# HMC390LP4 / 390LP4E

v02.0505

## MMIC VCO w/ BUFFER AMPLIFIER, 3.55 - 3.9 GHz

### Typical Applications

Low noise MMIC VCO w/Buffer Amplifier for:

- Wireless Local Loop (WLL)
- VSAT & Microwave Radio
- Test Equipment & Industrial Controls
- Military

### Features

Pout: +4.7 dBm

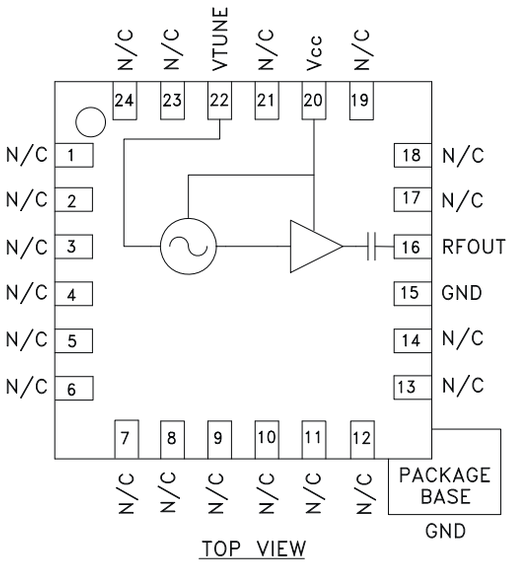
Phase Noise: -112 dBc/Hz @100 KHz

No External Resonator Needed

Single Supply: 3V @ 42 mA

QFN Leadless SMT Package, 16 mm²

### Functional Diagram



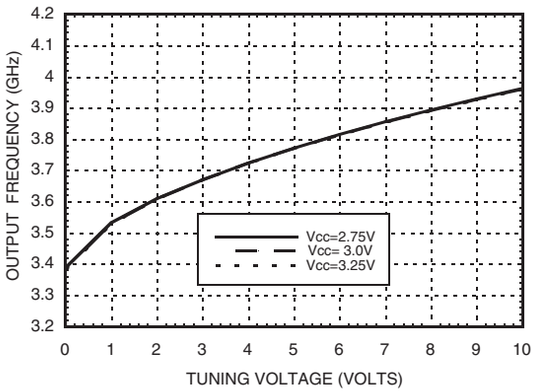

### General Description

The HMC390LP4 & HMC390LP4E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCOs with integrated resonators, negative resistance devices, varactor diodes, and buffer amplifiers. Covering 3.55 to 3.9 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 4.7 dBm typical from a single supply of 3V @ 42 mA. The voltage controlled oscillator is packaged in a low cost leadless QFN 4 x 4 mm surface mount package.

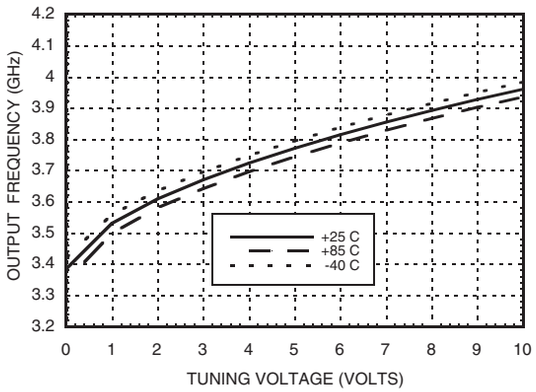
### Electrical Specifications, $T_A$ = +25° C, Vcc = +3V

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Frequency Range | | 3.55 - 3.9 | | GHz |
| Power Output | 1.5 | 4.7 | | dBm |
| SSB Phase Noise @ 100 kHz Offset, Vtune= +5V @ RF Output | | -112 | | dBc/Hz |
| Tune Voltage (Vtune) | 0 | | 10 | V |
| Supply Current (Icc) (Vcc = +3.0V) | | 42 | | mA |
| Tune Port Leakage Current | | | 10 | µA |
| Output Return Loss | | 6 | | dB |
| Harmonics<br>2nd<br>3rd | | <br>5<br>16 | | <br>dBc<br>dBc |
| Pulling (into a 2.0:1 VSWR) | | 3.3 | | MHz pp |
| Pushing @ Vtune= +5V | | -5 | | MHz/V |
| Frequency Drift Rate | | 0.4 | | MHz/°C |

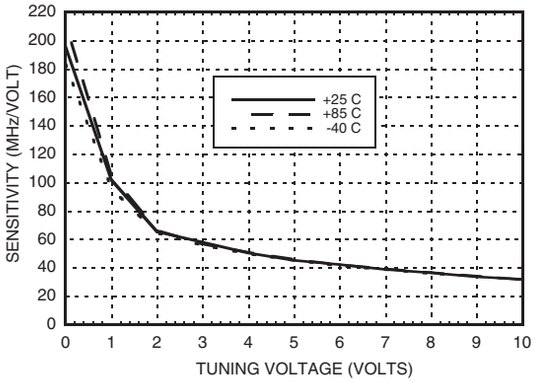
### Frequency vs. Tuning Voltage, T= 25°C



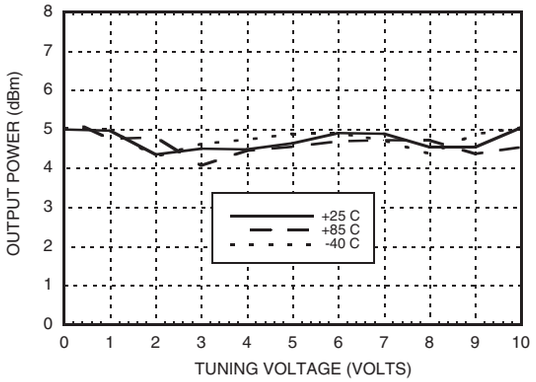

### Frequency vs. Tuning Voltage, Vcc= +3V



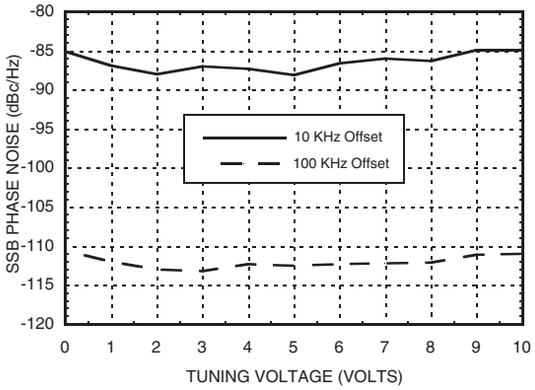

### Sensitivity vs. Tuning Voltage, Vcc= +3V



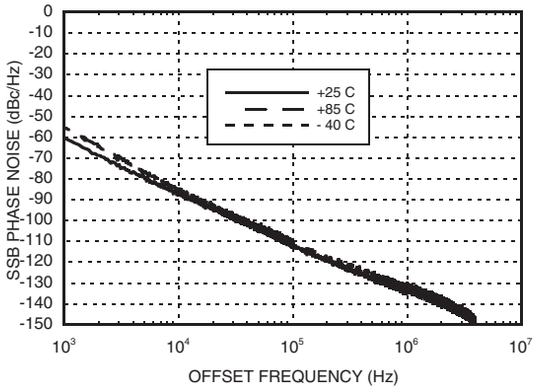

### Output Power vs. Tuning Voltage, Vcc= +3V




### Phase Noise vs. Tuning Voltage




### Typical SSB Phase Noise @ Vtune= +5V



## Absolute Maximum Ratings

| | |
|---|---|
| Vcc | +3.5 Vdc |
| Vtune | 0 to +11V |
| Channel Temperature | 135 °C |
| Continuous Pdiss (T = 85°C) (derate 6.28 mW/°C above 85°C) | 565 W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

## Typical Supply Current vs. Vcc

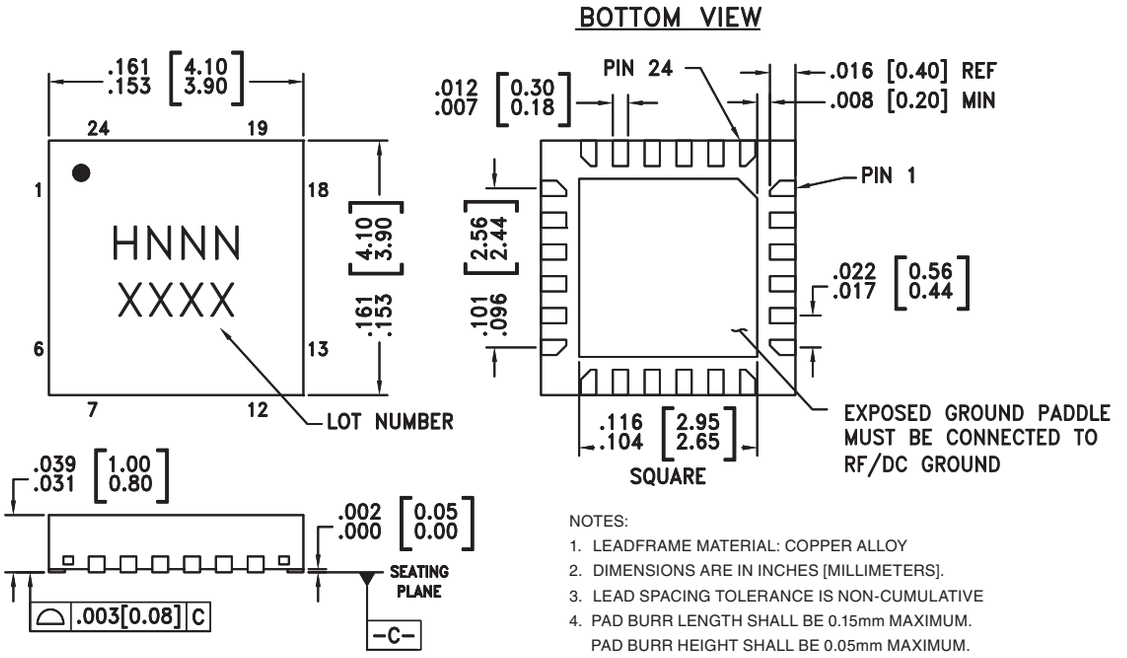
| Vcc (V) | Icc (mA) |
|---|---|
| 2.75 | 35 |
| 3.0 | 42 |
| 3.25 | 47 |

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

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS



## Outline Drawing




NOTES:

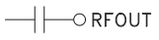
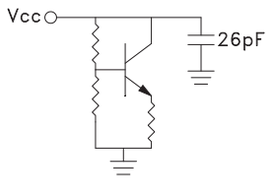
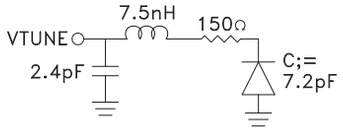
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN

## Package Information

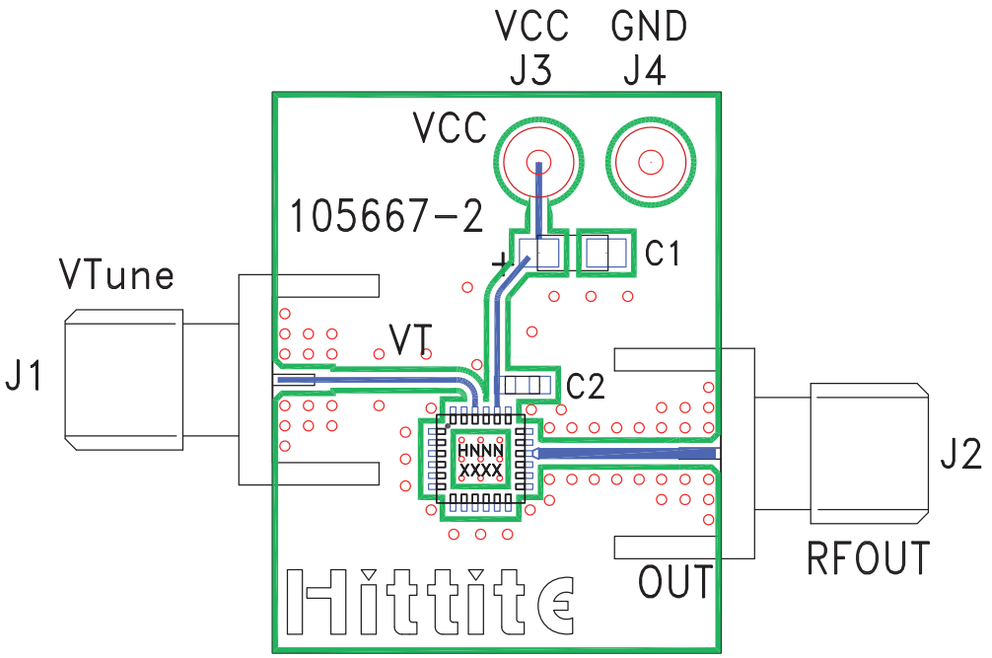
| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [3] |
|---|---|---|---|---|
| HMC390LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 [1] | H390<br>XXXX |
| HMC390LP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | H390<br>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- 14, 17 - 19, 21, 23, 24 | N/C | No Connection | |
| 15 | GND | This pin must be connected to RF & DC ground. |   |
| 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. |   |
| | GND | Package bottom has an exposed metal paddle that must be RF & DC grounded. |   |

### 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 µF Tantalum Capacitor |
| C2 | 10,000 pF Capacitor, 0603 Pkg. |
| U1 | HMC390LP4 / HMC390LP4E VCO |
| PCB* | 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.

**Notes:**

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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**Офис по работе с юридическими лицами:**

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9