# HMC736LP4 / 736LP4E

v01.0209

## MMIC VCO w/ HALF FREQUENCY OUTPUT 14.5 - 15.0 GHz

### Typical Applications

The HMC736LP4(E) is ideal for:

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

### Features

Dual Output: Fo = 14.5 - 15.0 GHz
Fo/2 = 7.25 - 7.5 GHz

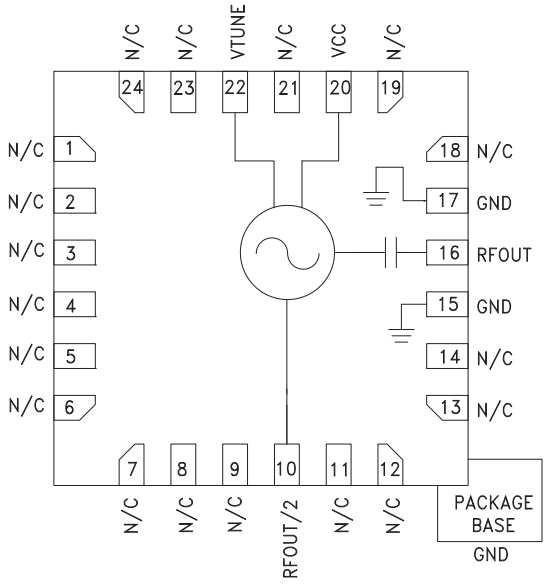
Pout: +9 dBm

Phase Noise: -105 dBc/Hz @ 100 kHz

No External Resonator Needed

24 Lead 4x4mm SMT Package: $16mm^2$

### Functional Diagram




### General Description

The HMC736LP4(E) is a GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCO. The HMC736LP4(E) integrates a resonator, negative resistance device, varactor diode and feature half frequency output. The VCO's phase noise performance is excellent over temperature, shock, and process due to the oscillator's monolithic structure. Power output is +9 dBm typical from a +4.2V supply voltage. The voltage controlled oscillator is packaged in a leadless QFN 4x4 mm surface mount package, and requires no external matching components.

### Electrical Specifications, $T_A$ = +25° C, Vcc = +4.2V

| Parameter | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Frequency Range | Fo<br>Fo/2 | | 14.5 - 15.0<br>7.25 - 7.5 | | GHz<br>GHz |
| Power Output | RFOUT<br>RFOUT/2 | 6<br>-8 | 9<br>-3 | 13<br>2 | dBm<br>dBm |
| SSB Phase Noise @ 100 kHz Offset, Vtune= +5V @ RFOUT | | | -105 | | dBc/Hz |
| Tune Voltage | Vtune | 1 | | 13 | V |
| Supply Current | | 120 | 150 | 180 | mA |
| Tune Port Leakage Current (Vtune= 13V) | | | | 10 | µA |
| Output Return Loss | | | 2.5 | | dB |
| Harmonics/Subharmonics | 1/2<br>3/2 | | -45<br>-42 | | dBc<br>dBc |
| Pulling (into a 2.0:1 VSWR) | | | 12 | | MHz pp |
| Pushing @ Vtune= 5V | | | 24 | | MHz/V |
| Frequency Drift Rate | | | 1.2 | | MHz/°C |



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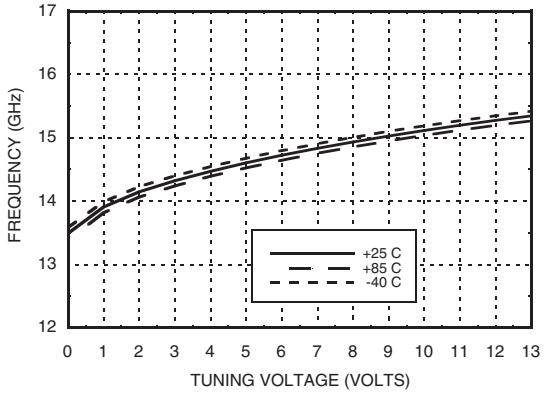
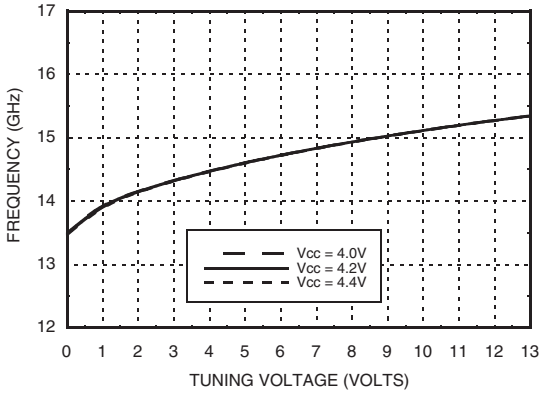
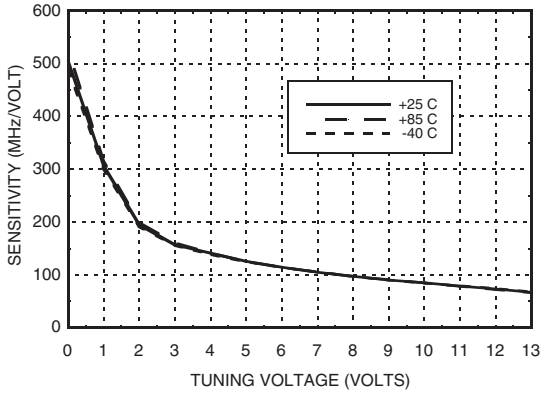
### Frequency vs. Tuning Voltage, Vcc = +4.2V



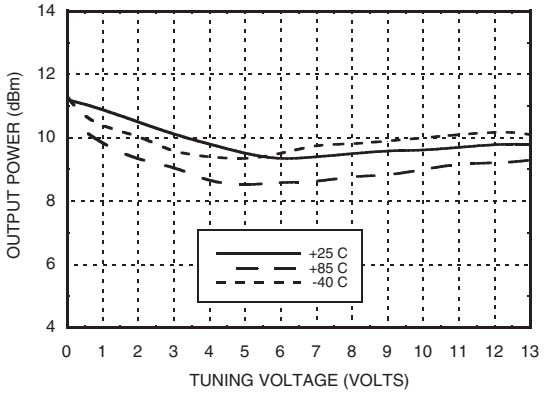

### Frequency vs. Tuning Voltage, T= 25°C



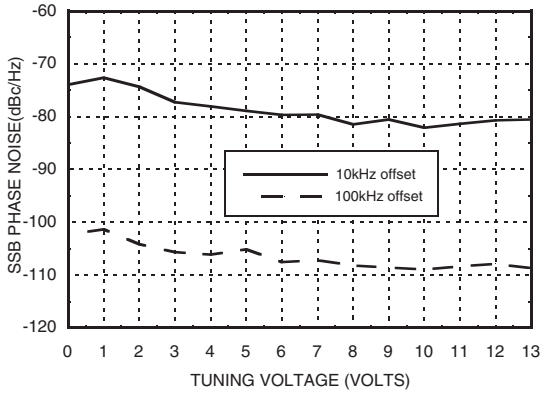

### Sensitivity vs. Tuning Voltage, Vcc = +4.2V



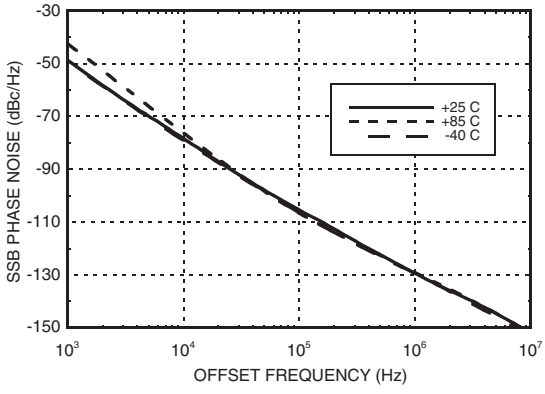

### Output Power vs. Tuning Voltage, Vcc = +4.2V




### SSB Phase Noise vs. Tuning Voltage




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





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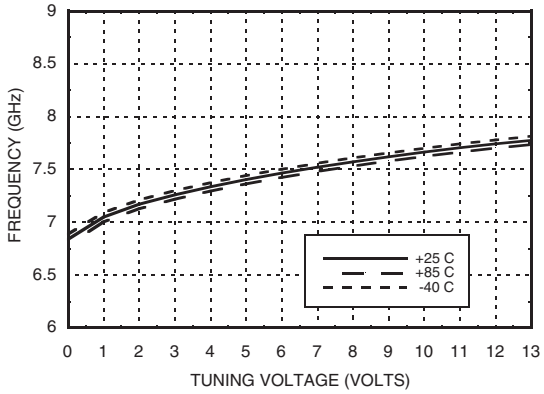
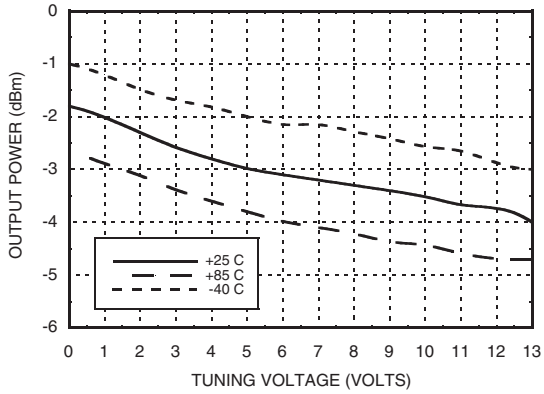
# MMIC VCO w/ HALF FREQUENCY OUTPUT 14.5 - 15.0 GHz

### RFOUT/2 Frequency vs. Tuning Voltage, Vcc = +4.2V




### RFOUT/2 Output Power vs. Tuning Voltage, Vcc = +4.2V




### Absolute Maximum Ratings

| | |
|---|---|
| Vcc | +5.5V |
| Vtune | 0 to 15V |
| Junction Temperature | 135 °C |
| Continuous Pdiss (T=85 °C) (derate 19.6 mW/C above 85 °C | 1 W |
| Thermal Resistance (junction to ground paddle) | 51 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

### Typical Supply Current vs. Vcc

| Vcc (V) | Icc (mA) |
|---|---|
| 4.0 | 140 |
| 4.2 | 150 |
| 4.4 | 160 |

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

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

### Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [3] |
|---|---|---|---|---|
| HMC736LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 [1] | H736<br>XXXX |
| HMC736LP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | H736<br>XXXX |

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





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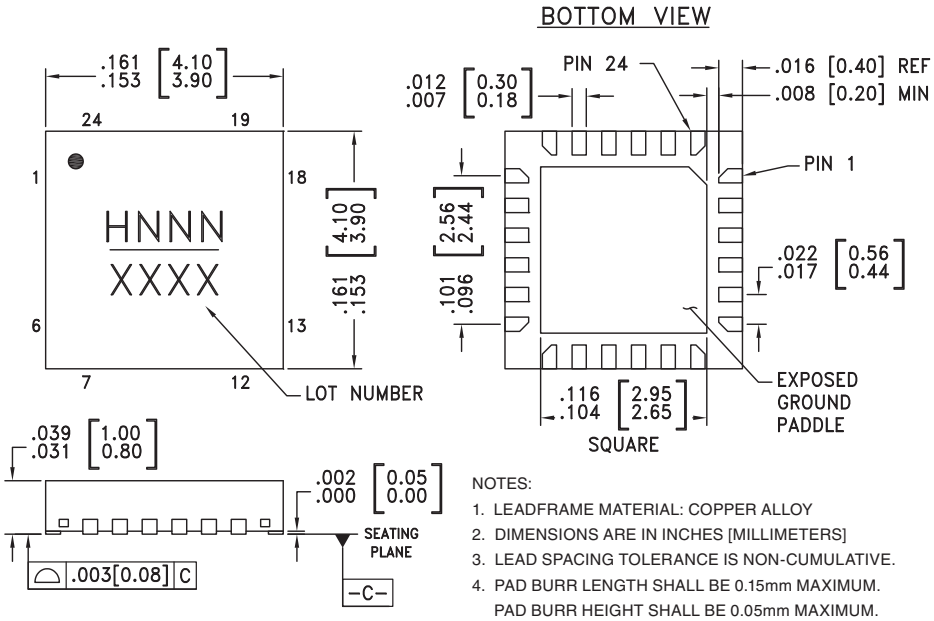
RoHS✓ EARTH FRIENDLY

## MMIC VCO w/ HALF FREQUENCY OUTPUT 14.5 - 15.0 GHz

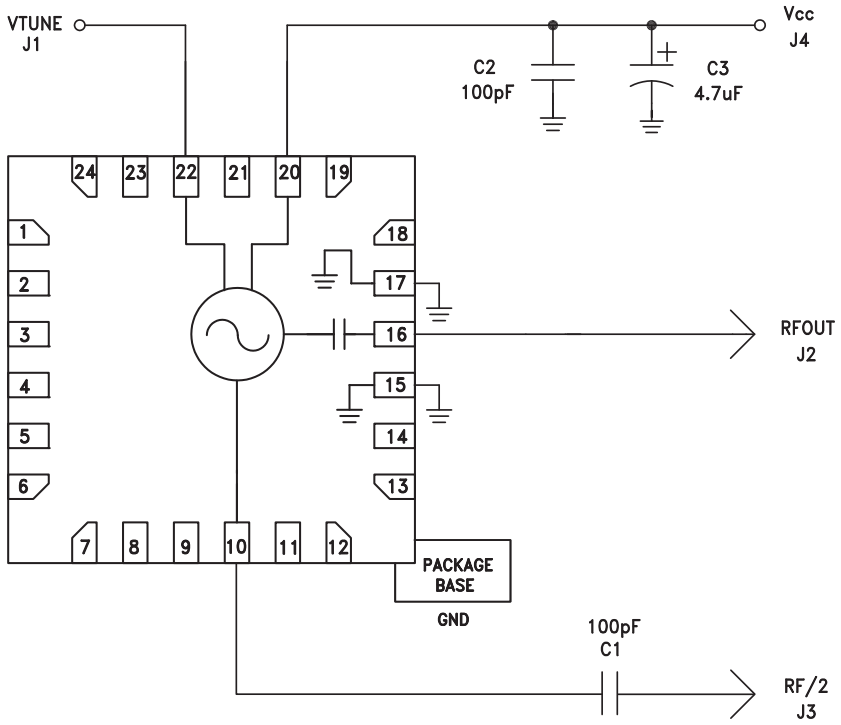
### Outline Drawing




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 SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

### Application Circuit



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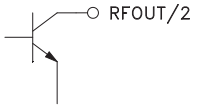
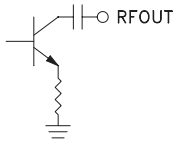
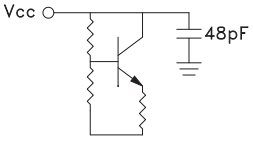
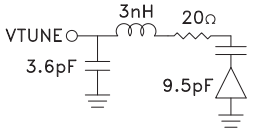
## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 - 9, 11 - 14, 18, 19, 21, 23, 24 | N/C | No Connection. These pins may be connected to RF/DC ground. Performance will not be affected. | |
| 10 | RFOUT/2 | Half frequency output (AC coupled). Requires external AC coupling capacitor. |   |
| 16 | RFOUT | RF output (AC coupled). |   |
| 20 | Vcc | Supply Voltage, +4.2V |   |
| 22 | 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. |   |
| 15, 17, Paddle | GND | Package bottom has an exposed metal paddle that must be connected to RF/DC ground. |   |





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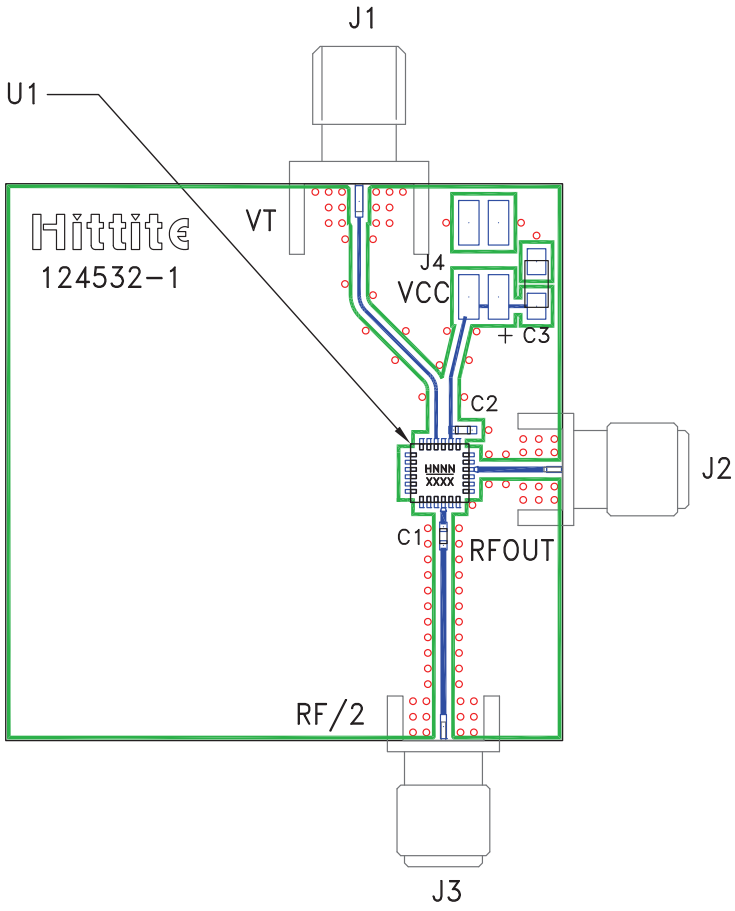
## Evaluation PCB




## List of Materials for Evaluation PCB 123987 [1]

| Item | Description |
|---|---|
| J1 - J3 | PCB Mount SMA RF Connector |
| J4 | 2 mm DC Header |
| C1, C2 | 100 pF Capacitor, 0402 Pkg. |
| C3 | 4.7 µF Tantalum Capacitor |
| U1 | HMC736LP4(E) VCO |
| PCB [2] | 124532 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 backside 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.





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