

## GaAs pHEMT MMIC X2 ACTIVE FREQUENCY MULTIPLIER, 3.8 - 5.6 GHz OUTPUT

### Typical Applications

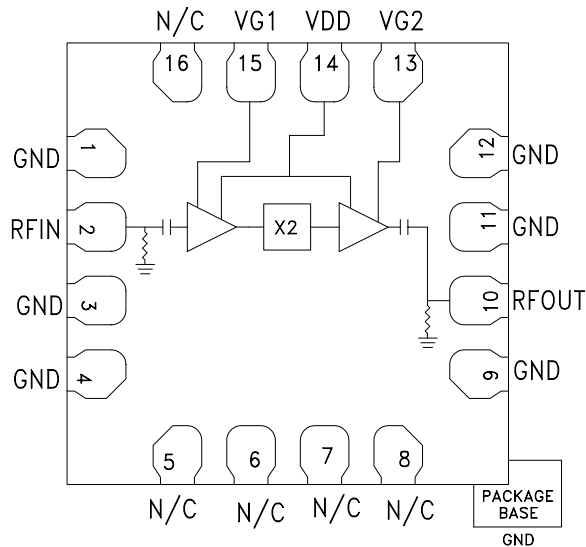
The HMC1096LP3E is suitable for:

- Point-to-Point & VSAT Radios
- Test Instrumentation
- Military & Space

### Features

- High Output Power: 12 dBm
- Low Input Power Drive: -2 to +5 dBm
- Fo, 3 Fo Isolation: +22 dBc
- Single Supply: +5V @100 mA
- 16 Lead 3 x 3 mm SMT Package

### Functional Diagram



### General Description

The HMC1096LP3E is a x2 active broadband frequency multiplier utilizing GaAs pHEMT technology in a leadless RoHS compliant Low Stress Injection Molded Plastic SMT package. When driven by a 0 dBm signal, the multiplier provides +12 dBm typical output power from 3.8 to 5.6 GHz. The Fo and 3 Fo isolations are 22 dBc with respect to the output signal level. This frequency multiplier features DC blocked I/Os, and is ideal for use in LO multiplier chains for Point-to-Point & VSAT radios yielding reduced parts count vs. traditional approaches. The HMC1096LP3E is compatible with surface mount manufacturing techniques.

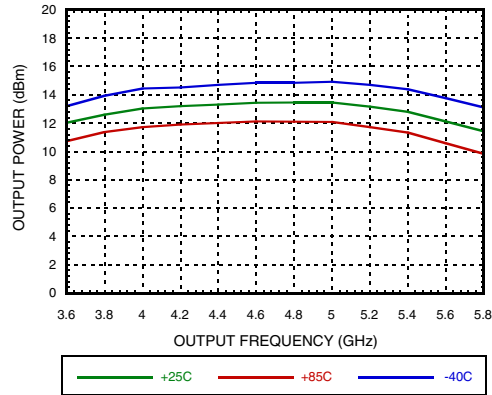
### Electrical Specifications, $T_A = +25^\circ C$ , $V_{DD} = +5 V$ , 0 dBm Drive Level <sup>[1]</sup>

| Parameter   | Min. | Typ. | Max. | Units    |
|---|------|------|------|----------|
| Frequency Range, Input                            | 1.9  |      | 2.8  | GHz      |
| Frequency Range, Output                           | 3.8  |      | 5.6  | GHz      |
| Output Power                                      | 9    | 12   |      | dBm      |
| Fo, 3 Fo Isolation (with respect to output level) |      | 22   |      | dBc      |
| Phase Noise (@ 10 KHz Offset)                     |      | -142 |      | dBc / Hz |
| Input Return Loss                                 |      | 12   |      | dB       |
| Output Return Loss                                |      | 8    |      | dB       |
| Supply Current <sup>[1]</sup>                     |      | 100  |      | mA       |

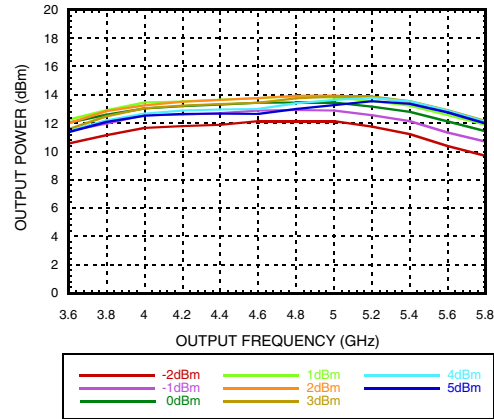
[1] External resistors R1 and R2 set the typical bias level for VG1 to 1.22 Vdc, 1.4mA and VG2 to 1.04 Vdc, 1.2 mA to achieve drain current of 100mA.

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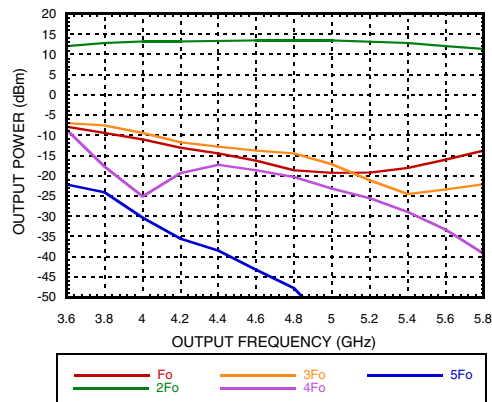
**Output Power vs. Temperature @ 0 dBm Drive Level**



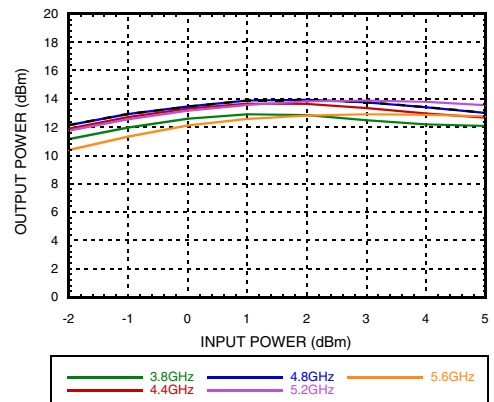
**Output Power vs. Drive Level**



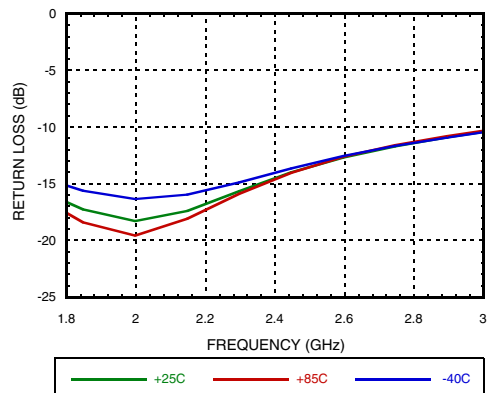
**Isolation @ 0 dBm Drive Level**



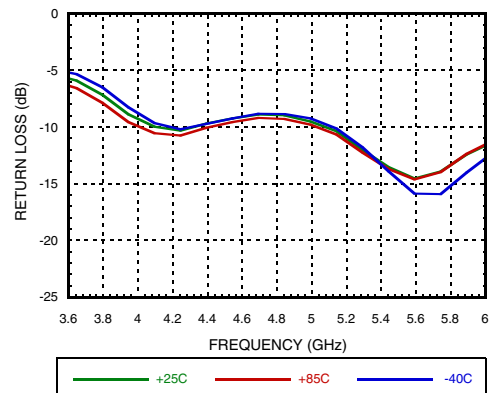
**Output Power vs. Input Power**



**Input Return Loss vs. Temperature**

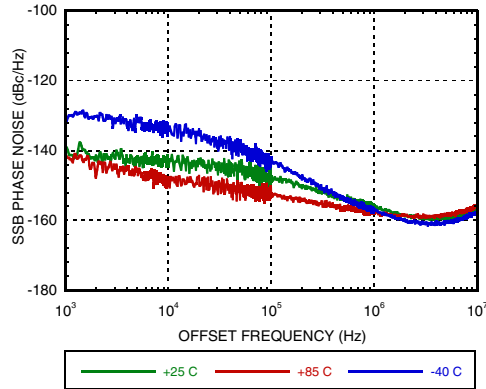


**Output Return Loss vs. Temperature**



**GaAs pHEMT MMIC X2 ACTIVE FREQUENCY  
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**Phase Noise vs. Temperature @ 4.7 GHz**



## GaAs pHEMT MMIC X2 ACTIVE FREQUENCY MULTIPLIER, 3.8 - 5.6 GHz OUTPUT

### Absolute Maximum Ratings

|  |                       |
|--|-----------------------|
| RF Input Power   | +5 dBm                |
| Supply Voltage (VDD)   | +6 V                  |
| VG1, VG2 (Bias Input)  | +2 V                  |
| Channel Temperature  | 175 °C                |
| Continuous P <sub>diss</sub> (T= 85 °C)<br>(derate 13.3 / mW / °C above 85 °C) | 1.2 W                 |
| Thermal Resistance<br>(channel to package bottom)                              | 75 °C/W               |
| Storage Temperature  | -65 to +150 °C        |
| Operating Temperature  | -40 to +85 °C         |
| ESD Sensitivity (HBM)  | Class 0, passed 150 V |

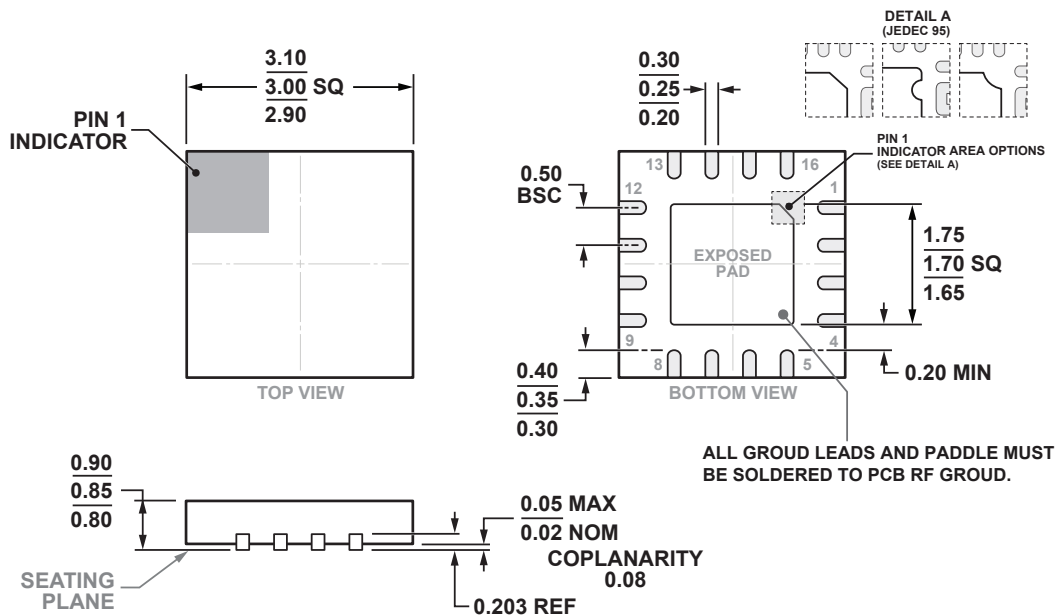
### Typical Supply Current vs. VDD

| VDD (Vdc) | IDD (mA) |
|-----------|----------|
| 5.0       | 100      |



ELECTROSTATIC SENSITIVE DEVICE  
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### Outline Drawing



PKG-004815

12-01-2016-B

### Package Information


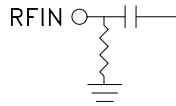
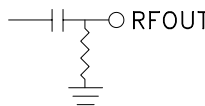
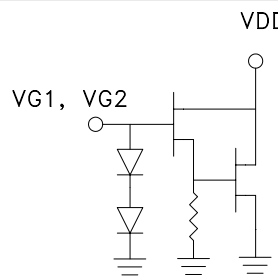
| Part Number | Package Body Material                              | Lead Finish   | MSL Rating [2] | Package Marking [1] |
|-------------|--|---------------|----------------|---------------------|
| HMC1096LP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1           | H1096<br>XXXX       |

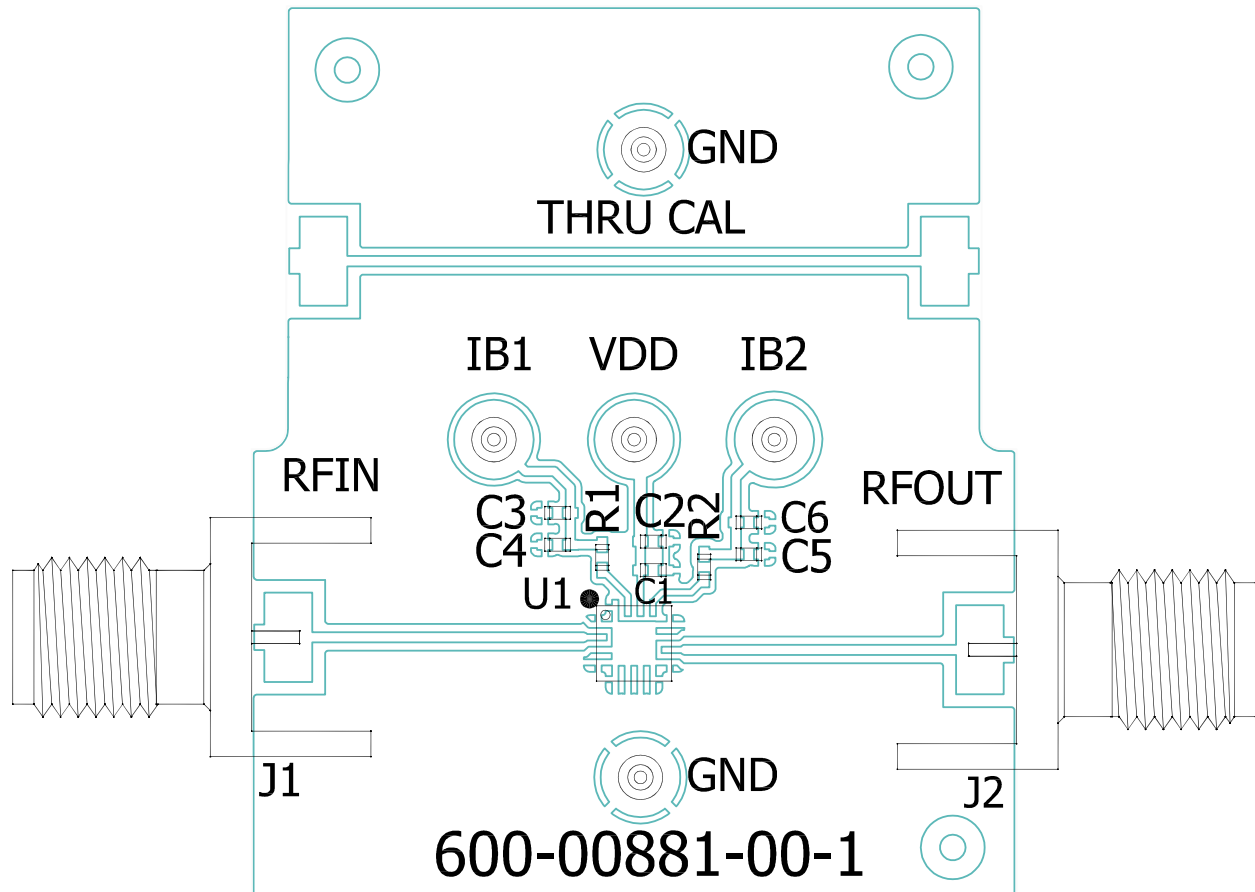
[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

## GaAs pHEMT MMIC X2 ACTIVE FREQUENCY MULTIPLIER, 3.8 - 5.6 GHz OUTPUT

### Pin Descriptions

| Pin Number         | Function | Description  | Pin Schematic  |
|--------------------|----------|--|--|
| 1, 3, 4, 9, 11, 12 | GND      | Package Bottom must be connected to RF/DC ground.  |   |
| 5, 6, 7, 8, 16     | N/C      | These pins are not connected internally. However, this product was specified with these pins connected to RF/DC ground.  |  |
| 2                  | RFIN     | This pin is dc-coupled internally and matched to 50 Ohms. The resistor is used for ESD protection.   |   |
| 10                 | RFOUT    | This pin is dc-coupled internally and matched to 50 Ohms. The resistor is used for ESD protection.   |   |
| 13, 15             | VG2, VG1 | Gate Voltage for first and second stage LO amplifier. Recommended DC voltage is +5 V at J5/J7 with bias resistors R1 and R2 applied. Typical. Refer to application circuit for required external components.       |  |
| 14                 | VDD      | Supply voltage for first and second stage LO amplifier. Recommended DC voltage is +5 V with external bypass capacitors of 100 pF and 10 nF applied. Refer to application circuit for required external components. |  |

**GaAs pHEMT MMIC X2 ACTIVE FREQUENCY  
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**Evaluation PCB**

**List of Materials for Evaluation PCB EV1HMC1096LP3<sup>[1]</sup>**

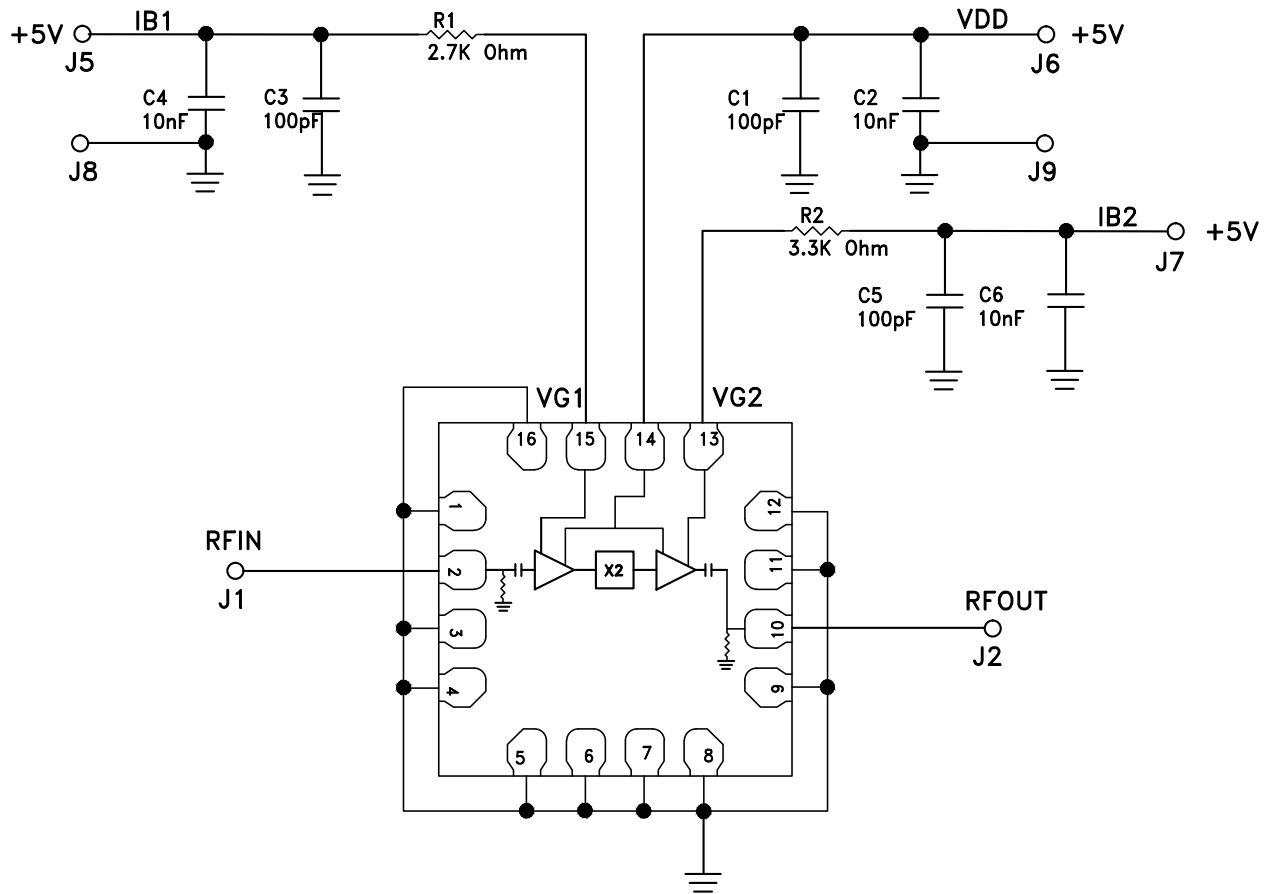
| Item               | Description                   |
|--------------------|-------------------------------|
| J1, J2             | PCB Mount SMA RF Connector    |
| J5 - J9            | DC PIN                        |
| C1, C3, C5         | 100 pF Capacitor, 0402 Pkg.   |
| C2, C4, C6         | 10000 pF Capacitor, 0402 Pkg. |
| R1                 | 2.70K Ohm Resistor, 0402 Pkg. |
| R2                 | 3.30K Ohm Resistor, 0402 Pkg. |
| U1                 | HMC1096LP3E                   |
| PCB <sup>[1]</sup> | 600-00881-00 Evaluation Board |

[1] Circuit Board Material: Rogers 4350 or 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 circuit board shown is available from Hittite upon request.

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**Application Circuit**



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**Notes:**



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