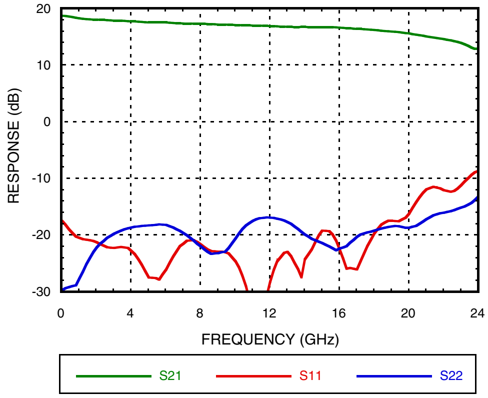
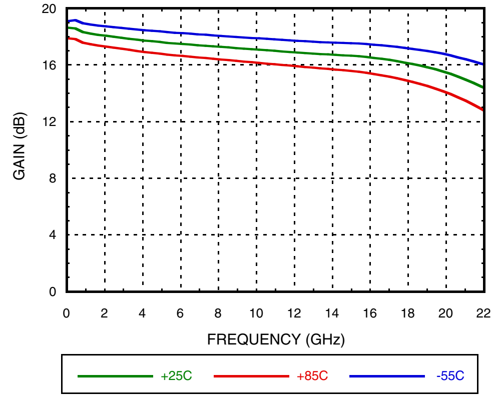
GaAs pHEMT MMIC MODULATOR DRIVER AMPLIFIER, DC - 20 GHz

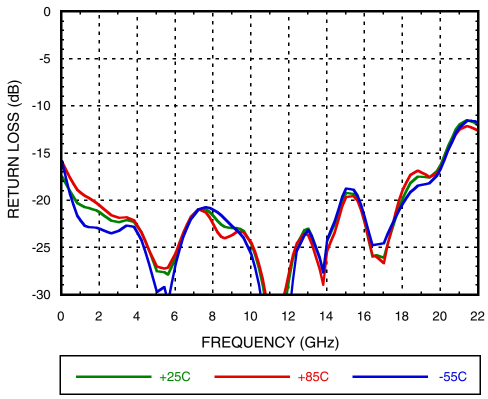
Gain & Return Loss



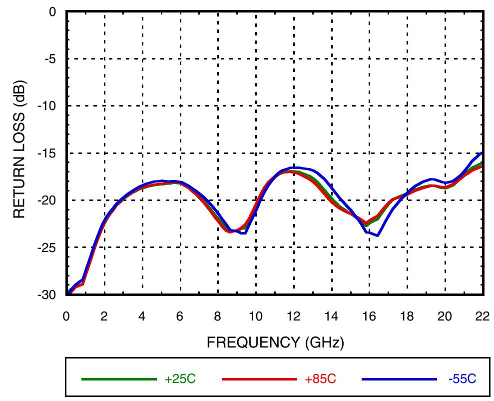
Gain vs. Temperature



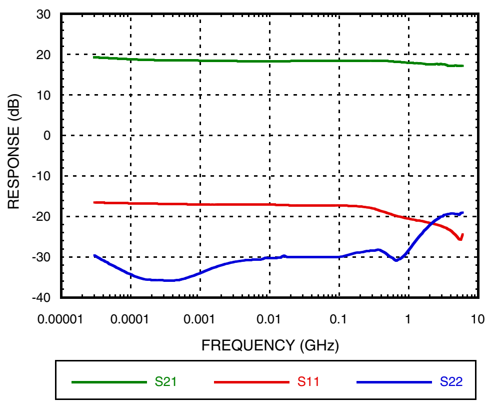
Input Return Loss vs. Temperature



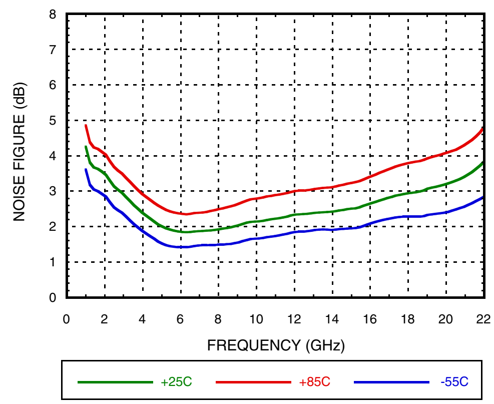
Output Return Loss vs. Temperature



Low Frequency Gain & Return Loss



Noise Figure vs. Temperature



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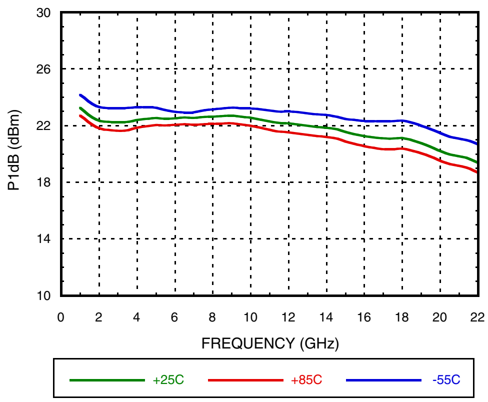
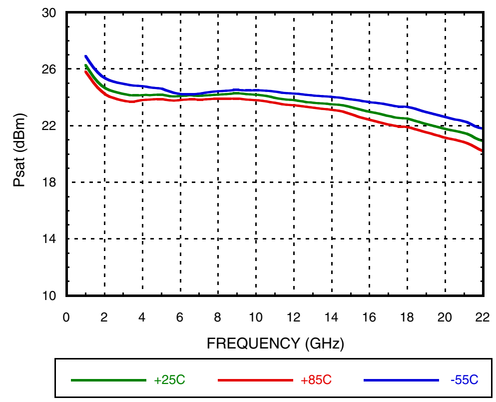
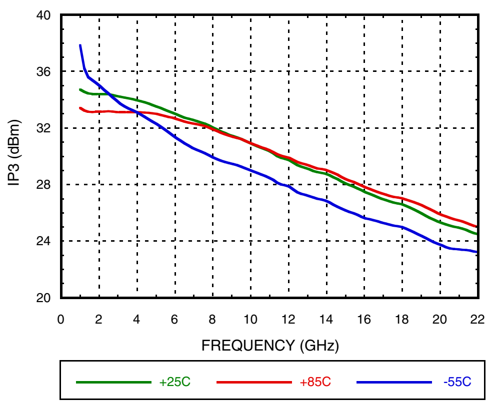
Output P1dB vs. Temperature



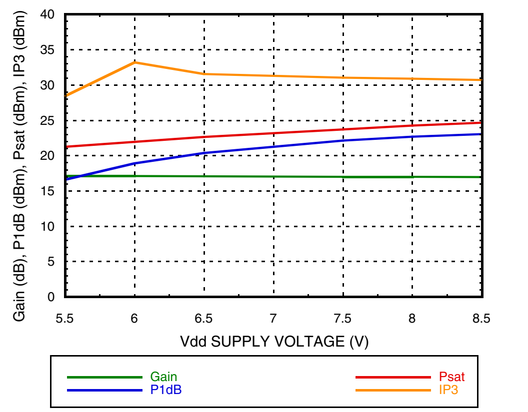
Psat vs. Temperature



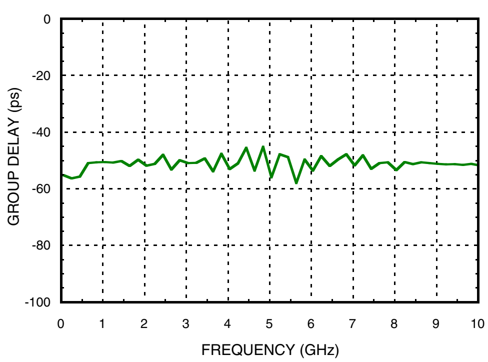
Output IP3 vs. Temperature



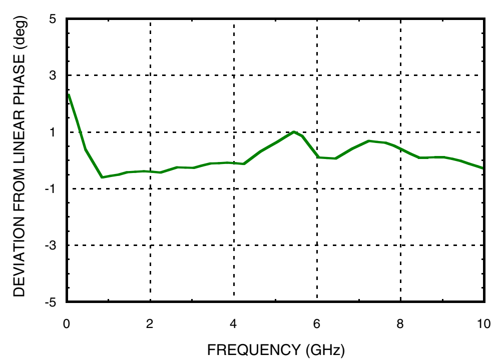
Gain, Power & Output IP3 vs. Supply Voltage @ 10 GHz, Idd= 160mA



Group Delay



Deviation from Linear Phase



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Absolute Maximum Ratings

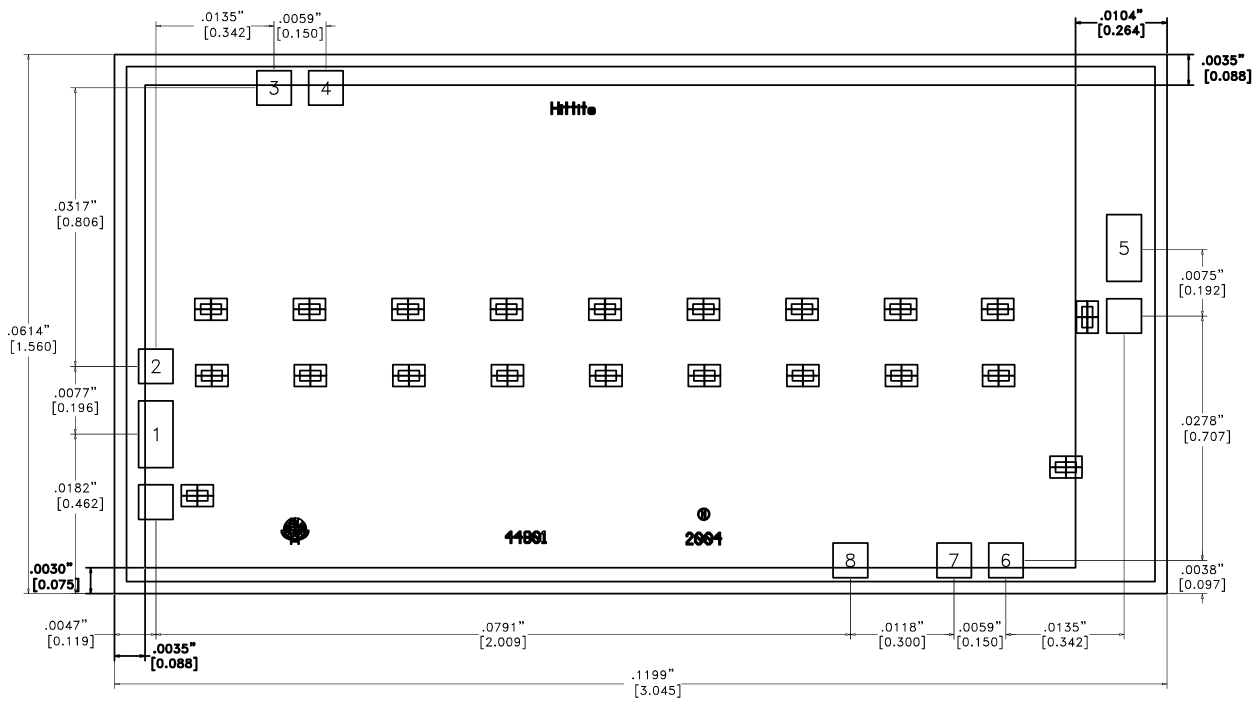
Drain Bias Voltage (Vdd)	+9V
Gate Bias Voltage (Vgg1)	-2 to 0V
Gate Bias Current (Igg1)	+3.2mA
Gate Bias Voltage (Vgg2)	(Vdd -8) V to +3 Vdc
Gate Bias Current (Igg2)	+3.2mA
RF Input Power (RFIN)(Vdd = +8V)	+23 dBm
Channel Temperature	175 °C
Continuous Pdiss (T = 85 °C) (derate 24 mW/°C above 85 °C)	2.17 W
Thermal Resistance (channel to die bottom)	41.5 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +85 °C

Typical Supply Current vs. Vdd

Vdd (V)	Idd (mA)
+7.5	161
+8.0	160
+8.5	159

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



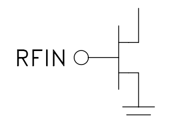
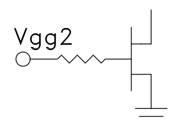
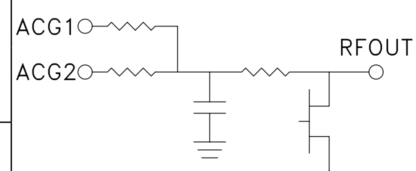
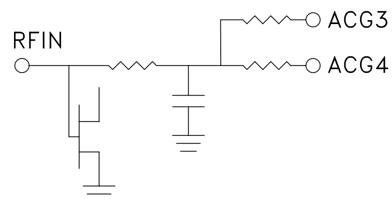
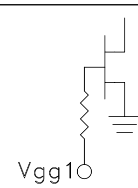
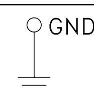
Die Packaging Information [1]

Standard	Alternate
GP-1 (Gel Pack)	[2]

[1] Refer to the "Packaging Information" section for die packaging dimensions.
[2] For alternate packaging information contact Hittite Microwave Corporation.

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	Pin Schematic
1	RFIN	This pad is DC coupled and matched to 50 Ohms.	
2	Vgg2	Gate Control 2 for amplifier. +1.5V should be applied to Vgg2 for nominal operation.	
3	ACG1	Low frequency termination. Attach bypass capacitor per application circuit herein.	
4	ACG2		
5	RFOUT & Vdd	RF output for amplifier. Connect the DC bias (Vdd) network to provide drain current (Idd). See application circuit herein.	
6	ACG3	Low frequency termination. Attach bypass capacitor per application circuit herein.	
7	ACG4		
8	Vgg1	Gate Control 1 for amplifier.	
Die Bottom	GND	Die botton must be connected to RF/DC ground.	

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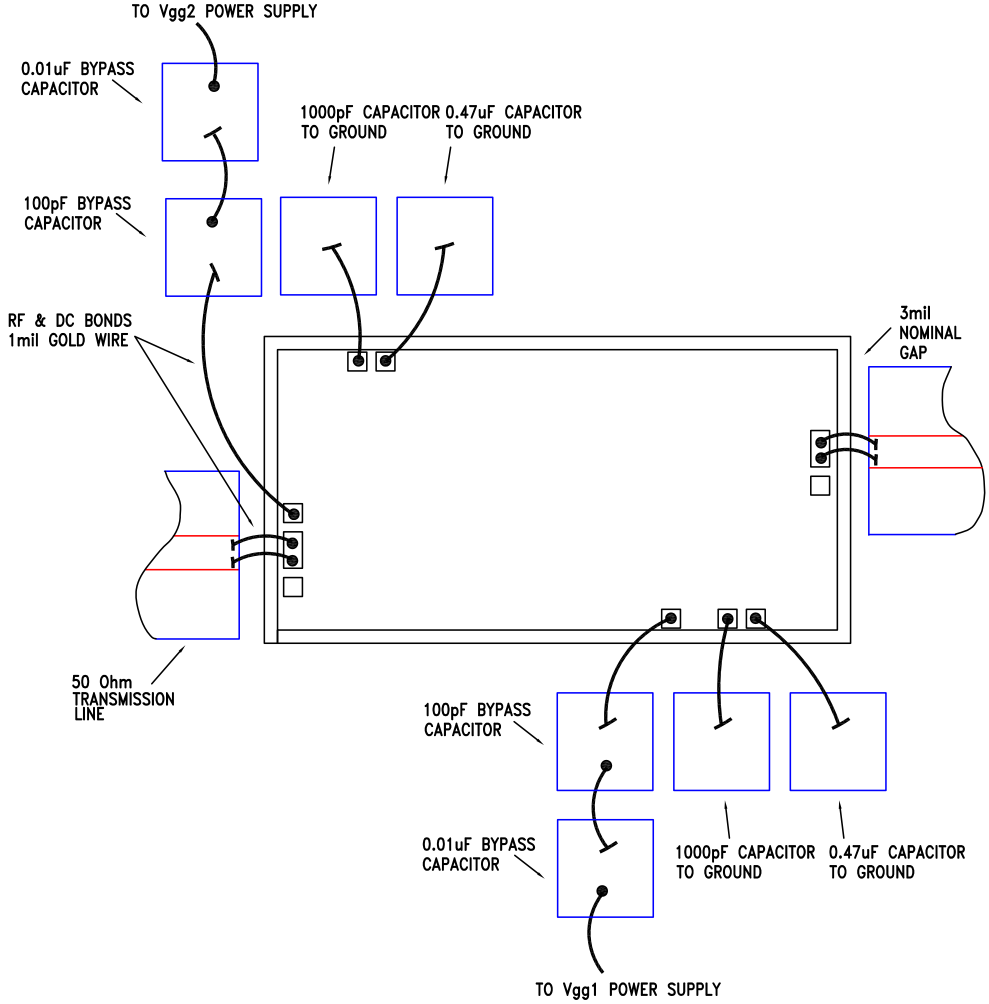
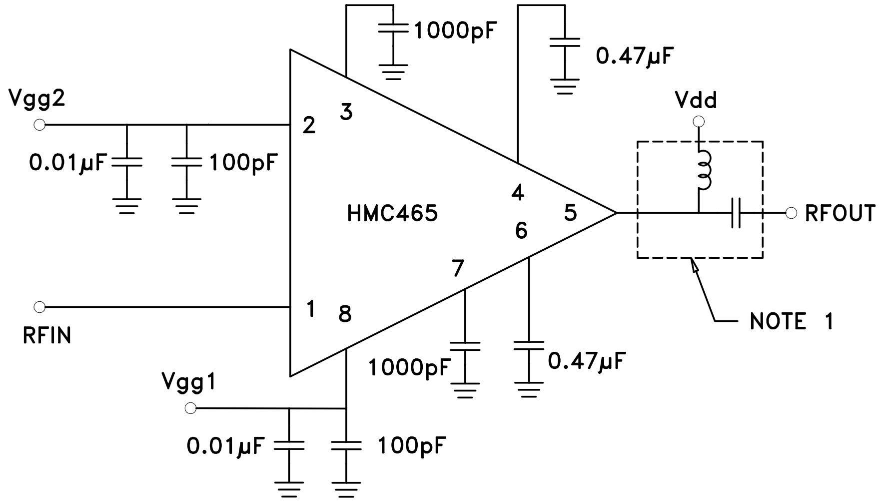
Assembly Diagram



Application Circuit



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Device Operation

These devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

The input to this device should be AC-coupled. To provide the typical 8Vp-p output voltage swing, a 1.2Vp-p AC-coupled input voltage swing is required.

1. Ground the device
2. Set Vgg1 to -2V (no drain current)
3. Set Vgg2 to +1.5V (no drain current)
4. Set Vdd to +8V (no drain current)
5. Adjust Vgg1 for Idd = 160mA (Vgg1 may be varied between -2V and 0V to set Idd to 160mA)
6. Apply RF signal to input.

Device Power Down Instructions

1. Remove RF signal from input
2. Remove Vdd
3. Remove Vgg2
4. Remove Vgg1

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Mounting & Bonding Techniques for Millimeterwave GaAs MMICs

The die should be attached directly to the ground plane eutectically or 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 be located 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).

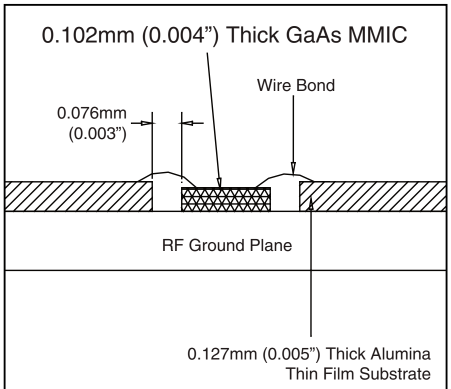

Figure 1.

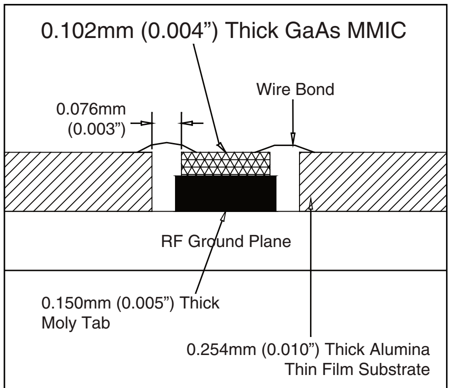

Figure 2.

Handling Precautions

Follow these precautions to avoid permanent damage.

Storage: All bare die are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

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 pickup.

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 may have 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 AuSn eutectic preforms or with electrically conductive epoxy. The mounting surface should be clean and flat.

Eutectic Die Attach: A 80/20 gold tin preform is recommended with a work surface temperature of 255 °C and a tool temperature of 265 °C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 °C. DO NOT expose the chip to a temperature greater than 320 °C for more than 20 seconds. No more than 3 seconds of scrubbing should be required for attachment.

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 °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).

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