

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

### Typical Applications

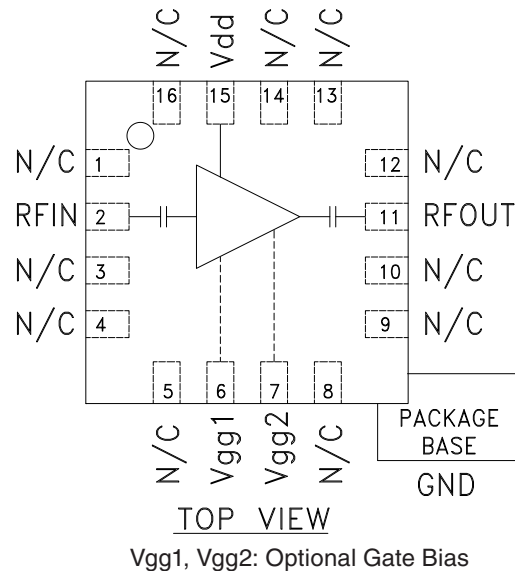
The HMC441LP3E is a medium PA for:

- 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



### General Description

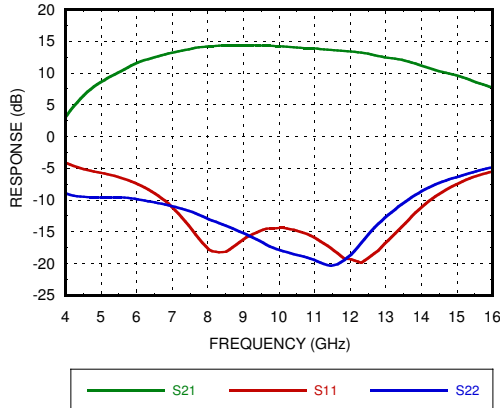
The HMC441LP3E is a broadband GaAs pHEMT MMIC Medium Power Amplifiers which operate between 6.5 and 13.5 GHz. The leadless plastic QFN surface mount packaged amplifier provides 14 dB of gain, +20 dBm saturated power at 20% PAE from a +5V supply voltage. An optional gate bias is provided to allow adjustment 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, $T_A = +25^\circ\text{C}$ , $V_{dd} = 5\text{V}$ , $V_{gg1} = V_{gg2} = \text{Open}$

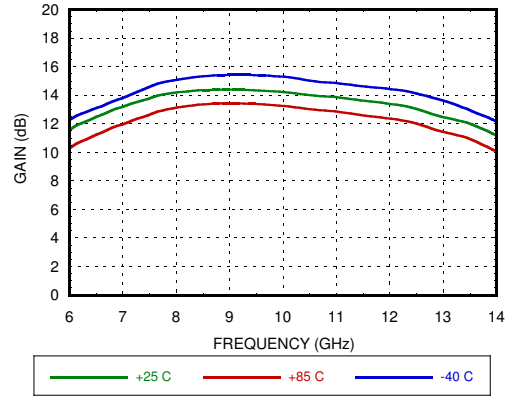
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range	6.5 - 8.0			8.0 - 11.0			11.0 - 13.5			GHz
Gain	10	13		12	14		10	13		dB
Gain Variation Over Temperature		0.02	0.025		0.02	0.025		0.02	0.025	dB/°C
Input Return Loss		12			15			14		dB
Output Return Loss		12			15			13		dB
Output 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

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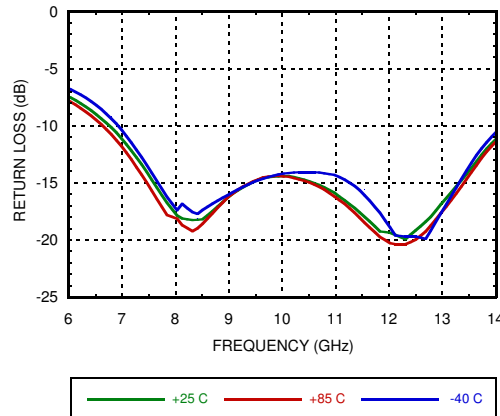
**Broadband Gain & Return Loss**



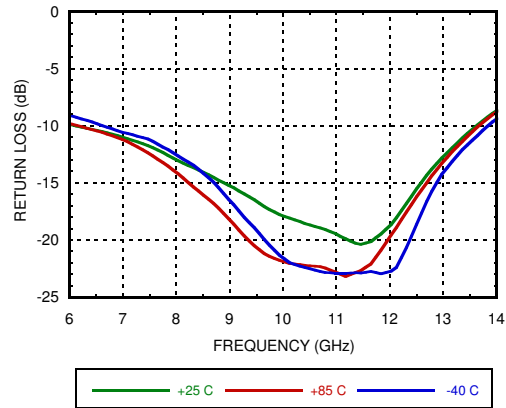
**Gain vs. Temperature**



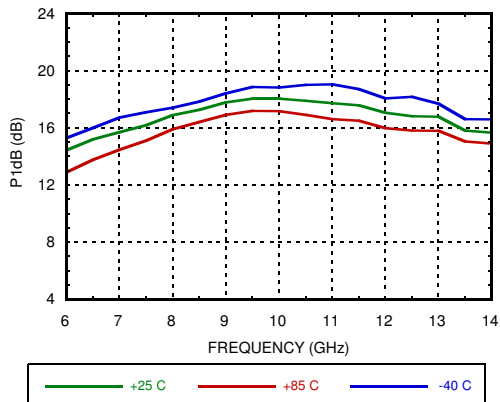
**Input Return Loss vs. Temperature**



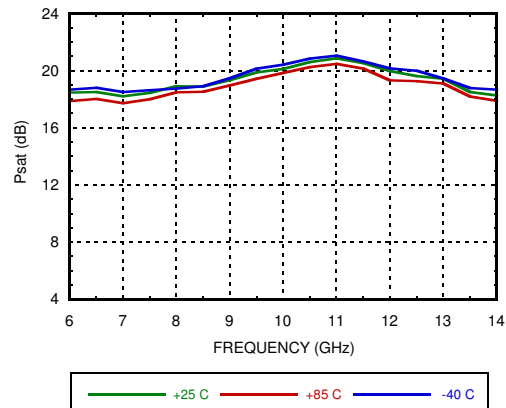
**Output Return Loss vs. Temperature**



**P1dB vs. Temperature**

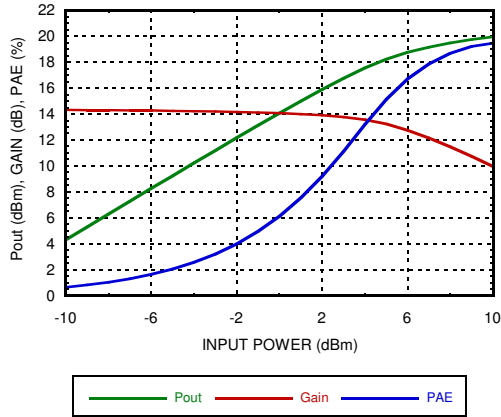


**Psat vs. Temperature**

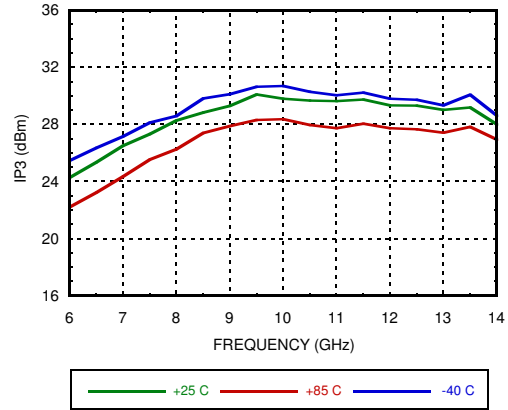


**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6.5 - 13.5 GHz**

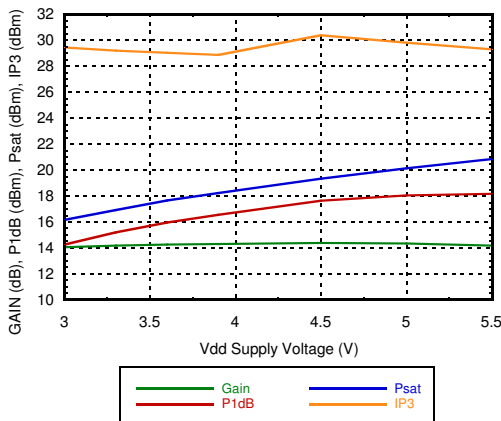
**Power Compression @ 10 GHz**



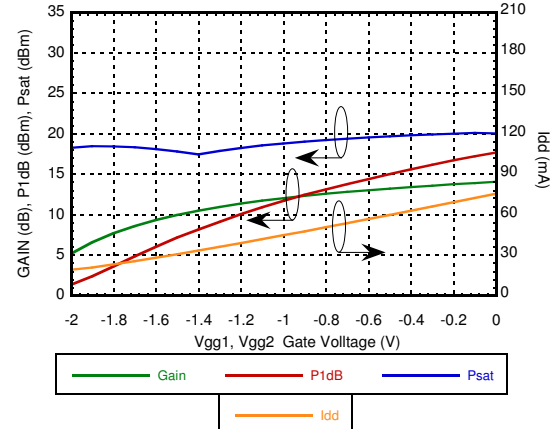
**Output IP3 vs. Temperature**



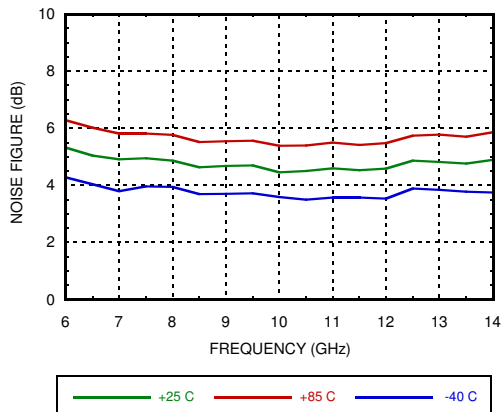
**Gain, Power & Output IP3 vs. Supply Voltage @ 10 GHz**



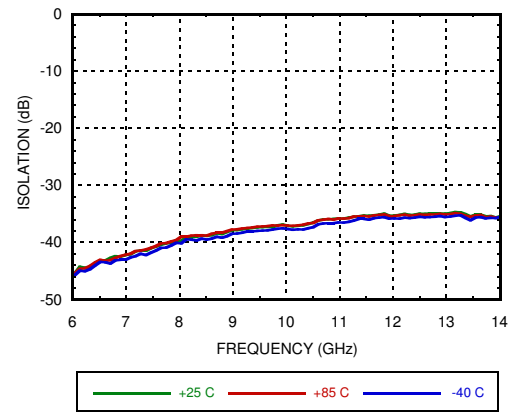
**Gain, Power & Idd vs. Gate Voltage @ 10 GHz**



**Noise Figure vs. Temperature**

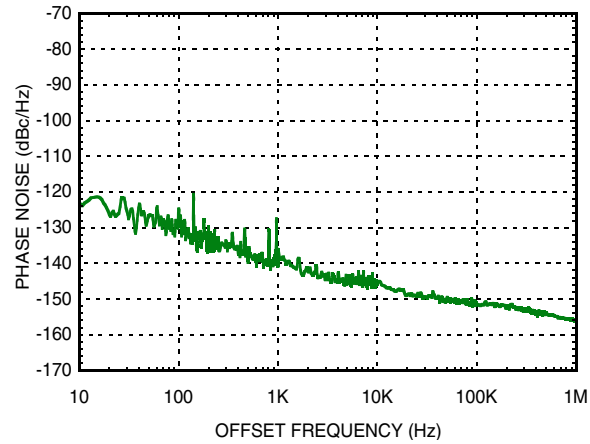


**Reverse Isolation vs. Temperature**



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**Phase Noise @ P1dB at , 8GHz  
vs. Frequency**



**Notes:**

## 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) (derate 8.5 mW/°C above 85 °C)	0.76 W
Thermal Resistance (channel to ground paddle)	118.2 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class0 Passed 100V

### Typical Supply Current vs. Vdd

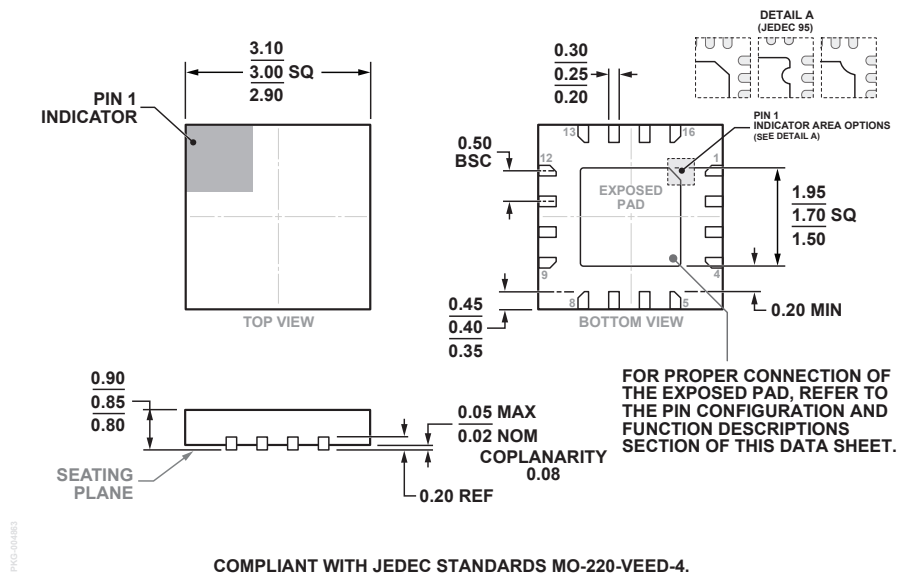
Vdd (V)	Idd (mA)
+5.5	92
+5.0	90
+4.5	88
+3.3	83
+3.0	82

Note: Amplifier will operate over full voltage range shown above



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



16-Lead Lead Frame Chip Scale Package [LFCSP]  
 3 mm x 3 mm and 0.85 mm Package Height  
 (HCP-16-1)  
 Dimensions shown in millimeters

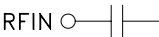
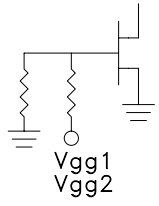
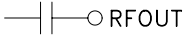
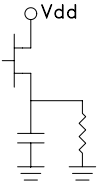

### Package Information

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

[1] Max peak reflow temperature of 260 °C

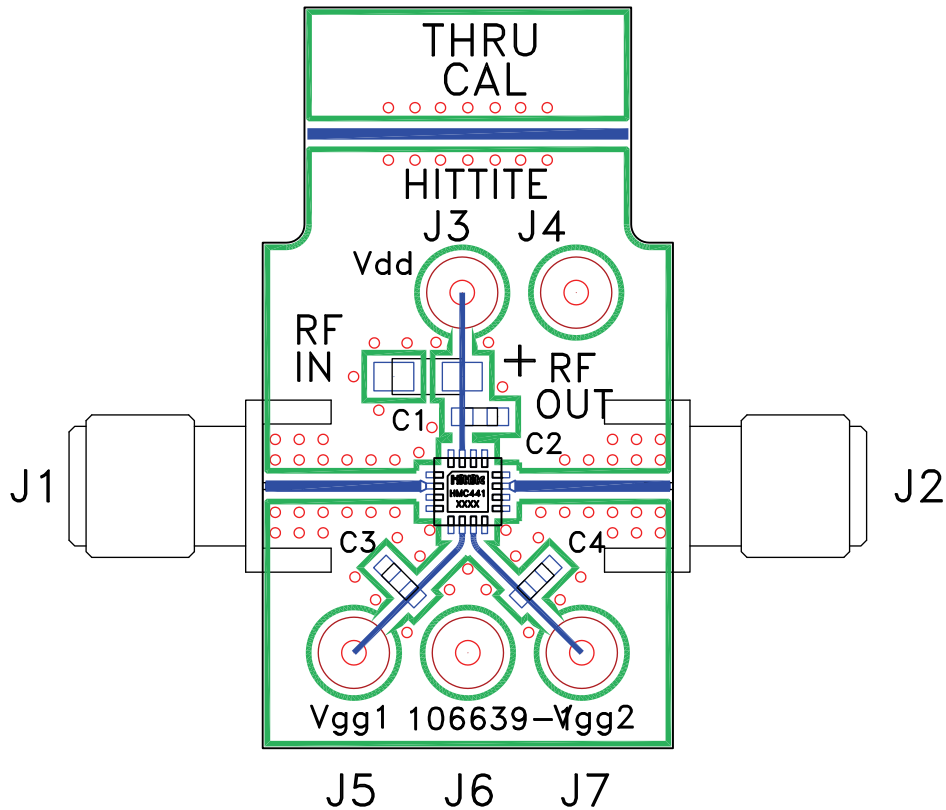
[2] 4-Digit lot number XXXX

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**Pin Descriptions**

Pin Number	Function	Description	Interface Schematic
1, 3-5, 8-10, 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.	

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**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 Analog Devices upon request.