



# THE DATASHEET OF HMC5445LS6





## GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, 24 - 27 GHz

### Typical Applications

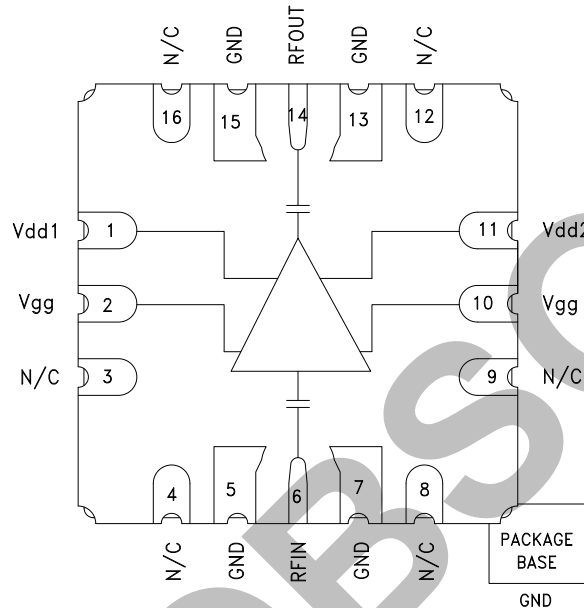
The HMC5445LS6 is ideal for:

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

### Features

- Saturated Output Power: +31.5 dBm @ 23% PAE
- High Output IP3: +40 dBm
- High Gain: 26 dB
- DC Supply: +6V @ 750 mA
- No External Matching Required
- 16 Lead Ceramic 6 x 6 mm SMT Package: 36 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC5445LS6 is a three-stage GaAs pHEMT MMIC 1 Watt Power Amplifier which operates between 24 and 27 GHz. The HMC5445LS6 provides 26 dB of gain, and +31 dBm of saturated output power and 18% PAE from a +6V supply. The RF I/Os are DC blocked and matched to 50 Ohms for ease of integration into Multi-Function-Modules (MFM). The HMC5445LS6 eliminates the need for wire bonding and allows the use of surface mount manufacturing techniques.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{dd} = V_{dd1} = V_{dd2} = +6\text{V}$ , $I_{dd} = 750\text{ mA}$ [1]

| Parameter  | Min.    | Typ. | Max. | Units |
|--|---------|------|------|-------|
| Frequency Range  | 24 - 27 |      |      | GHz   |
| Gain   | 23      | 26   |      | dB    |
| Gain Variation Over Temperature                                |         | 0.03 |      | dB/°C |
| Input Return Loss  |         | 17   |      | dB    |
| Output Return Loss   |         | 17   |      | dB    |
| Output Power for 1 dB Compression (P1dB)                       | 27      | 30.5 |      | dBm   |
| Saturated Output Power (P <sub>sat</sub> )                     |         | 31.5 |      | dBm   |
| Output Third Order Intercept (IP <sub>3</sub> ) <sup>[2]</sup> |         | 40   |      | dBm   |
| Total Supply Current (I <sub>dd</sub> )                        |         | 750  |      | mA    |

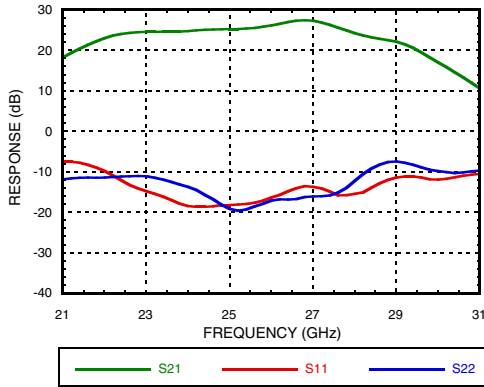
[1] Adjust V<sub>gg</sub> between -2 to 0V to achieve I<sub>dd</sub> = 750 mA typical.

[2] Measurement taken at +6V @ 750 mA, P<sub>out</sub> / Tone = +19 dBm

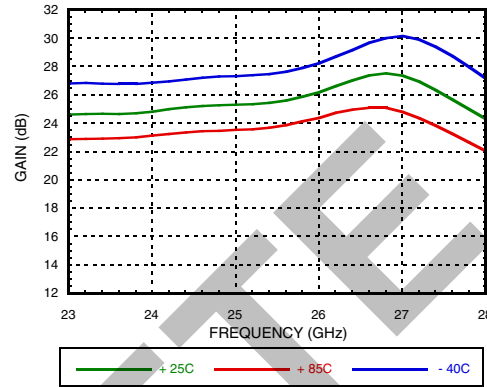


**GaAs pHEMT MMIC 1 WATT  
POWER AMPLIFIER, 24 - 27 GHz**

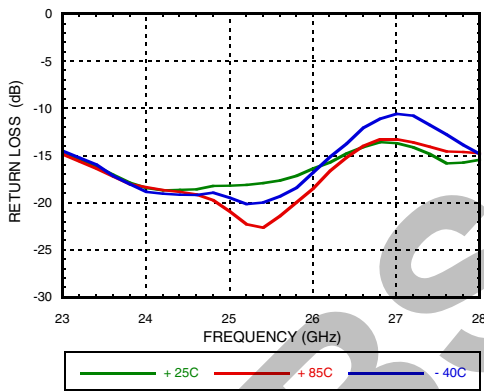
**Broadband Gain &  
Return Loss vs. Frequency**



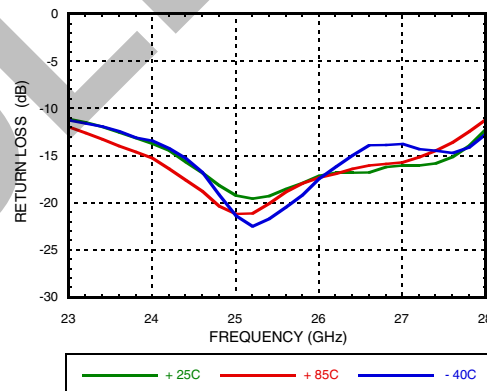
**Gain vs. Temperature**



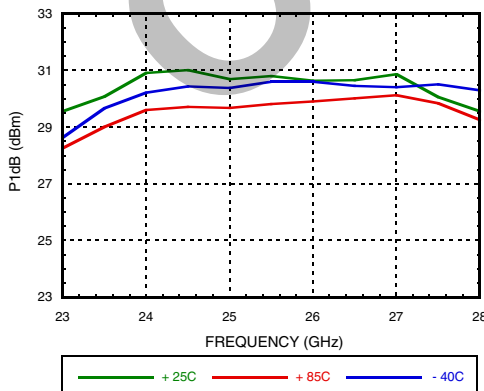
**Input Return Loss vs. Temperature**



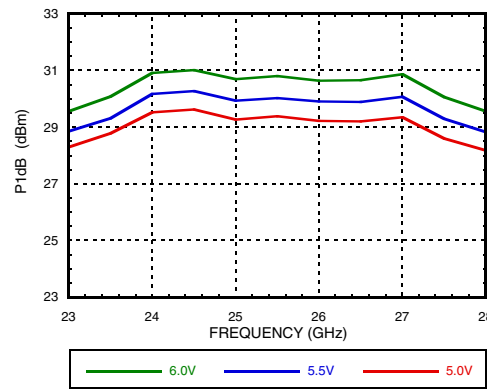
**Output Return Loss vs. Temperature**



**P1dB vs. Temperature**



**P1dB vs. Supply Voltage**



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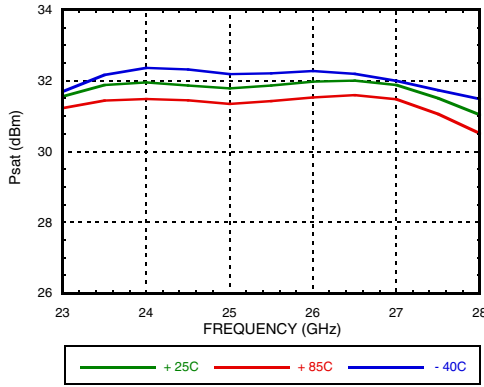
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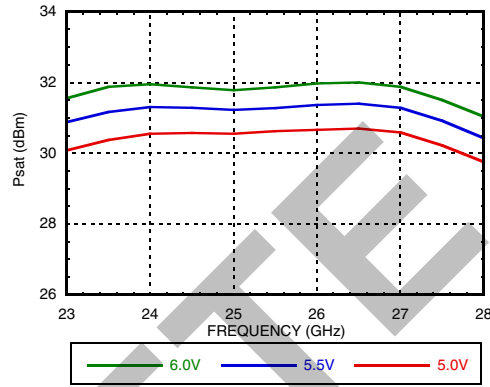
**GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, 24 - 27 GHz**

AMPLIFIER - LINEAR & POWER - SMT

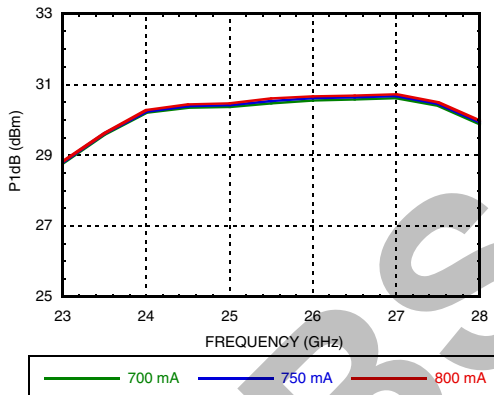
**Psat vs. Temperature**



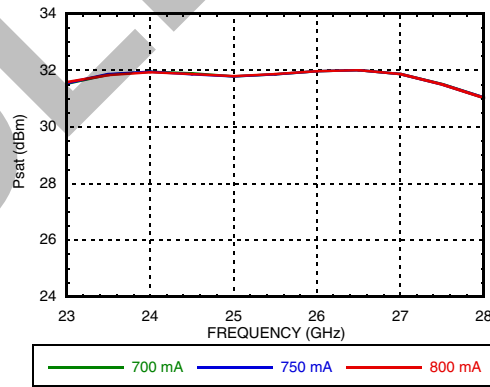
**Psat vs. Supply Voltage**



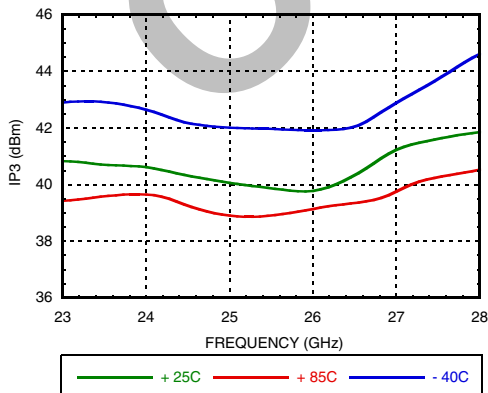
**P1dB vs. Supply Current (Idd)**



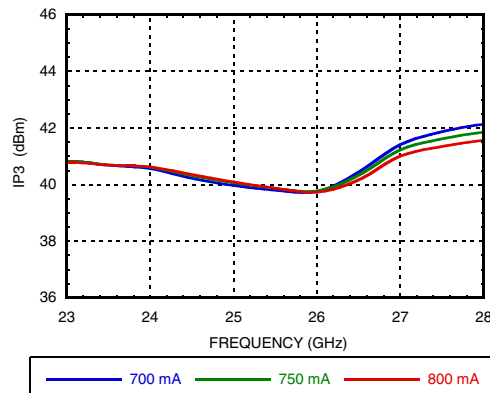
**Psat vs. Supply Current (Idd)**



**Output IP3 vs. Temperature, Pout/Tone = +19 dBm**



**Output IP3 vs. Supply Current, Pout/Tone = +19 dBm**



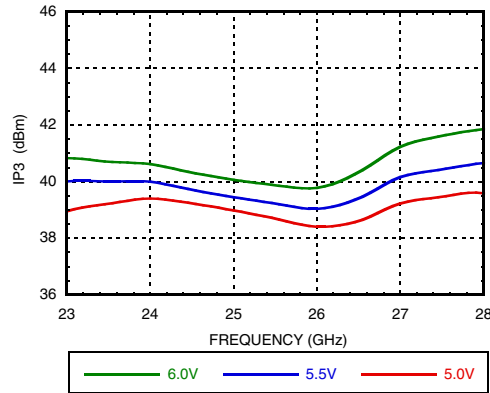
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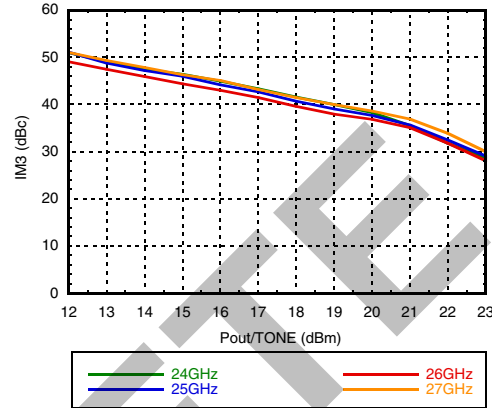


**GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, 24 - 27 GHz**

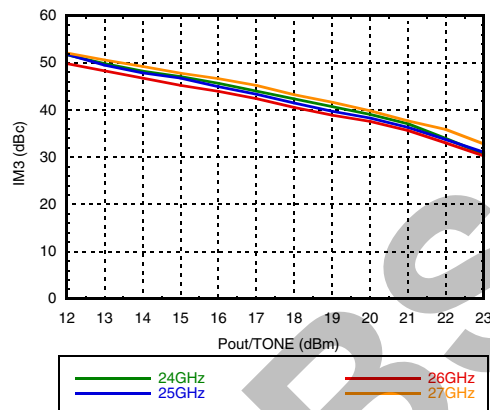
**Output IP3 vs. Supply Voltage, Pout/Tone = +19 dBm**



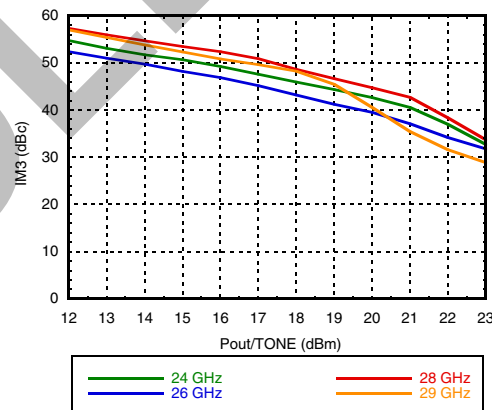
**Output IM3 @ Vdd = +5V**



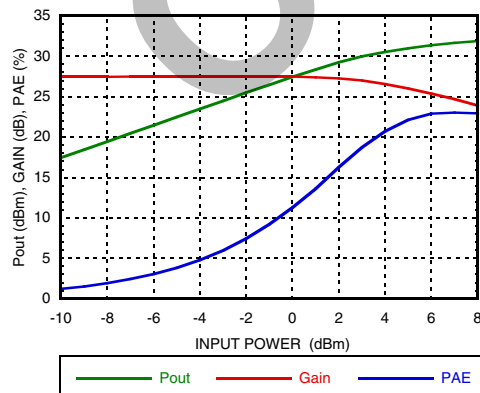
**Output IM3 @ Vdd = +5.5V**



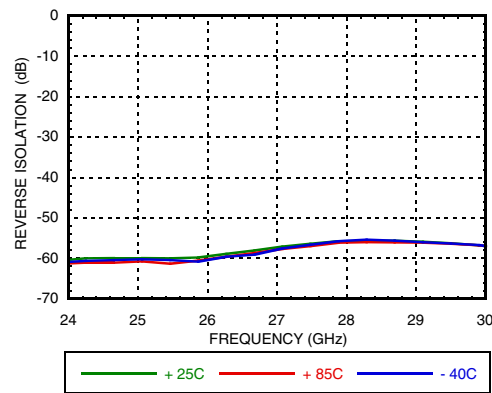
**Output IM3 @ Vdd = +6V**



**Power Compression @ 26 GHz**



**Reverse Isolation vs. Temperature**



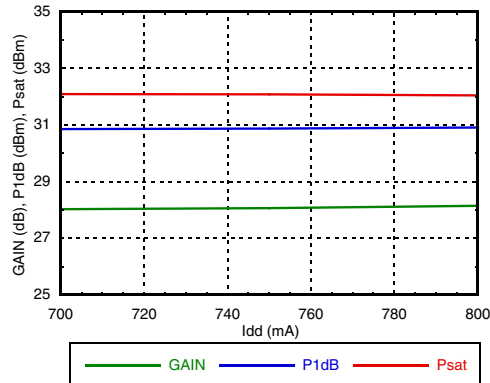
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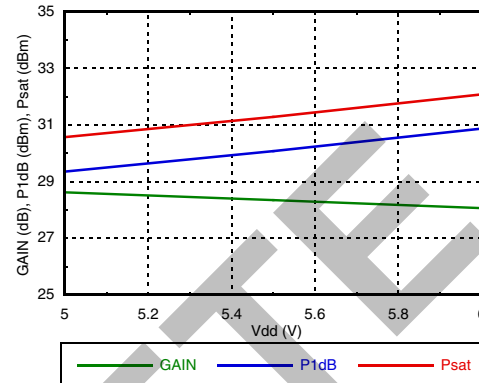


**GaAs pHEMT MMIC 1 WATT  
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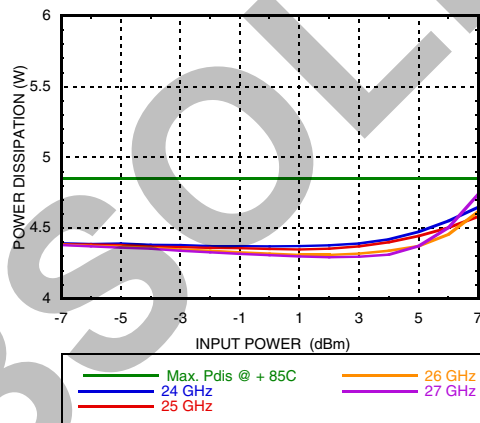
**Gain & Power vs.  
Supply Current @ 27 GHz**



**Gain & Power vs.  
Supply Voltage @ 27 GHz**



**Power Dissipation**





## GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, 24 - 27 GHz

### Absolute Maximum Ratings

|  |                |
|--|----------------|
| Drain Bias Voltage (Vd)                                    | +6.3V          |
| RF Input Power (RFIN)                                      | +23 dBm        |
| Channel Temperature  | +150 °C        |
| Continuous Pdis (T=85 °C)<br>(derate 72 mW/°C above 85 °C) | 4.7 W          |
| Thermal Resistance<br>(Channel to ground paddle)           | 13.83 °C/W     |
| Storage Temperature  | -65 to +150 °C |
| Operating Temperature                                      | -40 to +85 °C  |
| ESD Rating   | Class 0        |

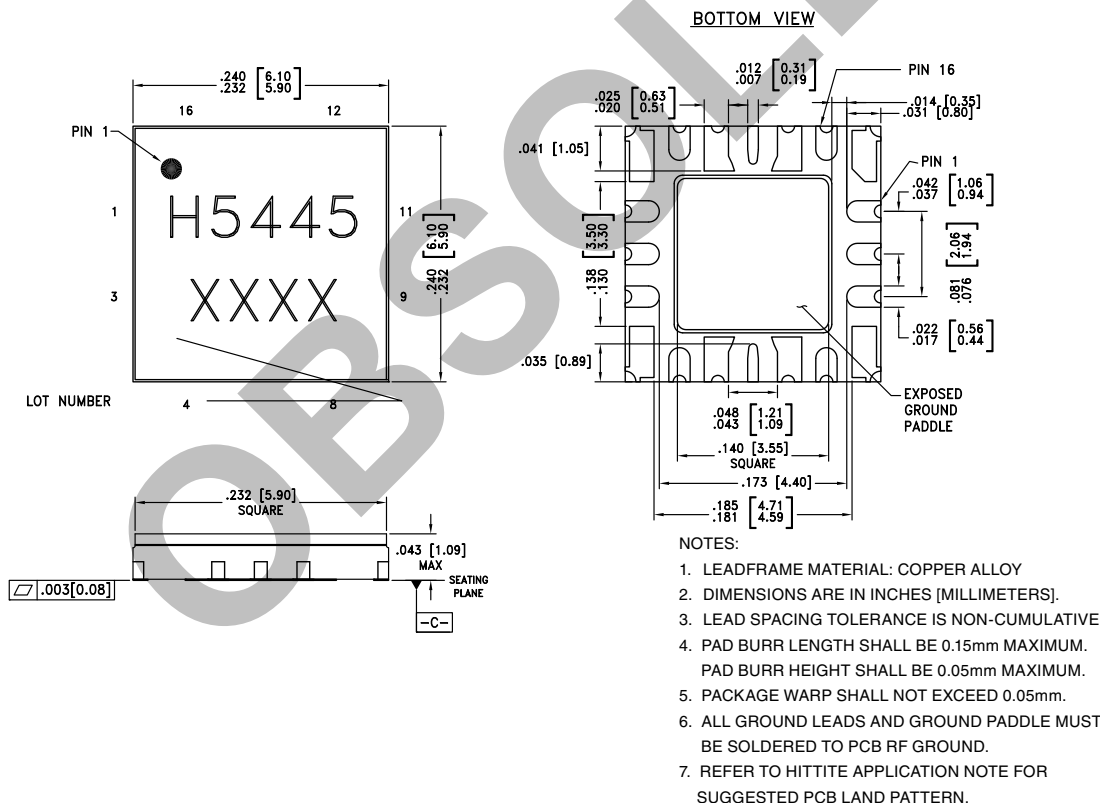
### Reliability Information

|  |               |
|--|---------------|
| Junction Temperature to Maintain<br>1 Million Hour MTTF      | 150 °C        |
| Nominal Junction Temperature<br>(T = 85 °C and Pin = 10 dBm) | 90 °C         |
| Operating Temperature  | -40 to +85 °C |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

### Outline Drawing



### Package Information

| Part Number | Package Body Material | Lead Finish      | MSL Rating <sup>[2]</sup> | Package Marking <sup>[1]</sup> |
|-------------|-----------------------|------------------|---------------------------|--------------------------------|
| HMC5445LS6  | ALUMINA WHITE         | Gold over Nickel | N/A                       | H5445<br>XXXX                  |

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

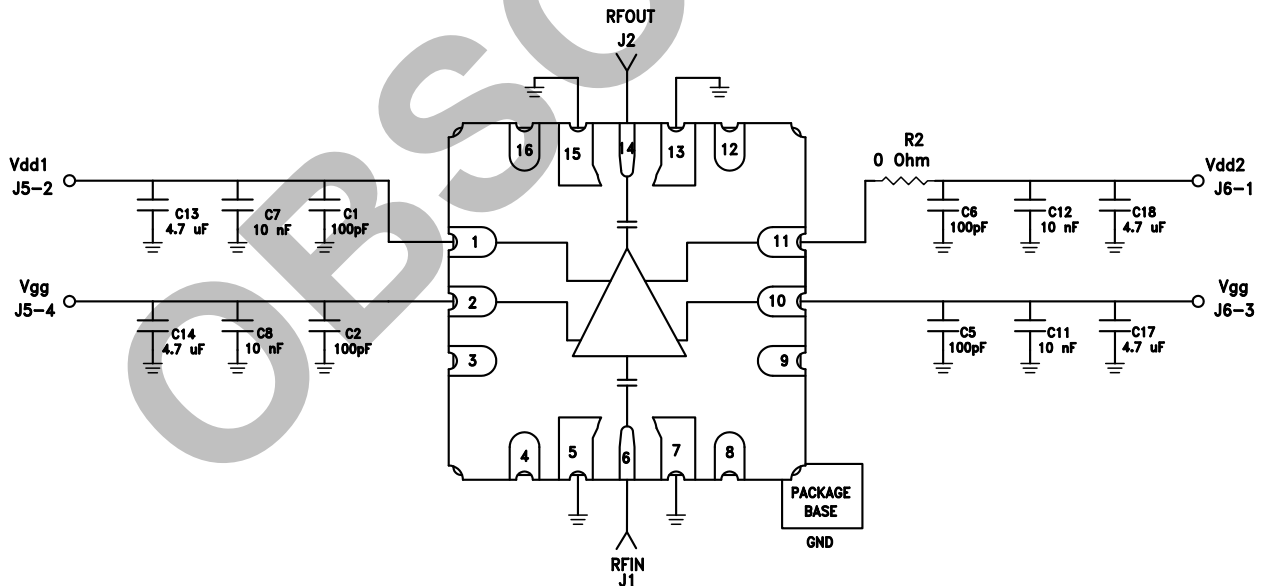


## GaAs pHEMT MMIC 1 WATT POWER AMPLIFIER, 24 - 27 GHz

### Pin Descriptions

| Pin Number         | Function   | Description   | Interface Schematic |
|--------------------|------------|---|---------------------|
| 1, 11              | Vdd1, Vdd2 | Drain bias voltage. External bypass capacitors of 100 pF, 0.1 $\mu$ F and 4.7 $\mu$ F are required for each pin.  |                     |
| 2, 10              | Vgg        | Gate control for PA. Adjust Vgg to achieve recommended bias current. Only one pin is required. External bypass caps 100 pF, 0.1 $\mu$ F and 4.7 $\mu$ F are required. |                     |
| 3, 4, 8, 9, 12, 16 | N/C        | The 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 exposed paddle must be connected to RF/DC ground.  |                     |
| 6                  | RFIN       | This pin is AC coupled and matched to 50 Ohms.  |                     |
| 14                 | RFOUT      | This pin is AC coupled and matched to 50 Ohms.  |                     |

### Application Circuit

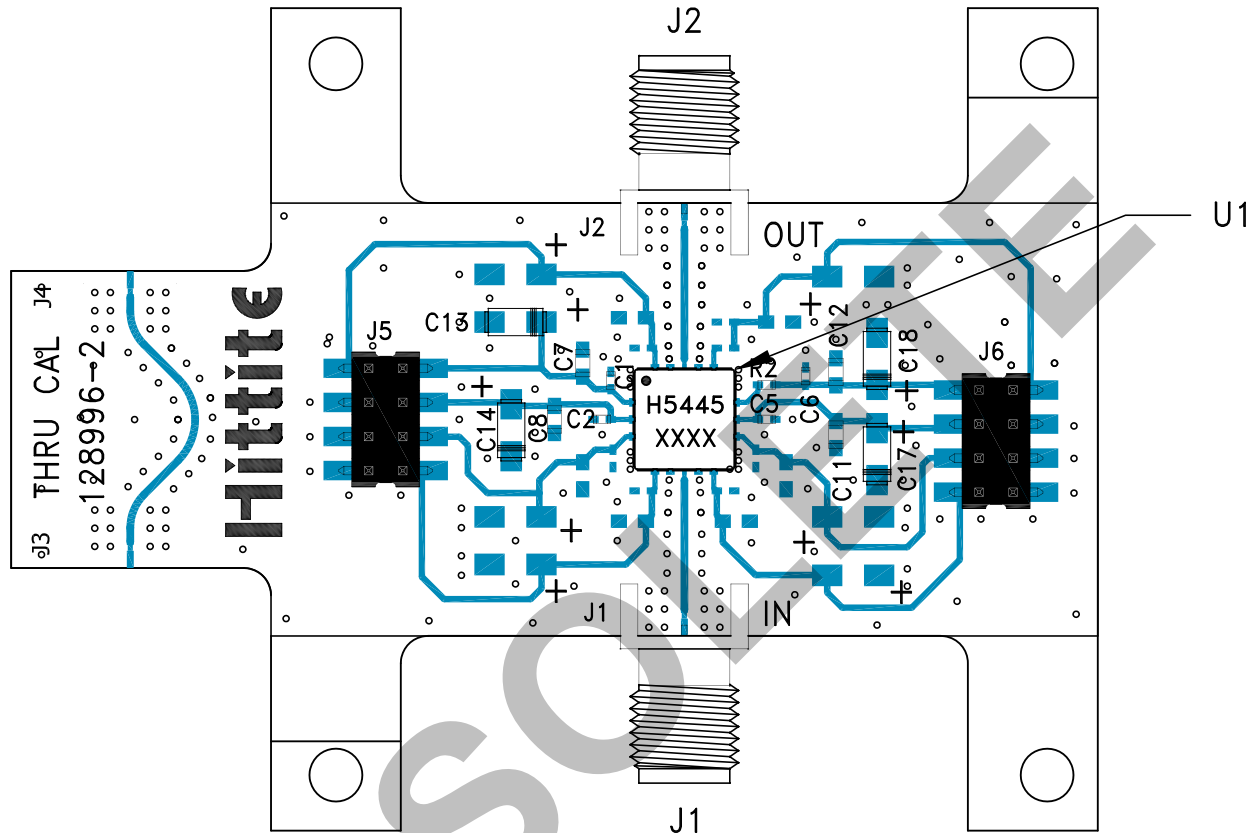


NOTE: Vgg – only one connection is required



**GaAs pHEMT MMIC 1 WATT  
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**Evaluation PCB**



**List of Materials for Evaluation PCB EVAL01-HMC5445LS6 [1]**

| Item               | Description                   |
|--------------------|-------------------------------|
| J1, J2             | "K" Connector, SRI            |
| J5, J6             | DC Pin                        |
| C1, C2, C5, C6     | 100 pF Capacitor, 0402 Pkg.   |
| C7, C8, C11, C12   | 10000 pF Capacitor, 0603 Pkg. |
| C13, C14, C17, C18 | 4.7 μF Capacitor, ? Pkg.      |
| R2                 | 0 Ohm Resistor, 0402 Pkg.     |
| U1                 | HMC5445LS6 Amplifier          |
| PCB [2]            | 128996 Eval Board             |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

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