

MMIC VCO WITH HALF FREQUENCY OUTPUT 8.45 - 9.55 GHz



Typical Applications

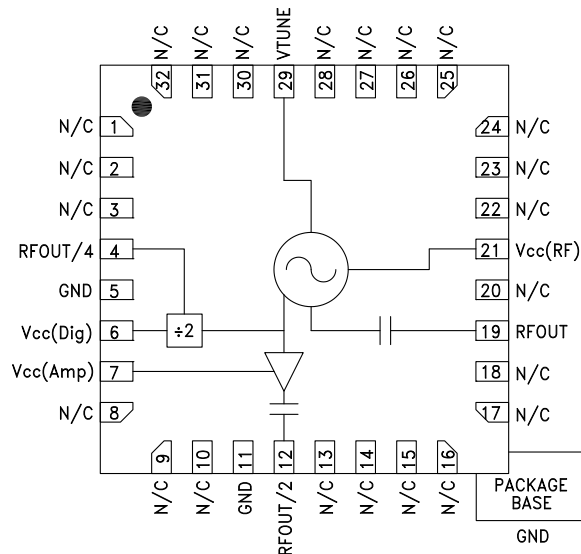
Low noise MMIC VCO w/Half Frequency, Divide-by-4 Outputs for:

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

Features

- Dual Output: $F_o = 8.45 - 9.55$ GHz
 $F_o/2 = 4.225 - 4.775$ GHz
- Pout: +13 dBm
- Phase Noise: -116 dBc/Hz @100 kHz Typ.
- No External Resonator Needed
- 32 Lead 5x5mm SMT Package: 25mm²

Functional Diagram



General Description

The HMC510LP5 & HMC510LP5E are GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC VCOs. The HMC510LP5 & HMC510LP5E integrate resonators, negative resistance devices, varactor diodes and feature half frequency and divide-by-4 outputs. The VCO's phase noise performance is excellent over temperature, shock, and process due to the oscillator's monolithic structure. Power output is +13 dBm typical from a +5V supply voltage. The prescaler and RF/2 functions can be disabled to conserve current if not required. The voltage controlled oscillator is packaged in a leadless QFN 5x5 mm surface mount package, and requires no external matching components.

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

| Parameter | Min. | Typ. | Max. | Units | |
|---|--|------------------------------|------------------|-------------------|----|
| Frequency Range | F_o $F_o/2$ | 8.45 - 9.55 4.225 - 4.775 | | GHz GHz | |
| Power Output | RFOUT RFOUT/2 RFOUT/4 | +10 +8 -8 | +15 +14 -4 | dBm dBm dBm | |
| SSB Phase Noise @ 100 kHz Offset, Vtune= +5V @ RFOUT | | -116 | | dBc/Hz | |
| Tune Voltage | Vtune | 2 | 13 | V | |
| Supply Current | $I_{cc}(Dig) + I_{cc}(Amp) + I_{cc}(RF)$ | 270 | 315 | 360 | mA |
| Tune Port Leakage Current (Vtune= 13V) | | | 10 | μA | |
| Output Return Loss | | 2 | | dB | |
| Harmonics/Subharmonics | 1/2 2nd 3rd | | 40 15 40 | dBc dBc dBc | |
| Pulling (into a 2.0:1 VSWR) | | 6 | | MHz pp | |
| Pushing @ Vtune= 5V | | 20 | | MHz/V | |
| Frequency Drift Rate | | 0.8 | | MHz/ $^\circ C$ | |

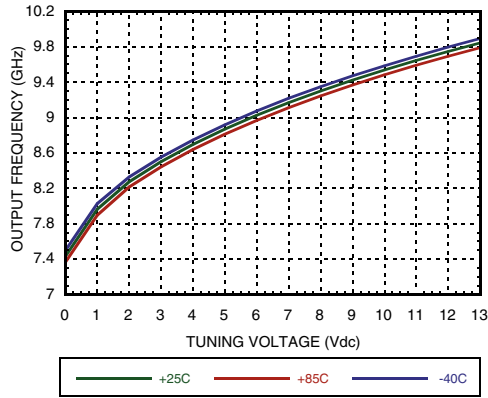
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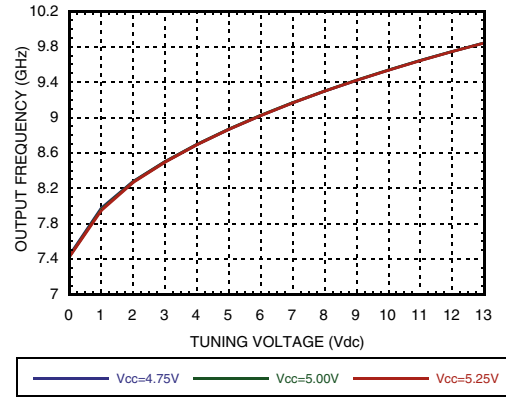


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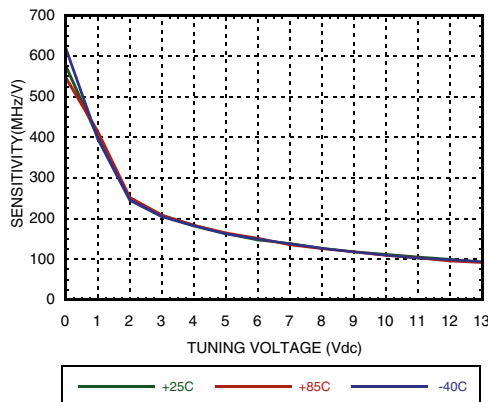
Frequency vs. Tuning Voltage, Vcc = +5V



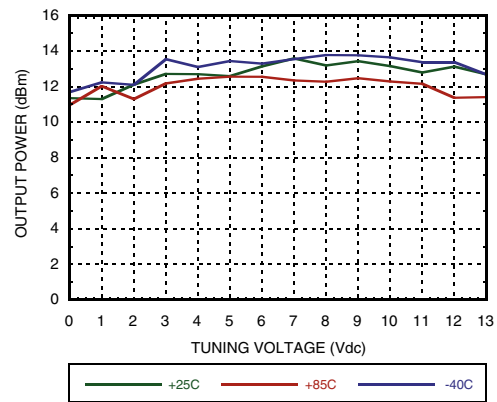
Frequency vs. Tuning Voltage, T = 25°C



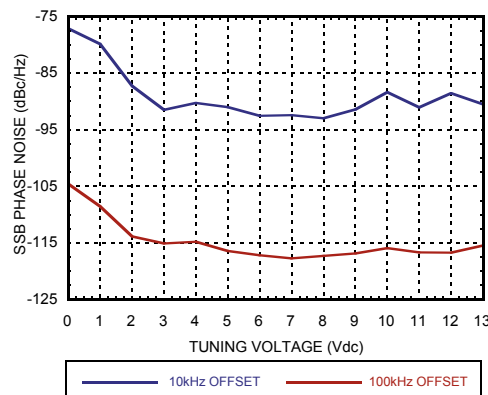
Sensitivity vs. Tuning Voltage, Vcc = +5V



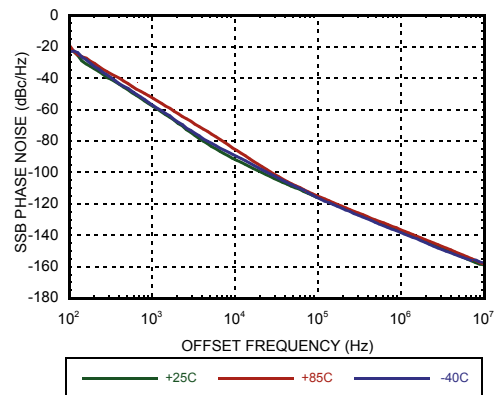
Output Power vs. Tuning Voltage, Vcc = +5V



SSB Phase Noise vs. Tuning Voltage



SSB Phase Noise @ Vtune = +5V



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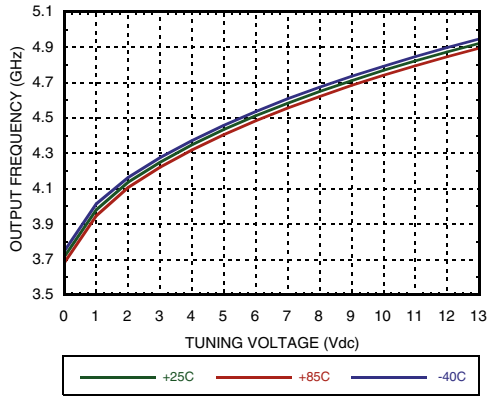
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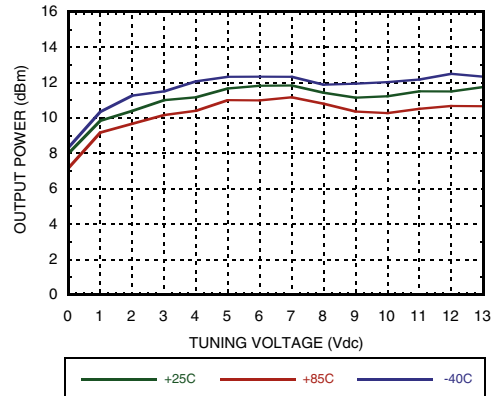
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VCOS WITH FO/2 OUTPUT - SMT

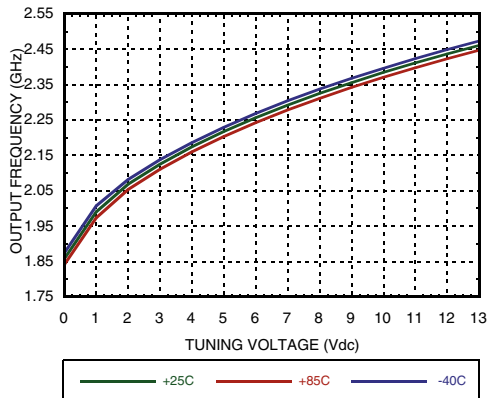
**RFOUT/2 Frequency
vs. Tuning Voltage, Vcc = +5V**



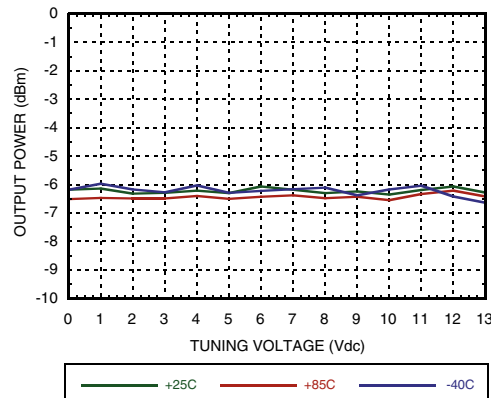
**RFOUT/2 Output Power
vs. Tuning Voltage, Vcc = +5V**



**Divide-by-4 Frequency
vs. Tuning Voltage, Vcc = +5V**



**Divide-by-4 Output Power
vs. Tuning Voltage, Vcc = +5V**



Absolute Maximum Ratings

| | |
|-----------------------------|----------------|
| Vcc(Dig), Vcc(Amp), Vcc(RF) | +5.5 Vdc |
| Vtune | 0 to +15V |
| Storage Temperature | -65 to +150 °C |
| ESD Sensitivity (HBM) | Class 1A |

Reliability Information

| | |
|--|---------------|
| Junction Temperature To Maintain 1 Million Hour MTTF | 135 °C |
| Nominal Junction Temperature (T=85 °C) | 121.2 °C |
| Thermal Resistance (junction to ground paddle) | 23 °C/W |
| Operating Temperature | -40 to +85 °C |



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

Typical Supply Current vs. Vcc

| Vcc (V) | Icc (mA) |
|---------|----------|
| 4.75 | 290 |
| 5.00 | 315 |
| 5.25 | 340 |

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

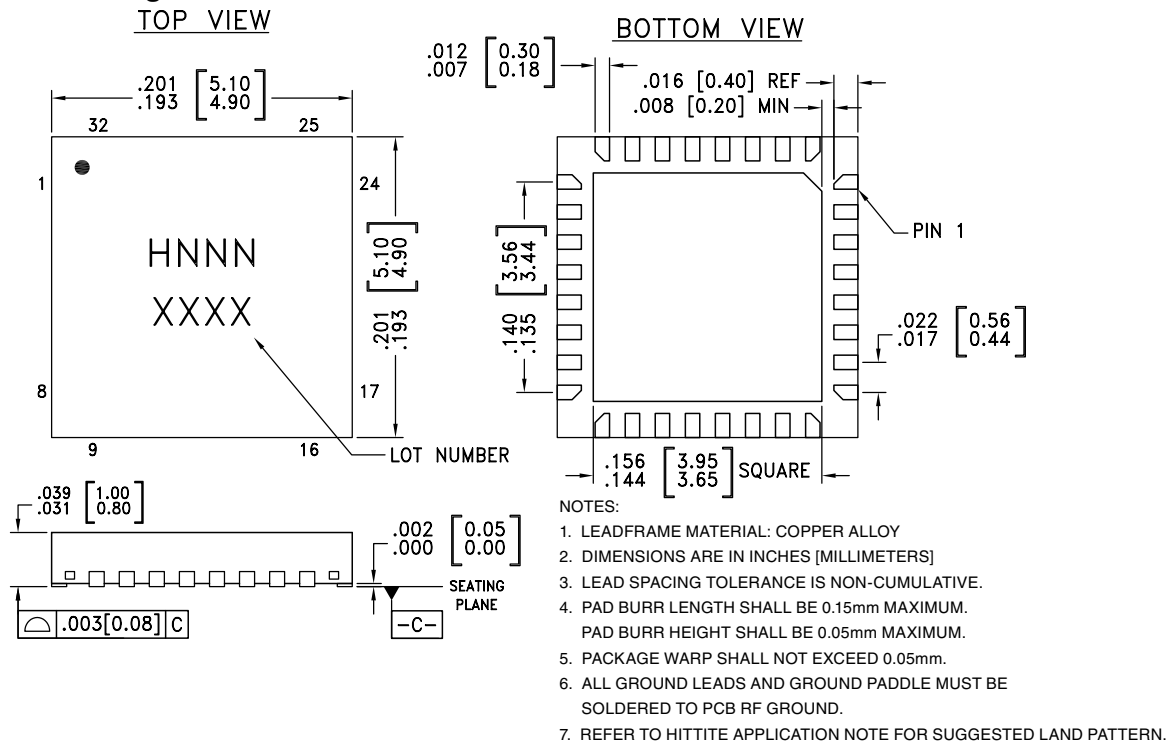
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Outline Drawing



Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC510LP5 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL3 ^[1] | H510 XXXX |
| HMC510LP5E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[2] | H510 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, 8-10, 13-18, 20, 22-28, 30-32 | N/C | No Connection. These pins may be connected to RF/DC ground. Performance will not be affected. | |
| 4 | RFOUT/4 | Divide-by-4 output. DC block required. | |
| 6 | Vcc (Dig) | Supply voltage for prescaler. If prescaler is not required, this pin may be left open to conserve approximately 65 mA of current. | |

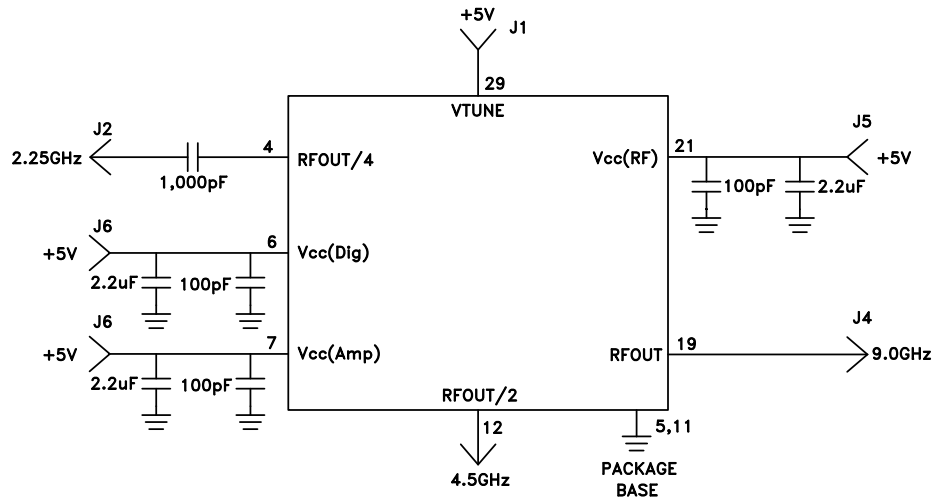
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Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---------------|-----------|---|---------------------|
| 7 | Vcc (Amp) | Supply voltage, for RFOUT/2 output. If RFOUT/2 is not required, this pin may be left open to conserve approximately 30 mA of current. | |
| 12 | RFOUT/2 | Half frequency output (AC coupled). | |
| 19 | RF OUT | RF output (AC coupled). | |
| 21 | Vcc (RF) | Supply Voltage, +5V | |
| 29 | 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. | |
| 5, 11, Paddle | GND | Package bottom has an exposed metal paddle that must be connected to RF/DC ground. | |

Typical Application Circuit



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