Precision Crystal Oscillators

**Frequency Control Solutions**

**EuM 2014**

Visit Us
Booth 146

**OCXO**
- Frequency Stability to ±0.005 ppm
- G-sensitivity to $5 \times 10^{-9}/g$
- Temperature Range: -55°C to +125°C
- Output Options: Sine, CMOS, PECL, LVDS
- Markets We Serve: Telecommunications, GNSS Satellite, Instrumentation, Test Equipment, Avionics

**TCXO**
- Frequency Stability to ±0.01 ppm

**VCXO**
- Phase Noise to -170 dBc/Hz

www.greenrayindustries.com
About Greenray Industries

Greenray Industries, Inc. is a leading manufacturer of precision crystal oscillators. Since 1961, we have produced innovative, high performance, frequency control solutions for commercial, defense, aerospace, communications and instrumentation markets. Our quality management system is certified compliant to the requirements of SAE Aerospace Standard AS9100C for Aviation, Space and Defense, incorporating the requirements of ISO 9001:2008.

Now into our second half-century of operation, Greenray quartz crystal oscillators are optimized for low phase noise, tight stability and world-leading, ultra-low g-sensitivity performance – and they are opening new horizons to design engineers working in the defense, space, GNSS, picocell, femtocell, and Stratum communications industries.

Greenray OCXOs, TCXOs, VCXOs and XO s are designed for demanding applications from 1 Hz to 1 GHz. Our state-of-the-art design, assembly and test operations enhance our ability to provide superior frequency control components, expert application support, and extraordinary customer service. We offer our customers in-house resources others cannot, while establishing new frequency control performance standards.

Greenray Product Features

- OCXO frequency stability to ±0.005 ppm
- TCXO frequency stability to ±0.01 ppm
- VCXO phase noise to -170 dBc/Hz
- G-Sensitivity to 5 x 10⁻¹¹/g
- Temperature range of -55°C to +125°C
- Sine wave, CMOS, PECL & LVDS outputs
- RoHS compliant upon request

In-house Electrical & Environmental Test Capabilities

- Aging
- Sine & random vibration testing
- Mechanical shock
- Acceleration
- Temperature cycling
- Stabilization bake
- Thermal shock
- Fine & gross leak testing
- Temperature testing
- Resistance to solvents
- Solderability
**TCXOs**

Greenray’s TCXO products are designed for wired and wireless communications, instrumentation, aerospace, position/location, including GPS, as well as defense applications. Our TCXOs feature temperature stability performance of 1 ppm or better and are available from 1 Hz to 1 GHz.

Greenray offers Stratum 3 compliant TCXOs for wired and wireless communications, including small cell, Ethernet and 1588 synchronization requirements. Greenray T1238 and T1239 Series TCXOs offer superior temperature stability performance and long-term stability in compact, SMD, RoHS-compliant packages.

Our TCXOs are available in a variety of configurations including miniature DIP, ceramic, SMD, MIL-spec, and industry-standard sizes. More options are available – contact the factory for options not listed here.

Greenray TCXOs feature innovative, state-of-the-art packaging to complement their outstanding performance attributes, while stringent materials, test & assembly, and quality assurance protocols satisfy the rigorous requirements of defense contractors and commercial customers alike.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Frequency Range (MHz)</th>
<th>Input Voltage (Vdc)</th>
<th>Best Stability (ppm)</th>
<th>Output Signal</th>
<th>Input Current (mA)</th>
<th>g-Sensitivity Standard Low g-Option</th>
<th>Package (mm), Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>T52</td>
<td>10 to 50</td>
<td>2.7 to 5</td>
<td>±0.1</td>
<td>CMOS/Clipped Sine</td>
<td>2 to 6</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>3.2 \times 5.0, SMD</td>
</tr>
<tr>
<td>T70</td>
<td>10 to 50</td>
<td>2.7 to 5</td>
<td>±0.1</td>
<td>CMOS/Clipped Sine</td>
<td>2 to 6</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>5.0 \times 7.0, SMD</td>
</tr>
<tr>
<td>T75</td>
<td>10 to 50</td>
<td>2.7 to 5</td>
<td>±0.3</td>
<td>CMOS/Clipped Sine</td>
<td>2 to 6</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>17.78 \times 22.86, SMD</td>
</tr>
<tr>
<td>T120</td>
<td>10 to 100</td>
<td>3.3 to 5</td>
<td>±0.5</td>
<td>CMOS</td>
<td>30</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>5.0 \times 7.0, SMD</td>
</tr>
<tr>
<td>T121</td>
<td>50 to 100</td>
<td>3.3 to 5</td>
<td>±0.3</td>
<td>Sine</td>
<td>30</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>17.27 \times 17.27, SMD</td>
</tr>
<tr>
<td>T1215</td>
<td>0.75 to 600</td>
<td>3.0 to 5</td>
<td>±0.3</td>
<td>CMOS/Cl.Sine/PECL/LVDS</td>
<td>75</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>7.49 \times 9.14, SMD</td>
</tr>
<tr>
<td>T1223</td>
<td>10 to 40</td>
<td>2.7 to 5</td>
<td>±0.1</td>
<td>CMOS/Clipped Sine</td>
<td>2 to 6</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>5.0 \times 7.0, SMD</td>
</tr>
<tr>
<td>T1239</td>
<td>10 to 40</td>
<td>2.7 to 5</td>
<td>±0.1</td>
<td>CMOS/Clipped Sine</td>
<td>2 to 6</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>3.2 \times 5.0, SMD</td>
</tr>
<tr>
<td>T1300</td>
<td>10 to 50</td>
<td>3.3 to 5</td>
<td>±0.1</td>
<td>CMOS</td>
<td>30</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>17.27 \times 22.86, SMD</td>
</tr>
<tr>
<td>T1307</td>
<td>10 to 50</td>
<td>3.3 to 5</td>
<td>±0.5</td>
<td>CMOS/Clipped Sine</td>
<td>5</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>7.49 \times 9.14, SMD</td>
</tr>
<tr>
<td>ZT600</td>
<td>10 to 500</td>
<td>3.3 to 5</td>
<td>±0.3</td>
<td>CMOS/Sine</td>
<td>25</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>26.4 \times 29.2, SMD</td>
</tr>
<tr>
<td>ZT610</td>
<td>10 to 100</td>
<td>5</td>
<td>±0.5</td>
<td>CMOS</td>
<td>25</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>12.70 \times 20.32, DIP</td>
</tr>
<tr>
<td>T1220</td>
<td>10 to 50</td>
<td>3 to 5</td>
<td>±0.01</td>
<td>CMOS/Clipped Sine</td>
<td>25</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>12.70 \times 20.32, DIP</td>
</tr>
</tbody>
</table>

**Note:** Contact Factory for High Shock/Vibration Options & Availability

**VCXOs**

Greenray VCXOs are often specified when low phase noise, tight precision and precise adjustment of the operating frequency are required.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Frequency Range (MHz)</th>
<th>Input Voltage (Vdc)</th>
<th>Best Stability (ppm)</th>
<th>Output Signal</th>
<th>Input Current (mA)</th>
<th>g-Sensitivity Standard Low g-Option</th>
<th>Package (mm), Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZN260</td>
<td>50 to 100</td>
<td>5</td>
<td>±1.0</td>
<td>CMOS</td>
<td>35</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>17.43 \times 17.43, SMD</td>
</tr>
<tr>
<td>N615</td>
<td>50 to 125</td>
<td>3 or 5</td>
<td>±1.0</td>
<td>CMOS/Sine</td>
<td>25</td>
<td>(&lt;2.5 \times 10^{-9}) /g (&lt;7 \times 10^{-10}) /g</td>
<td>9.14 \times 14.22, SMD</td>
</tr>
</tbody>
</table>

**Note:** Frequency Adjust is Available on All TCXOs and VCXOs with External Voltage
OCXOs

Greenray precision oscillators offer exceptional frequency stability, vibration, shock, and acceleration sensitivity performance.

Greenray OCXOs are optimized for low phase noise, tight stability over temperature, and long-term performance and reliability. Preferred by many for the most demanding communications, aerospace and defense applications, Greenray OCXOs deliver performance and reliability for wired and wireless communications, instrumentation and base station applications, and technologies like Stratum 3e.

Specification Parameters

In order to help you get the best solution for your particular application, please refer to the following Specifications Codes when speaking with your sales representative. Options not shown here may be available. If you’d like additional information or need assistance specifying a device, please call the plant or send us an e-mail at: technical@greenrayindustries.com.

Model   Temp/Stability   Output    Vdc    g-Sens  Frequency
T52               N17                  C         3.3          LG         10 M Hz

Ordering Example

Model   Temp/Stability   Output    Vdc    g-Sens  Frequency
T52               N17                  C         3.3          LG         10 M Hz

<table>
<thead>
<tr>
<th>Frequency Range (MHz)</th>
<th>Vdc or 5</th>
<th>±0.1</th>
<th>CMOS/Sine</th>
<th>±0.1</th>
<th>3W /1W</th>
<th>DIP</th>
<th>±0.1</th>
<th>22.1 x 29.4, SMD</th>
<th>5W /1.5W</th>
<th>CMOS</th>
<th>12.7 x 20.32, DIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>YH1420 10 to 100</td>
<td>3.3 or 5</td>
<td>±0.1</td>
<td>CMOS/Sine</td>
<td>±0.1</td>
<td>3W /1W</td>
<td>DIP</td>
<td>±0.1</td>
<td>22.1 x 29.4, SMD</td>
<td>5W /1.5W</td>
<td>CMOS</td>
<td>12.7 x 20.32, DIP</td>
</tr>
<tr>
<td>YH1440 10 to 100</td>
<td>3.3 or 5</td>
<td>±0.1</td>
<td>CMOS/Sine</td>
<td>±0.1</td>
<td>3W /1W</td>
<td>DIP</td>
<td>±0.1</td>
<td>22.1 x 29.4, SMD</td>
<td>5W /1.5W</td>
<td>CMOS</td>
<td>12.7 x 20.32, DIP</td>
</tr>
<tr>
<td>YH1460 10 to 120</td>
<td>3.3 to 15</td>
<td>±0.1</td>
<td>CMOS/Sine</td>
<td>±0.1</td>
<td>3W /1W</td>
<td>DIP</td>
<td>±0.1</td>
<td>22.1 x 29.4, SMD</td>
<td>5W /1.5W</td>
<td>CMOS</td>
<td>12.7 x 20.32, DIP</td>
</tr>
<tr>
<td>YH1300* 10 to 50</td>
<td>3.3 or 5</td>
<td>±0.2</td>
<td>CMOS</td>
<td>±0.2</td>
<td>5W /2W</td>
<td>Thru-Hole</td>
<td>±0.2</td>
<td>5W /2W</td>
<td>50.8 x 50.8, Thru-Hole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YH310 10 to 30</td>
<td>5 to 15</td>
<td>±0.1</td>
<td>CMOS/Sine</td>
<td>±0.1</td>
<td>5W /2W</td>
<td>Thru-Hole</td>
<td>±0.1</td>
<td>5W /2W</td>
<td>50.8 x 50.8, Thru-Hole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YH320 10 to 120</td>
<td>5 to 15</td>
<td>±0.1</td>
<td>CMOS/Sine</td>
<td>±0.1</td>
<td>5W /2W</td>
<td>Thru-Hole</td>
<td>±0.1</td>
<td>5W /2W</td>
<td>50.8 x 50.8, Thru-Hole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YH330 10 to 120</td>
<td>5 to 15</td>
<td>±0.1</td>
<td>CMOS/Sine</td>
<td>±0.1</td>
<td>5W /2W</td>
<td>Thru-Hole</td>
<td>±0.1</td>
<td>5W /2W</td>
<td>50.8 x 50.8, Thru-Hole</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*YH1300 offers g-Sensitivity to -7 x 10^-11/g
Aerospace & Defense
Greenray Industries has supported the aerospace and defense markets with high performance, precision oscillators for over half a century. Our engineering experience and manufacturing expertise have helped to establish Greenray as a key component supplier for a variety of programs, providing cost-efficient, leading-edge solutions and a long-term service commitment.

Today, Greenray oscillators feature various combinations of rugged packaging, ultra-low g-sensitivity and enhanced phase noise performance; many have been engineered to perform accurately and reliably in adverse environments, including those of extreme shock, temperature and vibration.

For the defense market, Greenray oscillators support smart munitions, missile guidance, airborne communications, airborne instrumentation, portable communications and equipment, radar, satellite communications, telemetry, GPS, jammers, detection and identification. Our expertise includes the design and manufacture of oscillators that withstand the severe environmental requirements of defense applications including MIL-PRF-55310, MIL-STD-202, MIL-STD-883, MIL-E-5400, and MIL-M-38510.

Greenray Specialized MIL Capabilities
- Testing and processing to MIL-PRF-55310
- Established reliable construction
- IPC-A-610 & J-STD-001 trained operators
- In-house qualification testing
- Phase noise under vibration testing
- Shock testing to 50,000 g
- Vibration testing to >50 g RMS
- Tin whisker mitigation

Communications & Instrumentation
Greenray Industries offers specialized products for commercial applications including Stratum 3 compliant TCXOs suitable for wired and wireless, small cell, Ethernet and 1588 synchronization requirements. Greenray TCXOs feature superior temperature and long-term stability in compact, RoHS compliant packages.

We offer ruggedized TCXOs for applications like GNSS/GPS that require tight stability, excellent low micro-jump performance and the best performance under shock available today.

Greenray VCXOs feature very low noise for PLL applications to support instrumentation and SATCOM market needs, with phase noise of -170 dBc/Hz and compact, cost-efficient SMD packages.
Quartz Precision for Industry. And Defense.

Greenray Industries, Mechanicsburg, PA

Stattek Corporation, Orange, CA
AdTech Ceramics, Chattanooga, TN

Solutions

Greenray is unique in its ability to draw on the specialized resources of our sister companies Statek Corporation (www.statek.com) and Advanced Technical Ceramics Company (www.adtechceramics.com). They provide high performance, miniature crystals and innovative, hermetic packaging for products like our T70 Series TCXOs. Working together for customers, we are able to offer state-of-the-art design, engineering and manufacturing solutions – that’s SOLUTIONS).

To learn more about how you can benefit from this unique set of resources, call your Greenray technical representative or visit www.greenrayindustries.com.