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HMC391LP4 / 391LP4E

MMIC VCO w/ BUFFER AMPLIFIER, 3.9 - 4.45 GHz

Typical Applications

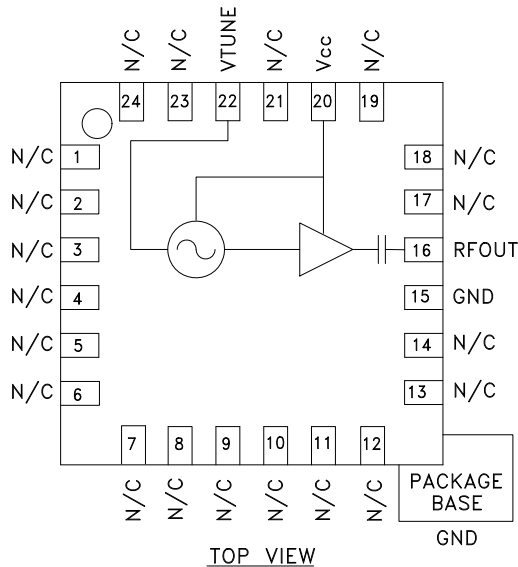
Low noise MMIC VCO w/Buffer Amplifier for:

- VSAT & Microwave Radio
- Radio Altimetry
- Test Equipment & Industrial Controls
- Military

Features

Pout: +5.0 dBm
Phase Noise: -106 dBc/Hz @100 KHz
No External Resonator Needed
Single Supply: +3V @ 30 mA
24 Lead 4x4mm QFN Package: 9 mm²

Functional Diagram



General Description

The HMC391LP4 & HMC391LP4E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCOs with integrated resonators, negative resistance devices, varactor diodes, and buffer amplifiers. Covering 3.9 to 4.45 GHz, the VCO's phase noise performance is excellent over temperature, shock, vibration and process due to the oscillator's monolithic structure. Power output is 5.0 dBm typical from a single supply of +3V @ 30 mA. The voltage controlled oscillator is packaged in a low cost leadless QFN 4 x 4 mm surface mount package.

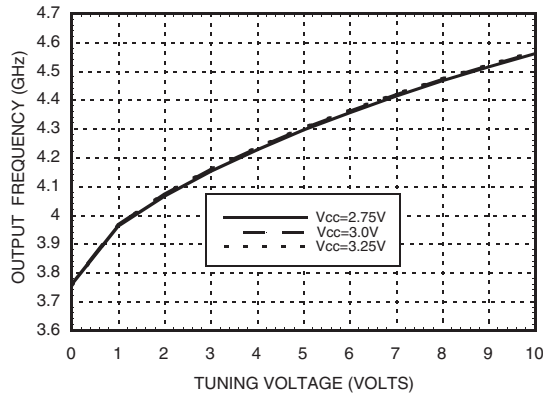
Electrical Specifications, $T_A = +25^\circ \text{C}$, $V_{CC} = +3\text{V}$

Parameter	Min.	Typ.	Max.	Units
Frequency Range	3.9 - 4.45			GHz
Power Output	1.5	5.0		dBm
SSB Phase Noise @ 100 kHz Offset, $V_{tune} = +5\text{V}$ @ RF Output		-106		dBc/Hz
Tune Voltage (V_{tune})	0		10	V
Supply Current (I_{CC}) ($V_{CC} = +3\text{V}$)		30	40	mA
Tune Port Leakage Current			10	μA
Output Return Loss		7		dB
Harmonics				
2nd		-9		dBc
3rd		-23		dBc
Pulling (into a 2.0:1 VSWR)		8.0		MHz pp
Pushing @ $V_{tune} = +5\text{V}$		16		MHz/V
Frequency Drift Rate		0.5		MHz/ $^\circ\text{C}$

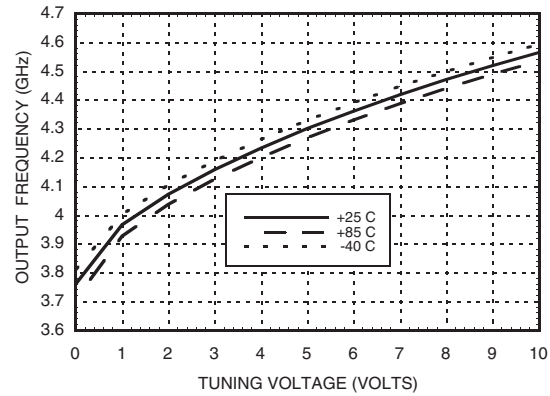
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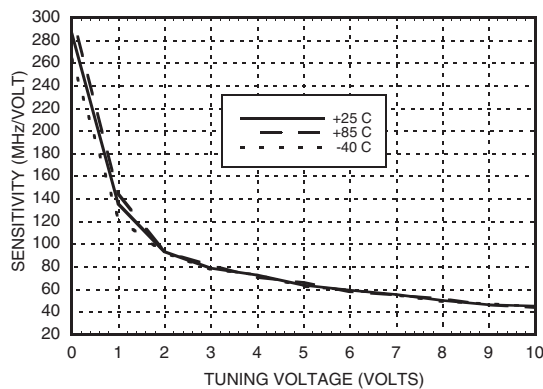
Frequency vs. Tuning Voltage, $T = 25^{\circ}\text{C}$



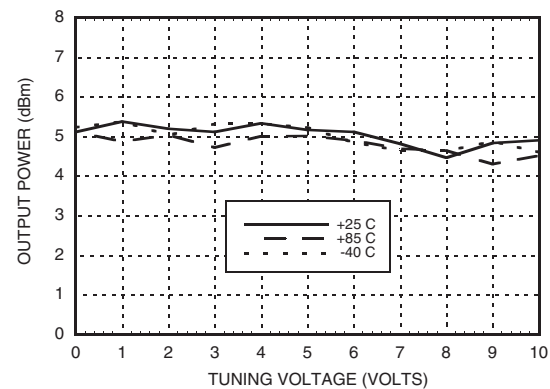
Frequency vs. Tuning Voltage, $V_{cc} = +3\text{V}$



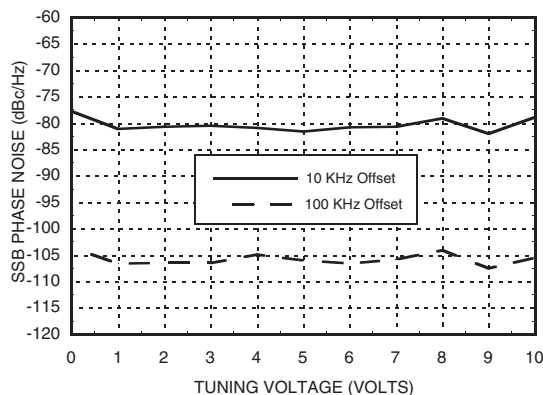
Sensitivity vs. Tuning Voltage, $V_{cc} = +3\text{V}$



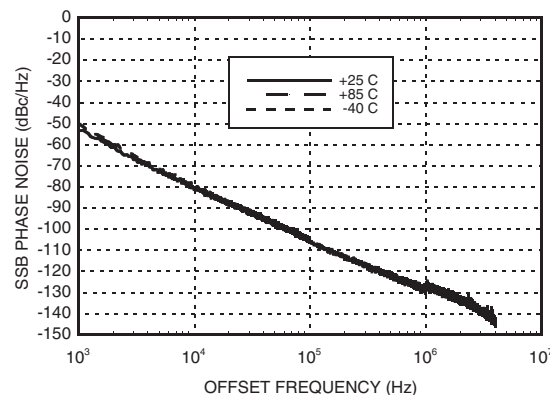
**Output Power vs.
Tuning Voltage, $V_{cc} = +3\text{V}$**



Phase Noise vs. Tuning Voltage



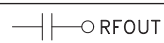
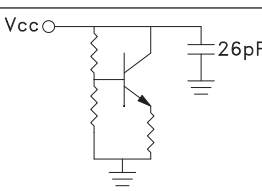
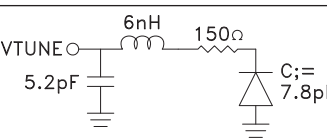
Typical SSB Phase Noise @ $V_{tune} = +5\text{V}$



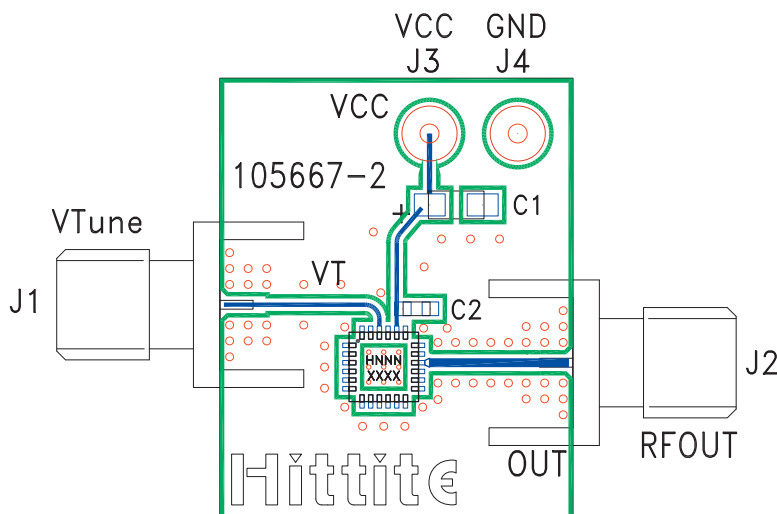
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VCOS - SMT

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1- 14, 17 - 19, 21, 23, 24	N/C	No Connection	
15	GND	This pin must be connected to RF & DC ground. Package bottom has an exposed metal paddle that must be RF & DC grounded.	
16	RFOUT	RF output (AC coupled)	
20	Vcc	Supply Voltage Vcc= 3V	
22	VTUNE	Control Voltage Input. Modulation port bandwidth dependent on drive source impedance.	

Evaluation PCB



List of Materials for Evaluation PCB 105706 ^[1]

Item	Description
J1 - J2	PCB Mount SMA RF Connector
J3 - J4	DC Pin
C1	4.7 μ F Tantalum Capacitor
C2	10,000 pF Capacitor, 0603 Pkg.
U1	HMC391LP4 / HMC391LP4E VCO
PCB ^[2]	105667 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 exposed 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.