MAOC-114850

Voltage Controlled Oscillator
14.5 - 15.2 GHz

Features
- Phase Noise: -84/-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-114850 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-114850 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 Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAOC-114850-TR0500</td>
<td>500 piece reel</td>
</tr>
<tr>
<td>MAOC-114850-TR1000</td>
<td>1000 piece reel</td>
</tr>
<tr>
<td>MAOC-114850-SMB</td>
<td>Sample Board</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.


2. Connecting all N/C pins to RF/DC ground in the layout is also recommended.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.
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Electrical Specifications: \( T_A = +25^\circ C, V_{CC} = 5.0 \text{ V} \), \( Z_0 = 50 \Omega \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Units</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power</td>
<td>RF Port, 14.5 - 15.2 GHz</td>
<td>dBm</td>
<td>0</td>
<td>-5</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>RF/2 Port, 7.25 - 7.6 GHz</td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>SSB Phase Noise</td>
<td>dBc/Hz</td>
<td>-84</td>
<td>-108</td>
<td>-106</td>
</tr>
<tr>
<td>Harmonics/Subharmonics ( V_{CC} = V_{TUNE} = 5 \text{ V} )</td>
<td>RF Port, 1/2 ( F_0 )</td>
<td>dBc</td>
<td>-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RF Port, 2 ( F_0 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulling (Sensitivity to Match) ( V_{CC} = V_{TUNE} = 5 \text{ V} )</td>
<td>RF Port, VSWR = 1.95:1 to 2.25:1</td>
<td>MHz pk-pk</td>
<td>6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pushing (Sensitivity to Supply Voltage) ( V_{CC} = V_{TUNE} = 5 \text{ V} )</td>
<td>RF Port, ( V_{TUNE} = 5 \text{ V} )</td>
<td>MHz/V</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Drift Rate (Sensitivity to Temperature) ( V_{CC} = V_{TUNE} = 5 \text{ V} )</td>
<td>RF Port, 14.5 - 15.2 GHz</td>
<td>MHz/ºC</td>
<td>1.5</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>RF Port, 14.5 - 15.2 GHz</td>
<td>dB</td>
<td>3.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RF/2 Port, 7.25 - 7.6 GHz</td>
<td></td>
<td>3.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuning Sensitivity @ RF Port</td>
<td>( V_{TUNE} = 5 \text{ V} )</td>
<td>GHz/V</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Current</td>
<td>( I_{CC} )</td>
<td>mA</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tune Voltage</td>
<td>( V_{TUNE} )</td>
<td>V</td>
<td>1.5</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Tuning Current Leakage</td>
<td>( V_{TUNE} = 13 \text{ V} )</td>
<td>µA</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Absolute Maximum Ratings\(^5,6,7\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Absolute Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>5.5 Vdc</td>
</tr>
<tr>
<td>( V_{TUNE} )</td>
<td>0 to 15 Vdc</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-55ºC to +150ºC</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40ºC to +85ºC</td>
</tr>
<tr>
<td>Junction Temperature(^8)</td>
<td>+150ºC</td>
</tr>
</tbody>
</table>

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with \( T_j \leq +150^\circ \text{C} \) will ensure \( \text{MTBF} > 1 \times 10^6 \text{ hours} \).
8. Typical thermal resistance (\( \Theta_{jc} \)) = 61.7ºC/W.

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 1C devices.
Typical Performance Curves: $V_{CC} = 5$ V, $T_A = +25^\circ$C (unless otherwise indicated)

**Output Frequency vs. Tuning Voltage - RF Port**

- **Output Frequency vs. Tuning 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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Typical Performance Curves: \( V_{CC} = 5V, T_A = +25^\circ C \) (unless otherwise indicated)

**Control Sensitivity vs. Tuning Voltage - RF Port**

![Control Sensitivity vs. Tuning Voltage - RF Port](image)

**Control Sensitivity vs. Tuning Voltage - RF/2 Port**

![Control Sensitivity vs. Tuning Voltage - RF/2 Port](image)

**Phase Noise vs. Tuning Voltage - RF Port**

![Phase Noise vs. Tuning Voltage - RF Port](image)

**Phase Noise vs. Frequency Offset - RF Port (\( V_{TUNE} = 5V \))**

![Phase Noise vs. Frequency Offset - RF Port](image)
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Sample Board

Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Case Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>100 pF</td>
<td>0402</td>
</tr>
<tr>
<td>C2, C4</td>
<td>0.1 µF</td>
<td>0402</td>
</tr>
<tr>
<td>C5</td>
<td>10 µF</td>
<td>0805</td>
</tr>
</tbody>
</table>

Lead-Free 5 mm 32-Lead Package†

Reference Application Note S2083 for lead-free solder reflow recommendations.
Meet JEDEC moisture sensitivity level 3 requirements.
Plating is ENEPIG over Copper.

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