



GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, 6.0 - 9.5 GHz

Typical Applications

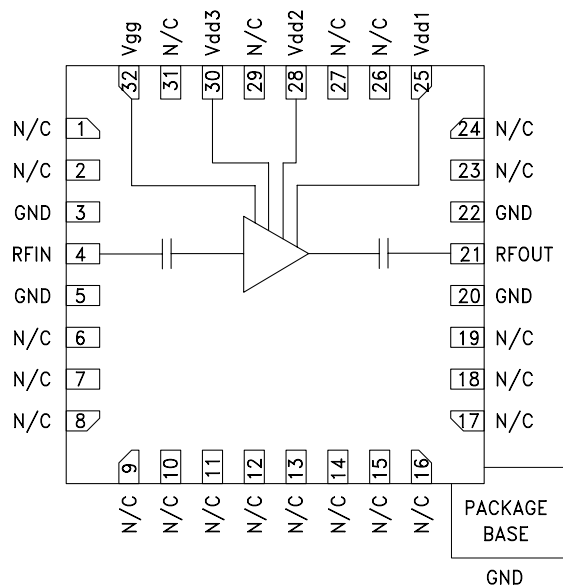
The HMC590LP5E is ideal for use as a power amplifier for:

- Point-to-Point Radios
- Point-to-Multi-Point Radios
- Test Equipment & Sensors
- Military End-Use
- Space

Features

- Saturated Output Power: +31.5 dBm @ 23% PAE
- Output IP3: +40 dBm
- Gain: 21 dB
- DC Supply: +7V @ 820 mA
- 50 Ohm Matched Input/Output
- QFN Leadless SMT Packages, 25 mm²

Functional Diagram



General Description

The HMC590LP5E are high dynamic range GaAs pHEMT MMIC 1 Watt Power Amplifiers which operate from 6 to 9.5 GHz. The amplifier provides 21 dB of gain, +31 dBm of saturated power, and 23% PAE from a +7V supply. This 50 Ohm matched amplifier does not require any external components and the RF I/Os are DC blocked for robust operation. For applications which require optimum OIP3, I_{dd} should be set for 520 mA, to yield +40 dBm OIP3. For applications which require optimum output P1dB, I_{dd} should be set for 820 mA, to yield +30 dBm Output P1dB.

Electrical Specifications, T_A = +25° C, V_{dd} = +7V, I_{dd} = 820 mA^[1]

| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|---|-------|------|---------|------|------|------|-------|
| Frequency Range | 6 - 8 | | 6 - 9.5 | | | | GHz |
| Gain | 18 | 21 | | 18 | 21 | | dB |
| Gain Variation Over Temperature | | 0.05 | | | 0.05 | | dB/°C |
| Input Return Loss | | 15 | | | 12 | | dB |
| Output Return Loss | | 11 | | | 10 | | dB |
| Output Power for 1 dB Compression (P1dB) | 27 | 30 | | 27.5 | 30.5 | | dBm |
| Saturated Output Power (Psat) | | 30.5 | | | 31 | | dBm |
| Output Third Order Intercept (IP3) ^[2] | | 40 | | | 40 | | dBm |
| Supply Current (I _{dd}) | | 820 | | | 820 | | mA |

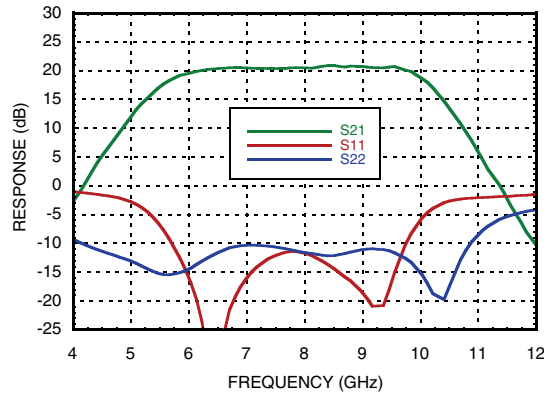
[1] Adjust V_{gg} between -2 to 0V to achieve I_{dd}= 820 mA typical.

[2] Measurement taken at 7V @ 520mA, Pin/Tone = -15 dBm

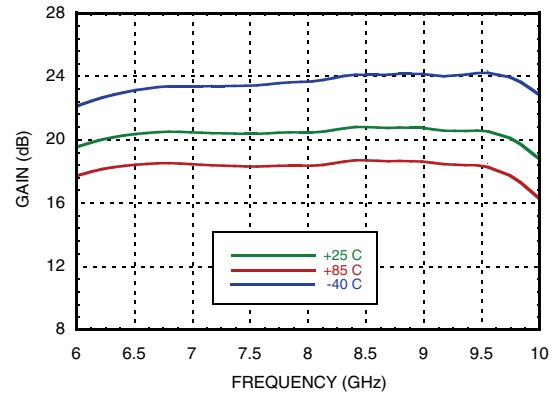


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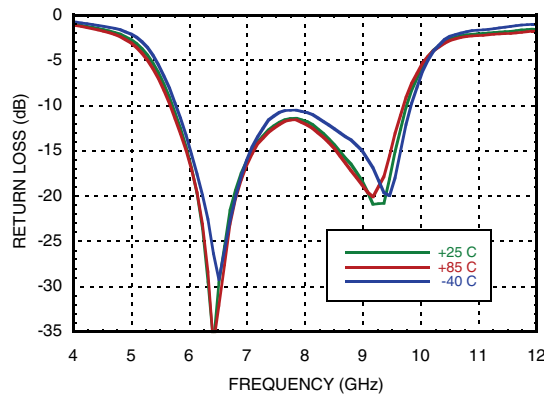
Broadband Gain & Return Loss



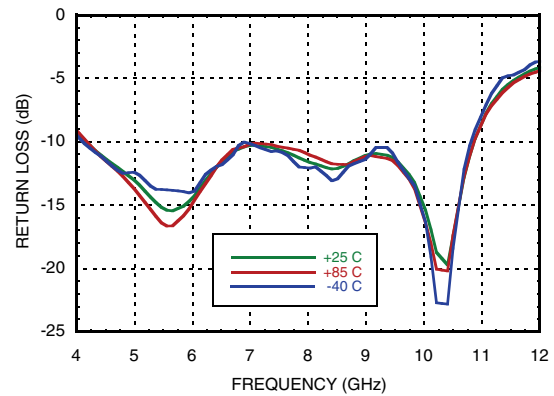
Gain vs. Temperature



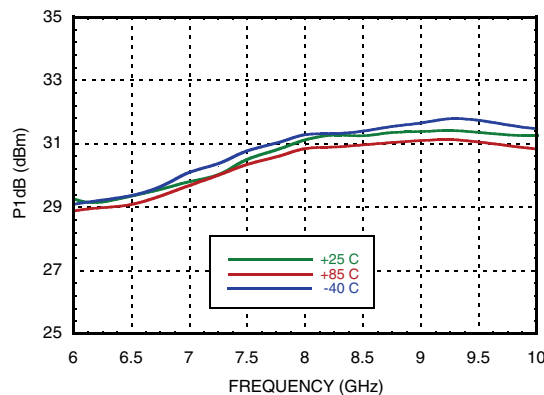
Input Return Loss vs. Temperature



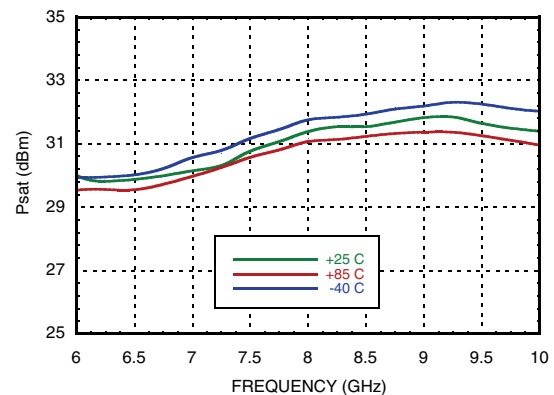
Output Return Loss vs. Temperature



P1dB vs. Temperature



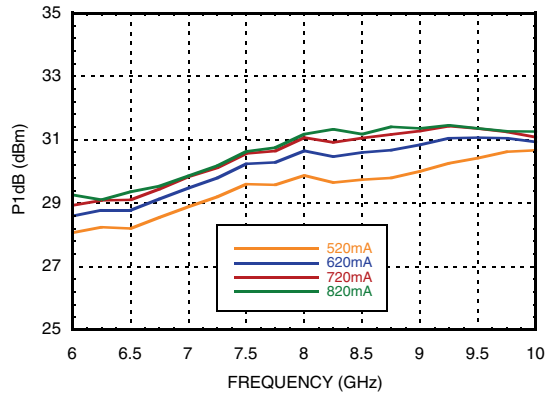
Psat vs. Temperature



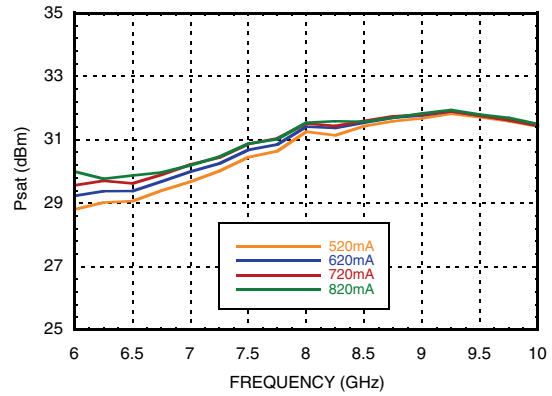


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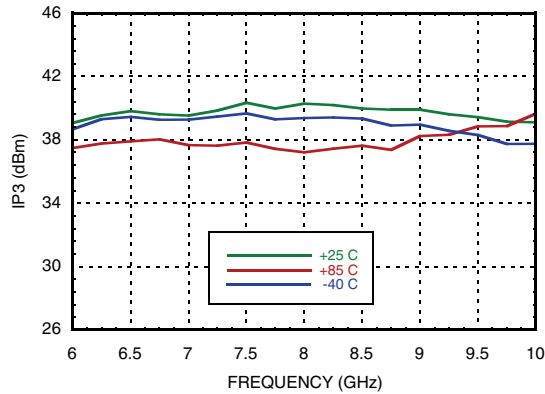
P1dB vs. Current



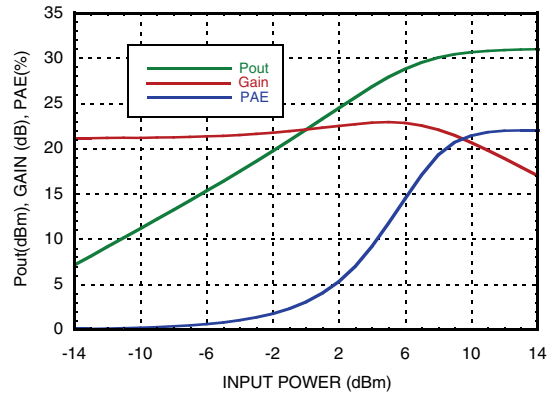
Psat vs. Current



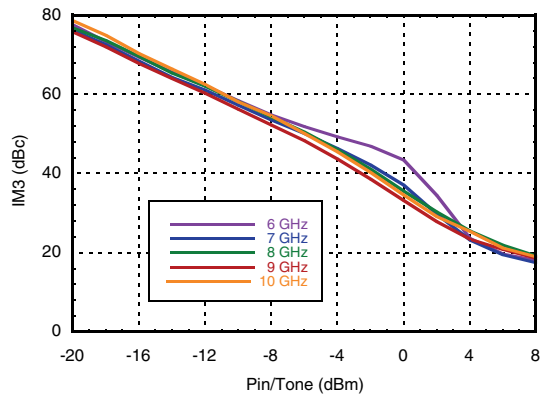
Output IP3 vs. Temperature
7V @ 520 mA, Pin/Tone = -15 dBm



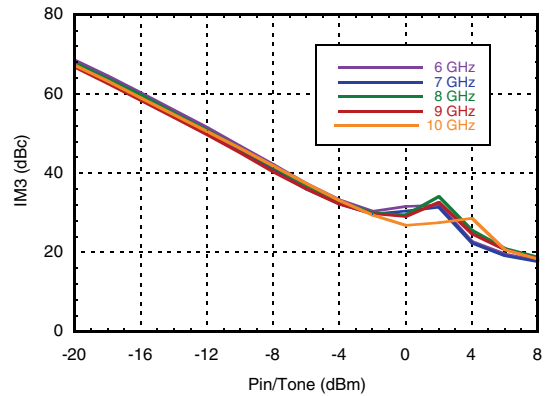
Power Compression @ 8 GHz,
7V @ 820 mA



Output IM3, 7V @ 520 mA



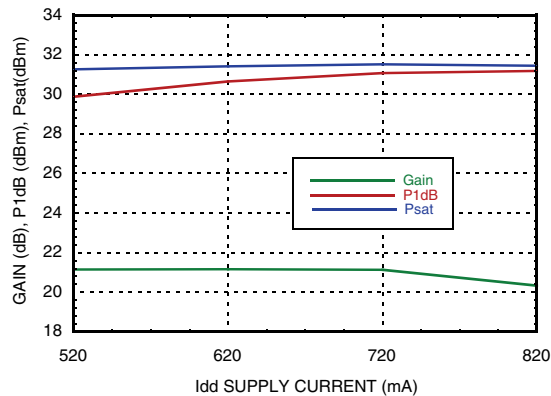
Output IM3, 7V @ 820 mA



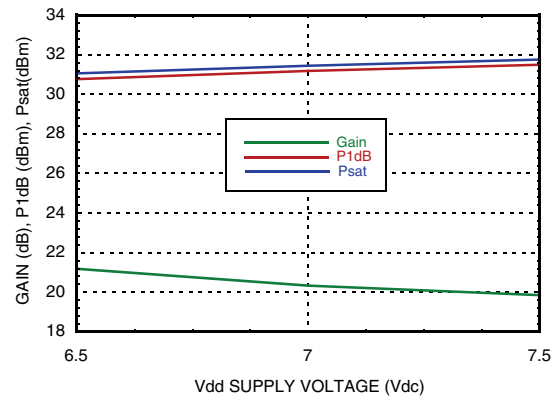


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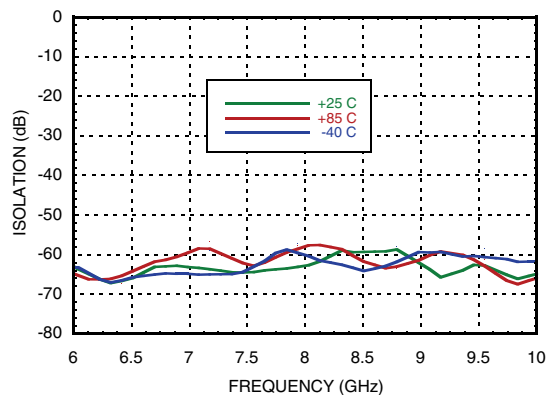
Gain & Power vs. Supply Current @ 8 GHz



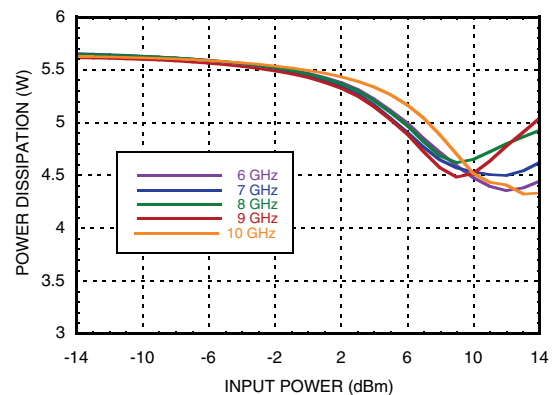
Gain & Power vs. Supply Voltage @ 8 GHz



Reverse Isolation vs. Temperature, 7V @ 820 mA



Power Dissipation



Absolute Maximum Ratings

| | |
|--|-----------------------|
| Drain Bias Voltage (V _{dd}) | +8 Vdc |
| Gate Bias Voltage (V _{gg}) | -2.0 to 0 Vdc |
| RF Input Power (RFIN)(V _{dd} = +7.0 Vdc) | +12 dBm |
| Channel Temperature | 175 °C |
| Continuous Pdiss (T= 75 °C) (derate 59.8 mW/°C above 75 °C) | 5.98 W |
| Thermal Resistance (channel to package bottom) | 16.72 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -55 to +85 °C |
| ESD Sensitivity (HBM) | Class 0B. Passed 200V |

Typical Supply Current vs. V_{dd}

| V _{dd} (V) | I _{dd} (mA) |
|---------------------|----------------------|
| +6.5 | 824 |
| +7.0 | 820 |
| +7.5 | 815 |

Note: Amplifier will operate over full voltage ranges shown above V_{gg} adjusted to achieve I_{dd} = 820 mA at +7.0V

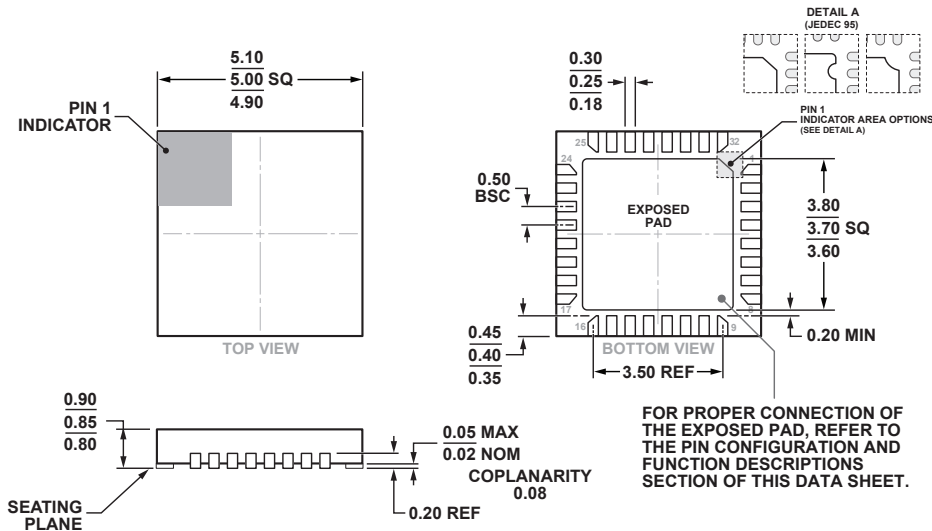


ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS



**GaAs pHEMT MMIC 1 WATT
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Outline Drawing



COMPLIANT TO JEDEC STANDARDS MO-220-VHHD-4.

32-Lead Lead Frame Chip Scale Package [LFCSP]
5 mm × 5 mm and 0.90 mm Package Height
(HCP-32-3)
Dimensions shown in millimeters


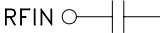
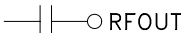
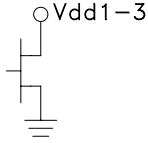
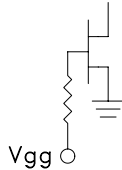
Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[2] |
|--------------|--|---------------|---------------------|--------------------------------|
| HMC590LP5E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[1] | H590 XXXX |
| HMC590LP5ETR | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[1] | H590 XXXX |

[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

**GaAs pHEMT MMIC 1 WATT
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Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|--|----------|---|--|
| 1, 2, 6 - 19, 23, 24, 26, 27, 29, 31 | N/C | Not connected. | |
| 3, 5, 20, 22 | GND | These pins and package bottom must be connected to RF/DC ground. |  |
| 4 | RFIN | This pad is AC coupled and matched to 50 Ohms. |  |
| 21 | RFOUT | This pad is AC coupled and matched to 50 Ohms. |  |
| 25, 28, 30 | Vdd 1-3 | Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF and 2.2 μF are required. |  |
| 32 | Vgg | Gate control for amplifier. Adjust to achieve I _{dd} of 820 mA. Please follow "MMIC Amplifier Biasing Procedure" Application Note. External bypass capacitors of 100 pF and 2.2 μF are required. |  |



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Application Circuit

| Component | Value |
|-----------|-------|
| C1 - C4 | 100pF |
| C5 - C8 | 2.2μF |

