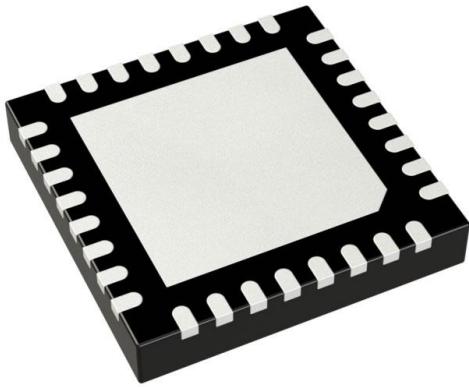


HMC509LP5 Datasheet

www.digi-electronics.com



https://www.DiGi-Electronics.com

DiGi Electronics Part Number	HMC509LP5-DG
Manufacturer	Analog Devices Inc.
Manufacturer Product Number	HMC509LP5
Description	VCO 4.15GHZ/8.3GHZ 2-13V 5X5MM
Detailed Description	4.15GHZ, 8.3GHZ Center Frequency 2 V ~ 13 V Voltage Controlled Oscillator 7.5±2.5, 12.5±2.5 dBm 10 2nd Harmonic Typ (dBc)

This model HMC509LP5 is available at DiGi Electronics.

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We welcome your inquiries regarding pricing, lead time, or other product-related questions.

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Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

DiGi is a global authorized distributor of electronic components.

Purchase and inquiry

Manufacturer Product Number:

HMC509LP5

Series:

-

Frequency Range:

3.9 ~ 4.4GHz, 7.8 ~ 8.8GHz

Voltage - Supply:

5V

2nd Harmonic, Typ (dBc):

10

Pushing (MHz/V):

10

Phase Noise Typ (dBc/Hz):

-115

Package / Case:

32-VFQFN Exposed Pad

Height:

0.039" (1.00mm)

Manufacturer:

Analog Devices Inc.

Product Status:

Obsolete

Frequency - Center:

4.15GHz, 8.3GHz

Tuning Voltage (VDC):

2 V ~ 13 V

Icc Max:

270mA

Power (dBm):

7.5±2.5, 12.5±2.5

Operating Temperature:

-40°C ~ 85°C

Size / Dimension:

0.197" L x 0.197" W (5.00mm x 5.00mm)

Base Product Number:

HMC509

Environmental & Export classification

Moisture Sensitivity Level (MSL):

3 (168 Hours)

HTSUS:

8542.39.0001

ECCN:

EAR99



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HMC509LP5 / 509LP5E

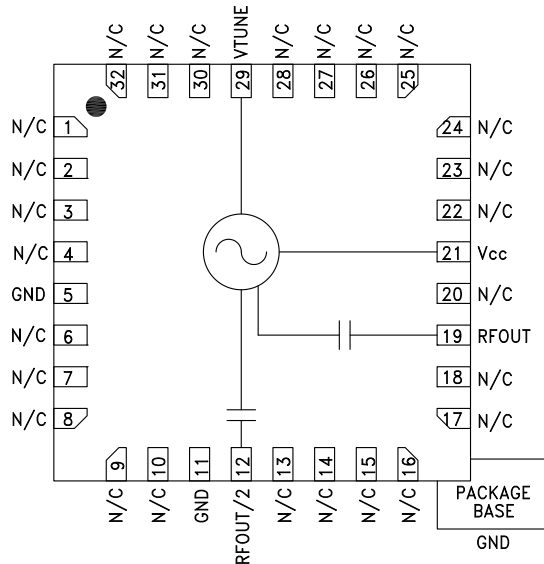
MMIC VCO w/ HALF FREQUENCY OUTPUT 7.8 - 8.8 GHz

Typical Applications

Low noise MMIC VCO w/Half Frequency, for:

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

Functional Diagram



Features

Dual Output: $F_o = 7.8 - 8.8 \text{ GHz}$
 $F_o/2 = 3.9 - 4.4 \text{ GHz}$

Pout: +13 dBm

Phase Noise: -115 dBc/Hz @100 kHz Typ.

No External Resonator Needed

32 Lead 5x5mm SMT Package: 25mm²

General Description

The HMC509LP5 & HMC509LP5E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCOs. The HMC509LP5 & HMC509LP5E integrate resonators, negative resistance devices, varactor diodes and feature a half frequency output. The VCO's phase noise performance is excellent over temperature, shock, and process due to the oscillator's monolithic structure. Power output is +13 dBm typical from a +5V supply. The voltage controlled oscillator is packaged in a leadless QFN 5x5 mm surface mount package, and requires no external matching components.

Electrical Specifications, $T_A = +25^\circ \text{C}$, $V_{cc} = +5V$

Parameter	Min.	Typ.	Max.	Units
Frequency Range		7.8 - 8.8		GHz
		3.9 - 4.4		GHz
Power Output	+10		+15	dBm
	+5		+10	dBm
SSB Phase Noise @ 100 kHz Offset, $V_{tune} = +5V$ @ RFOUT		-115		dBc/Hz
Tune Voltage	2		13	V
Supply Current (I_{cc}) ($V_{cc} = +5.0V$)	200	250	270	mA
Tune Port Leakage Current ($V_{tune} = 13V$)			10	μA
Output Return Loss		2		dB
Harmonics/Subharmonics				
	1/2	35		dBc
	2nd	10		dBc
	3rd	32		dBc
Pulling (into a 2.0:1 VSWR)		5		MHz pp
Pushing @ $V_{tune} = 5V$		10		MHz/V
Frequency Drift Rate		0.9		MHz/ $^\circ C$

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Application Support: Phone: 1-800-ANALOG-D



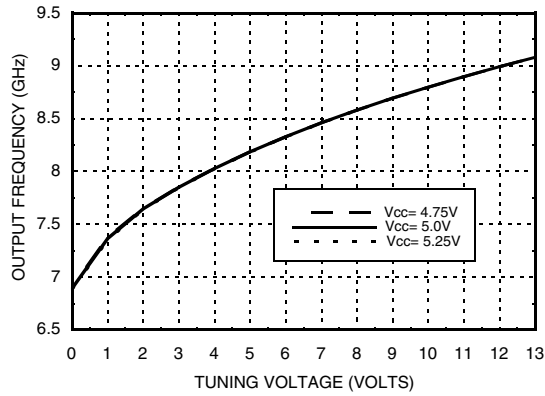
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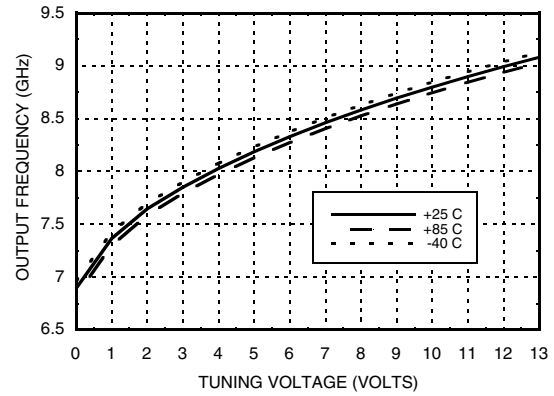
HMC509LP5 / 509LP5E

MMIC VCO w/ HALF FREQUENCY OUTPUT 7.8 - 8.8 GHz

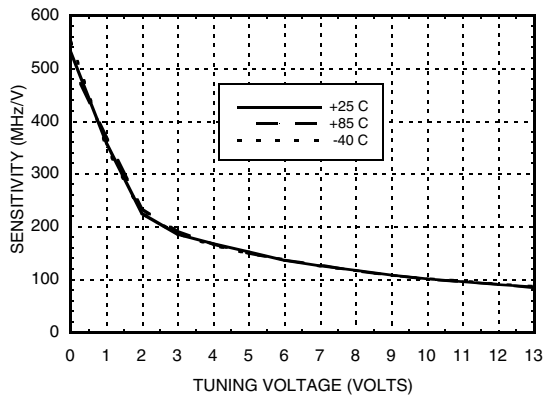
Frequency vs. Tuning Voltage, $T = 25^{\circ}\text{C}$



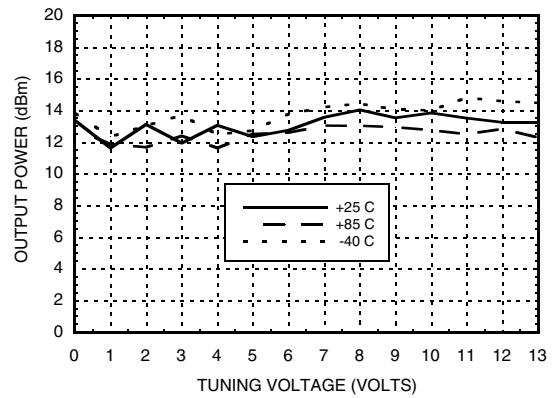
Frequency vs. Tuning Voltage, $V_{cc} = +5V$



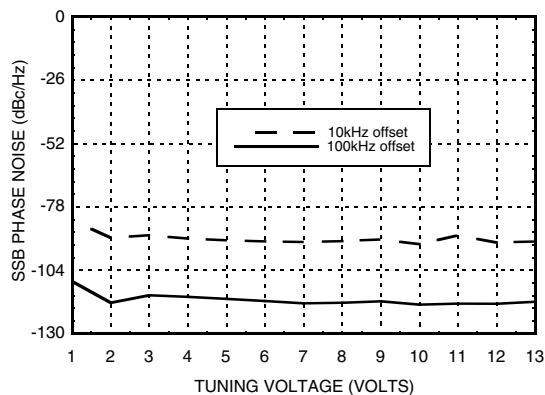
Sensitivity vs. Tuning Voltage, $V_{cc} = +5V$



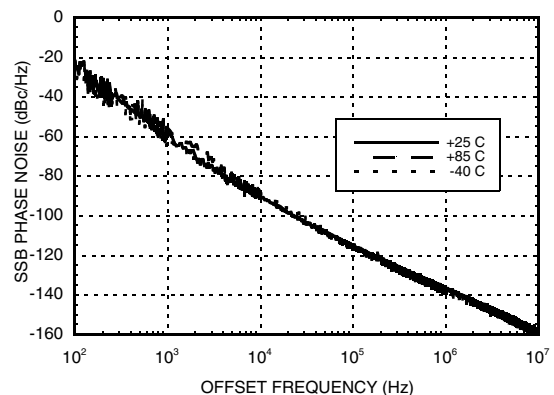
Output Power vs. Tuning Voltage, $V_{cc} = +5V$



SSB Phase Noise vs. Tuning Voltage



SSB Phase Noise @ $V_{tune} = +5V$



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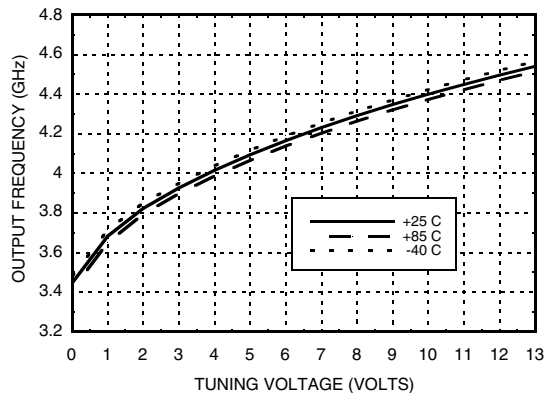
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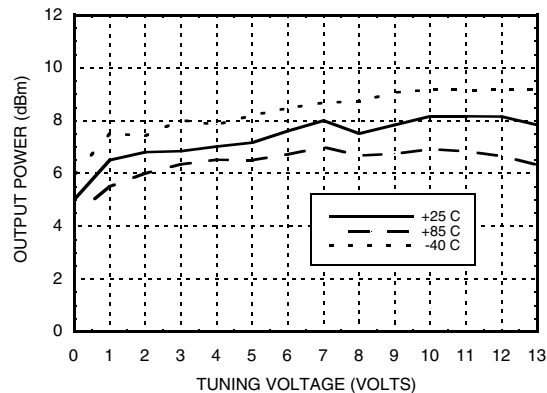


MMIC VCO w/ HALF FREQUENCY OUTPUT 7.8 - 8.8 GHz

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



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



Absolute Maximum Ratings

Vcc	+5.5 Vdc
Vtune	0 to +15V
Junction Temperature	135 °C
Continuous Pdiss (T=85 °C) (derate 26.7 mW/C above 85 °C)	1.34 W
Thermal Resistance (junction to ground paddle)	37.3 °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)	Icc (mA)
4.75	210
5.0	250
5.25	270

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



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**



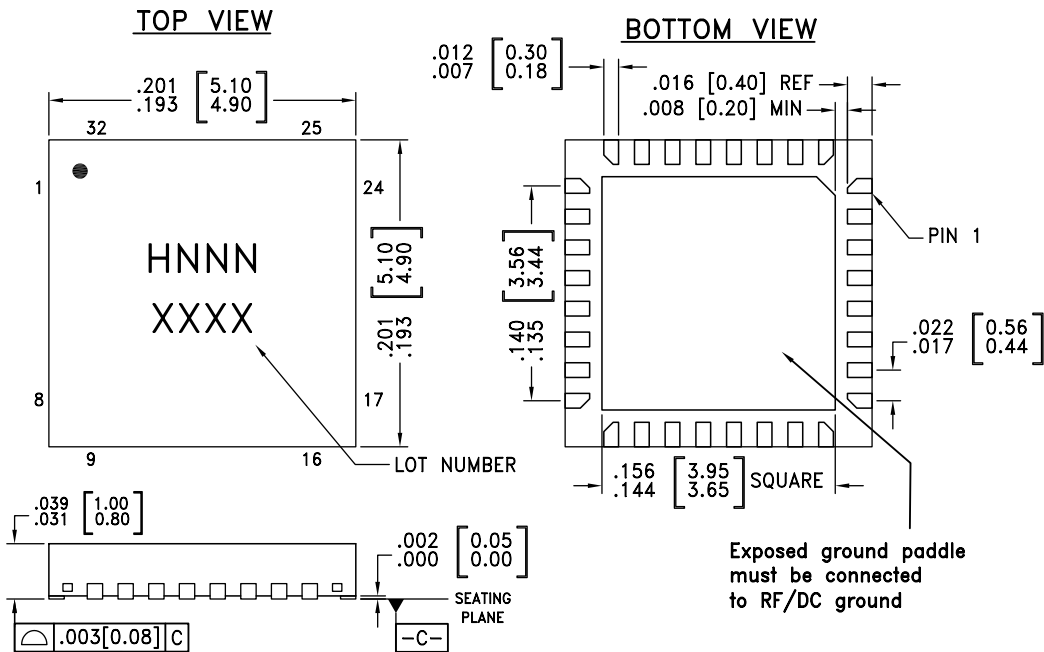
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MMIC VCO w/ HALF FREQUENCY OUTPUT 7.8 - 8.8 GHz



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 NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking ^[3]
HMC509LP5	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL3 ^[1]	H509 XXXX
HMC509LP5E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL3 ^[2]	H509 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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MMIC VCO w/ HALF FREQUENCY OUTPUT 7.8 - 8.8 GHz

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1 - 4, 6 - 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.	
12	RFOUT/2	Half frequency output (AC coupled).	
19	RFOUT	RF output (AC coupled).	
21	Vcc	Supply Voltage, +5V	
29	VTUNE	Control Voltage Input. Modulation port bandwidth dependent on drive source impedance.	
5, 11, Paddle	GND	Package bottom has an exposed metal paddle that must be connected to RF/DC ground.	

8

VCOS WITH Fo/2 OUTPUT - SMT

8 - 5

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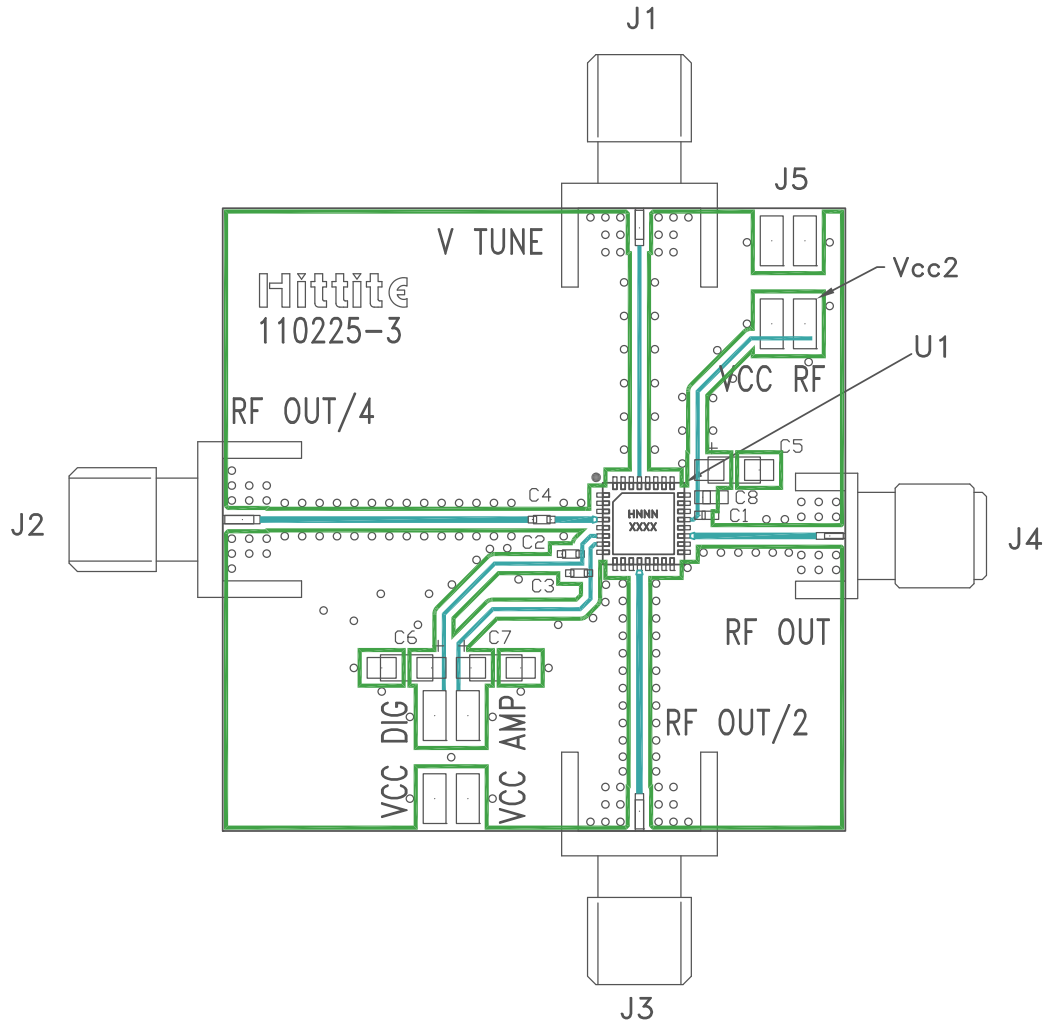
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MMIC VCO w/ HALF FREQUENCY OUTPUT 7.8 - 8.8 GHz



Evaluation PCB



List of Materials for Evaluation PCB 110227 [1]

Item	Description
J1 - J4	PCB Mount SMA RF Connector
J5	2 mm DC Header
C1 - C3	100 pF Capacitor, 0402 Pkg.
C4	1,000 pF Capacitor, 0402 Pkg.
C5 - C7	2.2 μ F Tantalum Capacitor
U1	HMC509LP5(E) VCO
PCB [2]	110225 Eval Board

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR

The circuit board used in the 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.

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