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## GaAs pHEMT MMIC 1/2 WATT POWER AMPLIFIER, 16 - 24 GHz

### Typical Applications

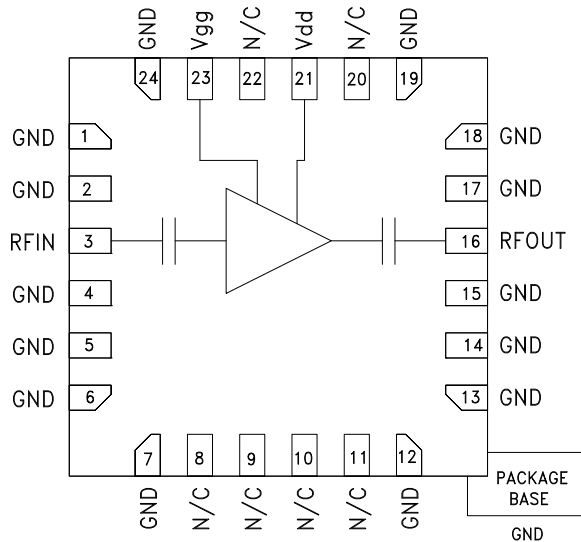
The HMC757LP4E is ideal for:

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

### Features

- Saturated Output Power: 27.5 dBm @ 21% PAE
- High Output IP3: 34.5 dBm
- High Gain: 20.5 dB
- DC Supply: +5V @ 400 mA
- No External Matching Required
- 24 Lead 4x4 mm SMT Package: 16 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC757LP4E is a three stage GaAs pHEMT MMIC 1 Watt Power Amplifier which operates between 16 and 24 GHz. The HMC757LP4E provides 20.5 dB of gain, and 27.5 dBm of saturated output power and 21% PAE from a +5V supply. The RF I/Os are DC blocked and matched to 50 Ohms. The 4x4 mm plastic package eliminates the need for wirebonding, and is compatible with surface mount manufacturing techniques.

### Electrical Specifications, $T_A = +25^\circ C$ , $V_{dd} = +5V$ , $I_{dd} = 400mA$ [1]

| Parameter   | Min.    | Typ.  | Max. | Units  |
|---|---------|-------|------|--------|
| Frequency Range                                   | 16 - 24 |       |      | GHz    |
| Gain  | 18.5    | 20.5  |      | dB     |
| Gain Variation Over Temperature                   |         | 0.028 |      | dB/ °C |
| Input Return Loss                                 |         | 11    |      | dB     |
| Output Return Loss                                |         | 12    |      | dB     |
| Output Power for 1 dB Compression (P1dB)          | 24.5    | 26.5  |      | dBm    |
| Saturated Output Power (P <sub>sat</sub> )        |         | 27.5  |      | dBm    |
| Output Third Order Intercept (IP3) <sup>[2]</sup> |         | 34.5  |      | dBm    |
| Total Supply Current (I <sub>dd</sub> )           |         | 400   |      | mA     |

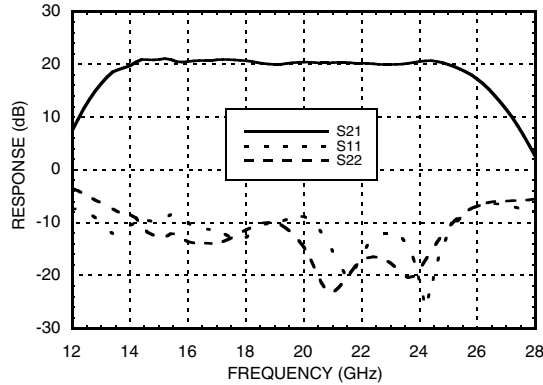
[1] Adjust V<sub>gg</sub> between -2 to 0V to achieve I<sub>dd</sub> = 400 mA typical.

[2] Measurement taken at P<sub>out</sub> / Tone = +16 dBm

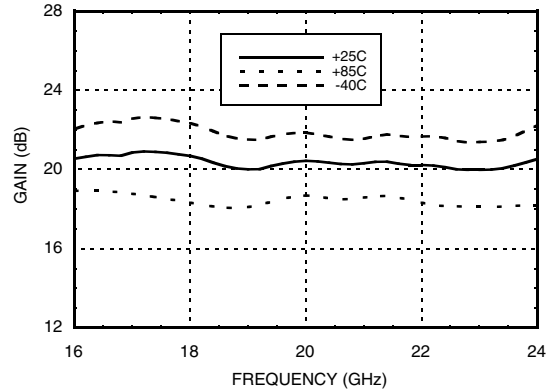


**GaAs pHEMT MMIC 1/2 WATT  
POWER AMPLIFIER, 16 - 24 GHz**

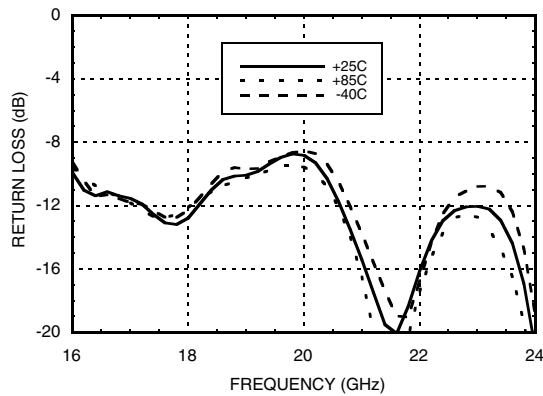
**Broadband Gain &  
Return Loss vs. Frequency**



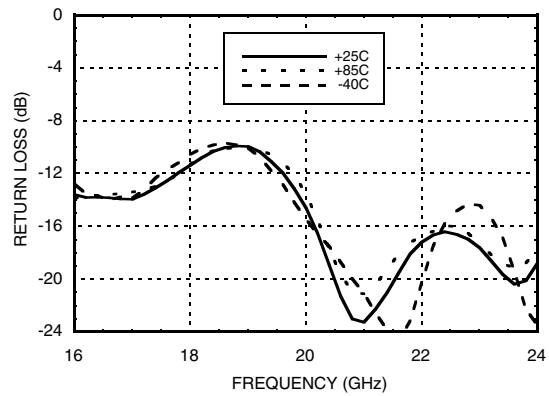
**Gain vs. Temperature**



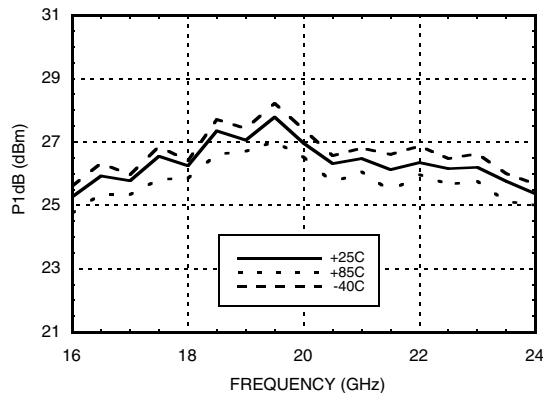
**Input Return Loss vs. Temperature**



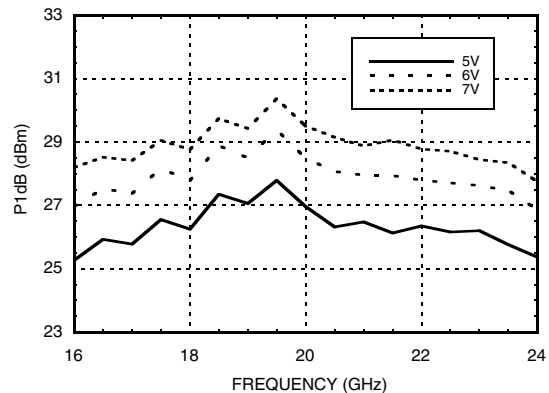
**Output Return Loss vs. Temperature**



**P1dB vs. Temperature**



**P1dB vs. Supply Voltage**



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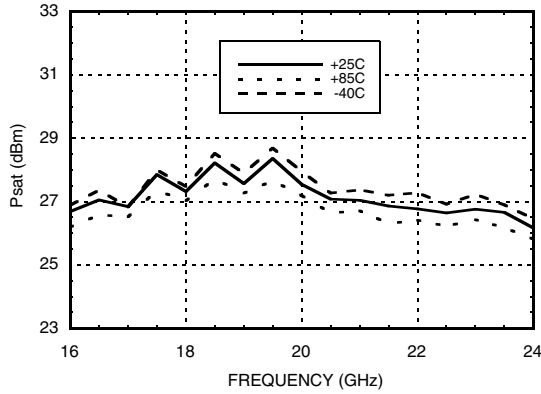
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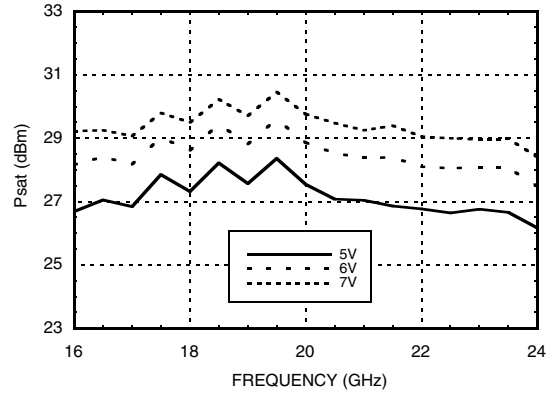


**GaAs pHEMT MMIC 1/2 WATT  
POWER AMPLIFIER, 16 - 24 GHz**

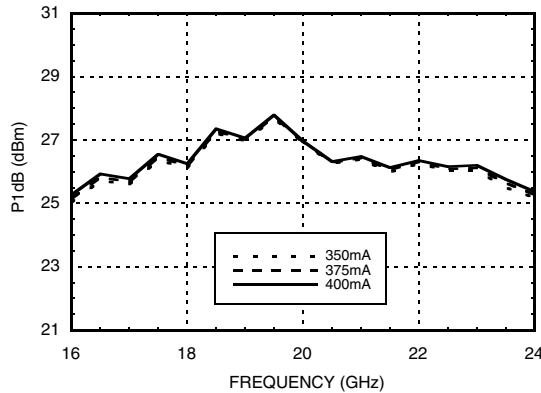
**Psat vs. Temperature**



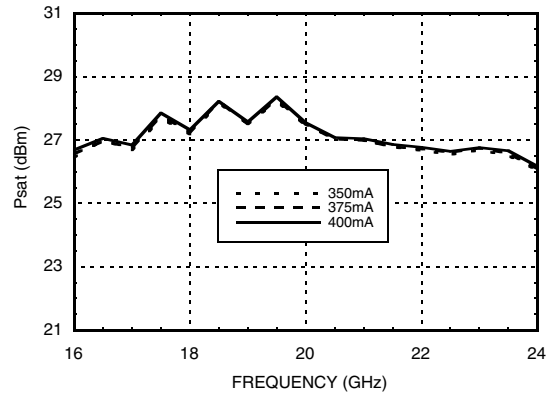
**Psat vs. Supply Voltage**



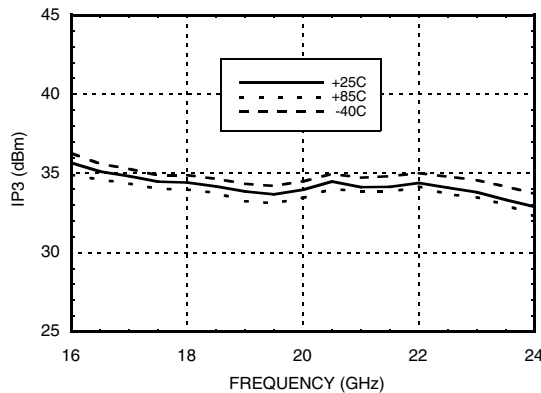
**P1dB vs. Supply Current (Idd)**



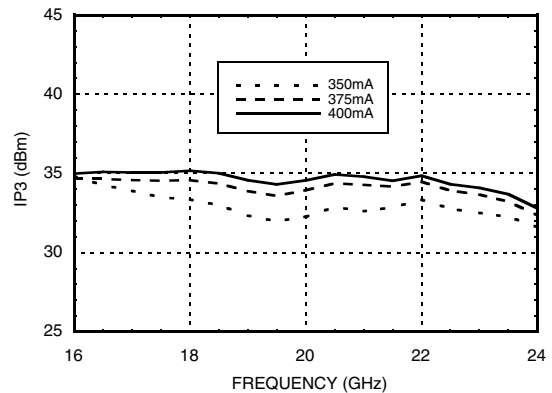
**Psat vs. Supply Current (Idd)**



**Output IP3 vs. Temperature, Pout/Tone = +16 dBm**



**Output IP3 vs. Supply Current, Pout/Tone = +16 dBm**



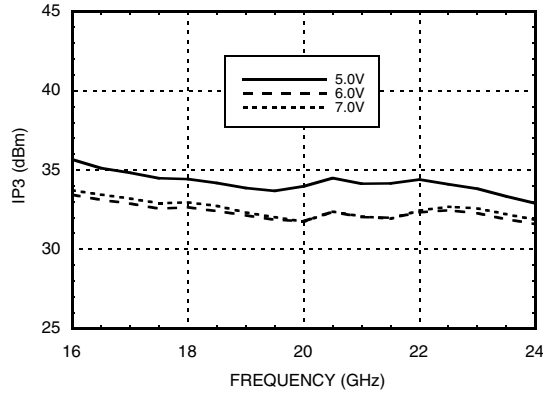
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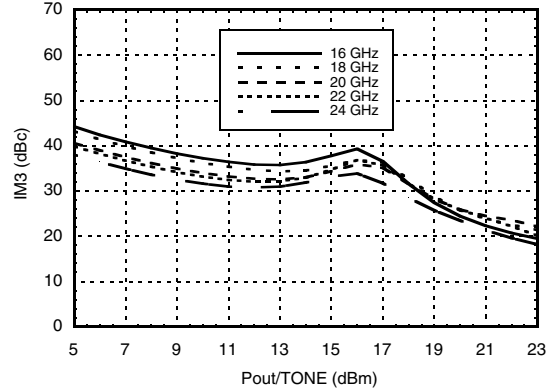


**GaAs pHEMT MMIC 1/2 WATT POWER AMPLIFIER, 16 - 24 GHz**

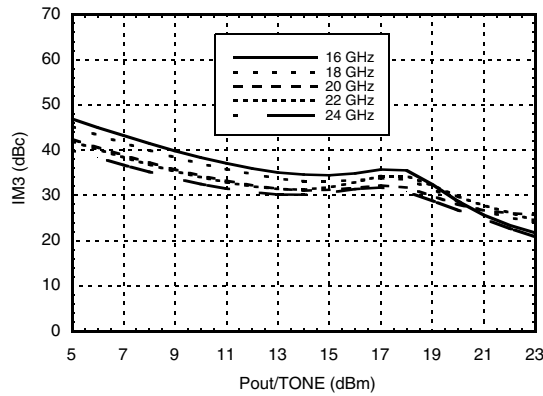
**Output IP3 vs. Supply Voltage, Pout/Tone = +16 dBm**



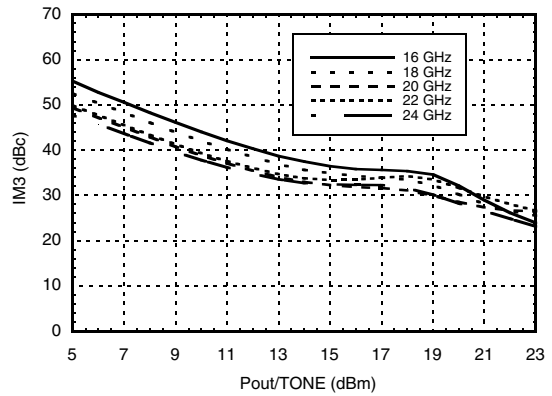
**Output IM3 @ Vdd = +5V**



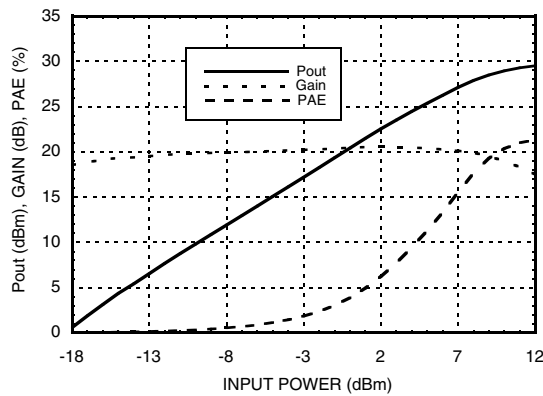
**Output IM3 @ Vdd = +6V**



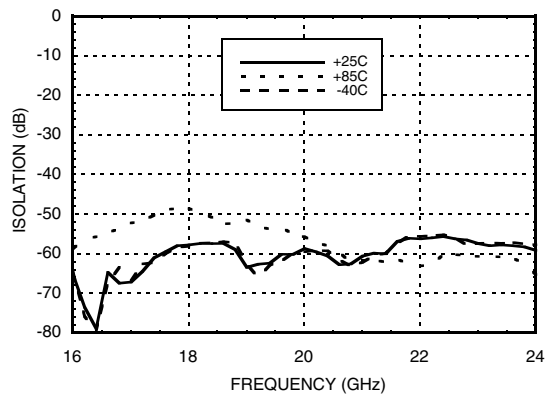
**Output IM3 @ Vdd = +7V**



**Power Compression @ 20 GHz**



**Reverse Isolation vs. Temperature**



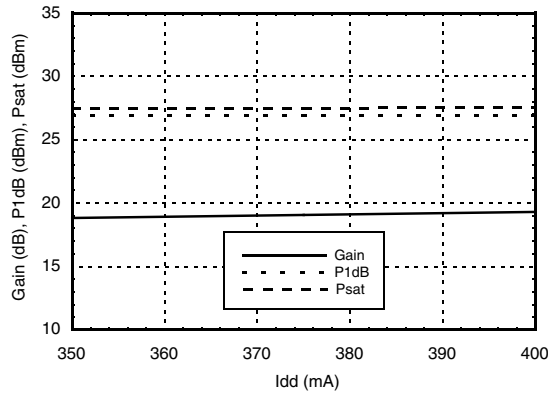
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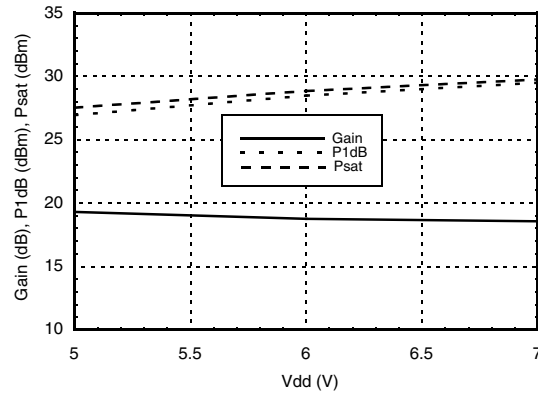


## GaAs pHEMT MMIC 1/2 WATT POWER AMPLIFIER, 16 - 24 GHz

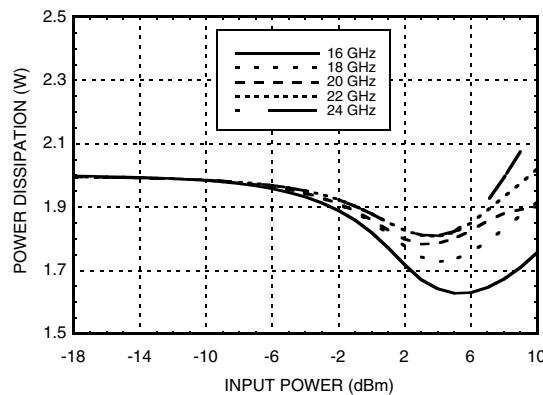
**Gain & Power vs.  
Supply Current @ 20 GHz**



**Gain & Power vs.  
Supply Voltage @ 20 GHz**



**Power Dissipation**



### Absolute Maximum Ratings

|  |                |
|--|----------------|
| Drain Bias Voltage (Vdd)                                     | 7V             |
| RF Input Power (RFIN)  | 23 dBm         |
| Channel Temperature  | 150 °C         |
| Continuous Pdiss (T= 85 °C)<br>(derate 40 mW/°C above 85 °C) | 2.7 W          |
| Thermal Resistance<br>(channel to exposed ground paddle)     | 24.85 C/W      |
| Storage Temperature  | -65 to +150 °C |
| Operating Temperature  | -55 to +85 °C  |

### Typical Supply Current vs. Vdd

| Vdd (V) | Idd (mA) |
|---------|----------|
| +5.0    | 400      |
| +5.5    | 400      |
| +6.0    | 400      |

Note: Amplifier will operate over full voltage ranges shown above Vgg adjusted to achieve Idd = 400 mA at +5.5V

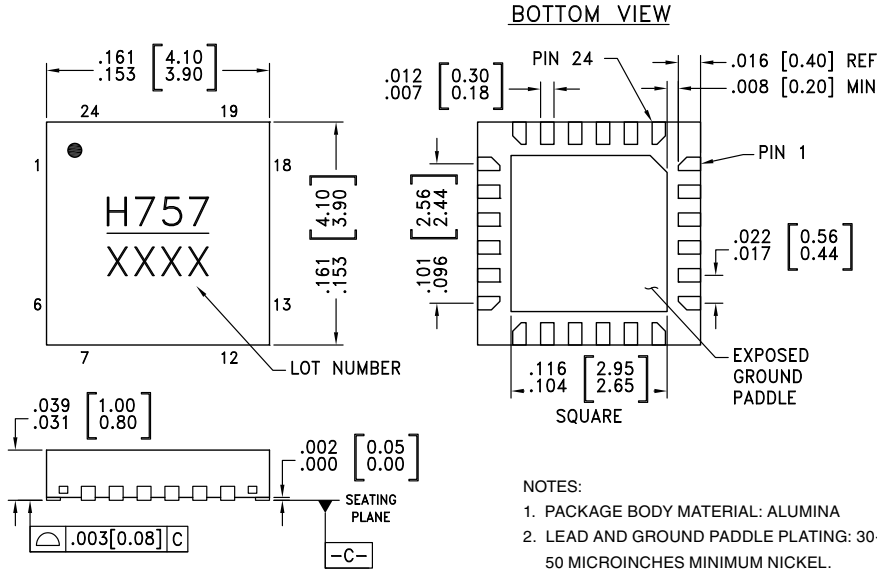


**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

## GaAs pHEMT MMIC 1/2 WATT POWER AMPLIFIER, 16 - 24 GHz



### Outline Drawing



NOTES:

1. PACKAGE BODY MATERIAL: ALUMINA
2. LEAD AND GROUND PADDLE PLATING: 30-80 MICROINCHES GOLD OVER 50 MICROINCHES MINIMUM NICKEL.
3. DIMENSIONS ARE IN INCHES [MILLIMETERS].
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm DATUM -C-
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. CLASSIFIED AS MOISTURE SENSITIVITY LEVEL (MSL) 1.

### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[1]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC757LP4E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H757<br>XXXX                   |

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

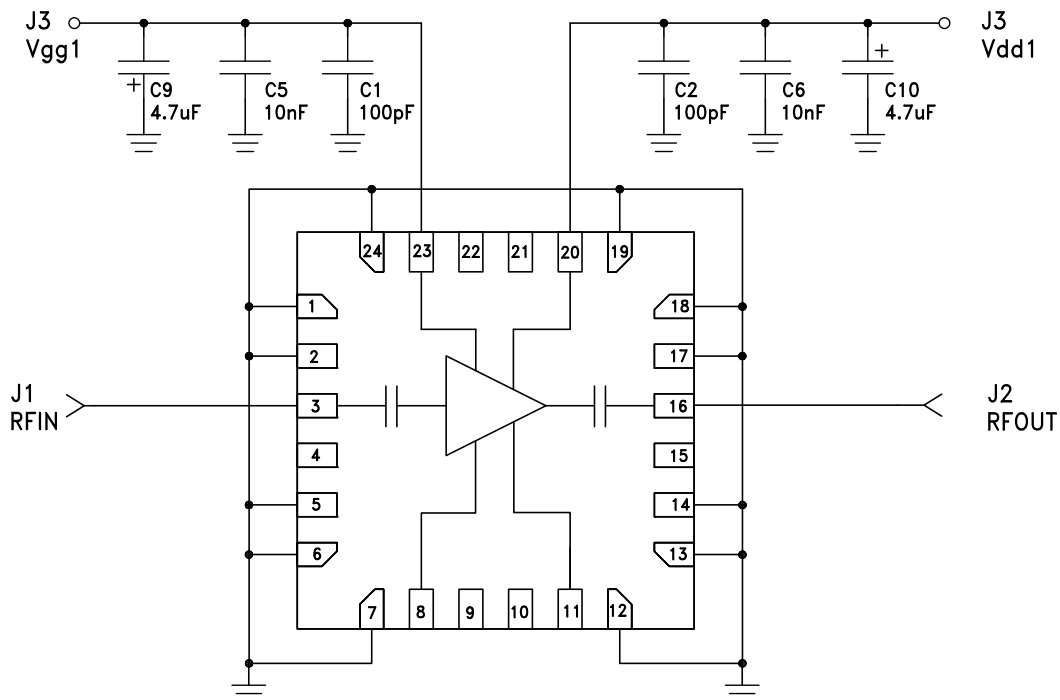
## GaAs pHEMT MMIC ½ WATT POWER AMPLIFIER, 16 - 24 GHz



### Pin Descriptions

| Pin Number                           | Function | Description  | Interface Schematic |
|--------------------------------------|----------|--|---------------------|
| 1, 2, 4 - 7,<br>12 - 15, 17 - 19, 24 | GND      | These pins and package bottom must be connected to RF/DC ground.   |                     |
| 3                                    | RFIN     | This pin is AC coupled and matched to 50 Ohms.   |                     |
| 8 - 11, 20, 22                       | N/C      | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. |                     |
| 16                                   | RFOUT    | This pin is AC coupled and matched to 50 Ohms.   |                     |
| 21                                   | Vdd      | Drain bias for amplifier. External bypass caps 100pF, 0.1uF and 4.7uF are required   |                     |
| 23                                   | Vgg      | Gate control for PA. Adjust Vgg to achieve recommended bias current. External bypass caps 100pF, 0.1uF and 4.7uF are required.           |                     |

### Application Circuit



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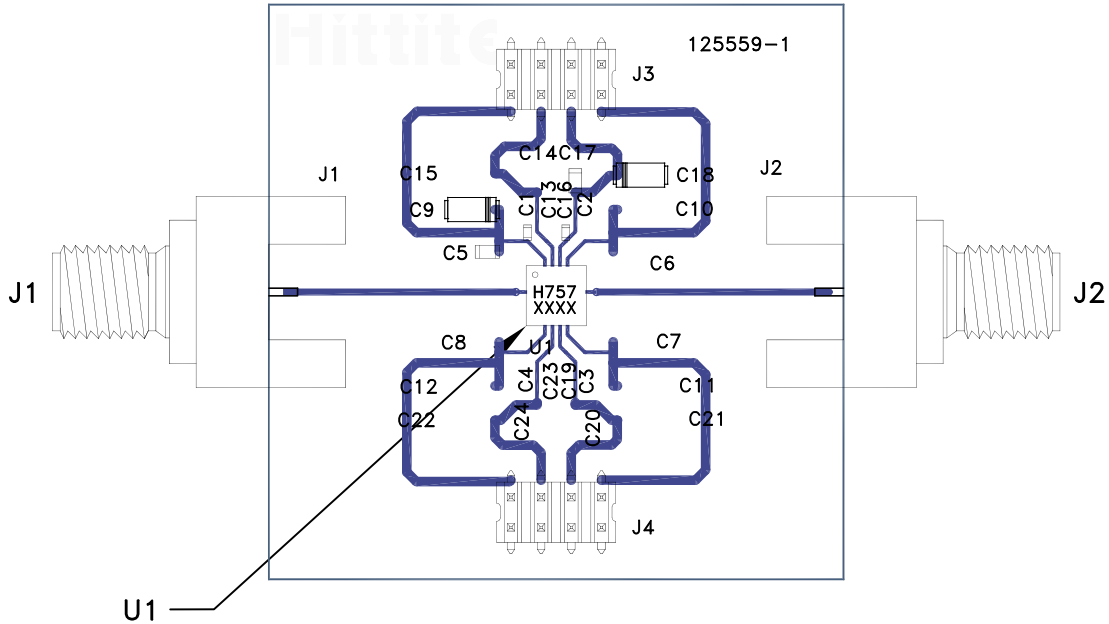
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## GaAs pHEMT MMIC ½ WATT POWER AMPLIFIER, 16 - 24 GHz



### Evaluation PCB



### List of Materials for Evaluation PCB 131216 [1]

| Item    | Description                 |
|---------|-----------------------------|
| J1, J2  | 2.9 mm Connectors           |
| J3, J4  | DC Pins                     |
| C1, C16 | 100 pF Capacitor, 0402 Pkg. |
| C5, C17 | 10 kpF Capacitor, 0402 Pkg. |
| C9, C18 | 4.7 μF Capacitor, 0402 Pkg. |
| U1      | HMC757LP4E Power Amplifier  |
| PCB [2] | 125559 Evaluation PCB       |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon FR4

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.