

# HMC739LP4 / 739LP4E

## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-16, 23.8 - 26.8 GHz

### Typical Applications

The HMC739LP4(E) is ideal for:

- Point-to-Point Radios
- Point-to-Multi-Point Radios / LMDS
- VSAT

### Features

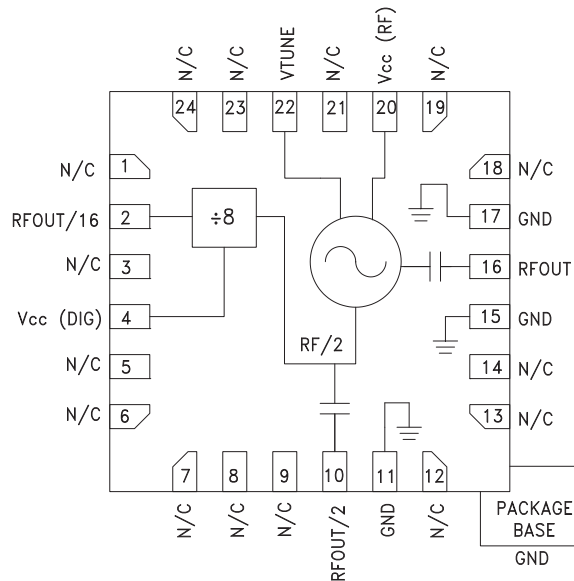
Pout: +8 dBm

Phase Noise: -93 dBc/Hz @ 100 kHz Typ.

No External Resonator Needed

24 Lead 4x4mm SMT Package: 16mm<sup>2</sup>

### Functional Diagram



### General Description

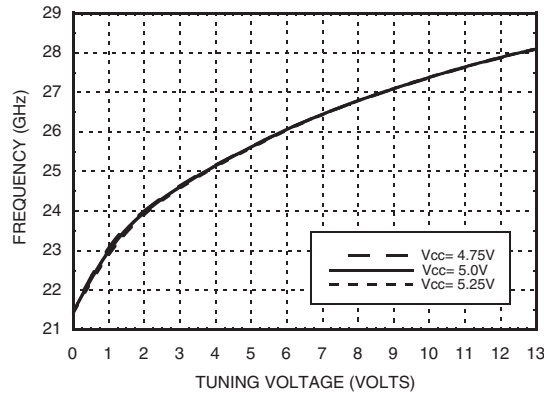
The HMC739LP4(E) is a GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCO. The HMC739LP4(E) integrates a resonator, negative resistance device, varactor diode and divide-by-16 prescaler. The VCO's phase noise performance is excellent over temperature, shock, and process due to the oscillator's monolithic structure. Power output is +8 dBm typical from a 5V supply voltage. The voltage controlled oscillator is packaged in a low cost leadless QFN 4x4 mm surface mount package

### Electrical Specifications, $T_A = +25^\circ \text{C}$ , $V_{cc}(\text{RF})$ , $V_{cc}(\text{DIG}) = +5\text{V}$

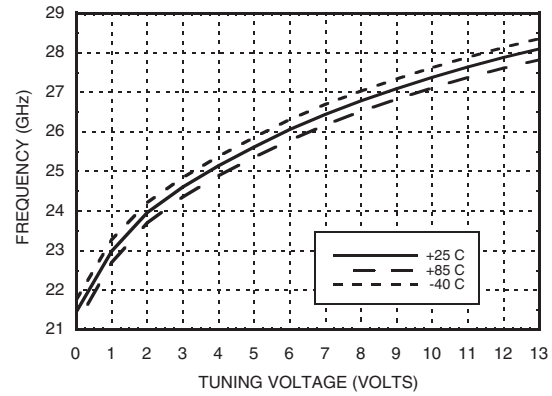
| Parameter                                                             | Min.          | Typ.       | Max.          | Units                 |
|-----------------------------------------------------------------------|---------------|------------|---------------|-----------------------|
| Frequency Range                                                       | 23.8 - 26.8   |            |               | GHz                   |
| Power Output                                                          | 3<br>-3<br>-7 |            | 14<br>5<br>-1 | dBm<br>dBm<br>dBm     |
| SSB Phase Noise @ 100 kHz Offset, $V_{tune} = +5\text{V}$ @ RF Output |               | -93        |               | dBc/Hz                |
| Tune Voltage                                                          | 1             |            | 13            | V                     |
| Supply Current                                                        | 160           | 200        | 220           | mA                    |
| Tune Port Leakage Current ( $V_{tune} = 13\text{V}$ )                 |               |            | 10            | $\mu\text{A}$         |
| Output Return Loss                                                    |               | 3          |               | dB                    |
| Harmonics/Subharmonics                                                | 1/2<br>3/2    | -20<br>-30 |               | dBc<br>dBc            |
| Pulling (into a 2.0:1 VSWR)                                           |               | 30         |               | MHz pp                |
| Pushing @ $V_{tune} = 5\text{V}$                                      |               | -65        |               | MHz/V                 |
| Frequency Drift Rate                                                  |               | 4          |               | MHz/ $^\circ\text{C}$ |

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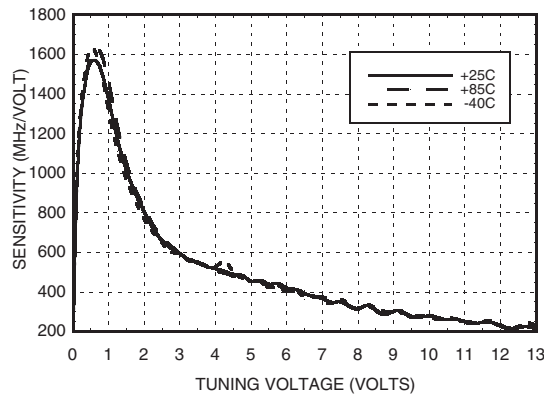
**Frequency vs. Tuning Voltage,  $T = 25^{\circ}\text{C}$**



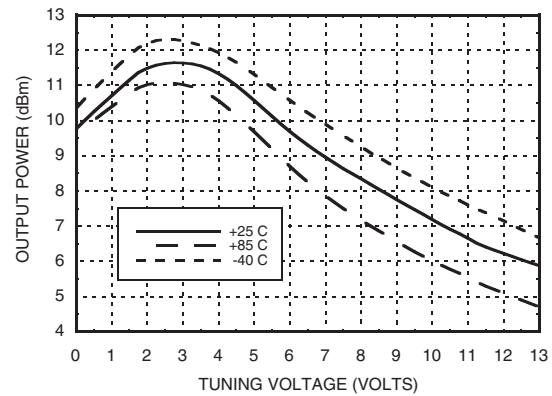
**Frequency vs. Tuning Voltage,  $V_{cc} = +5V$**



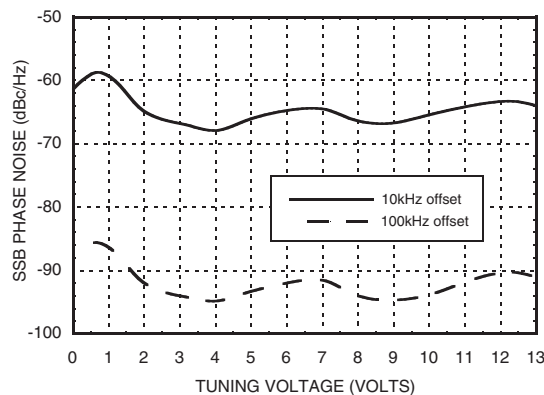
**Sensitivity vs. Tuning Voltage,  $V_{cc} = +5V$**



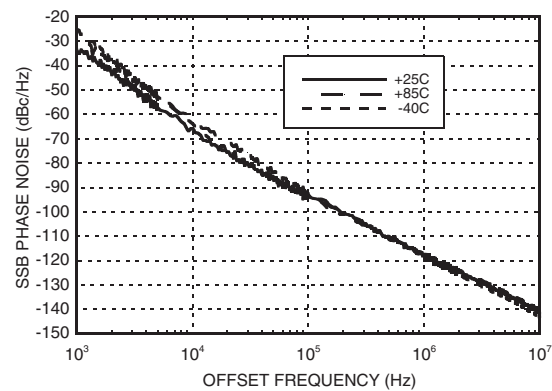
**Output Power vs. Tuning Voltage,  $V_{cc} = +5V$**



**SSB Phase Noise vs. Tuning Voltage**

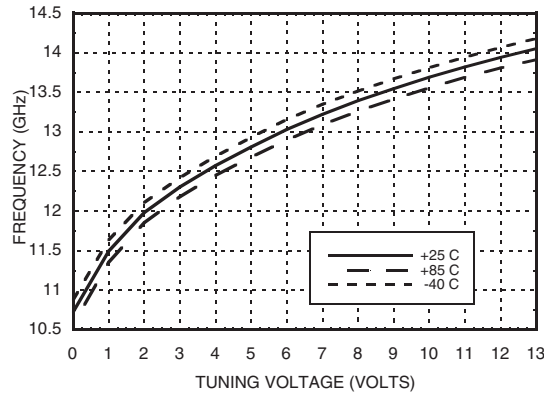


**SSB Phase Noise @  $V_{tune} = 5V$**

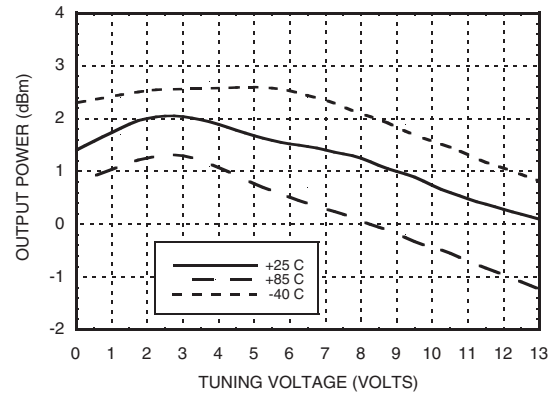


## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-16, 23.8 - 26.8 GHz

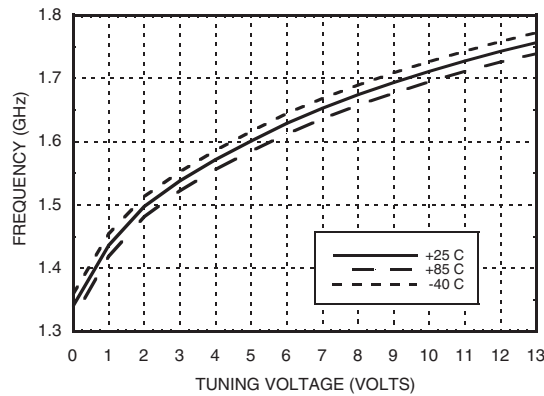
**RFOUT/2 Frequency  
vs. Tuning Voltage, Vcc= +5V**



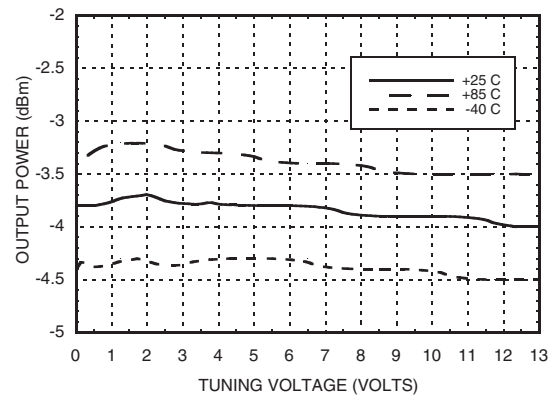
**RFOUT/2 Output Power  
vs. Tuning Voltage, Vcc= +5V**



**Divide-by-16 Frequency  
vs. Tuning Voltage, Vcc = +5V**



**Divide-by-16 Output Power  
vs. Tuning Voltage, Vcc = +5V**



### Absolute Maximum Ratings

|                                                                           |                |
|---------------------------------------------------------------------------|----------------|
| Vcc (RF), Vcc (DIG)                                                       | +5.5V          |
| Vtune                                                                     | 0 to +15V      |
| Junction Temperature                                                      | 135° C         |
| Continuous P <sub>diss</sub> (T= 85 °C)<br>(derate 23.3 mW/° above 85 °C) | 1.2 W          |
| Thermal Resistance<br>(junction to ground paddle)                         | 43 °C/W        |
| Storage Temperature                                                       | -65 to +150 °C |
| Operating Temperature                                                     | -40 to +85 °C  |

### Typical Supply Current vs. Vcc

| Vcc(RF), Vcc DIG) (V) | I <sub>cc</sub> (mA) |
|-----------------------|----------------------|
| 4.75                  | 172                  |
| 5.0                   | 192                  |
| 5.25                  | 212                  |

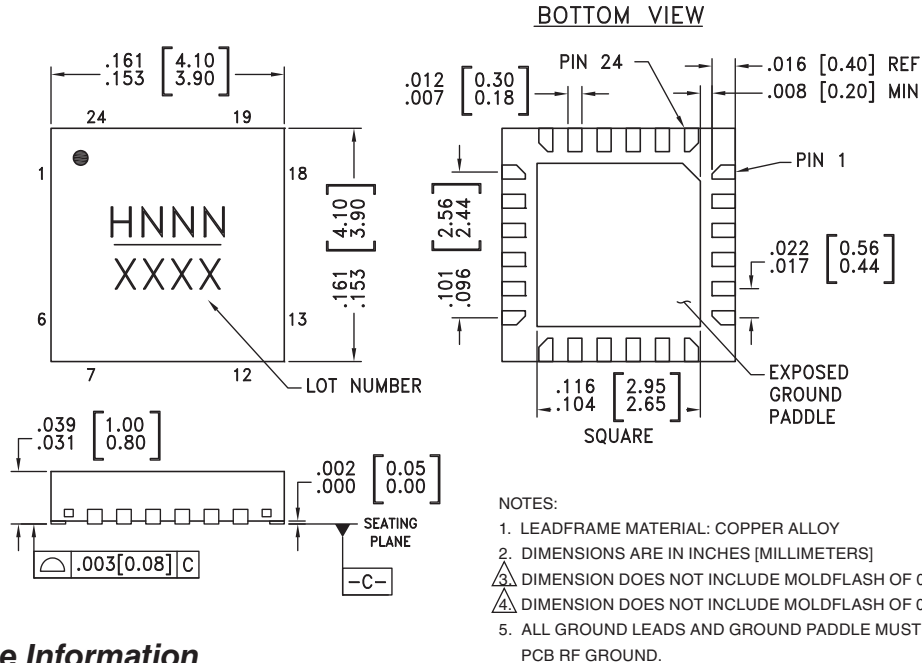
Note: VCO will operate over full voltage range shown above.



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-16, 23.8 - 26.8 GHz

### Outline Drawing



### Package Information

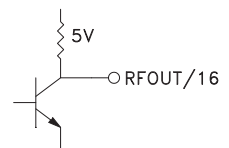
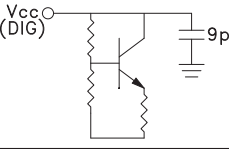
| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC739LP4   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H739<br>XXXX                   |
| HMC739LP4E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H739<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, 3, 5, 6, 7, 8,<br>9, 12, 13, 14, 18,<br>19, 21, 23, 24 | N/C       | No Connection required. These pins may be connected to RF/DC ground without affecting performance.          |                                                                                       |
| 2                                                         | RFOUT/16  | RF/16 Divided Output. Requires DC Block.                                                                    |  |
| 4                                                         | Vcc (DIG) | Supply voltage for prescaler.<br>Can be omitted if prescaler is not needed to conserve approximately 100 mA |  |



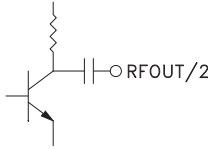
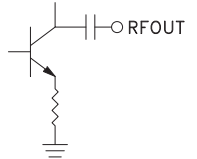
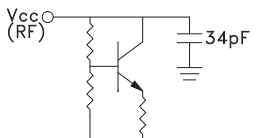
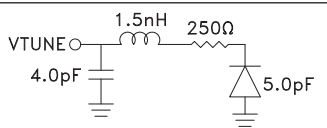
MICROWAVE CORPORATION v03.0309



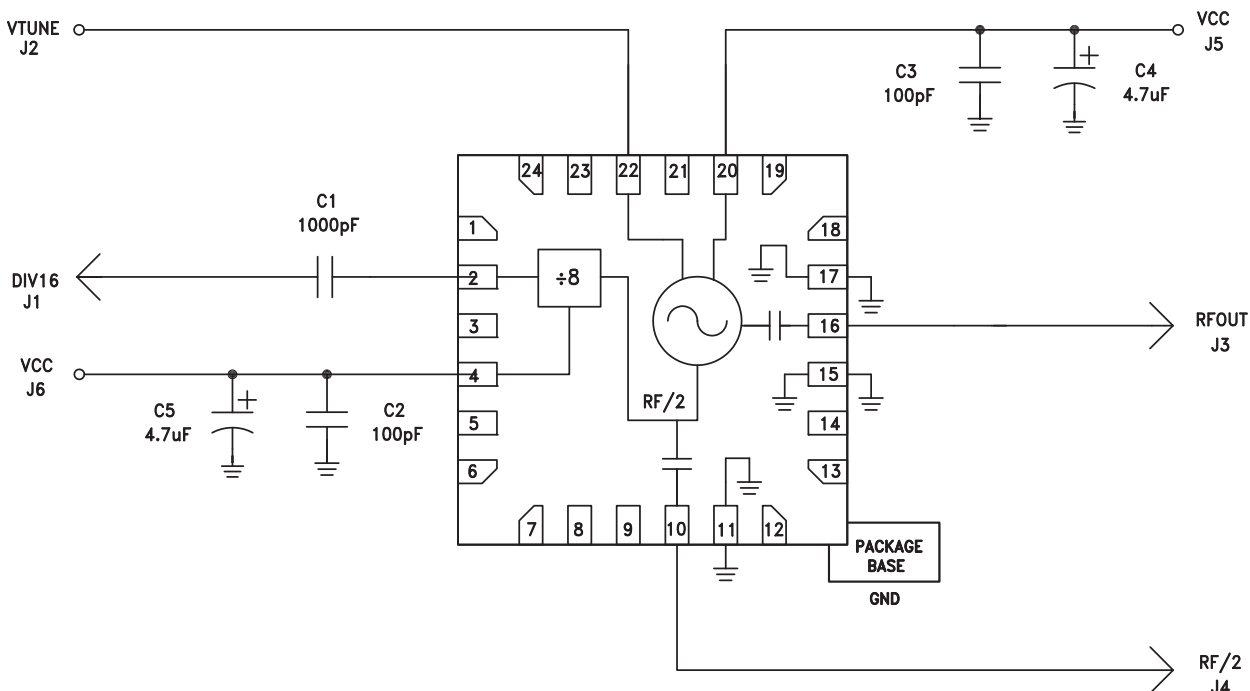
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## MMIC VCO w/ HALF FREQUENCY OUTPUT & DIVIDE-BY-16, 23.8 - 26.8 GHz

### Pin Descriptions (Continued)

| Pin Number | Function | Description                                                                           | Interface Schematic                                                                   |
|------------|----------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 10         | RFOUT/2  | Half frequency output (AC coupled)                                                    |    |
| 11, 15, 17 | GND      | Package bottom has an exposed metal paddle that must be RF & DC grounded.             |    |
| 16         | RFOUT    | RF output (AC coupled).                                                               |    |
| 20         | Vcc (RF) | Supply Voltage                                                                        |    |
| 22         | VTUNE    | Control Voltage Input. Modulation port bandwidth dependent on drive source impedance. |  |

### Typical Application Circuit



For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824  
 Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)  
 Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

| Item               | Description                            |
|--------------------|----------------------------------------|
| J1 - J2            | PCB Mount SMA Connector                |
| J3                 | PCB Mount K-Connector                  |
| J4                 | PCB Mount SRI SMA Connector            |
| J5, J6             | 2mm SMT 8 Pin Molex Header             |
| C1                 | 1000 pF, 0402 Pkg.                     |
| C2, C3             | 100 pF, 0402 Pkg.                      |
| C4, C5             | 4.7 $\mu$ F Tantalum Capacitors Case A |
| U1                 | HMC739LP4(E) VCO                       |
| PCB <sup>[2]</sup> | 112259 Eval Board                      |

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 slug 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.