

SURFACE MOUNT PHEMT 2 WATT POWER AMPLIFIER, 9 - 12 GHz

Typical Applications

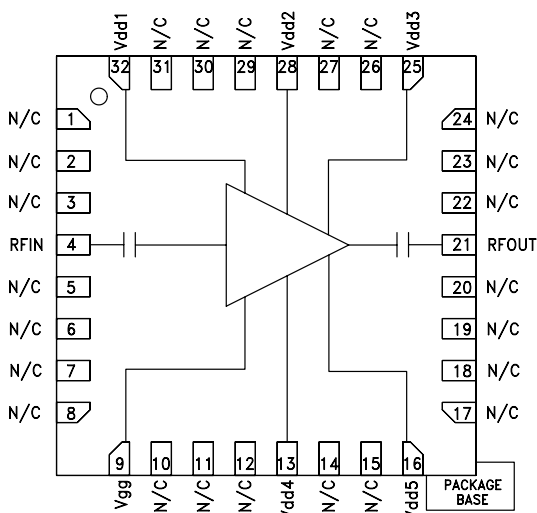
The HMC487LP5E is ideal for use as a power amplifier for:

- Point-to-Point Radios
- Point-to-Multi-Point Radios
- Test Equipment and Sensors
- Military End-Use

Features

- Saturated Power: +33 dBm @ 20% PAE
- Output IP3: +36 dBm
- Gain: 20 dB
- +7V @ 1300 mA Supply
- 50 Ohm Matched Input/Output
- 25 mm² Leadless SMT Package

Functional Diagram



General Description

The HMC487LP5E is a high dynamic range GaAs PHEMT MMIC 2 Watt Power Amplifiers housed in leadless 5 x 5 mm surface mount packages. Operating from 9 to 12 GHz, the amplifier provides 20 dB of gain, +33 dBm of saturated power and 20% PAE from a +7V supply voltage. Output IP3 is +36 dBm typical. The RF I/Os are DC blocked and matched to 50 Ohms for ease of use. The HMC487LP5E eliminates the need for wire bonding, allowing use of surface mount manufacturing techniques.

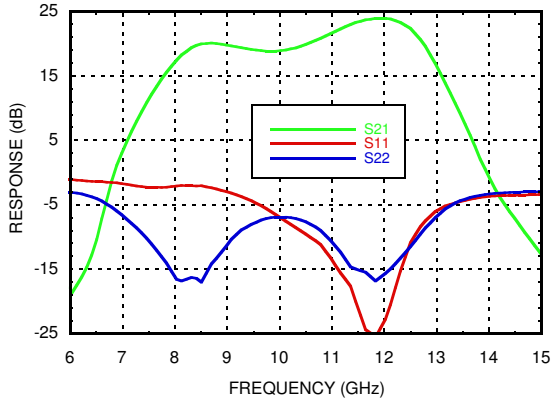
Electrical Specifications, $T_A = +25^\circ\text{C}$, $V_{dd1, 2, 3, 4, 5} = +7\text{V}$, $I_{dd} = 1300\text{ mA}^*$

| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|--|--------|------|---------|------|------|------|-------|
| Frequency Range | 9 - 11 | | 11 - 12 | | | | GHz |
| Gain | 17 | 20 | | 19 | 22 | | dB |
| Gain Variation Over Temperature | | 0.05 | 0.07 | | 0.05 | 0.07 | dB/°C |
| Input Return Loss | | 7 | | | 15 | | dB |
| Output Return Loss | | 7 | | | 15 | | dB |
| Output Power for 1 dB Compression (P1dB) | 29 | 32 | | 28 | 31 | | dBm |
| Saturated Output Power (Psat) | | 33 | | | 32 | | dBm |
| Output Third Order Intercept (IP3) | | 36 | | | 35 | | dBm |
| Noise Figure | | 9 | | | 8 | | dB |
| Supply Current (I _{dd})(V _{dd} = +7V, V _{gg} = -0.3V Typ.) | | 1300 | | | 1300 | | mA |

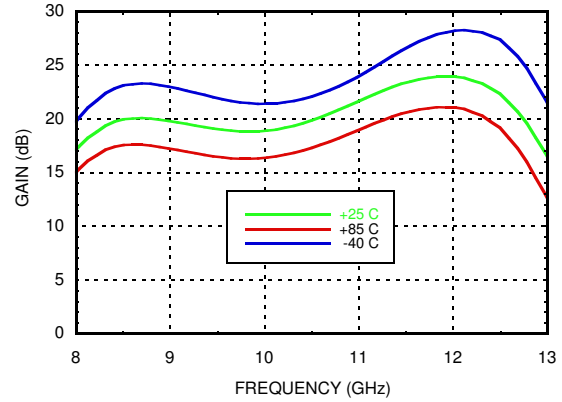
* Adjust V_{gg} between -2 to 0V to achieve I_{dd} = 1300 mA typical.

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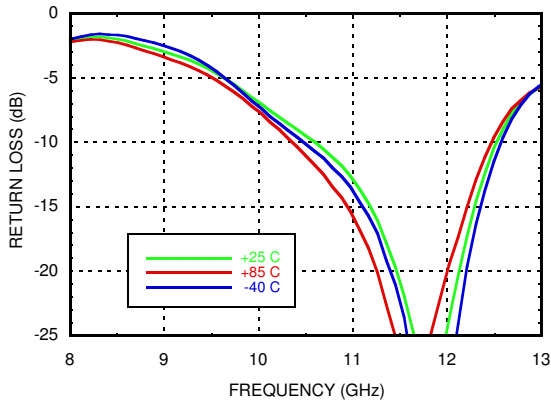
Broadband Gain and Return Loss



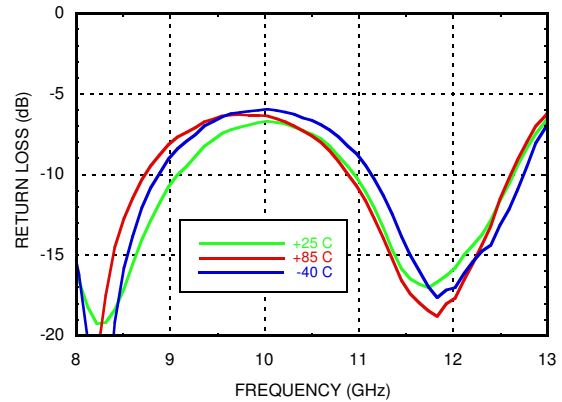
Gain vs. Temperature



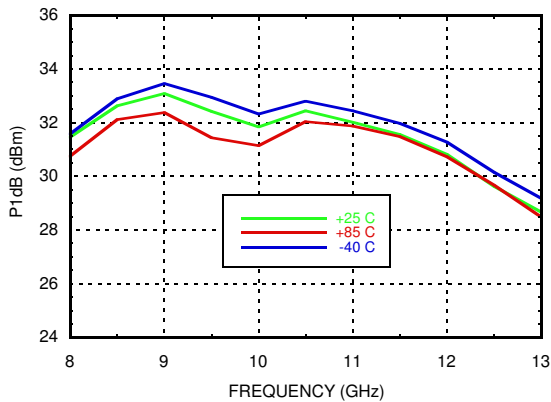
Input Return Loss vs. Temperature



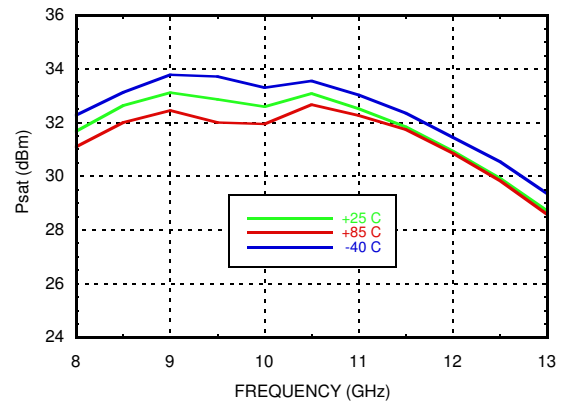
Output Return Loss vs. Temperature



P1dB vs. Temperature

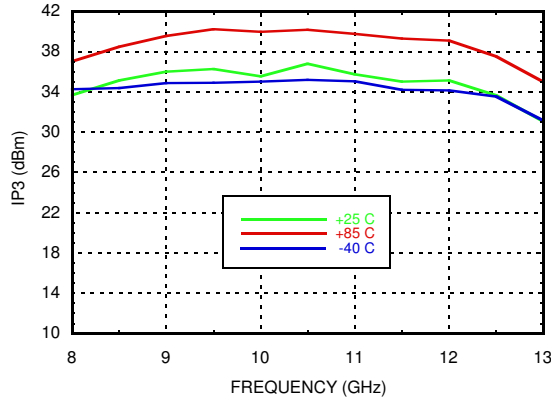


Psat vs. Temperature

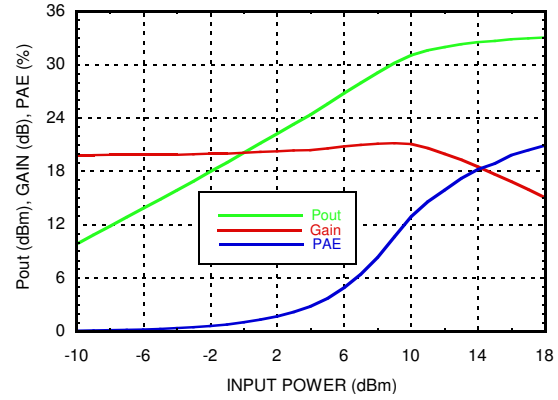


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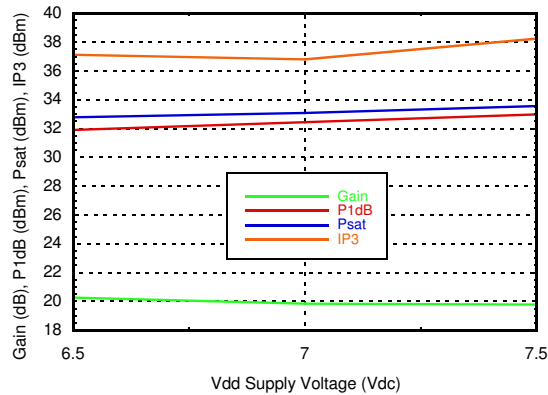
Output IP3 vs. Temperature



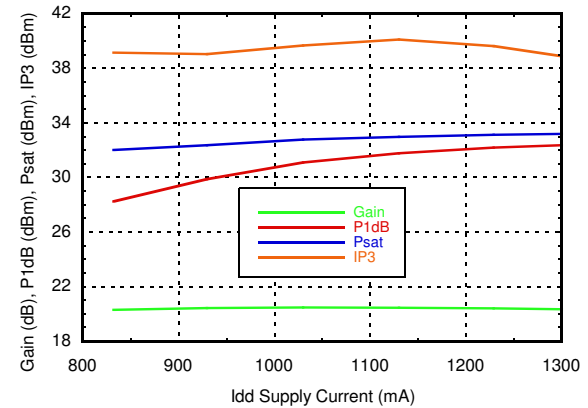
Power Compression @ 10.5 GHz



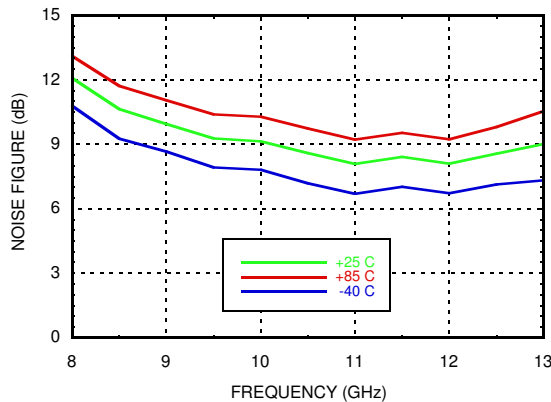
Gain Power and OIP3 vs. Supply Voltage @10.5 GHz



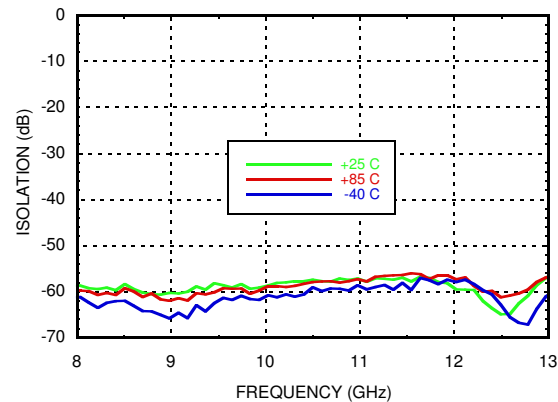
Gain, Power and OIP3 vs. Supply Current @ 10.5 GHz



Noise Figure vs. Temperature

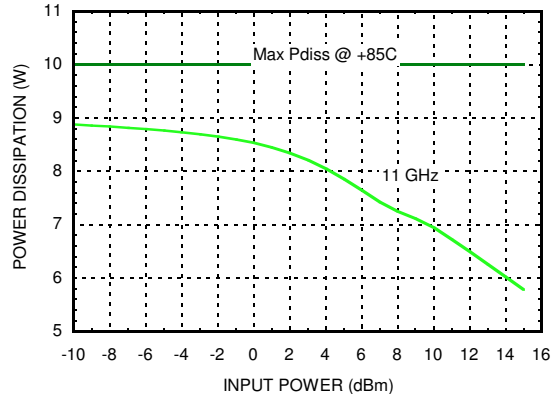


Reverse Isolation vs. Temperature



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Power Dissipation*

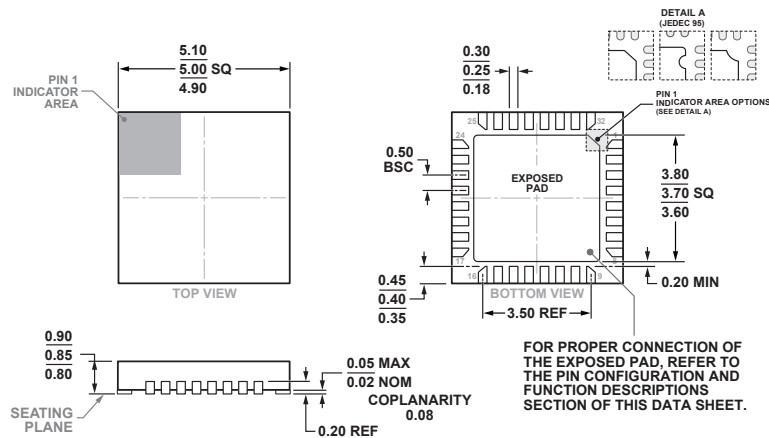


* Refer to "Thermal Management for Surface Mount Components" application note herein.



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

Outline Drawing



COMPLIANT TO JEDEC STANDARDS MO-220-VHHD-4

32-Lead Lead Frame Chip Scale Package [LFCSP]
5 mm x 5 mm Body and 0.85 mm Package Height
(HCP-32-1)

Dimensions shown in millimeters

Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[2] |
|--------------|--|---------------|---------------------|--------------------------------|
| HMC487LP5ETR | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[1] | H487 XXXX |
| HMC487LP5E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[1] | <u>H487</u> XXXX |

[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

Typical Supply Current vs. Vdd

| Vdd (Vdc) | Idd (mA) |
|-----------|----------|
| +6.5 | 1330 |
| +7.0 | 1300 |
| +7.5 | 1285 |

Note: Amplifier will operate over full voltage ranges shown above. Vgg adjusted to achieve Idd = 1300 mA at +7.0V.

Absolute Maximum Ratings

| | |
|--|----------------|
| Drain Bias Voltage (Vdd1, 2, 3, 4, 5) | +8 Vdc |
| Gate Bias Voltage (Vgg) | -2.0 to 0 Vdc |
| RF Input Power (RFIN)(Vdd = +7.0 Vdc) | +20 dBm |
| Channel Temperature | 150 °C |
| Continuous Pdiss (T = 85 °C) (derate 154 mW/°C above 85 °C) | 10 W |
| Thermal Resistance (channel to ground paddle) | 6.5 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

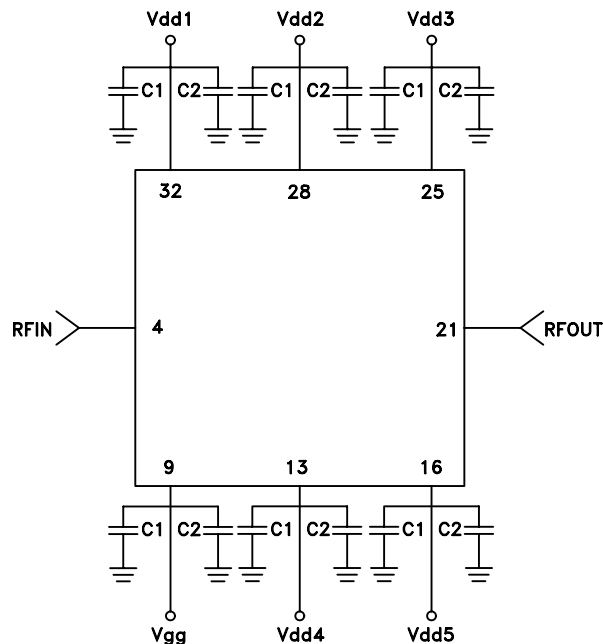
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Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|--|------------------------------|--|---------------------|
| 1 - 3, 5 - 8, 10 - 12, 14, 15, 17 - 20, 22 - 24, 26, 27, 29 - 31 | N/C | No connection required. These pins may be connected to RF/DC ground without affecting performance. | |
| 4 | RFIN | This pin is AC coupled and matched to 50 Ohms. | |
| 9 | Vgg | Gate control for amplifier. Adjust to achieve I _{dd} of 1300 mA. Please follow "MMIC Amplifier Biasing Procedure" Application Note. External bypass capacitors of 100 pF and 2.2 μF are required. | |
| 21 | RFOUT | This pin is AC coupled and matched to 50 Ohms. | |
| 32, 28, 25, 13, 16 | Vdd1, Vdd2, Vdd3, Vdd4, Vdd5 | Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF and 2.2 μF are required. | |
| | GND | Ground: Backside of package has exposed metal ground slug that must be connected to ground through a short path. Vias under the device are required | |

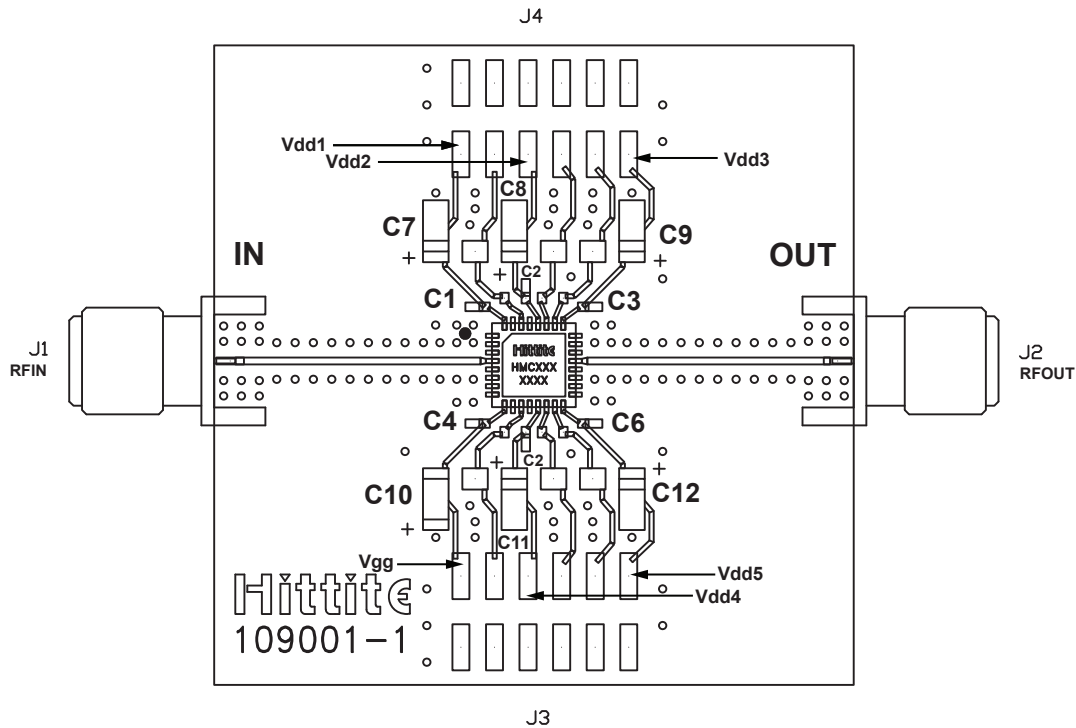
Application Circuit

| Component | Value |
|-----------|--------|
| C1 | 100 pF |
| C2 | 2.2 μF |



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Evaluation PCB



List of Materials for Evaluation PCB 108190 [1]

| Item | Description |
|----------|-----------------------------|
| J1, J2 | SRI PC Mount SMA Connector |
| J3, J4 | 2mm DC Header |
| C1 - C6 | 100 pF capacitor, 0402 pkg. |
| C7 - C12 | 2.2µF Capacitor, Tantalum |
| U1 | HMC487LP5E Amplifier |
| PCB [2] | 109001 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350.

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. Copper filled vias under the device are recommended. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Analog Devices upon request.

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