



v04.0210

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

#### **Functional Diagram**

#### N/C $\frac{2}{2}$ Vcc Z $\geq$ $\geq$ 24 23 22 21 20 19 N/C 1 18 N/C 17 N/C N/C 2 RFIN 3 X16 16 RFOUT GND 15 GND 4 N/C 5 N/C 14 N/C 6 13 N/C 8 10 11 12 7 9 PACKAGE N/C V/C N/C N/C Ó $\geq$ BASE GND TOP VIEW

#### 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<sup>2</sup>

### **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, $T_A = +25^{\circ} C$ , Vcc= 5V

Parameter		Min.	Тур.	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

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5 - 54

# 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 $\square$

• 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.

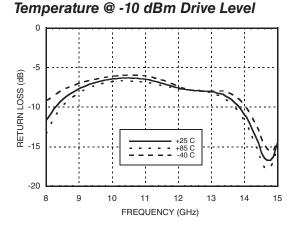




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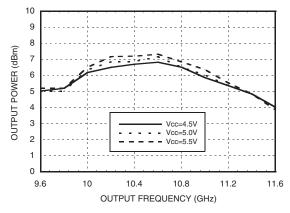
**Output Power vs. Drive Level** 

Output Power vs.



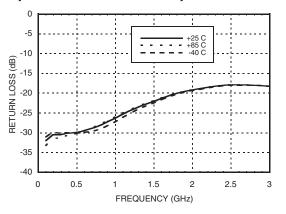
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Output Power vs. Supply Voltage @ -10 dBm Drive Level

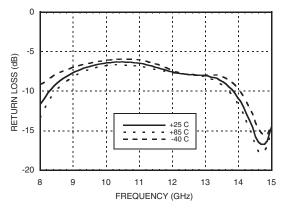


с 8 OUTPUT POWER (dBm) 7 6 5 4 -20 dBm -20 dBm -15 dBm -10 dBm -5 dBm 0 dBm +5 dBm 3 2 0 9.6 10 10.4 10.8 11.2 11.6 **OUTPUT FREQUENCY (GHz)** 

Input Return Loss vs. Temperature



#### **Output Return Loss vs. Temperature**



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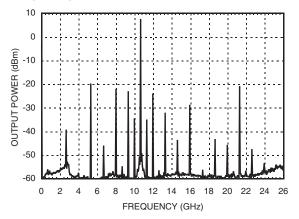
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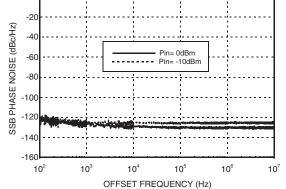
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#### **Output Spectrum**



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SSB Phase Noise Performance, Fout= 10.5 GHz





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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 11.5 mW/°C above 85 °C)	750 mW
Thermal Resistance (R <sub>th</sub> ) (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.



BOTTOM VIEW

ELECTROSTATIC SENSITIVE DEVICE **OBSERVE HANDLING PRECAUTIONS** 

### **Outline Drawing**

4.10 3.90 **PIN 24** .016 [0.40] REF .012 0.30 .008 [0.20] MIN 19 24 PIN 1 18 1 Г HNNN 0.56 0.44 XXXX Г 13 6 12 7 EXPOSED GROUND PADDLE .116 .104 2.95 LOT NUMBER MUST BE CONNECTED TO 1.00 0.80 RF/DC GROUND SQUARE .002 .000 0.05 NOTES: SEATING

PLANE

-C-

- 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

.003[0.08] C

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Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC445LP4	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 <sup>[1]</sup>	H445 XXXX
HMC445LP4E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 <sup>[2]</sup>	<u>H445</u> 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 - 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.	RFIN 0
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.	○ RFOUT
19	Vcc	Supply voltage 5V ± 0.5V.	

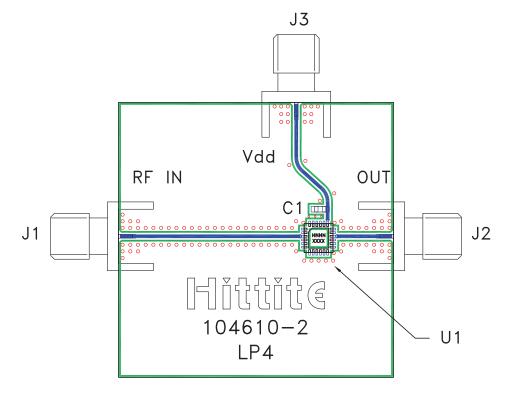


v04.0210



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

**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.

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