



Telecom Performance 5x7mm TCXO / VCTCXO T / TV Series



2111 Comprehensive Drive

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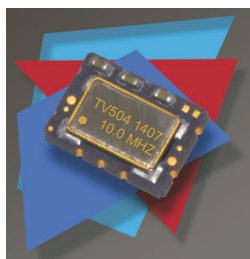
www.conwin.com

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



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

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

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.

** Not all
Models
available at
Digi-Key

Ordering Information

| TV | 5 | 0 | 4 | - 010.0M |
|---|--|--|--|---|
| Type / Package TCXO / VCTCXO Series T = 5.0x7.0 mm 10 Pads TV = 5.0x7.0 mm 4 Pads | Temperature Range 3 = 0 to 85 °C 5 = 0 to 70 °C 6 = -40 to 85 °C 7 = -20 to 70 °C | Frequency Stability 0 = ± 0.28 ppm 1 = ± 0.50 ppm 2 = ± 1.00 ppm 3 = ± 2.00 ppm | Features 2 = TCXO, LVCMOS, 3.3 Vdc 3 = TCXO, Clipped Sinewave, 3.3 Vdc 4 = VCTCXO, LVCMOS, 3.3 Vdc 5 = VCTCXO, Clipped Sinewave, 3.3 Vdc | Output Frequency Frequency Format -xxx.xM Min -xxx.xxxxxM Max *Amount of numbers after the decimal point. M = MHz |

Example: Part Number

TV504-010.0M = 5x7mm 4 pad package, ± 0.28 ppm, 0 to 70 °C, 3.3 Vdc, LVCMOS Output, VCTCXO
T715-012.8M = 5x7mm 10 pad package, ± 0.50 ppm, -20 to 70 °C, 3.3 Vdc, Clipped Sinewave Output, VCTCXO
T522-050.0M = 5x7mm 10 pad package, ± 1.0 ppm, 0 to 70 °C, 3.3 Vdc, LVCMOS Output, TCXO
TV602-010.0M = 5x7mm 4 pad package, ± 0.28 ppm, -40 to 85 °C, 3.3 Vdc, LVCMOS Output, TCXO



Absolute Maximum Ratings

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|----------------------|---------|---------|-----------|-------|-------|
| Storage Temperature | -55 | - | 95 | °C | |
| Supply Voltage (Vcc) | -0.5 | - | 6.0 | Vdc | |
| Input Voltage | -0.5 | - | Vcc + 0.5 | Vdc | |

Operating Specifications

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|--|---|----------|----------|--------|--------------|
| Output Frequency (Fo) | | | | | |
| Models Tx0x, TVx0x | 6.4 | - | 50 | MHz | |
| Models Tx1x, TVx1x | 6.4 | - | 50 | MHz | |
| Models Tx2x, TVx2x | 6.4 | - | 54 | MHz | |
| Models Tx3x, TVx3x | 6.4 | - | 54 | MHz | |
| 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 | -0.28 | - | 0.28 | ppm | 2 |
| Holdover Stability | -0.32 | - | 0.32 | ppm | 3 |
| Constant Temperature Stability | -40 | - | 40 | ppb | 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) | -3.0 | - | 3.0 | ppm | |
| per Day | -40 | - | 40 | ppb | |
| 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 | - | 3.0 | 5.0 | ps RMS | |
| Integrated Phase Jitter (12K to Fo/2) | - | 0.3 | 1.0 | ps RMS | 8 |
| Allan Deviation (1s) | - | 1.0E-10 | - | | |
| Typical SSB Phase Noise | | | | | |
| For Fo | 10.0 MHz | 25.0 MHz | 50.0 MHz | | |
| @ 10 Hz offset | -98 | -90 | -73 | dBc/Hz | |
| @ 100 Hz offset | -125 | -120 | -103 | dBc/Hz | |
| @ 1 KHz offset | -143 | -140 | -134 | dBc/Hz | |
| @ 10 KHz offset | -151 | -151 | -151 | dBc/Hz | |
| @ 100 KHz offset | -152 | -152 | -152 | dBc/Hz | |
| @ 1 MHz offset | -155 | -154 | -154 | 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 | ±12 | - | ppm | |
| Pull Slope (Vc=1.65V) | - | 8.00 | - | ppm/V | |
| Control Voltage Slope | Positive Slope | | | | |
| Monotonic Linearity | - | - | 5 | % | |
| Input Impedance | 100K | - | - | Ohm | |
| Modulation Bandwidth (3dB) | 10 | - | - | | KHz |

OE Enable /Disable Input Characteristics (Pad 8) T Series only

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|-------------------------------|---------------------------|---------|---------|-------|-------|
| Enable Input Voltage -(Vih) | 70%Vcc | - | - | Vdc | 9 |
| Disable Input Voltage - (Vil) | - | - | 30%Vcc | Vdc | 9 |
| Function | Output | | | | |
| Low: | Disabled (High Impedance) | | | | |
| High or Open: | Enabled | | | | |

LVC MOS Output Characteristics

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

Clipped Sinewave Output Characteristics

| Parameter | Minimum | Nominal | Maximum | Units | Notes |
|---------------------------|---------|---------|---------|-------|-------|
| Load (RC) | | | | | 11 |
| Output Load Resistance | - | 10K | - | Ohm | 12 |
| Output Load Capacitance | - | 10 | - | pF | |
| Output Voltage (< 40 MHz) | 1.0 | 1.2 | - | V | pk-pk |
| Output Voltage (≥40 MHz) | 0.8 | 1.0 | - | V | pk-pk |
| Output Impedance | - | 200 | - | Ohms | |

Package Characteristics

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

Environmental Characteristics

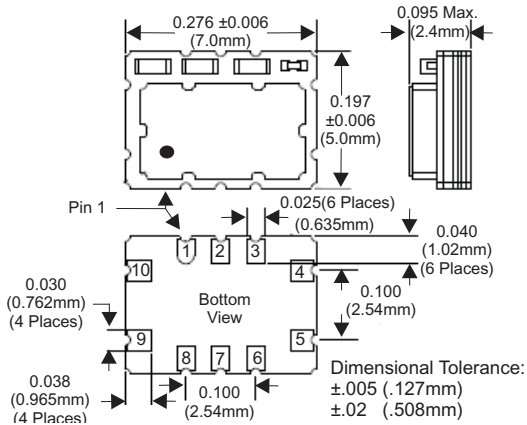
| | |
|--------------------|---|
| Vibration: | Vibration per Mil Std 883E Method 2007.3 Test Condition A. |
| Shock: | Mechanical Shock per Mil Std 883E Method 2002.4 Test Condition B. |
| Soldering Process: | RoHS compliant lead free. See soldering profile on page 6. |

Notes:

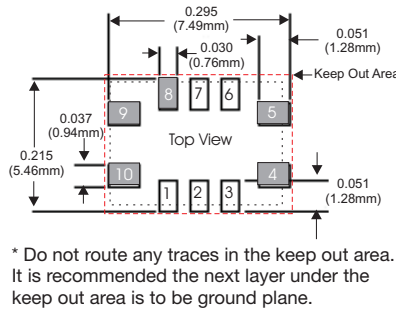
- Initial calibration @ 25°C. ±2°C, for VCTCXO's Vc = 1.65V. Specifications at time of shipment
- Frequency stability vs. change in temperature. $[\pm(F_{max}-F_{min})/(2 \cdot F_0)]$. For VCTCXO's - Vc = 1.65V
- Inclusive of frequency stability, supply voltage change (±1%), aging, for 24 hours. Per STRATUM 3 GR-1244-CORE.
- Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C
- Two consecutive solder reflows after 1 hour recovery @ 25°C.
- Frequency drift over 1 year @ 25°C.
- 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.
- BW = 12 KHz to 20 MHz
- Leave Pad 8 on the T Series 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).
- 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.
- Load components are required for proper operation of the device.
- Output is AC coupled.

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|----------|--------------------|
| Bulletin | Tx176 |
| Page | 3 of 6 |
| Revision | 22 |
| Date | 02 Aug 2018 |

T Series Package Outline



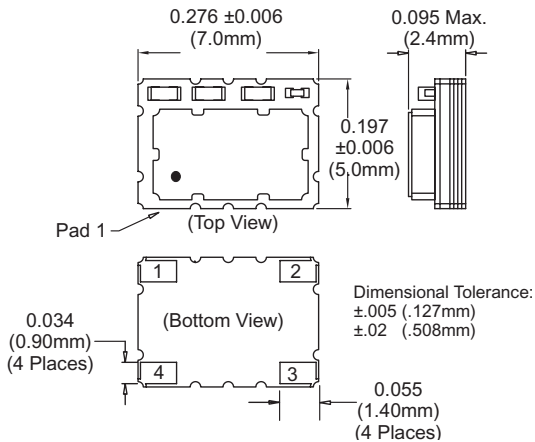
T Series Suggested Pad Layout



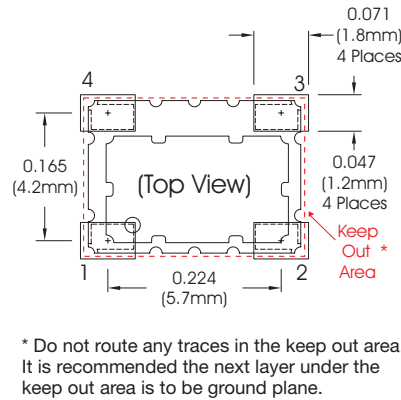
T Series Pad Connections

- 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 (OE)
- 9: Supply Voltage (Vcc)
- 10: VCTCXO: Control Voltage (Vc)
TCXO: N/C

TV Series Package Outline



TV Series Suggested Pad Layout



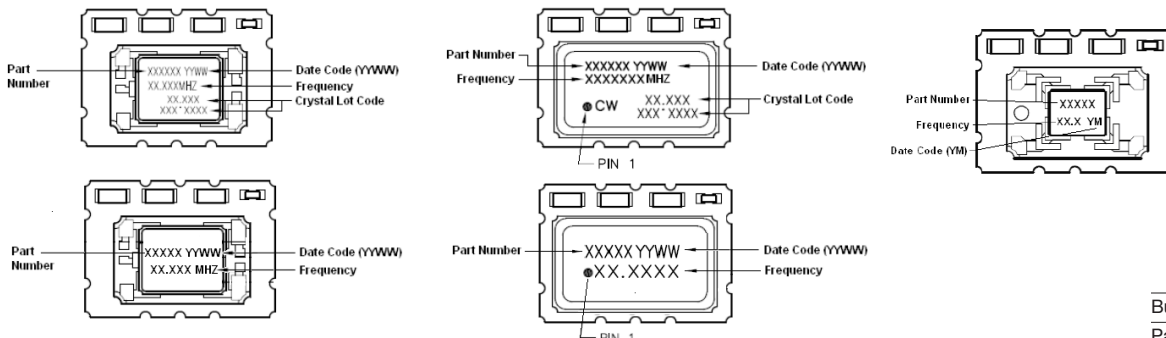
TV Series Pad Connections

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

Marking Information

The following are examples of possible marking configurations

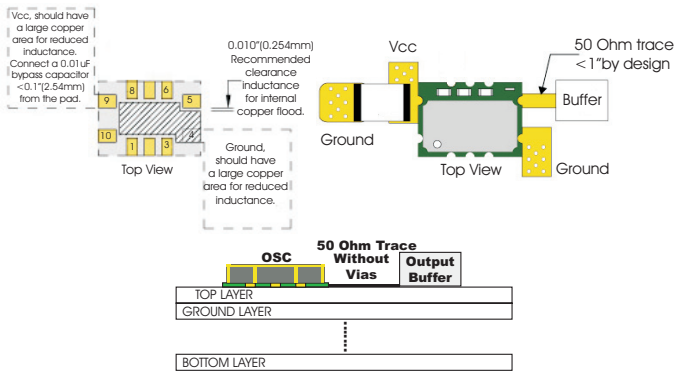
The marking varies with design configuration. All marking configurations below are valid.



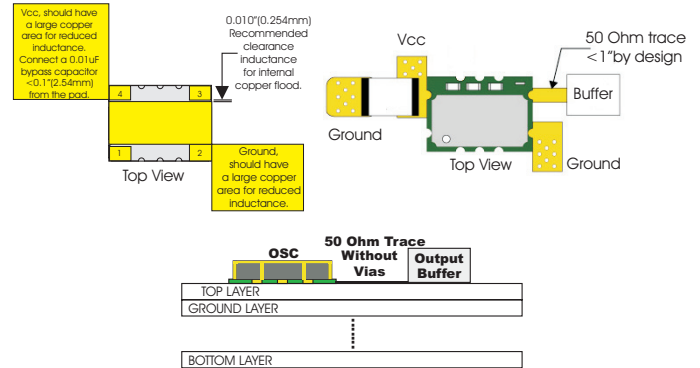
| 2 CHARACTER DATE CODE | |
|-----------------------|---------------|
| Y = Year | M = Month |
| 8 = 2018 | A = January |
| 9 = 2019 | B = February |
| 0 = 2020 | C = March |
| 1 = 2021 | D = April |
| | E = May |
| | F = June |
| | G = July |
| | H = August |
| | J = September |
| | K = October |
| | M = November |
| | N = December |

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|----------|--------------------|
| Bulletin | Tx176 |
| Page | 4 of 6 |
| Revision | 22 |
| Date | 02 Aug 2018 |

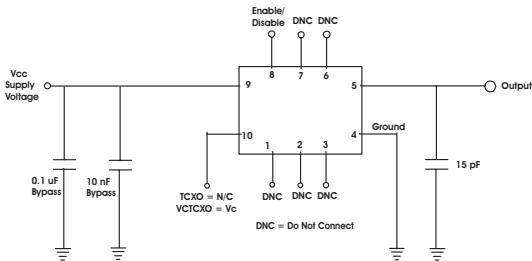
T Series Design Recommendations



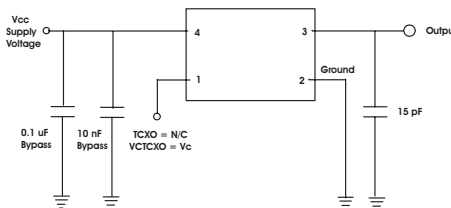
TV Series Design Recommendations



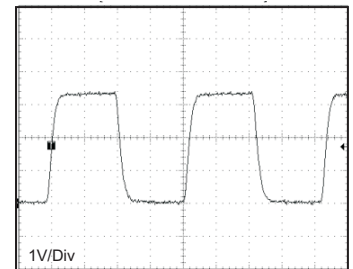
T Series LVC MOS Test Circuit



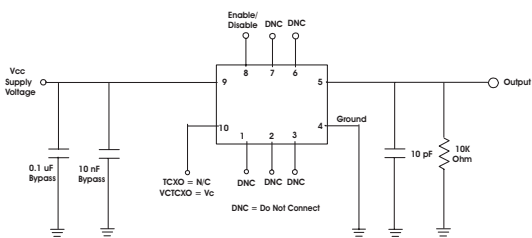
TV Series LVC MOS Test Circuit



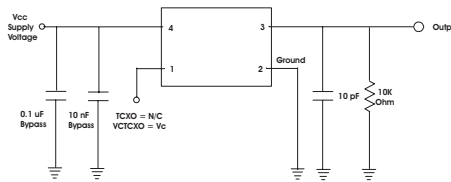
LVC MOS Output Waveform



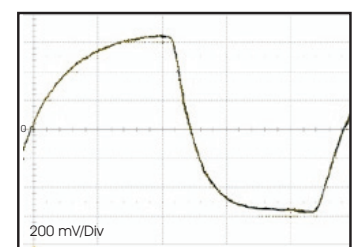
T Series Clipped Sinewave Test Circuit



TV Series Clipped Sinewave Test Circuit

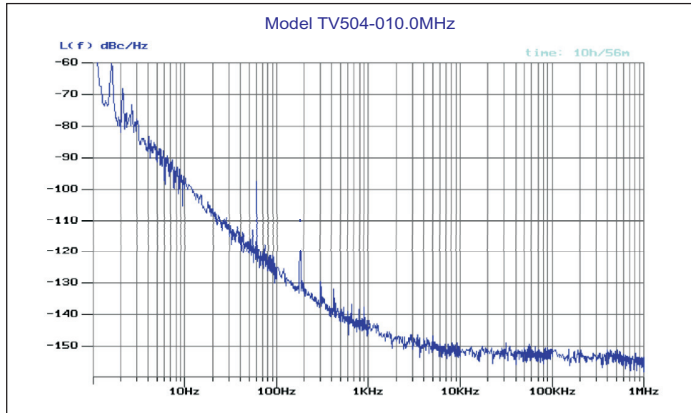


Clipped Sinewave Output Waveform

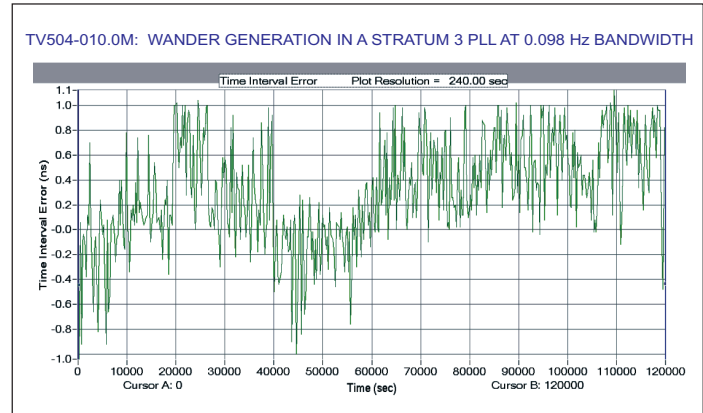


Note: The clipped sinewave output is AC coupled

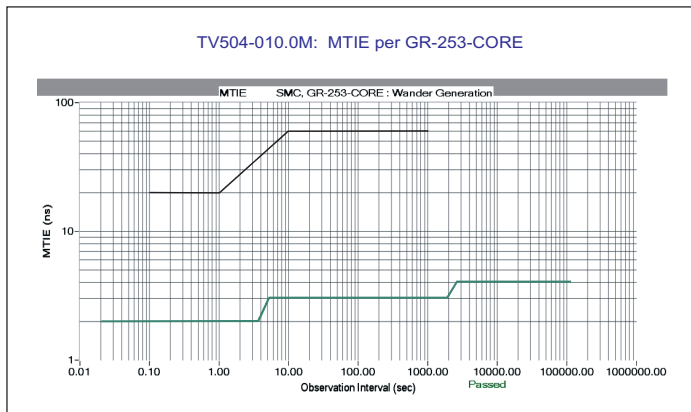
Phase Noise Information



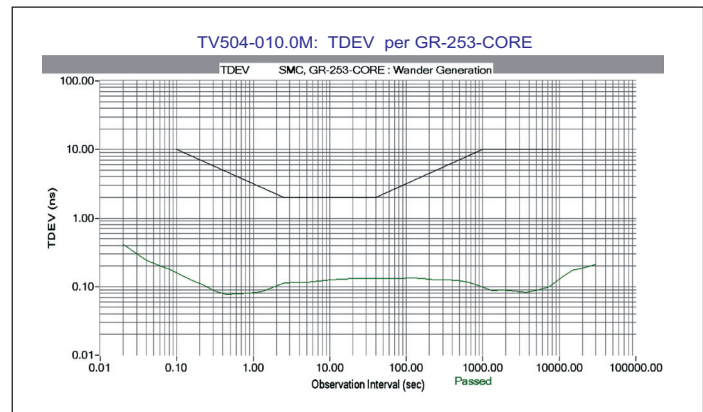
TIE



MTIE

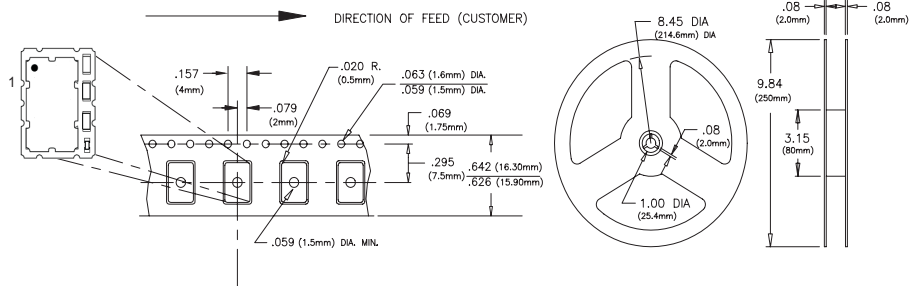


TDEV

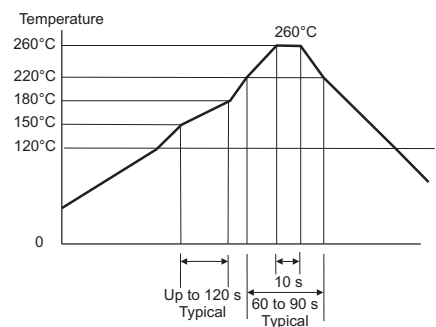


5x7mm Tape and Reel Information

MEETS EIA-481A AND EIAJ-1009B
2000 PCS/REEL MAXIMUM



Solder Profile



Meets IPC/JEDEC J-STD-020C

Revision History

| Revision | Date | Action |
|----------|----------|---|
| 17 | 02/11/14 | Updated specifications and combined the T and TV series data sheets. |
| 18 | 09/15/14 | Added Alternate Package Outline |
| 19 | 04/01/15 | Updated Frequency Stabilities |
| 20 | 07/27/16 | Extended operating frequency range, and updated standard frequency list |
| 21 | 05/10/17 | Added marking variations |
| 22 | 08/02/18 | Height change to 2.4mm Max and added additional marking variation |

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|----------|--------------------|
| Bulletin | Tx176 |
| Page | 6 of 6 |
| Revision | 22 |
| Date | 02 Aug 2018 |