



## GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6.5 - 13.5 GHz

### Typical Applications

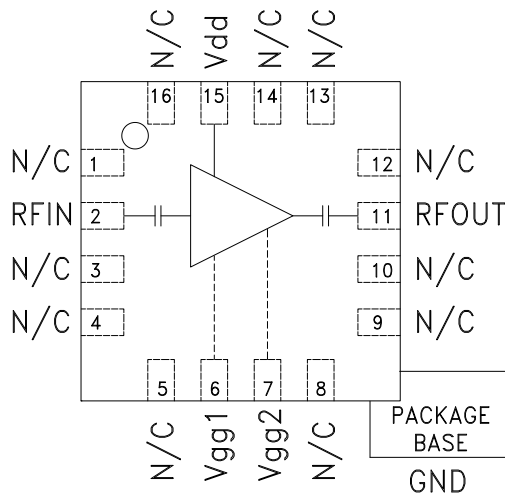
The HMC441LP3 / HMC441LP3E is a medium PA for:

- Point-to-Point Radios
- Point-to-Multi-Point Radios
- VSAT
- LO Driver for HMC Mixers
- Military EW & ECM

### Features

- Gain: 14 dB
- Saturated Power: +20 dBm @ 20% PAE
- Single Supply Voltage: +5V w/ Optional Gate Bias
- 50 Ohm Matched Input/Output
- 16 Lead 3x3mm SMT Package: 9mm<sup>2</sup>

### Functional Diagram



TOP VIEW

Vgg1, Vgg2: Optional Gate Bias

### General Description

The HMC441LP3 & HMC441LP3E are broadband GaAs PHEMT MMIC Medium Power Amplifiers which operate between 6.5 and 13.5 GHz. The leadless plastic QFN surface mount packaged amplifier provides 14 dB of gain, +20 dBm saturated power at 20% PAE from a +5V supply voltage. An optional gate bias is provided to allow adjustment of gain, RF output power, and DC power dissipation. This 50 Ohm matched amplifier does not require any external components making it an ideal linear gain block or driver for HMC SMT mixers.

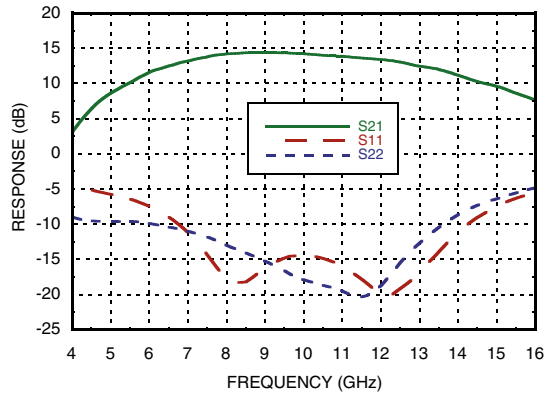
### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{dd} = 5\text{V}$ , $V_{gg1} = V_{gg2} = \text{Open}$

| Parameter                                  | Min.      | Typ. | Max.  | Min.       | Typ. | Max.  | Min.        | Typ. | Max.  | Units |
|--|-----------|------|-------|------------|------|-------|-------------|------|-------|-------|
| Frequency Range                            | 6.5 - 8.0 |      |       | 8.0 - 11.0 |      |       | 11.0 - 13.5 |      |       | GHz   |
| Gain                                       | 10        | 13   |       | 12         | 14   |       | 10          | 13   |       | dB    |
| Gain Variation Over Temperature            |           | 0.02 | 0.025 |            | 0.02 | 0.025 |             | 0.02 | 0.025 | dB/°C |
| Input Return Loss                          |           | 12   |       |            | 15   |       |             | 14   |       | dB    |
| Output Return Loss                         |           | 12   |       |            | 15   |       |             | 13   |       | dB    |
| Output Power for 1 dB Compression (P1dB)   | 13        | 16   |       | 15         | 18   |       | 14          | 17   |       | dBm   |
| Saturated Output Power (P <sub>sat</sub> ) |           | 18.5 |       |            | 20   |       |             | 19.5 |       | dBm   |
| Output Third Order Intercept (IP3)         | 23        | 26   |       | 26         | 29   |       | 26          | 29   |       | dBm   |
| Noise Figure                               |           | 5.0  |       |            | 4.5  |       |             | 4.75 |       | dB    |
| Supply Current (I <sub>dd</sub> )          |           | 90   | 115   |            | 90   | 115   |             | 90   | 115   | mA    |

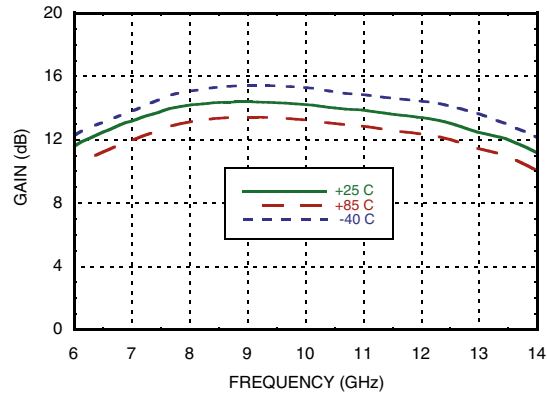


**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6.5 - 13.5 GHz**

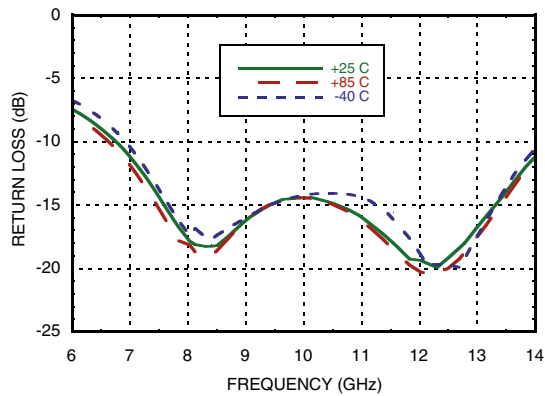
**Broadband Gain & Return Loss**



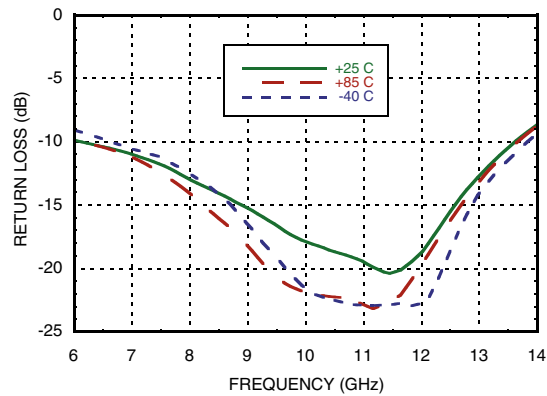
**Gain vs. Temperature**



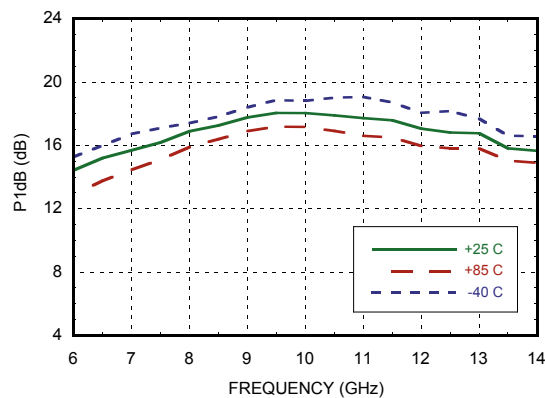
**Input Return Loss vs. Temperature**



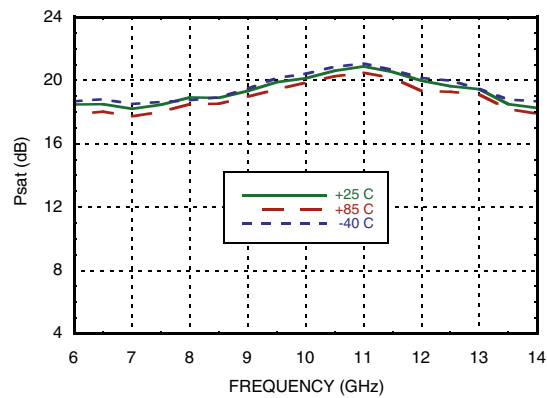
**Output Return Loss vs. Temperature**



**P1dB vs. Temperature**



**Psat vs. Temperature**

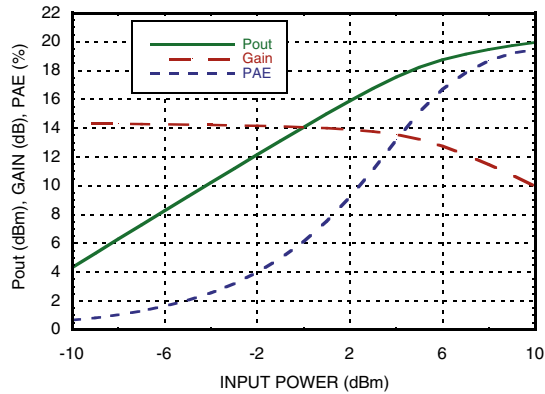


Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

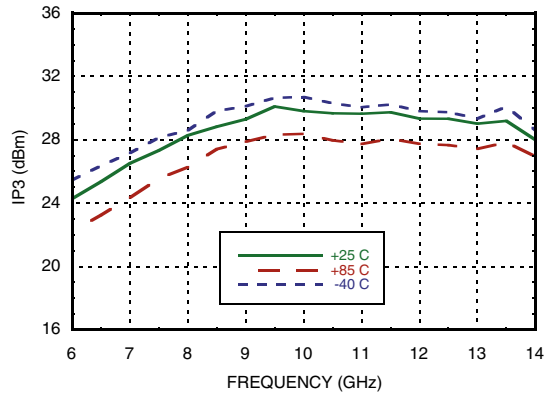
For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com) Application Support: Phone: 1-800-ANALOG-D



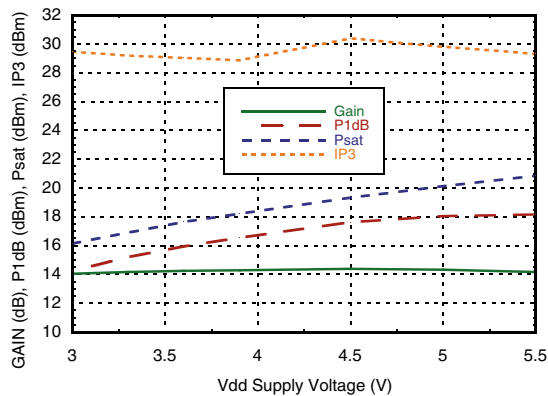
**Power Compression @ 10 GHz**



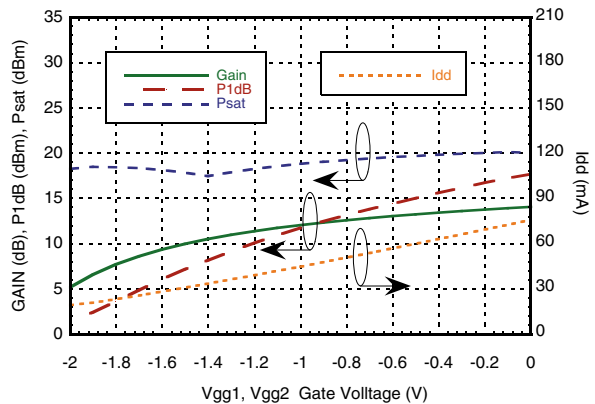
**Output IP3 vs. Temperature**



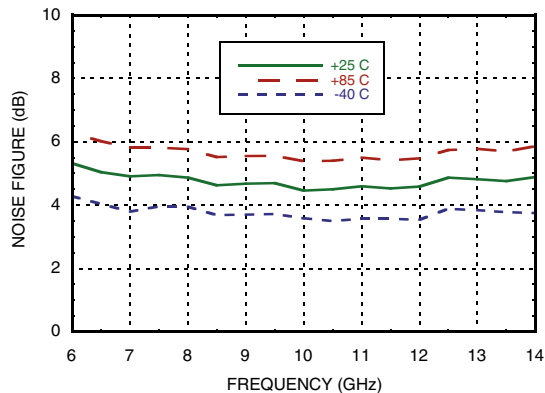
**Gain, Power & Output IP3 vs. Supply Voltage @ 10 GHz**



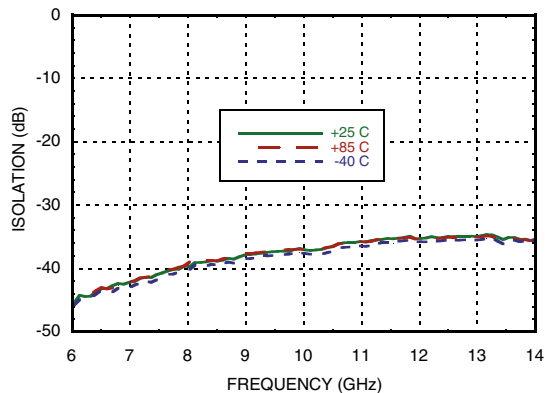
**Gain, Power & Idd vs. Gate Voltage @ 10 GHz**



**Noise Figure vs. Temperature**



**Reverse Isolation vs. Temperature**



Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com) Application Support: Phone: 1-800-ANALOG-D



## GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6.5 - 13.5 GHz

### Absolute Maximum Ratings

|  |                |
|--|----------------|
| Drain Bias Voltage (Vdd)                                       | +6 Vdc         |
| Gate Bias Voltage (Vgg1,Vgg2)                                  | -8 to 0 Vdc    |
| RF Input Power (RFIN)(Vdd = +5 Vdc)                            | +15 dBm        |
| Channel Temperature  | 175 °C         |
| Continuous Pdiss (T = 85 °C)<br>(derate 8.5 mW/°C above 85 °C) | 0.76 W         |
| Thermal Resistance<br>(channel to ground paddle)               | 118.2 °C/W     |
| Storage Temperature  | -65 to +150 °C |
| Operating Temperature  | -40 to +85 °C  |

### Typical Supply Current vs. Vdd

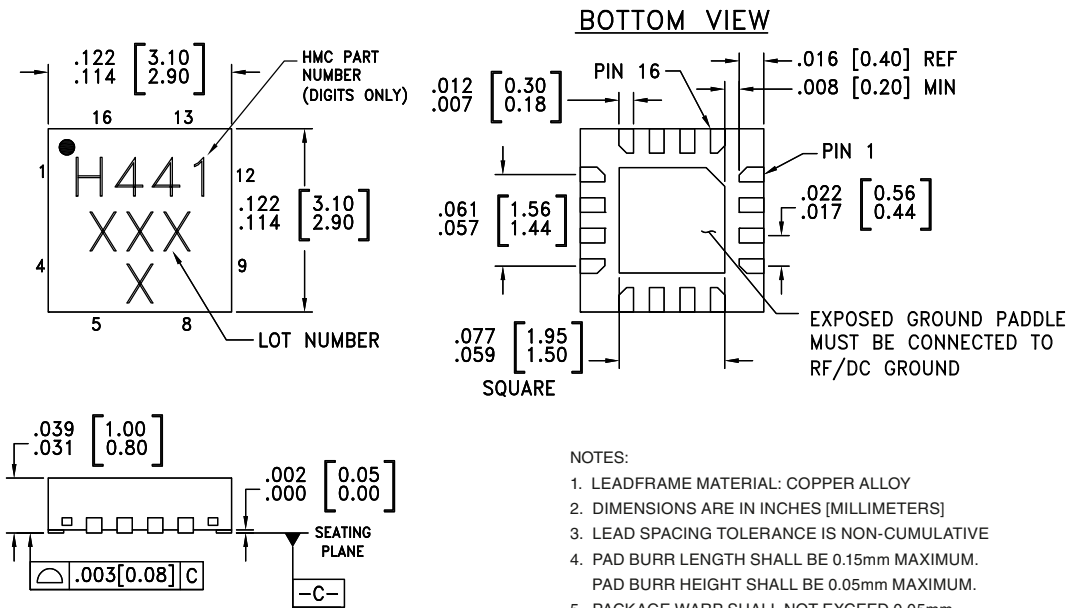
| Vdd (V) | Idd (mA) |
|---------|----------|
| +5.5    | 92       |
| +5.0    | 90       |
| +4.5    | 88       |
| +3.3    | 83       |
| +3.0    | 82       |

Note: Amplifier will operate over full voltage range shown above



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



NOTES:

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

### Package Information

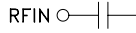
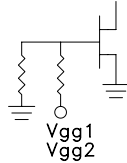
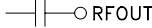
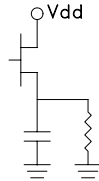
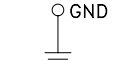
| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC441LP3   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 441<br>XXXX                    |
| HMC441LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 441<br>XXXX                    |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

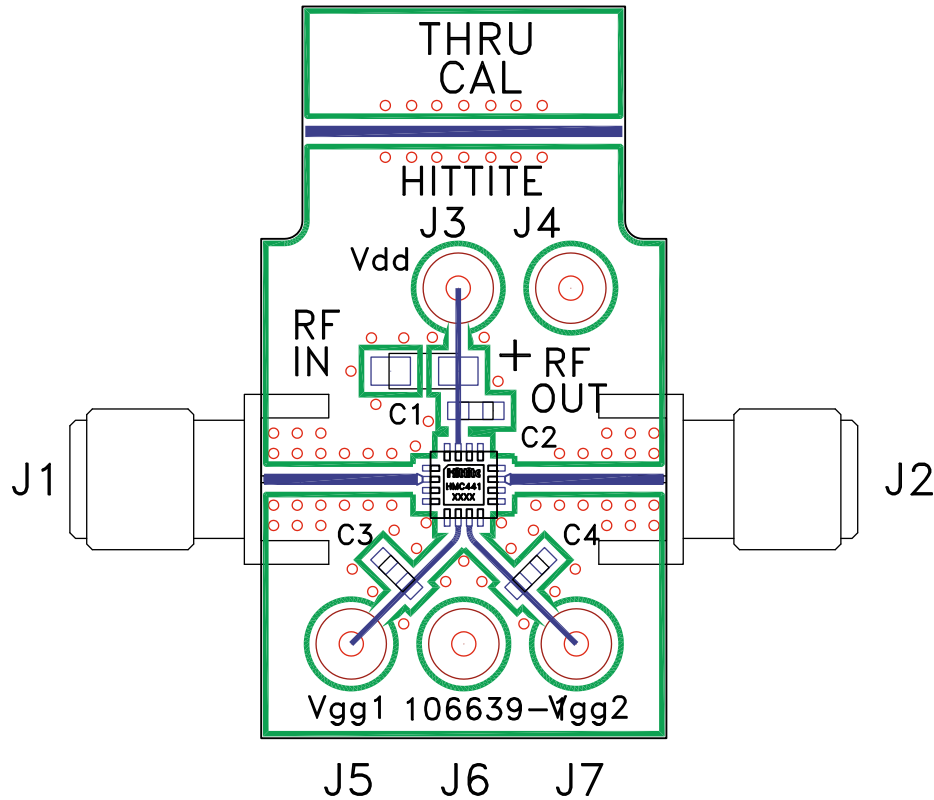

**GaAs pHEMT MMIC MEDIUM  
POWER AMPLIFIER, 6.5 - 13.5 GHz**
**Pin Descriptions**

| Pin Number                 | Function   | Description  | Interface Schematic  |
|----------------------------|------------|--|--|
| 1, 3-5, 8-10,<br>12-14, 16 | N/C        | This pin may be connected to RF/DC ground.   |  |
| 2                          | RFIN       | This pin is AC coupled and matched to 50 Ohms.   | RFIN  |
| 6, 7                       | Vgg1, Vgg2 | Optional gate control for amplifier. If left open, the amplifier will run at standard current. Negative voltage applied will reduce current. |       |
| 11                         | RFOUT      | This pin is AC coupled and matched to 50 Ohms.   |       |
| 15                         | Vdd        | Power Supply Voltage for the amplifier. An external bypass capacitor of 100 pF is required.  |      |
|                            | GND        | Package bottom must be connected to RF/DC ground.  |     |



## GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6.5 - 13.5 GHz

### Evaluation PCB



### List of Materials for Evaluation PCB 106705 [1]

| Item    | Description                      |
|---------|----------------------------------|
| J1 - J2 | PCB Mount SMA Connector          |
| J3 - J7 | DC Pin                           |
| C1      | 4.7 $\mu$ F Capacitor, Tantalum  |
| C2 - C4 | 100 pF Capacitor, 0402 Pkg.      |
| U1      | HMC441LP3 / HMC441LP3E Amplifier |
| PCB [2] | 106639 Evaluation PCB, 10 mils   |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final 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. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Analog Devices Inc.:](#)

[HMC441LP3ETR](#) [HMC441LP3E](#) [HMC441LP3](#)