

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

Typical Applications

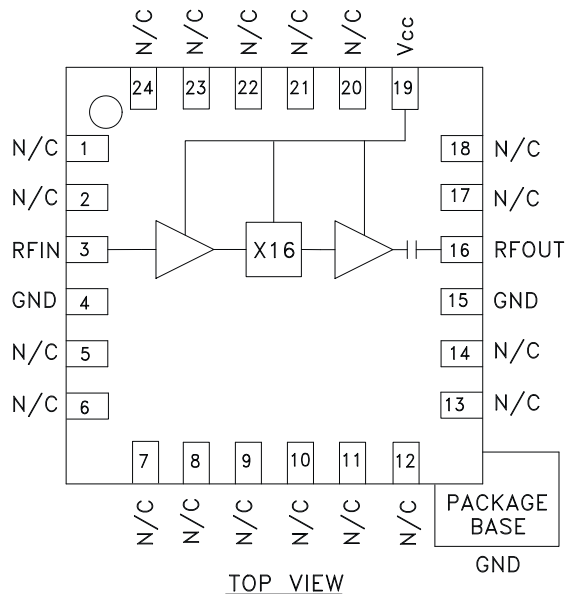
Active Multiplier for X Band Applications:

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

| 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 |

HMC445* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

COMPARABLE PARTS

View a parametric search of comparable parts.

EVALUATION KITS

- HMC445LP4 Evaluation Board

DOCUMENTATION

Data Sheet

- HMC445 Data Sheet

TOOLS AND SIMULATIONS

- HMC445 S-Parameter

REFERENCE MATERIALS

Quality Documentation

- Package/Assembly Qualification Test Report: LP4, LP4B, LP4C, LP4K (QTR: 2013-00487 REV: 04)
- Package/Assembly Qualification Test Report: Plastic Encapsulated QFN (QTR: 05006 REV: 02)
- Semiconductor Qualification Test Report: GaAs HBT-A (QTR: 2013-00228)

Technical Articles

- Active Multipliers & Dividers to Simplify Synthesizers

DESIGN RESOURCES

- HMC445 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all HMC445 EngineerZone Discussions.

SAMPLE AND BUY

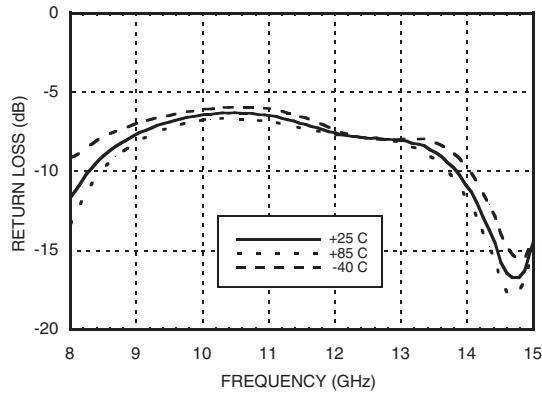
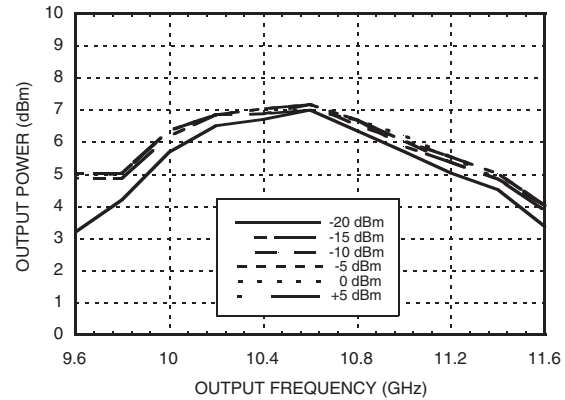
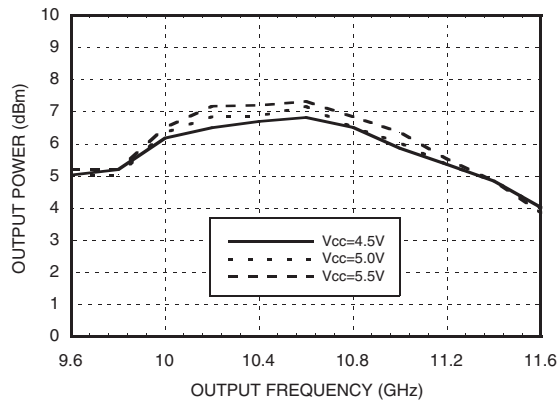
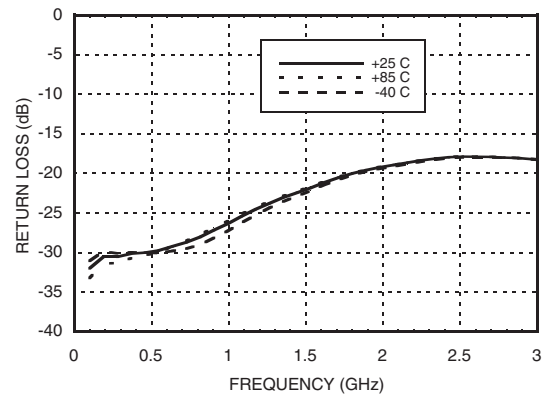
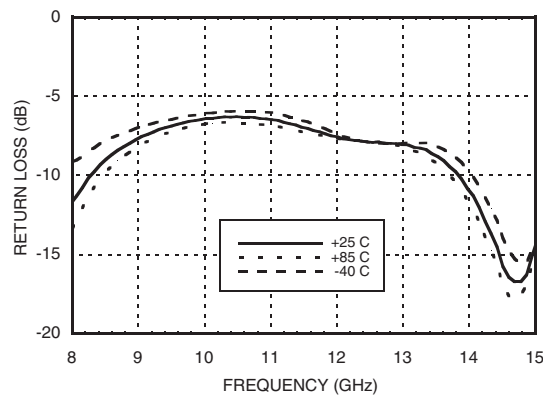
Visit the product page to see pricing options.

TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

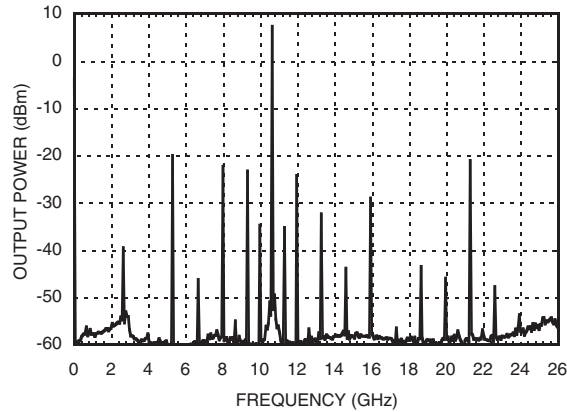
DOCUMENT FEEDBACK

Submit feedback for this data sheet.

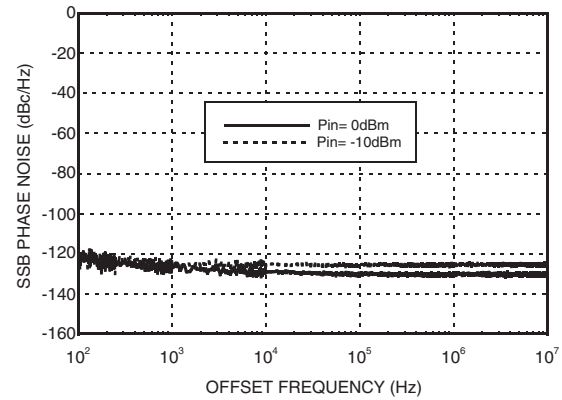

**SMT GaAs HBT MMIC x16 ACTIVE
FREQUENCY MULTIPLIER, 9.9 - 11.0 GHz OUTPUT**
**Output Power vs.
Temperature @ -10 dBm Drive Level**

Output Power vs. Drive Level

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

Input Return Loss vs. Temperature

Output Return Loss vs. Temperature


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Output Spectrum



**SSB Phase Noise
Performance, $F_{out} = 10.5$ GHz**

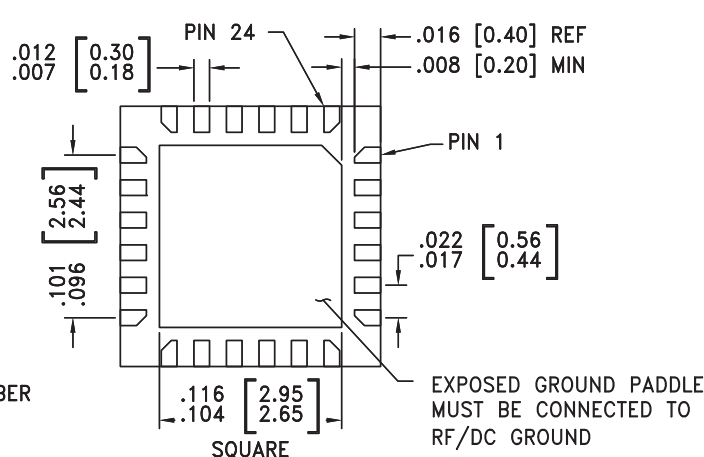




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| | |
|--|----------------|
| RF Input (Vcc = +5V) | +20 dBm |
| Vcc | +5.5V |
| Channel Temperature | 135 °C |
| Continuous Pdiss (T=85 °C) (derate 11.5 mW/°C above 85 °C) | 750 mW |
| Thermal Resistance (R _{th}) (junction to ground paddle) | 87.2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

Figure 1: Drawing of a rectangular plate with dimensions and features. The plate is 24 units wide and 18 units high. It has a hole at the top left and a central area labeled "HNNN" and "XXXX". Dimensions are given in inches and millimeters. A "LOT NUMBER" is indicated on the right. A detail view shows a cross-section of the plate with a thickness of .039 inches (1.00 mm) and a .031 inch (0.80 mm) feature. A "SEATING PLANE" is indicated on the right. A detail view shows a cross-section of the plate with a thickness of .003 inches (0.08 mm) and a .002 inch (0.05 mm) feature. A "SEATING PLANE" is indicated on the right. A detail view shows a cross-section of the plate with a thickness of .003 inches (0.08 mm) and a .002 inch (0.05 mm) feature. A "SEATING PLANE" is indicated on the right.



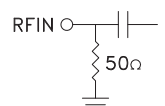

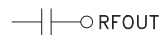
| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC445LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | H445 XXXX |
| HMC445LP4E | RoHS-compliant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

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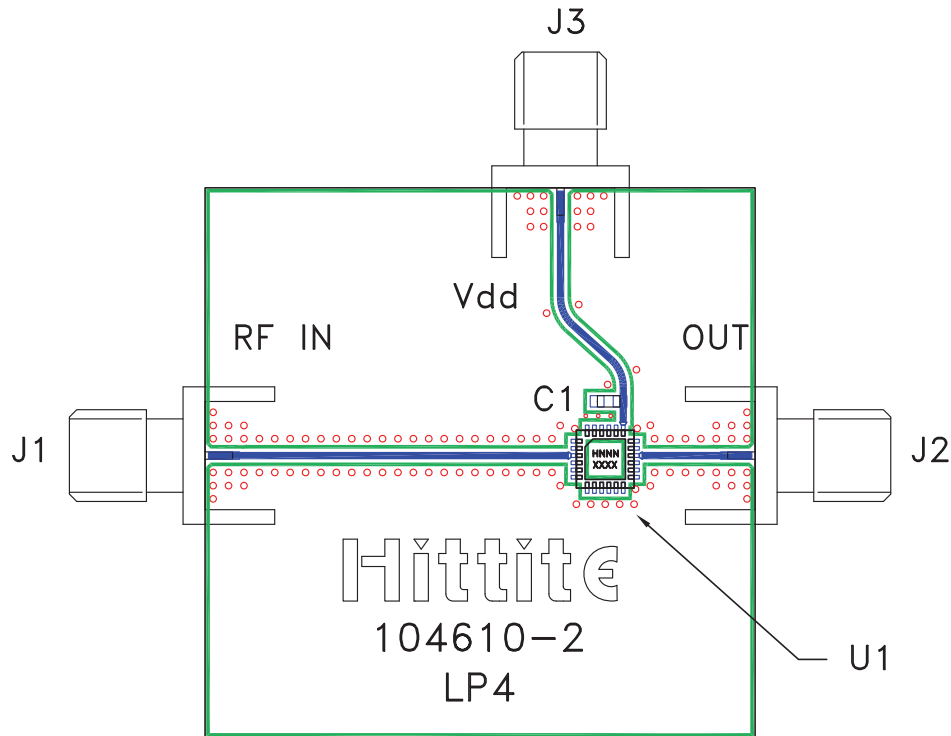


**SMT GaAs HBT MMIC x16 ACTIVE
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Pin Description

| 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.