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Description:

The Connor-Winfield's TX14 Series of Temperature Compensated Crystal Oscillators and Voltage Controlled Temperature Compensated Crystal Oscillators are designed for use in S3 Telecom Applications. Through the use of Analog Temperature Compensation, this device is capable of holding sub 1-ppm stabilities over the commercial or the industrial temperature ranges. Most models will meet ± 4.6 ppm accuracies for twenty years. STRATUM 3 compliant models are available.

The TX14 series provides temperature stabilities in the range of ± 0.28 ppm to ± 2.50 ppm, over the commercial, extended commercial or the industrial temperature range.

The TX14 series is available with a LVCMOS or Clipped Sinewave output along with Tri-State Enable / Disable function or optional Electronic Frequency Tuning (VCTCXO). These oscillators provide outstanding phase noise characteristics that will meet the most stringent requirements.



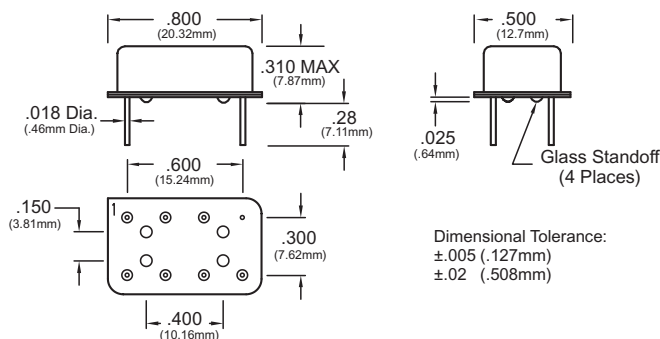
Features:

- TCXO / VCTCXO
- CMOS Frequency Range: 1 to 100 MHz
- Clipped Sine Freq. Range: 6.4 to 100 MHz
- 3.3 Vdc Operation
- LVCMOS, or Clipped Sinewave Output
- Frequency Stabilities Available:
 - ± 0.28 ppm, **STRATUM 3**
 - ± 0.5 ppm, ± 1.0 ppm or ± 2.5 ppm
- Temperature Ranges Available:
 - 0 to 70°C, -20 to 70°C or -40 to 85°C
- Frequency Tolerance:
 - ± 4.60 ppm for 20 years.
- Low Jitter <1ps RMS
- Tri-State Enable/Disable Function or Voltage Control on Pin 1
- Hermetically Sealed 14 Pin DIP Package
- RoHS Compliant / Lead Free **RoHS**
- Recommended for New Designs

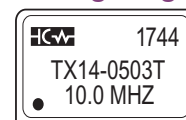
Applications:

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

Package Outline



Marking Diagram



Pin Connections

- 1: Enable / Disable or Vc (optional)
- 7: Ground
- 8: Output
- 14: Supply Voltage (Vcc)

Ordering Information

| TX14- | 05 | 0 | 3 | T | -010.0M |
|---------------------------|--|---|---|---|---|
| Oscillator Type | Frequency Stability | Temperature Range | Supply Voltage Output Type | Enable / Disable Voltage Control | Output Frequency |
| 14 Pin DIP TCXO or VCTCXO | 28 = ± 0.28 ppm 05 = ± 0.50 ppm 10 = ± 1.00 ppm 25 = ± 2.50 ppm | 0 = 0 to 70°C 1 = -20 to 70°C 2 = -40 to 85°C | 3 = 3.3 Vdc - LVCMOS 4 = 3.3 Vdc, Clipped Sine | T = TCXO (Fixed Freq.) V = VCTCXO (Voltage Controlled) | Frequency Format -xxx.xM Min.* xxx.xxxxxxM Max* |

* Min 1 and Max 6 digits after the decimal point



Example Part Numbers:

TX14-0503T-010.0M = 14 Pin DIP package, ± 0.50 ppm, 0 to 70°C, 3.3 Vdc, LVCMOS Output, TCXO, Output Frequency 10.0 MHz

TX14-1023V-020.0M = 14 Pin DIP package, ± 1.00 ppm, -40 to 85°C, 3.3 Vdc, LVCMOS Output, VCTCXO, 20.0 MHz

Absolute Maximum Ratings

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|------------------------------|---------|---------|---------|-------|-------|
| Storage Temperature | -55 | - | 125 | °C | |
| Supply Voltage 3.3 Vdc (Vcc) | -0.6 | - | 4.6 | Vdc | |
| Control Voltage (Vc) | -0.5 | - | Vcc+0.5 | Vdc | |

Absolute Ratings: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only. The functional operation of the device at those or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to conditions outside the "recommended operating conditions" for any extended period of time may adversely impact device reliability and result in failures not covered by warranty.

Operating Specifications for TX14-28xxx Series

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|---|-----------|---------|----------|---------|-------|
| Frequency Range (Fo) | 1.0 | - | 50 | MHz | |
| Frequency Calibration | -1.0 | - | 1.0 | ppm | 1 |
| Frequency Stability vs. Change in Temperature: (See Ordering Information) ✓STRATUM 3 | | | | | |
| Stability Code 28 | -0.28 | - | 0.28 | ppm | 2 |
| Holdover Stability | -0.32 | - | 0.32 | ppm | 3 |
| Frequency Stability vs. Load | -50 | - | 50 | ppb | ±5% |
| Frequency Stability vs. Voltage | -50 | - | 50 | ppb | ±5% |
| Aging / Life (20 Years) | -3.0 | - | 3.0 | ppm | |
| Aging / Day (@25 °C) | -40 | - | 40 | ppb/day | |
| Aging / Second | -4.63E-13 | - | 4.63E-13 | | |
| Total Frequency Tolerance (20 Years) | -4.60 | - | 4.60 | ppm | 4 |

Operating Specifications for TX14-05xxx Series

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|---|---------|---------|---------|-------|-------|
| Frequency Range (Fo) | 1.0 | - | 100 | MHz | |
| Frequency Calibration | -1.0 | - | 1.0 | ppm | 1 |
| Frequency Stability vs. Change in Temperature: (See Ordering Information) | | | | | |
| Stability Code 05 | -0.50 | - | 0.50 | ppm | 2 |
| Frequency Stability vs. Load | -50 | - | 50 | ppb | ±5% |
| Frequency Stability vs. Voltage | -50 | - | 50 | ppb | ±5% |
| Aging / Life (20 Years) | -3.0 | - | 3.0 | ppm | |
| Total Frequency Tolerance (20 Years) | -4.60 | - | 4.60 | ppm | 4 |

Operating Specifications for TX14-10xxx Series

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|---|---------|---------|---------|-------|-------|
| Frequency Range (Fo) | 1.0 | - | 100 | MHz | |
| Frequency Calibration | -1.0 | - | 1.0 | ppm | 1 |
| Frequency Stability vs. Change in Temperature: (See Ordering Information) | | | | | |
| Stability Code 10 | -1.00 | - | 1.00 | ppm | 2 |
| Frequency Stability vs. Load | -50 | - | 50 | ppb | ±5% |
| Frequency Stability vs. Voltage | -50 | - | 50 | ppb | ±5% |
| Aging / Life (20 Years) | -3.0 | - | 3.0 | ppm | |
| Total Frequency Tolerance (20 Years) | -4.60 | - | 4.60 | ppm | 4 |

Operating Specifications for TX14-25xxx Series

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|---|---------|---------|---------|-------|-------|
| Frequency Range (Fo) | 1.0 | - | 100 | MHz | |
| Frequency Calibration | -1.0 | - | 1.0 | ppm | 1 |
| Frequency Stability vs. Change in Temperature: (See Ordering Information) | | | | | |
| Stability Code 25 | -2.50 | - | 2.50 | ppm | 2 |
| Frequency Stability vs. Load | -50 | - | 50 | ppb | ±5% |
| Frequency Stability vs. Voltage | -50 | - | 50 | ppb | ±5% |
| Aging / Life (20 Years) | -3.0 | - | 3.0 | ppm | |
| Total Frequency Tolerance (20 Years) | -6.1 | - | 6.1 | ppm | 4 |

Notes:

- Initial calibration @ 25°C. Specifications at time of shipment after 48 hours of operation. For VCTCXO control voltage must be fixed.
- Frequency stability vs. change in temperature. $\pm(F_{max} - F_{min})/(2 \cdot F_0)$.
- Inclusive of frequency stability, supply voltage change (±1%), aging, for 24 hours.
- Inclusive of calibration @ 25°C, frequency vs. change in temperature, change in supply voltage (±5%), load change (±5%), shock and vibration and 20 years aging.

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Operating Temperature Ranges

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|---|---------|---------|---------|-------|-------|
| Operating Temperature Range: (See Ordering Information) | | | | | |
| Temperature Code 0 | 0 | - | 70 | °C | |
| Temperature Code 1 | -20 | - | 70 | °C | |
| Temperature Code 2 | -40 | - | 85 | °C | |

Operating Specifications

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|--|---------|---------|---------|--------|-------|
| Supply Voltage: (Vcc) (See Ordering Information) | | | | | |
| Supply Voltage Code 3, Code 4 | 3.13 | 3.30 | 3.47 | Vdc | ±5% |
| Supply Current (Icc) | | | | | |
| LVC MOS (10 to 52 MHz) | - | 2.1 | 6.0 | mA | |
| LVC MOS (>52 to 100 MHz) | - | - | 12 | mA | |
| Clipped Sine (10 to 52 MHz) | - | 1.3 | 2.9 | mA | |
| Clipped Sine (>52 to 100 MHz) | - | - | 12 | mA | |
| Static Temperature Hysteresis | -0.4 | - | 0.4 | ppm | 5 |
| Jitter | | | | | |
| Period Jitter: | - | 3 | 5 | ps RMS | |
| Phase Jitter: (BW: 12 KHz to Fo/2) | - | 0.5 | 1.0 | ps RMS | |
| Typical SSB Phase Noise (Fo = 5.0 MHz) | | | | | |
| @ 10 Hz offset | - | -100 | - | dBc/Hz | |
| @ 100 Hz offset | - | -130 | - | dBc/Hz | |
| @ 1 KHz offset | - | -145 | - | dBc/Hz | |
| @ 10 KHz offset | - | -154 | - | dBc/Hz | |
| @ > 100 KHz offset | - | -155 | - | dBc/Hz | |
| Start-Up Time: | - | - | 1 | ms | |

CMOS Output Characteristics

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|--|---------|---------|---------|-------|-------|
| LVC MOS Output Code 3 (See Ordering Information) | | | | | |
| Load | - | 15 | - | pF | |
| Output Voltage: | | | | | |
| High (Voh) | 90%Vcc | - | - | V | |
| Low (Vol) | - | - | 10%Vcc | V | |
| Output Drive Current: | | | | | |
| Ioh | - | - | -4 | mA | |
| Iol | 4 | - | - | mA | |
| Duty Cycle at 50% of Vcc | 45 | 50 | 55 | % | |
| Rise / Fall Time: 10% to 90% | - | - | 8 | ns | |

Clipped Sinewave Output Characteristics

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|--------------------------------|---------|----------------------------|---------|---------|------------|
| Clipped Sinewave Output Code 4 | | (See Ordering Information) | | | |
| Load | - | 10K Ohm // 10pF | - | pF | AC Coupled |
| Output Voltage: | | | | | |
| ≤ 40 MHz | 1.00 | - | - | V pk-pk | |
| > 40 MHz | 0.80 | - | - | V pk-pk | |

Voltage Control Input Characteristics (Pin 1) Optional

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|--|----------------------------|----------------------------|---------|-------|-------|
| Control Voltage Range: (Vc) Voltage Control Code V | | (See Ordering Information) | | | |
| Vcc = 3.3 Vdc | 0.30 | 1.65 | 3.00 | V | |
| Frequency Pullability: | ±10.0 | - | - | ppm | 6 |
| Input Impedance | 100K | - | - | Ohms | |
| Linearity | ±5 | - | - | % | |
| Slope | Positive Transfer Function | | | | |

Notes:

- Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C
- Referenced to Fo
- (On page 4) Leave Pin 1 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 ≤ 1mA).

Enable / Disable Function Characteristics (Pin 1)

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|--|---------|---------|---------|-------|-------|
| Enable / Disable Code T (See Ordering Information) | | | | | |
| Enable Voltage (High) or Open Circuit | 70%Vcc | - | - | Vdc | 7 |
| Disable Voltage (Low) Output Tri-States | - | - | 30%Vcc | Vdc | |

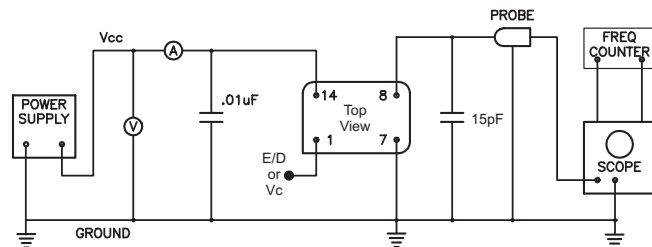
Package Characteristics

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|---------------------|--|
| TX14-Series Package | 14 Pin DIP Hermetically Sealed Metal Package |
|---------------------|--|

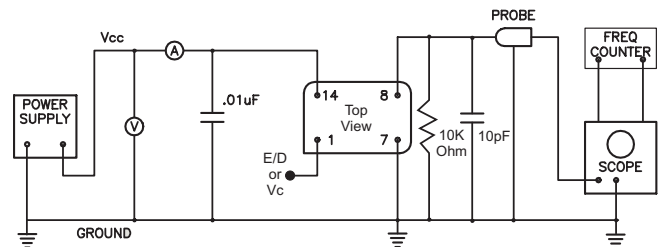
Environmental Characteristics

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|----------------------|--|
| Shock | 500 G's 1ms, Halfsine, 3 shocks per direction, per MIL-STD 202G, Method 213B Test Condition D. |
| Sinusoidal Vibration | 0.06" D.A. or 10G's Peak, 10 to 500 Hz, per MIL-STD-202G, Method 204D, Test Condition A. |
| Random Vibration | 5.35 G's rms. 20 to 2000 Hz per MIL-STD-202G, Method 214, Test Condition 1A, 15 minutes each axis. |
| Moisture | 10 cycles, 95% RH, Per MIL-STD-202G, Method 112. |
| Marking Permanency | Per MIL-STD-202G, Method 215J. |
| Solder Process | RoHS compliant, lead free. See solder profile below. |

CMOS Test Circuit

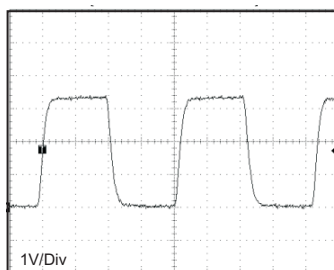


Clipped Sinewave Test Circuit

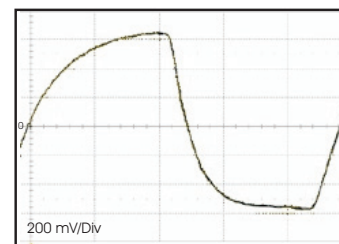


Attention: To achieve optimal frequency stability, and in some cases to meet the specification stated on this data sheet, it is required that the circuit connected to this TCXO output must have the equivalent input capacitance that is specified by the nominal load capacitance. Deviations from the nominal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

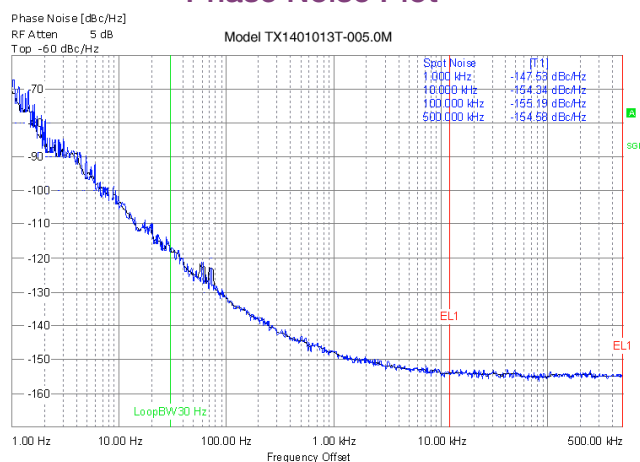
LVCMS Output Waveform



Clipped Sinewave Output Waveform

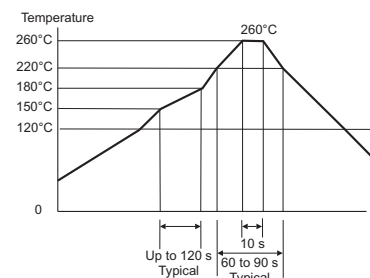


Phase Noise Plot



RoHS Solder Profile

✓ RoHS



Meets IPC/JEDEC J-STD-020C

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