GaAs PHEMT MMIC LOW NOISE AMPLIFIER, 2.0 - 20.0 GHz

Typical Applications

The HMC462 Wideband LNA is ideal for:

- Telecom Infrastructure
- Microwave Radio & VSAT
- Military & Space
- Test Instrumentation
- Fiber Optics

Features

Noise Figure: 2 dB @ 10 GHz

Gain: 15 dB

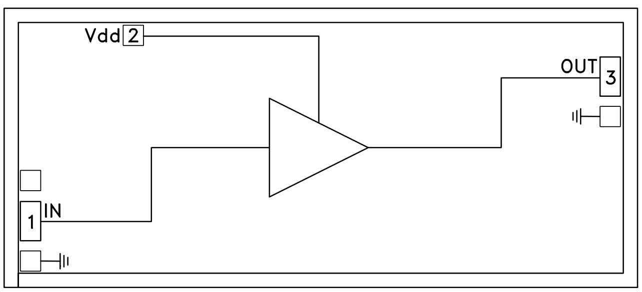
P1dB Output Power: +15 dBm @ 10 GHz

Self-Biased: +5.0V @ 63 mA

50 Ohm Matched Input/Output

3.12 mm x 1.38 mm x 0.1 mm

Functional Diagram



General Description

The HMC462 is a GaAs MMIC PHEMT Low Noise Distributed Amplifier die which operates between 2 and 20 GHz. The amplifier provides 15 dB of gain, 2.0 to 2.5 dB noise figure and +15 dBm of output power at 1 dB gain compression while requiring only 63 mA from a single +5V supply. Gain flatness is excellent at ±0.5 dB from 6 - 18 GHz making the HMC462 ideal for EW, ECM and RADAR applications. The HMC462 requires a single supply of +5V @ 63 mA and is the self-biased version of the HMC463. The wideband amplifier I/Os are internally matched to 50 Ohms facilitating easy integration into Multi-Chip-Modules (MCMs). All data is 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° C, Vdd= 5V

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		2.0 - 6.0			6.0 - 18.0			18.0 - 20.0		GHz
Gain	13.5	15.5		13	15		12	14		dB
Gain Flatness		±0.5			±0.5			±0.5		dB
Gain Variation Over Temperature		0.015	0.025		0.015	0.025		0.015	0.025	dB/ °C
Noise Figure		3.0	4.0		2.5	3.5		3.0	3.7	dB
Input Return Loss		15			20			14		dB
Output Return Loss		12			13			8		dB
Output Power for 1 dB Compression (P1dB)	12.5	15.5		11	14		9.5	12.5		dBm
Saturated Output Power (Psat)		18			16			15.5		dBm
Output Third Order Intercept (IP3)		26.5			25.5			24		dBm
Supply Current (Idd) (Vdd= 5V)		63			63			63		mA

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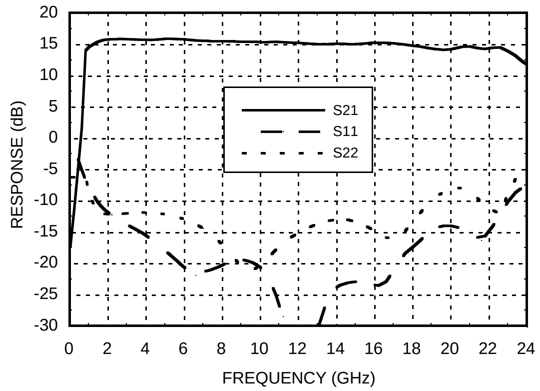
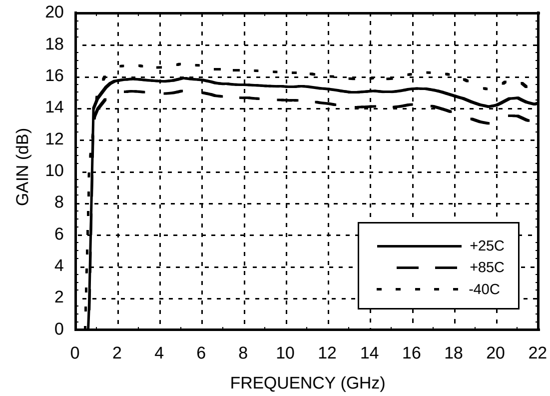
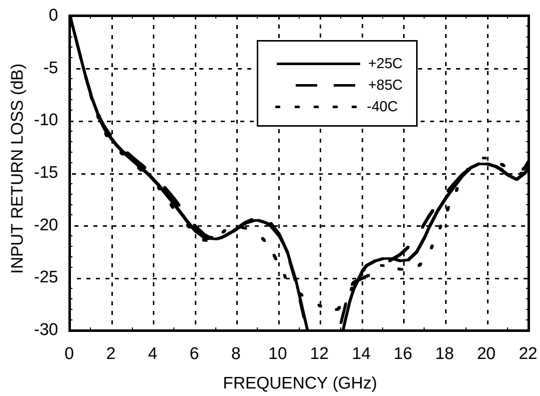
Gain & Return Loss



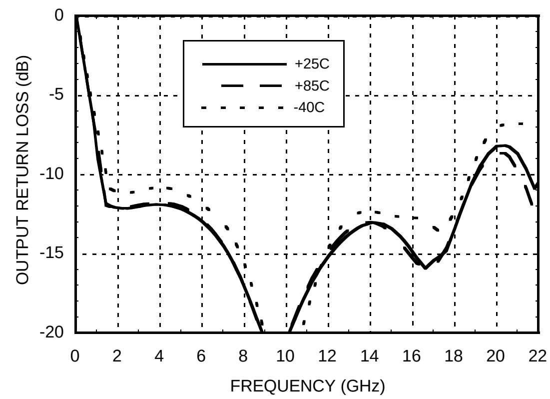
Gain vs. Temperature



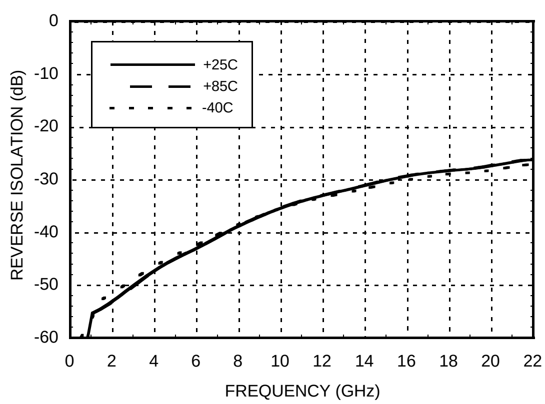
Input Return Loss vs. Temperature



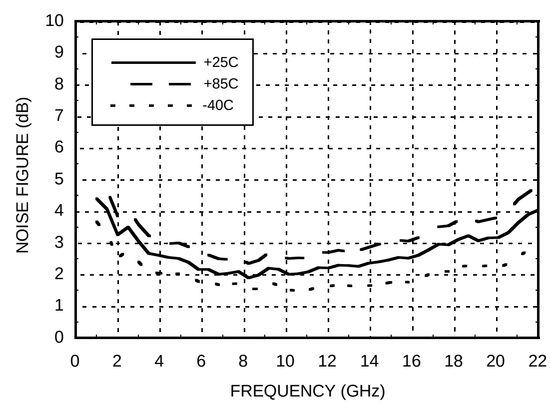
Output Return Loss vs. Temperature



Reverse Isolation vs. Temperature



Noise Figure vs. Temperature



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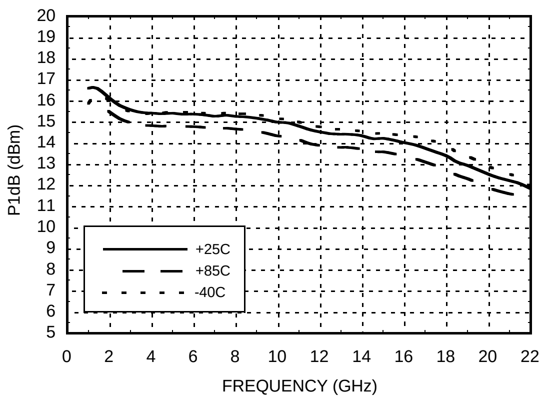
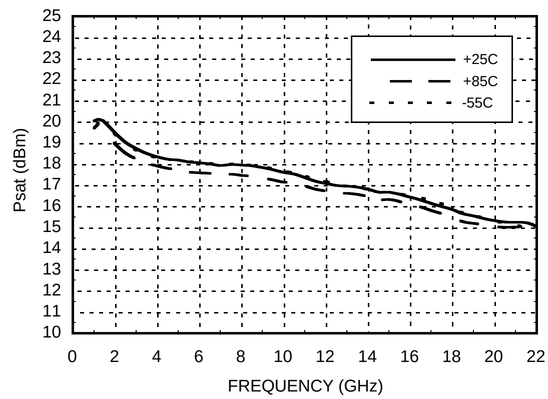
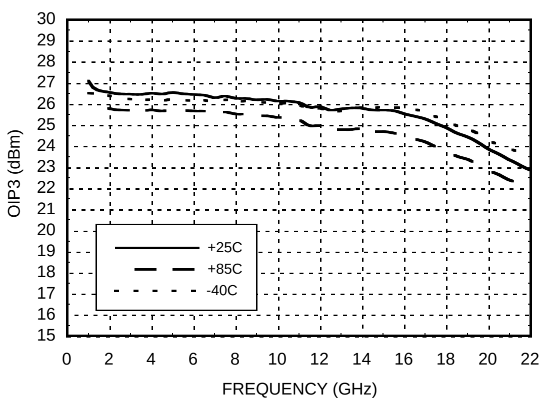
P1dB vs. Temperature



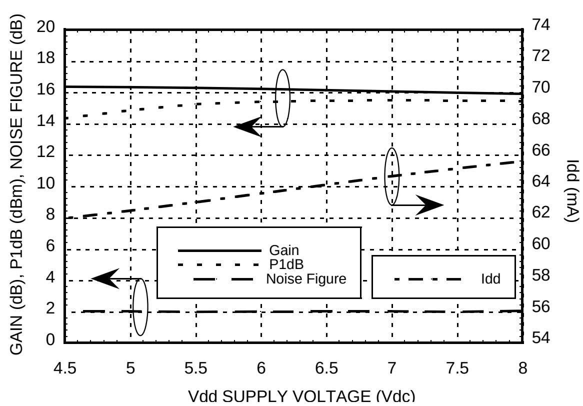
Psat vs. Temperature



Output IP3 vs. Temperature



Gain, Power, Noise Figure & Supply Current vs. Supply Voltage @ 10 GHz



Absolute Maximum Ratings

Drain Bias Voltage (Vdd)	+9.0 Vdc
RF Input Power (RFin)(Vdd = +5.0 Vdc)	+23 dBm
Channel Temperature	175 °C
Continuous Pdiss (T = 85 °C) (derate 50 mW/°C above 85 °C)	4.5 W
Thermal Resistance (channel to die bottom)	20 °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	62
+5.0	63
+5.5	64
+7.0	65
+7.5	66
+8.0	67

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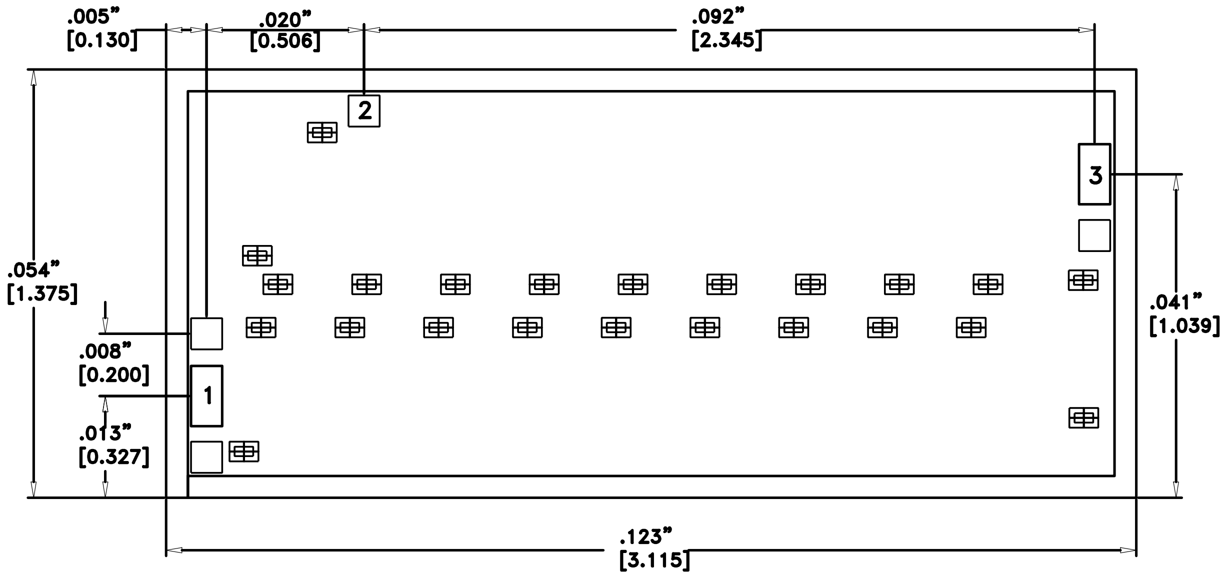
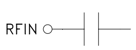
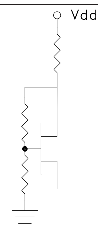
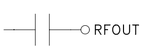
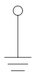
Outline Drawing



NOTES:
1. ALL DIMENSIONS IN INCHES [MILLIMETERS]
2. NO CONNECTION REQUIRED FOR UNLABELED BOND PADS
3. DIE THICKNESS IS 0.004 (0.100)
4. TYPICAL BOND PAD IS 0.004 (0.100) SQUARE
5. BACKSIDE METALLIZATION: GOLD
6. BACKSIDE METAL IS GROUND
7. BOND PAD METALIZATION: GOLD

Pad Descriptions

Pad Number	Function	Description	Interface Schematic
1	RFIN	This pad is AC coupled and matched to 50 Ohms from 2.0 - 20.0 GHz	
2	Vdd	Power supply voltage for the amplifier. External bypass capacitors are required	
3	RFOUT	This pad is AC coupled and matched to 50 Ohms from 2.0 - 20.0 GHz	
Die Bottom	GND	Die bottom must be connected to RF/DC ground.	

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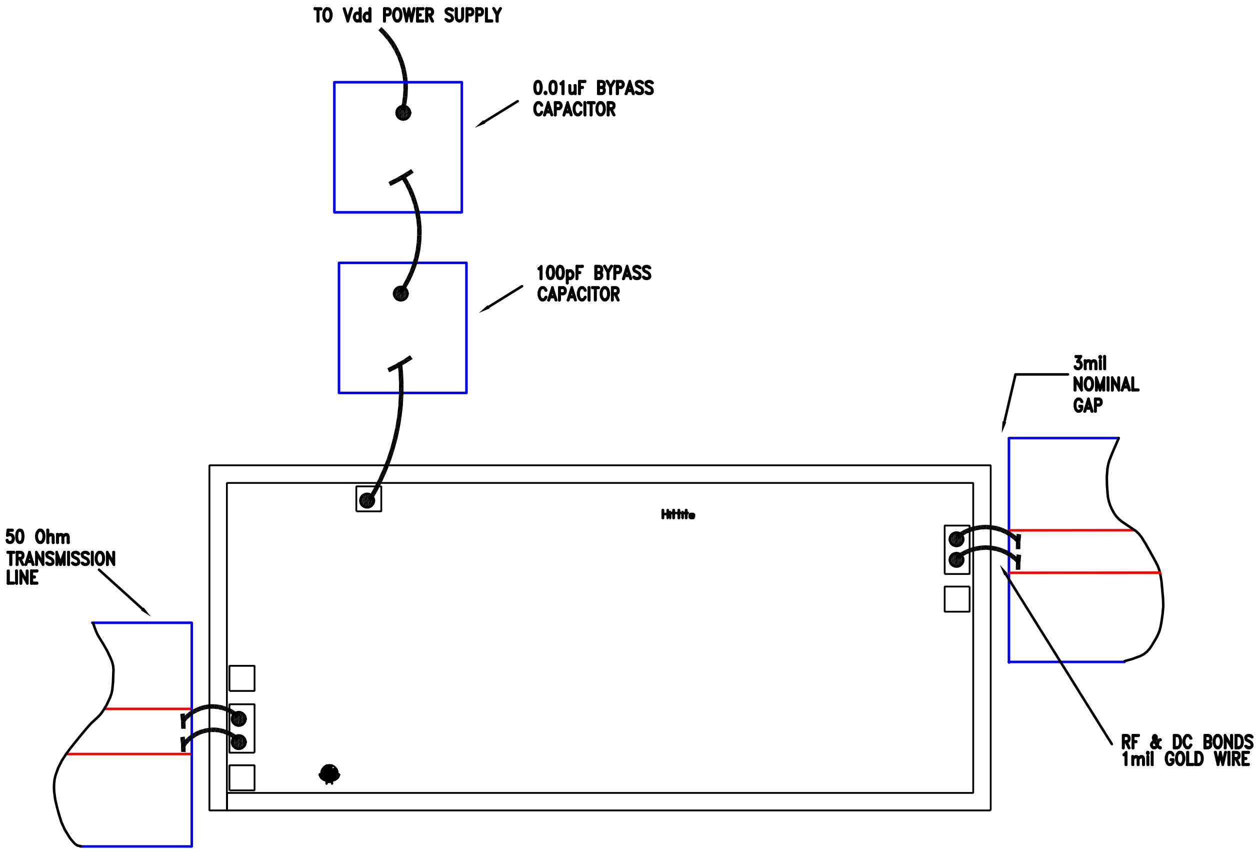
Assembly Diagram



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Mounting & Bonding Techniques for Millimeterwave GaAs MMICs

The die should be attached directly to the ground plane with conductive epoxy (see HMC general Handling, Mounting, Bonding Note).

50 Ohm Microstrip transmission lines on 0.127mm (5 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1). If 0.254mm (10 mil) thick alumina thin film substrates must be used, the die should be raised 0.150mm (6 mils) so that the surface of the die is coplanar with the surface of the substrate. One way to accomplish this is to attach the 0.102mm (4 mil) thick die to a 0.150mm (6 mil) thick molybdenum heat spreader (moly-tab) which is then attached to the ground plane (Figure 2).

Microstrip substrates should brought as close to the die as possible in order to minimize bond wire length. Typical die-to-substrate spacing is 0.076mm to 0.152 mm (3 to 6 mils).

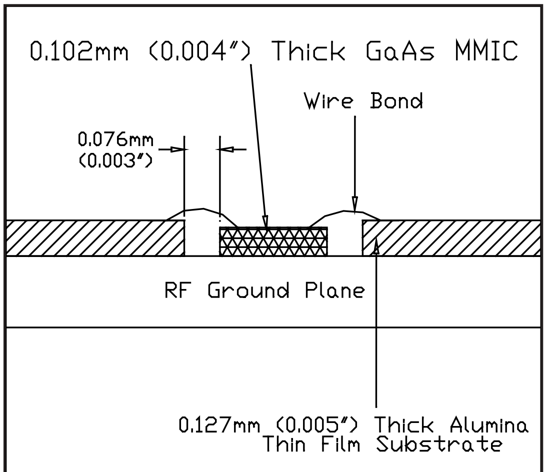

Figure 1.

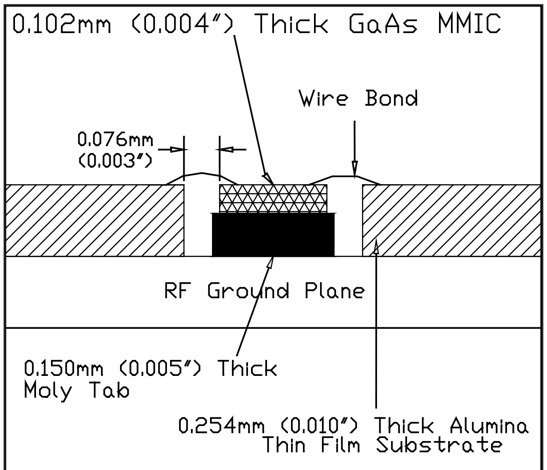

Figure 2.

Handling Precautions

Follow these precautions to avoid permanent damage.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.
Static Sensitivity: Follow ESD precautions to protect against > ± 250V ESD strikes.
Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.
General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip has fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

Mounting

The chip is back-metallized and can be die mounted with electrically conductive epoxy. The mounting surface should be clean and flat.

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 deg. C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31mm (12 mils).