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MICROWAVE CORPORATION v03.0705



# HMC368LP4 / 368LP4E

**SMT GaAs PHEMT MMIC**  
**AMP-DOUBLER-AMP, 9 - 16 GHz OUTPUT**

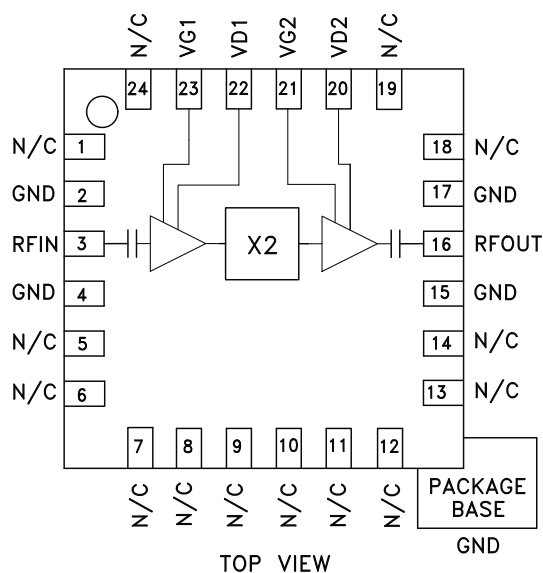
## Typical Applications

- Microwave Radios & VSAT
- Fiber Optic Infrastructure
- Military Communications & Radar

## Features

Output Power: +15 dBm  
 Wide Input Power Range: 0 to +10 dBm  
 100 kHz SSB Phase Noise: -140 dBc/Hz  
 +5V @ 75 mA Supply  
 16 mm<sup>2</sup> Leadless QFN SMT Package

## Functional Diagram



## General Description

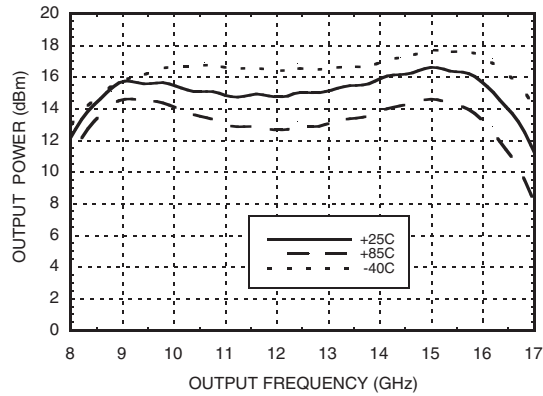
The HMC368LP4 & HMC368LP4E are miniature amp-doubler-amps utilizing GaAs PHEMT technology in 4 x 4 mm leadless surface mount packages. When driven by a +2 dBm signal, the multiplier provides +15 dBm typical output power from 9 to 16 GHz. The Fo and the 3Fo isolations are 18 dB typical. The low additive SSB phase noise of -140 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance. The HMC368LP4(E) is ideal for use in LO multiplier chains allowing reduced parts count vs. traditional approaches.

## Electrical Specifications, $T_A = +25^\circ \text{C}$ , $V_{d1} = V_{d2} = +5.0 \text{ Vdc}$ , +2 dBm Drive Level

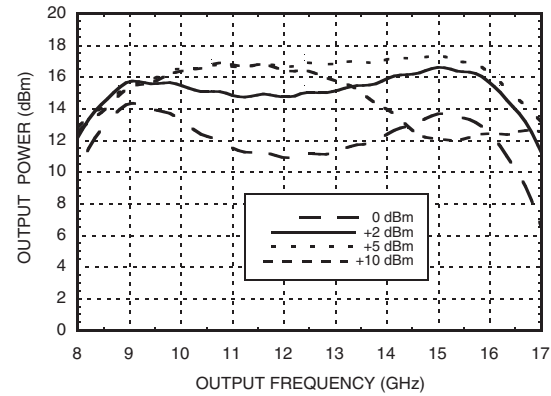
| Parameter                                       | Min. | Typ.       | Max. | Units  |
|-------------------------------------------------|------|------------|------|--------|
| Frequency Range, Input                          |      | 4.5 - 8.0  |      | GHz    |
| Frequency Range, Output                         |      | 9.0 - 16.0 |      | GHz    |
| Output Power                                    | 12   | 15         |      | dBm    |
| Fo Isolation (with respect to output level)     |      | 18         |      | dB     |
| 3Fo Isolation (with respect to output level)    |      | 18         |      | dB     |
| Input Return Loss                               |      | 10         |      | dB     |
| Output Return Loss                              |      | 10         |      | dB     |
| SSB Phase Noise (Fout = 13 GHz, 100 kHz Offset) |      | -140       |      | dBc/Hz |
| Supply Current (Idd)*                           |      | 75         |      | mA     |

\*Adjust Vg1, Vg2 between -2V to 0V to achieve Idd = 75 mA typical

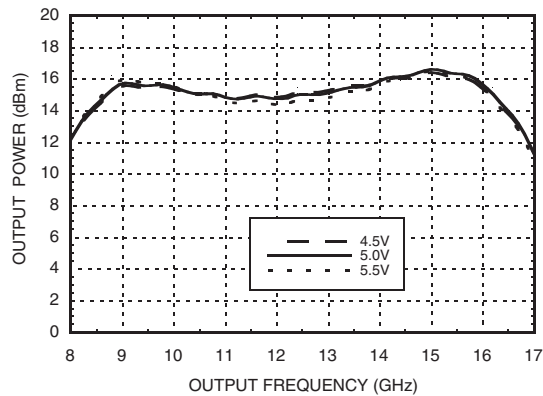
**Output Power vs.  
Temperature @ +2 dBm Drive Level**



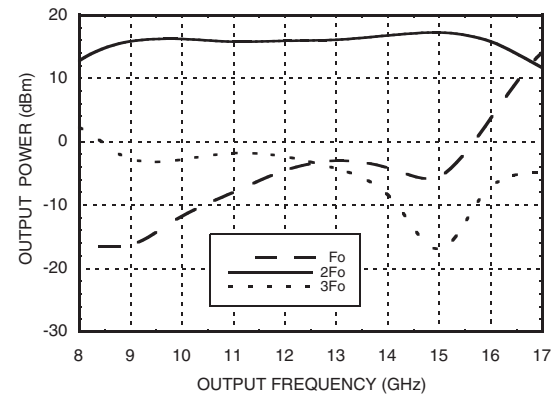
**Output Power vs. Drive Level**



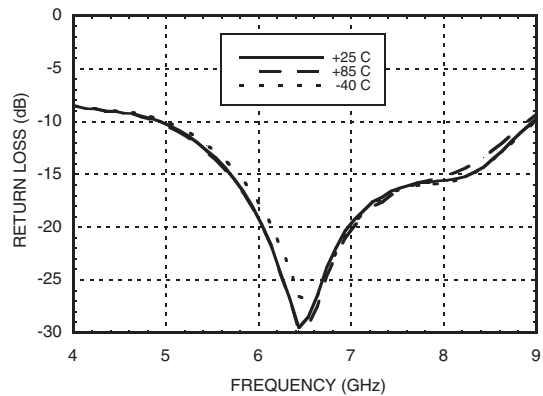
**Output Power vs.  
Supply Voltage @ +2 dBm Drive Level**



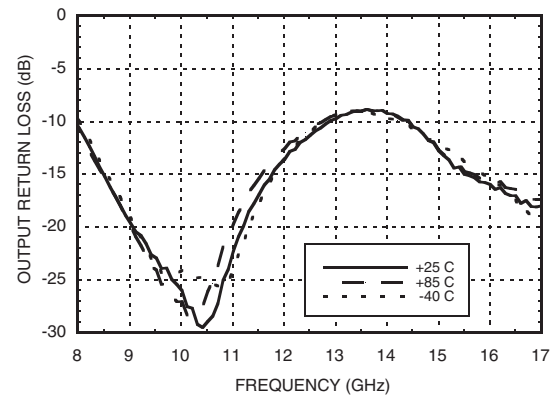
**Isolation @ +2 dBm Drive Level**



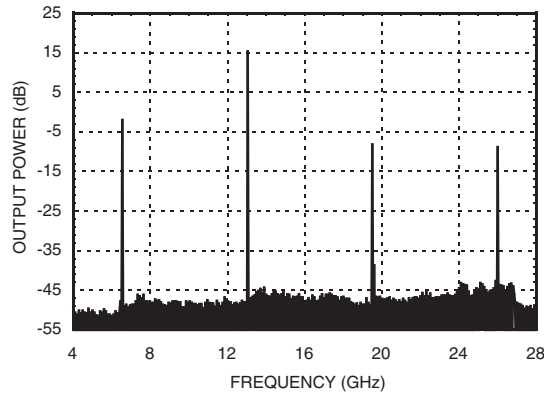
**Input Return Loss vs. Temperature**



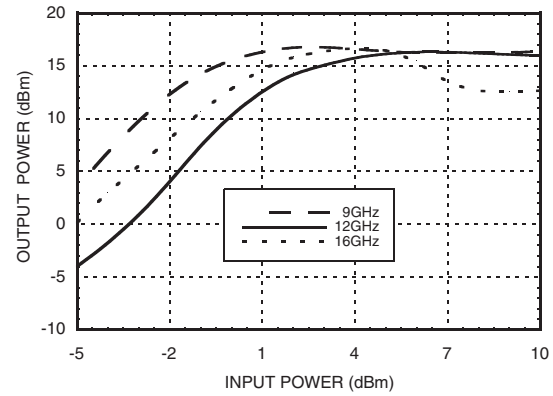
**Output Return Loss vs. Temperature**



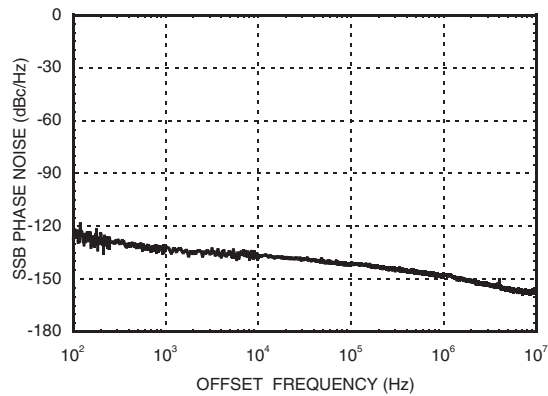
**Output Spectrum @  $F_{in} = 6.5$  GHz,  
 $P_{in} = +2$  dBm**



**Output Power vs. Input Power  
@ Three Frequencies**



**SSB Phase Noise  
Performance,  $F_{out} = 13$  GHz,  
Input Power = +2 dBm**



## Absolute Maximum Ratings

|                                                                             |                |
|-----------------------------------------------------------------------------|----------------|
| RF Input (Vdd = +5V)                                                        | +20 dBm        |
| Supply Voltage, Vd1, Vd2                                                    | +6.0V          |
| Gate Bias Voltage (Vg1, Vg2)                                                | -4 to 0 Vdc    |
| Channel Temperature                                                         | 150 °C         |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 12.5 mW/°C above 85 °C) | 812 mW         |
| Thermal Resistance<br>(junction to ground paddle)                           | 80 °C/W        |
| Storage Temperature                                                         | -65 to +150 °C |
| Operating Temperature                                                       | -40 to +85 °C  |

## Typical Supply Current vs. Vdd

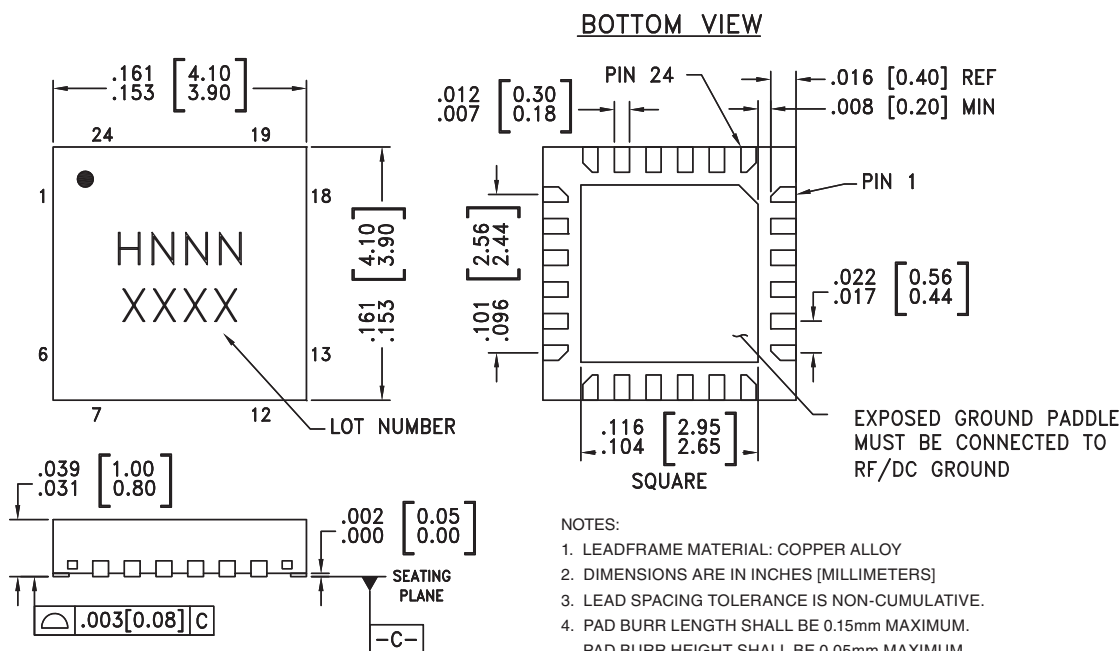
| Vdd (V) | I <sub>dd</sub> (mA) |
|---------|----------------------|
| 4.5     | 73                   |
| 5.0     | 75                   |
| 5.5     | 77                   |

Note: Amp-Doubler-Amp will operate over full voltage range shown above.



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

## Outline Drawing



### NOTES:

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

## Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC368LP4   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H368<br>XXXX                   |
| HMC368LP4E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H368<br>XXXX                   |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX



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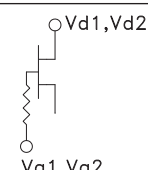
v03.0705



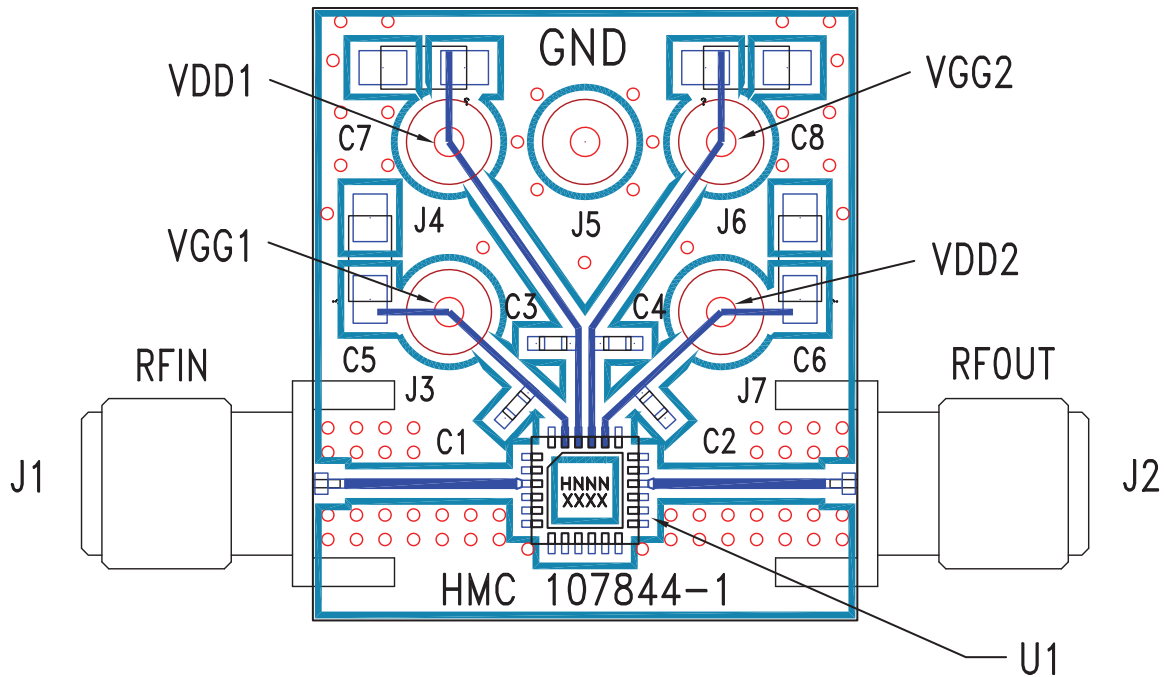
# HMC368LP4 / 368LP4E

## SMT GaAs PHEMT MMIC AMP-DOUBLER-AMP, 9 - 16 GHz OUTPUT

### Pin Description

| Pin Number             | Function | Description                                                                                | Interface Schematic                                                                       |
|------------------------|----------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 1, 5-14,<br>18, 19, 24 | N/C      | No Connection. These pins may be connected to RF ground. Performance will not be affected. |                                                                                           |
| 3                      | RFIN     | Multiplier Input. AC Coupled.<br>No external DC blocks required.                           | RFIN   |
| 2, 4, 15, 17           | GND      | All ground leads and ground paddle must be soldered to PCB RF/DC ground.                   |  GND   |
| 16                     | RFOUT    | Multiplied Output. AC coupled.<br>No external DC blocks necessary.                         |  RFOUT |
| 20, 22                 | Vd2, Vd1 | Drain supply voltage 5V $\pm$ 0.5V.                                                        |        |
| 21, 23                 | Vg2, Vg1 | Gate supply voltages.<br>Adjust between -2 Vdc to 0 Vdc to achieve 75 mA drain current.    |                                                                                           |

**Evaluation PCB**



**List of Materials for Evaluation PCB 107846 [1]**

| Item    | Description                        |
|---------|------------------------------------|
| J1 - J2 | PCB Mount SMA Connector            |
| J3 - J7 | DC Pin                             |
| C1 - C4 | 100 pF capacitor, 0402 Pkg.        |
| C5 - C8 | 2.2 $\mu$ F capacitor, case size A |
| U1      | HMC368LP4 / HMC368LP4E Amp-x2-Amp  |
| PCB [2] | 107844 PCB                         |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final 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.



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Электрон  
Связь**

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