

GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

Typical Applications

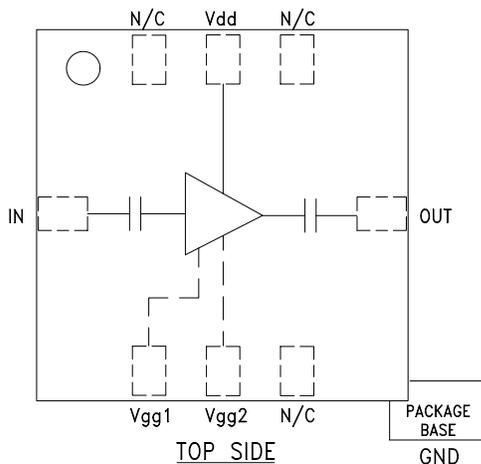
The HMC441LM1 is a medium PA for:

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

Features

- Gain: 15 dB
- Saturated Power: +21.5 dBm @ 27% PAE
- Single Supply Voltage: +5V w/ Optional Gate Bias
- 50 Ohms Matched Input/Output
- Leadless SMT Package, 25mm²

Functional Diagram



Vgg1, Vgg2: Optional Gate Bias

General Description

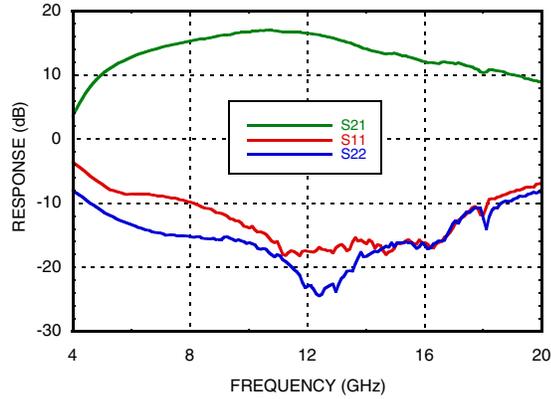
The HMC441LM1 is a broadband 7 to 15.5 GHz GaAs PHEMT MMIC Medium Power Amplifier in an SMT leadless chip carrier package. The amplifier provides 15 dB of gain, 21.5 dBm of saturated power at 27% PAE from a +5V supply voltage. An optional gate bias is provided to allow adjustment of gain, RF output power, 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, $T_A = +25^\circ\text{C}$, $V_{dd} = 5\text{V}$, $V_{gg1} = V_{gg2} = \text{Open}$

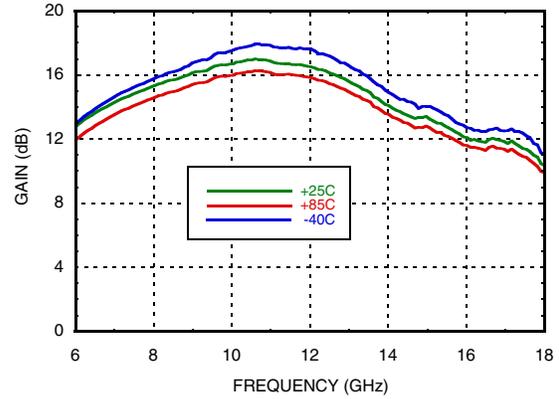
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range	7.0 - 8.0			8.0 - 12.5			12.5 - 14.0			14.0 - 15.5			GHz
Gain	12.5	15		13.5	16		12.5	15		11	13.5		dB
Gain Variation Over Temperature		0.015	0.02		0.015	0.02		0.015	0.02		0.015	0.02	dB/°C
Input Return Loss		9			13			16			16		dB
Output Return Loss		14			17			20			17		dB
Output Power for 1 dB Compression (P1dB)	15.5	18.5		16	19		17	20		16	19		dBm
Saturated Output Power (Psat)		19.5			20.5			21.5			20.5		dBm
Output Third Order Intercept (IP3)		29			30			30			30		dBm
Noise Figure		4.5			4.5			4.5			4.5		dB
Supply Current (Idd)		90	115		90	115		90	115		90	115	mA

GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

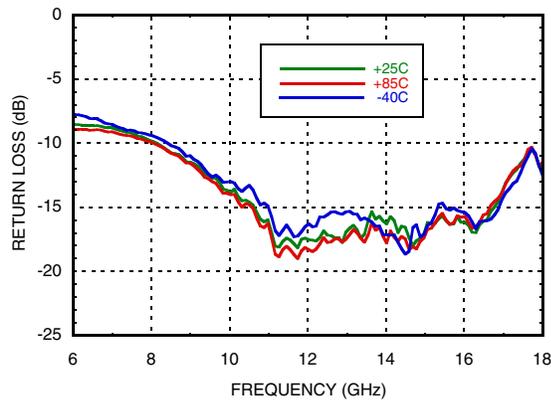
Broadband Gain & Return Loss



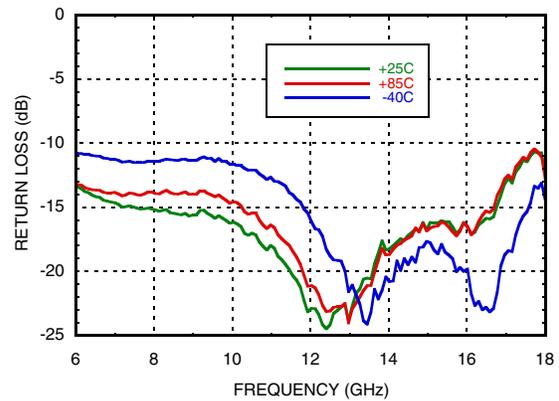
Gain vs. Temperature



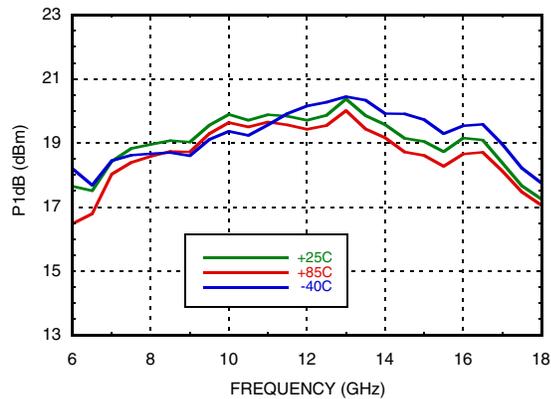
Input Return Loss vs. Temperature



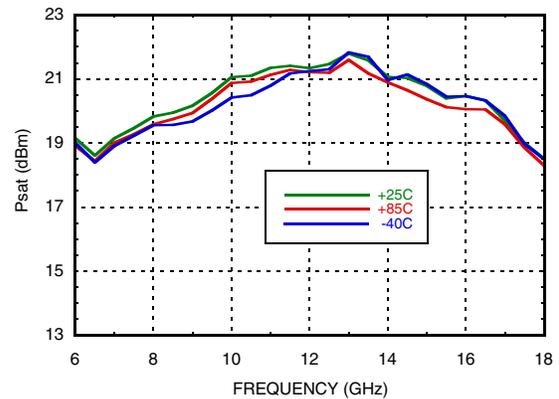
Output Return Loss vs. Temperature



P1dB vs. Temperature

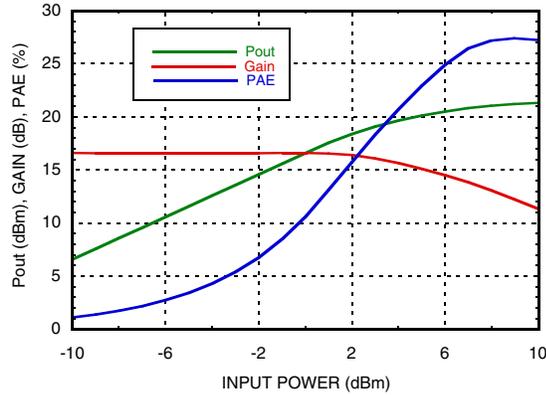


Psat vs. Temperature

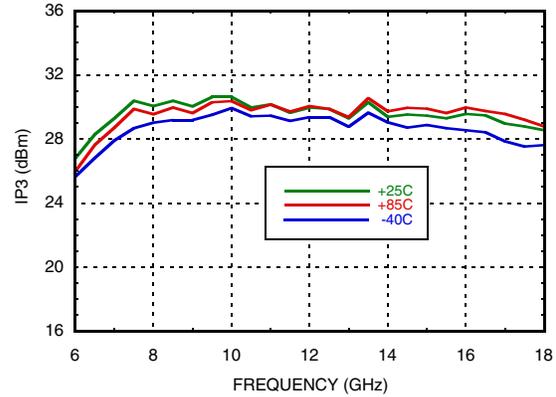


GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

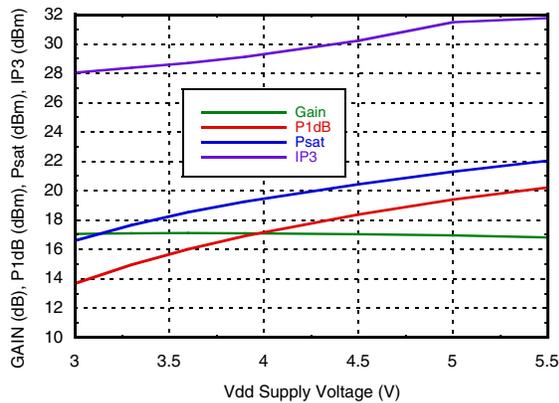
Power Compression @ 12 GHz



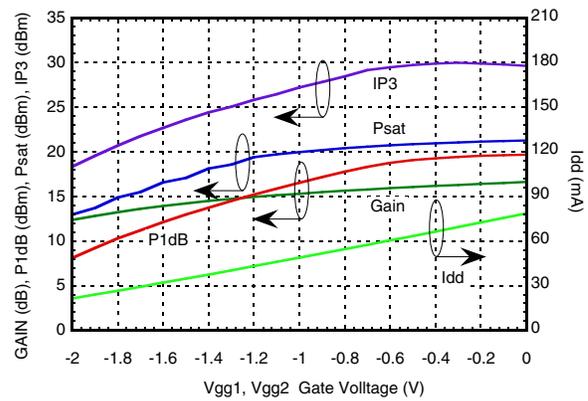
Output IP3 vs. Temperature



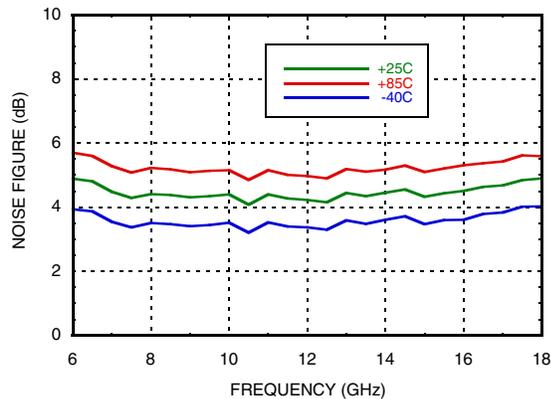
Gain, Power & Output IP3 vs. Supply Voltage @ 12 GHz



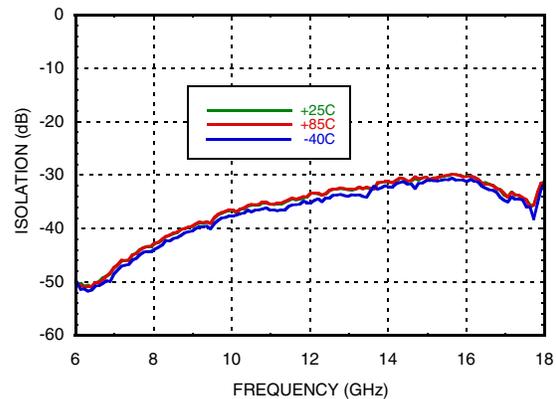
Gain, Power, Output IP3 & Idd vs. Gate Voltage @ 12 GHz



Noise Figure vs. Temperature

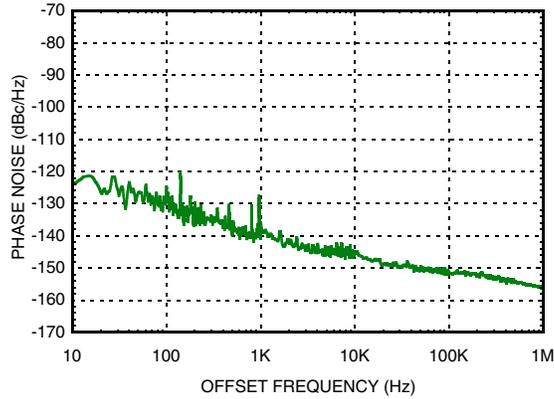


Reverse Isolation vs. Temperature



**GaAs PHEMT MMIC MEDIUM
POWER AMPLIFIER, 7 - 15.5 GHz**

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



Notes:

GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

Absolute Maximum Ratings

Drain Bias Voltage (Vdd)	+5.5 V
Gate Bias Voltage (Vgg1,Vgg2)	-8 to 0V
RF Input Power (RFIN) (Vdd = +5 Vdc)	+15 dBm
Channel Temperature	175 °C
Continuous Pdiss (T = 85 °C) (derate 7.5 mW/°C above 85 °C)	0.67 W
Thermal Resistance (channel to ground paddle)	133 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

Typical Supply Current vs. Vdd

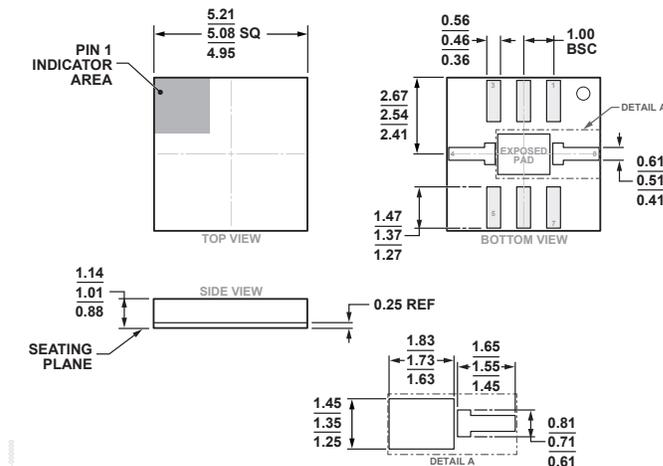
Vdd (V)	Idd (mA)
+5.5	92
+5.0	90
+4.5	88
+3.3	83
+3.0	82

Note: Amplifier will operate over full voltage range shown above



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



8-Terminal Chip Array Small Outline No Lead Cavity [LGA_CAV]
5.08 mm x 5.08 mm Body and 1.01 mm Package Height
(CE-8-1)

Dimensions shown in millimeters

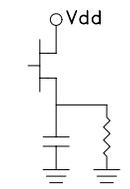
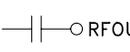
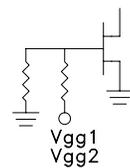
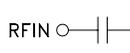
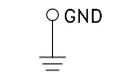
Package Information

Part Number	Package Body Material	Lead Finish	Package Marking ^[1]
HMC441LM1	Plastic	Gold plated	H441 XXXX
HMC441LM1TR	Plastic	Gold plated	H441 XXXX

[1] 4-Digit lot number XXXX

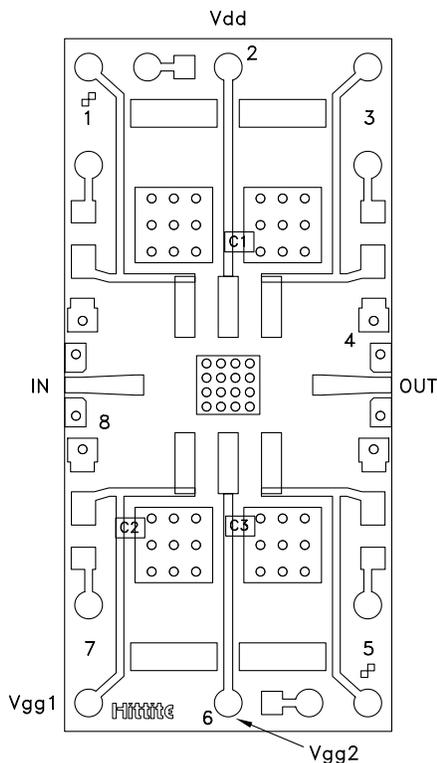
GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

Pin Descriptions

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

GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

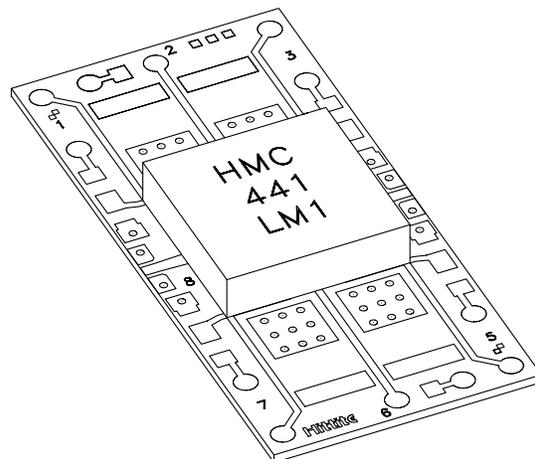
Evaluation PCB



The grounded Co-Planar Wave Guide (CPWG) PCB input/output transitions allow use of Ground-Signal-Ground (GSG) probes for testing. Suggested probe pitch is 400um (16 mils). Alternatively, the board can be mounted in a metal housing with 2.4mm coaxial connectors.

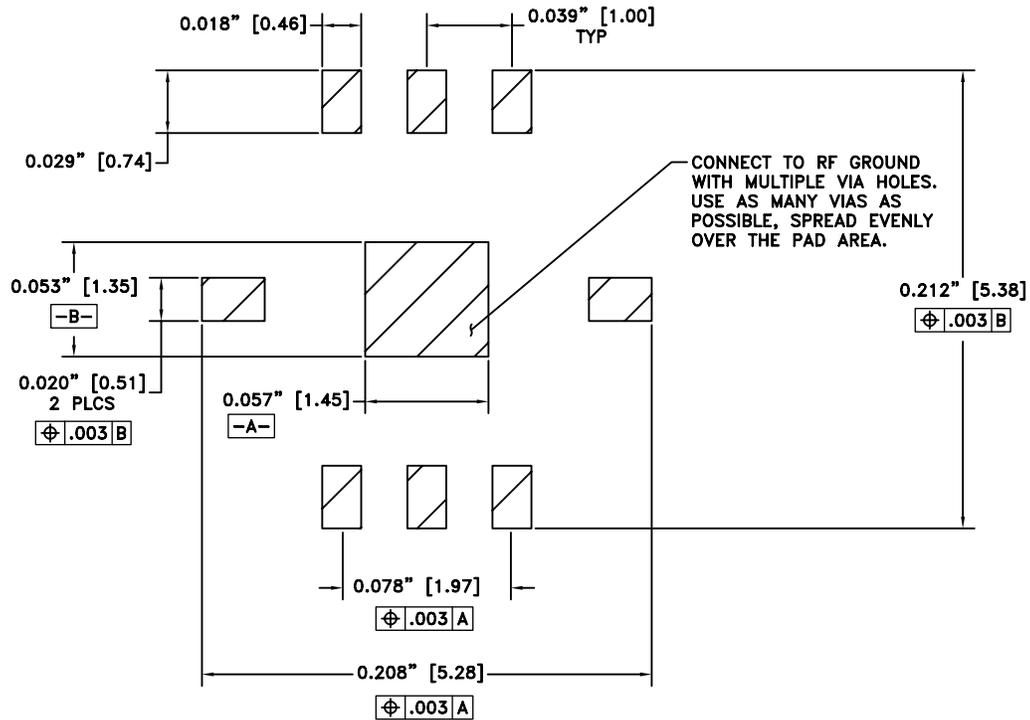
Evaluation Circuit Board Layout Design Details

Layout Technique	Micro Strip to CPWG
Material	Rogers 4003 with 1/2 oz, Cu
Dielectric Thickness	0.008" (0.20 mm)
Microstrip Line Width	0.018" (0.46 mm)
CPWG Line Width	0.016" (0.41 mm)
CPWG Line to GND Gap	0.005" (0.13 mm)
Ground Via Hole Diameter	0.008" (0.20 mm)
C1 - C3	100 pF Capacitor, 0402 Pkg.

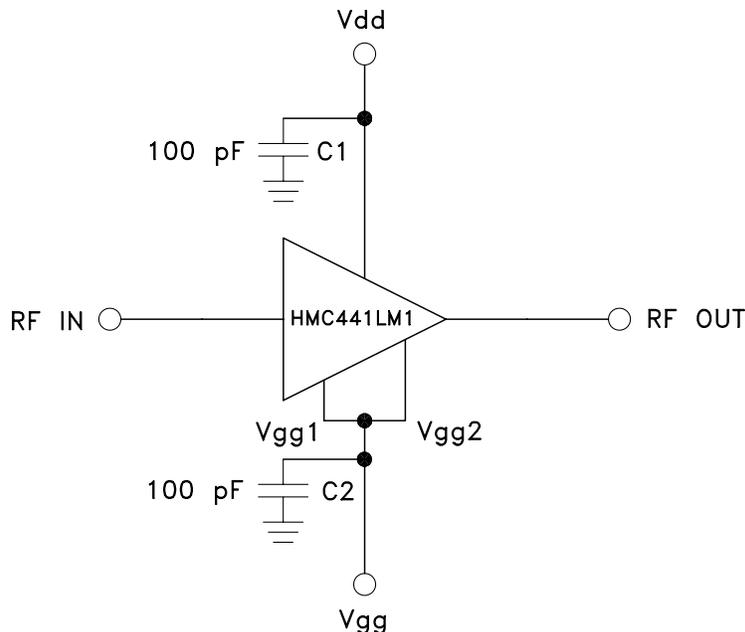


GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 7 - 15.5 GHz

Suggested LM1 PCB Land Pattern Tolerance: $\pm 0.003''$ (± 0.08 mm)



Amplifier Application Circuit



Note: Optional gate bias connections. Vgg1 and Vgg2 may be connected to a common Vgg feed.