Model 1500002
12.8 MHz, 9x14mm Stratum 3 OCXO

Features
- Industry Standard 9x14mm footprint
- 3.3Vdc Supply Voltage
- -40°C to 85°C Operating Temperature Range
- HCMOS Square Wave Output
- Stratum 3 per Telcordia GR-1244-CORE

Description
CTS model 1500002 is a small size, high performance SMT OCXO for use in telecom switching, and wireless communication applications.

Electrical Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions &amp; Remarks</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>( T_{op}; ) max. rate of change 0.5°C/minute</td>
<td>-40</td>
<td>-</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>( V_{cc}; ) ± 5%</td>
<td>3.135</td>
<td>3.3</td>
<td>3.465</td>
<td>Vdc</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>( P_{max}; ) Steady State; ( T_{a} = 25^\circ C; ) Still Air</td>
<td>-</td>
<td>0.6</td>
<td>1.0</td>
<td>W</td>
</tr>
<tr>
<td>Load</td>
<td></td>
<td>13.5</td>
<td>15</td>
<td>16.5</td>
<td>pF</td>
</tr>
</tbody>
</table>

Frequency Stability

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions &amp; Remarks</th>
<th>Min</th>
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<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>( F_{nom}; )</td>
<td>12.800</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>Calibration</td>
<td>( \Delta f/F_{nom}; ) ( T_{a} = 25^\circ C; ) ( V_{cc} = 3.3Vdc ) at time of shipment</td>
<td>-</td>
<td>-</td>
<td>±0.5</td>
<td>ppm</td>
</tr>
<tr>
<td>Temperature Stability</td>
<td>( \Delta f/F ; ) referenced to 25°C</td>
<td>-</td>
<td>-</td>
<td>±100</td>
<td>ppb</td>
</tr>
<tr>
<td>Frequency vs. Voltage</td>
<td>( V_{cc}; ) ±5%</td>
<td>-</td>
<td>-</td>
<td>±50</td>
<td>ppb</td>
</tr>
<tr>
<td>Frequency vs. Load</td>
<td>15 pf ±5%</td>
<td>-</td>
<td>-</td>
<td>±50</td>
<td>ppb</td>
</tr>
<tr>
<td>Aging (After 30 days continuous operation)</td>
<td>Per day</td>
<td>-</td>
<td>±2</td>
<td>-</td>
<td>ppb</td>
</tr>
<tr>
<td></td>
<td>Per year</td>
<td>-</td>
<td>±300</td>
<td>-</td>
<td>ppb</td>
</tr>
<tr>
<td></td>
<td>20 years</td>
<td>-</td>
<td>±3</td>
<td>-</td>
<td>ppm</td>
</tr>
<tr>
<td>Free run accuracy</td>
<td>All causes – 20 years</td>
<td>-</td>
<td>-</td>
<td>±4.6</td>
<td>ppm</td>
</tr>
<tr>
<td>Short Term Stability (ADEV)</td>
<td>1.0 sec</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
<td>ppb</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>@ 25°C, After 5 mins referenced to the freq after 1 hour on</td>
<td>-</td>
<td>-</td>
<td>±500</td>
<td>ppb</td>
</tr>
<tr>
<td>Holdover (still air)</td>
<td>- Constant temperature (24 hrs)</td>
<td>-</td>
<td>-</td>
<td>±10</td>
<td>ppb</td>
</tr>
<tr>
<td></td>
<td>- Variable temperature</td>
<td>-</td>
<td>-</td>
<td>250</td>
<td>ppb, pk-pk</td>
</tr>
<tr>
<td>Wander Generation</td>
<td>Meets Stratum 3 MTIE and TDEV per Telcordia GR-1244-CORE</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Electrical Specifications (Continued)

Model 1500002  
12.8 MHz, 9x14mm Stratum 3 OCXO

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions &amp; Remarks</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Parameters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output Signal</strong></td>
<td>LVCMOS Square Wave</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude</td>
<td>$V_{OL}$</td>
<td>-</td>
<td>-</td>
<td>0.4</td>
<td>Vdc</td>
</tr>
<tr>
<td></td>
<td>$V_{OH}$</td>
<td>2.4</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Rise/Fall Times</td>
<td>10% to 90%, 15pf load</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>ns</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>@50% of output signal</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>%</td>
</tr>
<tr>
<td>Phase Noise</td>
<td>1Hz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10Hz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100Hz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1kHz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10kHz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100kHz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>dBc/Hz</td>
</tr>
</tbody>
</table>

Typical Stratum 3 Wander Generation performance per Telcordia GR-1244-CORE  
(locked through a 0.1Hz loop bandwidth)

![MTIE Graph](image1.png)

![TDEV Graph](image2.png)
**Mechanical and Environmental**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temp Range</td>
<td>-55 to +105°C</td>
</tr>
<tr>
<td>Operating Temp Range</td>
<td>-40 to +85°C</td>
</tr>
<tr>
<td>Reflow Profile</td>
<td>IPC/IEDEC J-STD-20; &gt;217°C, 1.5 min and 245°C (Absolute max temperature), 10 secs. Note: Part is not designed to be reflowed in an inverted position</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>100g, 6mS duration, 1/2 sine wave, 3 shocks each direction along 3 mutually perpendicular planes.</td>
</tr>
<tr>
<td>Drop</td>
<td>10 cm height, 3 times onto hard board with thickness 3cm. - IEC60028-2-32 test Ed</td>
</tr>
<tr>
<td>Vibration</td>
<td>Frequency range: 1Hz-4Hz-100Hz-200</td>
</tr>
<tr>
<td></td>
<td>Acceleration: 0.0001g²/Hz-0.01g²/Hz-0.01g²/Hz-0.001g²/Hz</td>
</tr>
<tr>
<td></td>
<td>Grms=1.15g – 30 minutes per axis</td>
</tr>
<tr>
<td></td>
<td>Sine: 10 – 55 Hz, 0.75mm DA, Sweep time 30 minutes per axis</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>-40°C ~ +85°C; 0.5 hour dwells with &lt;30 second transitions. 100 cycles</td>
</tr>
<tr>
<td>RoHS</td>
<td>Lead-Free. Fully compliant to RoHS Directive 2011/65/EU</td>
</tr>
<tr>
<td>MSL</td>
<td>Level 2</td>
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</table>

**Mechanical Specifications**

Package Drawing

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Dimension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symbol</td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Pad</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>V_CC</td>
</tr>
</tbody>
</table>

**Marking**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YYWWXX</td>
<td>Serial Number (mfg date code = first 4 digits of s/n)</td>
</tr>
</tbody>
</table>

**CTS**

1500002
12M800
YYWWXXXXX
Recommended Solder Pad Geometry

Packing: Tape and Reel

Device quantity is 500 pcs maximum per 330 mm reel
Note: The temperatures shown below represent the device body temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ts max to Tl (Ramp-up Rate)</td>
<td>5°C/second max</td>
</tr>
<tr>
<td>Preheat</td>
<td></td>
</tr>
<tr>
<td>Temperature Min (Ts Min)</td>
<td>150°C</td>
</tr>
<tr>
<td>Temperature Max (Ts Max)</td>
<td>200°C</td>
</tr>
<tr>
<td>Time (ts)</td>
<td>60-120 seconds</td>
</tr>
<tr>
<td>Ramp-up Rate (Tl to Tp)</td>
<td>3°C/second max</td>
</tr>
<tr>
<td>Time Maintained Above:</td>
<td></td>
</tr>
<tr>
<td>--Temperature (Tl)</td>
<td>217°C</td>
</tr>
<tr>
<td>--Time (ts)</td>
<td>90 seconds max</td>
</tr>
<tr>
<td>Peak Temperature (Tp)</td>
<td>245°C max for 10 seconds</td>
</tr>
<tr>
<td>Time within 5°C of actual peak</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Ramp-down Rate</td>
<td>6°C/second max</td>
</tr>
<tr>
<td>Time 25°C to Peak Temperature</td>
<td>8 minutes max</td>
</tr>
</tbody>
</table>