



## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 14.25 - 15.65 GHz

### Typical Applications

The HMC632LP5(E) is ideal for:

- Point to Point/Multipoint Radio
- Test Equipment & Industrial Controls
- SATCOM
- Military End-Use

### Features

Dual Output:  $F_o = 14.25 - 15.65$  GHz  
 $F_o/2 = 7.125 - 7.825$  GHz

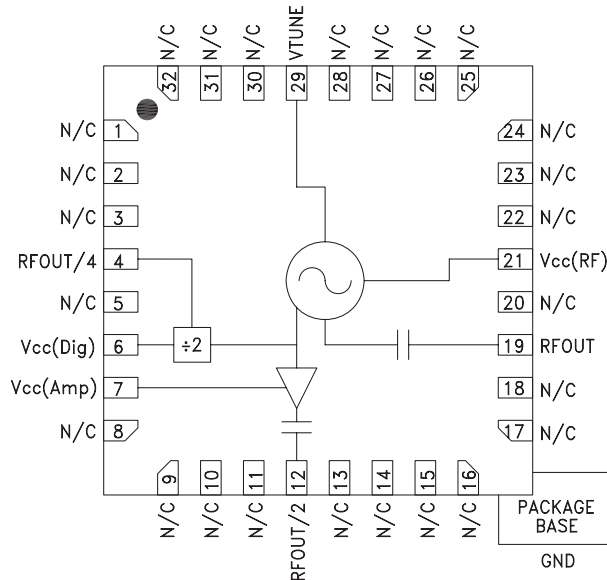
Power: +9 dBm

Phase Noise: -107 dBc/Hz @100 kHz Typ.

No External Resonator Needed

QFN Leadless SMT Package, 25 mm<sup>2</sup>

### Functional Diagram



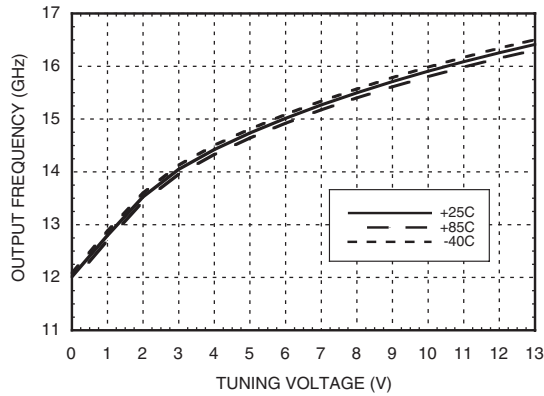
### General Description

The HMC632LP5(E) is a GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCO. The HMC632LP5(E) integrates resonators, negative resistance devices, varactor diodes and features half frequency and divide-by-4 outputs. The VCO's phase noise performance is excellent over temperature, shock, and process due to the oscillator's monolithic structure. Power output is +9 dBm typical from a +5V supply voltage. The prescaler and RF/2 functions can be disabled to conserve current if not required. The voltage controlled oscillator is packaged in a leadless QFN 5x5 mm surface mount package, and requires no external matching components.

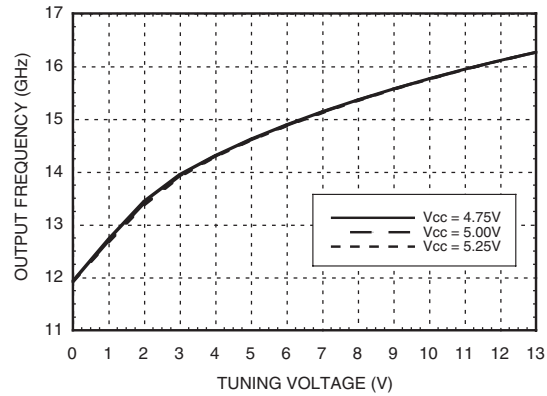
### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{cc}(\text{Dig})$ , $V_{cc}(\text{Amp})$ , $V_{cc}(\text{RF}) = +5\text{V}$

Parameter	Min.	Typ.	Max.	Units
Frequency Range		14.25 - 15.65		GHz
		7.125 - 7.825		GHz
Power Output				
	4		12	dBm
	7		13	dBm
	-8		-2	dBm
SSB Phase Noise @ 100 kHz Offset, Vtune= +5V @ RFOUT		-107		dBc/Hz
Tune Voltage	2		13	V
Supply Current	280	350	400	mA
Tune Port Leakage Current (Vtune= 13V)			10	μA
Output Return Loss		2		dB
Harmonics/Subharmonics		25		dBc
	1/2	25		dBc
	2nd	25		dBc
Pulling (into a 2.0:1 VSWR)		10		MHz pp
Pushing @ Vtune= 5V		35		MHz/V
Frequency Drift Rate		1.0		MHz/°C

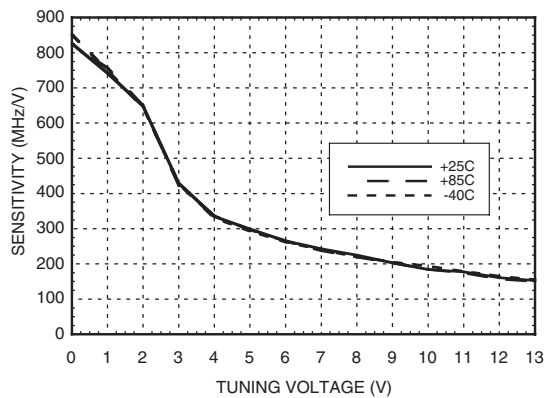
**Frequency vs. Tuning Voltage, Vcc = +5V**



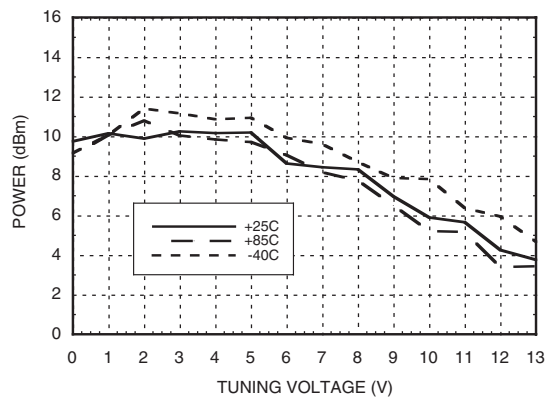
**Frequency vs. Tuning Voltage, T = 25°C**



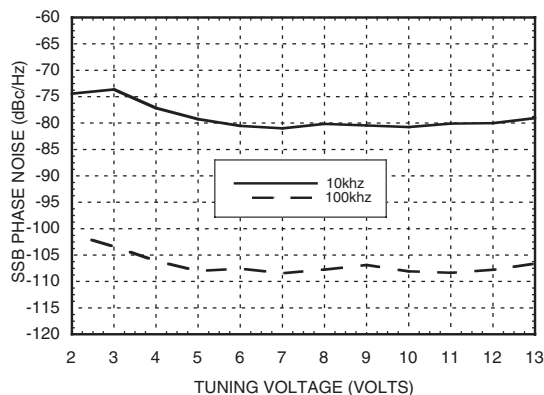
**Sensitivity vs. Tuning Voltage, Vcc = +5V**



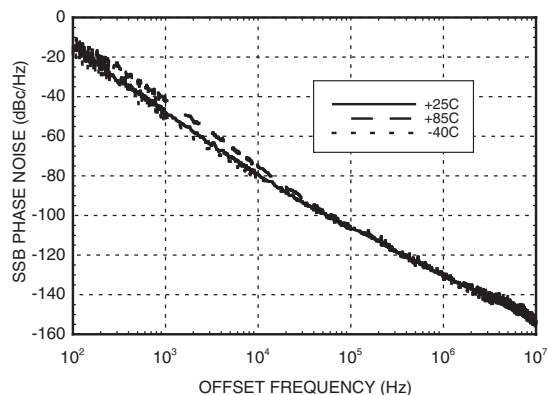
**Output Power vs. Tuning Voltage, Vcc = +5V**



**SSB Phase Noise vs. Tuning Voltage**



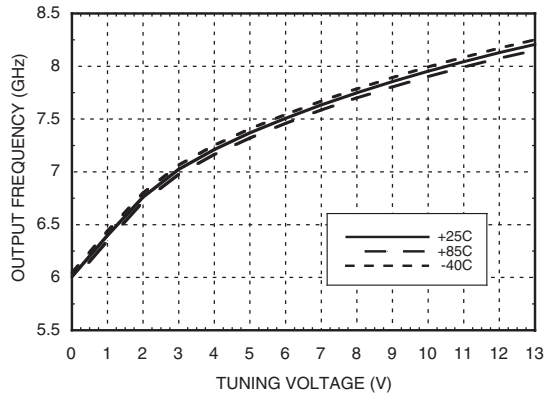
**SSB Phase Noise @ Vtune = +5V**



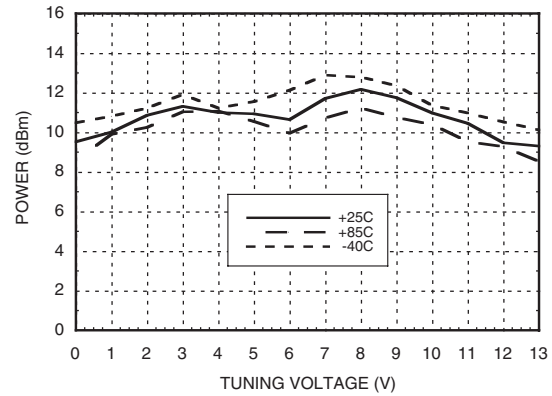


**MMIC VCO w/ HALF FREQUENCY OUTPUT  
& DIVIDE-BY-4, 14.25 - 15.65 GHz**

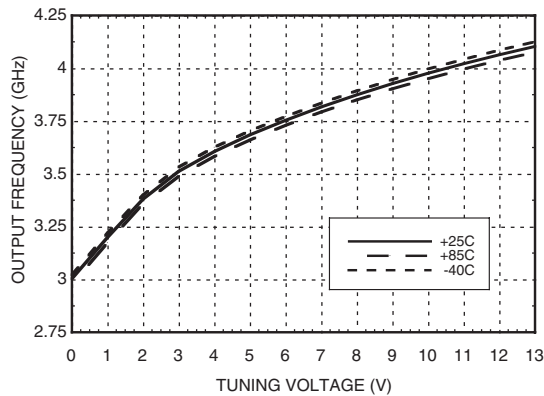
**RFOUT/2 Frequency  
vs. Tuning Voltage, Vcc = +5V**



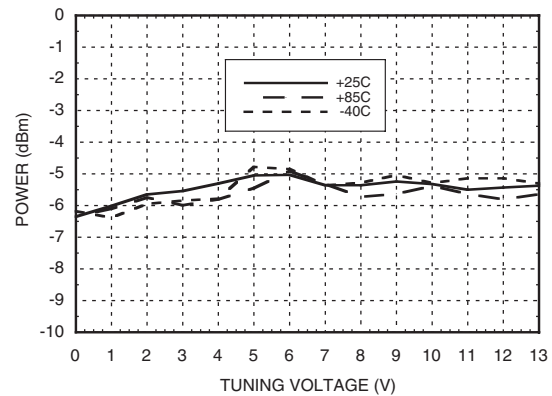
**RFOUT/2 Output Power  
vs. Tuning Voltage, Vcc = +5V**



**Divide-by-4 Frequency  
vs. Tuning Voltage, Vcc = +5V**



**Divide-by-4 Output Power  
vs. Tuning Voltage, Vcc = +5V**



### Absolute Maximum Ratings

Vcc(Dig), Vcc(Amp), Vcc(RF)	+5.5 Vdc
Vtune	0 to +15V
Junction Temperature	135 °C
Continuous Pdiss (T=85 °C) (derate 46 mW/C above 85 °C)	2.27 W
Thermal Resistance (junction to ground paddle)	22 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

### Typical Supply Current vs. Vcc

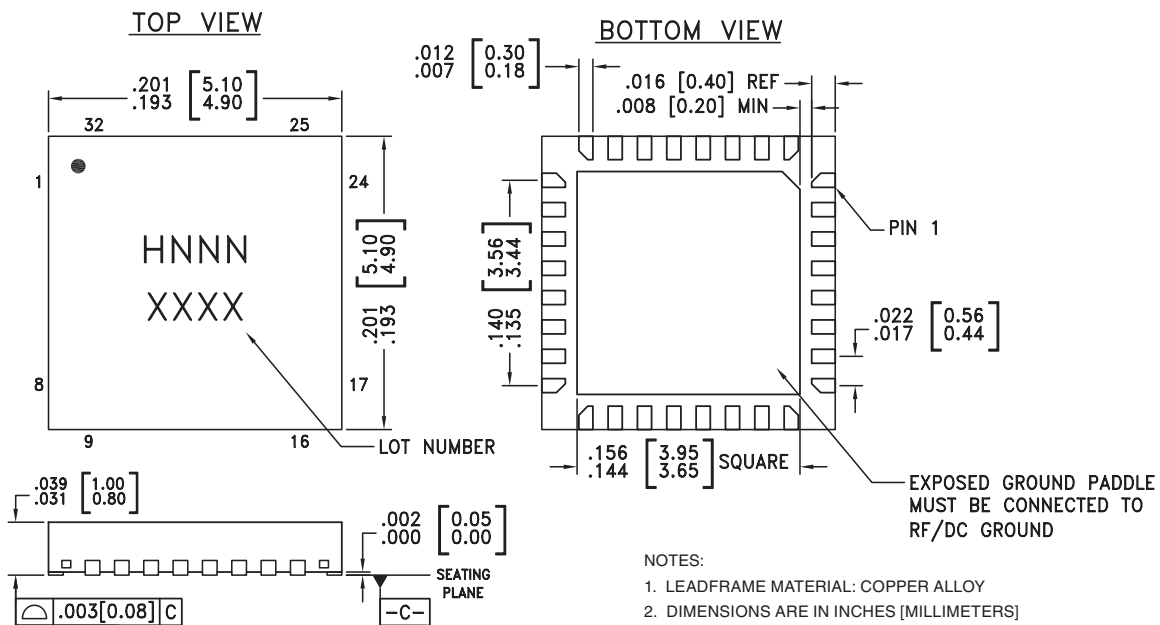
Vcc (V)	Icc (mA)
4.75	325
5.00	350
5.25	375

Note: VCO 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 <sup>[3]</sup>
HMC632LP5	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 <sup>[1]</sup>	H632 XXXX
HMC632LP5E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 <sup>[2]</sup>	H632 XXXX

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

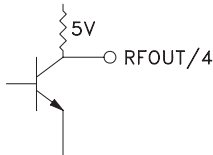
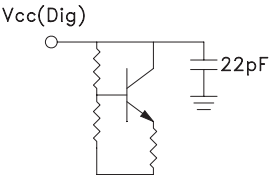
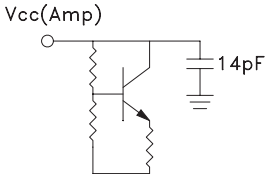
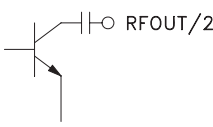
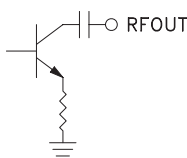
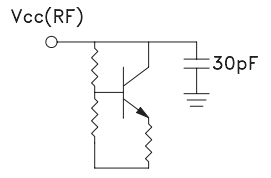
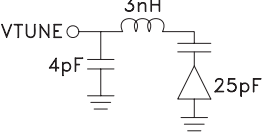

[3] 4-Digit lot number XXXX

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](http://www.hittite.com)

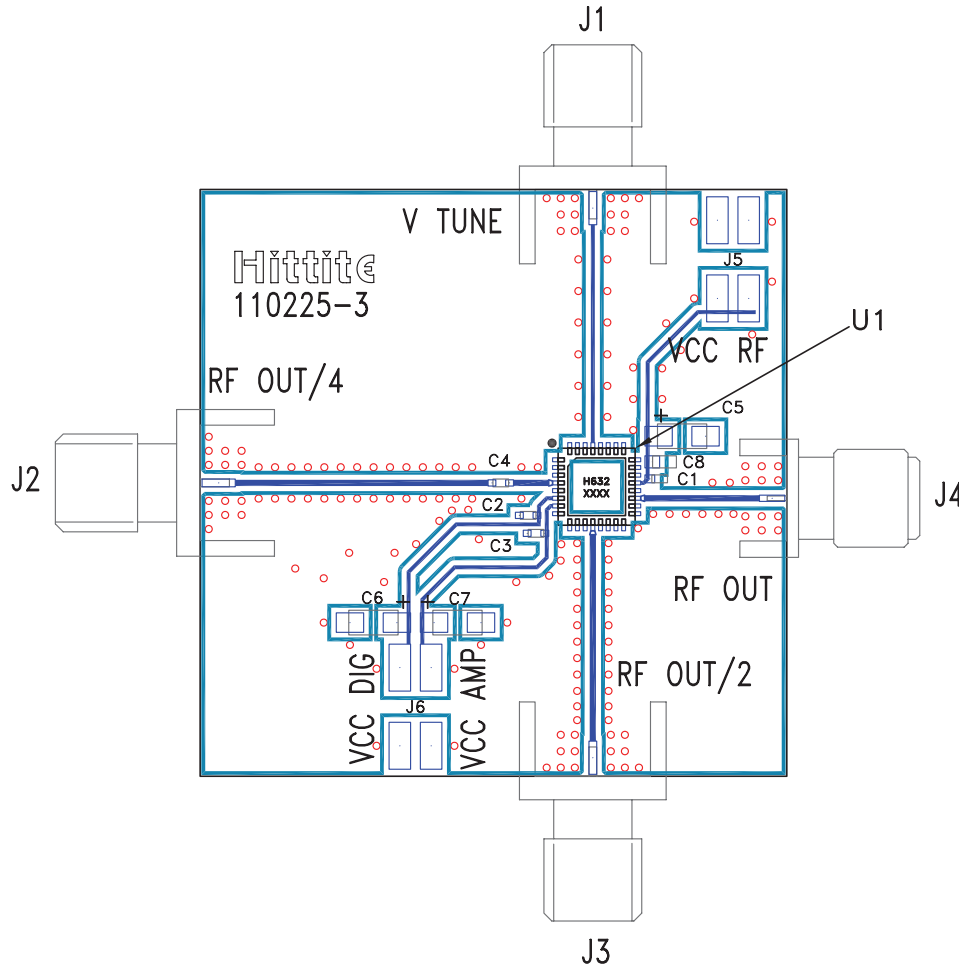


## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 14.25 - 15.65 GHz

### Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1-3, 5, 8-11, 13-18, 20, 22-28, 30-32	N/C	No Connection. These pins may be connected to RF/DC ground. Performance will not be affected.	
4	RFOUT/4	Divide-by-4 output. DC block required.	
6	Vcc (Dig)	Supply voltage for prescaler. If prescaler is not required, this pin may be left open to conserve approximately 65 mA of current.	
7	Vcc (Amp)	Supply voltage, for RFOUT/2 output. If RFOUT/2 is not required, this pin may be left open to conserve approximately 30 mA of current.	
12	RFOUT/2	Half frequency output (AC coupled).	
19	RF OUT	RF output (AC coupled).	
21	Vcc (RF)	Supply Voltage, +5V	
29	VTUNE	Control voltage and modulation input. Modulation bandwidth dependent on drive source impedance. See "Determining the FM Bandwidth of a Wideband Varactor Tuned VCO" application note.	
	GND	Package bottom has an exposed metal paddle that must be connected to RF/DC ground.	

### Evaluation PCB



### List of Materials for Evaluation PCB 110227 [1]

Item	Description
J1 - J4	PCB Mount SMA RF Connector
J5 - J6	2 mm DC Header
C1 - C3	100 pF Capacitor, 0402 Pkg.
C4	1,000 pF Capacitor, 0402 Pkg.
C5 - C7	2.2 μF Tantalum Capacitor
U1	HMC632LP5(E) VCO
PCB [2]	110225 Eval Board

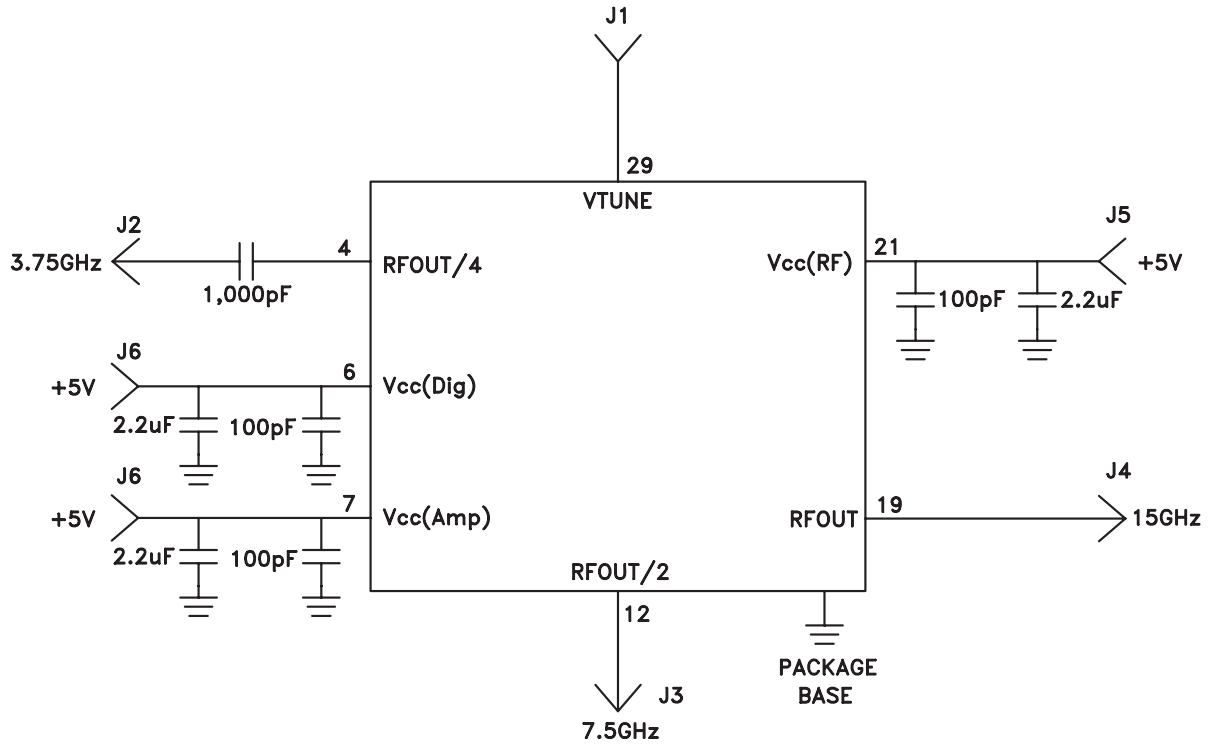
[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and backside ground paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.



### Typical Application Circuit





**Notes:**





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VCOs & PLOs - SMT

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