



# High Precision TCXO / VCTCXO Oscillators

# CONNOR WINFIELD



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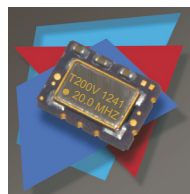
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## Description:

The Connor-Winfield's T100/T200 and the TV100/TV200 series have very high frequency stability with excellent phase noise performance. Available in a 5x7mm surface mount package. These TCXO's and VCTCXO's through the use of Analog Temperature Compensation are capable of holding sub 100-ppb or 200-ppb stabilities over the commercial or industrial temperature ranges. The surface mount package is designed for high-density mounting and is optimum for mass production.



## Features:

### Models:

T100 / T200-Series  
TV100 / TV200-Series

- Package  
T100-T200 Series 5 x 7mm 10 Pad  
TV100-TV200 Series 5 x 7mm 4 Pad
- Frequencies Available:  
10, 12.8, 19.2, 20.0, 24.576 or 40.0 MHz
- 3.3 Vdc Operation
- Output Logic: LVCMOS
- Frequency Stability:  
T100 / TV100: +/-100 ppb, 0 to 70°C  
T200 / TV200: +/-200 ppb, -40 to 85°C
- Fixed Frequency - TCXO
- Optional Control Voltage - VCTCXO
- Low Jitter <0.50 ps RMS
- Low Phase Noise
- Tri-State Enable/Disable:  
Available on T100 / T200 Models.
- Tape and Reel Packaging
- RoHS Compliant / Lead Free ✓RoHS

## Applications:

Basestation, Communications, DSL / ADSL,  
Femtocell, IP Timing, LTE, Precision GPS,  
SONET / SDH, WiMAX / WiBro, WLAN.

## Absolute Maximum Ratings

| Parameter            | Minimum | Nominal | Maximum   | Units | Notes |
|----------------------|---------|---------|-----------|-------|-------|
| Storage Temperature  | -40     | -       | 85        | °C    |       |
| Supply Voltage (Vcc) | -0.5    | -       | 4.6       | Vdc   |       |
| Input Voltage        | (Vc)    | -0.5-   | Vcc + 0.5 | Vdc   |       |

\*\* T200 &  
TV200 not  
available at  
Digi-Key

## Ordering Information

| T                                                                                          | 200                                                                                                                                                        | V                                        | - 20.0M                                                                                                                          |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Type / Package<br>TCXO / VCTCXO Series<br>T = 5.0x7.0 mm 10 Pads<br>TV = 5.0x7.0 mm 4 Pads | Frequency Stability and Temperature Range<br>100 = ±100 ppb, 0 to 70°C<br>200 = ±200 ppb, -40 to 85°C<br>Supply Voltage = 3.3 Vdc<br>Output Logic = LVCMOS | TCXO or VCTCXO<br>F = TCXO<br>V = VCTCXO | Output Frequency<br>Frequency Format<br>-xxx.xM Min<br>-xxx.xxxxxM Max<br>*Amount of numbers after the decimal point.<br>M = MHz |

Example: Part Number

T100F-019.2M = 5x7mm 10 pad package, ±100 ppb, 0 to 70°C, 3.3 Vdc, LVCMOS Output, TCXO, 19.2 MHz  
T200V-020.0M = 5x7mm 10 pad package, ±200 ppb, -40 to 85°C, 3.3 Vdc, LVCMOS Output, VCTCXO, 20.0 MHz  
TV100F-010.0M = 5x7mm 4 pad package, ±100 ppb, 0 to 70°C, 3.3 Vdc, LVCMOS Output, TCXO, 10.0 MHz  
TV200V-012.8M = 5x7mm 4 pad package, ±200 ppb, -40 to 85°C, 3.3 Vdc, LVCMOS Output, VCTCXO, 12.8 MHz



## Operating Specifications

| Parameter                            | Minimum                                         | Nominal  | Maximum | Units  | Notes |
|--------------------------------------|-------------------------------------------------|----------|---------|--------|-------|
| Output Frequency (Fo)                | 10.0, 12.8, 19.2, 20.0, 24.576 and 40.0M        |          |         | MHz    |       |
| Frequency Calibration @ 25 °C        | -1.0                                            | -        | 1.0     | ppm    | 1     |
| Frequency Stability                  | (See Ordering Information for full part number) |          |         |        |       |
| Model T100x, TV100x                  | -100                                            | -        | 100     | ppb    | 2     |
| Model T200x, TV200x                  | -200                                            | -        | 200     | ppb    | 2     |
| Frequency vs. Load Stability         | -0.20                                           | -        | 0.20    | ppm    | ±5%   |
| Frequency vs. Voltage Stability      | -0.20                                           | -        | 0.20    | ppm    | ±5%   |
| Static Temperature Hysteresis        | -                                               | -        | 0.40    | ppm    | 3     |
| Freq. shift after reflow soldering   | -1.0                                            | -        | 1.0     | ppm    | 4     |
| Long Term Stability                  | -1.0                                            | -        | 1.0     | ppm    | 5     |
| Aging                                |                                                 |          |         |        |       |
| per Life (20 Years)                  | -3.0                                            | -        | 3.0     | ppm    |       |
| per Day                              | -40                                             | -        | 40      | ppb    |       |
| per Second                           | -                                               | 4.63E-13 |         |        |       |
| Operating Temperature Range          | (See Ordering Information for full part number) |          |         |        |       |
| Model T100x, TV100x                  | 0                                               | -        | 70      | °C     |       |
| Model T200x, TV200x                  | -40                                             | -        | 85      | °C     |       |
| Supply Voltage (Vcc)                 | 3.135                                           | 3.30     | 3.465   | Vdc    |       |
| Supply Current (Icc)                 | -                                               | -        | 2.1     | mA     |       |
| Jitter:                              |                                                 |          |         |        |       |
| Period Jitter                        | -                                               | 3.0      | 5.0     | ps RMS |       |
| Integrated Phase Jitter (12K to 20M) | -                                               | 0.3      | 1.0     | ps RMS | 6     |
| SSB Phase Noise for Fo=10.0 MHz      |                                                 |          |         |        |       |
| @ 1 Hz offset                        | -                                               | -60      | -       | dBc/Hz |       |
| @ 10 Hz offset                       | -                                               | -98      | -       | dBc/Hz |       |
| @ 100 Hz offset                      | -                                               | -126     | -       | dBc/Hz |       |
| @ 1 KHz offset                       | -                                               | -143     | -       | dBc/Hz |       |
| @ 10 KHz offset                      | -                                               | -151     | -       | dBc/Hz |       |
| @ 100 KHz offset                     | -                                               | -152     | -       | dBc/Hz |       |
| @ 1 MHz offset                       | -                                               | -155     | -       | dBc/Hz |       |
| Start-Up Time                        | -                                               | -        | 10      | ms     |       |

## Control Voltage Input Characteristics

| Parameter                  | Minimum        | Nominal | Maximum | Units | Notes |
|----------------------------|----------------|---------|---------|-------|-------|
| Control Voltage            | 0.3            | 1.65    | 3.0     | V     |       |
| Frequency Pullability      | ±10            | -       | -       | ppm   |       |
| Control Voltage Slope      | Positive Slope |         |         |       |       |
| Monotonic Linearity        | -              | -       | 10      | %     |       |
| Input Impedance            | 100K           | -       | -       | Ohm   |       |
| Modulation Bandwidth (3dB) | 10             | -       | -       | KHz   |       |

## Enable /Disable Input Characteristics (Pad 8) (Models T100F, T200F, T100V and T200V Only)

| Parameter                     | Minimum | Nominal | Maximum | Units | Notes |
|-------------------------------|---------|---------|---------|-------|-------|
| Enable Input Voltage -(Vih)   | 70%Vcc  | -       | -       | Vdc   | 7     |
| Disable Input Voltage - (Vil) | -       | -       | 30%Vcc  | Vdc   | 7     |

| Function      | Output                    |
|---------------|---------------------------|
| Low:          | Disabled (High Impedance) |
| High or Open: | Enabled                   |

## LVC MOS Output Characteristics

| Parameter                   | Minimum | Nominal | Maximum | Units | Notes |
|-----------------------------|---------|---------|---------|-------|-------|
| Load (CL)                   | -       | 15      | -       | pF    | 8     |
| Voltage (High) (Voh)        | 90%Vcc  | -       | -       | Vdc   |       |
| (Low) (Vol)                 | -       | -       | 10%Vcc  | Vdc   |       |
| Duty Cycle at 50% of Vcc    | 45      | 50      | 55      | %     |       |
| Rise / Fall Time 10% to 90% | -       | 4       | 8       | ns    |       |

## Package Characteristics

|         |                                                               |
|---------|---------------------------------------------------------------|
| Package | Hermetically sealed ceramic package with grounded metal cover |
|---------|---------------------------------------------------------------|

## Environmental Characteristics

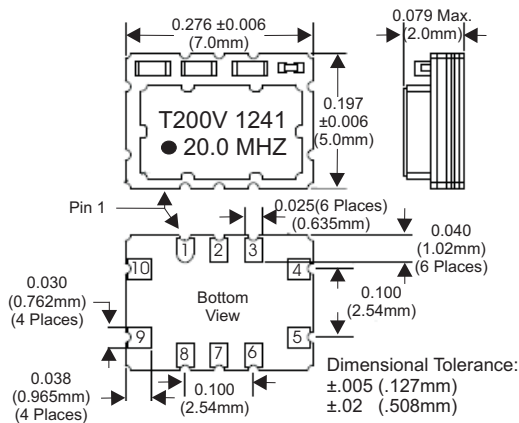
|                    |                                                                   |
|--------------------|-------------------------------------------------------------------|
| Vibration:         | Vibration per Mil Std 883E Method 2007.3 Test Condition A.        |
| Shock:             | Mechanical Shock per Mil Std 883E Method 2002.4 Test Condition B. |
| Soldering Process: | RoHS compliant lead free. See soldering profile on page 2.        |

### Notes:

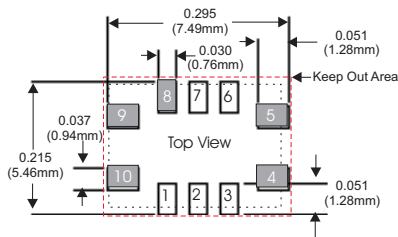
1. Initial calibration @ 25°C.  $\pm 2^\circ\text{C}$ , for VCTCXO's  $V_c = 1.65\text{V}$ . Specifications at time of shipment after 48 hours of operation.
2. Frequency stability vs. change in temperature.  $[\pm(F_{\text{max}} - F_{\text{min}})/2.F_0]$ . For VCTCXO's -  $V_c = 1.65\text{V}$
3. Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C
4. Two consecutive reflows after 1 hour recovery @ 25°C.
5. Frequency drift over 1 year @ 25°C.
6. BW = 12 KHz to  $F_0/2$  MHz
7. Leave Pad 8 on models, T100F, T200F, T100V, T200V unconnected if enable / disable function is not required. When tri-stated, the output stage is disabled but the oscillator and compensation circuit are still active (current consumption < 1 mA).
8. 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.

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## T100/T200 Package Outline



## T100/T200 Suggested Pad Layout

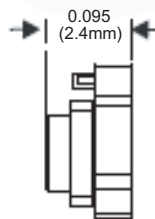
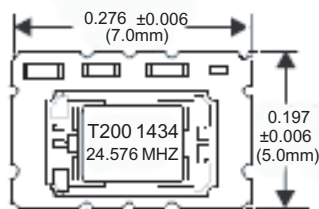


\* Do not route any traces in the keep out area. It is recommended the next layer under the keep out area is to be ground plane.

## T100/T200 Pad Connections

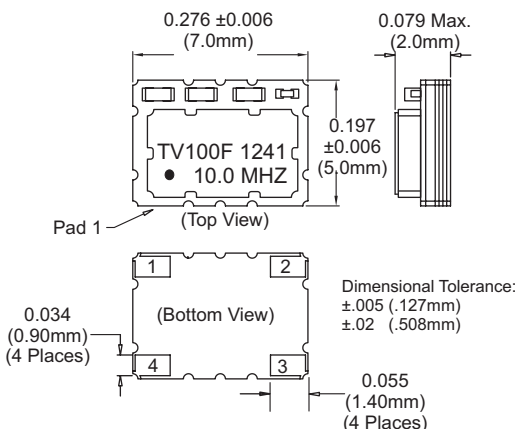
|     |                                           |
|-----|-------------------------------------------|
| 1:  | Do Not Connect                            |
| 2:  | Do Not Connect                            |
| 3:  | Do Not Connect                            |
| 4:  | Ground                                    |
| 5:  | Output                                    |
| 6:  | Do Not Connect                            |
| 7:  | Do Not Connect                            |
| 8:  | Enable / Disable                          |
| 9:  | Supply Voltage (Vcc)                      |
| 10: | VCTCXO: Control Voltage (Vc)<br>TCXO: N/C |

## T100/T200 Series Alternate Package Outline

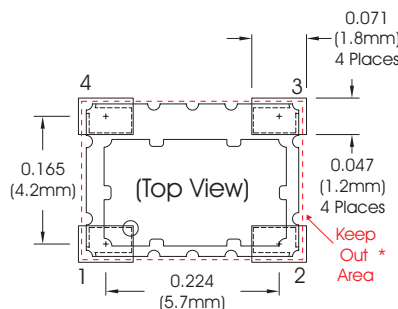


Alternate package applies to all part numbers with output frequency of 24.576 MHz.  
 The differences are the top view crystal size, and the overall height.  
 Bottom view, suggested pad layout, and pad connections all remain the same as above.

## TV100/TV200 Package Outline



## TV100/TV200 Suggested Pad Layout



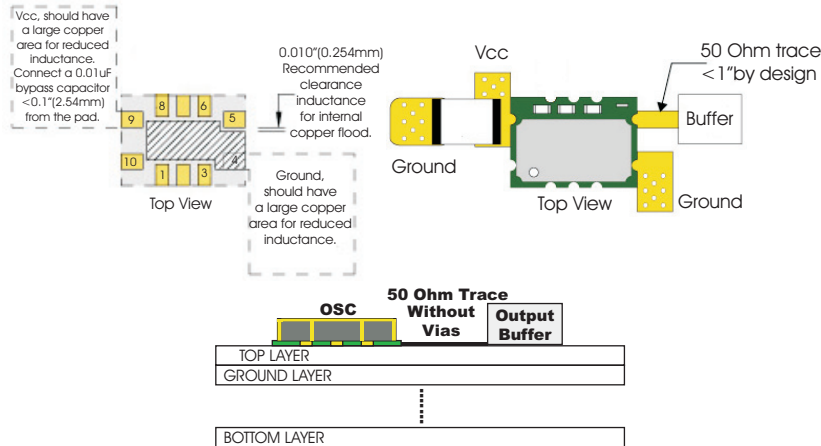
\* Do not route any traces in the keep out area. It is recommended the next layer under the keep out area is to be ground plane.

## TV100/TV200 Pad Connections

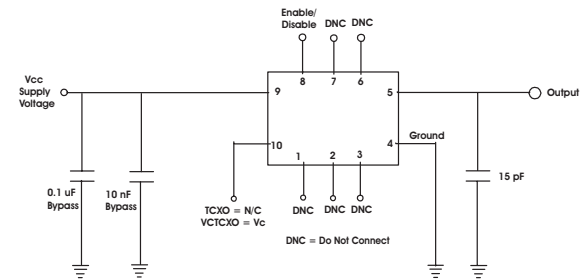
|    |                                           |
|----|-------------------------------------------|
| 1: | VCTCXO: Voltage Control (Vc)<br>TCXO: N/C |
| 2: | Ground                                    |
| 3: | Output                                    |
| 4: | Supply (Vcc)                              |

|          |                      |
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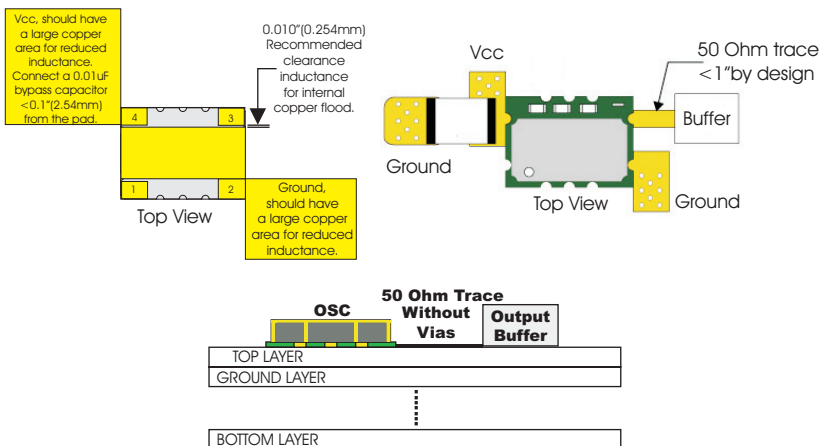
## T100 / T200 Design Recommendations



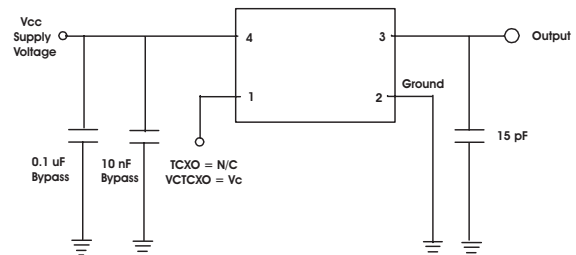
## T100 / T200 Test Circuit



## TV100 / TV200 Design Recommendations

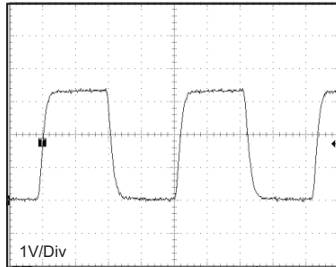


## TV100 / TV200 Test Circuit



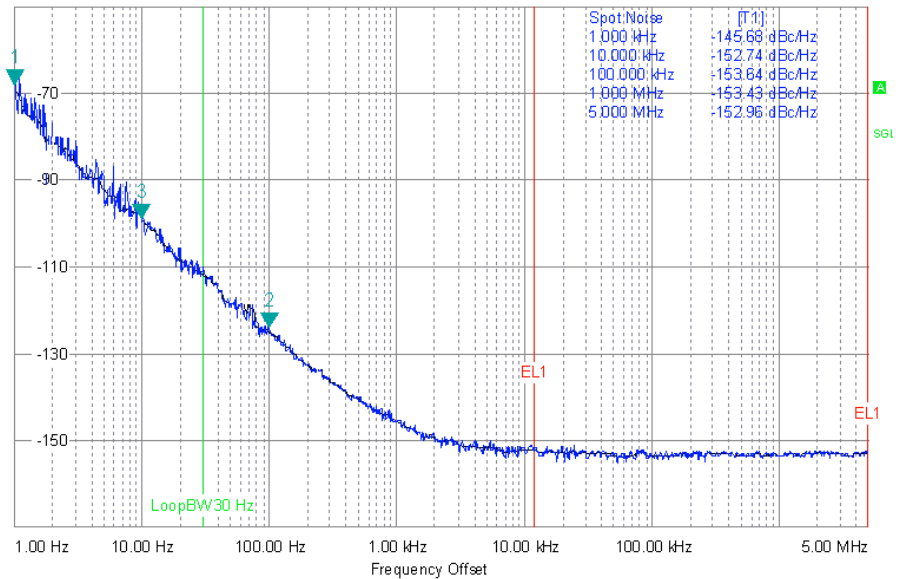
Attention: To achieve optimal frequency stability, and in some cases to meet the specification stated on this data sheet, it is required that the circuit connected to this TCXO output must have the equivalent input capacitance that is specified by the nominal load capacitance. Deviations from the nominal load capacitance will have a graduated effect on the stability of approximately 20 ppb per pF load difference.

## LVC MOS Output Waveform

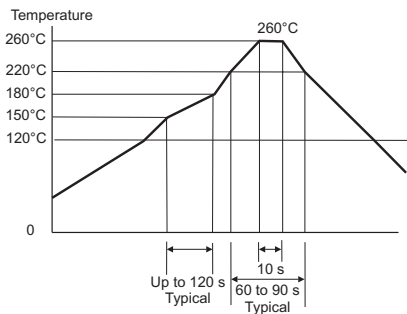


## Phase Noise Information

Typical Phase Noise for TV100F-010.0M

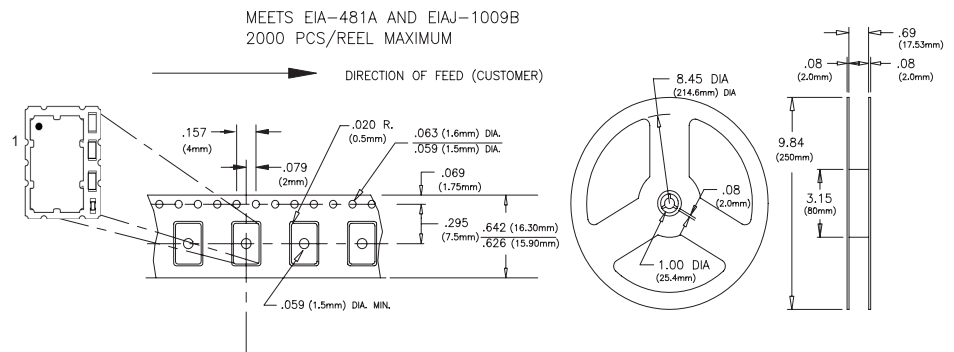


## Solder Profile



Meets IPC/JEDEC J-STD-020C

## 5x7 mm Tape and Reel Information



## Revision History

| Revision | Date     | Changes                                                |
|----------|----------|--------------------------------------------------------|
| A00      | 12/05/11 | Advanced information data sheet released               |
| A01      | 04/24/12 | Added 12.8 MHz and +/-50ppb 0 to 70 °C Models          |
| 02       | 04/26/12 | Updated integrated phase jitter to 0.3 ps RMS nominal. |
| 03       | 10/12/12 | Removed M series                                       |
| 04       | 01/09/13 | Updated phase noise information                        |
| 05       | 02/04/15 | Updated to 24.576 MHz and 40.0 MHz Frequencies         |

|          |                      |
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