>38</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Supply Current (Idd)</td>
<td>750</td>
<td>800</td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

$^{[1]}$ Adjust Vgg between -2 to 0V to achieve Idd= 750 mA typical.

$^{[2]}$ Measurement taken at 7V @ 400mA, Pin / Tone = -15 dBm
GaAs PHEMT MMIC 1 WATT
POWER AMPLIFIER, 10 - 13 GHz

Broadband Gain & Return Loss

Gain vs. Temperature

Input Return Loss vs. Temperature

Output Return Loss vs. Temperature

P1dB vs. Temperature

Psat vs. Temperature

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POWER AMPLIFIER, 10 - 13 GHz

P1dB vs. Current

Psat vs. Current

Output IP3 vs. Temperature
7V @ 400 mA, Pin/Tone = -15 dBm

Power Compression @ 8 GHz, 7V @ 750 mA

Output IM3, 7V @ 400 mA

Output IM3, 7V @ 750 mA
GaAs PHEMT MMIC 1 WATT POWER AMPLIFIER, 10 - 13 GHz

Gain & Power vs. Supply Current @ 8 GHz

Gain & Power vs. Supply Voltage @ 8 GHz

Reverse Isolation vs. Temperature

Power Dissipation
HMC592
GaAs PHEMT MMIC 1 WATT POWER AMPLIFIER, 10 - 13 GHz

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Bias Voltage (Vdd)</td>
<td>+8 Vdc</td>
</tr>
<tr>
<td>Gate Bias Voltage (Vgg)</td>
<td>-2.0 to 0 Vdc</td>
</tr>
<tr>
<td>RF Input Power (RFIN)(Vdd = +7.0 Vdc)</td>
<td>+15 dBm</td>
</tr>
<tr>
<td>Continuous Pdiss (T= 85 °C) (derate 62.7 mW/°C above 85 °C)</td>
<td>5.64 W</td>
</tr>
<tr>
<td>Thermal Resistance (channel to die bottom)</td>
<td>15.94 °C/W</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65 to +150 °C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-55 to +85 °C</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>+6.5</td>
<td>757</td>
</tr>
<tr>
<td>+7.0</td>
<td>750</td>
</tr>
<tr>
<td>+7.5</td>
<td>745</td>
</tr>
</tbody>
</table>

Note: Amplifier will operate over full voltage ranges shown above Vgg adjusted to achieve Idd = 750 mA at +7.0V

Outline Drawing

Die Packaging Information [1]

<table>
<thead>
<tr>
<th>Standard</th>
<th>Alternate</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-1 (Gel Pack)</td>
<td>[2]</td>
</tr>
</tbody>
</table>

[1] Refer to the "Packaging Information" section for die packaging dimensions.

NOTES:
1. ALL DIMENSIONS ARE IN INCHES [MM]
2. DIE THICKNESS IS .004"
3. TYPICAL BOND PAD IS .004" SQUARE
4. BACKSIDE METALLIZATION: GOLD
5. BOND PAD METALLIZATION: GOLD
6. BACKSIDE METAL IS GROUND.
7. CONNECTION NOT REQUIRED FOR UNLABELED BOND PADS.
8. OVERALL DIE SIZE ± .002

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## Pad Descriptions

<table>
<thead>
<tr>
<th>Pad Number</th>
<th>Function</th>
<th>Description</th>
<th>Interface Schematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RFIN</td>
<td>This pad is AC coupled and matched to 50 Ohms.</td>
<td><img src="image1" alt="RFIN Interface" /></td>
</tr>
<tr>
<td>2, 4, 6</td>
<td>Vgg 1-3</td>
<td>Gate control for amplifier. Adjust to achieve Idd of 750 mA. Please follow &quot;MMIC Amplifier Biasing Procedure&quot; Application Note. External bypass capacitors of 100 pF and 0.1 μF are required.</td>
<td><img src="image2" alt="Vgg 1-3 Interface" /></td>
</tr>
<tr>
<td>3, 5, 7</td>
<td>Vdd 1-3</td>
<td>Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF and 0.1 μF are required.</td>
<td><img src="image3" alt="Vdd 1-3 Interface" /></td>
</tr>
<tr>
<td>8</td>
<td>RFOUT</td>
<td>This pad is AC coupled and matched to 50 Ohms.</td>
<td><img src="image4" alt="RFOUT Interface" /></td>
</tr>
<tr>
<td>Die Bottom</td>
<td>GND</td>
<td>Die bottom must be connected to RF/DC ground.</td>
<td><img src="image5" alt="GND Interface" /></td>
</tr>
</tbody>
</table>
Assembly Diagram

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Mounting & Bonding Techniques for Millimeterwave GaAs MMICs

The die should be attached directly to the ground plane eutectically or with conductive epoxy (see HMC general Handling, Mounting, Bonding Note).

50 Ohm Microstrip transmission lines on 0.127mm (5 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1). If 0.254mm (10 mil) thick alumina thin film substrates must be used, the die should be raised 0.150mm (6 mils) so that the surface of the die is coplanar with the surface of the substrate. One way to accomplish this is to attach the 0.102mm (4 mil) thick die to a 0.150mm (6 mil) thick molybdenum heat spreader (moly-tab) which is then attached to the ground plane (Figure 2).

Microstrip substrates should be located as close to the die as possible in order to minimize bond wire length. Typical die-to-substrate spacing is 0.076mm to 0.152 mm (3 to 6 mils).

Handling Precautions

Follow these precautions to avoid permanent damage.

Storage: All bare die are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

Static Sensitivity: Follow ESD precautions to protect against > ± 250V ESD strikes.

Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip may have fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

Mounting

The chip is back-metallized and can be die mounted with electrically conductive epoxy. The mounting surface should be clean and flat.

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31mm (12 mils).