



# High Precision TCXO / VCTCXO Oscillators



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## Description:

The Connor-Winfield M100, M170, and M200 models offer precise frequency stability and excellent phase noise in a 5x3.2mm package.



Through the use of analog temperature compensation, these TCXO's and VCTCXO's are capable of holding sub 100 ppb and 200ppb stabilities over the commercial or industrial temperature ranges.

## Applications:

Basestation

DSL / ADSL

IP Timing

Precision GPS

WiMAX / WiBro

Communications

Femtocell

LTE

SONET / SDH

WLAN

## Features:

**Models: M100, M170, M200 Series**

- Package: 5 x 3.2mm, 8 Pads
- Frequencies Available: 10, 12.288, 12.8, 19.2, 19.44, 20.0, 24.576, or 40.0 MHz
- 3.3 Vdc Operation
- Output Logic: LVCMOS
- Frequency Stability:
  - M100:  $\pm 100$  ppb: 0 to 70°C
  - M170:  $\pm 100$  ppb: -20 to 70°C
  - M200:  $\pm 200$  ppb: -40 to 85°C
- Fixed Frequency - TCXO
- Optional Control Voltage - VCTCXO
- Low Jitter <0.50 ps RMS
- Low Phase Noise
- Tape and Reel Packaging
- RoHS Compliant / Lead Free

## Absolute Maximum Ratings

| Parameter            | Minimum | Nominal | Maximum   | Units | Notes |
|----------------------|---------|---------|-----------|-------|-------|
| Storage Temperature  | -40     | -       | 85        | °C    |       |
| Supply Voltage (Vcc) | -0.6    | -       | 4.6       | Vdc   |       |
| Input Voltage (Vc)   | -0.5    | -       | Vcc + 0.6 | Vdc   |       |

\*\* Not all  
available at  
Digi-Key

## Ordering Information

| M                                                        | 100                                                                                                                                                                                                      | F                                        | - 012.8M                                                                                                                         |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Type / Package<br>TCXO / VCTCXO Series<br>M = 5.0x3.2 mm | Frequency Stability and Temperature Range<br>100 = $\pm 100$ ppb, 0 to 70°C<br>170 = $\pm 100$ ppb, -20 to 70°C<br>200 = $\pm 200$ 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

M100F-012.8M = 5x3.2mm package,  $\pm 100$  ppb, 0 to 70°C, 3.3 Vdc, LVCMOS Output, TCXO, 12.8 MHz  
 M100V-019.2M = 5x3.2mm package,  $\pm 100$  ppb, 0 to 70°C, 3.3 Vdc, LVCMOS Output, VCTCXO, 19.2 MHz  
 M200F-010.0M = 5x3.2mm package,  $\pm 200$  ppb, -40 to 85°C, 3.3 Vdc, LVCMOS Output, TCXO, 10 MHz  
 M200V-020.0M = 5x3.2mm package,  $\pm 200$  ppb, -40 to 85°C, 3.3 Vdc, LVCMOS Output, VCTCXO, 20 MHz



## Operating Specifications

| Parameter                          | Minimum                                             | Nominal  | Maximum | Units  | Notes |
|------------------------------------|-----------------------------------------------------|----------|---------|--------|-------|
| Output Frequency (Fo)              | 10.0, 12.288, 12.8, 19.2, 19.44, 20.0, 24.576, 40.0 |          |         | MHz    |       |
| Frequency Calibration @ 25 °C      | -1.0                                                | -        | 1.0     | ppm    | 1     |
| Frequency Stability                | (See Ordering Information for full part number)     |          |         |        |       |
| Model M100x and M170x              | -100                                                | -        | 100     | ppb    | 2     |
| Model M200x                        | -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 | -       | pps    |       |
| Operating Temperature Range        | (See Ordering Information for full part number)     |          |         |        |       |
| Model M100x                        | 0                                                   | -        | 70      | °C     |       |
| Model M170x                        | -20                                                 | -        | 70      | °C     |       |
| Model M200x                        | -40                                                 | -        | 85      | °C     |       |
| Supply Voltage (Vcc)               | 3.135                                               | 3.30     | 3.465   | Vdc    |       |
| Supply Current (Icc)               | -                                                   | -        | 3.3     | mA     |       |
| Jitter:                            |                                                     |          |         |        |       |
| Period Jitter                      | -                                                   | 3.0      | 5.0     | ps RMS |       |
| Integrated Phase Jitter            | -                                                   | 0.5      | 1.0     | ps RMS | 6     |
| SSB Phase Noise for Fo=10.0 MHz    |                                                     |          |         |        |       |
| @ 10 Hz offset                     | -                                                   | -98      | -       | dBc/Hz |       |
| @ 100 Hz offset                    | -                                                   | -121     | -       | dBc/Hz |       |
| @ 1 KHz offset                     | -                                                   | -143     | -       | dBc/Hz |       |
| @ 10 KHz offset                    | -                                                   | -156     | -       | dBc/Hz |       |
| @ 100 KHz offset                   | -                                                   | -157     | -       | dBc/Hz |       |
| @ 1 MHz offset                     | -                                                   | -158     | -       | dBc/Hz |       |
| SSB Phase Noise for Fo=19.2MHz     |                                                     |          |         |        |       |
| @ 10 Hz offset                     | -                                                   | -90      | -       | dBc/Hz |       |
| @ 100 Hz offset                    | -                                                   | -115     | -       | dBc/Hz |       |
| @ 1 KHz offset                     | -                                                   | -135     | -       | dBc/Hz |       |
| @ 10 KHz offset                    | -                                                   | -151     | -       | dBc/Hz |       |
| @ 100 KHz offset                   | -                                                   | -154     | -       | 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   |       |

## LVC MOS Output Characteristics

| Parameter                   | Minimum | Nominal | Maximum | Units | Notes |
|-----------------------------|---------|---------|---------|-------|-------|
| Load (CL)                   | -       | 15      | -       | pF    | 7     |
| 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.                             |
| Package Terminations:      | 0.5 to 1.0 um (20 to 40 micro-inches) Gold over minimum of 2.0um (80 micro-inches) Nickel. |
| Moisture sensitivity level | MSL-1.                                                                                     |

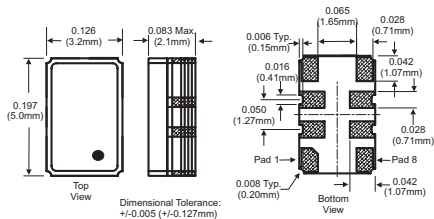
## Environmental Characteristics

|                    |                                                                   |
|--------------------|-------------------------------------------------------------------|
| 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 4.        |
| Solderability:     | Mil Std 883E Method 2003.                                         |

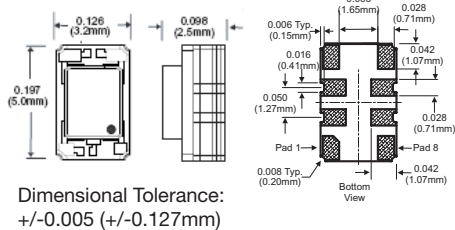
### Notes:

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 products,  $V_c = 1.65\text{V}$ .
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  $F_0/2$ .
7. 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.

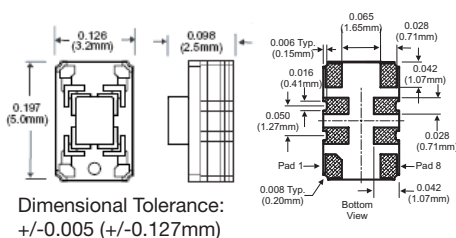
### Package Outline for 12.8, 19.2 MHz



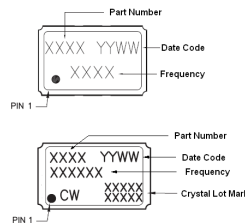
### Package Outline for 10.0, 12.288, 19.44, 20.0, 24.576 MHz



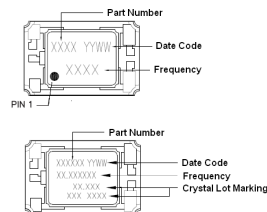
### Package Outline for 40.0 MHz



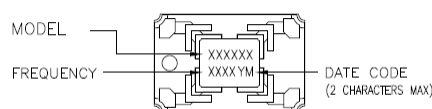
### Marking Configuration



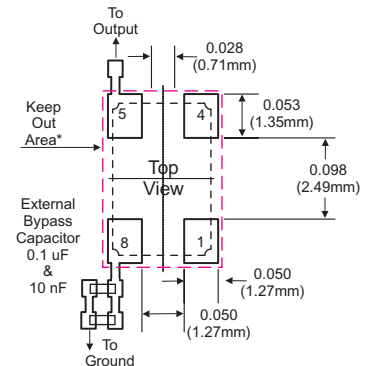
### Marking Configuration



### Marking Configuration



### Suggested Pad Layout (all package outlines)



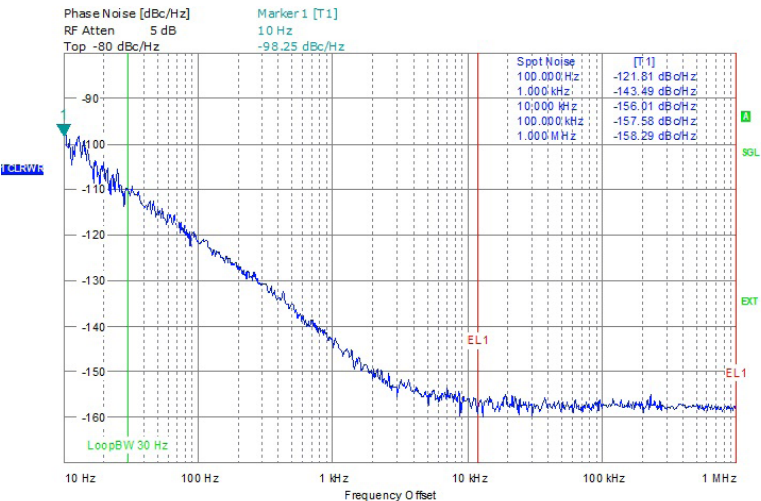
\* Do not route any traces in the keep out area. It is recommended the next layer under the keep out area is to be ground plane.

### Pad Connections (all package outlines)

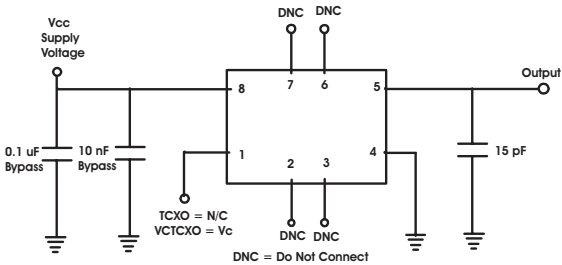
- 1: VCTCXO: Control Voltage ( $V_c$ ) TCXO: N/C
- 2: Do Not Connect
- 3: Do Not Connect
- 4: Ground
- 5: Output
- 6: Do Not Connect
- 7: Do Not Connect
- 8: Supply Voltage ( $V_{cc}$ )

|          |             |
|----------|-------------|
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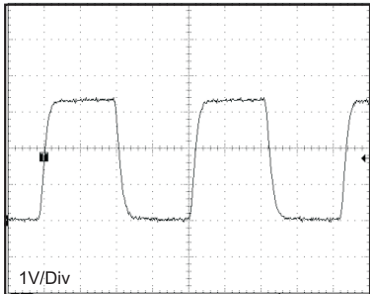
10MHz Phase Noise Plot



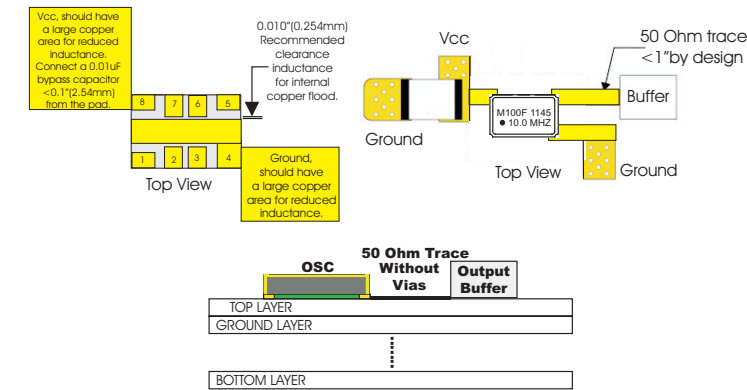
Test Circuit



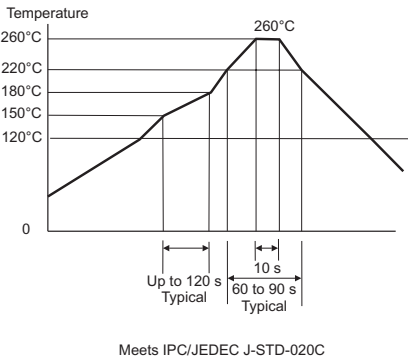
LVC MOS Output Waveform



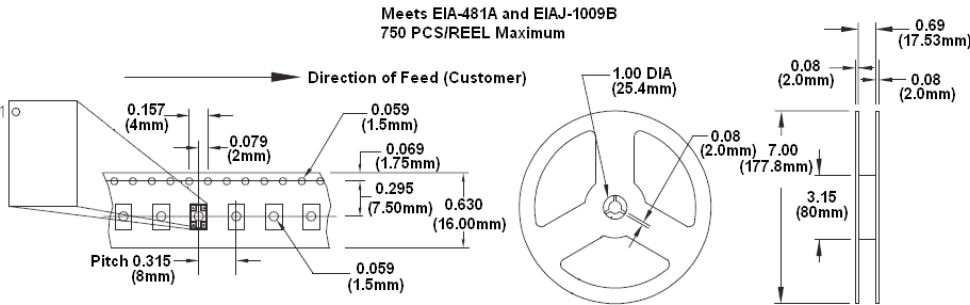
M100 - M200 Design Recommendations



Solder Profile



Tape and Reel Information



Revision History

| Revision | Date     | Changes                                                                 |
|----------|----------|-------------------------------------------------------------------------|
| 00       | 10/31/12 | Data sheet released.                                                    |
| 01       | 09/02/14 | Phase Noise Plot and Specifications Update.                             |
| 02       | 03/25/15 | Updated Frequencies & Alternate Package                                 |
| 03       | 12/06/17 | Added 19.44MHz to available frequency list.                             |
| 04       | 10/09/19 | Added package and marking options, and updated tape and reel.           |
| 05       | 03/02/23 | Updated frequency listing for the different package outlines.           |
| 06       | 11/21/23 | Updated Supply Voltage (Vcc).                                           |
| 07       | 02/08/24 | Update Digi-Key availability notes.                                     |
| 08       | 03/27/25 | Update phase noise information and product photo.                       |
| 09       | 10/16/25 | Replace product photo, update environmental characteristics and Note 2. |

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