

## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 11.5 - 12.5 GHz



### Typical Applications

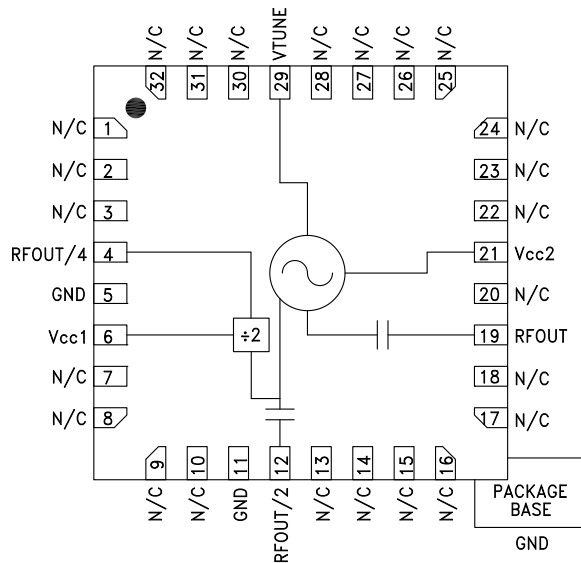
Low noise MMIC VCO w/Half Frequency, Divide-by-4 Outputs for:

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

### Features

- Dual Output:  $F_o = 11.5 - 12.5$  GHz  
 $F_o/2 = 5.75 - 6.25$  GHz
- Pout: +10 dBm
- Phase Noise: -110 dBc/Hz @100 kHz Typ.
- No External Resonator Needed
- 32 Lead 5x5mm SMT Package: 25mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC515LP5 & HMC515LP5E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCOs. The HMC515LP5 & HMC515LP5E integrate resonators, negative resistance devices, varactor diodes and feature 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 +10 dBm typical from a +5V supply voltage. The prescaler function 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, $T_A = +25^\circ C$ , $V_{cc1}, V_{cc2} = +5V$

Parameter	Min.	Typ.	Max.	Units	
Frequency Range		11.5 - 12.5		GHz	
		5.75 - 6.25		GHz	
Power Output					
RFOUT	+6		+15	dBm	
RFOUT/2	+3		+9	dBm	
RFOUT/4	-9		-3	dBm	
SSB Phase Noise @ 100 kHz Offset, $V_{tune} = +5V$ @ RFOUT		-110		dBc/Hz	
Tune Voltage	$V_{tune}$	2	13	V	
Supply Current	$I_{cc1}$ & $I_{cc2}$	160	200	240	mA
Tune Port Leakage Current ( $V_{tune} = 13V$ )			10	$\mu A$	
Output Return Loss		2		dB	
Harmonics/Subharmonics					
	1/2	30		dBc	
	3/2	35		dBc	
	2nd	24		dBc	
	3rd	40		dBc	
Pulling (into a 2.0:1 VSWR)		8		MHz pp	
Pushing @ $V_{tune} = 5V$		6		MHz/V	
Frequency Drift Rate		1.2		MHz/ $^\circ C$	

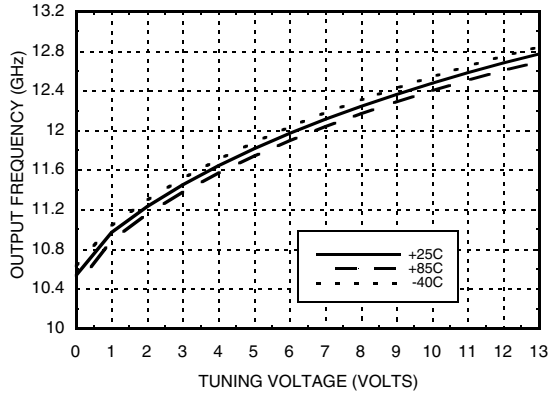
Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106  
Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com)  
Application Support: Phone: 1-800-ANALOG-D

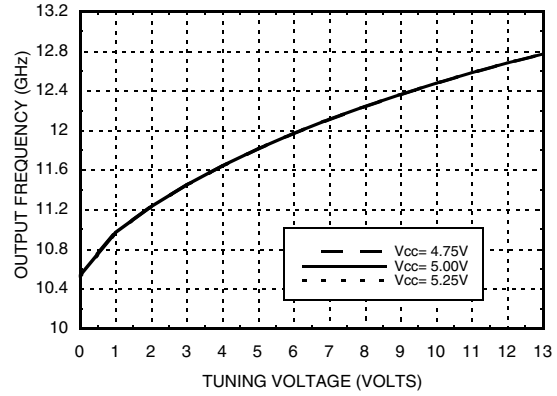


**MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 11.5 - 12.5 GHz**

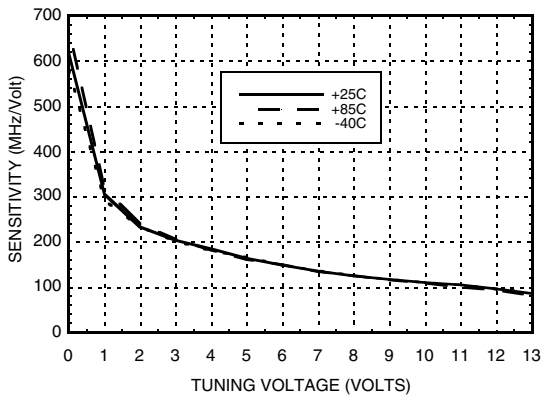
**Frequency vs. Tuning Voltage, Vcc = +5V**



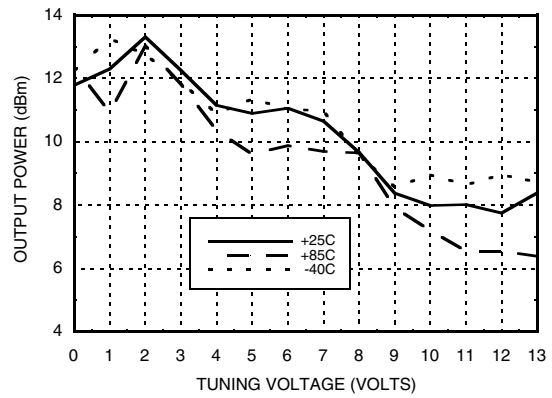
**Frequency vs. Tuning Voltage, T = 25°C**



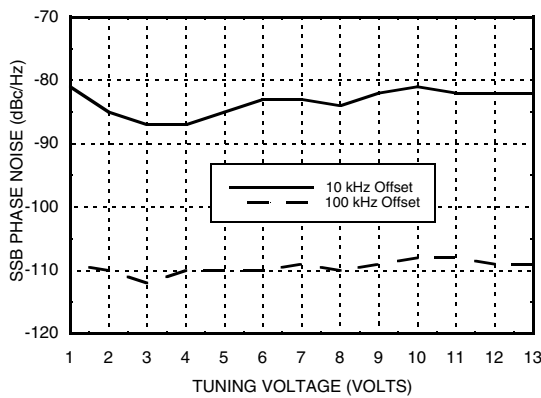
**Sensitivity vs. Tuning Voltage, Vcc = +5V**



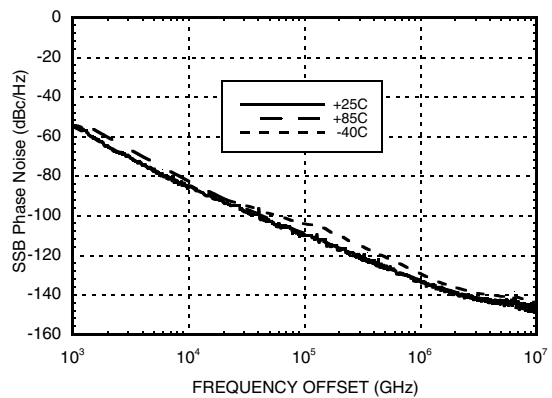
**Output Power vs. Tuning Voltage, Vcc = +5V**



**SSB Phase Noise vs. Tuning Voltage**



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



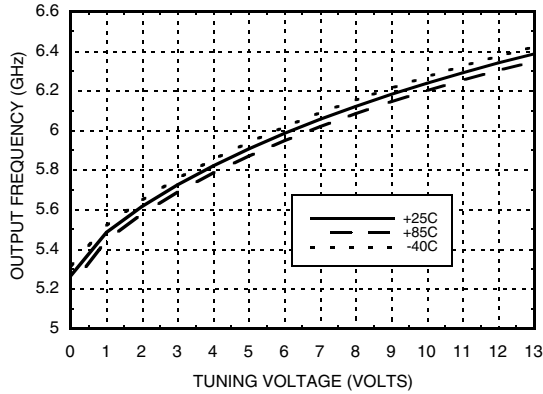
Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com) Application Support: Phone: 1-800-ANALOG-D

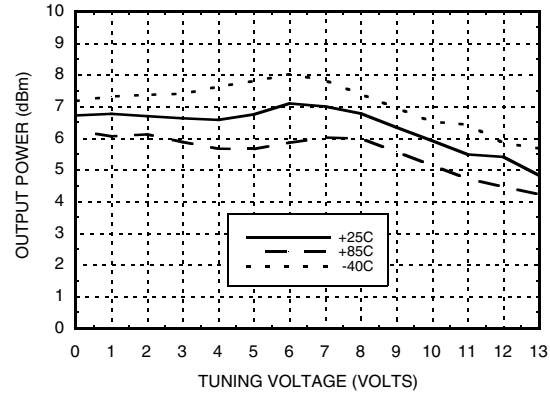


## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 11.5 - 12.5 GHz

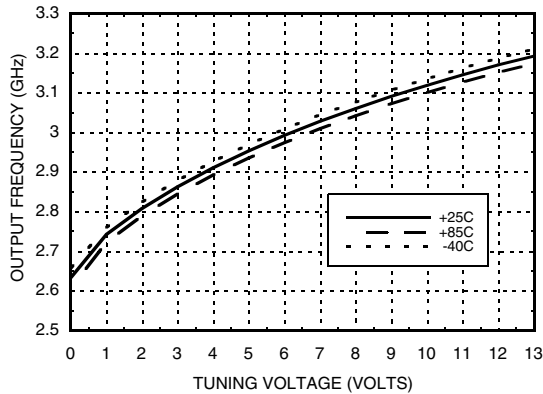
**RFOUT/2 Frequency vs. Tuning Voltage, Vcc= +5V**



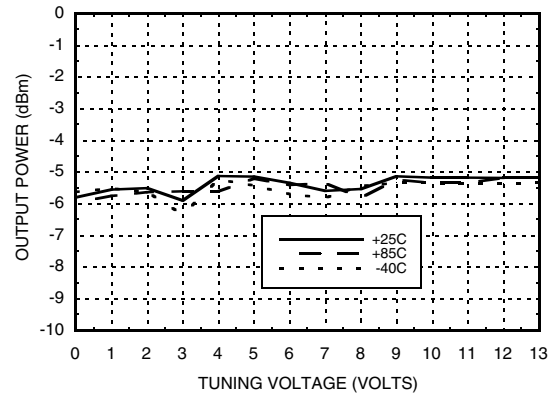
**RFOUT/2 Output Power vs. Tuning Voltage, Vcc= +5V**



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



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



### Absolute Maximum Ratings

Vcc1, Vcc2	+5.5 Vdc
Vtune	0 to +15V
Junction Temperature	135 °C
Continuous P <sub>diss</sub> (T=85 °C) (derate 28.6 mW/C above 85 °C)	1.43 W
Thermal Resistance (junction to ground paddle)	35 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A

### Typical Supply Current vs. Vcc

Vcc (V)	I <sub>cc</sub> (mA)
4.75	180
5.00	200
5.25	220

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

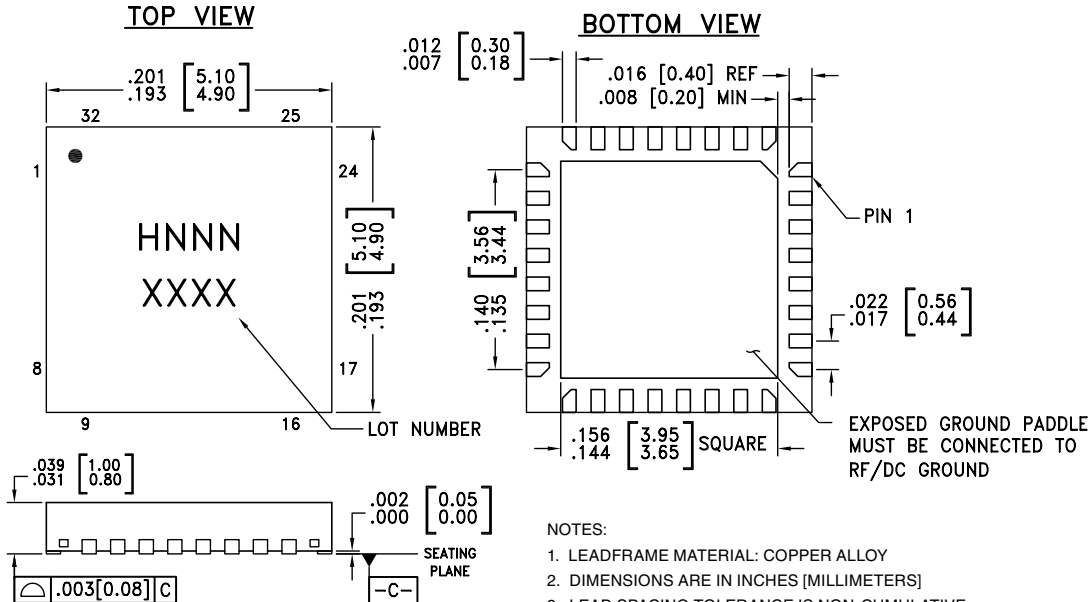


**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 11.5 - 12.5 GHz



### Outline Drawing



### Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[3]</sup>
HMC515LP5	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL3 <sup>[1]</sup>	H515 XXXX
HMC515LP5E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL3 <sup>[2]</sup>	H515 XXXX

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

### Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1 - 3, 7 - 10, 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.	
6	Vcc1	Supply Voltage for prescaler. If prescaler is not required, this pin may be left open to conserve 65 mA of current.	

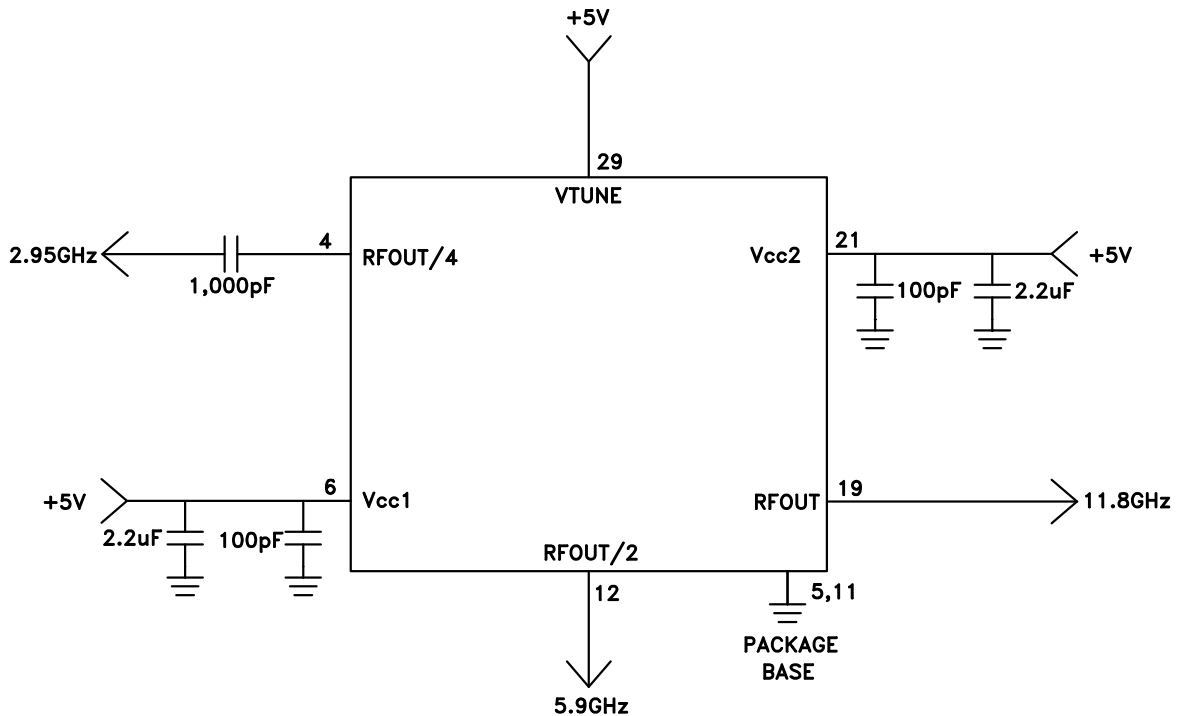


## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-4, 11.5 - 12.5 GHz

### Pin Descriptions

Pin Number	Function	Description	Interface Schematic
12	RFOUT/2	Half frequency output (AC coupled).	
19	RF OUT	RF output (AC coupled).	
21	Vcc2	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.	
5, 11, Paddle	GND	Package bottom has an exposed metal paddle that must be connected to RF/DC ground.	

### Typical Application Circuit



Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective owners.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com) Application Support: Phone: 1-800-ANALOG-D