

## GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 5 - 18 GHz

### Typical Applications

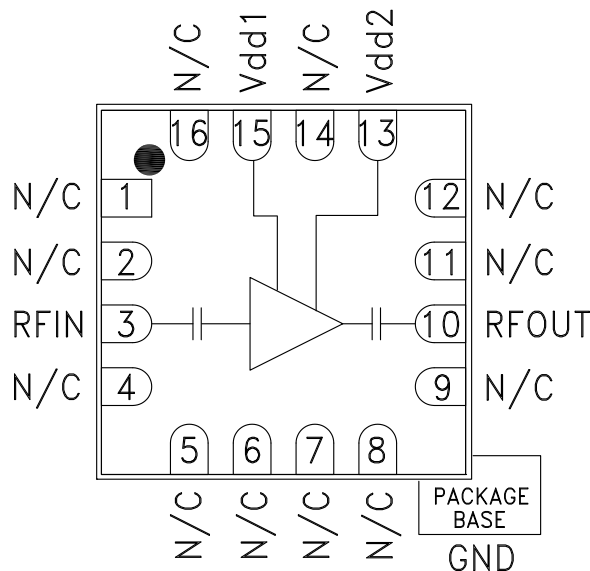
The HMC451LP3(E) is ideal for:

- Microwave Radio & VSAT
- Military & Space
- Test Equipment & Sensors
- Fiber Optics
- LO Driver for HMC Mixers

### Features

- Gain: 18 dB
- Saturated Power: +21 dBm @ 18% PAE
- Output IP3: +28 dBm
- Single Supply: +5V @ 120 mA
- 50 Ohm Matched Input/Output
- 16 Lead 3x3mm SMT Package: 9mm<sup>2</sup>

### Functional Diagram



### General Description

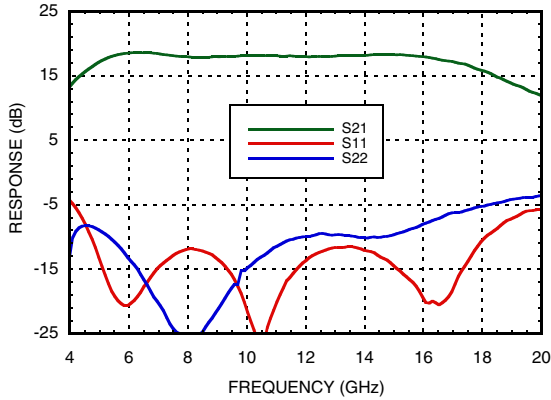
The HMC451LP3(E) is an efficient GaAs PHEMT MMIC Medium Power Amplifier housed in a leadless RoHS compliant SMT package. Operating between 5 and 18 GHz, the amplifier provides 18 dB of gain, +21 dBm of saturated power and 18% PAE from a single +5V supply. This 50 Ohm matched amplifier does not require any external components and the RF I/O's are DC blocked, making it an ideal linear gain block or LO driver for HMC mixers. The HMC451LP3(E) eliminates the need for wire bonding, and allows the use of surface mount manufacturing techniques.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{dd1} = V_{dd2} = +5\text{V}$

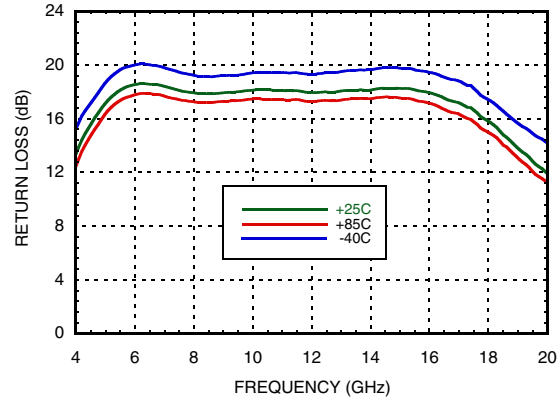
| Parameter                                | Min.   | Typ. | Max.    | Min. | Typ. | Max. | Units |
|--|--------|------|---------|------|------|------|-------|
| Frequency Range                          | 5 - 16 |      | 16 - 18 |      |      |      | GHz   |
| Gain                                     | 15     | 18   |         | 12.5 | 16   |      | dB    |
| Gain Variation Over Temperature          |        | 0.02 | 0.03    |      | 0.02 | 0.03 | dB/°C |
| Input Return Loss                        |        | 13   |         |      | 13   |      | dB    |
| Output Return Loss                       |        | 12   |         |      | 8    |      | dB    |
| Output Power for 1 dB Compression (P1dB) | 16.5   | 19.5 |         | 16   | 19   |      | dBm   |
| Saturated Output Power (Psat)            |        | 21   |         |      | 20   |      | dBm   |
| Output Third Order Intercept (IP3)       |        | 28   |         |      | 25   |      | dBm   |
| Noise Figure                             |        | 7    |         |      | 7    |      | dB    |
| Supply Current (I <sub>dd</sub> )        |        | 120  | 150     |      | 120  | 150  | mA    |

**GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 5 - 18 GHz**

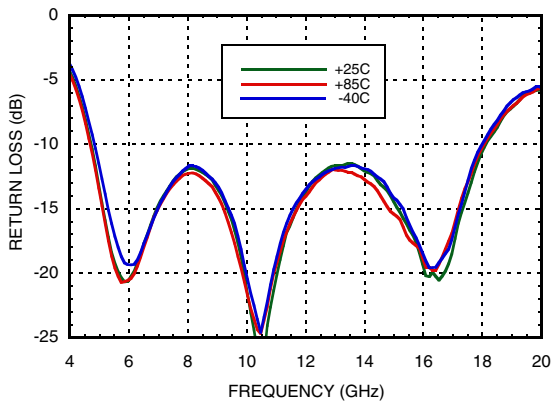
**Broadband Gain & Return Loss**



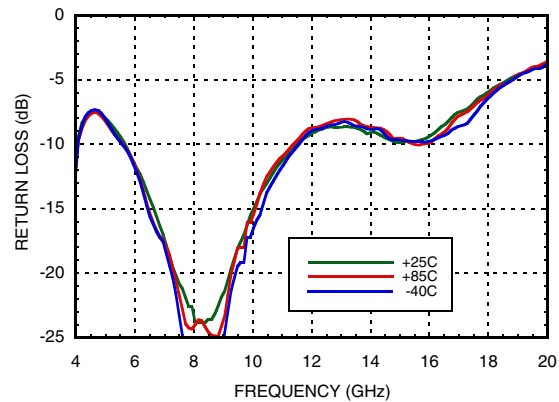
**Gain vs. Temperature**



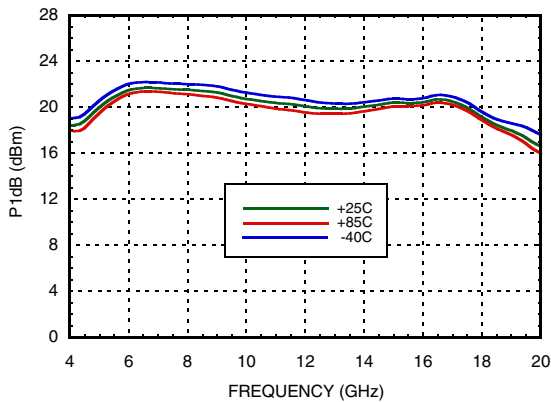
**Input Return Loss vs. Temperature**



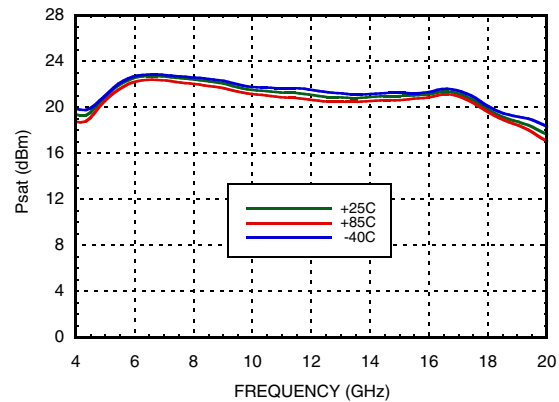
**Output Return Loss vs. Temperature**



**P1dB vs. Temperature**

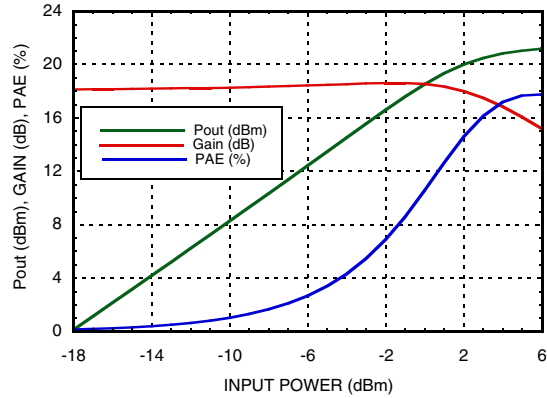


**Psat vs. Temperature**

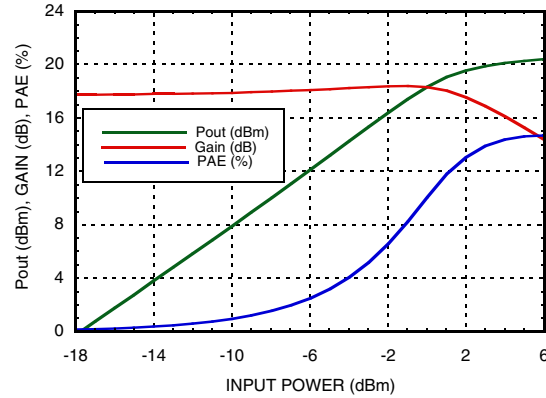


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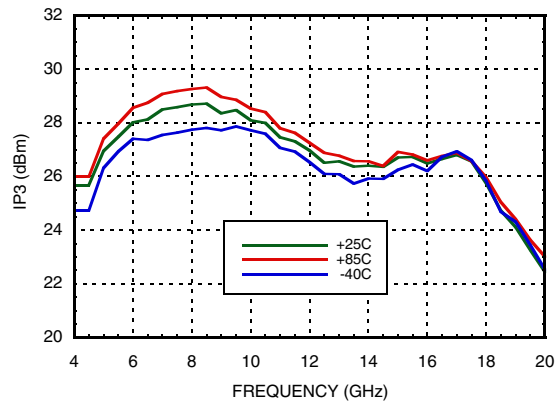
**Power Compression @ 10 GHz**



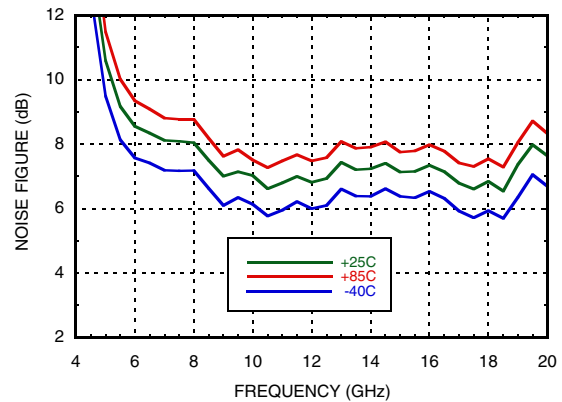
**Power Compression @ 17 GHz**



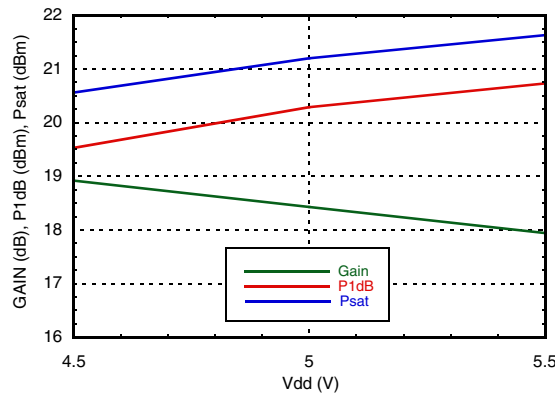
**Output IP3 vs. Temperature**



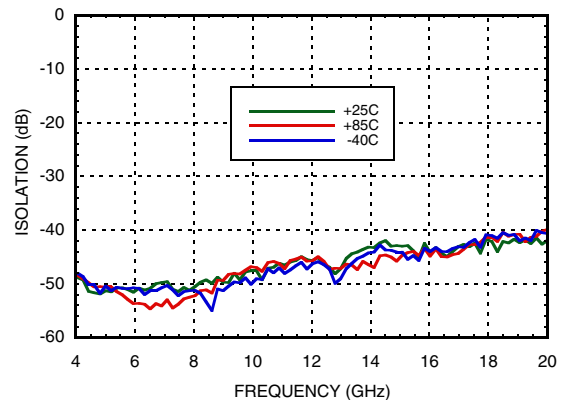
**Noise Figure vs. Temperature**



**Gain, P1dB & PSAT vs. Supply Voltage @ 11 GHz**



**Reverse Isolation vs. Temperature**



## GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 5 - 18 GHz

### Absolute Maximum Ratings

|  |                       |
|--|-----------------------|
| Drain Bias Voltage ( $V_{dd1} = V_{dd2}$ )                           | +5.5V                 |
| RF Input Power (RFIN)( $V_{dd} = +5V_{dc}$ )                         | +10 dBm               |
| Channel Temperature  | 175 °C                |
| Continuous $P_{diss}$ (T = 85 °C)<br>(derate 12.8 mW/°C above 85 °C) | 1.15 W                |
| Thermal Resistance<br>(channel to ground paddle)                     | 78 °C/W               |
| Storage Temperature  | -65 to +150 °C        |
| Operating Temperature  | -40 to +85 °C         |
| ESD Sensitivity (HBM)  | Class 1A, passed 250V |

### Typical Supply Current vs. $V_{dd1} = V_{dd2}$

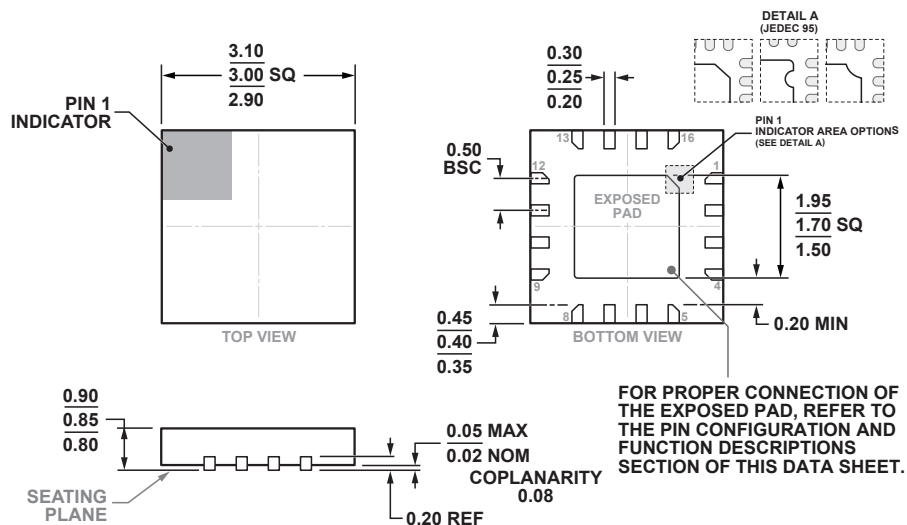
| $V_{dd1} = V_{dd2}$ (V) | $I_{dd1} + I_{dd2}$ (mA) |
|-------------------------|--------------------------|
| +4.5                    | 120                      |
| +5.0                    | 122                      |
| +5.5                    | 124                      |

Note: Amplifier will operate over full voltage range shown above



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



COMPLIANT WITH JEDEC STANDARDS MO-220-VEED-4.

16-Lead Lead Frame chip Scale Package [LFCSP]  
3 mm × 3 mm Body and 0.85 mm Package Height  
(HCP-16-1)

Dimensions shown in millimeters.

### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC451LP3   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 451<br>XXXX                    |
| HMC451LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 451<br>XXXX                    |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

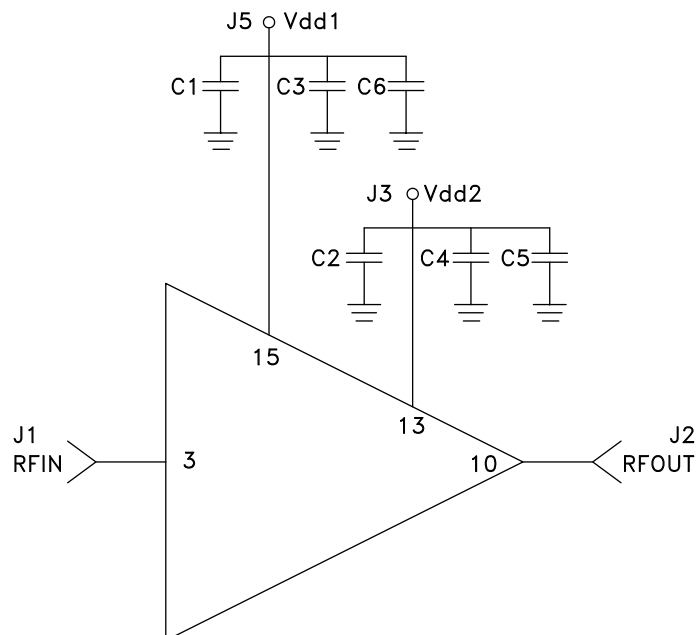
## GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 5 - 18 GHz

### Pin Descriptions

| Pin Number                  | Function | Description   | Interface Schematic |
|-----------------------------|----------|---|---------------------|
| 1, 2, 4 - 9, 11, 12, 14, 16 | N/C      | This pin may be connected to RF/DC ground. Performance will not be affected.                                    |                     |
| 3                           | RFIN     | This pin is AC coupled and matched to 50 Ohms.  |                     |
| 10                          | RFOUT    | This pin is AC coupled and matched to 50 Ohms.  |                     |
| 13                          | Vdd2     | Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF, 1,000 pF and 2.2 μF are required. |                     |
| 15                          | Vdd1     | Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF, 1,000 pF and 2.2 μF are required. |                     |
|                             | GND      | Package bottom must be connected to RF/DC ground.   |                     |

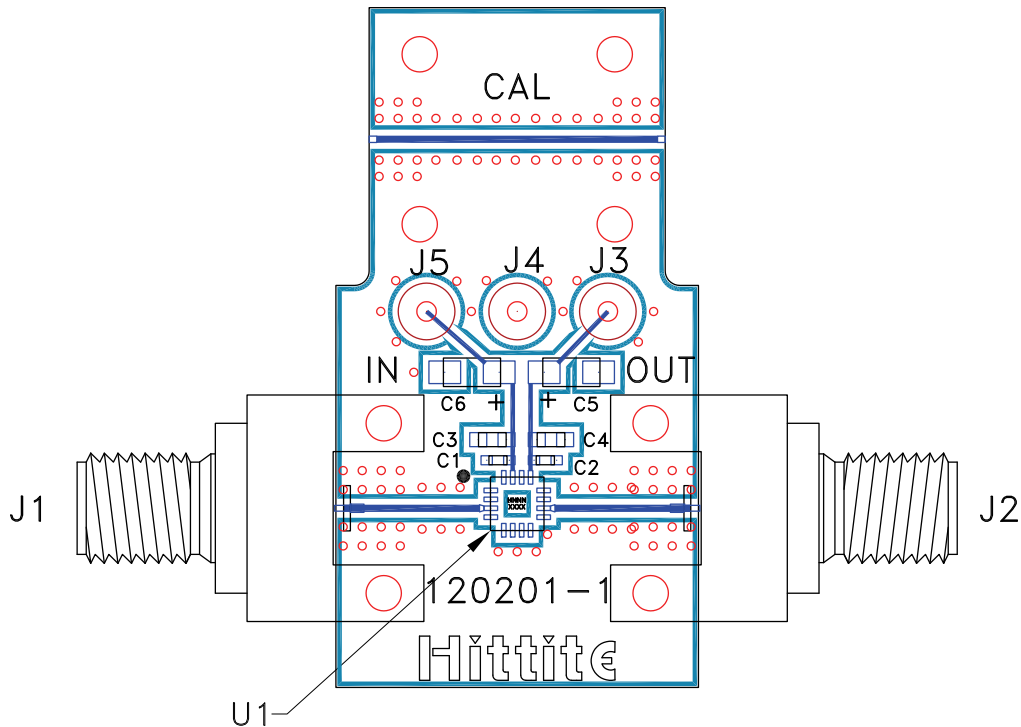
### Application Circuit

| Component | Value    |
|-----------|----------|
| C1, C2    | 100 pF   |
| C3, C4    | 1,000 pF |
| C5, C6    | 2.2 μF   |



## GaAs PHEMT MMIC MEDIUM POWER AMPLIFIER, 5 - 18 GHz

### Evaluation PCB



### List of Materials for Evaluation PCB 120202 [1]

| Item    | Description                  |
|---------|------------------------------|
| J1 - J2 | PCB Mount SMA Connector      |
| J3 - J5 | DC Pin                       |
| C1, C2  | 100 pF Capacitor, 0402 Pkg.  |
| C3, C4  | 1000 pF Capacitor, 0603 Pkg. |
| C5, C6  | 2.2 μF Capacitor, Tantalum   |
| U1      | HMC451LP3(E) Amplifier       |
| PCB [2] | 120201 Evaluation PCB        |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: 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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Analog Devices, upon request.