

## WIDEBAND MMIC VCO WITH BUFFER AMPLIFIER

### 6 - 12 GHz

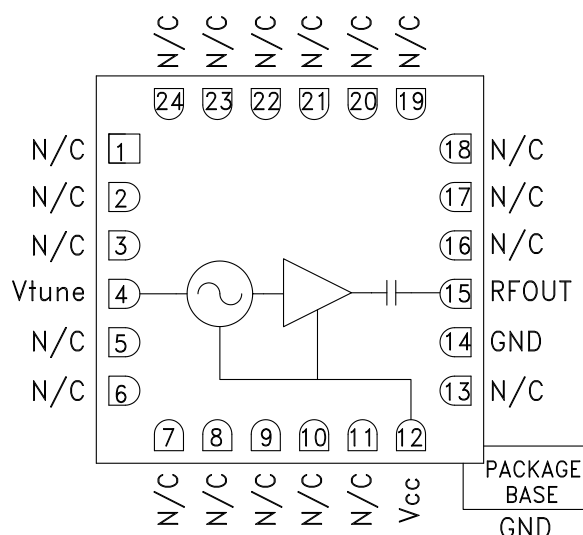


### Typical Applications

Low Noise wideband MMIC VCO is ideal for:

- Industrial/Medical Equipment
- Test & Measurement Equipment
- Military Radar, EW & ECM

### Functional Diagram



### Features

Wide Tuning Bandwidth

Pout: +1 dBm

Low SSB Phase Noise: -95 dBc/Hz @100 kHz

No External Resonator Needed

Single Positive Supply: +5V @ 57 mA

24 Lead Ceramic 4x4 mm SMT Package: 16 mm<sup>2</sup>

### General Description

The HMC732LC4B is a wideband MMIC Voltage Controlled Oscillator which incorporates the resonator, negative resistance device, and varactor diode. Output power and phase noise performance are excellent over temperature due to the oscillator's monolithic construction. The Vtune port accepts an analog tuning voltage from 0 to +23V. The HMC732LC4B VCO operates from a single +5V supply, consumes only 57 mA of current, and is housed in a RoHS compliant SMT package. This wideband VCO uniquely combines the attributes of ultra small size, low phase noise, low power consumption, and wide tuning range.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{CC} = +5\text{V}$ [1]

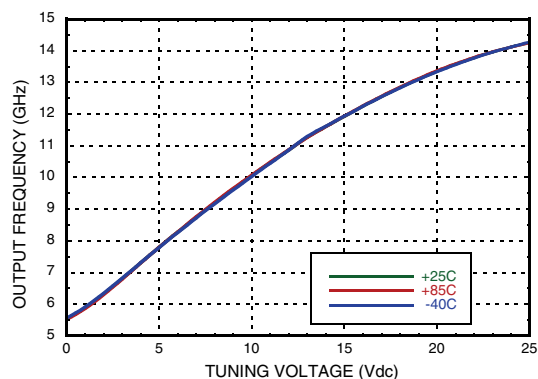
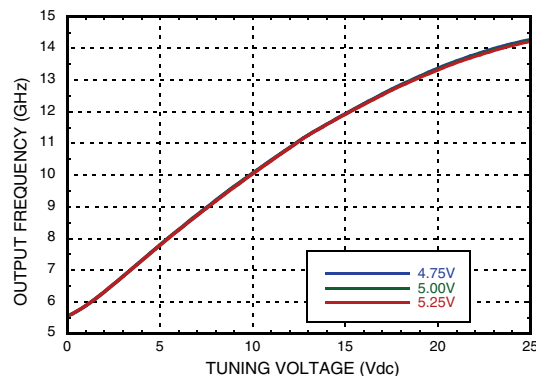
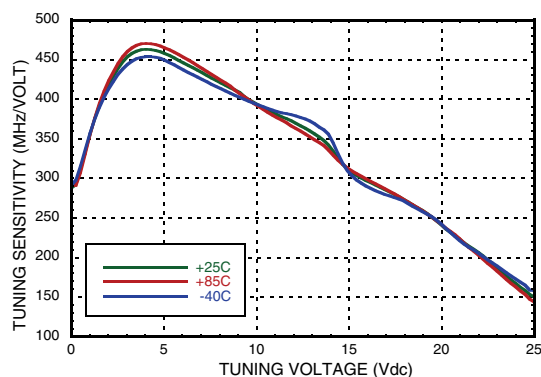
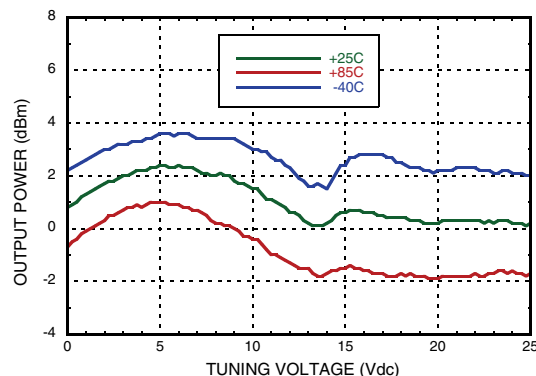
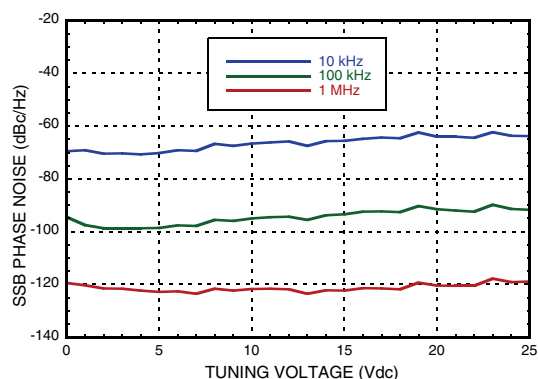
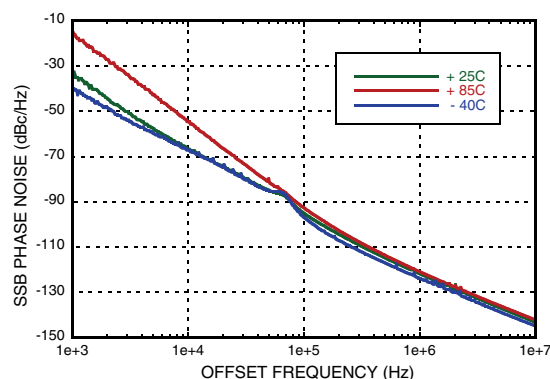
| Parameter                                | Min.   | Typ. | Max. | Units  |
|------------------------------------------|--------|------|------|--------|
| Frequency Range                          | 6 - 12 |      |      | GHz    |
| Power Output                             |        | 1    |      | dBm    |
| SSB Phase Noise @ 10 kHz Offset          |        | -65  |      | dBc/Hz |
| SSB Phase Noise @ 100 kHz Offset         |        | -95  |      | dBc/Hz |
| Tune Voltage (Vtune)                     | 0      |      | 23   | V      |
| Supply Current (Icc) (Vcc = +5V)         |        | 57   |      | mA     |
| Tune Port Leakage Current (Vtune = +23V) |        | 10   |      | μA     |
| Output Return Loss                       |        | 15   |      | dB     |
| 2nd Harmonic                             |        | -12  |      | dBc    |
| Pulling (into a 2.0:1 VSWR)              |        | 7    |      | MHz pp |
| Pushing @ Vtune = +20V, F = 12 GHz       |        | -85  |      | MHz/V  |
| Frequency Drift Rate @ 6 GHz             |        | 0.4  |      | MHz/°C |
| Frequency Drift Rate @ 12 GHz            |        | 0.25 |      | MHz/°C |

[1] A load VSWR of  $\leq 2.0:1$ , across the frequency range of 0.01-14 GHz, is required for proper operation.

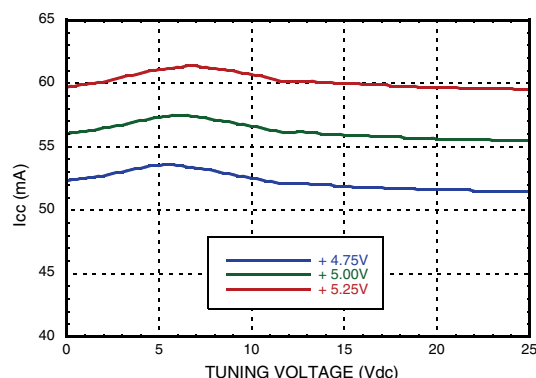
# HMC732LC4B

## WIDEBAND MMIC VCO WITH BUFFER AMPLIFIER

### 6 - 12 GHz

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

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

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

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

**SSB Phase Noise vs. Tuning Voltage**

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


**WIDEBAND MMIC VCO WITH BUFFER AMPLIFIER**  
**6 - 12 GHz**

**Supply Current vs. Vcc, T = 25 °C**

**Absolute Maximum Ratings**

|                       |                   |
|-----------------------|-------------------|
| Vcc                   | +5.5 V            |
| Vtune                 | -1 to +25V        |
| Storage Temperature   | -65 °C to +150 °C |
| ESD Sensitivity (HBM) | Class 1A          |

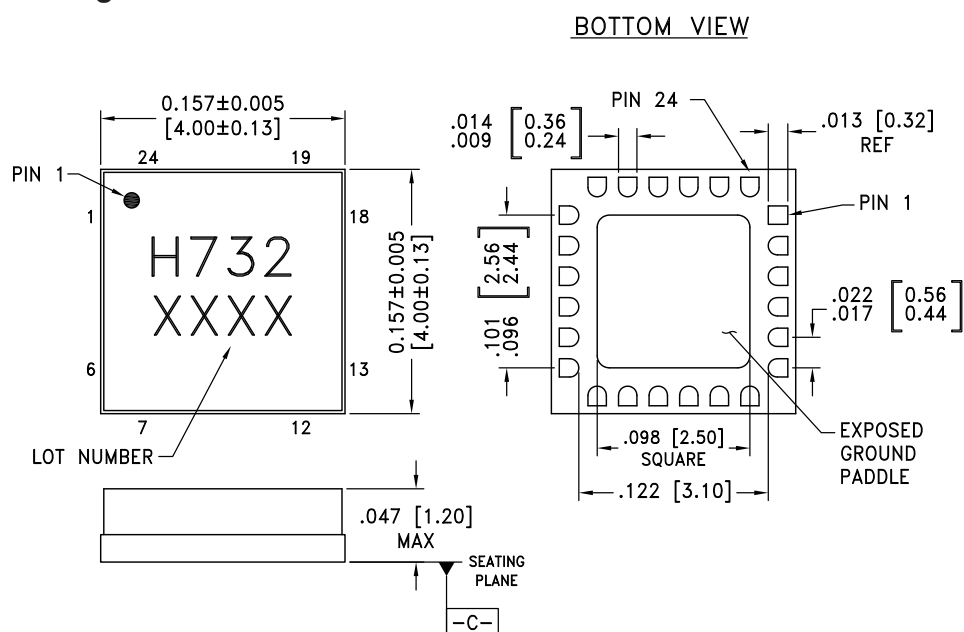
**Reliability Information**

|                                                           |                   |
|-----------------------------------------------------------|-------------------|
| Junction Temperature To Maintain<br>1 Million Hour MTTF   | 135 °C            |
| Nominal Junction Temperature<br>(T = 85 °C)               | 110 °C            |
| Thermal Resistance<br>(Junction to GND paddle, 5V supply) | 91 °C/W           |
| Operating Temperature                                     | -40 °C to + 85 °C |



**ELECTROSTATIC SENSITIVE DEVICE**  
**OBSERVE HANDLING PRECAUTIONS**

**WIDEBAND MMIC VCO WITH BUFFER AMPLIFIER**  
**6 - 12 GHz**

**Outline Drawing**

**NOTES:**

1. PACKAGE BODY MATERIAL: ALUMINA
2. LEAD AND GROUND PADDLE PLATING: GOLD FLASH OVER NI.
3. DIMENSIONS ARE IN INCHES [MILLIMETERS].
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm DATUM -C-
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

**Package Information**

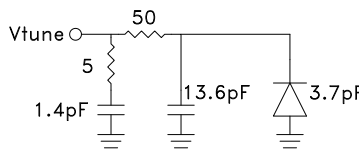
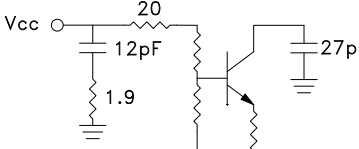
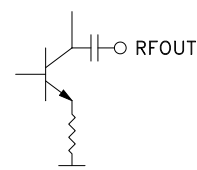
| Part Number | Package Body Material | Lead Finish      | MSL Rating          | Package Marking <sup>[2]</sup> |
|-------------|-----------------------|------------------|---------------------|--------------------------------|
| HMC732LC4B  | Alumina, White        | Gold over Nickel | MSL3 <sup>[1]</sup> | H732<br>XXXX                   |

[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

**WIDEBAND MMIC VCO WITH BUFFER AMPLIFIER**  
**6 - 12 GHz**

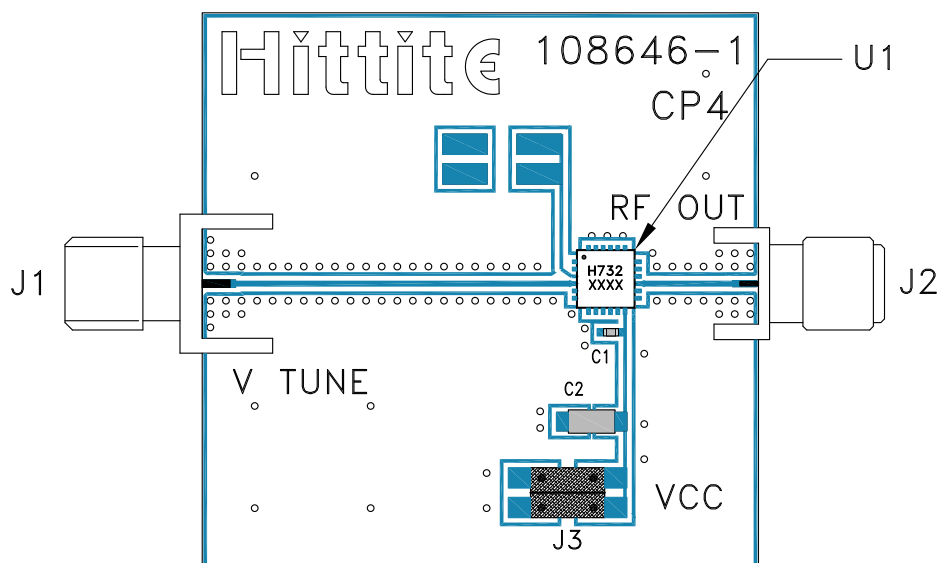
**Pin Descriptions**

| Pin Number                 | Function | Description                                                                                                                                                                           | Interface Schematic                                                                  |
|----------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1 - 3, 5 - 11, 13, 16 - 24 | N/C      | No Connection. These pins may be connected to RF/DC ground. Performance will not be affected.                                                                                         |                                                                                      |
| 4                          | Vtune    | Control Voltage and Modulation Input. Modulation bandwidth dependent on drive source impedance. See "Determining the FM Bandwidth of a Wideband Varactor Tuned VCO" application note. |   |
| 12                         | Vcc      | Supply Voltage Vcc= +5V                                                                                                                                                               |   |
| 14                         | GND      | Package bottom has an exposed metal paddle that must also be RF & DC grounded.                                                                                                        |   |
| 15                         | RFOUT    | RF output (AC coupled)<br>(A load VSWR of $\leq 2.0:1$ , across the frequency range of 0.01-14 GHz, is required for proper operation.)                                                |  |

## WIDEBAND MMIC VCO WITH BUFFER AMPLIFIER 6 - 12 GHz



### Evaluation PCB



### List of Materials for Evaluation PCB 108648 [1]

| Item    | Description                     |
|---------|---------------------------------|
| J1      | RF Connector, SMA               |
| J2      | RF Connector, SMA               |
| J3      | DC Header                       |
| C1      | 1000 pF Capacitor, 0402 Pkg.    |
| C2      | 4.7 $\mu$ F Capacitor, Tantalum |
| U1      | HMC732LC4B VCO                  |
| PCB [2] | 108646 Eval Board               |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR or Rogers 4350

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 exposed 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.