



MICROWAVE CORPORATION v00.0410



# HMC916LP3E

## SMT MMIC x3 ACTIVE FREQUENCY MULTIPLIER, 8 - 16 GHz OUTPUT

### Typical Applications

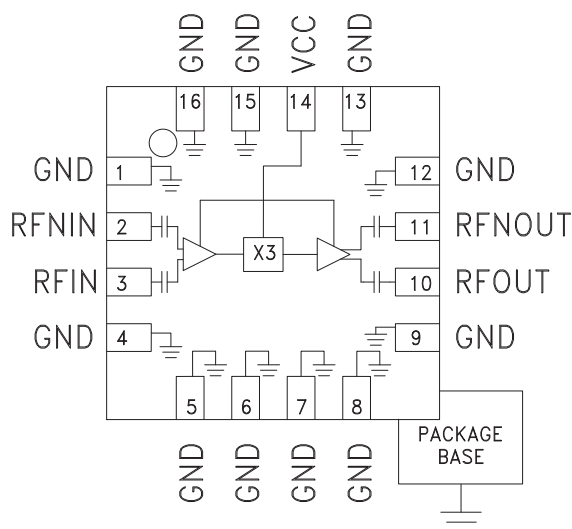
The HMC916LP3E is Ideal for:

- Microwave Radio & VSAT
- Military Radios, Radar & ECM
- Test Instrumentation

### Features

- Output Power: 2 dBm
- Spurious Suppression: >15 dBc
- SSB Phase Noise: -152 dBc/Hz @ 100 kHz Offset
- Single Supply: +5V @ 83 mA
- 16 Lead 3x3 mm SMT Package: 9 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC916LP3E is an active x3 frequency multiplier in a 3x3 mm leadless QFN surface mount package. Power output is 2 dBm typical from a single +5V supply and varies little vs. input power, temperature and supply voltage. Suppression of undesired fundamental and spurious is 15 dBc typical with respect to output signal level. The low additive SSB phase noise of -152 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance. The HMC916LP3E is ideal for use in LO multiplier chains allowing reduced parts count versus traditional approaches.

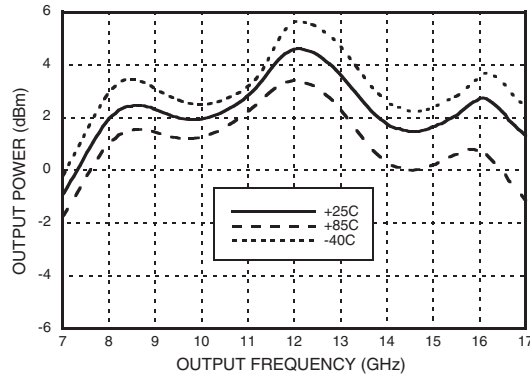
### Electrical Specifications, $T_A = +25^\circ \text{C}$ , $V_{CC} = 5V$ [1]

| Parameter                                                  | Min.        | Typ. | Max. | Units  |
|------------------------------------------------------------|-------------|------|------|--------|
| Frequency Range, Input                                     | 2.66 - 5.33 |      |      | GHz    |
| Frequency Range, Output                                    | 8 - 16      |      |      | GHz    |
| Input Power Range                                          | 0           | 5    | 10   | dBm    |
| Output power Range                                         |             | 2    |      | dBm    |
| Spurious                                                   |             | -15  |      | dBc    |
| Input Return Loss                                          |             | 13   |      | dB     |
| Output Return Loss                                         |             | 15   |      | dB     |
| SSB Phase Noise (100 kHz offset) $P_{in} = +5 \text{ dBm}$ |             | -152 |      | dBc/Hz |
| Supply Current ( $I_{CC}$ )                                |             | 83   |      | mA     |

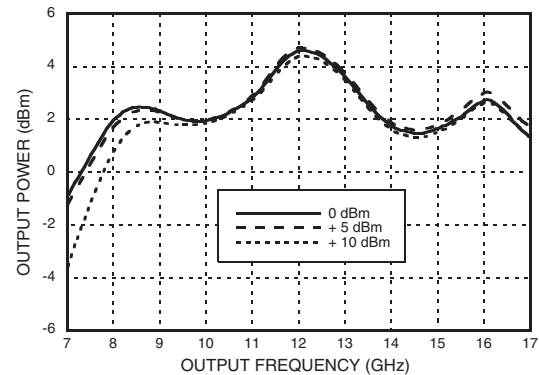
[1] All data shown is single ended operation.

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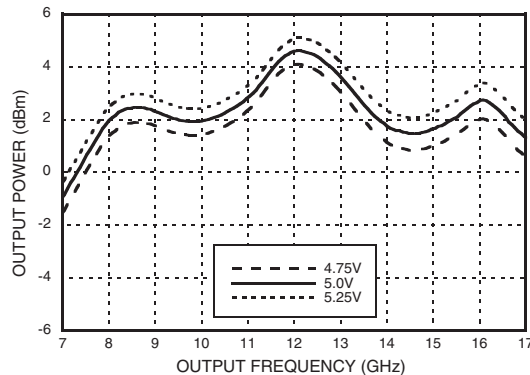
**Output Power vs.  
Temperature @ 0 dBm Drive Level <sup>[1]</sup>**



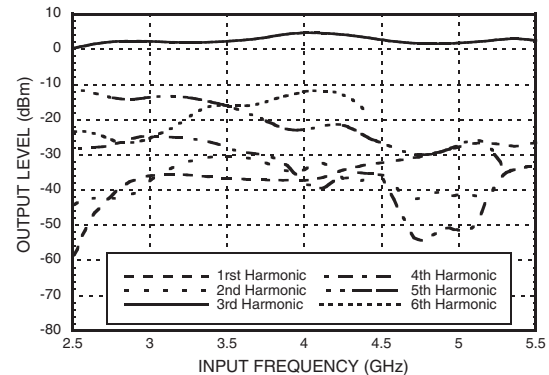
**Output Power vs. Drive Level <sup>[1]</sup>**



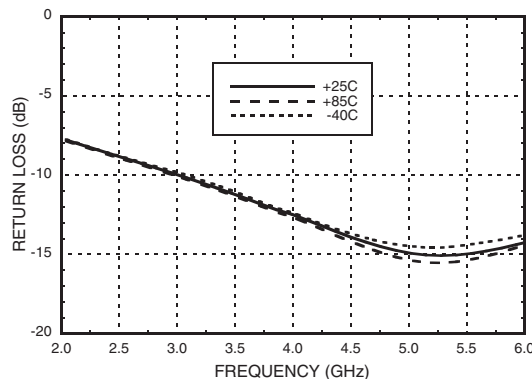
**Output Power vs.  
Supply Voltage @ 0 dBm Drive Level <sup>[1]</sup>**



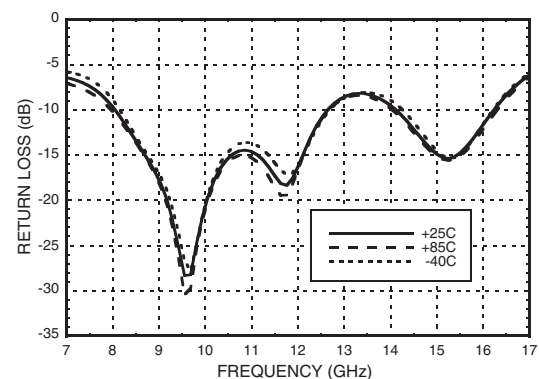
**Spurious Output vs. Fin  
Pin = +5 dBm <sup>[1]</sup>**



**Input Return Loss vs. Temperature <sup>[1]</sup>**



**Output Return Loss vs. Temperature <sup>[1]</sup>**

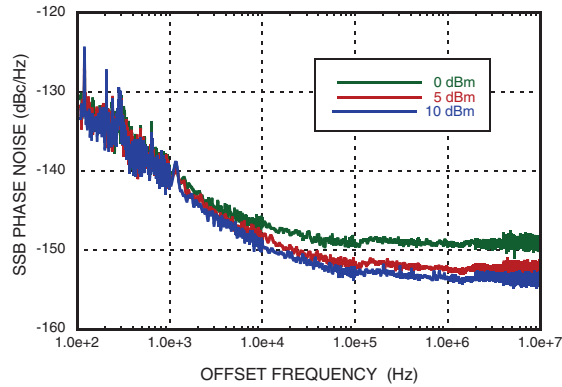


[1] All data shown is single ended operation.

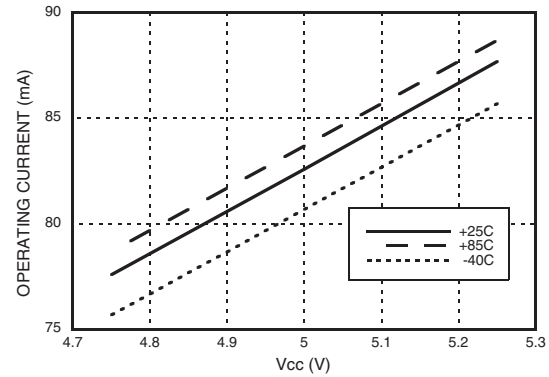


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**SSB Phase Noise vs. Pin**  
**Fout = 12 GHz, T = 25 °C [1]**



**Icc vs. Temperature [1]**



**Absolute Maximum Ratings**

|                       |                |
|-----------------------|----------------|
| RF Input (Vcc = +5V)  | +20 dBm        |
| Vcc                   | +6.0V          |
| Storage Temperature   | -65 to +150 °C |
| ESD Sensitivity (HBM) | 100V           |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

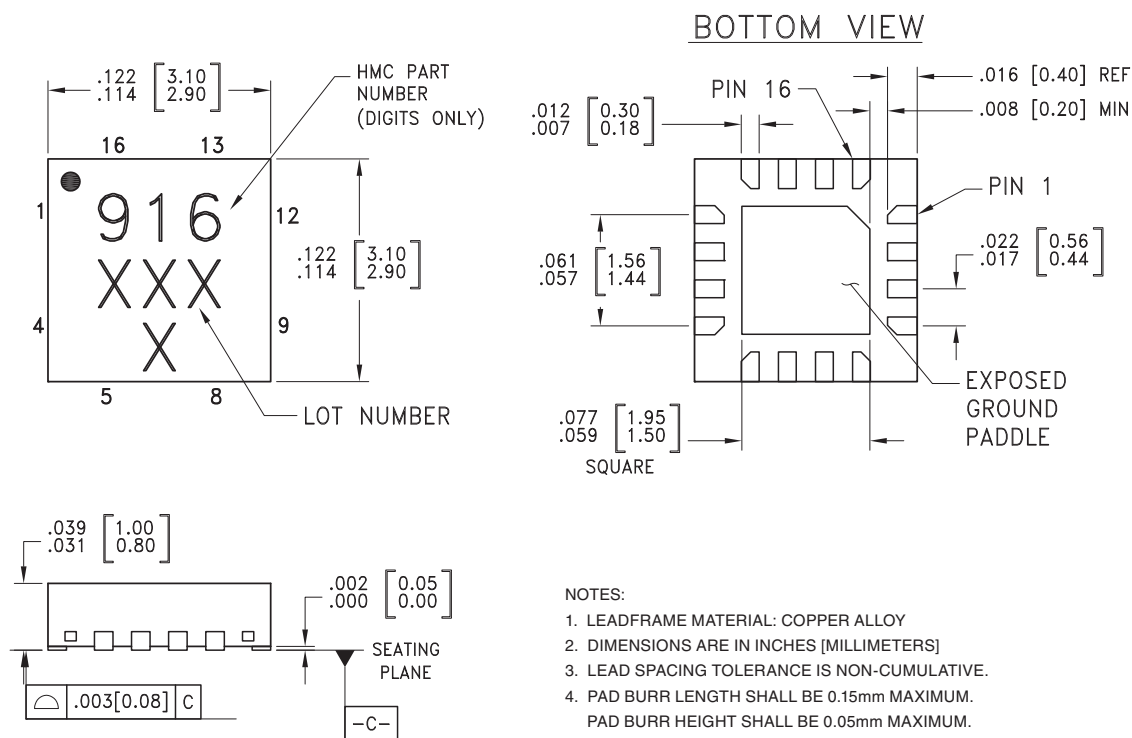
**Reliability Information**

|                                                        |                   |
|--------------------------------------------------------|-------------------|
| Junction Temperature To Maintain 1 Million Hour MTTF   | 150 °C            |
| Nominal Junction Temperature (T = 85 °C)               | 101.4 °C          |
| Thermal Resistance (Junction to GND paddle, 5V supply) | 39.5 °C/W         |
| Operating Temperature                                  | -40 °C to + 85 °C |

[1] All data shown is single ended operation.

## SMT MMIC x3 ACTIVE FREQUENCY MULTIPLIER, 8 - 16 GHz OUTPUT

### Outline Drawing



### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[1]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC916LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 916<br>XXXX                    |

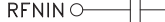
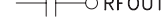
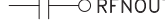
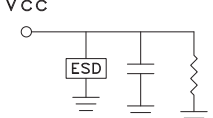
[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C



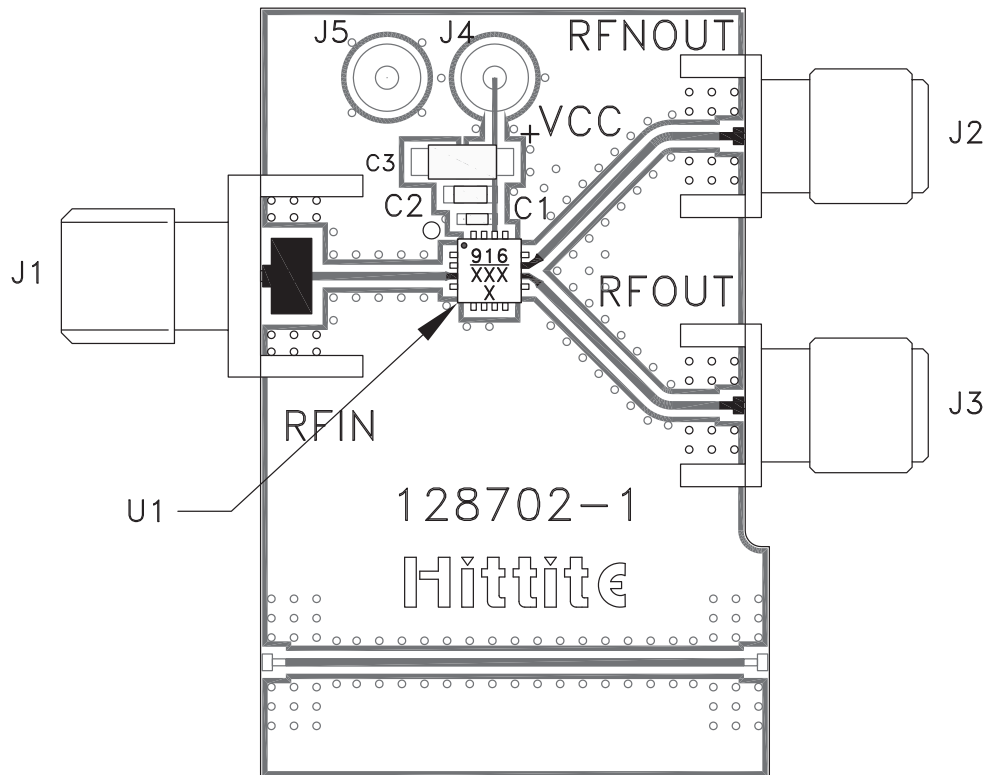
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**Pin Description**

| Pin Number                  | Function          | Description                                                                                                                                                      | Interface Schematic                                                                 |
|-----------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1, 4 - 9, 12,<br>13, 15, 16 | GND               | These pins and exposed paddle must be connected to RF/DC ground.                                                                                                 |  |
| 2                           | RFNIN<br>(or GND) | This pin is AC coupled and matched to 50 ohms, and is 180° out of phase with pin 3 for differential operation. RF/DC ground for single ended operation.          |  |
| 3                           | RFIN              | This pin is AC coupled and matched to 50 ohms                                                                                                                    |  |
| 10                          | RFOUT             | This pin is AC coupled and matched to 50 ohms                                                                                                                    |  |
| 11                          | RFNOUT            | This pin is AC coupled and matched to 50 ohms, and is 180° out of phase with pin 10 for differential operation. Terminate in 50 ohms for single ended operation. |  |
| 14                          | Vcc               | Supply voltage +5V                                                                                                                                               |  |

**SMT MMIC x3 ACTIVE  
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**Evaluation PCB**



**List of Materials for Evaluation PCB 128383 [1]**

| Item    | Description                      |
|---------|----------------------------------|
| J1 - J3 | PCB Mount SMA Connector          |
| J4, J5  | DC Pin                           |
| C1      | 100 pF Capacitor, 0402 Pkg.      |
| C2      | 1000 pF Capacitor, 0402 Pkg.     |
| C3      | 4.7 $\mu$ F Capacitor, 0402 Pkg. |
| U1      | HMC916LP3E x3 Active Multiplier  |
| PCB [2] | 128702 Eval Board                |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should be generated with proper 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. The evaluation circuit board shown is available from Hittite upon request.