

### Typical Applications

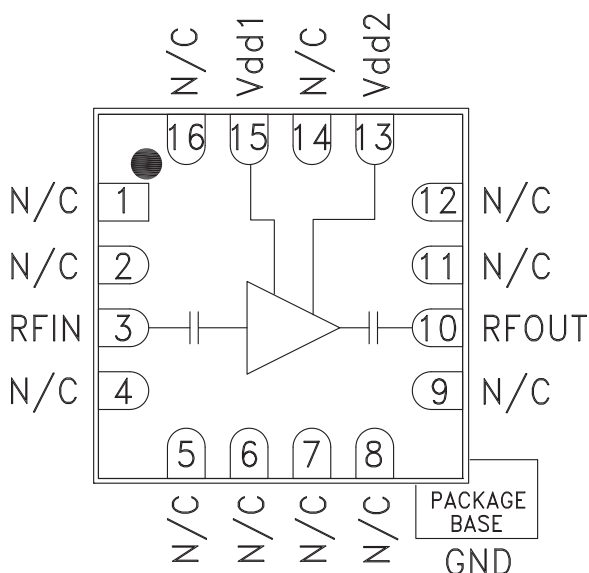
The HMC451LP3(E) is ideal for:

- 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\* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

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## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- HMC451LP3 Evaluation Board

## DOCUMENTATION

### Application Notes

- Broadband Biasing of Amplifiers General Application Note
- MMIC Amplifier Biasing Procedure Application Note
- Thermal Management for Surface Mount Components General Application Note

### Data Sheet

- HMC451LP3 Data Sheet

## TOOLS AND SIMULATIONS

- HMC451LP3 S-Parameters

## REFERENCE MATERIALS

### Quality Documentation

- Package/Assembly Qualification Test Report: LP2, LP2C, LP3, LP3B, LP3C, LP3D, LP3F, LP3G (QTR: 2014-0364)
- Semiconductor Qualification Test Report: PHEMT-F (QTR: 2013-00269)

## DESIGN RESOURCES

- HMC451LP3 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all HMC451LP3 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

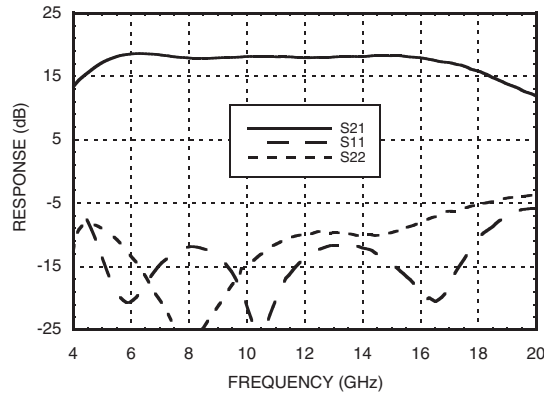
## TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

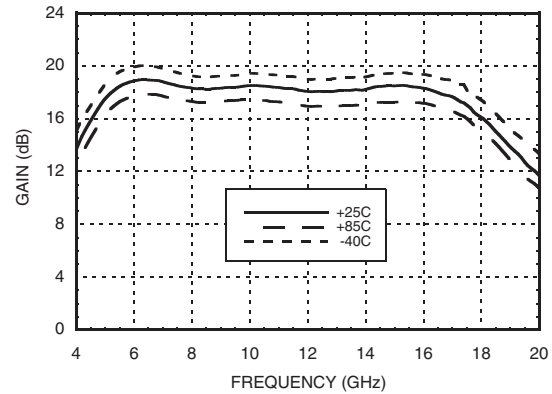
## DOCUMENT FEEDBACK

Submit feedback for this data sheet.

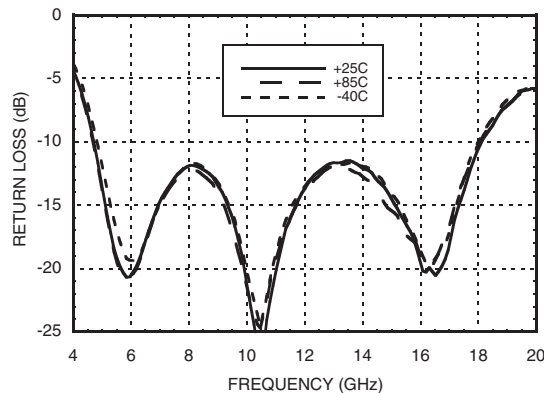
**Broadband Gain & Return Loss**



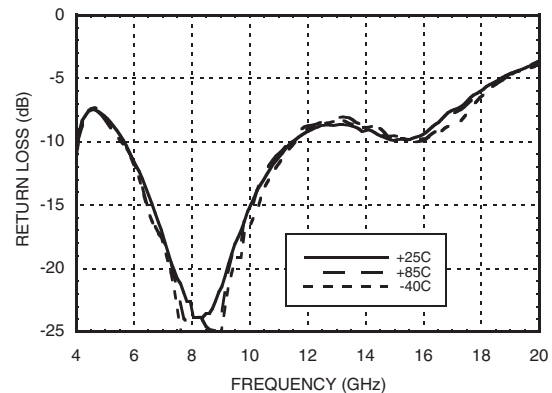
**Gain vs. Temperature**



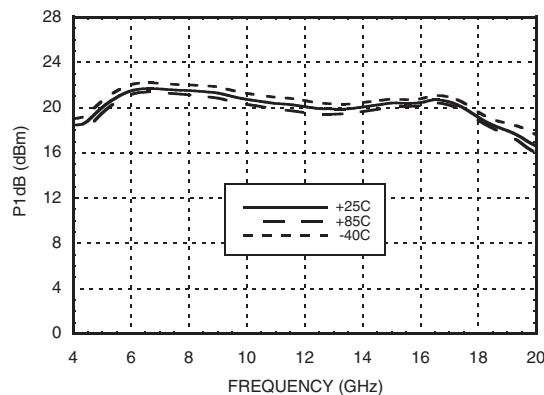
**Input Return Loss vs. Temperature**



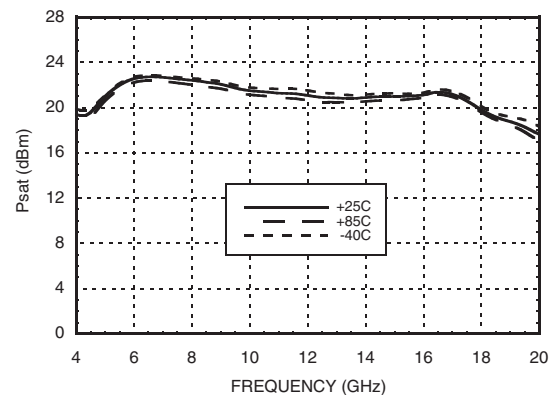
**Output Return Loss vs. Temperature**

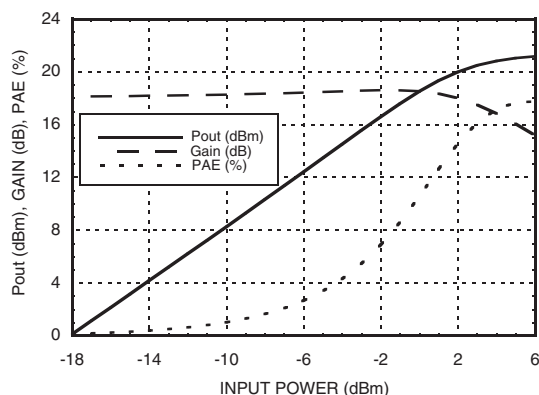
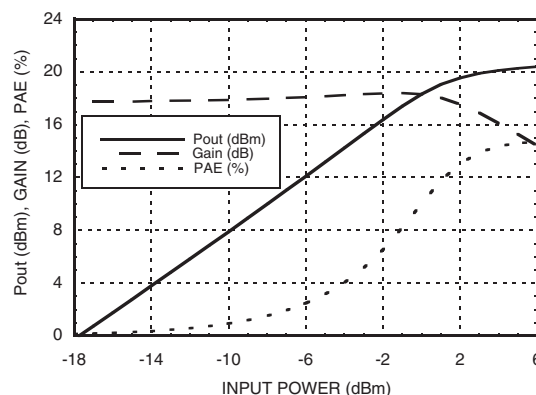
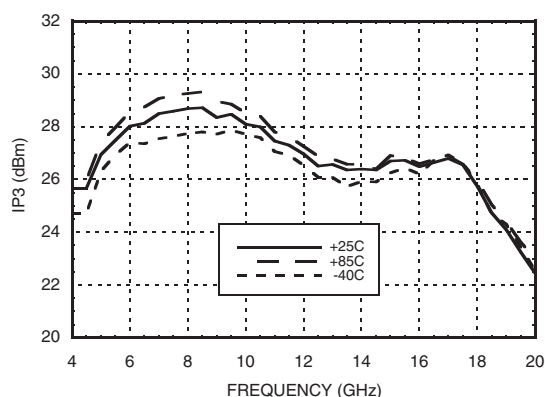
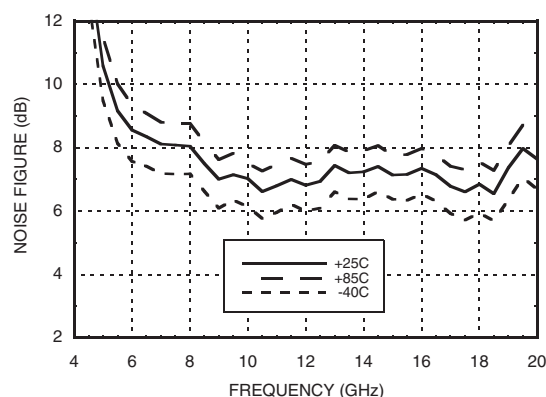
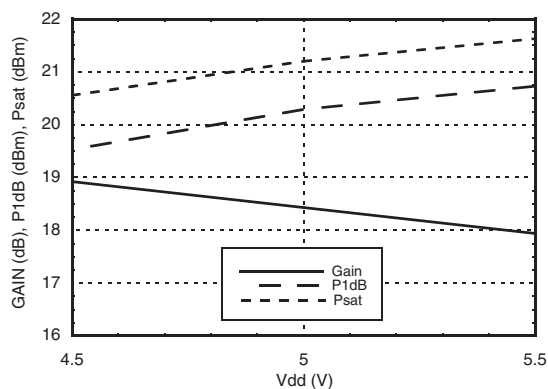
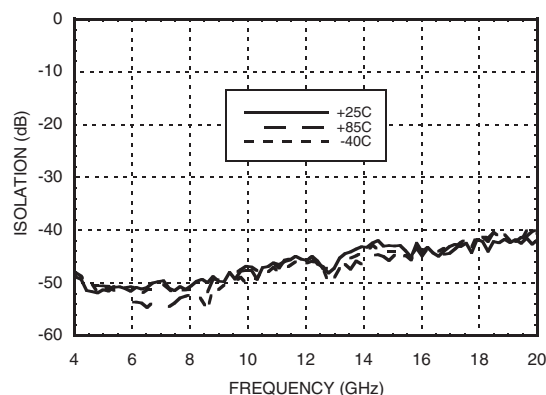


**P1dB vs. Temperature**



**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 P <sub>diss</sub> (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                                      |

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The diagram shows a rectangular label with overall dimensions of 16 inches by 13 inches. The label is divided into two main sections. The top section, labeled 'HMC PART NUMBER (DIGITS ONLY)', contains the part number '122 .114' and '[ 3.10 ]' in the top right corner. The bottom section, labeled 'LOT NUMBER', contains the lot number '122 .114' and '[ 3.10 ]' in the bottom right corner. The label also features a circular hole in the top left corner, a grid of 'N' and 'X' characters, and a '5' in the bottom left corner. Dimensions are indicated by arrows: 16 inches for the total width, 13 inches for the total height, 12 inches for the height of the top section, 9 inches for the height of the bottom section, 5 inches for the width of the left section, and 8 inches for the width of the right section.

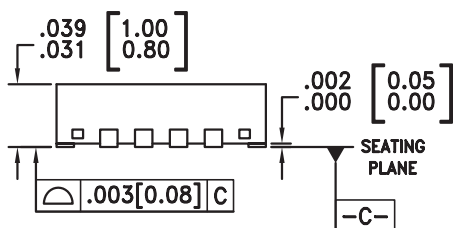


Diagram of a square package with dimensions and labels:

- 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]
- Left 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

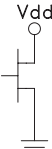
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.
5. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
6. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
7. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED 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  
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Application Support: Phone: 1-800-ANALOG-D

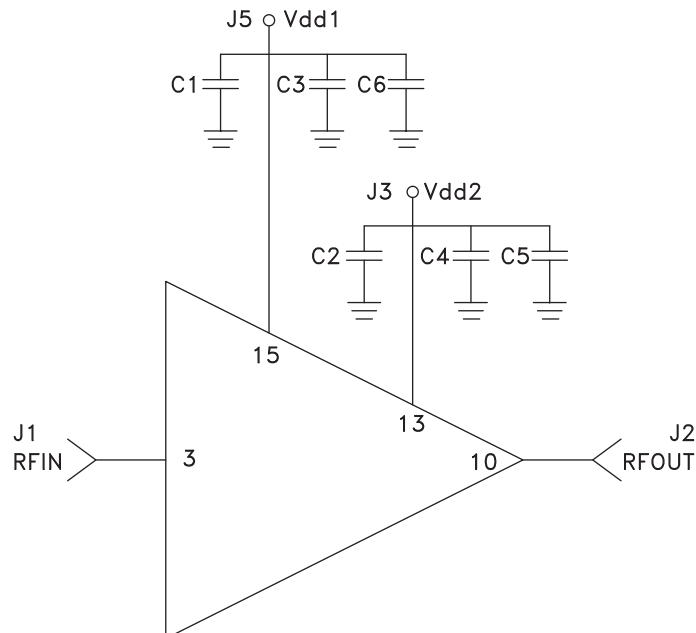


## Pin Descriptions

| 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.<br>Performance will not be affected.                                      |                                                                                           |
| 3                           | RFIN     | This pin is AC coupled and matched to 50 Ohms.                                                                       | RFIN   |
| 10                          | RFOUT    | This pin is AC coupled and matched to 50 Ohms.                                                                       |  RFOUT |
| 13                          | Vdd2     | Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF, 1,000 pF and 2.2 $\mu$ F are required. |        |
| 15                          | Vdd1     | Power Supply Voltage for the amplifier. External bypass capacitors of 100 pF, 1,000 pF and 2.2 $\mu$ F are required. |        |
|                             | GND      | Package bottom must be connected to RF/DC ground.                                                                    |       |

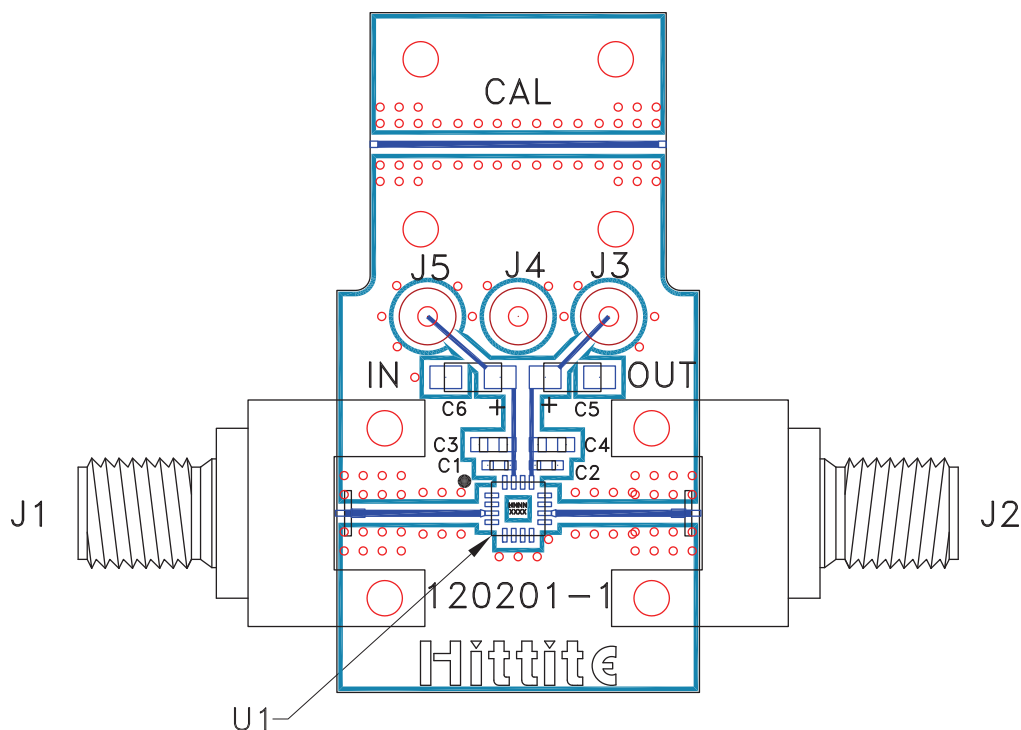
## Application Circuit

| Component | Value       |
|-----------|-------------|
| C1, C2    | 100 pF      |
| C3, C4    | 1,000 pF    |
| C5, C6    | 2.2 $\mu$ F |



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**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.