

Typical Applications

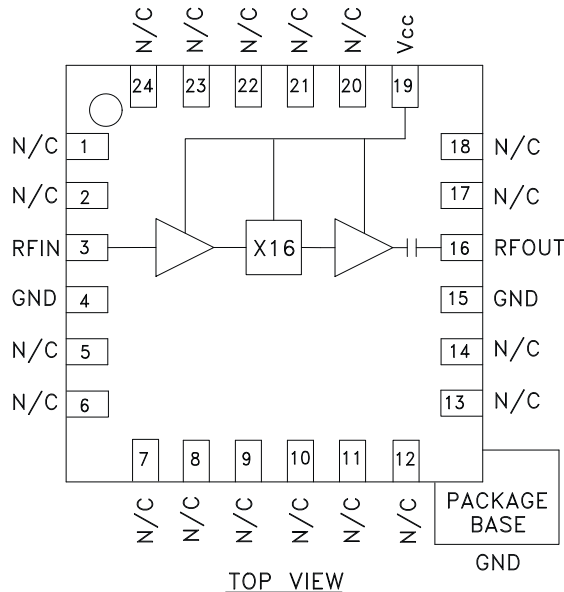
Active Multiplier for X Band Applications:

- Fiber Optic
- Point-to-Point Radios
- Military Radar

Features

- Output Power: +7 dBm
- Sub-Harmonic Suppression: >25 dBc
- SSB Phase Noise: -130 dBc/Hz
- Single Supply: 5V @ 78 mA
- 24 Lead 4x4 mm SMT Package: 16 mm²

Functional Diagram



General Description

The HMC445LP4 & HMC445LP4E are active miniature x16 frequency multipliers utilizing InGaP GaAs HBT technology in 4x4 mm leadless surface mount packages. Power output is +7 dBm typical from a 5V supply voltage and varies little vs. input power, temperature and supply voltage. Suppression of undesired fundamental and sub-harmonics is >25 dBc typical with respect to output signal level. The low additive SSB phase noise of -130 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance. The HMC445LP4 & HMC445LP4E are ideal for use in LO multiplier chains allowing reduced parts count vs. traditional approaches.

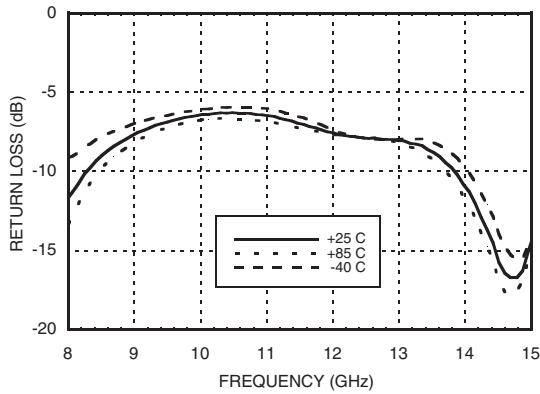
Electrical Specifications, $T_A = +25^\circ C$, $V_{CC} = 5V$

| Parameter | Min. | Typ. | Max. | Units |
|-----------------------------------|-----------------|------|------|--------|
| Frequency Range, Input | 618.75 - 687.50 | | | MHz |
| Frequency Range, Output | 9.9 - 11.0 | | | GHz |
| Input Power Range | -15 | | 5 | dBm |
| Output Power | 4 | 7 | | dBm |
| Sub-Harmonic Suppression | | 25 | | dBc |
| Input Return Loss | | 28 | | dB |
| Output Return Loss | | 7 | | dB |
| SSB Phase Noise (100 kHz Offset) | Pin = 0 dBm | | | dBc/Hz |
| Supply Current (I _{CC}) | | 78 | 104 | mA |

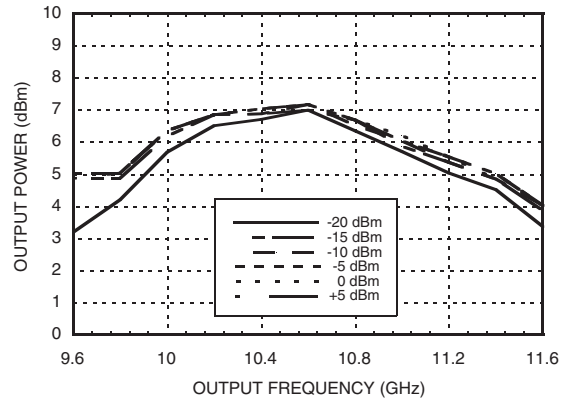


SMT GaAs HBT MMIC x16 ACTIVE FREQUENCY MULTIPLIER, 9.9 - 11.0 GHz OUTPUT

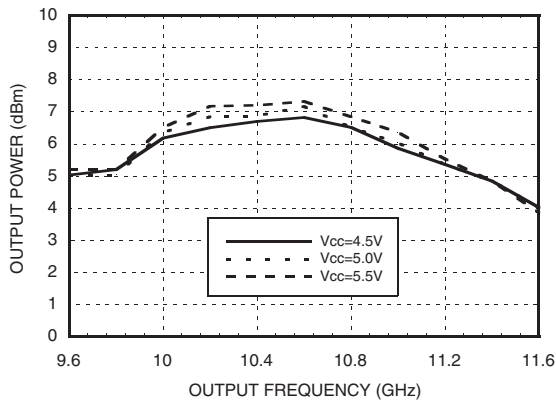
Output Power vs. Temperature @ -10 dBm Drive Level



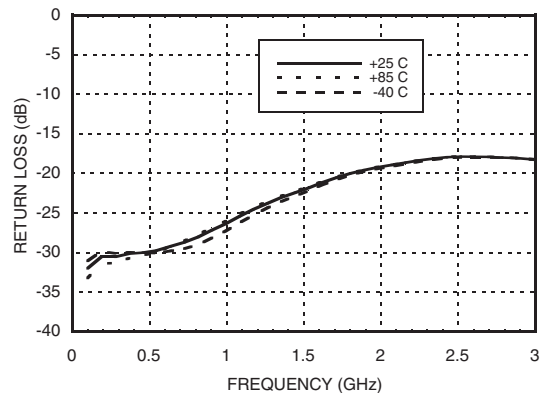
Output Power vs. Drive Level



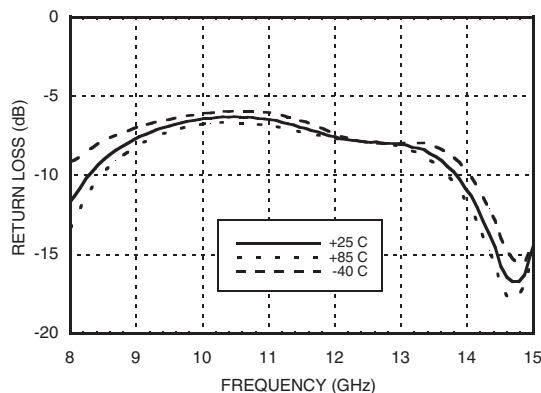
Output Power vs. Supply Voltage @ -10 dBm Drive Level



Input Return Loss vs. Temperature



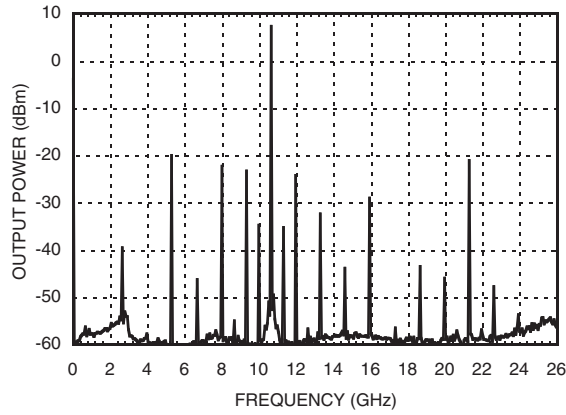
Output Return Loss vs. Temperature



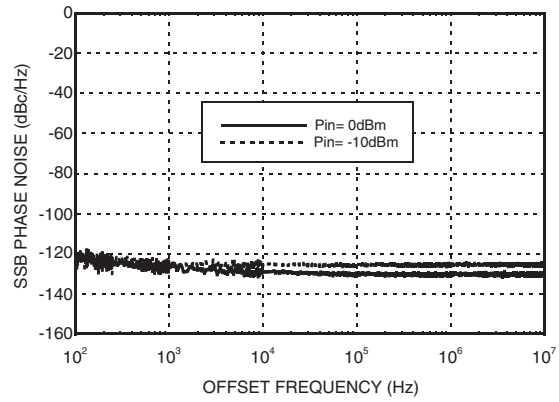


**SMT GaAs HBT MMIC x16 ACTIVE
FREQUENCY MULTIPLIER, 9.9 - 11.0 GHz OUTPUT**

Output Spectrum



**SSB Phase Noise
Performance, Fout= 10.5 GHz**



SMT GaAs HBT MMIC x16 ACTIVE FREQUENCY MULTIPLIER, 9.9 - 11.0 GHz OUTPUT

Absolute Maximum Ratings

| | |
|---|----------------|
| RF Input (Vcc = +5V) | +20 dBm |
| Vcc | +5.5V |
| Channel Temperature | 135 °C |
| Continuous Pdiss (T=85 °C) (derate 11.5 mW/°C above 85 °C) | 750 mW |
| Thermal Resistance (R _{thj}) (junction to ground paddle) | 87.2 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

Typical Supply Current vs. Vcc

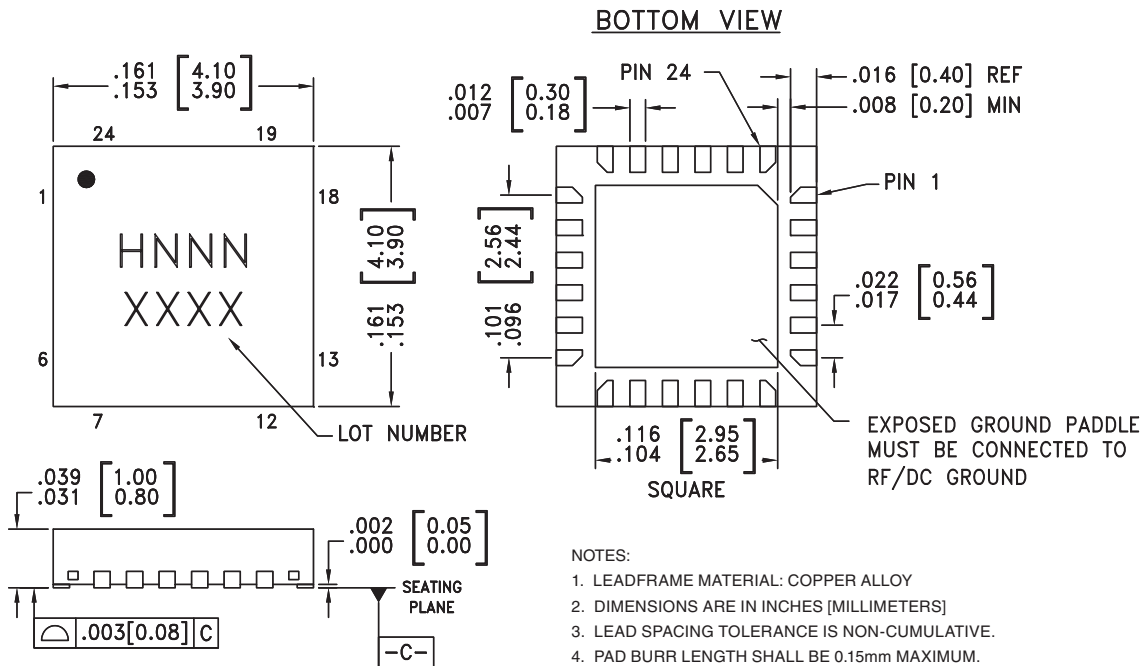
| Vcc (V) | Icc (mA) |
|---------|----------|
| 4.5 | 75 |
| 5.0 | 78 |
| 5.5 | 80 |

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



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC445LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | H445 XXXX |
| HMC445LP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | H445 XXXX |

[1] Max peak reflow temperature of 235 °C

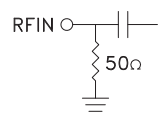

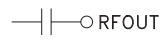
[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

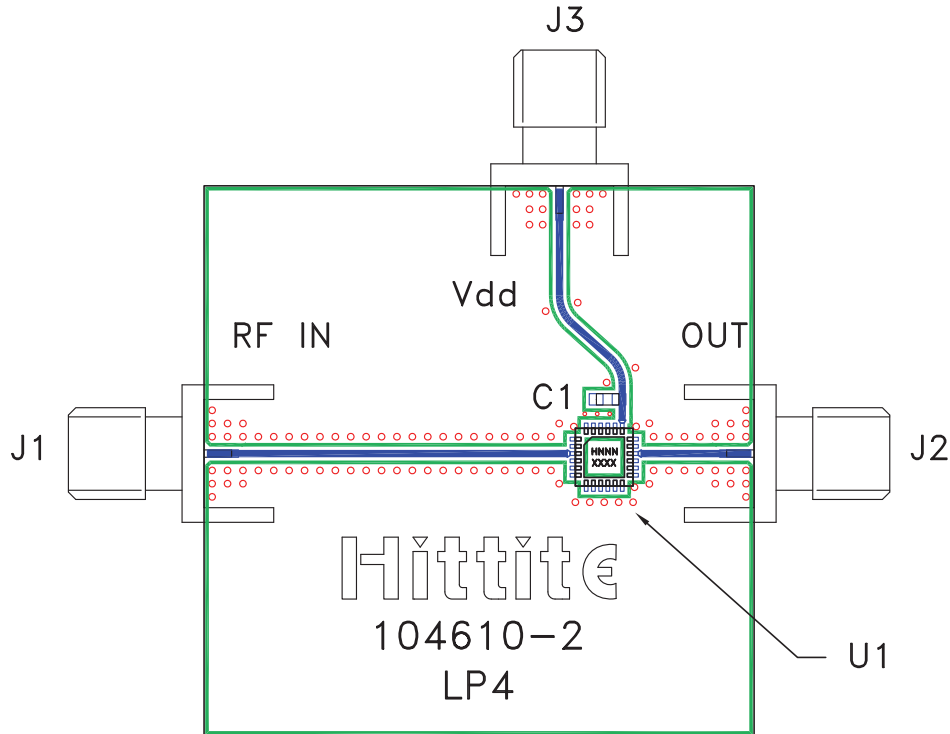


**SMT GaAs HBT MMIC x16 ACTIVE
FREQUENCY MULTIPLIER, 9.9 - 11.0 GHz OUTPUT**

Pin Description

| Pin Number | Function | Description | Interface Schematic |
|----------------------------------|----------|--|---|
| 1, 2, 5 - 14, 17, 18, 20 - 24 | 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 RF IN. |  |
| 4, 15 | GND | All ground leads and ground paddle must be soldered to PCB RF/DC ground. |  |
| 16 | RFOUT | Multiplied Output. AC coupled. No external DC blocks necessary. |  |
| 19 | Vcc | Supply voltage 5V ± 0.5V. | |

Evaluation PCB



List of Materials for Evaluation PCB 106137 [1]

| Item | Description |
|---------|--|
| J1 - J3 | PCB Mount SMA Connector |
| C1 | 1,000 pF Capacitor, 0603 Pkg. |
| U1 | HMC445LP4 / HMC445LP4E x16 Active Multiplier |
| PCB [2] | 104610 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.