# HMC7229LS6

v00.0513

## GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER With Power Detector, 37 - 40 GHz

### Typical Applications

The HMC7229LS6 is ideal for:

- Point-to-Point Radios
- Point-to-Multi-Point Radios
- VSAT & SATCOM
- Military & Space

### Features

P1dB Output Power: 31.5 dBm

Saturated Output Power: +32 dBm

High Output IP3: 40 dBm

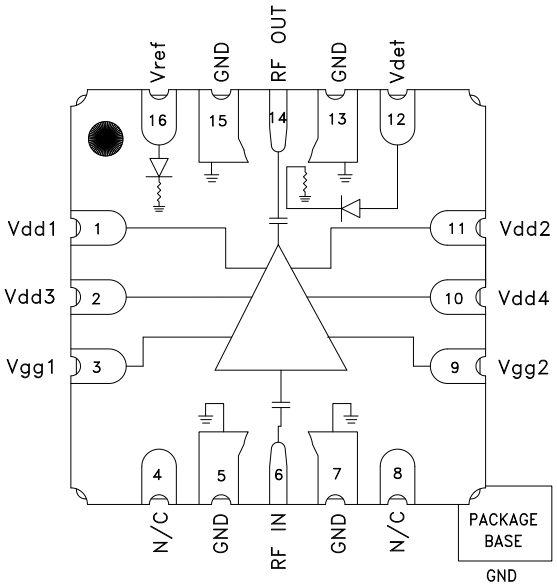
High Gain: 24 dB

DC Power Supply: 6V @ 1200 mA

50 Ohm Matched Input/Output

16 Lead 6x6 mm SMT Package: 36 $mm^2$

### Functional Diagram




### General Description

The HMC7229LS6 is a four-stage GaAs pHEMT MMIC 1 Watt Power Amplifier which operates between 37 and 40 GHz. The HMC7229LS6 provides 24 dB of gain, +32 dBm of saturated output power, and 18% PAE from a +6V supply. With an excellent OIP3 of +40 dBm, the HMC7229LS6 is ideal for high linearity applications in military and space as well as point-to-point and point-to-multi-point radios. The RF I/Os are internally matched and DC blocked for ease of integration into higher level assemblies. The HMC7229LS6 is housed in a ceramic air cavity package which exhibits low thermal resistance and is compatible with surface mount manufacturing techniques.

## Electrical Specifications

**$T_A$ = +25° C, Vdd = Vdd1 = Vdd2 = Vdd3 = Vdd4 = +6V, Idd = 1200 mA** [1]

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Frequency Range | | 37 - 40 | | GHz |
| Gain | 21 | 24 | | dB |
| Gain Variation over Temperature | | 0.058 | | dB/°C |
| Input Return Loss | | 16 | | dB |
| Output Return Loss | | 14 | | dB |
| Output Power for P1dB Compression | 28.5 | 31.5 | | dBm |
| Saturated Output Power (Psat) | | 32 | | dBm |
| Output Third Order Intercept (IP3) [2] | | 40 | | dBm |
| Total Supply Current (Idd) | | 1200 | | mA |

[1] Adjust Vgg between -2 to 0V to achieve Idd = 1200mA typical

[2] Measurement taken at Pout / tone = +20dBm.

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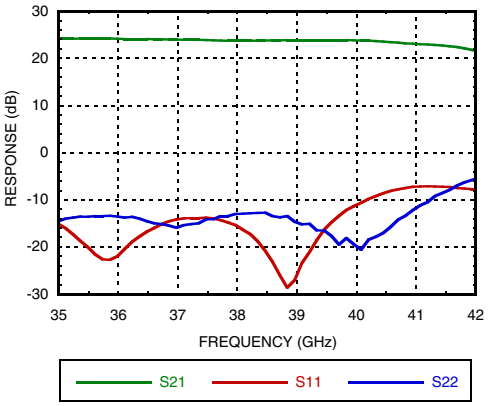
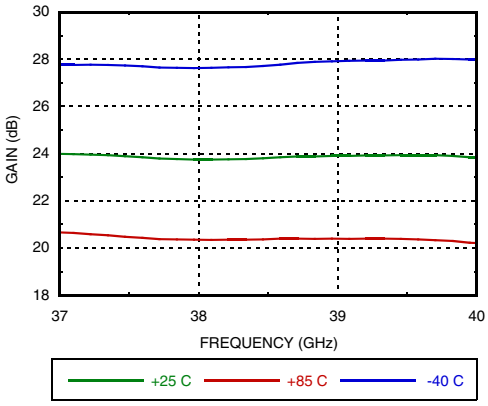
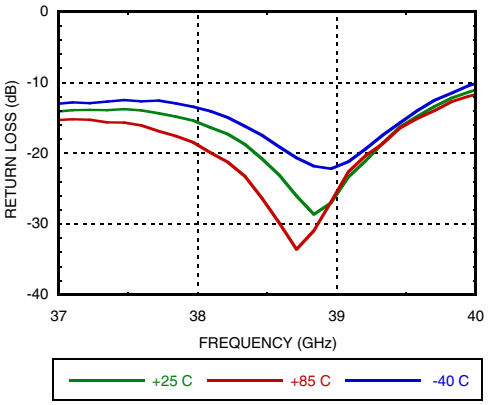
### Gain & Return Loss



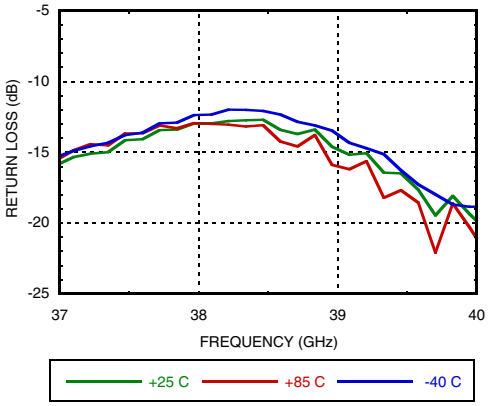

### Gain vs. Temperature



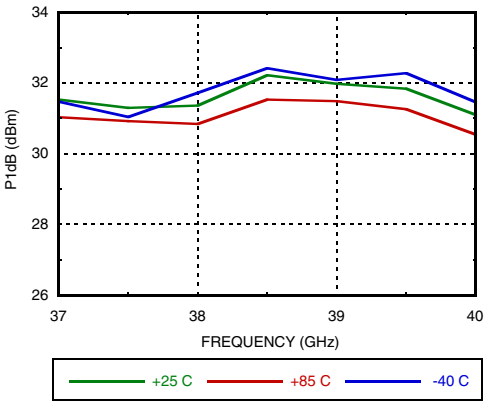

### Input Return Loss vs. Temperature



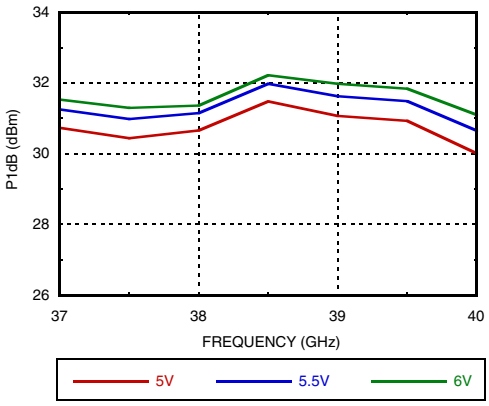

### Output Return Loss vs. Temperature



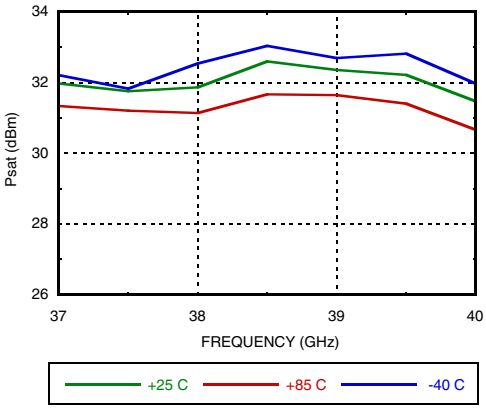

### P1dB vs. Temperature



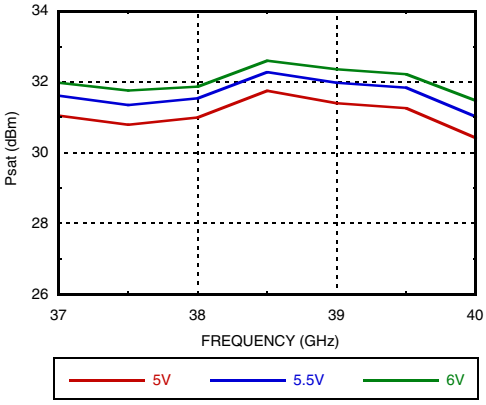

### P1dB vs. Supply Voltage



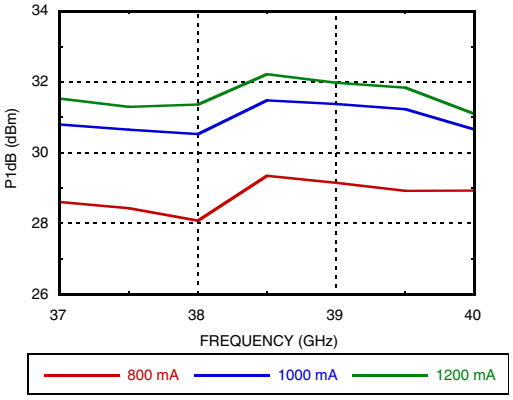
### Psat vs. Temperature



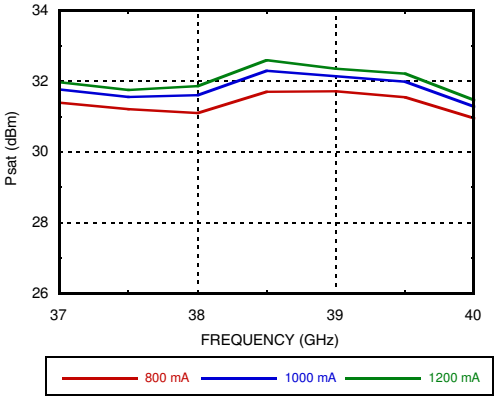

### Psat vs. Supply Voltage



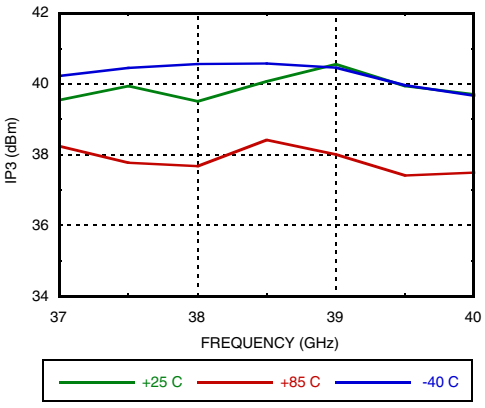

### P1dB vs. Supply Current



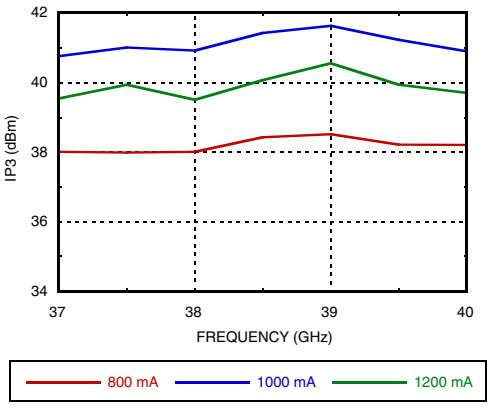

### Psat vs. Supply Current



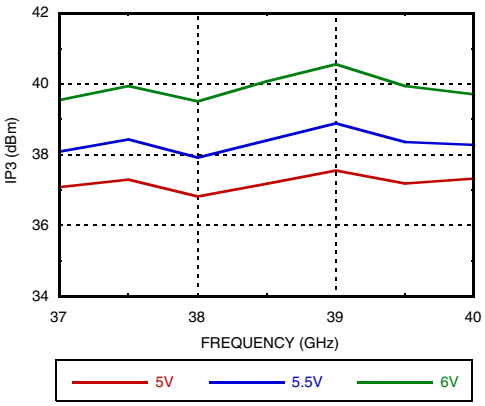

### Output IP3 vs. Temperature, Pout/tone = +20 dBm



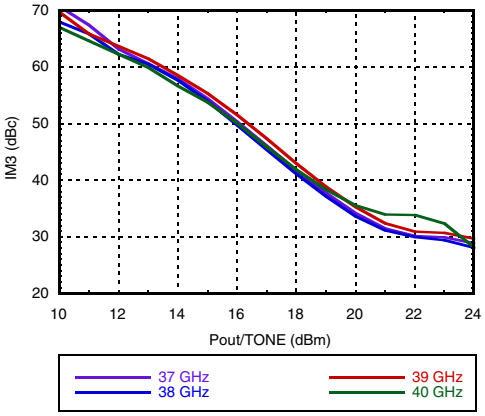

### Output IP3 vs. Supply Current, Pout/tone = +20 dBm



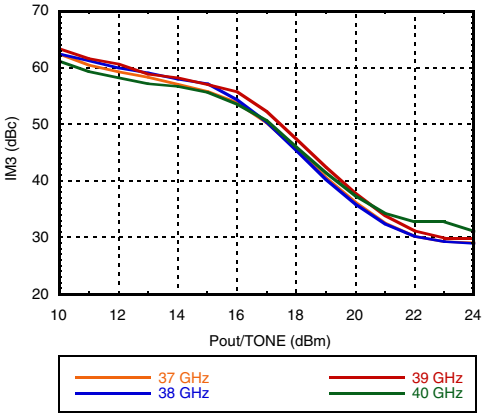
### Output IP3 vs. Supply Voltage, Pout/tone = +20 dBm



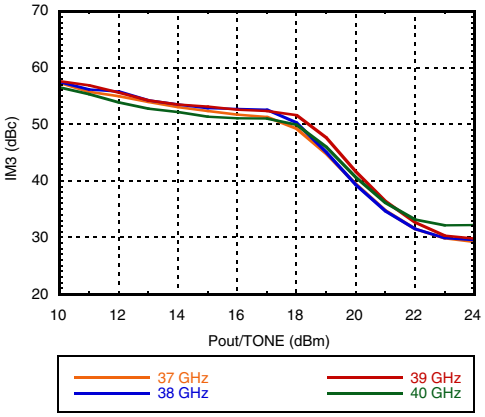

### Output IM3 @ Vdd = +5V



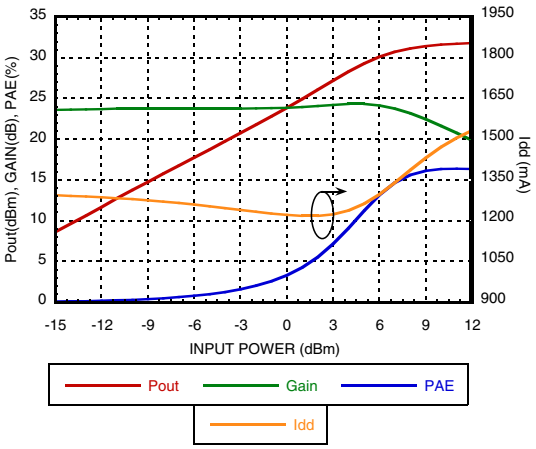

### Output IM3 @ Vdd = +5.5V



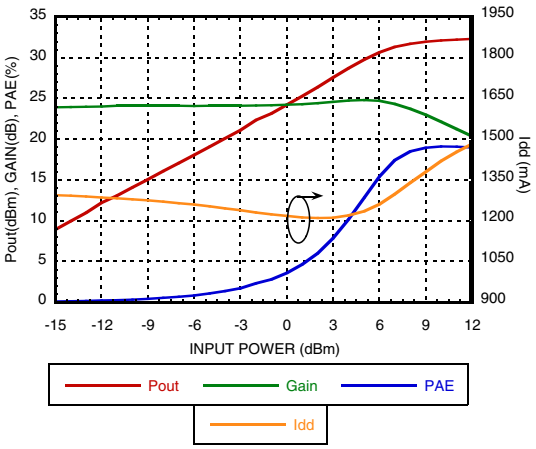

### Output IM3 @ Vdd = +6V




### Power Compression @ 38 GHz




### Power Compression @ 39 GHz



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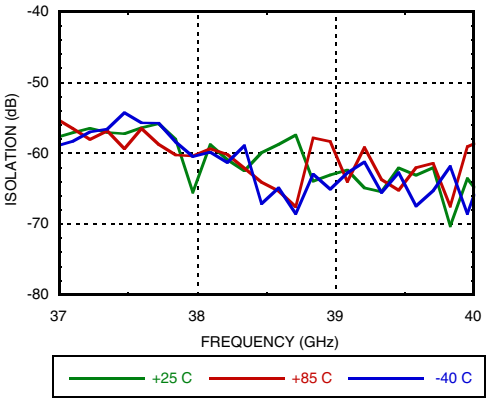
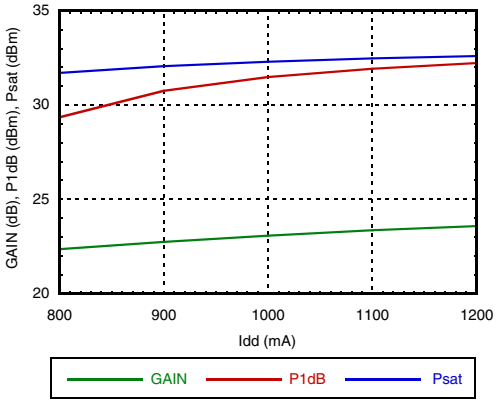
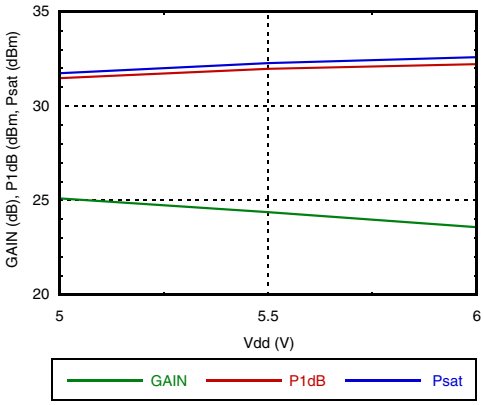
### Reverse Isolation vs. Temperature



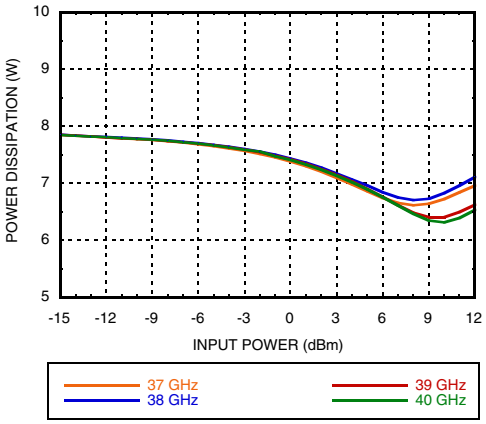

### Gain & Power vs. Supply Current @ 38.5 GHz



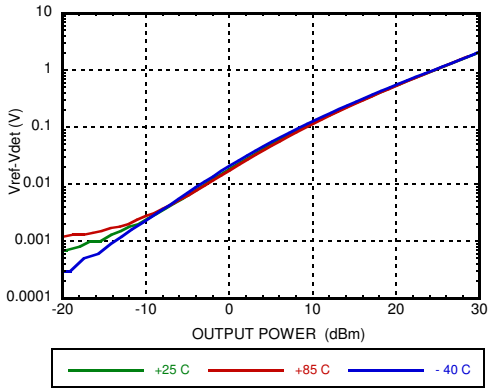

### Gain & Power vs. Supply Voltage @ 38.5 GHz




### Power Dissipation




### Detector Voltage vs. Temperature @ 38.5 GHz



# GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER With Power Detector, 37 - 40 GHz

## Absolute Maximum Ratings

| | |
|---|---|
| Drain Bias Voltage (Vdd) | +7V |
| RF Input Power (RFIN) | +21 dBm |
| Channel Temperature | 175 °C |
| Continuous Pdiss (T= 85 °C) (derate 95 mW/°C above 85 °C) | 9.0 W |
| Thermal Resistance (channel to ground paddle) | 10 °C/W |
| Operating Temperature | -65°C to +150°C |
| Storage Temperature | -40°C to 85°C |
| ESD Sensitivity (HBM) | Class 0, Passed 150V |

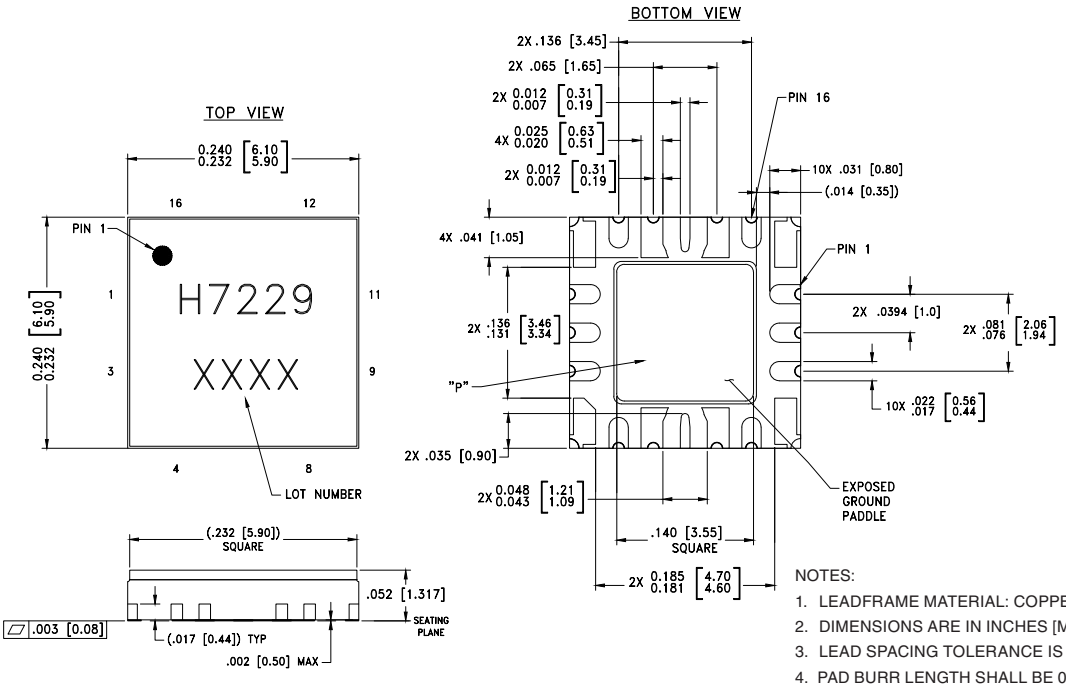
## Typical Supply Current vs. Vdd

| Vdd (V) | Idd (mA) |
|---|---|
| +5 | 1200 |
| +5.5 | 1200 |
| +6 | 1200 |

Adjust Vgg1 to achieve Idd = 1200 mA

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

## Outline Drawing




NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

## Package Information

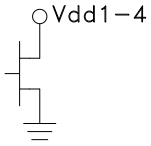
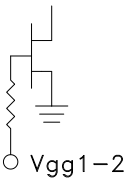
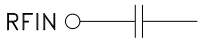
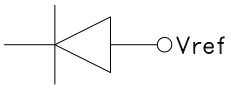
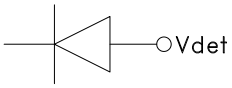
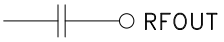
| Part Number | Package Body Material | Lead Finish | MSL Rating [2] | Package Marking [1] |
|---|---|---|---|---|
| HMC7229LS6 | ALUMINA WHITE | Gold over Nickel | N/A [3] | H7229<br>XXXX |

[1] 4-Digit lot number XXXX.
[2] Max peak reflow temperature of 260 °C.
[3] Not Applicable to air cavity packages.

## GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER With Power Detector, 37 - 40 GHz



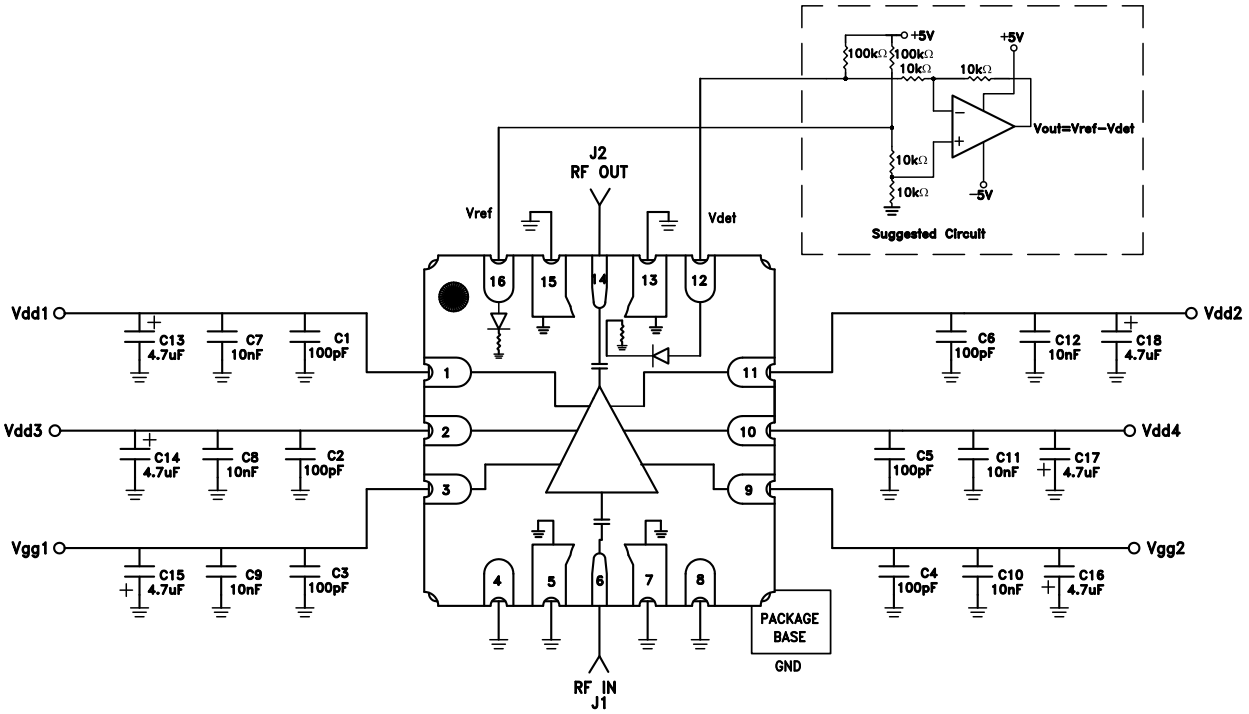
### Pin Descriptions

| Pin Number | Function | Description | Pin Schematic |
|---|---|---|---|
| 1, 2, 10, 11 | Vdd1, Vdd3, Vdd4, Vdd2 | Drain bias voltage. External bypass capacitors of 100 pF, 10 nF and 4.7 µF are required for each pin. |   |
| 3, 9 | Vgg1, Vgg2 | Gate control for PA. Adjust Vgg to achieve recommended bias current. External bypass caps 100 pF, 10 nF and 4.7 µF are required. Apply Vgg bias to either pin 3 or pin 9. |   |
| 4, 8 | N/C | These pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |
| 5, 7, 13, 15 | GND | These pins and the exposed ground paddle must be connected to RF/DC ground. |   |
| 6 | RF IN | This pin is AC coupled and matched to 50 Ohms. |   |
| 16 | Vref | DC voltage of diode biased through external resistor used for temperature compensation of Vdet. See application circuit. |   |
| 12 | Vdet | DC voltage representing RF output power rectified by diode which is biased through an external resistor. See application circuit. |   |
| 14 | RF OUT | This pin is AC coupled and matched to 50 Ohms. |   |

# GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER With Power Detector, 37 - 40 GHz



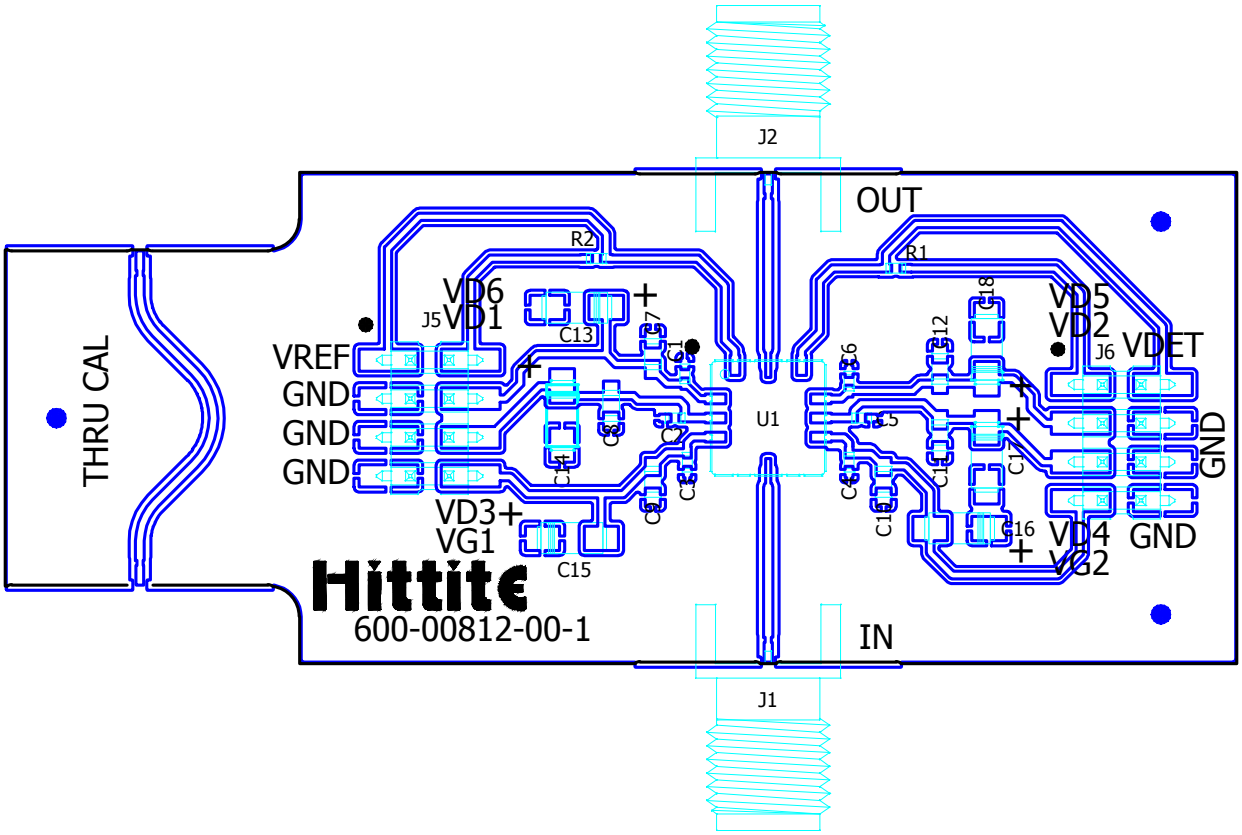
## Application Circuit



## GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER With Power Detector, 37 - 40 GHz



### Evaluation PCB




### List of Materials for Evaluation PCB EV1HMC7229LS6 [1]

| Item | Description |
|---|---|
| J1 - J2 | "K" Connector, SRI |
| J5 - J6 | DC Pin |
| C1 - C6 | 100 pF Capacitor, 0402 Pkg. |
| C7 - C12 | 10000 pF Capacitor, 0603 Pkg.. |
| C13 - C18 | 4.7 uF Capacitor, Case A Pkg. |
| R1 - R2 | 40.2K Ohm Resistor, 0402 Pkg. |
| U1 | HMC7229LS6 Amplifier |
| PCB [2] | 600-00812-00 Evaluation Board |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25FR

The circuit board used in the 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 circuit board shown is available from Hittite upon request.

**Notes**