

Compliance to 15.407(g)
HZB-U58-S60

Emissions of the HZB-U58-S60 will be maintained within the band under all conditions of normal operation under the worst case of frequency shift. As described in the theory of operations document, the frequency of the RF signal is completely determined by a single reference oscillator of 20.75MHz frequency. Two vendors have been approved to supply the reference oscillator, part #690-00173-06, and the frequency-stability characteristics of each vendor's part are shown in the following table. Data sheets are attached for reference.

Frequency-Stability Characteristics of Reference Oscillator (p/n 690-00173-06)

Characteristic	Vectron OSC-2B2@20.75	Rakon VTXO220U-20.75MHz
Type	TCXO	TCXO
Initial Calibration	±2 ppm	±5 ppm
Stability vs. Temperature (-33°C to +70°C)	±2	±2
Stability vs. Supply Voltage	±0.3	±0.3
Aging (7years)	±5	±5
Total:	±9.3 ppm	±12.3 ppm

The worst-case stability is ±12.3 ppm, or ±72 kHz, over all operating conditions. This is sufficient to maintain the emissions within the allowable band; the supporting reasoning for this claim is as follows:

- a) The lowest channel center frequency is 5740.40MHz, with a maximum 26dBc bandwidth of 26MHz. The margin from the lower band edge of 5.725GHz to the lower 26dBc point is 2.4MHz. This margin is greater than the maximum oscillator error of 130kHz.
- b) The highest channel center frequency is 5809.57MHz, with a maximum 26dBc bandwidth of 26MHz. The margin from the upper band edge of 5.825GHz to the upper 26dBc point is 2.43MHz. This margin is also greater than the maximum oscillator error of 130kHz.

Therefore, it is determined that the frequency-determining components offer superior stability to ensure compliance with 15.407(g).

MODEL VTXO200U

SMD Voltage Controlled Temperature Compensated Crystal Oscillators

Small SMD TCXO with standard 4-terminal interface available in custom frequencies ranging from 8.2MHz to 32MHz with a clipped sinewave output.

Product Description

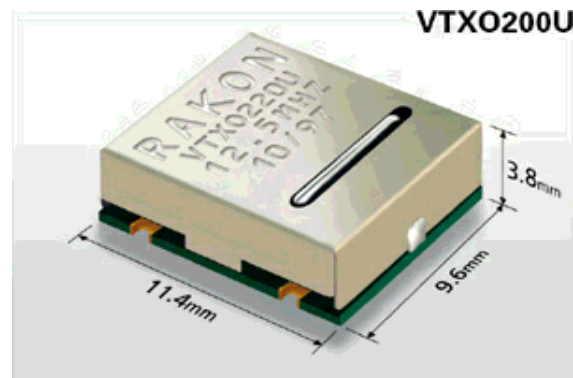
This Colpitts oscillator uses the direct two-port temperature compensation method. Operating on the fundamental mode, the circular AT-cut crystal is housed in the environmentally rugged UM-1 SLIM resistance weld package.

The product can be configured to operate on any voltage between 2.7V and 5V. A mechanical trimmer is available for adjusting the frequency.

Customized frequencies readily available make this model suitable for many timing and frequency applications.

Applications include

GPS, TDMA/APMS/CDMA cellular and satellite phones, PCMCIA CDPD cards, two-way pagers and many other wireless possibilities.



Features

- Uses the high performance UM-1 slim crystal
- Excellent phase noise performance, very little aging and low temperature hysteresis under high vibration environments
- Clipped sinewave frequency output (8.2MHz to 32MHz)
- Standard temperature stability choices are +/-1ppm, +/-1.5ppm and +/-2.5ppm, over wide temperature range
- This product has no trimmer to allow for an aqueous wash process
- Non-standard frequencies available on quick turn around
- Frequency control ranges from 6 to 50ppm available

1.0 SPECIFICATION REFERENCES

1.1	Model Description	VTXO220U 20.75 MHz
1.2	Reference Number	1133
1.3	Company	WirelessHome
1.4	Rakon Internal Part No.	TX2046

2.0 FREQUENCY CHARACTERISTICS

Line	Parameter	Test Condition	Min.	Max.	Units
2.1	Nominal Frequency	Nominal Frequency referenced to 25 deg. C.			20.75 MHz
2.2	Frequency calibration	Frequency at 23 deg. C +/-2 deg. C (see Note 1)		3.0	+/-ppm
2.3	Frequency stability over temperature	Referenced to frequency reading at 25 deg. C. Temperature varied at max. of 2 deg. C per minute. Control voltage varied between min. and max. (Note 2)		2.0	+/-ppm
2.4	Temperature range	The operating temperature range over which the frequency stability is measured (Note 3)	-30.0	75.0	Degrees C
2.5	Frequency perturbations	Peak to peak amplitude of frequency perturbation within operating temperature range (Note 1)		0.5	ppm
2.6	Frequency slope of perturbations	Minimum of 1 frequency reading every 2 degrees C, over the operating temperature range (Note 1)		0.5	ppm/deg C

2.7	Static temperature hysteresis	Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25 deg C.	0.4	+/-ppm
2.8	Supply voltage stability	Supply voltage varied +/-5% at 25 deg C. Frequencies above 25MHz are not able to be specified below the max. value given. (Note 1)	0.3	+/-ppm
2.9	Load sensitivity	+/-10% load change	0.2	+/-ppm
2.10	Root Allan Variance	1 second Tau. (Note 1)	1.0	ppb
2.11	Long term stability	Frequency drift over 1 year (Note 1)	1.0	+/-ppm
2.12	Long term stability (10 years)	Frequency drift over 10 years (note 1)	0.0 5.0	+/-ppm
2.13	G Sensitivity	Gamma vector of all three axes from 30Hz to 1500Hz (Note 1)	1.0	ppb/G

3.0 POWER SUPPLY

<i>Line</i>	<i>Parameter</i>	<i>Test Condition</i>	<i>Min.</i>	<i>Max.</i>	<i>Units</i>
3.1	Supply voltage	Supply voltage range based on nominal 3.3V	3.14	3.46	V
3.2	Current	At Max. supply voltage	2.0		mA

4.0 CONTROL VOLTAGE

<i>Line</i>	<i>Parameter</i>	<i>Test Condition</i>	<i>Min.</i>	<i>Max.</i>	<i>Units</i>
4.1	Control voltage range	Determined by supply voltage. Nominal control 1.65V	0.5	2.8	V
4.2	Frequency tuning	Frequency shift from Min. to Max. control voltages (Note 6)	24.0		ppm
4.3	Frequency tuning linearity	Deviation from straight line curve fit (Note 1)		20.0	%
4.4	Port input impedance		100.0		K Ohms

5.0 OSCILLATOR OUTPUT

<i>Line</i>	<i>Parameter</i>	<i>Test Condition</i>	<i>Min.</i>	<i>Max.</i>	<i>Units</i>
5.1	Output waveform	Clipped sinewave.			
5.2	Output voltage level	At min. supply voltage	0.8		V
5.3	Output load resistance	Operating range	18.0	22.0	K Ohms
5.4	Output load capacitance	Operating range	4.5	5.5	pF

6.0 SSB PHASE NOISE

<i>Line</i>	<i>Parameter</i>	<i>Test Condition</i>	<i>Min.</i>	<i>Max.</i>	<i>Units</i>
	<i>Quiescent measurement at room temperature. Phase noise dependent on oscillator frequency.</i>				
6.1	SSB Phase noise density	1Hz offset	-45.0		dBc/Hz
6.2	SSB Phase noise density	100Hz offset	-105.0		dBc/Hz
6.3	SSB Phase noise density	1KHz offset	-130.0		dBc/Hz
6.4	SSB Phase noise density	10KHz offset	-140.0		dBc/Hz

6.5 SSB Phase noise density 100KHz offset -145.0 dBc/Hz

7.0 ENVIRONMENTAL

The oscillator shall meet electrical characteristics and suffer no physical damage after being subject to the following conditions:

- 7.1 Shock** Half sinewave acceleration of 100G peak amplitude for 11ms duration, 3 cycles each plane.
- 7.2 Random Vibration** 10G's RMS 30Hz to 1500Hz duration of 6 hours
- 7.3 Humidity** After 48hours at 85 deg C +/-2% deg C 85% relative humidity non-condensing
- 7.4 Thermal shock test** Exposed at -40 deg C for 30 minutes then to 85 deg C for 30 minutes constantly for a period of 5 days.
- 7.5 Storage Temperature** -40 to 85 deg C.

8.0 MARKING

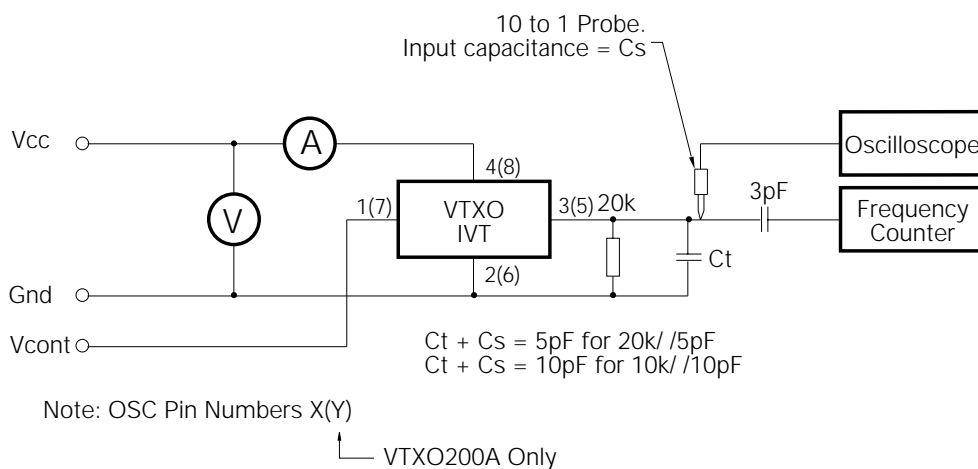
- 8.1 Type** Engrave
- 8.2 Line 1** Rakon logo
- 8.3 Line 2** Model descriptive
- 8.4 Line 3** Frequency in MHz (to 3 decimal places or greater depending on the no. of significant digits after the decimal point)
- 8.5 Line 4** Date Code MM/YY

9.0 MANUFACTURING INFORMATION

- 9.1 Reflow and washing** Able to withstand aqueous washing process and normal solder reflow processes
- 9.2 Packaging description** Tape and reel

10.0 SPECIFICATION NOTES

- 10.1 Note 1** The Max. value is the specification. A Min. value, if present, indicates the tightest specification available.
- 10.2 Note 2** A max. frequency stability over the temperature is required to be specified. For this model series, values between to +/-1ppm and +/-10ppm are available. Standard options are +/-1ppm, +/-1.5ppm, +/-2ppm and +/-2.5ppm.
- 10.3 Note 3** The operating temperature range needs to be specified. The extremes for this model are -40 and +85 deg C. If either or both ends of the operating temperature range are at these extremes, then the frequency stability options are limited to greater than +/-1.5ppm.
- 10.4 Note 4** Standard power supply options are 2.7V, 3V, 3.3V, 4V or 5V, but any value between Min. & Max. is available.
- 10.5 Note 5** This range is normally 0.5V to Supply voltage less 0.5V i.e. for a supply voltage of 3V, the range is 0.5V to 2.5V.
- 10.6 Note 6** The Min value is the specification. A Max value, if present, indicates the widest tuning range available for this model (subject to other parameters).



TITLE: VTXO & IVT CLIPPED SINEWAVE TEST CIRCUIT FILENAME: CAT003

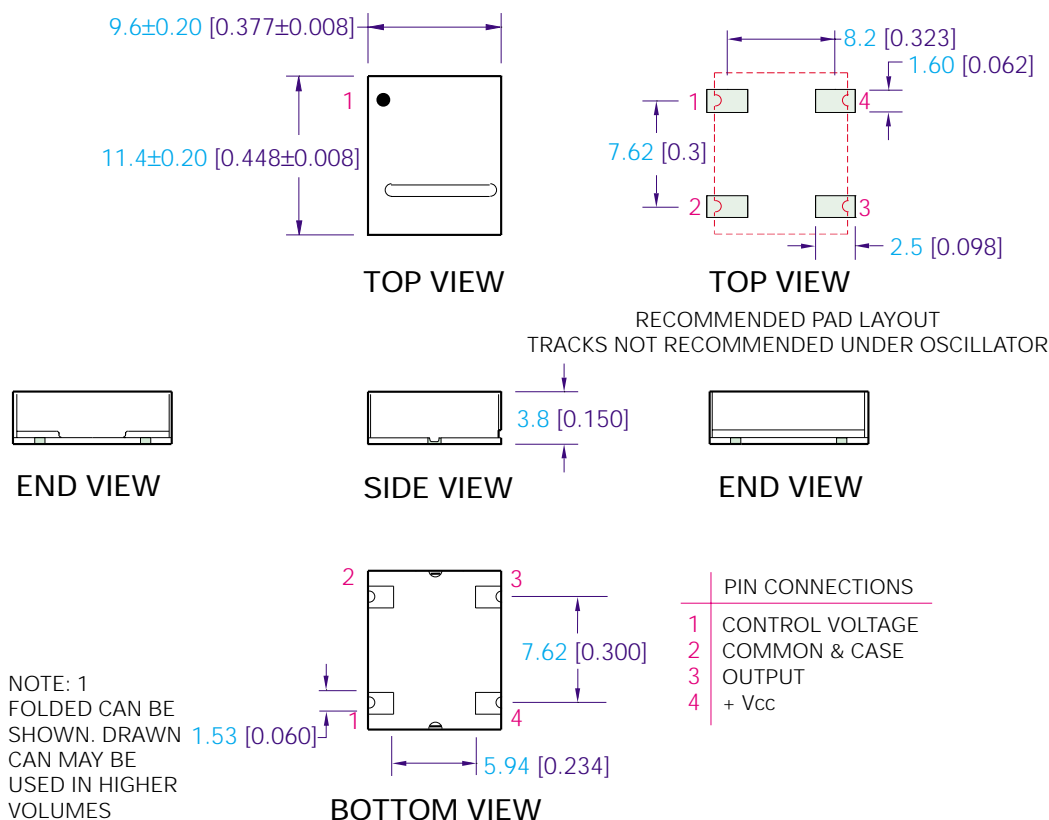
REVISION: B

RELATED DRAWINGS: VTXO100 VTXO200A
 IVT100 VTXO200B
 IVT200B VTXO200U

DATE: 28 AUG 98

SCALE: NTS

Millimetres [inch]



TITLE: VTXO200U MODEL

FILENAME: CAT006

REVISION: C

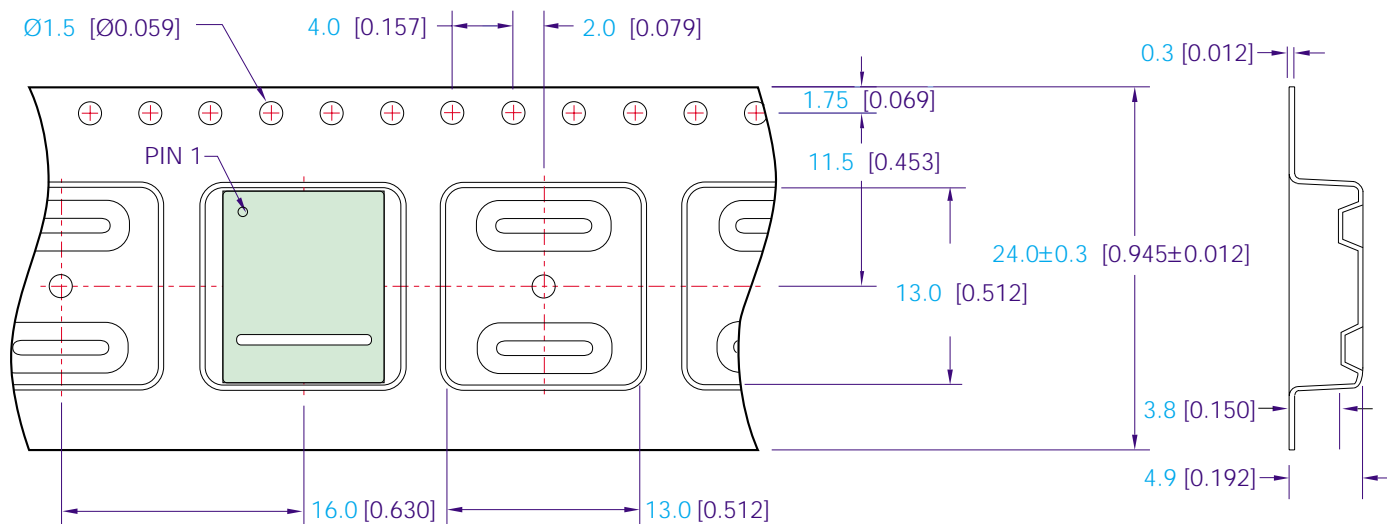
RELATED DRAWINGS: VTXO & IVT CLIPPED
SINEWAVE TEST CIRCUIT (CAT003)
200U TAPE & REEL (CAT012)
200 SERIES REFLOW (CAT015)

DATE: 13 APRIL 99

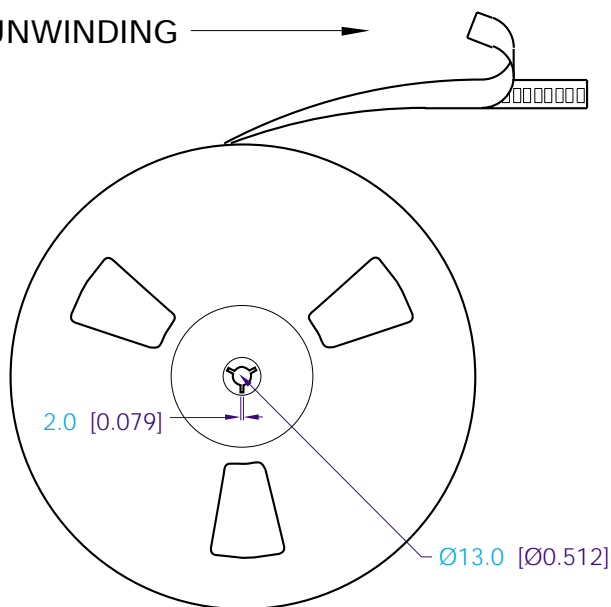
SCALE: 2:1

Millimetres [inch]

Tolerances:
XX = ± 0.5
X.X = ± 0.10
X.XX = ± 0.05
X.XXX = ± 0.05
X⁰ = $\pm 1.0^{\circ}$
Hole = ± 0.10



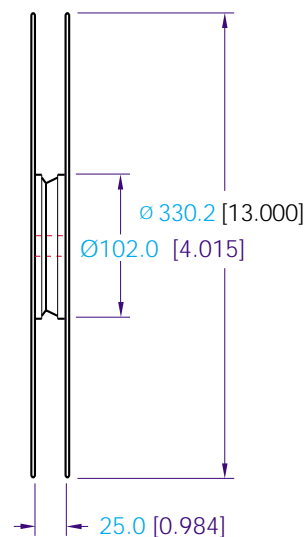
UNWINDING →



REEL DETAIL

SCALE 1:5

STANDARD REEL QUANTITY 800 PCS



TITLE: 200U TAPE & REEL

FILENAME: CAT012

REVISION: B

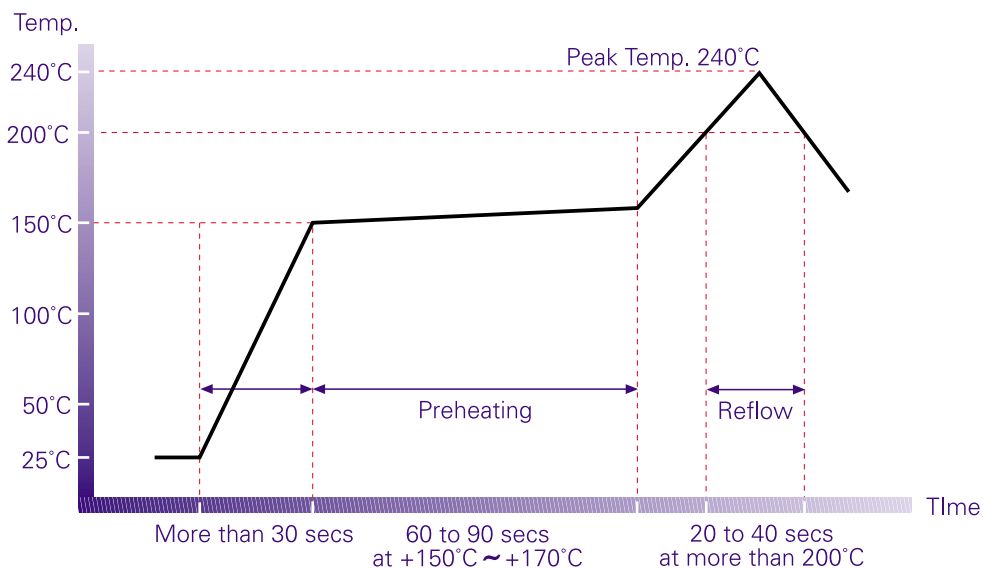
RELATED DRAWINGS: TXO200U MODEL (CAT010)
VTXO200U MODEL (CAT006)

DATE: 11 Feb 99

SCALE: 2:1

Millimetres [inch]

200 Series A,B & U TXO/VTXO



TITLE: 200 SERIES REFLOW

FILENAME: CAT015

REVISION: B

RELATED DRAWINGS: TXO200A (CAT008) VTXO200A (CAT004) IT200B (CAT082)
TXO200B (CAT009) VTXO200B (CAT005) IVT200B (CAT083)
TXO200U (CAT010) VTXO200U (CAT006)

DATE: 16 SEPT 98

SCALE: NTS

Millimetres [inch]

OSC Series Ultra Miniature TCXO's



Features

- Low Cost
- 3.0 or 5.0 Vdc Option
- Reflow Solderable
- <2.2 mm Height
- Voltage Tune Option

Applications

- Wireless handsets, PCS, GSM, Cellular
- PCMCIA Applications
- GPS

Description

Vectron International has introduced a series of low-profile, low cost, *surface mount, Temperature Compensated Crystal Oscillators (TCXOs)* available in frequencies from 10 MHz to 25 MHz.

The OSC series low-profile (0.09 inch maximum height), surface mount TCXOs can be mounted using the standard convection reflow process. The units feature a ± 1.5 PPM frequency vs. temperature characteristic over a -20°C to +70°C operating range and operate from a 3.0V or 5V supply. Current drain <2.0 mA. Aging <1ppm/year and phase noise is -125 dBc/Hz at 100 Hz and -150 dBc/Hz at 100 kHz.

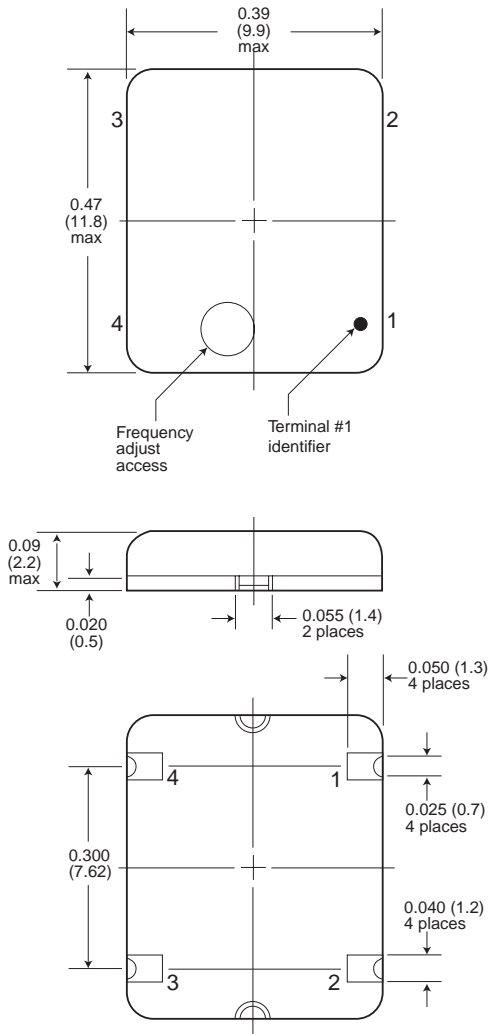
The OSC series of TCXOs and TCVCXOs has been designed for pick-and-place mounting and reflow soldering. Units are available on tape-and-reel at no additional charge. The reel size is 2000 pcs. and is compatible with EIAJ-1009B standards. The low-cost, miniature units are ideal for wireless handsets, PCMCIA applications, and GPS receivers.

OSC Series Ultra Miniature TCXO s

Performance Characteristics

Parameter	Characteristics	
	Option A = +5 Vdc	Option B= +3 Vdc
Frequency range:	10 MHz to 25 MHz	
Stability Options: (relative to +25°C)	1 = ± 1.5 ppm -20 to +70°C 2 = ± 2.0 ppm -30 to +70°C 3 = ± 2.5 ppm -30 to +75°C 4 = ± 5.0 ppm -40 to +85°C	
Stability vs. Supply Aging (typical):	$< \pm 0.3$ ppm vs B+ of $\pm 5\%$ < 1.0 ppm/year at +40°C	
Input Voltage:	+5.0 Vdc $\pm 5\%$	+3.0 Vdc $\pm 5\%$
Current:	< 1.5 mA (10.0 to 16.8 MHz). < 2.0 mA (16.8 to 20.0 MHz).	
Output: Clipped Sinewave	+5.0 Vdc = 1.0 VP-P minimum	+3.0 Vdc = 0.7 VP-P minimum
Load:	10 K Ω /10pf	
Mechanical trim:	± 3.0 PPM min.	
Trim options:	0 = Mechanical trim, no VCO 1 = ± 5.0 ppm VC & mechanical 2 = Voltage trim only ± 8.0 ppm min.	
Voltage Control Input Impedance:	100K Ω minimum	
Supply Voltage:	+5.0 Vdc	+3.0 Vdc
Control Voltage Range:	+0.5Vdc to +4.5Vdc	+0.5Vdc to +2.5Vdc
Frequency Tolerance at 25°C:	± 2.0 ppm at +2.5 Vdc	± 2.0 ppm at +1.5 Vdc
Start-up time:	< 10 mS (typical) to within ± 1.0 PPM	
Harmonics: 2nd harmonic 3rd harmonic Other	> 3 dBc down > 6 dBc down > 10 dBc down	
Phase Noise (typical): at 10 MHz	-80 dBc/Hz max. at 10 Hz offset -125 dBc/Hz max. at 100 Hz offset -145 dBc/Hz max. at 1 KHz offset -148 dBc/Hz max. at 10 KHz offset -150 dBc/Hz max. at 100 KHz offset	

OSC Series Ultra Miniature TCXO s

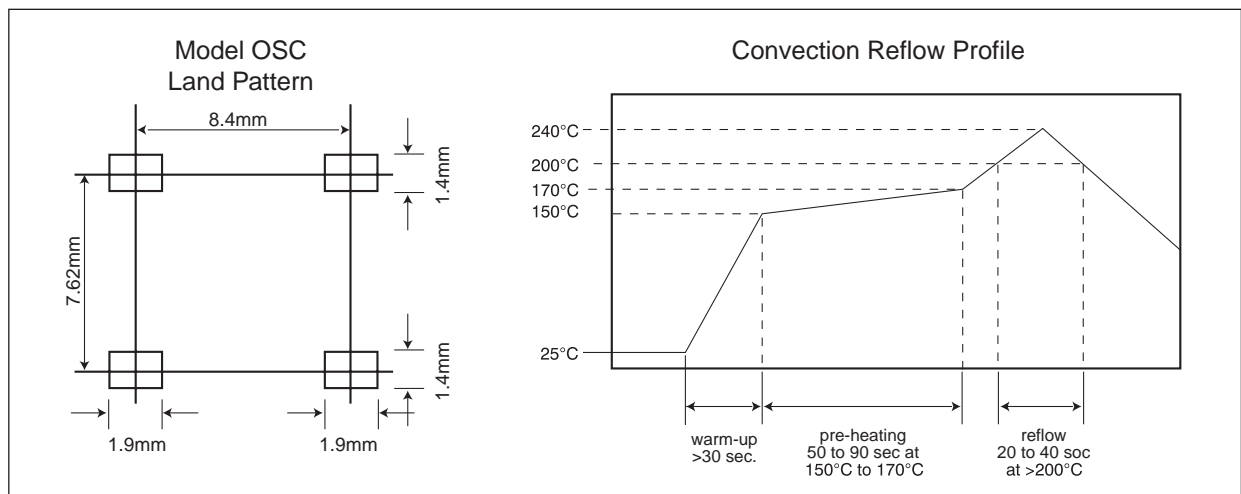


The OSC series of TCXO s and VCTCXO s has been designed for pick and place and reflow soldering. Units are available on **Tape and Reel** at no additional charge when ordering a complete reel. The reel size is 2000 pcs and is compatible with EIAJ-1009B standards. The suggested reflow profile is shown below. The TCXO may be reflowed two times. Frequency shift as a result of reflow will be <1.0PPM. Units should not be adjusted to center frequencies until at least 2 hours after reflow to allow the crystals to stabilize.

The OSC footprint is compatible with many of the previous generation 6 pin leaded TCXO s. Our **OSE** model is the same size as the OSC except it provides the two additional pads to match pad connections of 6 pin leaded TCXO s and VCTCXO s.

TCXO s are precision subsystems with tolerances measured to $\pm 0.1\text{PPM}$ ($\pm 0.00001\%$). Non-hermetically sealed TCXO s should not be subjected to a wash process that will immerse the TCXO in solvents. **No clean** is the recommended procedure.

PIN 1 = VC or N/C
PIN 2 = GROUND
PIN 3 = OUTPUT
PIN 4 = B+



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Standard Frequencies* (MHz)				
10.0	12.8	13.0	14.4	15.56
16.0	19.2	19.98	20.0	25.0

OSC- at **Frequency**

Stability Code (from page 2)

Input Voltage

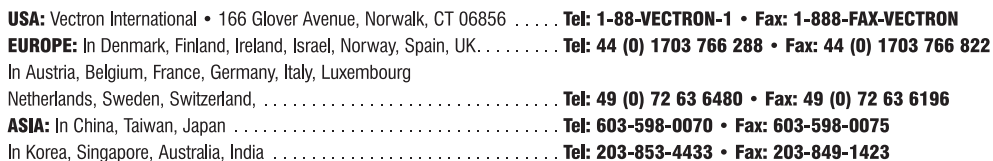
A = +5.0 Vdc $\pm 5\%$ <2.0 mA MAX.
 B = +3.0 Vdc $\pm 5\%$
 <1.5 mA (10.0 to 16.8 MHz)
 <2.0 mA (16.8 to 20.0 MHz)

Trim Option

0 = Mechanical trim, no VCO
 1 = ± 5.0 ppm VC & mechanical
 2 = Voltage trim only ± 8.0 ppm min.

Example of typical P/N
 OSC-3B2 19.2 MHz
 3 = ± 2.5 ppm
 B = +3.0 Vdc
 2 = Voltage Tune
 no mechanical trimmer

For additional information please contact:



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