HMC445LP4 / 445LP4E

v03.0907

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

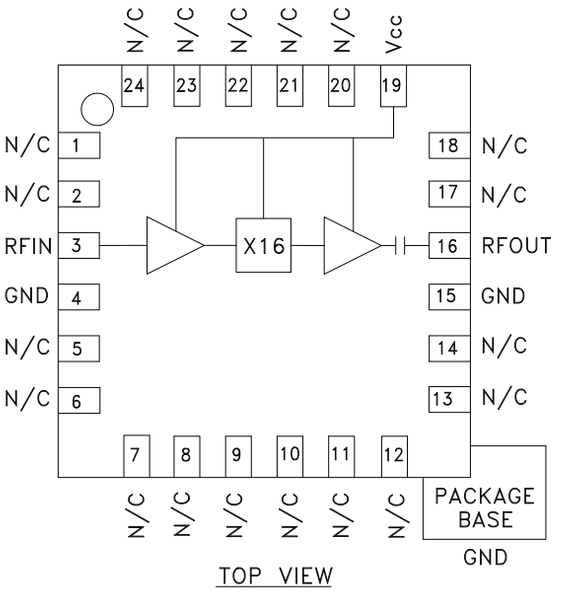
Sub-Harmonic Suppression: >25 dBc

SSB Phase Noise: -130 dBc/Hz

Single Supply: 5V @ 78 mA

24 Lead 4x4 mm SMT Package: 16 mm^2

Functional Diagram



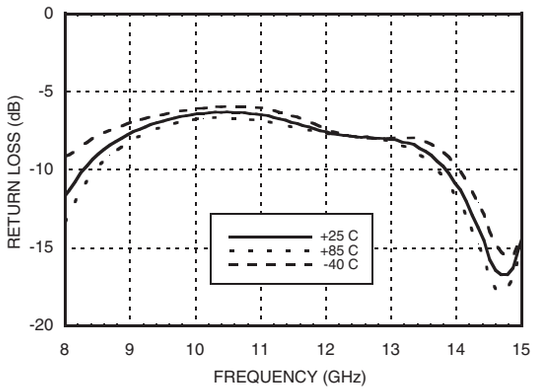
General Description

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 5.0V 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.

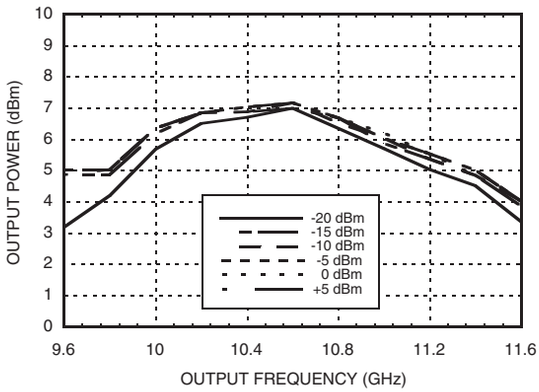
Electrical Specifications, T_A = +25° C, Vcc= 5.0V

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		-130		dBc/Hz
Supply Current (Icc)		78	104	mA

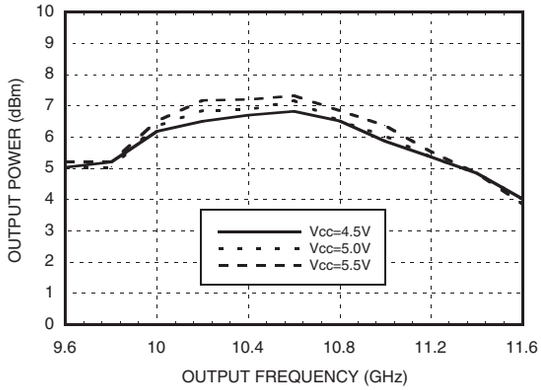
Output Power vs. Temperature @ -10 dBm Drive Level



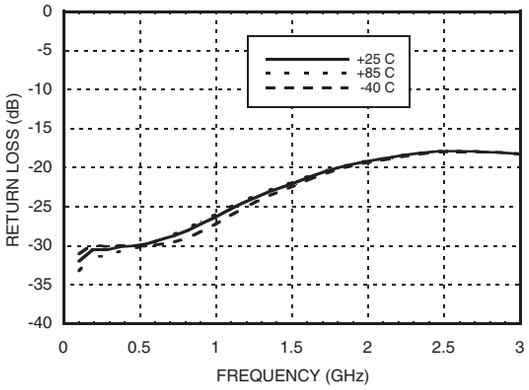
Output Power vs. Drive Level



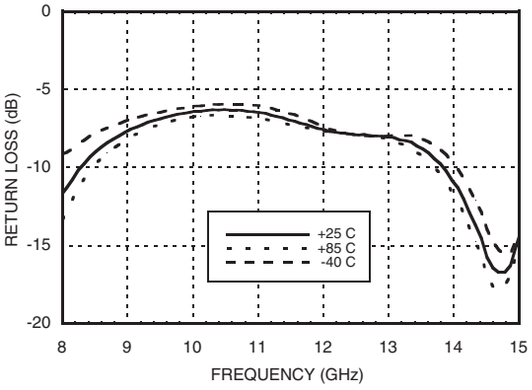
Output Power vs. Supply Voltage @ -10 dBm Drive Level



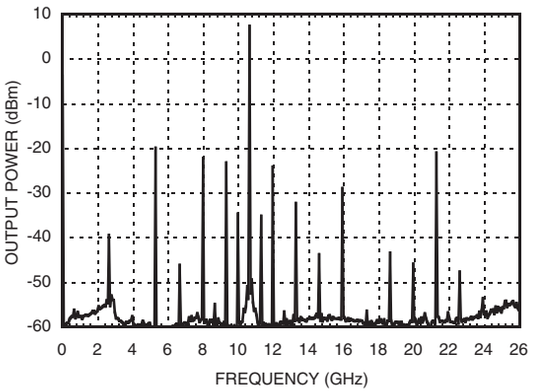
Input Return Loss vs. Temperature



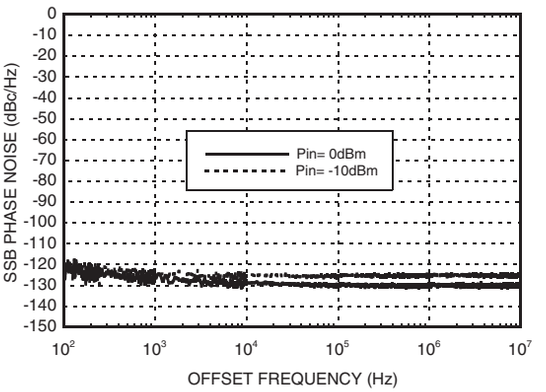
Output Return Loss vs. Temperature



Output Spectrum



SSB Phase Noise Performance, Fout= 10.5 GHz



For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
Order On-line at www.hittite.com

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

Absolute Maximum Ratings

RF Input (Vcc= +5V)	+20 dBm
Vcc	+6V
Channel Temperature	150 °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

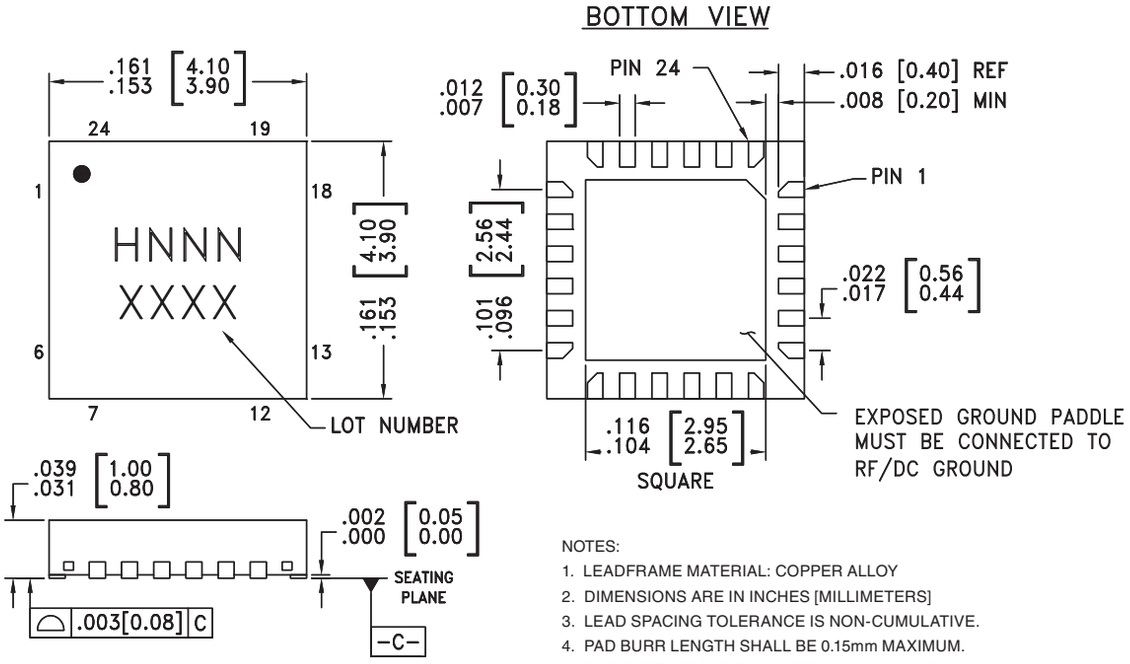
Typical Supply Current vs. Vcc

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



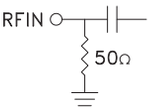
NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE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

Package Information

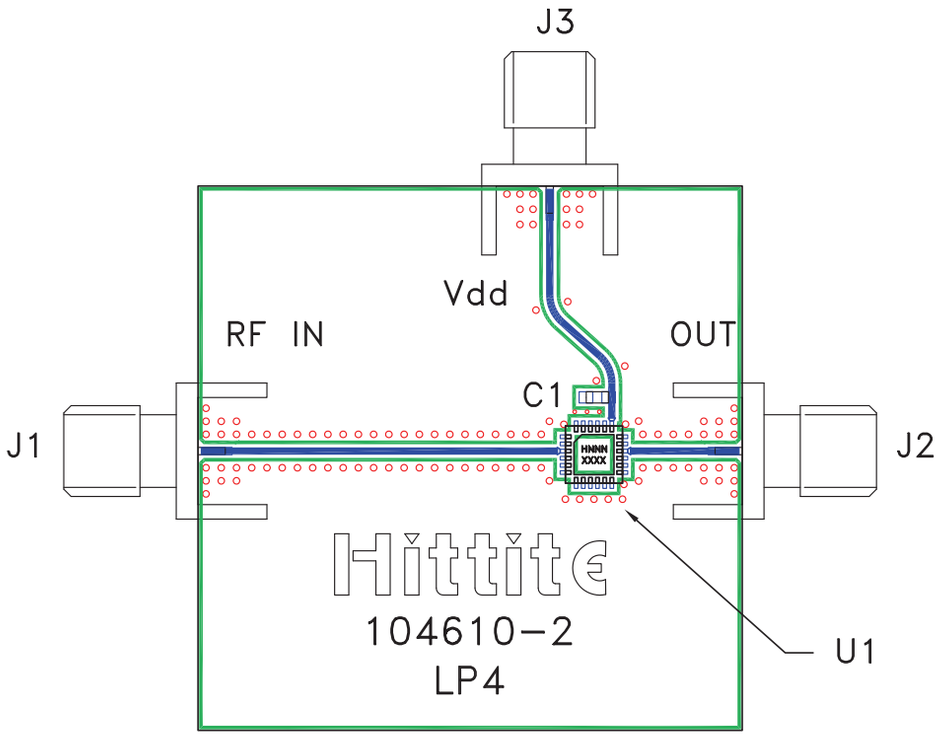
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC445LP4	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H445 XXXX
HMC445LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H445 XXXX

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

Pin Description

Pin Number	Function	Description	Interface Schematic
1, 2, 5-14, 17, 18, 20-24	N/C	No Connection	
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.