Precision Frequency Control and Timing Solutions
Vectron Brand Quartz Crystal Oscillators

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Introduction

Microchip’s timing portfolio includes the most extensive range of frequency control and timing solutions in the world. From silicon-based MEMs resonators, to quartz crystal and SAW oscillators, to atomic references, Microchip provides cost-effective solutions for any long or short-term stability requirement. Microchip’s network synchronization ICs include 1588, GNSS timing and Sync E. With clock generators, clock synthesizers, buffers and clock distribution, a total clock tree solution can be provided for any application.

This brochure highlights the precision frequency control solutions, including Vectron brand quartz crystal oscillators, atomic clocks and modular solutions that provide an additional layer of integration.

From deep water to deep space, and everywhere in between, Microchip synchronizes the universe.

- Integrated Precision Solutions
- Atomic Standards
- Chip Scale Atomic Clock (CSAC)
- Oven Controlled Crystal Oscillators (OCXO)
- Temperature Compensated Crystal Oscillators (TCXO)
- Clock Oscillators (XO)
- MEMs Oscillators
- Voltage Controlled Crystal Oscillators (OCXO)
- Voltage Controlled SAW Oscillators
- SAW Filters
- Quartz Crystals

Markets

- Data Centers
- Defense
- Medical
- Wireless

- Aerospace
- Energy Exploration
- Test and Measurement
- Wireline/Cable
Integrated Precision Solutions

**Hi-Temp Real Time Clock Module**

- Timing, calendar and alarm set via FC BUS
- Built-in 32.768 kHz quartz oscillator
- Package: 13 × 13 mm, 8-pin DIP
- Supply voltage: 2.7 to 3.6V
- Continuous operating temperature range: −40°C to 200°C
- Tight temperature stability of ±100 ppm or better
- Low-power consumption of 100 μA or less

**FX-700/FX-702**

**Frequency Translators**

- SAW or BAW quartz-based low-jitter PLL frequency translators
- Output frequency: 1 MHz to 1 GHz
- Input frequency: 8 kHz to 1 GHz
- Output logic: CMOS (FX-700), LVDS and LVPECL (FX-702)
- Supply voltage: 3.3V (FX-700 and FX-702) or 5.0V (FX-700)

**MD-261**

**Disciplined Oscillator Module**

- Miniature 25 × 20 mm footprint
- Embedded GNSS receiver - GPS and Glonass compatible
- 1 pps and 10 MHz output signals standard
- Embedded precision oscillator
- Serial communications interface standard
- Evaluation kit available

**MD-175/MD-176**

**GNSS Disciplined Oscillator Module**

- Embedded GNSS receiver (MD-176)
- Accepts auxiliary 1 pps input
- 1.5 μs 24 hour holdover
- 10 MHz Sinewave or CMOS output
- 1 pps CMOS output
- Adapative aging correction
- 50 × 40 mm SMD design
- Evaluation kit available

**MD-012/MD-013**

**GNSS Disciplined Oscillator Module**

- Embedded GNSS receiver (MD-013)
- Accepts auxiliary 1 pps input
- 1.5 μs 24 hour holdover
- 10 MHz Sinewave or CMOS output
- 1 pps CMOS output
- Adapative aging correction
- Barometric pressure correction
- Evaluation kit available

**Custom Module**

- Build to source control drawing or Vectron custom datasheet
- Integrate existing Vectron products into single solution
- Ruggedization for military applications
- Options Include: multiple outputs, multiple frequencies, low phase noise, frequencies to 1.5 GHz, input 1 pps, embedded receivers, embedded OCXO, TCXO, VCSO
MCXO, EMXO and OCXO
50 ppb to 0.4 ppb Temperature Stability

**MX-600**
*Low Power*
- Output: CMOS
- Frequency: 8 to 40 MHz
- Package: $7 \times 9 \times 4.1$ mm
- Supply voltage: 3.3V
- Temperature stability: $-20^\circ C$ to $70^\circ C$; $\pm 20$ ppb
  $-40^\circ C$ to $85^\circ C$; $\pm 30$ ppb
- Phase noise: $-153$ dBc/Hz @ 10 kHz
- OCXO replacement with low power consumption

**MX-503**
*Low Power*
- Output: CMOS
- Frequency: 8 to 50 MHz
- Package: $9 \times 14 \times 3.8$ mm
- Supply voltage: 3.3V
- Temperature stability: $-20^\circ C$ to $70^\circ C$; $\pm 20$ ppb
  $-40^\circ C$ to $85^\circ C$; $\pm 30$ ppb
  $-40^\circ C$ to $105^\circ C$; $\pm 100$ ppb
- Phase noise: $153$ dBc/Hz @ 10 kHz
- OCXO replacement with low power consumption

**OX-601**
- Output: CMOS
- Frequency: 10 to 40 MHz
- Package: $9.6 \times 7.4 \times 4.1$ mm
- Supply voltage: 3.3V
- Temperature stability: $-40^\circ C$ to $85^\circ C$; $\pm 10$ ppb
- High reliability OCXO ASIC design

**EX-421**
*Low Power*
- Output: CMOS, Sinewave
- Frequency: 10 to 100 MHz
- Package: $13 \times 13 \times 10$ mm
- Supply voltage: 3.3 or 5.0V
- Temperature stability: $0^\circ C$ to $70^\circ C$; $\pm 10$ ppb
  $-40^\circ C$ to $85^\circ C$; $\pm 30$ ppb
- Low power: 0.25W steady state
- Aging: 1 ppb/day, 100 ppb/year
- Phase noise floor: $-165$ dBc/Hz

**OX-405**
- Output: CMOS, Sinewave
- Frequency: 80 to 120 MHz
- Package: $13 \times 20 \times 8.3$ mm
- Supply voltage: 3.3V or 5.0V
- Temperature stability: $-40^\circ C$ to $85^\circ C$; $\pm 100$ ppb
- Phase noise: $-95$ dBc/Hz @ 10 Hz
  $-160$ dBc/Hz @ 100 kHz
- TCXO replacement for better short term stability
MCXO, EMXO and OCXO
50 ppb to 0.4 ppb Temperature Stability

OX-204/OX-205
Low Phase Noise

- Output: CMOS, Sinewave
- Frequency: OX-204 10 MHz standard (3.3, 5.0 or 12.0V)
- OX-205 100 MHz standard (5.0 or 12.0V)
- Package: 25.4 × 25.4 × 15 mm
- OX-204: phase noise –135 dBc/Hz @ 10 Hz
  –175 dBc/Hz @ 10 kHz
- OX-205: phase noise –135 dBc/Hz @ 100 Hz
  –176 dBc/Hz @ 100 kHz
- Other frequencies available upon request

OX-228

- Output: CMOS, Sinewave
- Frequency: 5 to 20 MHz
- Package: 22 × 25.4 × 12.1 mm
- Supply voltage: 3.3V
- Temperature stability: –40°C to 85°C; ±0.4 ppb [pk-pk]
- Low aging: 0.1 ppb/day

OX-208

- Output: CMOS, Sinewave
- Frequency: 5 to 20 MHz
- Package: 25.4 × 25.4 × 12.7 mm
- Supply voltage: 3.3 or 5.0V
- Temperature stability: 0°C to 70°C ; ±0.4 ppb
  –40°C to 85°C; ±0.8 ppb
- Low aging: 0.15 ppb/day

OX-171

- Output: CMOS, Sinewave
- Frequency: 5 to 20 MHz
- Package: 38 × 28 × 14 mm
- Supply voltage: 3.3, 5.0 or 12.0V
- Excellent temperature stability: 0°C to 70°C ; ±0.4 ppb
  –40°C to 85°C; ±0.8 ppb
- Allan deviation: 5E-12 @ 1 s
- Low aging: 0.06 ppb/day

MD-173

- Coefficient corrected crystal oscillator
- FC interface with frequency coefficient
- On-board temperature sensor
- Temperature stability: –40°C to 85°C; 0.4ppb [pk-pk]
  without correction
- Low aging: 0.06 ppb/day
- Frequency: 5 to 20 MHz
- Package: 38 × 25.4 × 22 mm

OX-047/OX-48
Low g, Low Phase noise

- Output: 10 MHz Sinewave (OX-047)
  100 MHz Sinewave (OX-048)
- Low g-sensitivity: 0.02 ppb/g to 250 Hz (OX-047)
  0.05 ppb/g to 250 Hz (OX-048)
- Low phase noise: –135 dBc/Hz @ 10 Hz (OX-047)
  –135 dBc/Hz @ 100 Hz (OX-048)
- Package: 50 × 75 × 25 mm with SMA connector
- Supply voltage: 12.0 or 15.0V
- Operating range: –40°C to 85°C
### TCXOs

**2.5 ppm to 100 ppb**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Frequency Range</th>
<th>Package Size</th>
<th>Supply Voltage</th>
<th>Temperature Stability</th>
<th>Phase Noise</th>
<th>Optional Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VT-860</strong></td>
<td>Output: Clipped Sinewave</td>
<td>13 to 52 MHz</td>
<td>2 × 1.6 × 0.7 mm</td>
<td>1.8V to 3.3V</td>
<td>-40°C to +85°C; ±500 ppb</td>
<td>-153 dBC/Hz @ 100 kHz</td>
<td></td>
</tr>
<tr>
<td><strong>VT-803</strong></td>
<td>Output: CMOS, Clipped Sinewave</td>
<td>10 to 52 MHz</td>
<td>5 × 3.2 × 1.5 mm</td>
<td>2.8, 3.0, 3.3 or 5.0V</td>
<td>-10°C to 70°C; ±100 ppb</td>
<td>-40°C to 85°C; ±200 ppb</td>
<td>Optional VCXO function available</td>
</tr>
<tr>
<td><strong>TX-707/TX-708</strong></td>
<td>Output: CMOS, Clipped Sinewave</td>
<td>10 to 52 MHz</td>
<td>7 × 5 × 2.8 mm</td>
<td>3.3 or 5.0V</td>
<td>-40°C to 85°C; ±1 ppm</td>
<td>0.1 ppb/g option</td>
<td>Low g</td>
</tr>
<tr>
<td><strong>TX-321</strong></td>
<td>Output: CMOS, Sinewave</td>
<td>10 to 52 MHz</td>
<td>23 × 18 × 4.5 mm</td>
<td>3.3 or 5.0V</td>
<td>-40°C to 85°C; ±1 ppm</td>
<td>0.2 ppb/g</td>
<td>Ultra-low phase noise: -116 dBC/Hz @ 10 Hz (10 MHz) &lt; 165 dBC/Hz noise floor</td>
</tr>
<tr>
<td><strong>MXT57</strong></td>
<td>Output: CMOS, LVPECL, LVDS, HCSL</td>
<td>2.5 to 850 MHz</td>
<td>7 × 5 × 1.4 mm</td>
<td>2.3 to 3.6V</td>
<td>-40°C to 85°C; ±2.5 ppm</td>
<td>500 fs-rms typical, 12 kHz to 20 MHz</td>
<td>500 fs-rms typical, 12 kHz to 20 MHz</td>
</tr>
<tr>
<td><strong>TX-500</strong></td>
<td>Output: CMOS, Sinewave, PECL</td>
<td>6.4 to 160 MHz</td>
<td>9 × 14 × 5.9 mm</td>
<td>3.3V or 5.0V</td>
<td>-40°C to 85°C; ±0.28 ppm</td>
<td></td>
<td>Low phase noise option, Low profile</td>
</tr>
</tbody>
</table>

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VC-840

- Output: CMOS
- Frequency: 1 to 160 MHz
- Package: 2.5 × 2 × 0.9 mm
- Supply voltage: 1.8, 2.5 or 3.3V
- Enable/disable for board test and debug
- Temperature stability: –40°C to 105°C; ±25 ppm

VC-827

- Output: LVPECL, LVDS
- Frequency: 20 to 220 MHz
- Package: 2.5 × 2 × 0.9 mm
- Supply voltage: 1.8, 2.5 or 3.3V
- Enable/disable for board test and debug
- Operating temperature: –40°C to 105°C
- Jitter: 90 fs-rms typical, 12 kHz to 20 MHz

HT-MM900B

MEMS

- Output: CMOS
- Frequency: 1 to 100 MHz
- Package: 3.2 × 2.5/2.5 × 2/2 × 1.6/1.6 × 1.2
- Supply voltage: 1.71 to 3.3V
- Enable/disable for board test and debug
- Operating temperature: –40°C to 85°C
- MEMs oscillator

PX-702

High Temp

- Output: CMOS
- Frequency 32.768 kHz to 50 MHz
- Package: 5 × 7 × 1.8 mm, 4 or 6 pad
- Supply voltage: 1.8, 2.5, 3.3 or 5.0V
- Operating temperature range: –55°C to 230°C
- Designed for high shock and vibration

HT-RTC-XO

High Temp

- Output: CMOS
- Frequency: 32.768 kHz
- Package: 6 different available footprints
- Ultra-low current option: 70 µA @ 1.8V, 90 µA @ 3.3V
- Enable/disable for board test and debug
- Operating temperature: –55°C to 200°C
- Designed for high shock and vibration

VC-711

Low Jitter

- Output: LVPECL, LVDS
- Frequency: 10 to 170 MHz
- Package: 5 × 7 × 1.8 mm
- Supply voltage: 2.5 or 3.3V
- Enable/disable for board test and debug
- Operating temperature: –40°C to 105°C
- Jitter: 75 fs-rms typical, 12 kHz to 20 MHz
VS-800

- Output: Sinewave, Balanced Sinewave
- Frequency: 800 MHz to 3.2 GHz
- Package: 5 × 3.2 × 1.8 mm
- Supply voltage: 3.3V
- Jitter: 6 fs-rms typical
  \((f_N = 1.56897 \text{ GHz}, \text{DIFF 1x}, 12 \text{ kHz to 20 MHz})\)

VS-705

- Output: LVPECL or LVDS
- Frequency: 122.88 MHz to 1 GHz
- Package: 5 × 7.5 × 2.5 mm
- Supply voltage: 2.5 or 3.3V
- Jitter: <120 fs-rms \((f_N = 622.08 \text{ MHz}, 12 \text{ kHz to 20 MHz})\)
  <105 fs-rms \((f_N = 622.08 \text{ MHz}, 50 \text{ kHz to 80 MHz})\)
- Spurious suppression, 90 dBc typical
- Tri-State output select (OD, OS, OE)

VS-709

- Output: LVPECL, LVDS
- Frequency: 155.52 to 983.04 MHz
- Package: 5 × 7 × 1.8 mm
- Supply voltage: 2.5 or 3.3V
- Dual-frequency VCSO
- Jitter: <120 fs-rms \((f_N = 622.08 \text{ MHz}, 12 \text{ kHz to 20 MHz})\)
  <105 fs-rms \((f_N = 622.08 \text{ MHz}, 50 \text{ kHz to 80 MHz})\)
- Tri-state frequency select (F1, OD, F2)

VS-507

- Output: Sinewave, Balanced Sinewave
- Frequency range: 3.0 to 6.0 GHz
- Package 9 × 14 × 4.9 mm
- Supply voltage: 3.3V
- Ultra-low jitter performance
- Jitter: < 10 fs-rms, 12 kHz to 20 MHz

VS-508

- Output: Sinewave, Balanced Sinewave, LVPECL
- Frequency range: 800 MHz to 2.9 GHz
- Low g-sensitivity:<0.6 ppb/g
- High shock and vibration
- Supply voltage: 3.3 or 5.0V
- Jitter: < 12 fs-rms, 12 KHz to 20 MHz

101765

- Output: Sinewave
- Frequency: 320 MHz to 2.5 GHz
- Package: 25 × 25 × 5 mm kovar flatpack
- Temperature stability: –40°C to 85°C; ± 20 ppm
- Supply voltage: 5–15V
- Phase noise: –160 dBc/Hz @ 10 KHz \((600 \text{ MHz})\)
  –180 dBc/Hz noise floor (fundamental)
- Output power: +18 dBm (fundamental)
VV-800
Low Jitter

- Output: CMOS
- Frequency: 1.544 to 77.76 MHz
- Package: 3.2 × 5 × 1.2 mm
- Supply voltage: 3.3 or 5.0V
- Fundamental crystal design with low-jitter performance
- Output disable feature
- Absolute pull range: ±50 ppm min

VX-805

- Output: LVPECL
- Frequency: 100 to 200 MHz
- Package: 5 × 3.2 × 1.8 mm
- Supply voltage: 3.3V
- Output disable feature
- Absolute pull range: ±50 ppm min
- Operating temperature: −40°C to 105°C
- Low phase noise: −148 dBC/Hz @ 10 kHz (122.88 MHz)

VX-708
High Temperature

- Output: CMOS
- Frequency: 2 to 40 MHz
- Package: 5 × 7 × 1.8 mm, 4 or 6 Pad SMD
- Supply voltage: 3.3V
- Continuous operating temperature range −55°C to 180°C
- Low jitter and phase noise
- Compliant crystal mount for high shock and vibration

VX-504

- Output: CMOS
- Frequency: 30 to 160 MHz
- Package: 9 × 14 × 2.8 mm
- Supply voltage: 3.3 or 5.0V
- Low g-sensitivity: 0.3 ppb/g
- Temperature stability: −40°C to 85°C; ±30 ppm
- Phase noise: −150 dBc/Hz @ 10 kHz

VX-505

- Output: CMOS and PECL
- Frequency: 10 MHz to 1.2 GHz
- Package: 14 × 9 × 5.9 mm or height option 2.8 mm
- Supply voltage: 3.3 or 5.0V
- Jitter: 100 fs-rms typical, 12 kHz to 20 MHz
- Absolute pull range: ±100 ppm

VS-702

- Output: LVPECL, LVDS
- Frequency: 150 MHz to 1 GHz
- Package: 5 × 7 × 2 mm
- Supply voltage: 3.3V
- Jitter: 100 fs-rms typical, 12 kHz to 20 MHz
- Absolute pull range: ±100 ppm
- Improved temperature stability over standard VCSO
- VCXO with on-board SAW filter
Crystals and Filters

Crystals

- Frequency: 32.768 kHz to 200 MHz
- Packages from HC-49 to SMD 1.6 × 1.2 mm
- Fundamental or third overtone modes
- Temperature stabilities of 10 to 50 ppm
- Load capacitance: 6 to 32 pF

Hi-Temp Packaged Crystals

- Frequency: 3 to 200 MHz
- Operating temperature range up to 250°C
- AT, SC, FC, AC and IT-Cut resonators
- Multiple package options available
- Designed for high shock and vibration
- Low aging
- Low phase noise

SAW Filters

- Frequency: 70 MHz to 2.6 GHz
- Standard/custom filters for GSM, TDMA, EDGE, CDMA, W-CDMA, UMTS and 4G-LTE
- Custom frequencies available
- Low loss, wide bandwidth
- Low temperature coefficient of frequency
- Package: optimized SMD and PIN
- High-input power capabilities

RF Filters

- Frequency: 700 MHz to 2.7 GHz
- Bandwidth: 0.2 to 85 MHz
- Low Loss: <=1 dB
- Custom designs
- Balanced, unbalanced and mixed mode
- Package: miniature SMD (3 × 3, 2.5 × 2 and 2 × 1.6 mm)
- High-input power capabilities
- Temperature-Compensated SAW (TC-SAW) solutions available

Military and Space

- Frequency: 35.42, 70, 465 MHz and others
- Bandwidth: 0.2 to 100 MHz
- Low loss: <10 dB depends on bandwidth
- Balanced or unbalanced or mixed mode
- Package: small SMD (3 × 3 and 13 × 6 mm LCC)
- Many custom designs
- High-input power capabilities

Navigation (GPS/GIS)

- 1.2 to 1.6 GHz for high precision receivers
- 1.227, 1.237, 1.57542, 1.590 GHz
- Frequency: 1227, 1237, 1575.42, 1590 MHz
- Bandwidth: 2.4, 20, 40 MHz
- Low loss: <2 dB
- Low ripple: <0.3 dB
- Balanced, unbalanced and mixed mode
- Package: miniature SMD (3 × 3 and 2.5 × 2 mm)
- High-input power capabilities

ISM Band Filters and Resonators

- Frequency: 433.92, 315, 868, 915 MHz
- Bandwidth: 0.1 to 2 MHz
- Custom frequencies available
- Low loss: <2 dB
- Low temperature coefficient of frequency
- Package: small SMD (3.8 × 3.8 and 3 × 3 mm)
- High-input power capabilities

Monolithic Crystal Filters

- Frequency: 4 to 250 MHz
- Bandwidth: 0.1 to 500 kHz
- Package: 3.8 × 3.8 and 3 × 3 mm, SMD
- Poles: up to 12
- High selectivity
- High frequency stability
- Internal matching available
Chip Scale Atomic Clock (CSAC)

- Power consumption <120 mW
- Less than 17 cc volume, 1.6” x 1.39” x 0.45”
- 10 MHz CMOS-compatible output
- 1 PPS output and 1 PPS input for synchronization
- RS-232 interface for monitoring and control
- Low-noise options and space versions available
- Temperature stability: –10°C to 70°C; ±0.5 ppb
- Low aging: < 0.9 ppb/month

Miniature Atomic Clock (MAC)

- High-precision atomic clock oscillator
- Small form factor (standard OCXO pinout)
- Rapid warm-up time
- 1 PPS output and 1 PPS input for synchronization
- Low power consumption
- Temperature Stability: –10°C to 75°C; ±0.05 ppb
- Low aging: 0.05 ppb/month

Ruggedized Rb (8200/LN)

- 10 MHz output
- 1 PPS output (8200 LN only)
- 1 PPS input (8200 LN only)
- Low phase noise (82000 LN only)
- Low weight < 2 lbs
- Shock/vibration hardened
- Digital monitor and control
- Low physical profile (<1.0” high)
- Temperature stability: –40°C to 75°C; ±0.3 ppb
- Low aging: < 0.05 ppb/month

Cesium Standards

- Frequency accuracies up to ±5E–13
- Long-term stabilities up to 1E–14
- Multiple output configurations available
- Rack mountable
- Optional battery backups

Hydrogen Masers

- Patented magnetic quadrapole for superior atomic beam focusing
- Demonstrated lifetime of greater than 20 years
- Unique, cavity auto tuning feature for exceptional long-term standalone stability
- A low-phase noise option for superior short-term stability in an active hydrogen maser
- Two year standard warranty
- Temperature sensitivity <8E-15/ºC
- Drift compensation mode enabling drift as low as <3E-16/day (typical, after 3 months)
- Allan Deviation: < 1.5E-15 @ 10,000s

Atomic References
1E-9 to 1E-15 Stabilities
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