Description:
Connor-Winfield’s Txxx and TVxxx series are 5x7mm TCXO and VCTCXO products with exceptional frequency stability and low phase noise. Through the use of analog temperature compensation, these products are capable of holding Stratum 3 level temperature stabilities of ±0.28 ppm over the commercial and industrial temperature ranges. Available in 4-pad or 10-pad surface mount footprints.

These products are designed for such applications as IEEE 1588 PTP and Synchronous Ethernet.

All models will meet ±4.6 ppm accuracies for twenty years.

Applications:
- IEEE 1588 Applications
- Synchronous Ethernet slave clocks, ITU-T G.8262 EEC options 1 & 2
- Compliant to Stratum 3, GR-1244-CORE & GR-253-CORE
- Wireless Communications
- Small Cells
- Test and Measurement
- GPS

Features:
- Frequency Stabilities Available:
  +/−0.28 ppm (6.4 to 50 MHz)✓ STRATUM 3
  +/−0.50 ppm (6.4 to 50 MHz)
  +/−1.00 ppm or +/−2.00 ppm (6.4 to 54 MHz)
- Temperature Ranges Available:
  0 to 85°C, 0 to 70°C, -40 to 85°C or -20 to 70°C Packages Available:
- T - Series: 5 x 7mm - 10 Pad
- TV - Series: 5 x 7mm - 4 Pad
- 3.3 Vdc Operation
- Output Logic: LVCMOS or Clipped Sinewave
- Fixed Frequency - TCXO
- Voltage Controlled - VCTCXO
- Low Jitter <0.50 ps RMS
- Low Phase Noise
- Tri-State Enable/Disable: (T Model Series Only)
- Tape and Reel Packaging
- RoHS Compliant / Lead Free ✓ RoHS

Standard Frequencies Available *
* 6.4, 9.72, 10, 10.24, 12.5, 12.8, 13.5, 19.2, 19.44, 20, 20.48, 25, 27, 38.88, 40 MHz
Available frequencies from the factory for small quantity orders or quick delivery.
Additional frequencies are available.

Example: Part Number
TV504-010.0M = 5x7mm 4 pad package, ±0.28 ppm, 0 to 70°C, 3.3 Vdc, LVCMOS Output, VCTCXO

Available at Digi-Key**
www.digikey.com

** Not all Models available at Digi-Key
### Operating Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Nominal</th>
<th>Maximum</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Frequency (Fo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Models Tx0x, TVx0x</td>
<td>6.4</td>
<td>-</td>
<td>50</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Models Tx1x, TVx1x</td>
<td>6.4</td>
<td>-</td>
<td>50</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Models Tx2x, TVx2x</td>
<td>6.4</td>
<td>-</td>
<td>54</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Models Tx3x, TVx3x</td>
<td>6.4</td>
<td>-</td>
<td>54</td>
<td>MHz</td>
<td></td>
</tr>
</tbody>
</table>

- **Operating Temperature Range** (See Ordering Information for full part number)

  | Models T3xx, TV3xx | 0       | -       | 85      | °C      |       |
  | Models T5xx, TV5xx | 0       | -       | 70      | °C      |       |
  | Models T6xx, TV6xx | -40     | -       | 85      | °C      |       |
  | Models T7xx, TV7xx | -20     | -       | 70      | °C      |       |

- **Frequency Calibration @ 25 °C**

  | -1.0     | -       | 1.0     | ppm     | 1      |

- **Frequency Stability (See Ordering Information for full part number)** Per STRATUM 3 GR-1244-CORE

  - Frequency Stability ±0.28 ppm is only available in the frequency range of 6.4 to 50 MHz.
  - Models Tx0x, TVx0x
  - Holdover Stability
  - Constant Temperature Stability -40 ppm Over 24 Hrs.

- **Frequency Stability (See Ordering Information for full part number)**

  | Models Tx1x, TVx1x | -0.50   | -       | 0.50    | ppm     | 2      |
  | Models Tx2x, TVx2x | -1.00   | -       | 1.00    | ppm     | 2      |
  | Models Tx3x, TVx3x | -2.00   | -       | 2.00    | ppm     | 2      |

- **Frequency vs. Load Stability**

  | -0.05   | -       | 0.05    | ppm     | ±5%    |

- **Frequency vs. Voltage Stability**

  | -0.05   | -       | 0.05    | ppm     | ±5%    |

- **Static Temperature Hysteresis**

  | -       | -       | 0.40    | ppm     | 4      |

- **Freq. shift after reflow soldering**

  | -1.0    | -       | 1.0     | ppm     | 5      |

- **Long Term Stability**

  | -1.0    | -       | 1.0     | ppm     | 6      |

- **Aging**

  - per Life (20 Years)
  - per Day

  | -3.0    | -       | 3.0     | ppm     |       |
  | -40     | -       | 40      | ppm     |       |

- **Total Frequency Tolerance**

  | -4.6    | -       | 4.6     | ppm     | 7      |

- **Supply Voltage (Vcc)**

  | 3.135   | 3.30    | 3.465   | Vdc     |       |

- **Supply Current (Icc)**

  | LVCMOS   | 2.1     | 6.0     | mA      |       |
  | Clipped Sinewave | 1.3     | 2.9     | mA      |       |

- **Jitter:**

  - Period Jitter
  - Integrated Phase Jitter (12K to Fo/2)
  - Allan Deviation (1s)

  | -       | 3.0     | 5.0     | ps RMS  | 8      |
  | -       | 0.3     | 1.0     | ps RMS  |       |
  | -       | 1.0E-10 | -       | -       |       |

- **G-sensitivity**

  | -       | -       | 2.0     | ppb/g   |       |

- **Typical SSB Phase Noise**

<table>
<thead>
<tr>
<th>For Fo 10.0 MHz</th>
<th>25.0 MHz</th>
<th>50.0 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 10 Hz offset</td>
<td>-98</td>
<td>-90</td>
</tr>
<tr>
<td>@ 100 Hz offset</td>
<td>-125</td>
<td>-120</td>
</tr>
<tr>
<td>@ 1 KHz offset</td>
<td>-143</td>
<td>-140</td>
</tr>
<tr>
<td>@ 10 KHz offset</td>
<td>-151</td>
<td>-151</td>
</tr>
<tr>
<td>@ 100 KHz offset</td>
<td>-152</td>
<td>-152</td>
</tr>
<tr>
<td>@ 1 MHz offset</td>
<td>-155</td>
<td>-154</td>
</tr>
</tbody>
</table>

- **Start-Up Time**

  | -       | -       | 10      | ms      |       |

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Specifications subject to change without notification. See Connor-Winfield’s website for latest revision.

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## Environmental Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Nominal</th>
<th>Maximum</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Soldering Process</td>
<td>RoHS compliant lead free. See soldering profile on page 4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

1. Initial calibration @ 25°C ±2°C, for VCTCXO’s Vc = 1.65V. Specifications at time of shipment.
2. Frequency stability vs. change in temperature. (σ=Fmax-Fmin)/2*Fo. For VCTCXO’s - Vc = 1.65V
3. Inclusive of frequency stability, supply voltage change (±1%), aging, for 24 hours. Per STRATUM 3 GR-1244-CORE.
4. Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C
5. Two consecutive solder reflows after 1 hour recovery @ 25°C.
6. Frequency drift over 1 year @ 25°C.
7. Inclusive of calibration @ 25°C, frequency vs. change in temperature, change in supply voltage (±5%), load change (±5%), reflow soldering process and 20 years aging.
8. BW = 12 KHz to 20 MHz
9. Leave Pad 8 unconnected if enable / disable function is not required. When tri-state, the output stage is disabled but the oscillator and compensation circuit are still active (current consumption < 1 mA).
10. Attention: To achieve optimal frequency stability, and in some cases to meet the specification stated on this data sheet, it is required that the circuit connected to this TCXO output must have the equivalent input capacitance that is specified by the nominal load capacitance. Deviations from the nominal load capacitance will have a graduated effect on the stability of approximately 20 ppb per pF load difference.
11. Load components are required for proper operation of the device.
12. Output is AC coupled.
**Marking Information**

The following are examples of possible marking configurations.

The marking varies with design configuration. All marking configurations below are valid.

---

**TV Series Package Outline**

**TV Series Suggested Pad Layout**

**TV Series Pad Connections**

1: VCTCXO: Voltage Control (Vc)
2: Ground
3: Output
4: Supply (Vcc)

* Do not route any traces in the keep out area. It is recommended the next layer under the keep out area is to be ground plane.

---

**Solder Profile**

Meets IPC/JEDEC J-STD-020C

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**T Series Design Recommendations**

- **Vcc**: Should have a large copper area for reduced inductance. Connect 100 Ohm resistor to 10µA current source.
- **Ground**: Should have a large copper area for reduced inductance.

**50 Ohm Trace**

- <1" by design

**Recommended clearance**

- 0.010" (0.254mm) for internal copper flood.

---

**TV Series Design Recommendations**

- **Vcc**: Should have a large copper area for reduced inductance. Connect 100 Ohm resistor to 10µA current source.
- **Ground**: Should have a large copper area for reduced inductance.

**50 Ohm Trace**

- <1" by design

---

**T Series LVCMOS Test Circuit**

- Vcc Supply Voltage
- 0.1µF Bypass
- 10 ohm Resistor
- Enable/Disable
- Output

**TV Series LVCMOS Test Circuit**

- Vcc Supply Voltage
- 0.1µF Bypass
- 10K Ohm
- Output

---

**Clipped Sinewave Test Circuit**

- Vcc Supply Voltage
- 0.1µF Bypass
- 10 ohm Resistor
- Enable/Disable
- Output

---

Note: The clipped sinewave output is AC coupled

---

**LVCMOS Output Waveform**

- 1V/Div

**Clipped Sinewave Output Waveform**

- 300 mV/Div
Phase Noise Information

Model TV504-010.0MHz

TIE

TV504-010.0M: WANDER GENERATION IN A STRATUM 3 PLL AT 0.098 Hz BANDWIDTH

MTIE

TV504-010.0M: MTIE per GR-253-CORE

TDEV

TV504-010.0M: TDEV per GR-253-CORE

5x7mm Tape and Reel Information

MEETS EIA-481A AND EIAJ-1009B
700 PCS/REEL MAXIMUM.

Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>04/01/15</td>
<td>Updated Frequency Stabilities</td>
</tr>
<tr>
<td>20</td>
<td>07/27/16</td>
<td>Extended operating frequency range, and updated standard frequency list</td>
</tr>
<tr>
<td>21</td>
<td>05/10/17</td>
<td>Added marking variations</td>
</tr>
<tr>
<td>22</td>
<td>08/02/18</td>
<td>Height change to 2.4mm Max and added additional marking variation</td>
</tr>
<tr>
<td>23</td>
<td>11/07/19</td>
<td>Added G-sensitivity specification.</td>
</tr>
</tbody>
</table>

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