

SMT GaAs HBT MMIC x2 ACTIVE FREQUENCY MULTIPLIER, 9.9 - 12.7 GHz OUTPUT



Typical Applications

Active Multiplier for X Band Applications:

- OC-192 Clock Recovery
- Microwave Radio & VSAT
- Military Radios, Radar & ECM
- Test Instrumentation

Features

- Output Power: +4 dBm
- Sub-Harmonic Suppression: 30 dBc
- SSB Phase Noise: -142 dBc/Hz
- Single Supply: 5V@ 46 mA
- 16 Lead 3x3mm SMT Package: 9mm²

Functional Diagram



General Description

The HMC369LP3 & HMC369LP3E are active miniature x2 frequency multipliers utilizing InGaP GaAs HBT technology in 3x3 mm leadless QFN surface mount packages. Power output is +4 dBm typical from a single +5V supply and varies little vs. input power, temperature and supply voltage. Suppression of undesired fundamental and sub-harmonics is 30 dBc typical with respect to output signal level. The low additive SSB phase noise of -142 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance. The HMC369LP3(E) is ideal for use in LO multiplier chains allowing reduced parts count versus traditional approaches. The HMC369LP3(E) are also useful for OC-192 clock recovery. The application of 10 GBPS data to the input generates a -7 dBm clock tone at the output with spurious signals suppressed by 25 dB.

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

| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|-----------------------------------|------------|------|-------------|------|------|------|--------|
| Frequency Range, Input | 4.95 - 5.3 | | 5.3 - 6.35 | | GHz | | |
| Frequency Range, Output | 9.9 - 10.6 | | 10.6 - 12.7 | | GHz | | |
| Input Power Range | -5 | | +5 | -5 | | +5 | dBm |
| Output Power | -1 | 3 | | 0 | 4 | | dBm |
| Sub-Harmonic Suppression | | 30 | | | 30 | | dBc |
| Input Return Loss | | 17 | | | 16 | | dB |
| Output Return Loss | | 5.5 | | | 6 | | dB |
| SSB Phase Noise (100 kHz Offset) | Pin= 0 dBm | | -142 | -142 | | | dBc/Hz |
| Supply Current (I _{CC}) | | 46 | 61 | | 46 | 61 | mA |

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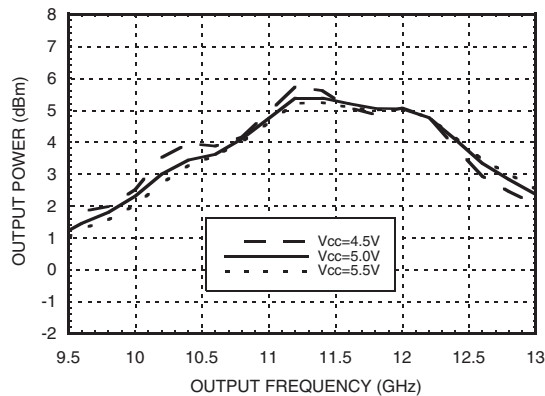
**Output Power vs.
Temperature @ 0 dBm Drive Level**



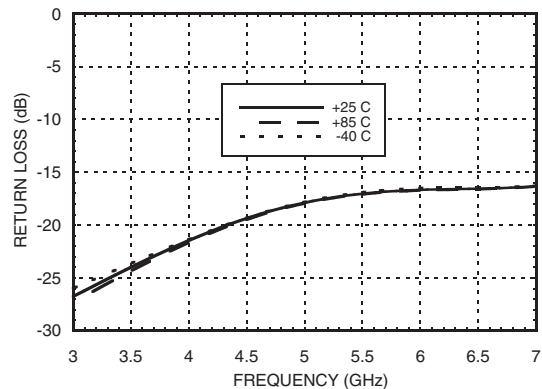
Output Power vs. Drive Level



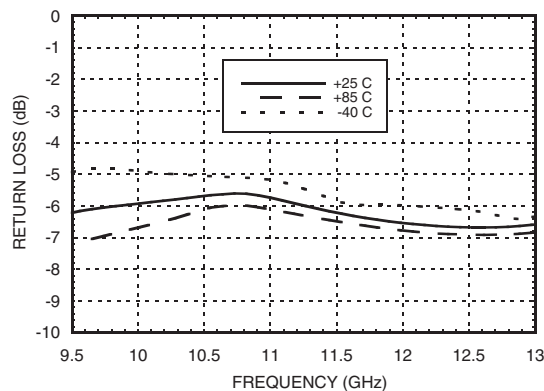
**Output Power vs.
Supply Voltage @ 0 dBm Drive Level**



Input Return Loss vs. Temperature



Output Return Loss vs. Temperature



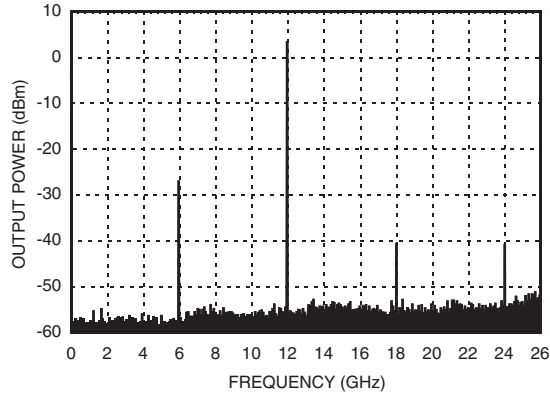
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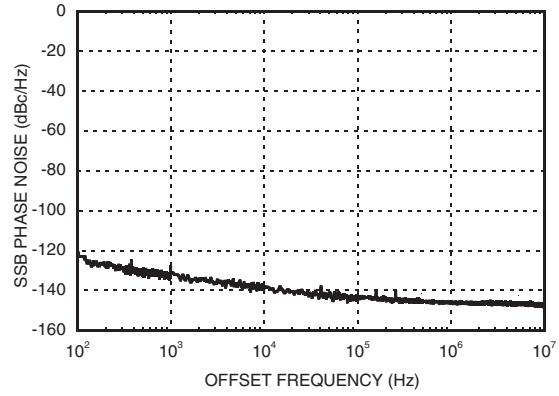


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Output Spectrum



**SSB Phase Noise
Performance, F_{out} = 10.66 GHz,
Input Power= 0 dBm**



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Absolute Maximum Ratings

| | |
|---|----------------|
| RF Input (Vcc = +5V) | +20 dBm |
| Vcc | +5.5V |
| Channel Temperature | 135 °C |
| Continuous Pdiss (T=85 °C) (derate 6.8 mW/°C above 85 °C) | 440 mW |
| Thermal Resistance (R _{thj}) (junction to ground paddle) | 147.8 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

Typical Supply Current vs. Vcc

| Vcc (V) | Icc (mA) |
|---------|----------|
| 4.5 | 45 |
| 5.0 | 46 |
| 5.5 | 47 |

Note: Multiplier will operate over full voltage range shown above.



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

Outline Drawing



NOTES:

- LEADFRAME MATERIAL: COPPER ALLOY
- DIMENSIONS ARE IN INCHES [MILLIMETERS]
- LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
- PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.
PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
- PACKAGE WARP SHALL NOT EXCEED 0.05mm.
- ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
- REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|---|---------------|---------------------|--------------------------------|
| HMC369LP3 | Low Stress Injection Molding Plastic | Sn/Pb Solder | MSL1 ^[1] | 369 XXXX |
| HMC369LP3E | RoHS-compliant Low Stress Injection Molding Plastic | 100% matte Sn | MSL1 ^[2] | 369 XXXX |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

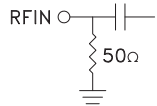

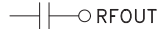
[3] 4-Digit lot number XXXX

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Pin Description

| Pin Number | Function | Description | Interface Schematic |
|---------------------------------|----------|--|---|
| 1, 2, 5 - 8, 11 - 13, 15, 16 | N/C | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |
| 3 | RFIN | RF input needs to be DC blocked only if there is an external DC voltage applied to RFIN. |  |
| 4, 9 | GND | All ground leads and ground paddle must be soldered to PCB RF/DC ground. |  |
| 10 | RFOUT | Multiplied Output. AC coupled. No external DC blocks necessary. |  |
| 14 | Vcc | Supply voltage 5V ± 0.5V. | |



Evaluation PCB



List of Materials for Evaluation PCB 107712 [1]

| Item | Description |
|---------|---|
| J1, J2 | PCB Mount SMA Connector |
| J3, J4 | DC Pin |
| C1 | 0.01 μ F Capacitor, 0603 Pkg. |
| U1 | HMC369LP3 / HMC369LP3E x2 Active Multiplier |
| PCB [2] | 107710 Eval Board |

[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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