Features

- Low Phase Noise
- Wide Tuning Range
- Divide-by-Two Output
- Integrated Buffer Amplifier
- Excellent Temperature Stability
- +5 V Bias
- Lead-Free 5 mm 32-Lead PQFN Package
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAOC-009261 is an InGaP HBT-based 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-009261 primary applications are Point-to-Point Radio, Point-to-Multipoint Radio, Communications Systems, and Low Phase Noise applications.

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

Pin Designations

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>17</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
<td>18</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
<td>19</td>
<td>RF</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
<td>20</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td>21</td>
<td>V_CCC</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>22</td>
<td>N/C</td>
</tr>
<tr>
<td>7</td>
<td>V_BUFFER</td>
<td>23</td>
<td>N/C</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
<td>24</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>25</td>
<td>N/C</td>
</tr>
<tr>
<td>10</td>
<td>N/C</td>
<td>26</td>
<td>N/C</td>
</tr>
<tr>
<td>11</td>
<td>N/C</td>
<td>27</td>
<td>N/C</td>
</tr>
<tr>
<td>12</td>
<td>RF/2</td>
<td>28</td>
<td>N/C</td>
</tr>
<tr>
<td>13</td>
<td>N/C</td>
<td>29</td>
<td>V_TUNE</td>
</tr>
<tr>
<td>14</td>
<td>N/C</td>
<td>30</td>
<td>N/C</td>
</tr>
<tr>
<td>15</td>
<td>N/C</td>
<td>31</td>
<td>N/C</td>
</tr>
<tr>
<td>16</td>
<td>N/C</td>
<td>32</td>
<td>N/C</td>
</tr>
</tbody>
</table>

1. Reference Application Note M513 for reel size information.

2. The exposed pad centered on the package bottom must be connected to RF and DC ground. Connecting all N/C pins to RF/DC Ground in the layout is also recommended.


For further information and support please visit: https://www.macom.com/support
Voltage Controlled Oscillator
7.06 - 7.9 GHz

Electrical Specifications: \( T_A = +25^\circ \text{C}, \ V_{CC} = V_{BUFFER} = 5 \ \text{V}, \ Z_0 = 50 \ \Omega \)

Parameter | Test Conditions | Units | Min. | Typ. | Max.
--- | --- | --- | --- | --- | ---
Output Power | RF Port, 7.06 - 7.9 GHz | dBm | 8 | 12 | —
 | RF/2 Port, 3.53 - 3.95 GHz | -2 | 2 | —
SSB Phase Noise | RF Port, 10 KHZ Offset | dBC/Hz | — | -93 | —
 | RF Port, 100 KHZ Offset | — | -116 | —
Harmonics/Subharmonics | RF Port, \( \frac{1}{2} F_{o} \) | dBC | — | -24 | —
 | RF Port, 2 \( F_{o} \) | — | -17 | —
Pulling (Sensitivity to Match) | RF Port, VSWR = 1.95:1 to 2.25:1 | MHz pk-pk | — | 8.7 | —
Pushing (Sensitivity to Supply Voltage) | RF Port, \( V_{TUNE} = 5 \ \text{V} \) | MHz/V | — | 2 | 1 |
 | RF/2 Port, \( V_{TUNE} = 5 \ \text{V} \) | — | 1 | —
Frequency Drift Rate (Sensitivity to Temperature) | RF Port, 7.06 - 7.9 GHz | MHz/°C | — | 0.6 | 0.3 |
 | RF/2 Port, 3.53 - 3.95 GHz | — | 0.3 | —
Output Return Loss | RF Port, 7.06 - 7.9 GHz | dB | — | 5 | 13 |
 | RF/2 Port, 3.53 - 3.95 GHz | — | 13 | —
Tuning Sensitivity @ RF Port | \( V_{TUNE} = 5 \ \text{V} \) | GHz/V | — | 0.12 | —
Supply Current | \( I_{TOTAL} (I_{CC} + I_{BUFFER}) \) | mA | — | 175 | 205 |
 | \( I_{CC} \) | — | 155 | 20 |
 | \( I_{BUFFER} \) | — | 175 | 30 |
Tune Voltage | \( V_{TUNE} \) | V | 1 | — | 13 |
Tuning Current Leakage | \( V_{TUNE} = 13 \ \text{V} \) | µA | — | 5 | 10 |

3. VCO can operate over the 4.75 V to 5.25 V supply voltage range.
4. RF and RF/2 frequency ranges are 7.0 - 7.9 GHz and 3.5 - 3.95 GHz respectively with tune voltage range of 0.5 - 13.0 volts.

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

Parameter | Absolute Maximum
--- | ---
Supply Voltage \( (V_{CC} \ & \ V_{BUFFER}) \) | +5.5 Vdc
\( V_{TUNE} \) | 0 to +15 Vdc
Storage Temperature | -55°C to +150°C
Operating Temperature | -40°C to +85°C
Case Temperature \( (T_{C}) \) (measured @ exposed pad) | +100°C
Junction Temperature \(^\text{8}\) | +135°C

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 \( T_J \leq +135^\circ \text{C} \) will ensure MTBF > 2.5 x 10^6 hours.
8. Junction Temperature \( (T_J) = T_C + \Theta_{jc} \ast (V \ast I) \)
   Typical thermal resistance \( (\Theta_{jc}) = 35^\circ \text{C}/\text{W.} \)
   a) For \( T_C = 25^\circ \text{C}, \ T_J = 56^\circ \text{C} @ 5 \ \text{V}, \ 175 \ \text{mA} \)
   b) For \( T_C = 85^\circ \text{C}, \ T_J = 117^\circ \text{C} @ 5 \ \text{V}, \ 180 \ \text{mA} \)

Handling Procedures
Please observe the following precautions to avoid damage:

Static Sensitivity
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

ESD Rating: Class 1A

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.
Voltage Controlled Oscillator
7.06 - 7.9 GHz

Typical Performance Curves: $V_{CC} = V_{BUFFER} = 5$ 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**
Voltage Controlled Oscillator
7.06 - 7.9 GHz

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

1. Frequency Sensitivity vs. Tuning Voltage - RF Port
2. Frequency Sensitivity vs. Tuning Voltage - RF/2 Port
3. Single Side Band Phase Noise vs. Tuning Voltage - RF Port
4. Single Side Band Phase Noise vs. Frequency Offset - RF Port \( (V_{TUNE} = 5 \, V) \)

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Visit www.macom.com for additional data sheets and product information.

For further information and support please visit:
https://www.macom.com/support
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, C3, C4</td>
<td>0.1 µF</td>
<td>0402</td>
</tr>
<tr>
<td>C5</td>
<td>10 µF Tantalum</td>
<td>1206</td>
</tr>
</tbody>
</table>

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 100% matte tin over copper.

NOTES:
1. Reference JEDEC MO-220-VHHD-5 for additional dimensional and tolerance information.
2. All dimensions shown as in/mm.