

# Telecom Performance TCXO / VCTCXO

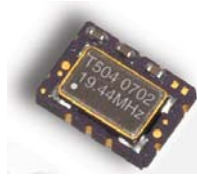


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## Description

The Connor-Winfield 5.0x7.0mm Temperature Compensated Crystal Controlled Oscillators and Voltage Controlled

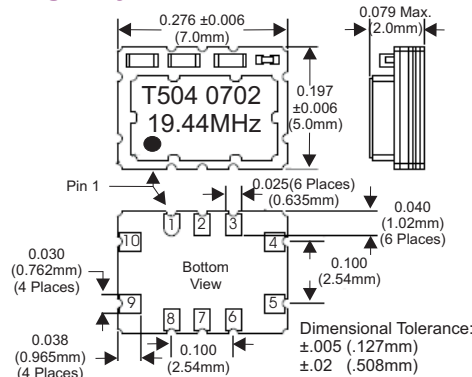


Temperature Compensated Crystal Controlled Oscillators are designed for use in S3 Telecom Applications. Through the use of Analog Temperature Compensation, this device is capable of holding sub 1-ppm stabilities over the commercial or the industrial temperature ranges. All models meet +/-4.6ppm accuracies for twenty years.

## Applications

STRATUM 3 Applications  
Timing Reference

## Package Layout



## Features:

Miniature 5.0 x7.0mm Surface Mount Package  
 3.3V Operation  
 LVCMOS or Clipped Sinewave Output Logic  
 Frequency Stabilities Available:  
 T50x / T60x: +/-0.28ppm  
 T51x / T61x: +/-0.50ppm  
 T52x / T62x: +/-1.00ppm  
 Temperature Ranges Available:  
 T5xx Series: 0 to 70°C  
 T6xx Series: -40 to 85°C  
 Frequency Tolerance: +/-4.60ppm for 20 yrs.  
 Low Jitter <1pS RMS  
 Tri-State Enable/Disable  
 Tape and Reel Packaging  
 RoHS Compliant / Lead Free **RoHS**  
 Recommended for New Designs

## Pin 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	Tri-state Enable / Disable
9	Supply, Vcc
10	Voltage Control (VCTCXO) N/C (TCXO)

## Standard Frequencies Available \*

6.4 MHz 9.72 MHz 10.0 MHz 10.24 MHz 12.5 MHz 12.8 MHz 13.5 MHz  
 19.2 MHz 19.44 MHz 20.0 MHz 20.48 MHz 25 MHz 27 MHz 38.88 MHz

\* Available frequencies from the factory for small quantity orders or quick delivery. Additional frequencies are available.

## Ordering Information

Table 1.0

<b>T</b>	<b>5</b>	<b>0</b>	<b>4</b>	-	<b>019.44M</b>
<b>Type:</b> Precision TCXO VCTCXO 5x7mm	<b>Temperature Range:</b> 5 = 0 to 70° C 6 = -40 to 85° C	<b>Frequency Stability:</b> 0 = +/-0.28 ppm 1 = +/- 0.50 ppm 2 = +/- 1.00 ppm	<b>Features:</b> 2 = TCXO, LVCMOS, 3.3Vdc. 3 = TCXO, Clipped Sinewave, 3.3Vdc. 4 = VCTCXO, LVCMOS, 3.3Vdc. 5 = VCTCXO, Clipped Sinewave, 3.3Vdc.		<b>Output Frequency:</b> Frequency Format -xxx.xM Min.* -xxx.xxxxxM Max.* *Amount of numbers after the decimal point. M = MHz

Example:  
 T504-019.44M = 5x7mm, TCXO, LVCMOS,  
 3.3Vdc, 0 to 70C, +/-0.28ppm, Output Frequency 19.44MHz

To order an T504 with an output frequency of:  
 6.4 MHz = T504-006.4M  
 20 MHz = T504-020.0M  
 38.88 MHz = T504-038.88M



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## Absolute Maximum Ratings

Table 2.0

Parameter	Minimum	Nominal	Maximum	Units	Notes
Storage Temperature	-55	-	125	°C	
Supply Voltage (Vcc)	-0.5	-	6.0	Vdc	
Input Voltage (Vcc)	-0.5	-	Vcc+0.6	Vdc	

## Model Specifications

Table 3.0  
Notes

Model Number	T502	T503	T504	T505	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.28ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	0 to 70°C				
Holdover Stability	±0.32ppm				2

Table 4.0  
Notes

Model Number	T602	T603	T604	T605	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.28ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	-40 to 85°C				
Holdover Stability	±0.32ppm				2

Table 5.0  
Notes

Model Number	T512	T513	T514	T515	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.50ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	0 to 70°C				

Table 6.0  
Notes

Model Number	T612	T613	T614	T615	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 40 MHz				
Frequency Stability	±0.50ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	-40 to 85°C				

Table 7.0  
Notes

Model Number	T522	T523	T524	T525	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 52 MHz				
Frequency Stability	±1.00ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	0 to 70°C				

Table 8.0  
Notes

Model Number	T622	T623	T624	T625	Notes
Output Type	LVC MOS	Clipped Sinewave	LVC MOS	Clipped Sinewave	
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO	
Frequency Range	6.4 to 52 MHz				
Frequency Stability	±1.00ppm				1
Supply Voltage	3.3Vdc				
Temperature Range	-40 to 85°C				

### Notes:

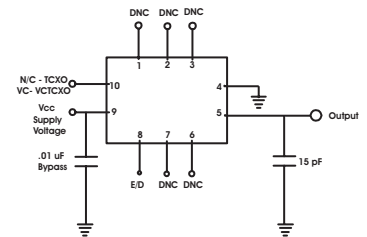
- 1) Frequency stability vs. change in temperature.  $[\pm(F_{max} - F_{min})/2.F_0]$ .
- 2) Inclusive of frequency stability, supply voltage change ( $\pm 1\%$ ), aging, for 24 hours.



## Features

TCXO  
VCTCXO  
3.3V Operation  
LVC MOS Output  
Clipped Sinewave Output  
Frequency Stability:  
T50x/T60xSeries  $\pm 0.28$ ppm  
T51x/T61x-Series  $\pm 0.50$ ppm  
T52x/T62x-Series  $\pm 1.00$ ppm  
Temperature Range:  
T5xx-Series 0 to 70°C  
T6xx-Series -40 to 85°C  
Low Jitter <1pS RMS  
Tri-State Enable/Disable  
Surface Mount Package  
Tape and Reel Packing  
RoHS Compliant / Lead Free

## LVC MOS Test Circuit



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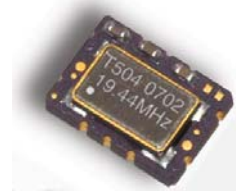
Date **25 Aug 2008**

## Electrical Specifications for all Models

### Operating Specifications

Table 9.0

Parameter	Minimum	Nominal	Maximum	Units	Notes
TCXO Frequency Calibration @ 25 C	-1.00	-	1.00	ppm	1
Supply Voltage Variation. (Vcc±5%)	-0.2	-	0.2	ppm	
Load Coefficient, ±5pF	-0.2	-	0.2	ppm	
Static Temperature Hysteresis	-0.4	-	0.4	ppm	2
Total Frequency Tolerance	-4.60	-	4.60	ppm	3
Supply Voltage (Vcc)	3.135	3.3	3.465	Vdc	4
Supply Current (Icc)	-	6	10	mA	
Period Jitter	-	3	5	ps rms	
Integrated Phase Jitter (BW=12kHz to 20MHz)	-	0.3	1.0	ps rms	
SSB Phase Noise at 10Hz offset	-	-80	-70	dBc/Hz	
SSB Phase Noise at 100Hz offset	-	-110	-100	dBc/Hz	
SSB Phase Noise at 1KHz offset	-	-135	-130	dBc/Hz	
SSB Phase Noise at >10KHz offset	-	-150	-145	dBc/Hz	
SSB Phase Noise at >100KHz offset	-	-150	-150	dBc/Hz	
Start Up Time	-	-	10	ms	



### Input Characteristics For Enable / Disable Function (Pad 8)

Table 10.0

Parameter	Minimum	Nominal	Maximum	Units	Notes
Enable Voltage (High) or open circuit (Vih)	70% Vcc	-	-	Vdc	5
Disable Voltage (Low) Output Tri-stated (Vil)	-	-	30% Vcc	Vdc	

### Input Characteristics For Voltage Control (Pad10)

Table 11.0

Parameter	Minimum	Nominal	Maximum	Units	Notes
Control Voltage Range (Vcc = 3.3V) (Vc)	0.3	1.65	3.0	Vdc	
Frequency Tuning	±10	-	-	ppm	6
Linearity	±5	-	-	%	
Slope	Positive				

### LVCMOS Output Characteristics

Table 12.0

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

### Clipped Sinewave Output Characteristics

Table 13.0

Parameter	Minimum	Nominal	Maximum	Units	Notes
Load	-	-	-	-	7
Output Load Resistance	-	10K	-	Ohms	
Output Load Capacitance	-	10	-	pF	
Output Voltage (<= 40 MHz)	1.00	-	-	V pk-pk	
Output Voltage (> 40 MHz)	0.80	-	-	V pk-pk	

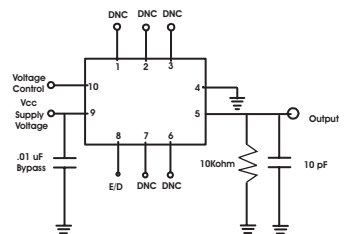
Notes:

- 1) TCXO: Initial calibration @ 25 C. Specifications at time of shipment after 48 hours of operation.
- 2) Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C.
- 3) 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.
- 4) For best in application performance, careful selection of an external power source is critical. Select an external regulator that meets or exceeds the following specifications regarding voltage regulation tolerance, initial accuracy, temperature coefficient, voltage noise, and low voltage noise density.  
**Factory Test Conditions:** Initial Accuracy ±2mv, Noise (0.1Hz to 10 KHz) 15µV p-p, Voltage Noise Density = 50nV/square root of Hz, Temperature Coefficient < 5ppm per degree C.
- 5) Leave Pad 8 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).
- 6) Additional pull ranges are available; please contact the factory for additional information.
- 7) Output is AC coupled.

## Features

- TCXO
- VCTCXO
- 3.3V Operation
- LVCMOS Output
- Clipped Sinewave Output
- Frequency Stability:
  - T50x/T60xSeries +/-0.28ppm
  - T51x/T61x-Series +/-0.50ppm
  - T52x/T62x-Series +/-1.00ppm
- Temperature Range:
  - T5xx-Series 0 to 70°C
  - T6xx-Series -40 to 85°C
- Low Jitter <1pS RMS
- Tri-State Enable/Disable
- Surface Mount Package
- Tape and Reel Packing
- RoHS Compliant / Lead Free

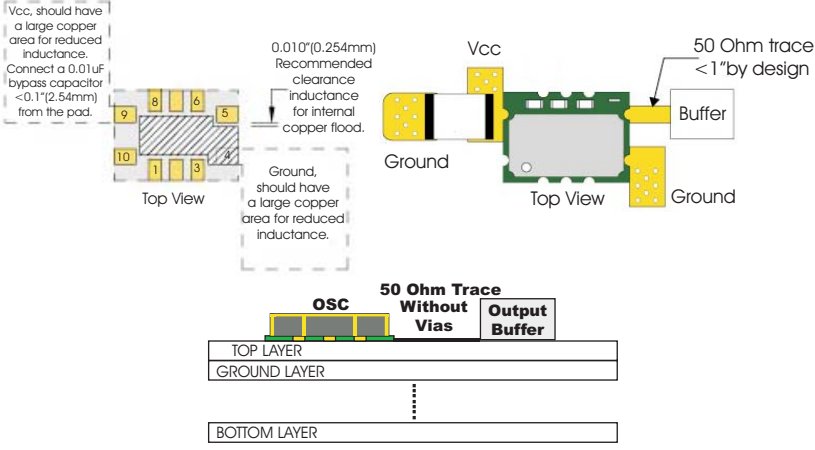
## Clipped Sinewave Test Circuit



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## Design Recommendations



## Package Characteristics

Table 14.0

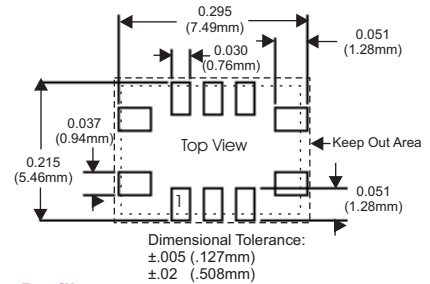
Package	Ceramic Surface Mount Package.
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## Environmental Characteristics

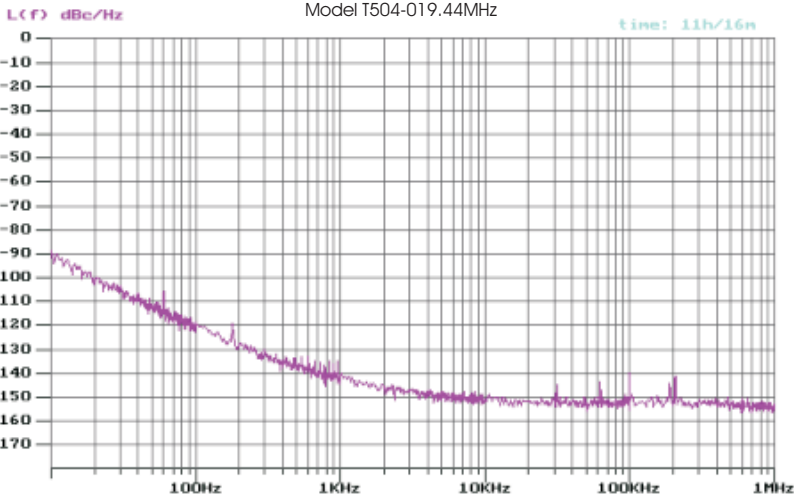
Table 15.0

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:	SMD product suitable for Convection Reflow soldering. Peak temperature 260 C. Maximum time above 220 C, 60 seconds.
Solderability:	Solderability per Mil Std 883E Method 2003

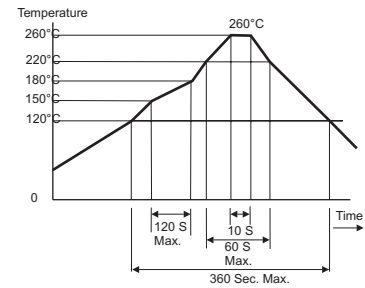
## Suggested Pad Layout



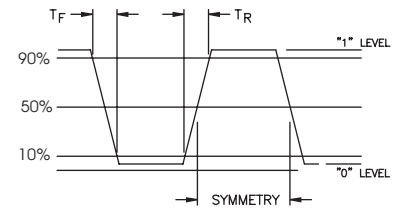
## Typical Phase Noise



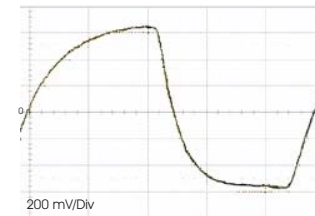
## Solder Profile



## LVC MOS Output Waveform



## Clipped Sinewave Output Waveform



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## Tape and Reel Specifications

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

