**ANALOG DEVICES**

# HMC506LP4 / 506LP4E

v01.0805

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

RoHS✓
EARTH FRIENDLY

## Typical Applications

Low noise MMIC VCO w/Buffer Amplifier for:

• VSAT Radio

• Point to Point/Multipoint Radio

• Test Equipment & Industrial Controls
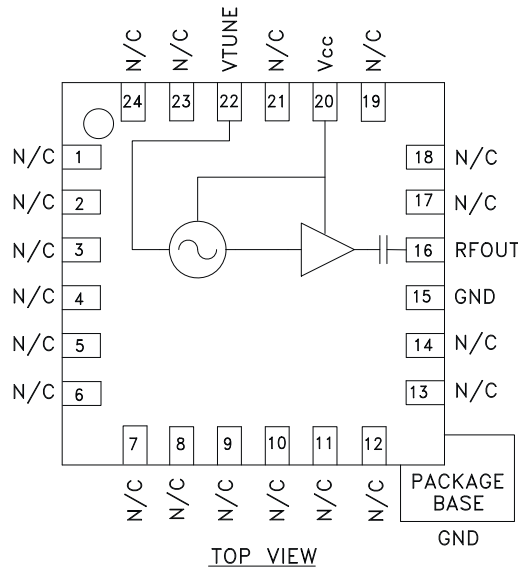
• Military End-Use

## 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$^2$

## Functional Diagram



TOP VIEW

## 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° C, Vcc = +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, Vtune= +5V @ RF Output | | -103 | | dBc/Hz |
| Tune Voltage (Vtune) | 1 | | 11 | V |
| Supply Current (Icc) (Vcc = +3.0V) | | 77 | | mA |
| Tune Port Leakage Current | | | 10 | µA |
| Output Return Loss | | 7 | | dB |
| Harmonics<br>2nd<br>3rd | | -16<br>-28 | | dBc<br>dBc |
| Pulling (into a 2.0:1 VSWR) | | 28 | | MHz pp |
| Pushing @ Vtune= +5V | | 78 | | MHz/V |
| Frequency Drift Rate | | 0.85 | | MHz/°C |

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

# HMC506* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- HMC506LP4 Evaluation Board

## DOCUMENTATION

**Application Notes**

- Determining the FM Bandwidth of a Wideband Varactor Tuned VCO

**Data Sheet**

- HMC506 Data Sheet

## REFERENCE MATERIALS

**Quality Documentation**

- Package/Assembly Qualification Test Report: LP4, LP4B, LP4C, LP4K (QTR: 2013-00487 REV: 04)
- Package/Assembly Qualification Test Report: Plastic Encapsulated QFN (QTR: 05006 REV: 02)
- Semiconductor Qualification Test Report: GaAs HBT-A (QTR: 2013-00228)

## DESIGN RESOURCES

- HMC506 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

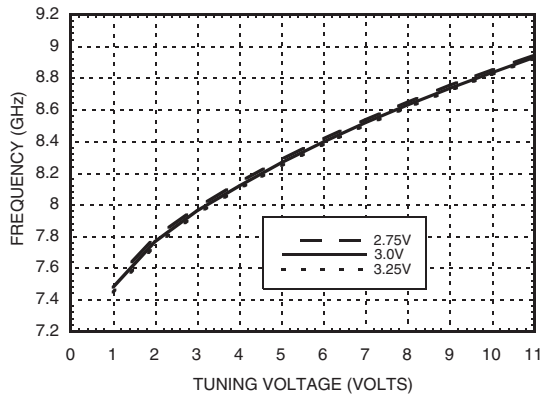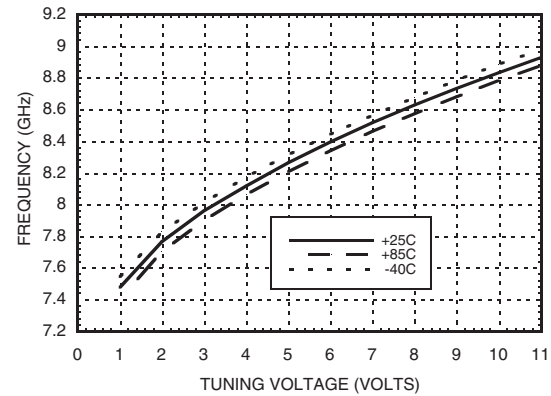View all HMC506 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

## TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

## DOCUMENT FEEDBACK

Submit feedback for this data sheet.

**ANALOG DEVICES**

RoHS✓
E
EARTH FRIENDLY

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

**VCOs & PLOs - SMT**

11

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



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



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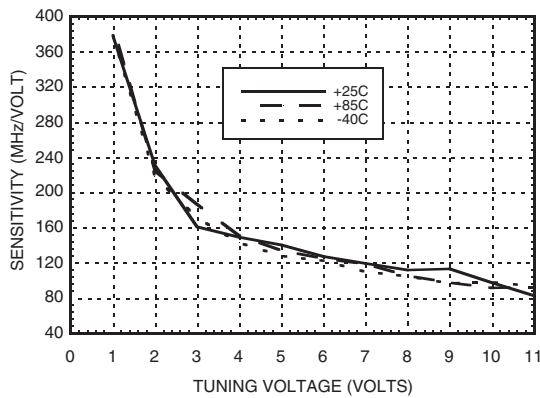


## Output Power vs. Tuning Voltage, Vcc= +3V
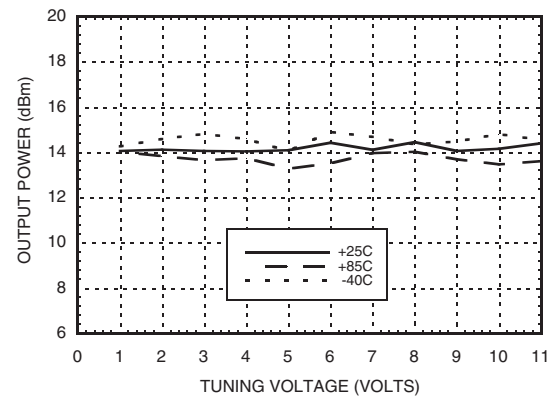


## Phase Noise vs. Tuning Voltage
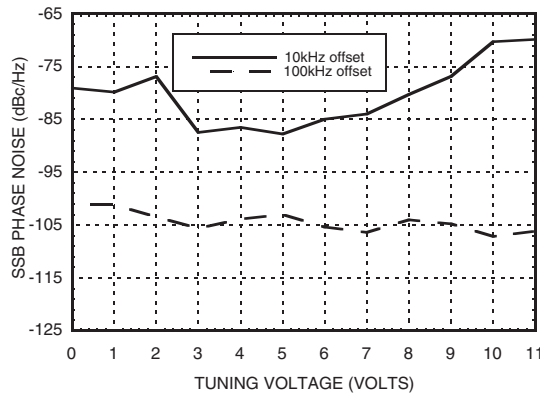


## Typical SSB Phase Noise @ Vtune= +5V
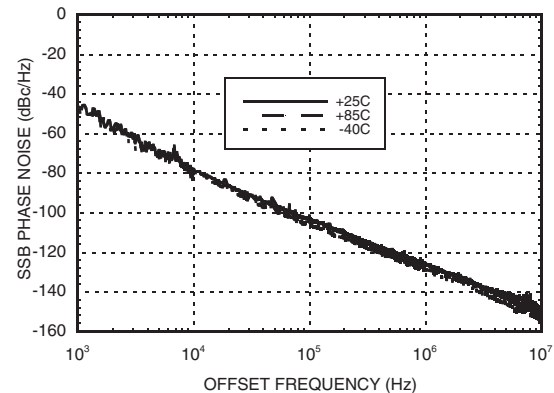
## MMIC VCO w/ BUFFER AMPLIFIER, 7.8 - 8.7 GHz

### Absolute Maximum Ratings

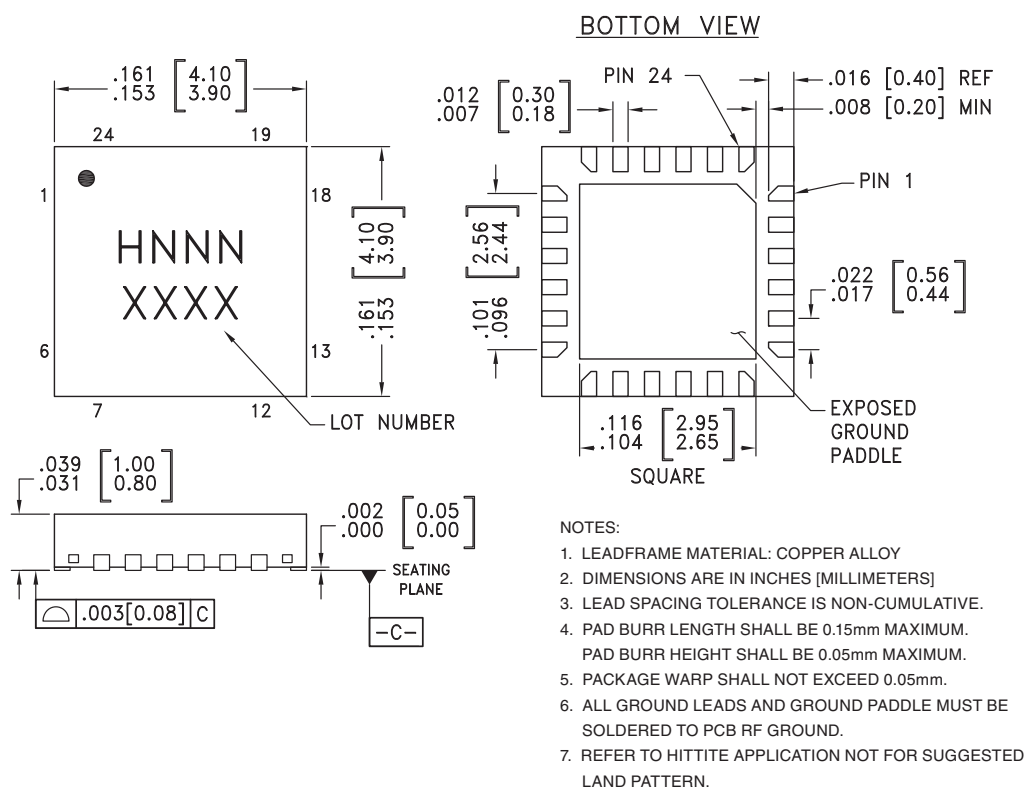| | |
|---|---|
| Vcc | +3.5 Vdc |
| Vtune | 0 to +11V |
| Channel Temperature | 135 °C |
| Continuous Pdiss (T = 85°C) (derate 6.07 mW/°C above 85°C) | 303 mW |
| Thermal Resistance (junction to ground paddle) | 165 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85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

### Typical Supply Current vs. Vcc

| Vcc (V) | Icc (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

### Outline Drawing



BOTTOM VIEW

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 NOT FOR SUGGESTED LAND PATTERN.

### Package Information

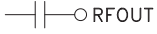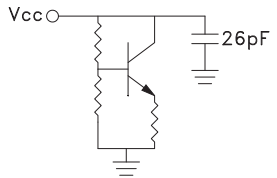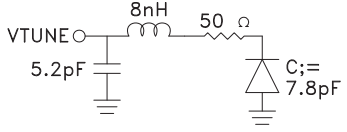| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [3] |
|---|---|---|---|---|
| HMC506LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 [1] | H506 XXXX |
| HMC506LP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | H506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

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

**ANALOG DEVICES**
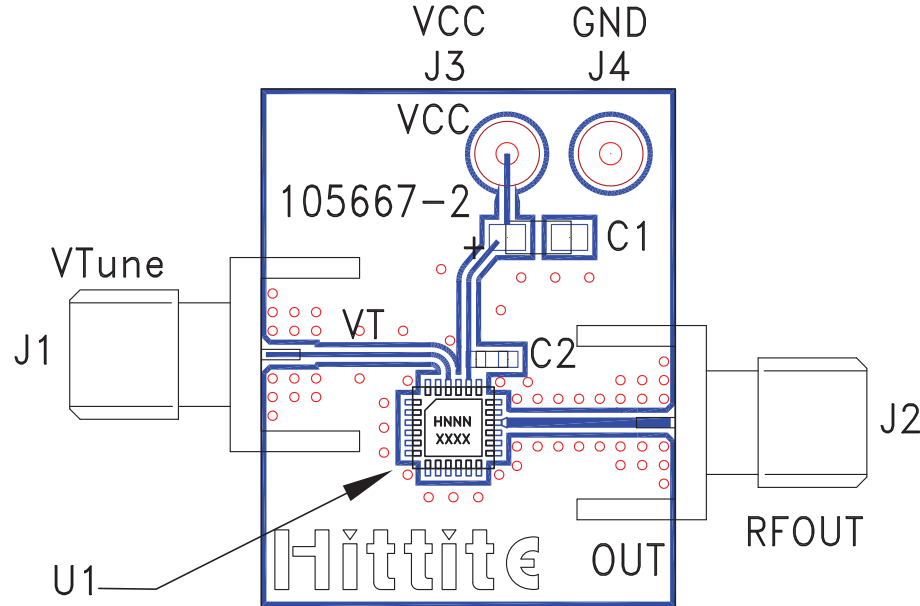
RoHS ✓
E
EARTH FRIENDLY

## 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. | GND |
| 16 | RFOUT | RF output (AC coupled) | RFOUT |
| 20 | Vcc | Supply Voltage Vcc= 3V | Vcc  26pF |
| 22 | VTUNE | Control Voltage Input. Modulation port bandwidth dependent on drive source impedance. | VTUNE  8nH  50 Ω  5.2pF  C;= 7.8pF |
| | GND | Package bottom has an exposed metal paddle that must be RF & DC grounded. | GND |

11

VCOs & PLOs - SMT

**ANALOG
DEVICES**

RoHS ✓
E
EARTH FRIENDLY

*VCOs & PLOs - SMT*

**11**

*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 | HMC506LP4 / HMC506LP4E 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.

*Notes:*

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