

### Typical Applications

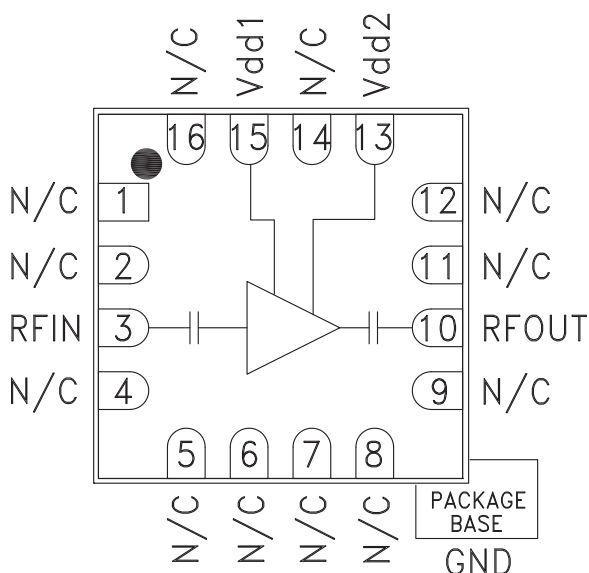
The HMC451LP3(E) is ideal for:

- 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

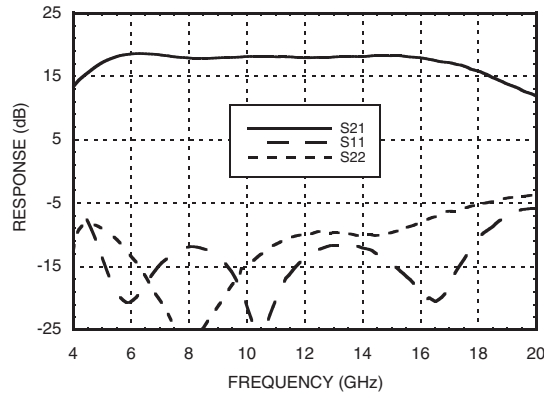
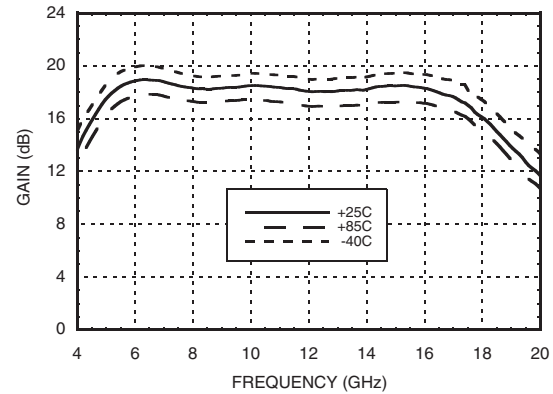
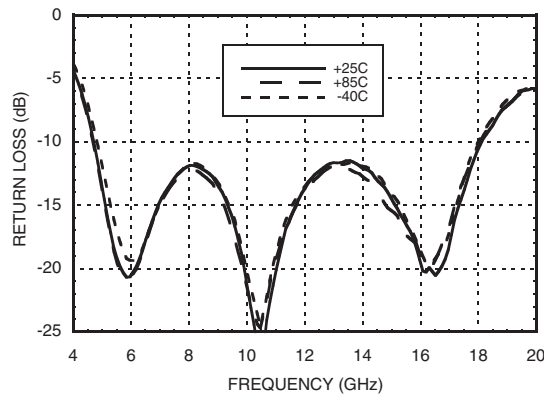
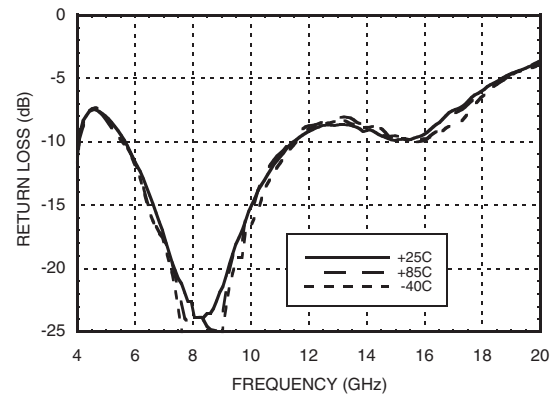
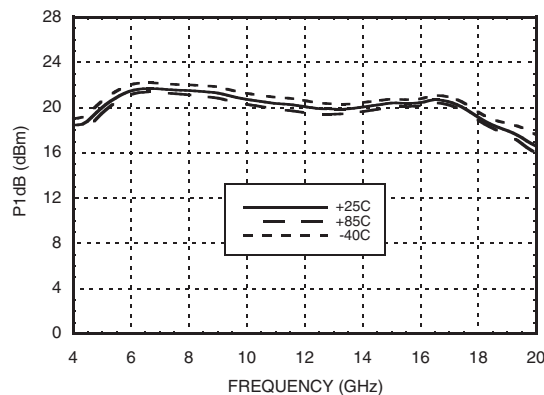
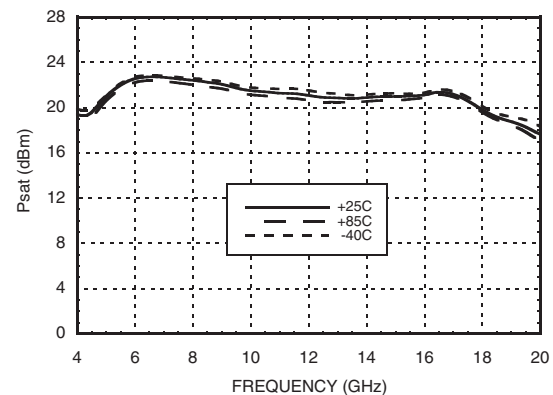
The HMC451LP3(E) is an efficient GaAs PHEMT MMIC Medium Power Amplifier housed in a leadless RoHS compliant SMT package. Operating between 5 and 18 GHz, the amplifier provides 18 dB of gain, +21 dBm of saturated power and 18% PAE from a single +5V supply. This 50 Ohm matched amplifier does not require 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.

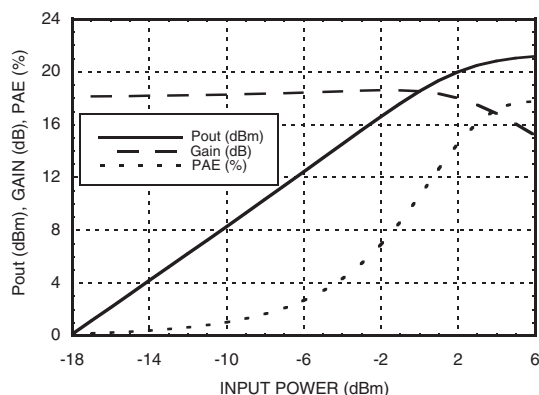
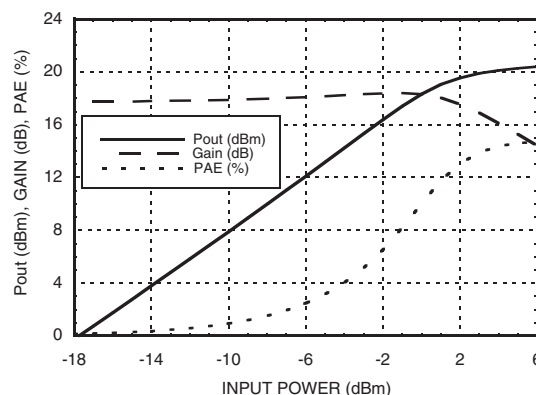
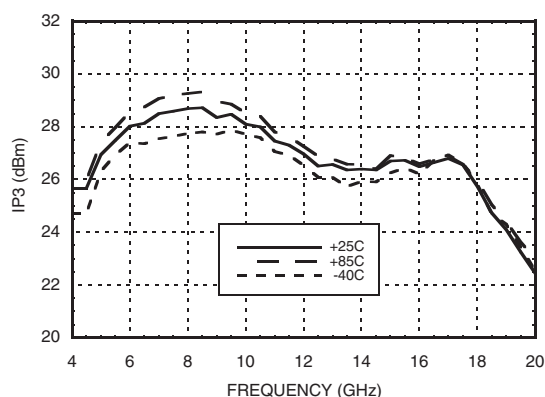
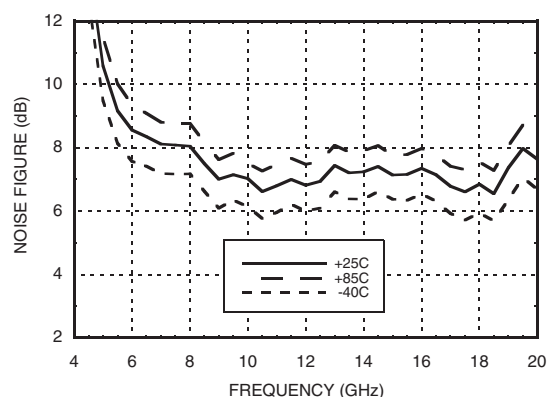
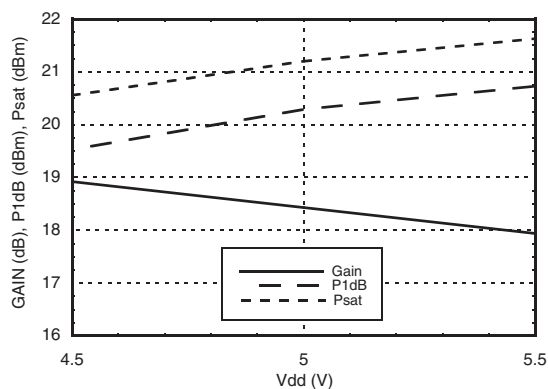
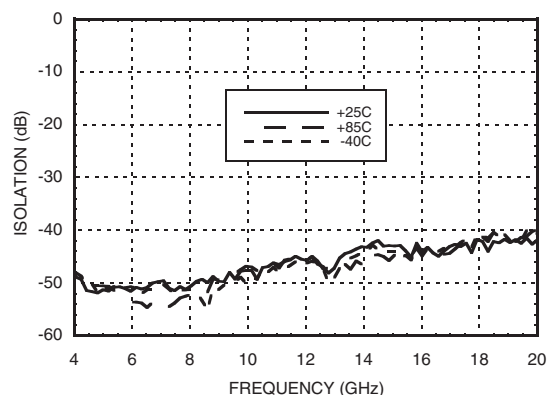
### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{dd1} = V_{dd2} = +5\text{V}$

| 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 (Idd)                     |        | 120  | 150  |         | 120  | 150  | mA    |

# HMC451LP3 / 451LP3E

## 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**


**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**

|   |                |
|---|----------------|
| Drain Bias Voltage ( $V_{dd1} = V_{dd2}$ )                      | +5.5V          |
| RF Input Power (RFIN)( $V_{dd} = +5V_{dc}$ )                    | +10 dBm        |
| Channel Temperature   | 150 °C         |
| Continuous Pdiss (T = 85 °C)<br>(derate 12.8 mW/°C above 85 °C) | 0.83 W         |
| Thermal Resistance<br>(channel to ground paddle)                | 78 °C/W        |
| Storage Temperature   | -65 to +150 °C |
| Operating Temperature   | -40 to +85 °C  |

| Vdd <sub>1</sub> = Vdd <sub>2</sub> (V) | Idd <sub>1</sub> + Idd <sub>2</sub> (mA) |
|---|--|
| +4.5                                    | 120                                      |
| +5.0                                    | 122                                      |
| +5.5                                    | 124                                      |

9

The diagram illustrates the layout of a 16mm film frame. A sprocket hole is located in the top left corner. The frame is divided into two main sections by a vertical line. The left section contains the text "NNNN" in the top row and "XXXX" in the bottom row. The right section contains the text ".122" and ".114" in the top row, and ".122" and ".114" in the bottom row. The text "[3.10]" and "[2.90]" is located in the top right corner. The text "HMC PART NUMBER (DIGITS ONLY)" is located in the top right corner. The text "LOT NUMBER" is located in the bottom right corner. Dimensions are indicated by arrows: 16 and 13 for the top width, 12 and 9 for the right height, 5 and 8 for the bottom width, and 1 and 4 for the left height.

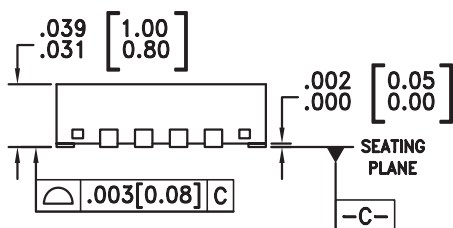


Diagram of a square package showing dimensions and labels:

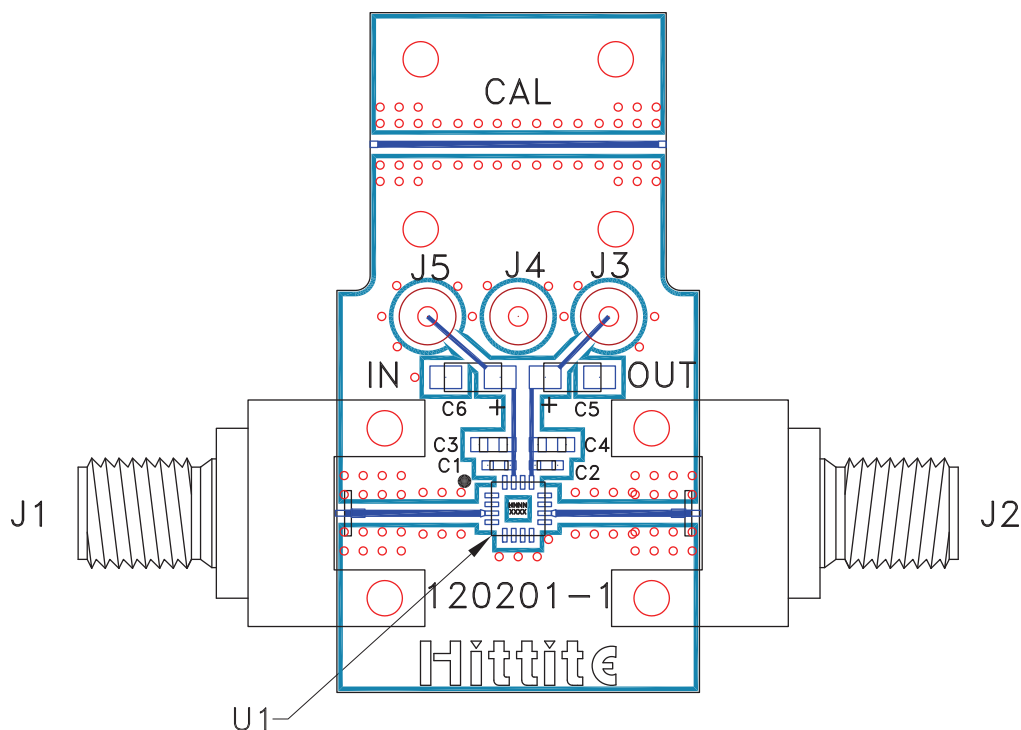
- Top dimensions: .012 [0.30] and .007 [0.18]
- Right dimensions: .016 [0.40] REF and .008 [0.20] MIN
- Bottom dimensions: .061 [1.56] and .057 [1.44]
- Bottom-right dimensions: .022 [0.56] and .017 [0.44]
- Bottom dimensions: .077 [1.95] and .059 [1.50]
- Labels: PIN 16, PIN 1, EXPOSED GROUND PADDLE MUST BE CONNECTED TO RF/DC GROUND
- Package shape: SQUARE

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.
5. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
6. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
7. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
8. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

| 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                    |

For price, delivery, and to place orders: Analog Devices, Inc.,  
One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106  
Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com)  
Application Support: Phone: 1-800-ANALOG-D

9 - 5

**Evaluation PCB**

**List of Materials for Evaluation PCB 120202 <sup>[1]</sup>**

| 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 $\mu$ F Capacitor, Tantalum |
| U1                 | HMC451LP3(E) Amplifier          |
| PCB <sup>[2]</sup> | 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 Hittite upon request.