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High Precision TCXO / VCTCXO Oscillators

CONNOR WINFIELD
HCW

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.
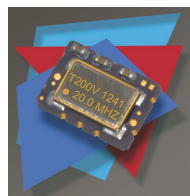
Features:

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

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

HCW
RoHS COMPLIANT

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

LVCMOS 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

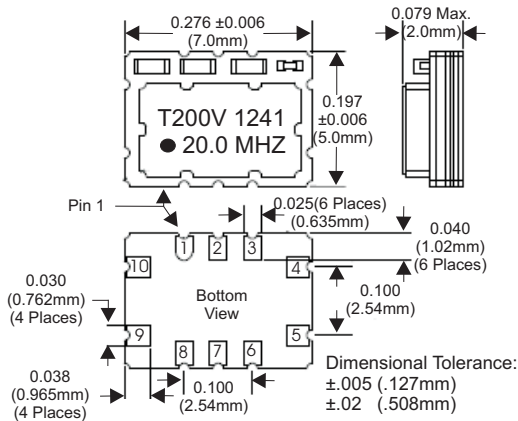| Package	Hermetically sealed ceramic package with grounded metal cover

Environmental Characteristics

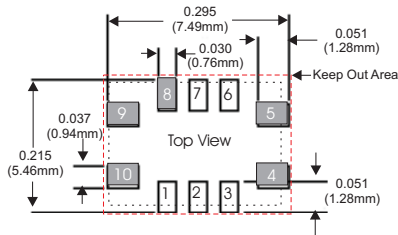| Vibration:	Vibration per Mil Std 883E Method 2007.3 Test Condition A.
Shock:	Mechanical Shock per Mil Std 883E Method 2002.4 Test Condition B.
Soldering Process:	RoHS compliant lead free. See soldering profile on page 2.

Notes:

1. *Initial calibration @ 25°C. ±2°C, for VCTCXO's Vc = 1.65V. Specifications at time of shipment after 48 hours of operation.*

2. *Frequency stability vs. change in temperature. [±(Fmax-Fmin)/2.Fo]. For VCTCXO's - Vc -= 1.65V*

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 Fo/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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CONNOR WINFIELD

T100/T200
Package Outline

0.276 ±0.006 (7.0mm)

0.079 Max. (2.0mm)

0.197 ±0.006 (5.0mm)

T200V 1241
● 20.0 MHZ

Pin 1

0.025(6 Places) (0.635mm)

0.040 (1.02mm) (6 Places)

0.030 (0.762mm) (4 Places)

Bottom View

0.100 (2.54mm)

0.038 (0.965mm) (4 Places)

0.100 (2.54mm)

Dimensional Tolerance: ±.005 (.127mm) ±.02 (.508mm)

T100/T200
Suggested Pad Layout

0.295 (7.49mm)

0.030 (0.76mm)

0.051 (1.28mm)

Keep Out Area

0.037 (0.94mm)
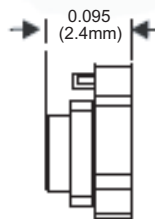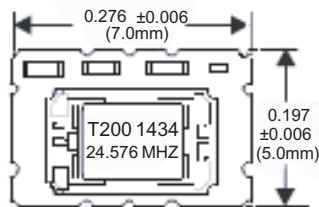
0.215 (5.46mm)

Top View

0.051 (1.28mm)

* 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.
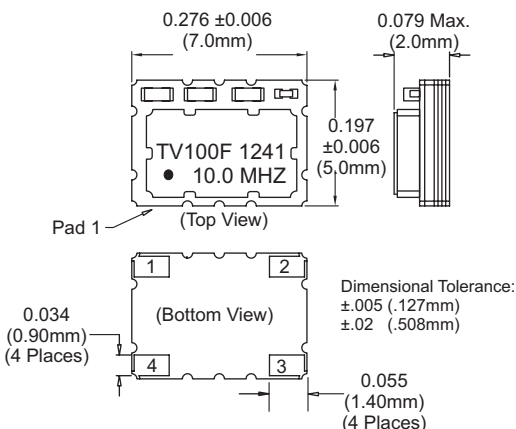
T100/T200
Pad Connections

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)
	TCXO: N/C

T100/T200 Series
Alternate Package Outline

0.276 ±0.006 (7.0mm)

0.095 (2.4mm)
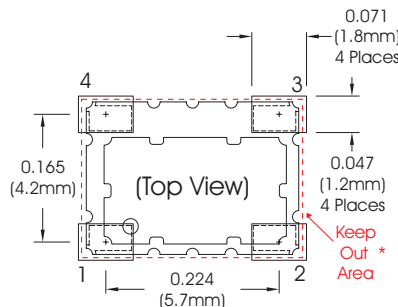
0.197 ±0.006 (5.0mm)

T200 1434 24.576 MHZ

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

0.276 ±0.006 (7.0mm)

0.079 Max. (2.0mm)

0.197 ±0.006 (5.0mm)

TV100F 1241
● 10.0 MHZ

Pad 1

(Top View)

0.034 (0.90mm) (4 Places)

(Bottom View)

Dimensional Tolerance: ±.005 (.127mm) ±.02 (.508mm)

0.055 (1.40mm) (4 Places)

TV100/TV200
Suggested Pad Layout

0.071 (1.8mm) 4 Places

0.165 (4.2mm)

(Top View)

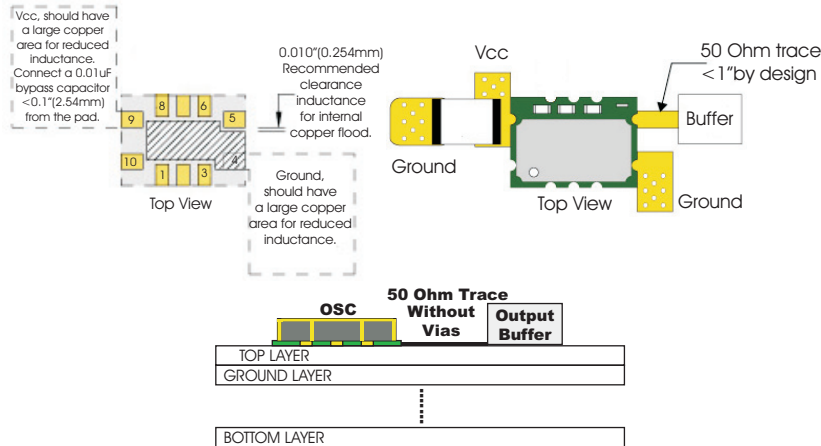0.047 (1.2mm) 4 Places

Keep Out * Area

0.224 (5.7mm)

* 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.

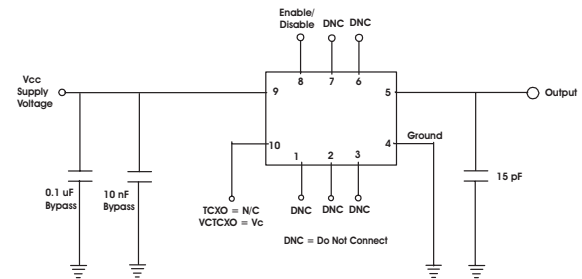## TV100/TV200
Pad Connections

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

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T100 / T200 Design Recommendations

Vcc, should have a large copper area for reduced inductance. Connect a 0.01 uF bypass capacitor <0.1"(2.54mm) from the pad.

0.010"(0.254mm) Recommended clearance inductance for internal copper flood.

Ground, should have a large copper area for reduced inductance.

Top View

Vcc

Ground

50 Ohm trace <1"by design

Buffer

Top View

Ground

OSC

50 Ohm Trace Without Vias

Output Buffer

TOP LAYER

GROUND LAYER

BOTTOM LAYER

T100 / T200 Test Circuit

Vcc Supply Voltage

0.1 uF Bypass

10 nF Bypass

Enable/Disable

DNC

DNC

8 7 6

9

5

Output

10

1 2 3

4

Ground

15 pF

TCXO = N/C
VCTCXO = Vc

DNC

DNC

DNC

DNC = Do Not Connect

TV100 / TV200 Design Recommendations

Vcc, should have a large copper area for reduced inductance. Connect a 0.01uF bypass capacitor <0.1"(2.54mm) from the pad.

0.010"(0.254mm) Recommended clearance inductance for internal copper flood.

Ground, should have a large copper area for reduced inductance.

Top View

Vcc

Ground

50 Ohm trace <1"by design

Buffer

Top View

Ground

OSC

50 Ohm Trace Without Vias

Output Buffer

TOP LAYER

GROUND LAYER

BOTTOM LAYER

TV100 / TV200 Test Circuit
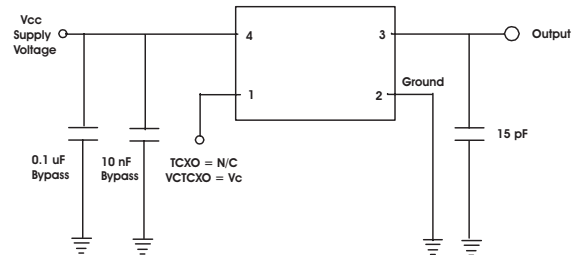
Vcc Supply Voltage

0.1 uF Bypass

10 nF Bypass

4

3

Output

1

2

Ground

15 pF

TCXO = N/C
VCTCXO = Vc
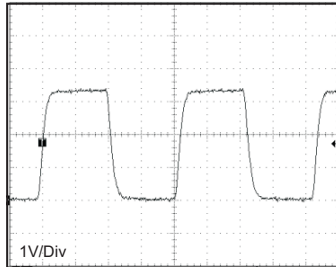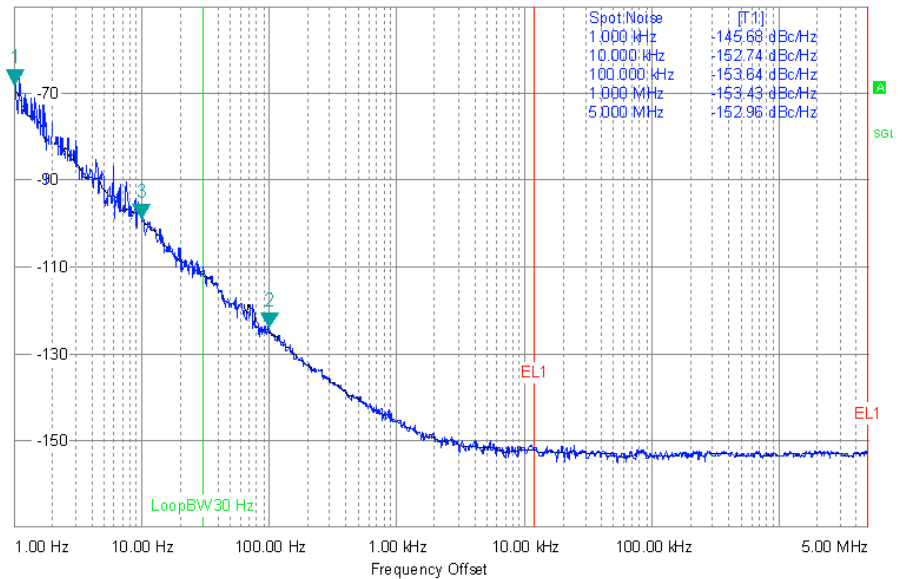
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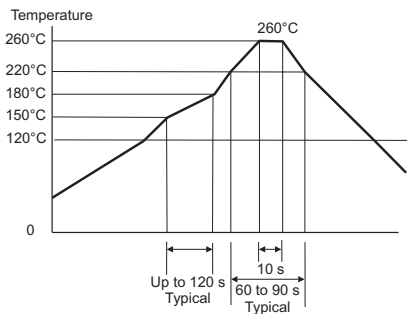| Bulletin	Tx350
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LVCMOS Output Waveform

1V/Div

Phase Noise Information

Typical Phase Noise for TV100F-010.0M

Spot Noise	[T1]:
1.000 kHz	-145.68 dBc/Hz
10.000 kHz	-152.74 dBc/Hz
100.000 kHz	-153.64 dBc/Hz
1.000 MHz	-153.43 dBc/Hz
5.000 MHz	-152.96 dBc/Hz

LoopBW 30 Hz

Solder Profile

Meets IPC/JEDEC J-STD-020C

5x7 mm Tape and Reel Information

MEETS EIA−481A AND EIAJ−1009B
2000 PCS/REEL MAXIMUM
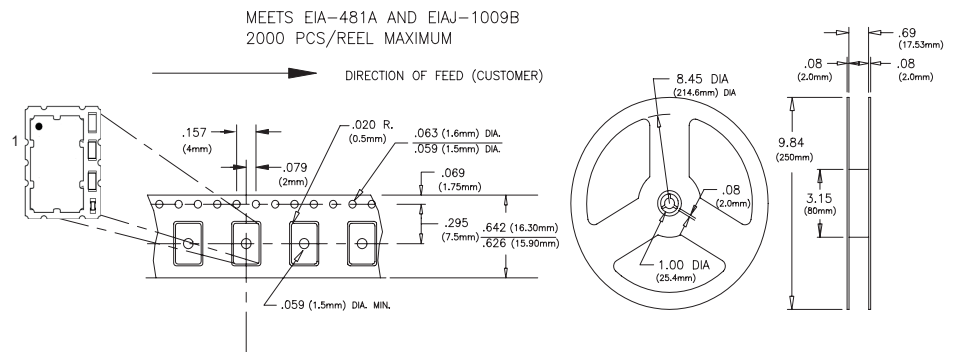
Revision History

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℃ 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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