



# HMC506LP4 / 506LP4E

## MMIC VCO w/ BUFFER AMPLIFIER, 7.8 - 8.7 GHz

### Typical Applications

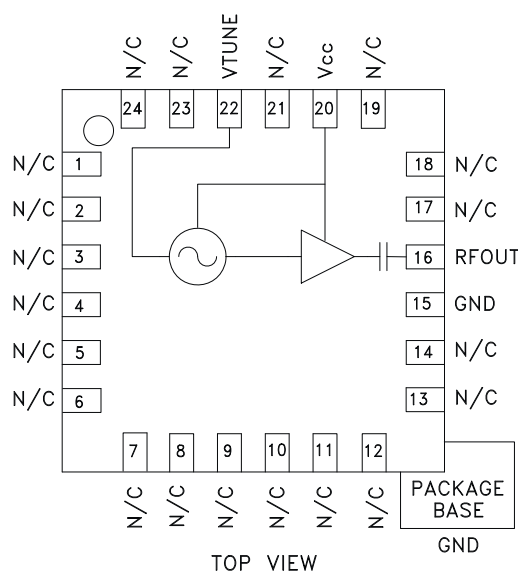
Low noise MMIC VCO w/Buffer Amplifier for:

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

### Features

- Pout: +14 dBm
- Phase Noise: -103 dBc/Hz @100 KHz
- No External Resonator Needed
- Single Supply: +3V @ 77 mA
- QFN Leadless SMT Package, 16 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC506LP4 & HMC506LP4E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCOs with integrated resonators, negative resistance devices, varactor diodes, and buffer amplifiers. Covering 7.8 to 8.7 GHz, the VCO's phase noise performance is excellent over temperature, shock and vibration due to the oscillator's monolithic structure. Power output is +14 dBm typical from a single supply of +3.0V @ 77 mA. The voltage controlled oscillator is packaged in a leadless QFN 4 x 4 mm surface mount package.

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

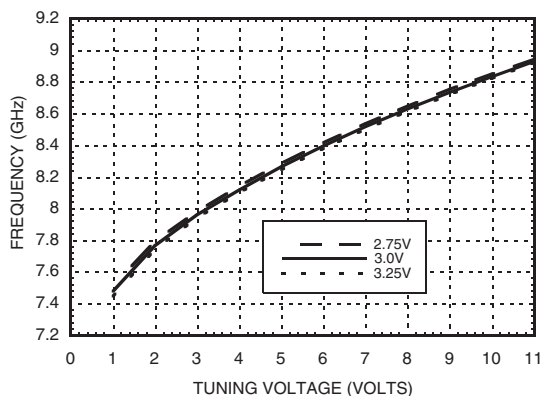
| Parameter                                                      | Min. | Typ.      | Max. | Units           |
|----------------------------------------------------------------|------|-----------|------|-----------------|
| Frequency Range                                                |      | 7.8 - 8.7 |      | GHz             |
| Power Output                                                   | 11.0 | 14.0      |      | dBm             |
| SSB Phase Noise @ 100 kHz Offset, $V_{tune} = +5V$ @ RF Output |      | -103      |      | dBc/Hz          |
| Tune Voltage ( $V_{tune}$ )                                    | 1    |           | 11   | V               |
| Supply Current ( $I_{CC}$ ) ( $V_{CC} = +3.0V$ )               |      | 77        |      | mA              |
| Tune Port Leakage Current                                      |      |           | 10   | $\mu A$         |
| Output Return Loss                                             |      | 7         |      | dB              |
| Harmonics                                                      |      |           |      |                 |
| 2nd                                                            |      | -16       |      | dBc             |
| 3rd                                                            |      | -28       |      | dBc             |
| Pulling (into a 2.0:1 VSWR)                                    |      | 28        |      | MHz pp          |
| Pushing @ $V_{tune} = +5V$                                     |      | 78        |      | MHz/V           |
| Frequency Drift Rate                                           |      | 0.85      |      | MHz/ $^\circ C$ |



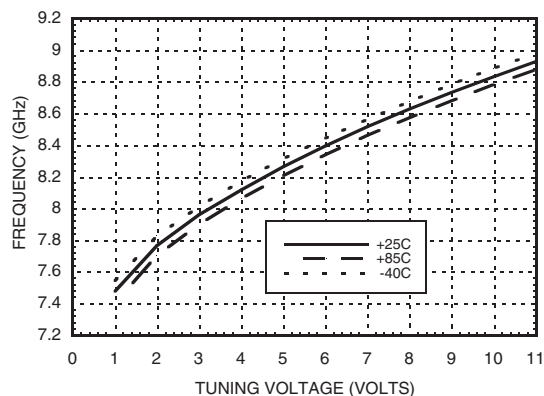
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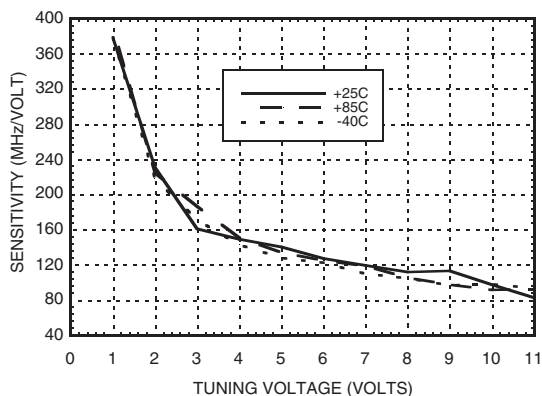
**Frequency vs. Tuning Voltage,  $T = 25^{\circ}\text{C}$**



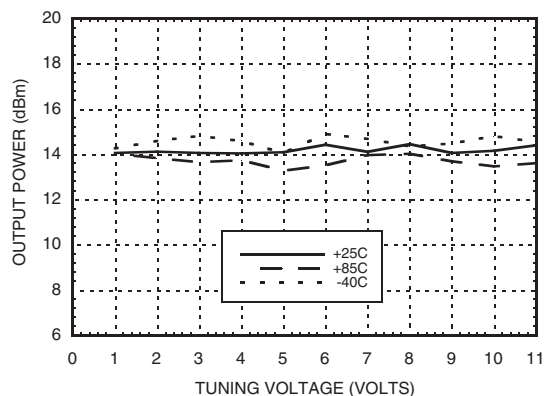
**Frequency vs. Tuning Voltage,  $V_{cc} = +3\text{V}$**



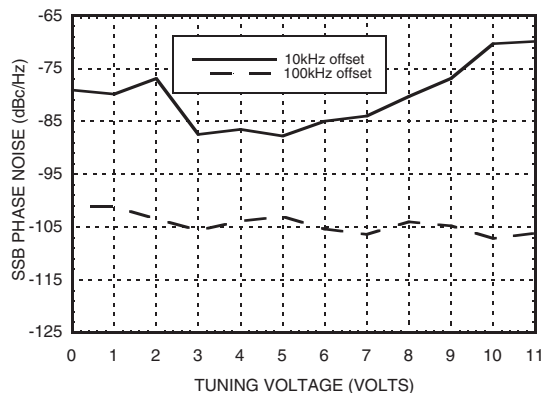
**Sensitivity vs. Tuning Voltage,  $V_{cc} = +3\text{V}$**



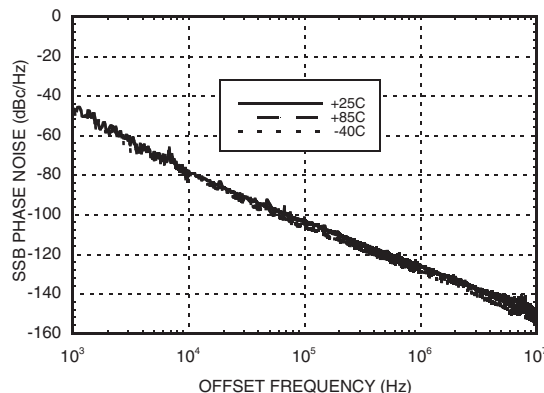
**Output Power vs.  
Tuning Voltage,  $V_{cc} = +3\text{V}$**



**Phase Noise vs. Tuning Voltage**



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





# HMC506LP4 / 506LP4E

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AMPLIFIER, 7.8 - 8.7 GHz**

### Typical Supply Current vs. Vcc

|                                                                           |                |
|---------------------------------------------------------------------------|----------------|
| Vcc                                                                       | +3.5 Vdc       |
| Vtune                                                                     | 0 to +11V      |
| Channel Temperature                                                       | 135 °C         |
| Continuous P <sub>diss</sub> (T = 85°C)<br>(derate 6.07 mW/°C above 85°C) | 303 mW         |
| Thermal Resistance<br>(junction to ground paddle)                         | 165 °C/W       |
| Storage Temperature                                                       | -65 to +150 °C |
| Operating Temperature                                                     | -40 to +85 °C  |

| V <sub>CC</sub> (V) | I <sub>CC</sub> (mA) |
|---------------------|----------------------|
| 2.75                | 66                   |
| 3.0                 | 77                   |
| 3.25                | 88                   |

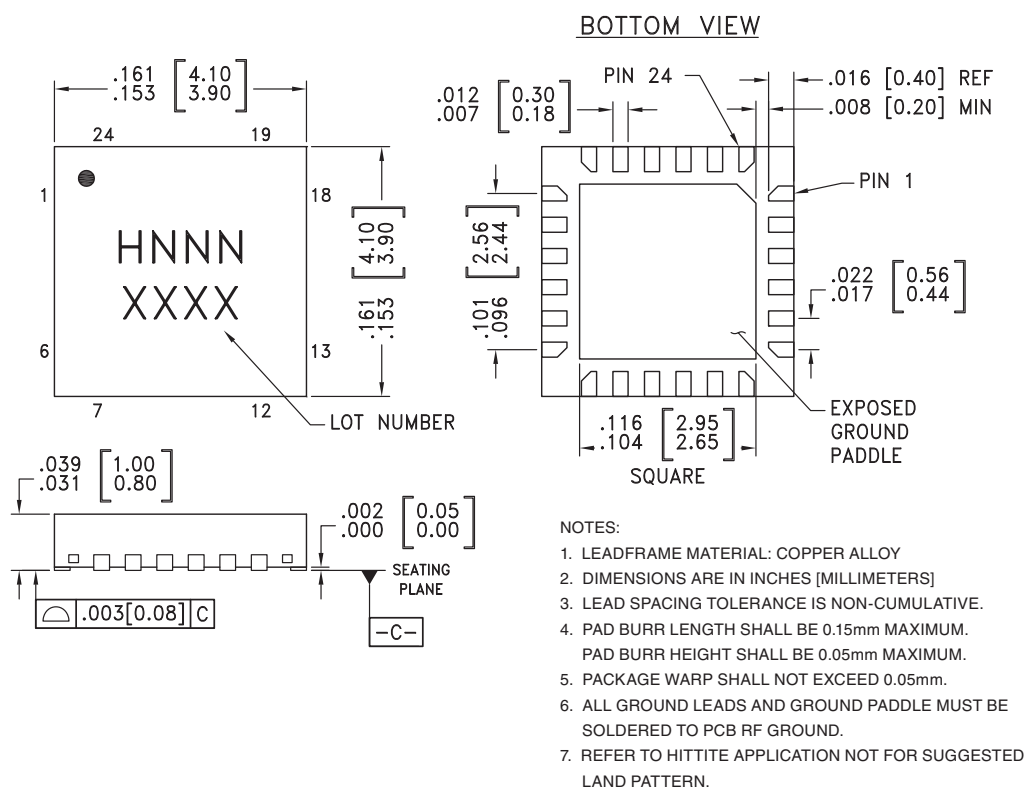
*Note: VCO will operate over full voltage range shown above.*



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

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## Outline Drawing



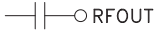
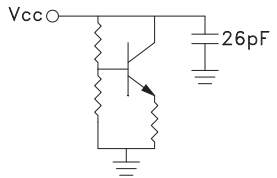
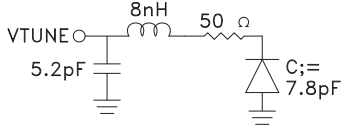
## Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC506LP4   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H506<br>XXXX                   |
| HMC506LP4E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | <u>H506</u><br>XXXX            |

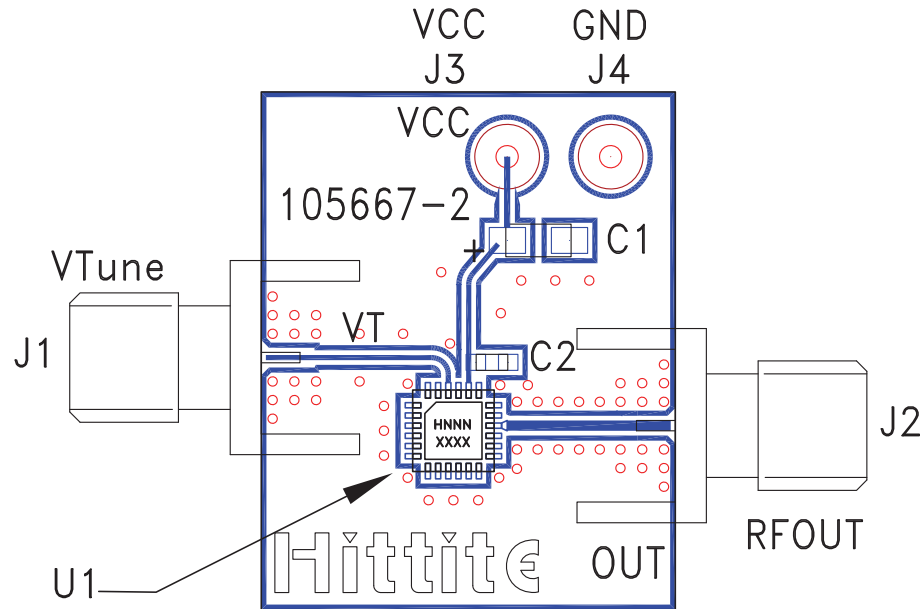
[3] 4-Digit lot number XXXX

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### Pin Descriptions

| Pin Number                    | Function | Description                                                                           | Interface Schematic                                                                   |
|-------------------------------|----------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1- 14, 17 - 19,<br>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 <sup>[1]</sup>**

| Item               | Description                    |
|--------------------|--------------------------------|
| J1 - J2            | PCB Mount SMA RF Connector     |
| J3 - J4            | DC Pin                         |
| C1                 | 4.7 $\mu$ F Tantalum Capacitor |
| C2                 | 10,000 pF Capacitor, 0603 Pkg. |
| U1                 | HMC506LP4 / HMC506LP4E VCO     |
| PCB <sup>[2]</sup> | 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:**

## HMC506LP4 / 506LP4E

v01.0805

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AMPLIFIER, 7.8 - 8.7 GHz**

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VCOs & PLOs - SMT

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