High Temperature Electronics

- Crystal Oscillators
- Packaged Quartz Crystals
- Real Time Clocks
- Electronic Module Products
Our Heritage

With over 50 years experience in custom design and manufacturing of microelectronics, Vectron encompasses a blend of harsh environment electronic design and packaging expertise not common in the industry today. Our staff are experts in Hybrid Multi-Chip Modules, High Temperature and Harsh Environment Electronics for Deep Space to Deep Earth applications, Physical Design Modeling, Finite Element Analysis, RF/signal conditioning, oscillator and digital embedded system designs.

The Vectron Family Tree
**Technical Capabilities**

- High Temperature Electronic Packaging (~-55°C to 250°C)
- RF Electrical Design
- Substrate and PCB Layout Design for HI-REL applications
- Custom Metal and Ceramic (HTCC, LTCC) Package Design
- Multi-layer Thick-Film Substrate Fabrication (Al₂O₃, AlN, BeO)
- Hybrid Microcircuit Assembly and Test in Class 10K clean room environment
- CSP, Flip Chip & BGA Component Mounting
- Hermetic Package Sealing for HI-REL applications (Projection, Seam and Cold welds)
- Bare Die Procurement and Handling
- Quartz BAW Resonator Design & Fabrication (Round, Strip and HFF Inverted Mesa configurations)
- SAW Wafer Fabrication in Class 100 clean room environment
- Wafer deep etching technology for Wafer Level Packaging
- Process and Test Equipment Design
- Environmental MIL-PRF Screening
- Custom Process Equipment Design
- Physical Design Modeling and Finite Element Analysis

**MIL-Spec Testing**

<table>
<thead>
<tr>
<th>Name</th>
<th>Mil-Spec</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destructive bond pull test</td>
<td>MIL-STD-883</td>
<td>2011</td>
</tr>
<tr>
<td>Nondestructive bond pull test</td>
<td>MIL-STD-883</td>
<td>2023</td>
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<tr>
<td>Die shear testing</td>
<td>MIL-STD-883</td>
<td>2019</td>
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<tr>
<td>Temperature testing</td>
<td>MIL-PRF-55310</td>
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<tr>
<td>Thermal shock-manual/automated</td>
<td>MIL-STD-883</td>
<td>1011</td>
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<tr>
<td>Thermal shock-manual/automated</td>
<td>MIL-STD-202</td>
<td>107</td>
</tr>
<tr>
<td>Temperature cycling</td>
<td>MIL-STD-883</td>
<td>1010</td>
</tr>
<tr>
<td>Constant acceleration</td>
<td>MIL-STD-883</td>
<td>2001</td>
</tr>
<tr>
<td>Constant acceleration</td>
<td>MIL-STD-202</td>
<td>212</td>
</tr>
<tr>
<td>Fine/gross leak testing</td>
<td>MIL-STD-883</td>
<td>1014</td>
</tr>
<tr>
<td>Fine/gross leak testing</td>
<td>MIL-STD-202</td>
<td>112</td>
</tr>
<tr>
<td>PIN-PD particle impact noise detection</td>
<td>MIL-STD-883</td>
<td>2020</td>
</tr>
<tr>
<td>Vibration - random</td>
<td>MIL-STD-202</td>
<td>214</td>
</tr>
<tr>
<td>Vibration - sine</td>
<td>MIL-STD-202</td>
<td>204</td>
</tr>
<tr>
<td>Shock (half-sine &amp; sawtooth)</td>
<td>MIL-STD-202</td>
<td>213</td>
</tr>
<tr>
<td>Humidity</td>
<td>MIL-STD-202</td>
<td>106</td>
</tr>
<tr>
<td>Solderability</td>
<td>MIL-STD-883</td>
<td>2003</td>
</tr>
<tr>
<td>Solderability</td>
<td>MIL-STD-202</td>
<td>208</td>
</tr>
<tr>
<td>Lead integrity</td>
<td>MIL-STD-883</td>
<td>2004</td>
</tr>
<tr>
<td>Terminal strength</td>
<td>MIL-STD-202</td>
<td>211</td>
</tr>
</tbody>
</table>

*Complete MIL-STD and custom harsh environment screenings are available. Vectron works closely with customers to define screening requirements.*

**Our Strengths**

A number of applications today require electronics to operate in extremely harsh environmental conditions. Operation temperatures of 150°C and higher are required for energy exploration as well as other emerging applications such as Geophysical Services, Avionics and Industrial Process Control. Environments like these require electronics designed and manufactured specifically to withstand such temperature extremes.

Extreme environment applications require electronic systems that are capable of surviving beyond the MIL-STD operating temperature range of -55°C to +125°C. Applications such as Deep Well Logging Tools (sensor, gauge and data acquisition etc.), Geothermal Logging, Light Weight Ground and Air Vehicles and Industrial Process Monitoring require robust electronic systems that can operate at 200°C and beyond. In addition, some of these applications also require survivability under high shock and vibration environments. Vectron’s expertise readily handles such harsh environments. For example, our custom engineered High-Temperature Electronic Modules have been qualified and deployed for 250°C+ “down-hole” drilling/exploration applications.

- Extending device reliability and operating life at the field
- Eliminating the need for auxiliary cooling techniques such as massive heat sinks or elaborate heat pipe designs
- Lighter weight and smaller sizes
- Integration of sensors and transducers along with electronics to operate reliably in high temperature environments

**Assembly Process**

Vectron offers the flexibility of applying a wide range of manufacturing processes, allowing us to accomplish unique product requirements and delivery of the highest quality workmanship to our customers. Vectron manufactures products with robust assembly techniques, intense process control and process automation.

*Our assembly processes include:*

- **Thick-Film Substrate**
  - Al₂O₃, BeO, AlN, Multi-Layer
- **Component Attachment**
  - Flip Chip, Eutectic die mount, Epoxy die mount
- **Wirebonding**
  - Al and Au wirebonding
- **Hermetic Sealing with Metal and Ceramic Packages**
  - Projection, seam and cold welding
High Temperature Crystal Oscillators

Vectron offers several High Temperature Crystal Oscillator product platforms for extreme environment applications. Typical operating temperature range is from -55°C to +230°C. In addition, Vectron also offers 250°C High Temperature Crystal Oscillators for ultra HT applications to meet today's and future downhole tools requirements. Vectron’s vertical integration in the following technical areas ensures the ability to design and manufacture state of the art High Temperature frequency control products:

- BAW & SAW quartz resonator design & fabrication
- RF oscillator circuit design
- High Temperature packaging expertise
- High Temperature assembly & test expertise
- Environmental screening
- RoHS compliant
- COO: USA
- ECCN: EAR99

### Oscillators Overview

<table>
<thead>
<tr>
<th>Product</th>
<th>Standard Frequency</th>
<th>Supply Voltage</th>
<th>Temperature Range</th>
<th>Package Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PX-702</td>
<td>500kHz to 50MHz</td>
<td>1.8, 2.5, 3.3 or 5.0</td>
<td>-55 to 230°C</td>
<td>5 x 7 x 1.8 mm, SMD Ceramic Package</td>
</tr>
<tr>
<td>PX-570</td>
<td>500kHz to 40MHz</td>
<td>1.8, 2.5, 3.3 or 5.0</td>
<td>-55 to 230°C</td>
<td>8 x 8.5 x 2.9 mm, Leaded Ceramic Package</td>
</tr>
<tr>
<td>PX-420</td>
<td>500kHz to 40MHz</td>
<td>3.3 or 5.0</td>
<td>-55 to 230°C</td>
<td>0.5” x 0.5” x 0.2” 4 Pin ½DIP</td>
</tr>
<tr>
<td>PX-610</td>
<td>32kHz to 40MHz</td>
<td>1.8, 2.5, 3.3 or 5.0</td>
<td>-55 to 230°C</td>
<td>3 pin TO-39, 0.38” Dia x 0.185” H</td>
</tr>
<tr>
<td>VX-708</td>
<td>2MHz to 40MHz</td>
<td>3.3</td>
<td>-55 to 180°C</td>
<td>5 x 7 x 1.8mm, SMD Ceramic Package</td>
</tr>
<tr>
<td>VX-400</td>
<td>1MHz to 32.768MHz</td>
<td>3.3 or 5.0</td>
<td>-55 to 200°C</td>
<td>0.8” x 0.5” x 0.2” 4 Pin DIP</td>
</tr>
</tbody>
</table>

**PX-702** Small footprint High Temperature Ceramic SMD Crystal Oscillator product platform for extreme environment applications. In addition to its wide operating temperature range, the PX-702 HTXO is also ideal for high shock & vibration applications. It is also designed to exceed 3000g shock and 36g vibration levels of the demanding MIL-STD-883 requirements.

**Features**
- Continuous operating temperature range -55°C to 230°C
- 1.8Vdc, 2.5Vdc, 3.3Vdc or 5Vdc operation
- Tight temperature stability
- Design for high shock & vibration to exceed 3000g shock & 36g vibration
- Output frequency 500 kHz to 50 MHz standard
- 4-point crystal mount
- Standard 5 x 7 x 1.8 mm SMD package

**PX-570** High Temperature Crystal Oscillator product platform for extreme environment applications. Typical operating temperature range is from -55°C to +230°C (Tighter temperature stability is available) with a frequency stability of ± 250 ppm over the entire operating temperature range.

**Features**
- Continuous operating temperature range -55°C to 230°C
- 1.8, 2.5, 3.3 or 5Vdc operation
- 3 lead options for thru-hole and SMD
- 4-point crystal mount for harsh environment applications
- High shock and vibration survival
- Output frequency 500kHz to 40MHz standard (see HT RTC XO datasheet for 32.768kHz requirements)
- 8 x 8.5 x 2.9mm ceramic leaded package
- 6 lead package standard (contact factory for 4 lead package option)
PX-420 High Temperature Crystal Oscillator product platform for extreme environment applications. Typical operating temperature range is from -55°C to +230°C with a frequency stability of ±250 ppm over the entire operating temperature range.

**Features**
- Continuous operating temperature range -55°C to 230°C
- Low jitter and phase noise
- 1.8Vdc, 2.5Vdc, 3.3Vdc or 5Vdc operation
- 4-point crystal mount for high shock & vibration survival
- Output frequency 500kHz to 40MHz standard
- Standard 4 pin ½ DIP package
- Custom HT temperature sensing oscillator available

![PX-420 High-Temp Temperature Sensor](chart)

\[ y = 25.452x - 544 \]
\[ R^2 = 0.9722 \]

Temperature (Degree C)

**PX-610** High Temperature Crystal Oscillator product platform for extreme environment applications. In addition to its wide operating temperature range, the PX-610 HTXO is also ideal for high shock & vibration applications. The footprint of the PX-610 design is based on an industry standard TO-39 package.

**Features**
- Continuous operating temperature range -55°C to 230°C
- Low jitter and phase noise
- 3.3Vdc or 5Vdc operation
- 4-point crystal mount for high shock & vibration survival
- Output frequency 32kHz to 40MHz standard
- 0.380” diameter x 0.185” high resistance welded 3 pin TO-39 package

![Phase Noise Performance](chart)

**VX-708** High Temperature Voltage Control Crystal Oscillator is now available in a 4 Pin and 6 Pin footprint. This VCXO supports a frequency range of 2MHz to 40MHz, provides an absolute pull range of ±50ppm and has a 4 point mount crystal making it ideal for high shock, vibration and harsh environmental applications.

**Features**
- Continuous operating temperature range -55°C to 200°C
- Low jitter and phase noise
- 3.3Vdc or 5Vdc operation
- 4-point crystal mount for harsh environment applications
- High shock & vibration survival
- Output frequency 1MHz to 32.768MHz standard
- Standard 5 x 7 x 1.8 mm SMD package

![Phase Noise Performance](chart)
**VX-400** High Temperature Voltage Control Crystal Oscillator product platform for extreme environment applications. Typical operating temperature range is from -55°C to +180°C with an absolute pull range of ±50 ppm.

**Features**
- Continuous operating temperature range -55°C to 200°C
- Low jitter and phase noise
- 3.3Vdc or 5Vdc operation
- 4-point crystal mount for harsh environment applications
- high shock & vibration survival
- Output frequency 1MHz to 32.768MHz standard
- Standard 4 pin DIP package

**HX-171** High Stability Oven Controlled Crystal Oscillator (OCXO) utilizes proprietary crystal designs and state of the art correction algorithms, the HX-171 achieves a stability of ±5ppb over the extended temperature range of -40°C to 150°C. Packaged in a hermetically sealed 38 x 28mm enclosure, this OCXO offers aging performances of ±1.5ppb/day and is specifically designed for extreme environmental conditions.

**Features**
- Frequency: 10 or 20 MHz (other frequencies available)
- Temperature range: -40°C to 150°C
- Temperature stability: ±5ppb
- Aging: ±1.5ppb/day
- Package: 38 x 28 x 23 mm
- Output: HCMOS
- Supply: 5.0 V

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**High Temperature Packaged Quartz Crystals**

Vectron International’s high temperature quartz crystal resonators are designed and manufactured for continuous operation in harsh environmental conditions at extreme temperatures as low as -55°C and as high as +250°C. Several different crystallographic orientations are offered for a wide range of applications. The resonators are available in all industry standard package styles with all internal components designed for outstanding performance in extreme environmental conditions.

**Features**
- Frequencies from 2.20 MHz to 225 MHz
- Standard Operating Temperature Range: -55°C to 250°C
- AT, SC, FC, AC and IT–cuts
- RoHS & WEEE compliant packaging
- Shock; 100g, 6ms
- Vibration; 20g, 10 to 2kHz
- Temp sensor crystals Y-cut (~85ppm/°C) or AC-cut (~20ppm/°C)
- Radiation Hardened Swept quartz available for space applications

**Packaged Quartz Crystals Overview**

<table>
<thead>
<tr>
<th>Product</th>
<th>Freq. Range (MHz)</th>
<th>Low Profile</th>
<th>High Shock</th>
<th>Package Type</th>
<th>Height (in)</th>
<th>Quartz Cuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>XR-R (HC35/TO-5)</td>
<td>4 to 225</td>
<td>●</td>
<td>●</td>
<td>Thru-hole</td>
<td>0.155 - 0.265</td>
<td>AT/SC/IT</td>
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<tr>
<td>XR-U (HC37/TO-8)</td>
<td>2.5 to 140</td>
<td>●</td>
<td>●</td>
<td>Thru-hole</td>
<td>0.200 - 0.265</td>
<td>AT/SC/IT</td>
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<tr>
<td>XR-B (HC43)</td>
<td>2.2 to 210</td>
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<td></td>
<td>Thru-hole, SMD</td>
<td>0.440 - 0.530</td>
<td>AT/SC/IT</td>
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<tr>
<td>XR-A (HC49)</td>
<td>2.2 to 210</td>
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<td></td>
<td>Thru-hole, SMD</td>
<td>0.440 - 0.530</td>
<td>AT</td>
</tr>
<tr>
<td>XR-P (SM1/SQ580)</td>
<td>4.2 to 30</td>
<td>●</td>
<td>●</td>
<td>SMD</td>
<td>8.2 x 8.2 x 2.5 mm</td>
<td>AT</td>
</tr>
</tbody>
</table>
**Real Time Clocks**

<table>
<thead>
<tr>
<th>Product</th>
<th>Standard Frequency</th>
<th>Supply Voltage</th>
<th>Temperature Range</th>
<th>Package Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM-4201-RTCM1 Real Time Clock Module</td>
<td>32.768kHz</td>
<td>2.7 to 3.6</td>
<td>-20 to 180°C</td>
<td>0.5” x 0.5” x .2” - 8 Pin ½DIP</td>
</tr>
<tr>
<td>HM-4201-RTCM2 Real Time Clock Module</td>
<td>32.768kHz</td>
<td>2.7 to 3.6</td>
<td>-40 to 200°C</td>
<td>0.5” x 0.5” x .2” - 8 Pin ½DIP</td>
</tr>
<tr>
<td>32.768kHz XO for Real Time Clock Applications</td>
<td>32.768kHz</td>
<td>1.8, 2.5, 3.3 or 5.0</td>
<td>-55 to 200°C</td>
<td>5 x 7 x 1.8 mm - SMD 8 x 8.5 x 2.9 mm - Leaded 0.5” x 0.5” x .2” - ½DIP</td>
</tr>
</tbody>
</table>

**HM-4201-RTCM1 -(Real Time Clock Module)**

+200°C High Temp Real Time Clock/Calendar Module with Build-In 32.768KHz Crystal Oscillator. Timing, Calendar and Alarm functions can be set via I2C BUS. The entire HT RTC Module is fully operational from 2.7V to 3.6V. The Timing/Calendar function is operational down to 1.8V range.

**Features**
- Driven by built-in High-Temp Crystal Oscillator at 32.768kHz
- Timing, Calendar and Alarm functions set via I2C BUS
- Timing: Hours, Min, Sec and Sub-sec
- Calendar: Day of the Wk, Day, Month and Year
- Software Alarm: Sec, Min, Hr, Day of the Wk, Day, Month
- Wide Operating Temp: -40°C to 200°C
- 2.7 to 3.6 Vdc operation
- Low current consumption: 100μA
- 512Hz frequency output for calibration
- RoHS compliant
- 8-pin ½ Dip hermetically seal package
- 4-point crystal mount for harsh environment applications
- Design to meet 3000kg shock & 36g rm vibration

**32.768kHz XO-(for Real Time Clock Applications)**

Is a High Temperature Low Power Real Time Clock Crystal Oscillator (HT RTC XO) product platform for extreme environment applications. Comparing with traditional RTC solution with 32.768KHz tuning folk resonator design, Vectron HT RTC XO solution provides unsurpassed reliability with long lifetime at elevated temperature and exceptional temperature stability performance for high temperature, high shock & vibration applications.

**Features**
- Output frequency 32.768kHz
- Continuous operating temperature range -55°C to 200°C
- 1.8V, 2.5V, 3.3V or 5.0 V operation
- Design for high shock & vibration
- Offer three standard product footprints
- Low current consumption option available
World-Wide Locations

United States

VI Hudson, Corporate Headquarters
267 Lowell Road, Suite 102
Hudson, NH 03051
Tel: 1.888.328.7661
Fax: 1.888.329.8328

VI Mount Holly Springs
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Mount Holly Springs, PA 17065
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Fax: 1.717.486.5920

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