

## GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6 - 18 GHz

### Typical Applications

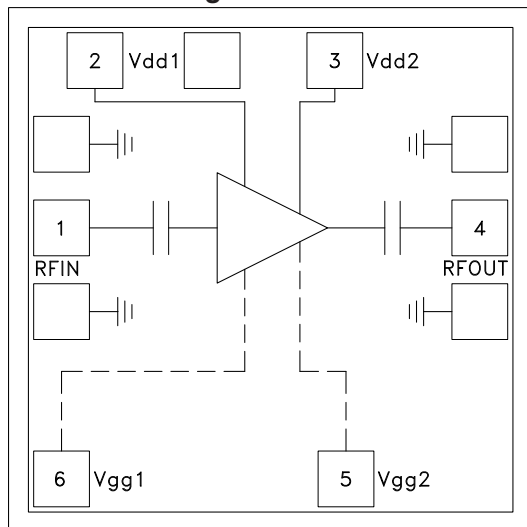
The HMC441 is ideal for:

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

### Features

- Gain: 15.5 dB
- Saturated Power: +22 dBm @ 23% PAE
- Single Supply Voltage: +5V w/ Optional Gate Bias
- 50 Ohm Matched Input/Output
- Die Size: 0.94 x 0.94 x 0.1 mm

### Functional Diagram



Vgg1, Vgg2: Optional Gate Bias

### General Description

The HMC441 is an efficient GaAs PHEMT MMIC Medium Power Amplifier which operates between 6 and 18 GHz. The amplifier provides 15.5 dB of gain, +22 dBm of saturated power, and 23% PAE from a +5V supply voltage. An optional gate bias is provided to allow adjustment of gain, RF output power, and DC power dissipation. The HMC441 amplifier can easily be integrated into Multi-Chip-Modules (MCMs) due to its small size. The backside of the die is both RF and DC ground, simplifying the assembly process and reducing performance variation. All data is tested with the chip in a 50 Ohm test fixture connected via 0.025mm (1 mil) diameter wire bonds of minimal length 0.31mm (12 mils).

### Electrical Specifications, $T_A = +25^\circ \text{C}$ , $V_{dd1} = V_{dd2} = 5\text{V}$ , $V_{gg1} = V_{gg2} = \text{Open}$

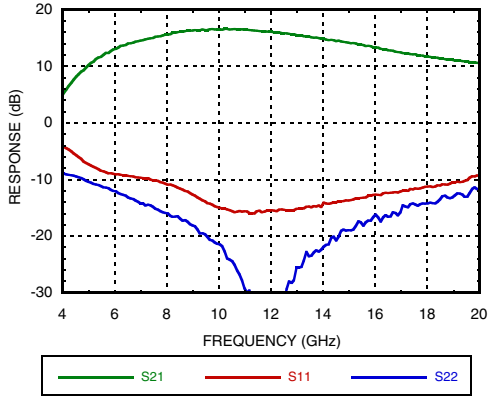
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range	7.0 - 8.0			8.0 - 12.5			12.5 - 14.0			14.0 - 15.5			GHz
Gain	13	15.5		14	16.5		13	15.5		12	14.5		dB
Gain Variation Over Temperature		0.015	0.02		0.015	0.02		0.015	0.02		0.015	0.02	dB/°C
Input Return Loss		10			13			15			14		dB
Output Return Loss		14			17			23			18		dB
Output Power for 1 dB Compression (P1dB)	15.5	18.5		16	19		17	20		17	20		dBm
Saturated Output Power (Psat)	17	20		18	21		19	22		19	22		dBm
Output Third Order Intercept (IP3)		29			31			32			32		dBm
Noise Figure		5.0			4.5			4.5			4.5		dB
Supply Current (Idd)		90	115		90	115		90			90	115	mA

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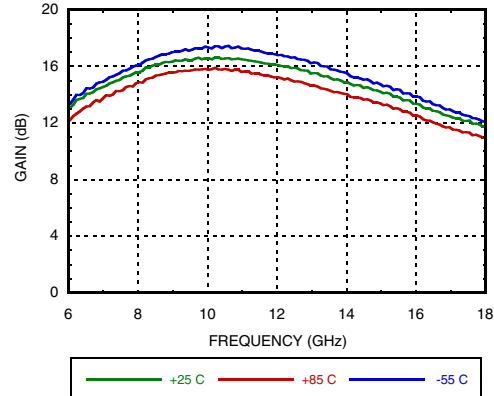
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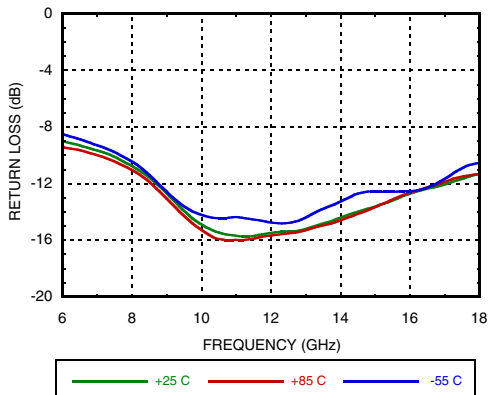
**Broadband Gain & Return Loss**



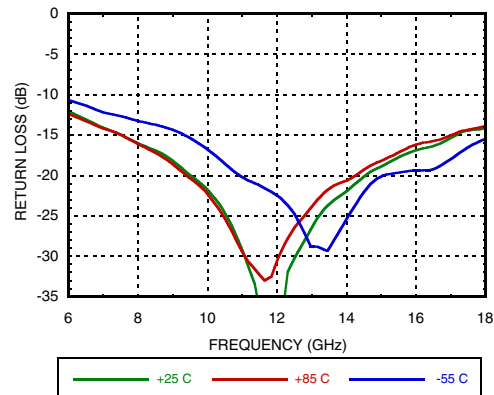
**Gain vs. Temperature**



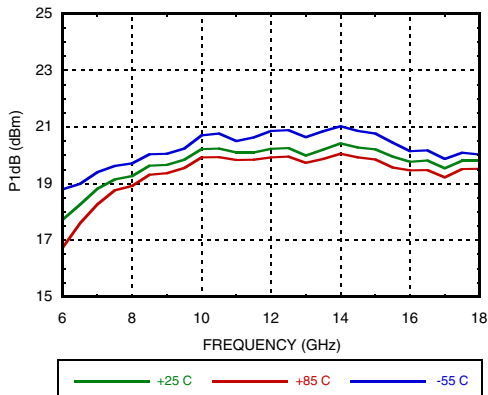
**Input Return Loss vs. Temperature**



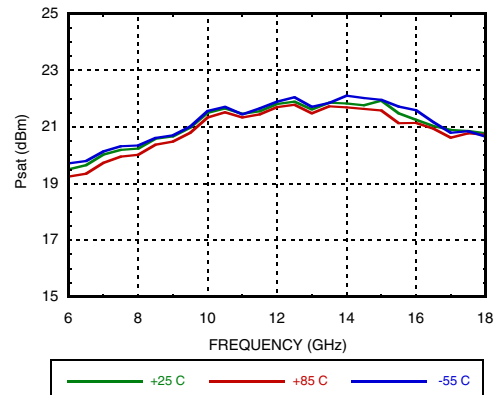
**Output Return Loss vs. Temperature**



**P1dB vs. Temperature**



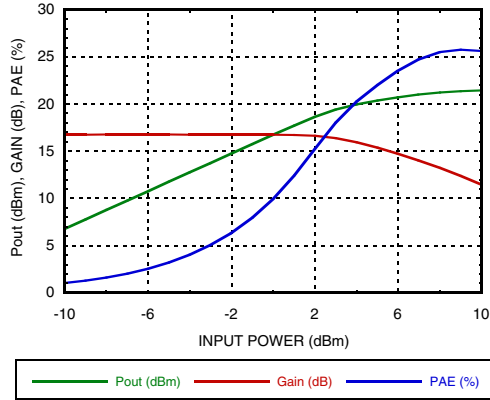
**Psat vs. Temperature**



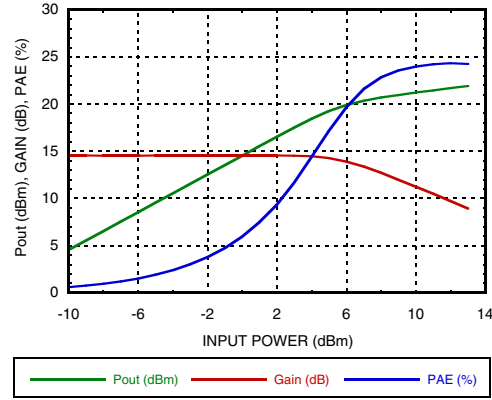
**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6 - 18 GHz**

LINEAR & POWER AMPLIFIERS - CHIP

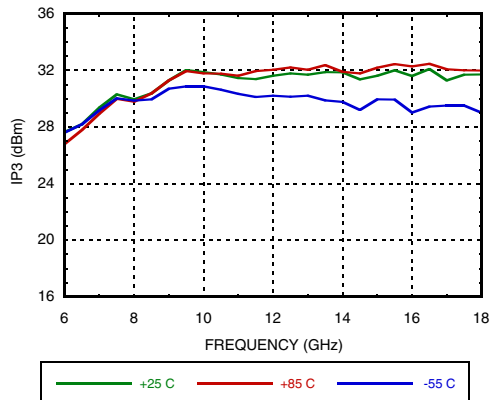
**Power Compression @ 11 GHz**



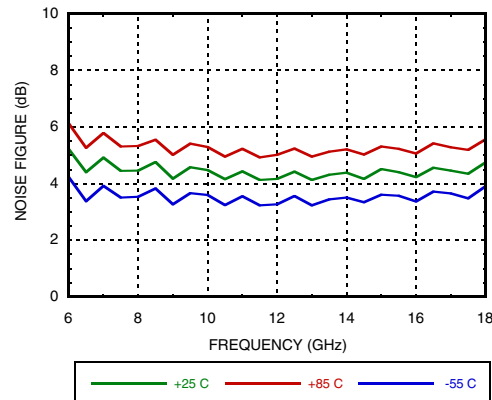
**Power Compression @ 15 GHz**



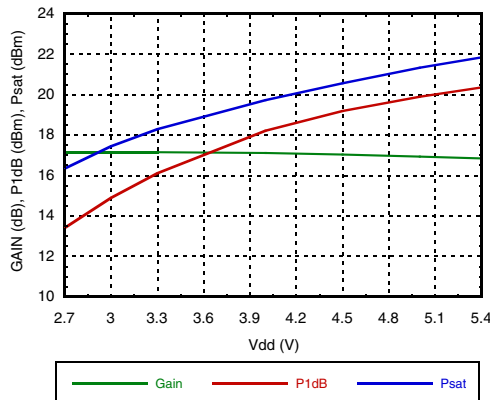
**Output IP3 vs. Temperature**



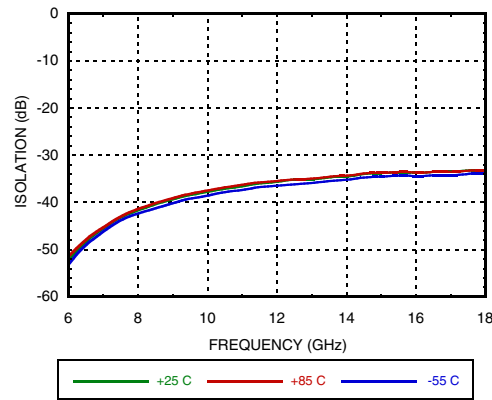
**Noise Figure vs. Temperature**



**Gain & Power vs. Supply Voltage @ 11 GHz**

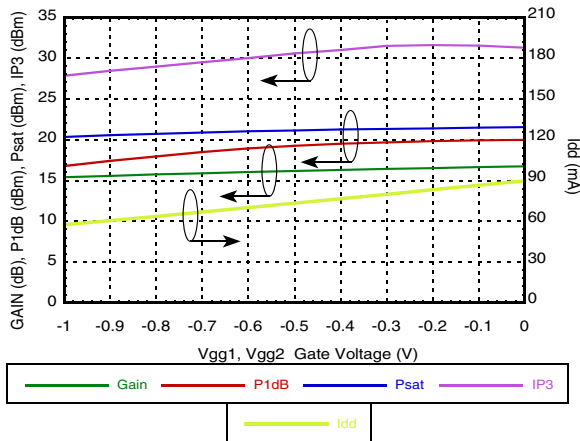


**Reverse Isolation vs. Temperature**

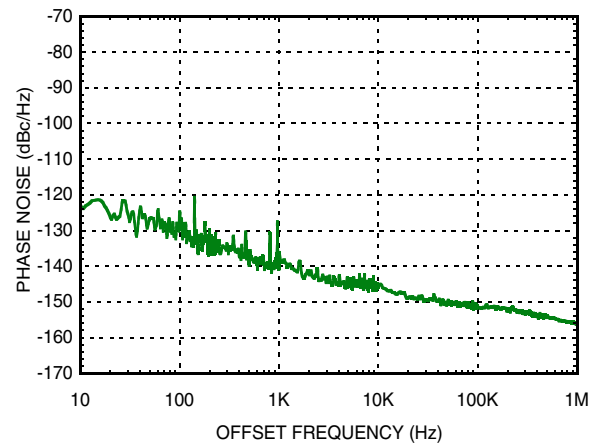


## GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6 - 18 GHz

### Gain, Power & Output IP3 vs. Gate Voltage @ 12 GHz



### Additive Phase Noise Vs Offset Frequency, RF Frequency = 8 GHz, RF Input Power = 5 dBm (P1dB)



### Absolute Maximum Ratings

Drain Bias Voltage (Vdd1, Vdd2)	+5.5 Vdc
Gate Bias Voltage (Vgg1, Vgg2)	-8 to 0 Vdc
RF Input Power (RFIN)(Vdd = +5Vdc)	+20 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 die bottom)	118 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +85 °C

### Typical Supply Current vs. Vdd

Vdd (V)	Idd (mA)
+4.5	88
+5.0	90
+5.5	92
+2.7	80
+3.0	82
+3.3	83

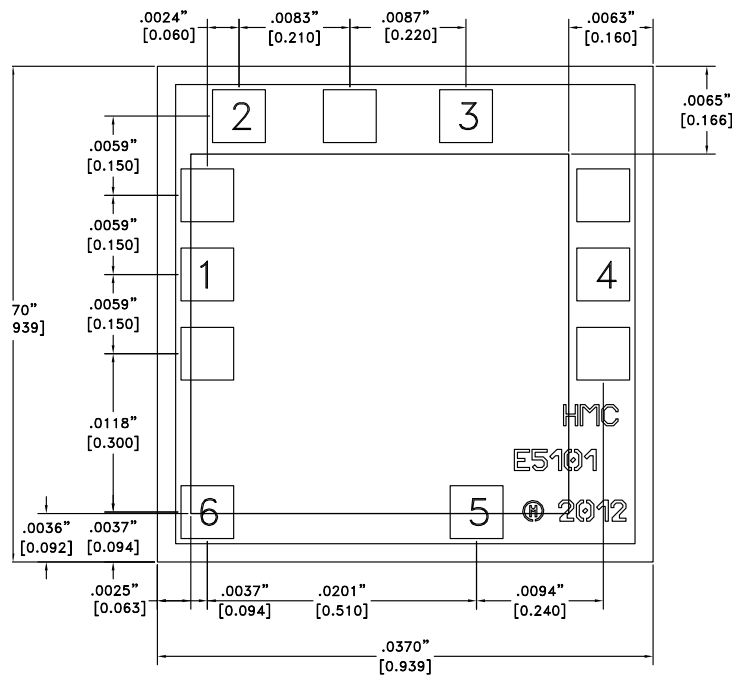
Note: Amplifier will operate over full voltage ranges shown above



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6 - 18 GHz**

**Outline Drawing**



**Die Packaging Information** [1]

Standard	Alternate
GP-2 (Gel Pack)	[2]

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

[2] For alternate packaging information contact Analog Devices, Inc.

NOTES:

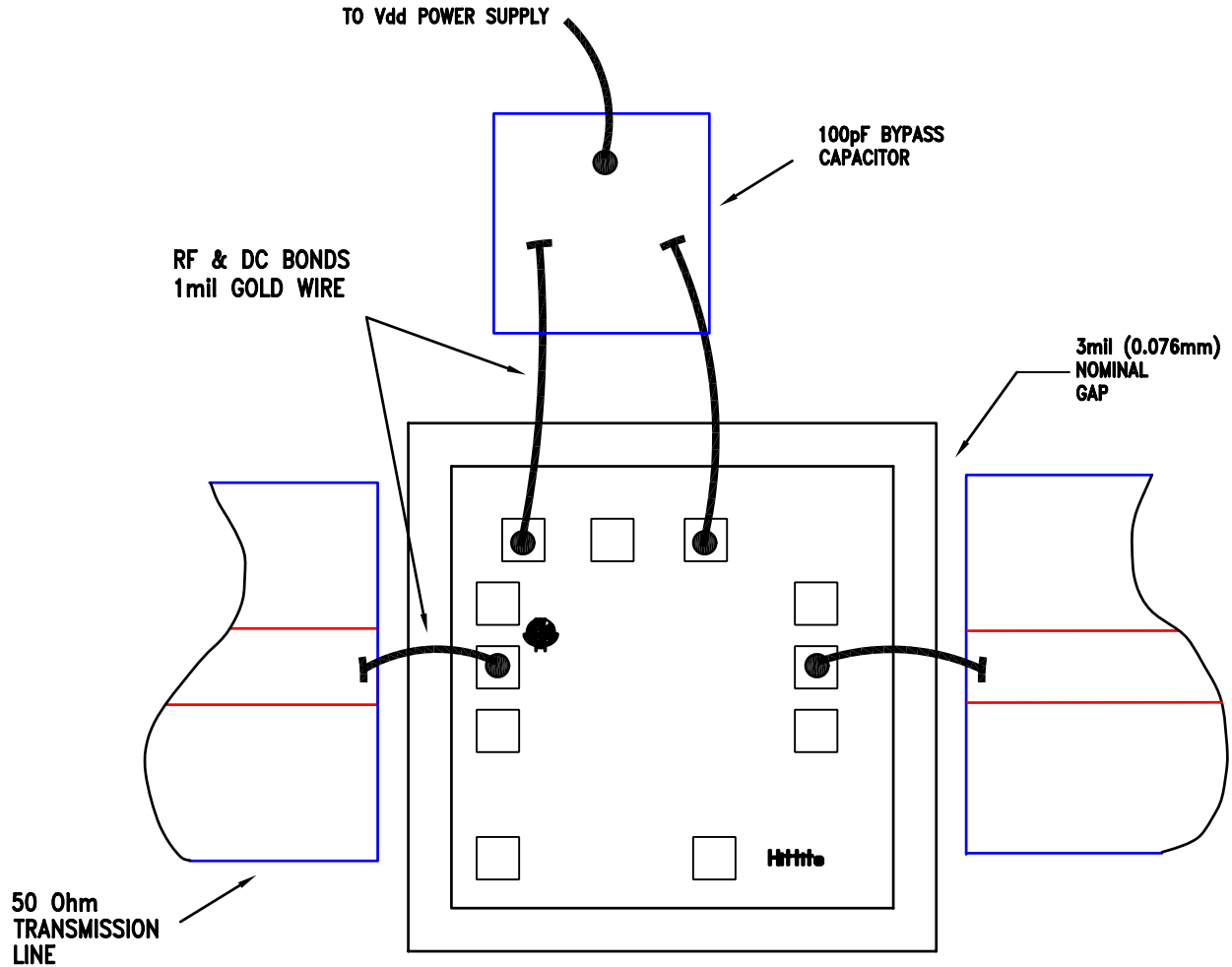
1. ALL DIMENSIONS ARE IN INCHES [MM]
2. DIE THICKNESS IS .004"
3. TYPICAL BOND IS .004" SQUARE
4. BACKSIDE METALLIZATION: GOLD
5. BOND PAD METALLIZATION: GOLD
6. BACKSIDE METAL IS GROUND.
7. CONNECTION NOT REQUIRED FOR UNLABELED BOND PADS.

**Pad Descriptions**

Pad Number	Function	Description	Pin Schematic
1	RFIN	This pad is AC coupled and matched to 50 Ohms.	
2, 3	Vdd1, Vdd2	Power Supply Voltage for the amplifier. An external bypass capacitor of 100 pF is required.	
4	RFOUT	This pad is AC coupled and matched to 50 Ohms.	
5, 6	Vgg1, Vgg2	Optional gate control for amplifier. If left open, the amplifier will run at standard current. Negative voltage applied will reduce current.	

**GaAs pHEMT MMIC MEDIUM  
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**(a) Assembly for Single Supply Voltage Operation**



**GaAs pHEMT MMIC MEDIUM POWER AMPLIFIER, 6 - 18 GHz**

**(b) Assembly with Optional Gate Bias Voltage Operation**

