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VT-803

## Description

Vectron's VT-803 Temperature Compensated Crystal Oscillator (TCXO) is a quartz stabilized, clipped sine wave or CMOS output, 5th order analog temperature compensated oscillator, operating off a 2.8 to 5.0 volt supply in a hermetically sealed 3.2x5 mm ceramic package.

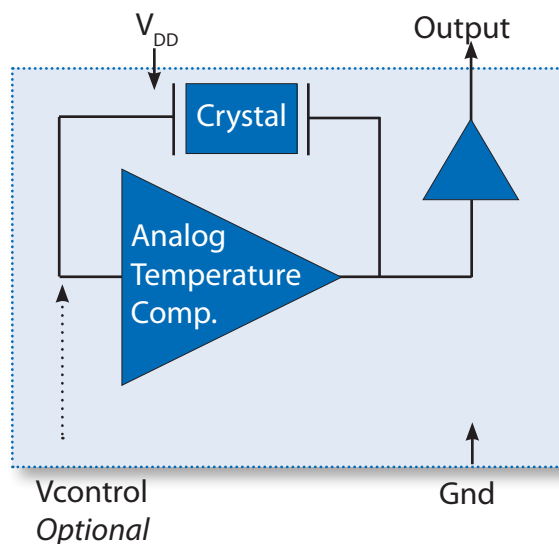
## Features

- Clipped Sine Wave or CMOS Output
- 10.000-52.000 MHz Output
- $\pm 100$  ppb Temperature Stability
- Optional Enable/Disable Function
- Optional VCXO
- Fundamental Crystal Design
- Gold over nickel contact pads
- Hermetically Sealed Ceramic SMD package
- Product is compliant to RoHS directive  and fully compatible with lead free assembly

## Applications

- Femto Cells
- Base Stations
- IP Networking
- GPS
- Point to Point Radio
- Manpack Radio
- Test and Measurement

## Block Diagram



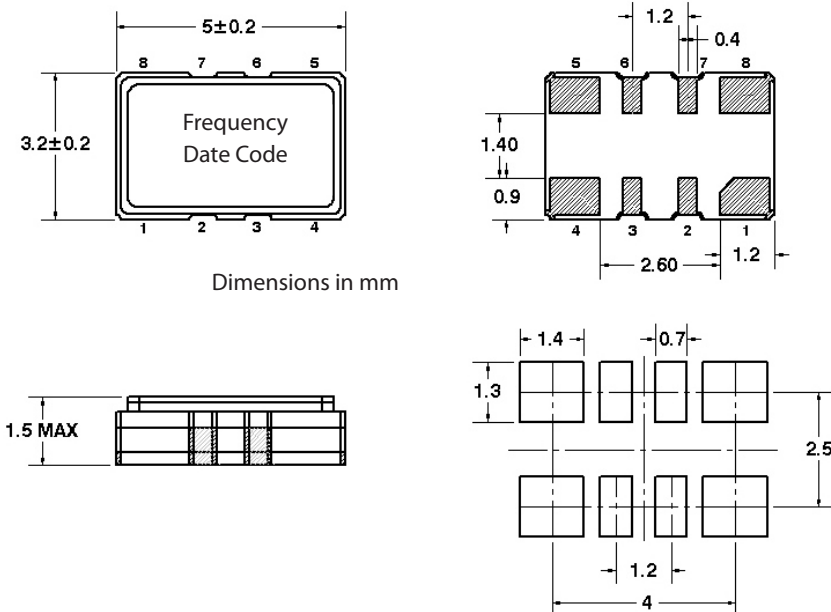
# Specifications

**Table 1. Electrical Performance, Clipped Sine Wave Option**

Parameter	Symbol	Min	Typ	Max	Units
Output Frequency, <sup>1</sup> <i>Ordering Option</i>	$f_o$	10		52	MHz
Supply Voltage <sup>2</sup> , <i>Ordering Option</i>	$V_{DD}$	+2.8, +3.0, +3.3, +5.0			V
Supply Current, 10-26.000MHz 26.001-52.000MHz	$I_{DD}$			2.0 2.6	mA
Operating Temperature, <i>Ordering Option</i>	$T_{OP}$	-10/70, -20/70, -30/85, -40/85			°C
Stability Over Operating Temperature <sup>3</sup> , <i>Ordering Option</i>		±0.10, ±0.20, ±0.28, ±0.50, ±1.00, ±2.00			ppm
Initial Accuracy, "No Adjust" Option <sup>4</sup>				±1.5	ppm
Power Supply Stability, ±5% change				±0.05	ppm
Load Stability, ±10% change				±0.05	ppm
Aging				±0.5	ppm/yr
Tuning Range, <i>Ordering Option</i>	PR	±5.0, ±8.0, ±10.0, ±12.0			ppm
Tuning Slope		Positive			
Control Voltage to reach Pull Range		0.5		2.5	V
Control Voltage Impedance		100			Kohm
Output Level	$V_o$ p/p	0.8			V
Output Load				10K    10pF	
Phase Noise, 26.000MHz 10Hz 100Hz 1kHz 10kHz 100kHz	$\phi_N$		-91 -117 -136 -150 -158		dBc/Hz
Start Up Time	$t_{SU}$			2	ms

1. The Output is DC coupled.
2. The VT-803 power supply pin should be filtered, eg, a 10uF, 0.1uF and 0.01uf capacitor.
3. Not all stabilities are available over all temperature ranges, refer to Table 9. Measured at mid Vc for parts with frequency tuning.
4. After 2 IR reflows and 24 hours.

## Package Outline Drawing



**Table 2. Pinout**

Pin #	Symbol	Function
1	$V_C$	TCXO Control Voltage or NC
2	NC	Make No Connection
3	NC	Make No Connection
4	GND	Ground
5	OUT	Output
6	NC	No Connection
7	NC	Make No Connection
8	$V_{DD}$	Supply Voltage

# Specifications

**Table 3. Electrical Performance, CMOS Option**

Parameter	Symbol	Min	Typ	Max	Units
Output Frequency <sup>1</sup> , <i>Ordering Option</i>	$f_o$	10		52	MHz
Supply Voltage <sup>2</sup> , <i>Ordering Option</i>	$V_{DD}$	+2.8, +3.0, +3.3, +5.0			V
Supply Current, 10-26.000MHz 26.001-40.000MHz 40.001- 52.000MHz	$I_{DD}$			3.5 5.0 6.0	mA
Operating Temperature, <i>Ordering Option</i>	$T_{OP}$	-10/70, -20/70, -30/85, -40/85			°C
Stability Over Operating Temperature <sup>3</sup> , <i>Ordering Option</i>		$\pm 0.10, \pm 0.20 \pm 0.28 \pm 0.50, \pm 1.00, \pm 2.00$			ppm
Initial Accuracy, "No Adjust" Option <sup>4</sup>				$\pm 1.5$	ppm
Power Supply Stability, $\pm 5\%$ change				$\pm 0.05$	ppm
Load Stability, $\pm 10\%$ change				$\pm 0.05$	ppm
Aging				$\pm 0.5$	ppm/yr
Tuning Range, <i>Ordering Option</i>	PR	$\pm 5.0, \pm 8.0 \pm 10.0, \pm 12.0$			ppm
Tuning Slope		Positive			
Control Voltage to reach Pull Range		0.5		2.5	V
Control Voltage Impedance		100			Kohm
Output Level Output Logic High Output Logic Low Output Logic High Drive Output Logic Low Drive	$V_{OH}$ $V_{OL}$ $I_{OH}$ $I_{OL}$	$0.9 * V_{DD}$  4		$0.1 * V_{DD}$  -4	V V mA mA
Output Load				15	pF
Phase Noise, 26.000MHz 10Hz 100Hz 1kHz 10kHz 100kHz	$\emptyset_N$		-91 -117 -139 -153 -157		dBc/Hz
Period Jitter <sup>5</sup> rms peak-peak			2.5 21.0		ps ps
Start Up Time	$t_{SU}$			2	ms

1. The Output is DC coupled.
2. The VT-803 power supply pin should be filtered, eg, a 10uF, 0.1uF and 0.01uf capacitor.
3. Not all stabilities are available over all temperatures, refer to Table 10. Measured at mid Vc for parts with frequency tuning
4. After 2 IR reflows and 24 hours.
5. Measured using a Wavecrest SIA3300C, 90K samples.

## Warm Up Time

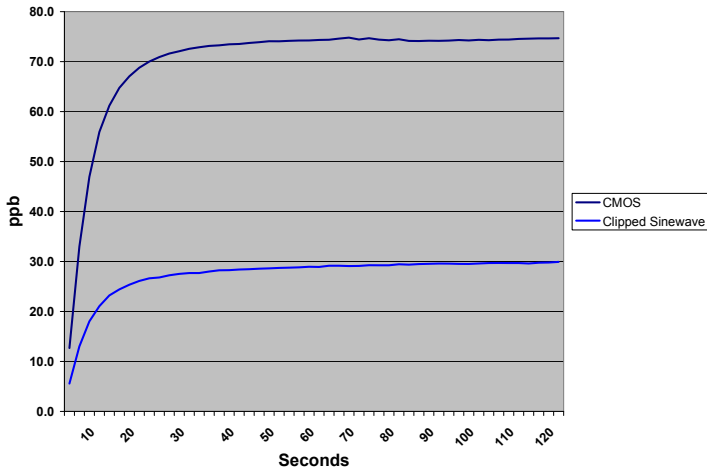


Figure 1

The VT-803 start up time is rated at 2ms. Figure 1 shows the Output Frequency versus time in seconds which shows the output reaching a steady state frequency within 60 seconds.

## Frequency versus Vc Over Temperature

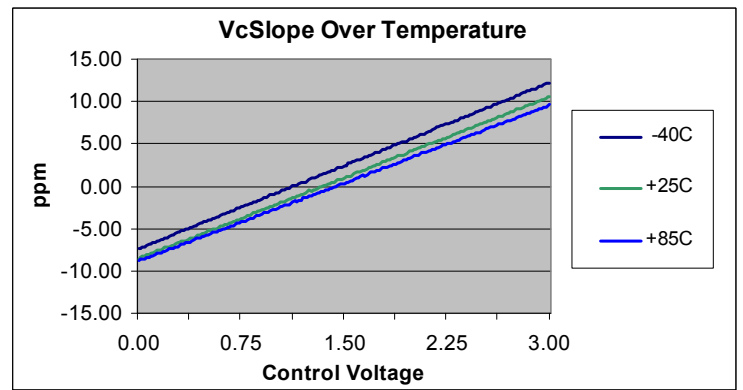


Figure 2

The VT-803 output frequency change versus control voltage is very linear and Figure 2 show the typical performance over temperature.

## Allan Deviation, Clipped Sine Wave Output

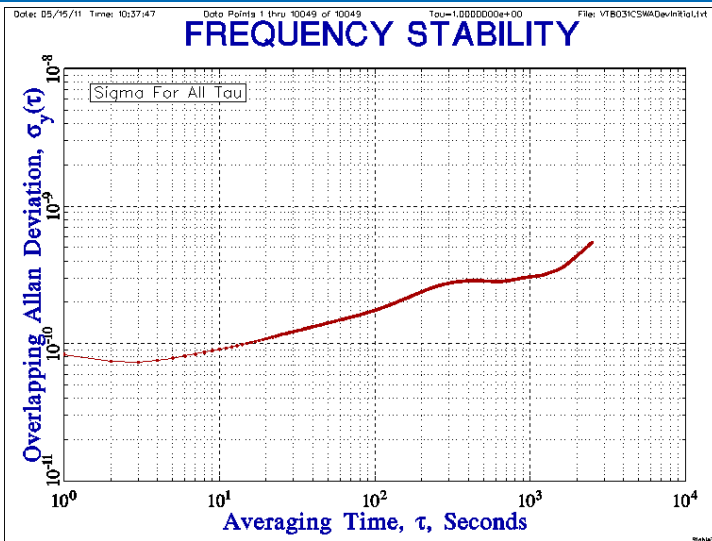


Figure 3

Test Conditions are under room ambient air flow (non insulated conditions).

## Allan Deviation, CMOS Output

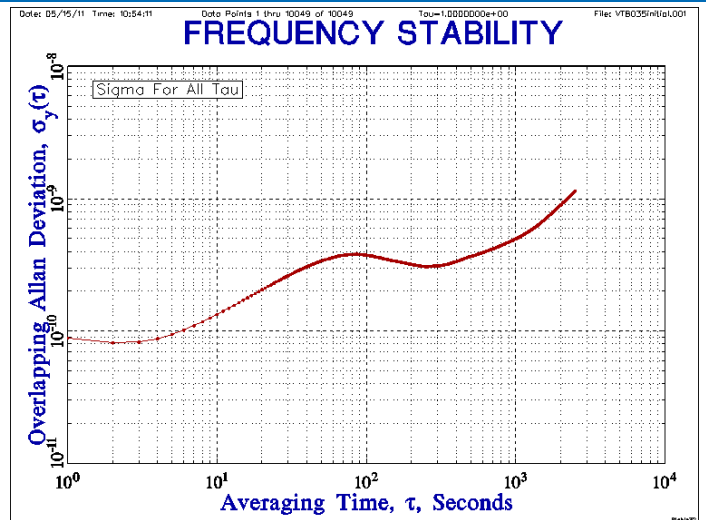


Figure 4

Test Conditions are under room ambient air flow (non insulated conditions).

## Aging

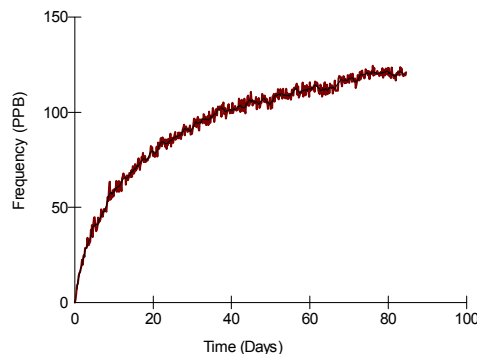
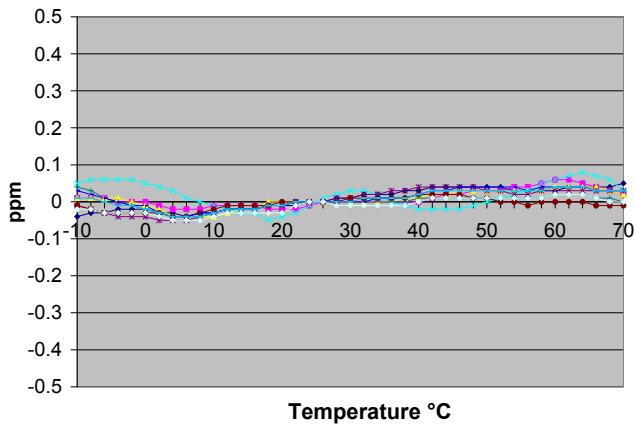


Figure 5

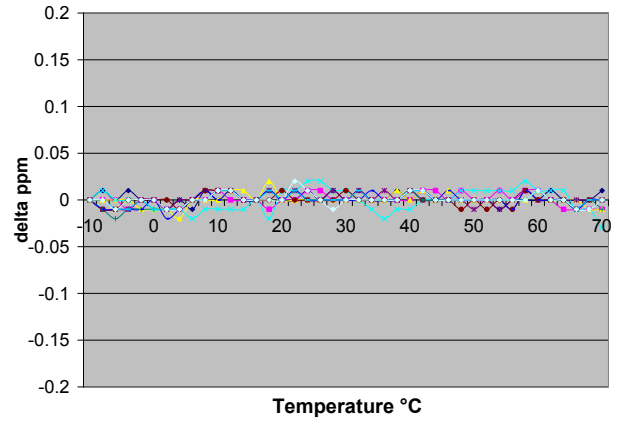
Figure 5 shows an output frequency change of 125ppb typical over 85 days at 85°C which would be equivalent to 125ppb over 2.25 years at 40°C.

## Temperature Stability Graph



Temperature °C  
Figure 6

## Delta Frequency vs. Temperature



Temperature °C  
Figure 7

Figure 7 shows the change in frequency reading between every adjacent 2°C readings.

## Phase Noise Performance, Clipped Sine Wave

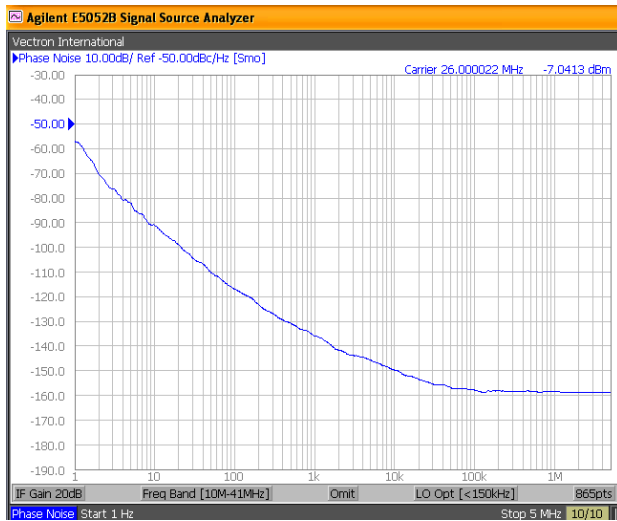


Figure 8

## Phase Noise Performance, CMOS

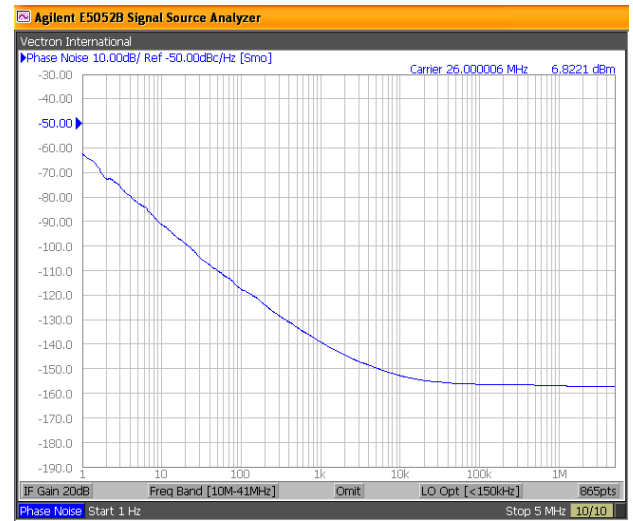


Figure 9

## Phase Noise Over Temperature

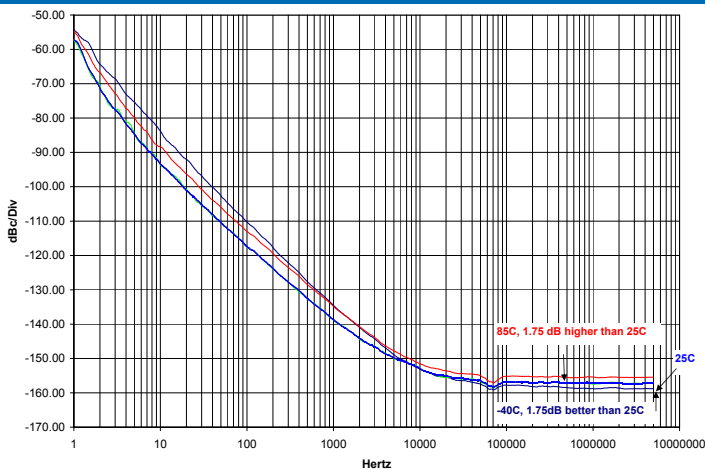


Figure 10

Figure 10 shows the difference in the phase noise at 85°C, 25°C and -40°C.

## Phase Noise Over Power Supply Variation

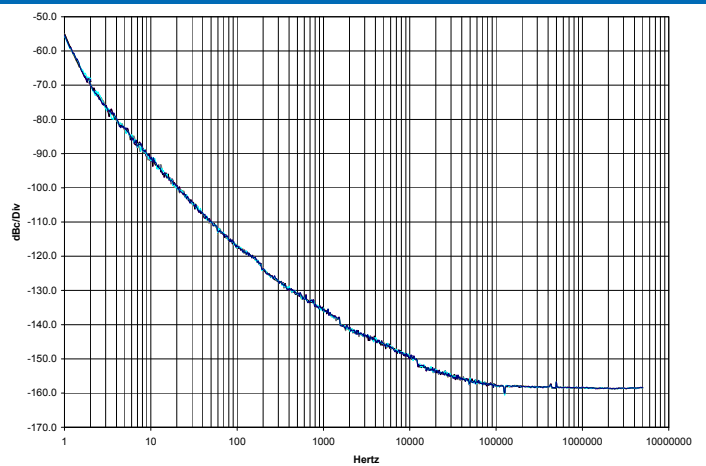


Figure 11

Figure 11 is a phase noise plot at a 2.8, 3.0, 3.3 and 3.6 volt power supply which demonstrates there is no significant change in performance.

## VCXO Function

**VCXO Feature:** The VT-803 is supplied with a VCXO function for applications where it will be used in a PLL, or the output frequency needs fine tune or calibration adjustments. This is a high impedance input, 100 Kohm, and can be driven with an op-amp or terminated with adjustable resistors etc. **Pin 1 should not be left floating on the VCXO optional device.**

## Maximum Ratings

### Absolute Maximum Ratings and Handling Precautions

Stresses in excess of the absolute maximum ratings can permanently damage the device. Functional operation is not implied or any other excess of conditions represented in the operational sections of this data sheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability.

Although ESD protection circuitry has been designed into the VT-803, proper precautions should be taken when handling and mounting. VI employs a Human Body Model and Charged Device Model for ESD susceptibility testing and design evaluation. ESD thresholds are dependent on the circuit parameters used to define the model. Although no industry standard has been adopted for the CDM a standard resistance of 1.5kOhms and capacitance of 100pF is widely used and therefore can be used for comparison purposes.

Parameter	Symbol	Rating	Unit
Storage Temperature	$T_{STORE}$	-55/125	°C
Supply Voltage	$V_{DD}$	-0.6/6	V
Control Voltage	$V_C$	$-0.6/V_{DD}+0.6$	V
Enable/Disable Voltage	E/D	$-0.6/V_{DD}+0.6$	V
ESD, Human Body Model		1500	V
ESD, Charged Device Model		1000	V

## Reliability

Parameter	Condition
Mechanical Shock	MIL-STD-883 Method 2002
Mechanical Vibration	MIL-STD-883 Method 2007
Temperature Cycle	MIL-STD-883 Method 1010
Solderability	MIL-STD-883 Method 2003
Fine and Gross Leak	MIL-STD-883 Method 1014
Resistance to Solvents	MIL-STD-883 Method 2015
Moisture Sensitivity Level	MSL1
Contact Pads	Gold over Nickel

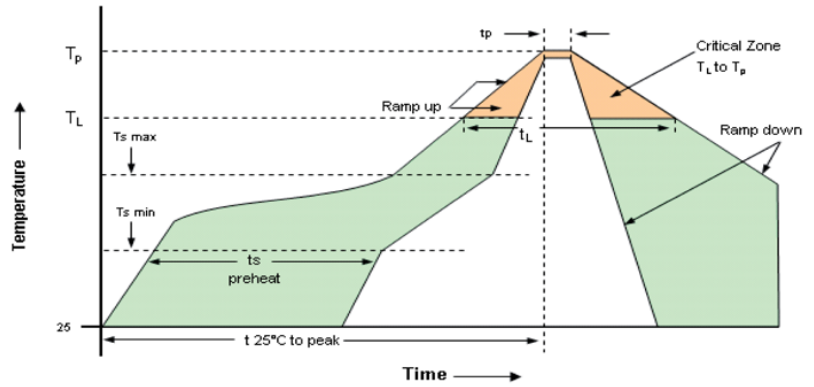
## IR Reflow

### Suggested IR Profile

Devices are built using lead free epoxy and can be subjected to standard lead free IR reflow conditions shown in Table 5. Contact pads are gold over nickel and lower maximum temperatures can also be used, such as 220°C.

#### Solderprofile:

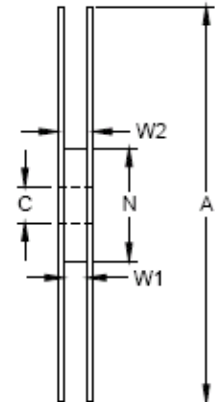
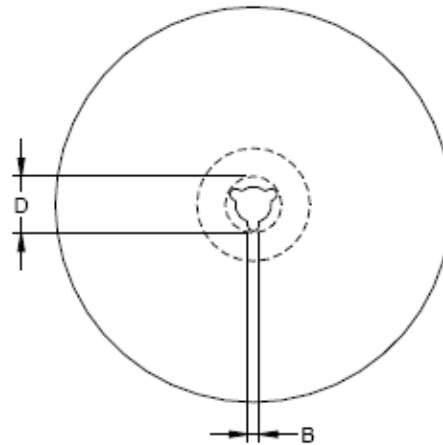
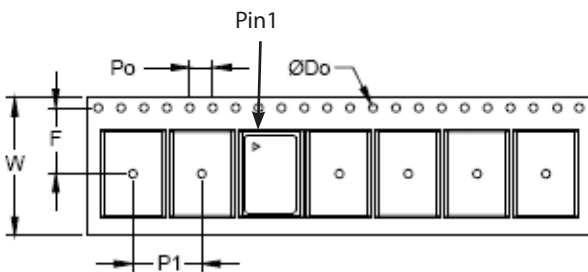
Table 6. Reflow Profile		
Parameter	Symbol	Value
PreHeat Time Ts-min Ts-max	$t_s$	200 sec Max 150°C 200°C
Ramp Up	$R_{UP}$	3°C/sec Max
Time above 217C	$t_L$	150 sec Max
Time to Peak Temperature	$t_{25C \text{ to peak}}$	480 sec Max
Time at 260C	$t_p$	30 sec Max
Time at 240C	$t_{p2}$	60 sec Max
Ramp down	$R_{DN}$	6°C/sec Max



## Tape & Reel

**Table 7. Tape and Reel Information**

Tape Dimensions (mm)						Reel Dimensions (mm)						
W	F	Do	Po	P1	A	B	C	D	N	W1	W2	#/Reel
12	5.5	1.5	4	8	254	2.5	13	21	100	13.5	17.5	2000



# Ordering Information

**Table 8. Standard Frequencies (MHz)**

10.000	12.800	16.000	16.384	19.200	20.000	20.480	24.576	25.000	26.000
27.000	28.800	30.720	32.000	40.000	48.000	50.000	52.000		

## VT-803- E A H - 507A- xxMxxxxxxxx

**Product**

TCXO

**Package**

5x3.2 Package

**Voltage Options**

D: +5.0 Vdc ±10%

E: +3.3 Vdc ±10%

F: +3.0 Vdc ±10%

G: +2.8 Vdc ±10%

**Output**

A: CMOS

F: Clipped Sine Wave

**Temp Range**

W: -10/70°C

J: -20/70°C

H: -30/85°C

E: -40/85°C

Frequency in MHz

**Tuning**

0: Fixed, No tuning

A: ±5ppm

B: ±8ppm

C: ±10ppm

D: ±12ppm

**Stability**

107: ±100ppb

207: ±200ppb

287: ±280ppb

507: ±500ppb

106: ±1.0ppm

206: ±2.0ppm

**Table 9. Capabilities, Clipped Sine Wave Output**

	100ppb	200ppb	280ppb	500ppb	1ppm
-10/70°C	●	●	●	●	●
-20/70°C	●	●	●	●	●
-30/85°C	●	●	●	●	●
-40/85°C	●	●	●	●	●

**Table 10. Capabilities, CMOS Output**

	100ppb	200ppb	280ppb	500ppb	1ppm	2ppm
-10/70°C	●	●	●	●	●	●
-20/70°C	●	●	●	●	●	●
-30/85°C	●	●	●	●	●	●
-40/85°C	●	●	●	●	●	●

● = Can be provided.

● = Under development. Please consult with factory.

● = Cannot be provided.

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09/03/14



Revision Date	Description
Nov 4, 2013	Updated product capability chart (Table 9 & 10). Changed VI Asia contact information.
Jan 7, 2014	Added "temperature stability measurement at Mid Vc for parts with frequency tuning option". Removed Delta 1s Frequency Plot.
Feb 18, 2014	Added temp stability measurement condition on parts with Vc feature. Changed Vectron logo and Hudson contact information.
Sep 3, 2014	Modified Package Drawing Orientation, added tuning slope (positive), red bullet in Capability Chart