

Features

- Phase Noise: -82/-108dBc/Hz @ 10/100kHz
- Wide Tuning Range
- Low Current Consumption: 90 mA
- Excellent Temperature Stability
- Proven Microphonic Performance
- +5 V Bias
- Lead-Free 5 mm 32-Lead Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAOC-113900 is a voltage controlled oscillator for frequency generation. No external matching components are required. This VCO is easily integrated into a phase lock loop using the divide-by-two output. The extremely low phase noise makes this part ideal for many radio applications including high capacity digital radios.

The MAOC-113900 primary applications are Point-to-Point Radio, Point-to-Multipoint Radio, Communications Systems, and Low Phase Noise applications.

The 5 mm package has a lead-free finish that is RoHS compliant and compatible with a 260°C reflow temperature. The package features low lead inductance and an excellent thermal path.

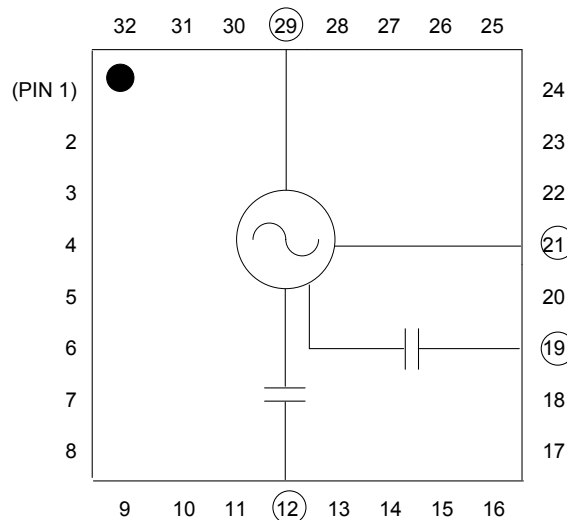
Ordering Information¹

| Part Number | Package |
|--------------------|----------------|
| MAOC-113900-TR0500 | 500 part Reel |
| MAOC-113900-TR1000 | 1000 part Reel |
| MAOC-113900-001SMB | Sample Board |

1. Reference Application Note M513 for reel size information.

* Restrictions on Hazardous Substances,
European Union Directive 2011/65/EU.

Block Diagram



Pin Configuration²

| Pin | Function |
|-----------------|-------------------|
| 1 - 11 | N/C |
| 12 | RF/2 |
| 13 - 18 | N/C |
| 19 | RF |
| 20 | N/C |
| 21 | V _{CC} |
| 22 - 28 | N/C |
| 29 | V _{TUNE} |
| 30 - 32 | N/C |
| 33 ³ | GND |

2. MACOM recommends connecting unused package pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Broadband Voltage Controlled Oscillator 13.4 - 14.4 GHz

Rev. V1

Electrical Specifications: $T_A = +25^\circ\text{C}$, $V_{CC} = 5.0 \text{ V}^4$, $Z_0 = 50 \Omega$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|--|---|-----------------------|---------|-------------|-----------|
| Output Power | RF Port, 13.4 - 14.4 GHz RF/2 Port, 6.7 - 7.2 GHz | dBm | 4 -2 | 8 2 | — |
| SSB Phase Noise | RF Port, 10 kHz Offset, 13.4 - 14.4 GHz RF Port, 100 kHz Offset, 13.4 - 14.4 GHz | dBc/Hz | — | -83 -109 | — -104 |
| Harmonics/Subharmonics $V_{CC} = V_{TUNE} = 5 \text{ V}$ | RF Port, $\frac{1}{2} F_o$ RF Port, $2 F_o$ | dBc | — | -32 -52 | — |
| Pulling (Sensitivity to Match) $V_{CC} = V_{TUNE} = 5 \text{ V}$ | RF Port, VSWR = 1.95:1 to 2.25:1 | MHz pk-pk | — | 5.0 | — |
| Pushing (Sensitivity to Supply Voltage) | RF Port, $V_{TUNE} = 5 \text{ V}$ RF/2 Port, $V_{TUNE} = 5 \text{ V}$ | MHz/V | — | 18 9 | — |
| Frequency Drift Rate (Sensitivity to Temperature) | RF Port, 13.4 - 14.4 GHz RF/2 Port, 6.7 - 7.2 GHz | MHz/ $^\circ\text{C}$ | — | 1.4 0.7 | — |
| Output Return Loss | RF Port, 13.4 - 14.4 GHz RF/2 Port, 6.7 - 7.2 GHz | dB | — | 6 3 | — |
| Tuning Sensitivity @ RF Port | $V_{TUNE} = 5 \text{ V}$ | GHz/V | — | 0.18 | — |
| Supply Current | I_{CC} | mA | — | 90 | 120 |
| Tune Voltage | V_{TUNE} | V | 1.5 | — | 12.5 |
| Tuning Current Leakage | $V_{TUNE} = 13 \text{ V}$ | μA | — | 5 | — |

4. VCO can operate over the 4.75 V to 5.25 V supply voltage range.

Absolute Maximum Ratings ^{5,6,7}

| Parameter | Absolute Maximum |
|-----------------------------------|---|
| Voltage | 5.5 Vdc |
| V_{TUNE} | 0 to 15 Vdc |
| Storage Temperature | -55 $^\circ\text{C}$ to +150 $^\circ\text{C}$ |
| Operating Temperature | -40 $^\circ\text{C}$ to +85 $^\circ\text{C}$ |
| Junction Temperature ⁸ | +150 $^\circ\text{C}$ |

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- Operating at nominal conditions with $T_J \leq +150^\circ\text{C}$ will ensure MTBF > 1×10^6 hours.
- Junction Temperature (T_J) = $T_C + \Theta_{jc} * (V * I)$
Typical thermal resistance (Θ_{jc}) = 42 $^\circ\text{C/W}$.
 - For $T_C = 25^\circ\text{C}$, $T_J = 44^\circ\text{C}$ @ 5 V, 90 mA
 - For $T_C = 85^\circ\text{C}$, $T_J = 104^\circ\text{C}$ @ 5 V, 91 mA

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B devices.



ESD Rating: Class 1B

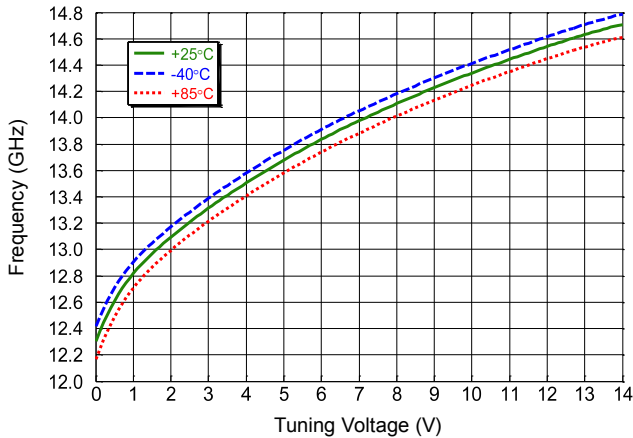
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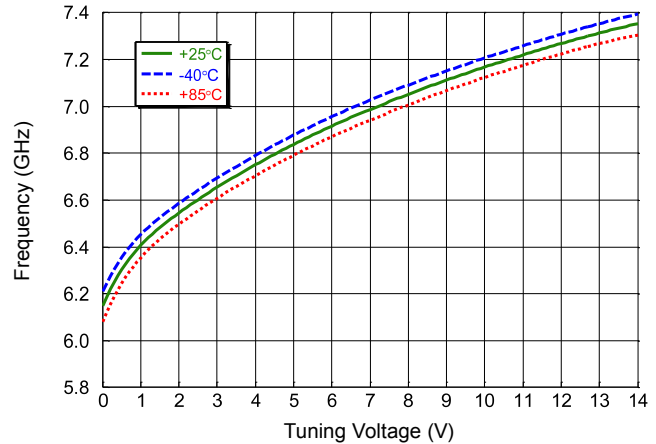
Rev. V1

Typical Performance Curves: $V_{CC} = 5\text{ V}$, $T_A = +25^\circ\text{C}$ (unless otherwise indicated)

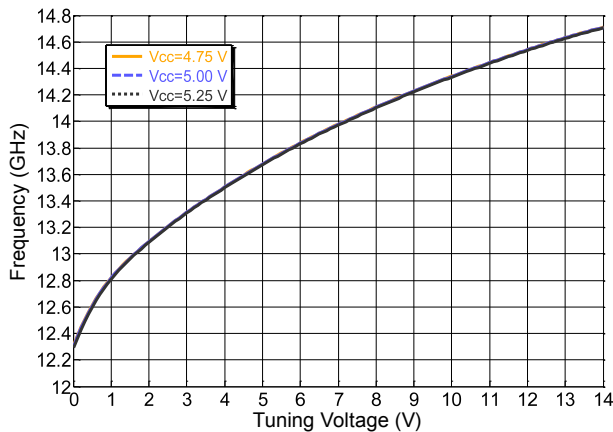
Output Frequency vs. Tune Voltage - RF Port



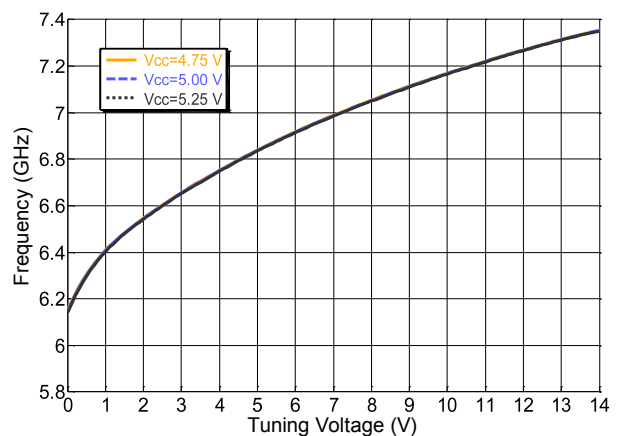
Output Frequency vs. Tune Voltage - RF/2 Port



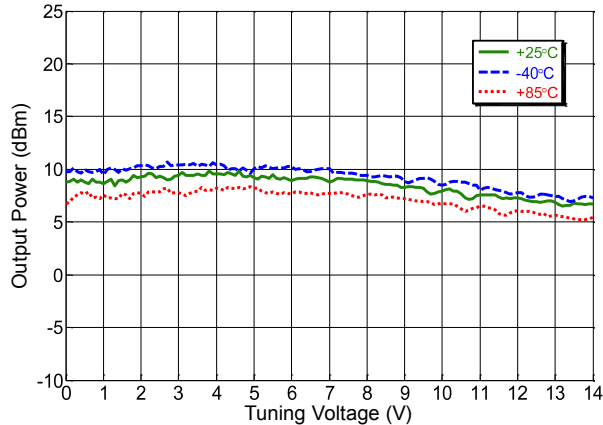
Output Frequency vs. Tuning / Supply Voltage - RF Port



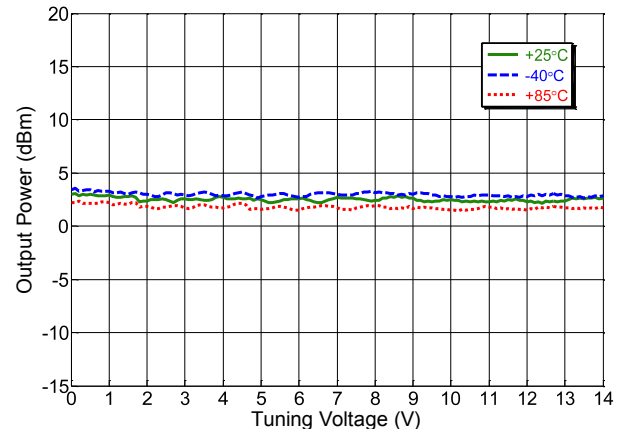
Output Frequency vs. Tuning / Supply Voltage - RF/2 Port



Output Power vs. Tuning Voltage - RF Port



Output Power vs. Tuning Voltage - RF/2 Port

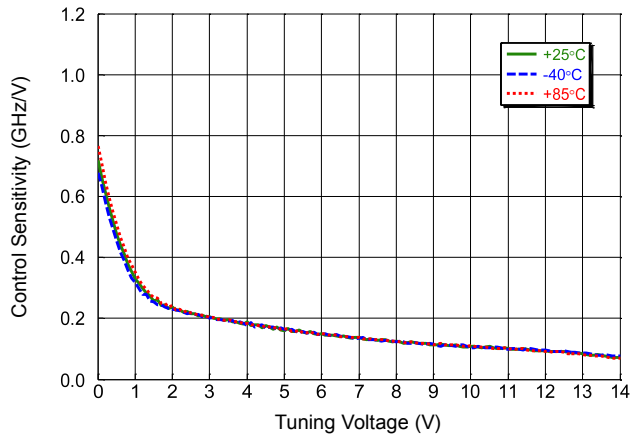


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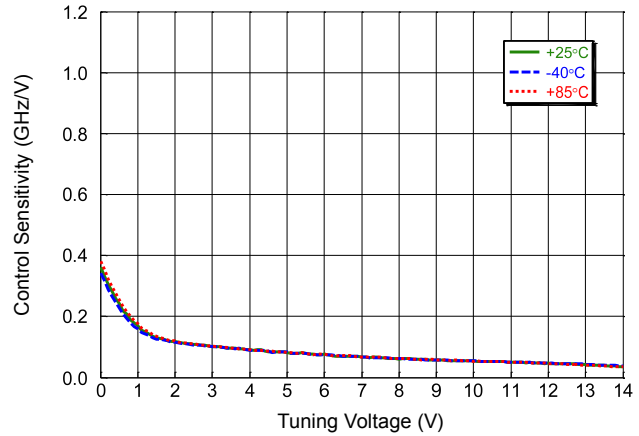
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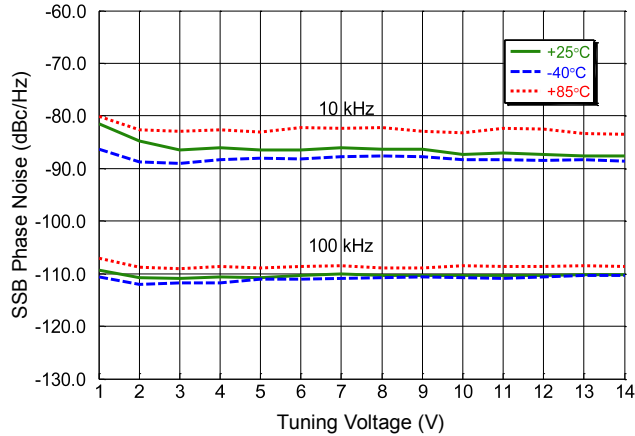
Frequency Sensitivity vs. Tuning Voltage - RF Port



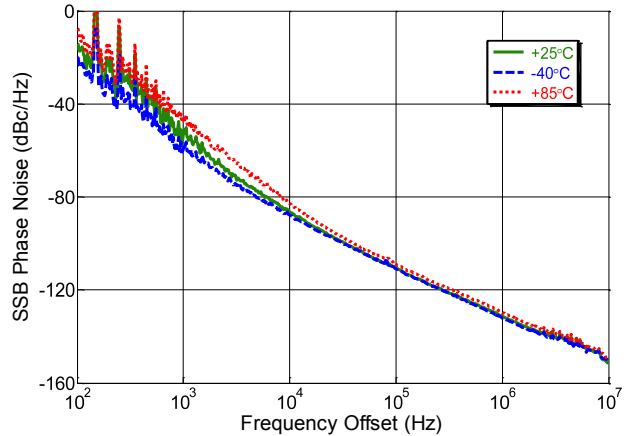
Frequency Sensitivity vs. Tuning Voltage - RF/2 Port



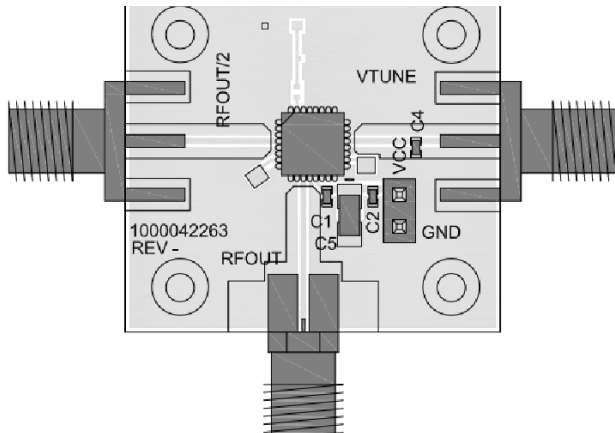
Single Side Band Phase Noise vs. Tuning Voltage - RF port



Single Side Band Phase Noise vs. Frequency Offset - RF Port ($V_{TUNE} = 5\text{V}$)



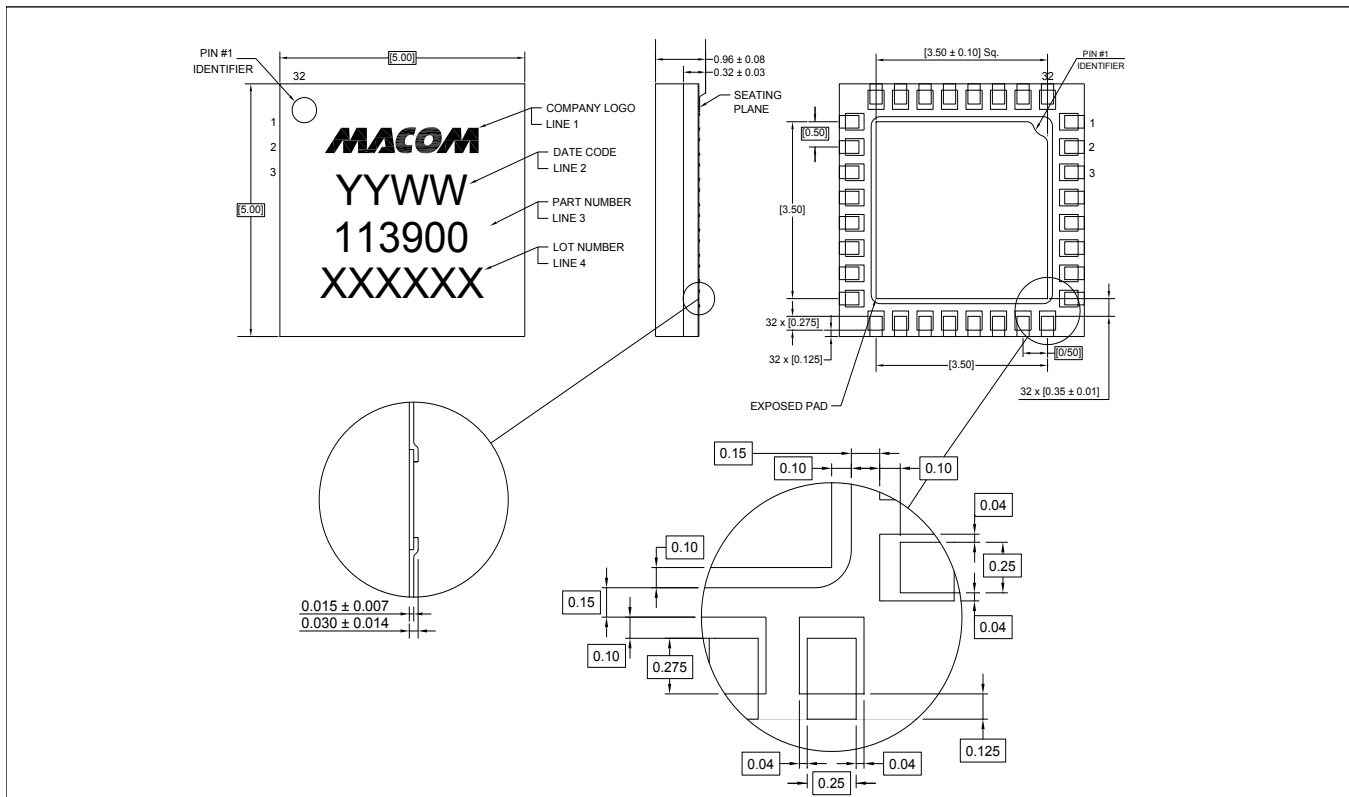
Sample Board



Parts List

| Component | Value | Case Size |
|-----------|---------------------|-----------|
| C1 | 100 pF | 0402 |
| C2, C4 | 0.1 μ F | 0402 |
| C5 | 10 μ F Tantalum | 1206 |

Lead-Free 5 mm 32-Lead PQFN[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is ENIG over copper.

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