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## Description

Vectron's VT-860 Temperature Compensated Crystal Oscillator (TCXO) is a quartz stabilized, Clipped sine wave output, analog temperature compensated oscillator, operating off a 3.3, 2.8, 2.5 or 1.8 volt supply in a hermetically sealed 2.0 x 1.6 mm ceramic package.

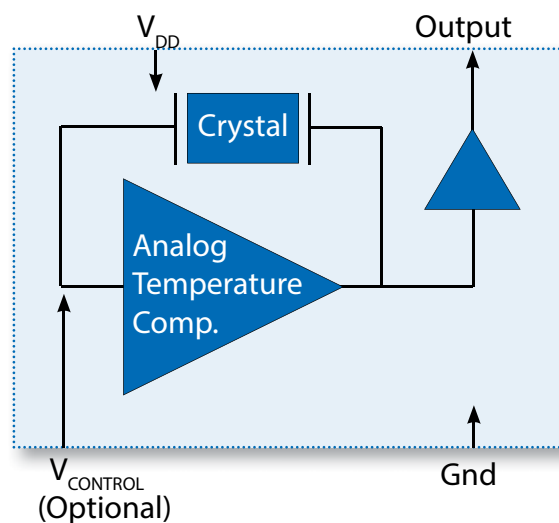
## Features

- 13.000 - 52.000MHz Output Frequency
- $\pm 0.5$ ppm Temperature Stability over  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- Optional Frequency Tuning
- Fundamental Crystal Design
- Gold over nickel contact pads
- Hermetically Sealed 2.0 x 1.6mm Ceramic SMD package
- Product is compliant to RoHS directive  and fully compatible with lead free assembly

## Applications

- GNSS Modules
- LoRa Base Station
- Wireless Connectivity
- Point to Point Radio
- Manpack Radio
- Test and Measurement

## Block Diagram



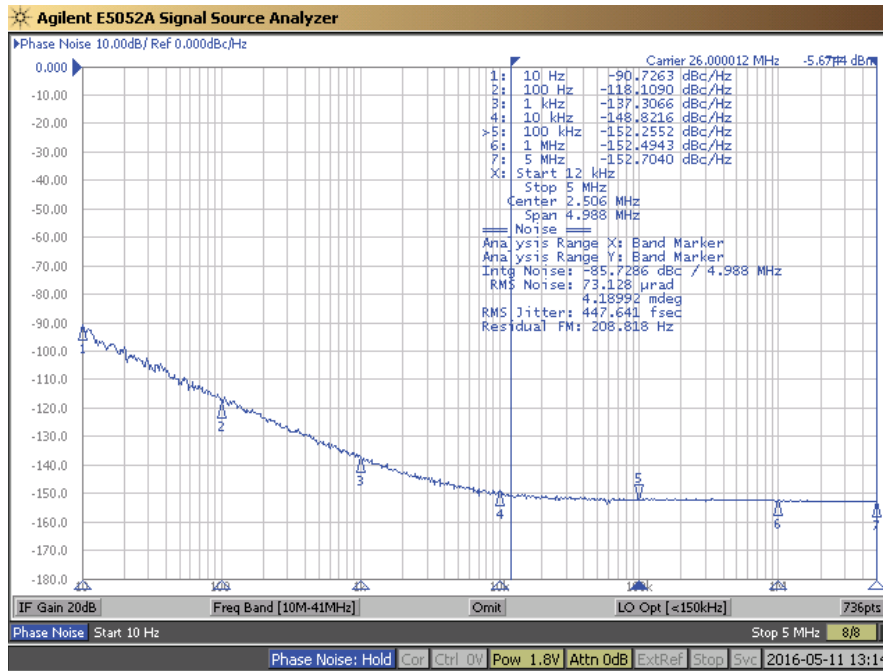
# Specifications

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

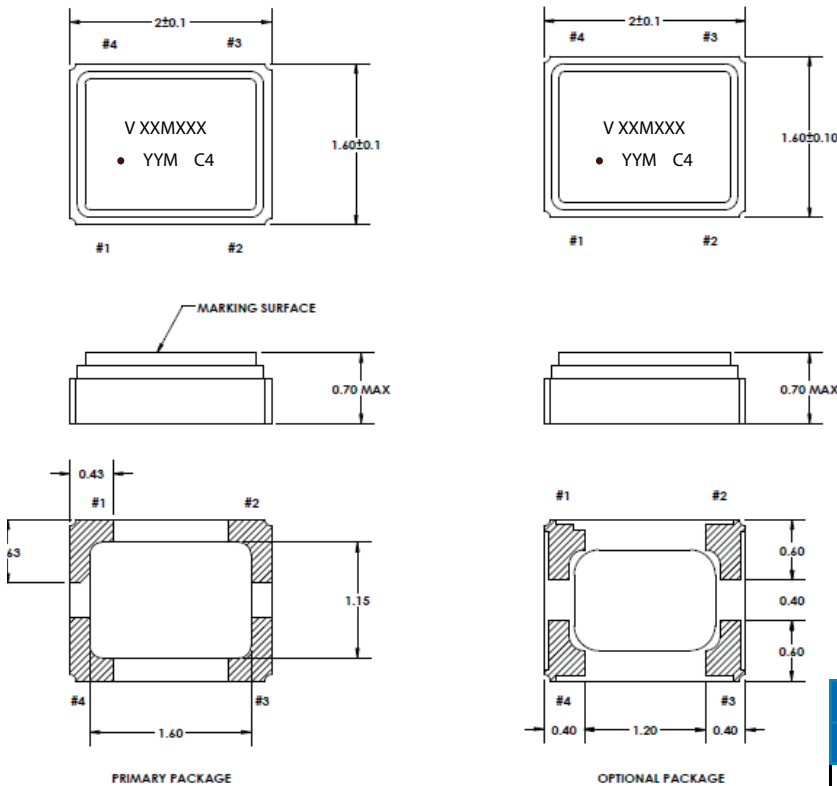
Parameter	Symbol	Min.	Typ	Max	Units
Output Frequency <sup>1</sup> , <i>Ordering Option</i>	$f_o$	13		52	MHz
Supply Voltage <sup>3</sup> , <i>Ordering Option</i>	$V_{DD}$	+1.8, +2.5, +2.8, +3.0, +3.3			V
Supply Current	$I_{DD}$			2.3	mA
Operating Temperature, <i>Ordering Option</i>	$T_{OP}$	-10/70, -20/70, -30/80, -30/85, -40/85			°C
<b>Frequency Stability</b>					
Stability Over $T_{OP}$ <sup>4</sup> , <i>Ordering Option</i>	$F_{STAB}$	±0.50, ±1.00, ±1.50, ±2.00			ppm
Frequency Tolerance <sup>5</sup>	$F_{TOL}$			±2.0	ppm
Power Supply Stability, ±5%	$F_{PWR}$			±0.1	ppm
Load Stability, ±10%	$F_{LOAD}$			±0.2	ppm
Static Hysteresis	HYS			±0.6	ppm
Aging / 1st year	$F_{AGE}$			±1.0	ppm
<b>Frequency Tuning (EFC), <i>Ordering Option</i></b>					
Tuning Range <sup>6</sup>	PR	±5.0, ±8.0, ±10.0, ±12.0, ±15.0, ±20.0			ppm
Tuning Slope		Positive			
Control Voltage to reach Pull Range 1.8V Supply Voltage Option 2.5V, 2.8V, 3.0V and 3.3V Supply Voltage Option	$V_c$	0.3 0.5	0.9 1.5	1.5 2.5	V V
Linearity	Lin			10	%
Control Voltage Impedance		500			Kohm
<b>RF Output (Clipped Sine Wave), <i>Ordering Option</i></b>					
Output Level High	$V_o$ p-p	0.8			V
Output Load	$C_L$		10k    10pF		
Start Up Time	$t_{SU}$			2	ms
<b>Phase Noise<sup>7</sup></b>					
Phase Noise, 26.00MHz <sup>7</sup> 10Hz 100Hz 1kHz 10kHz 100kHz	$\theta_N$		-90 -112 -132 -145 -147		dBc/Hz
Integrated Phase Jitter, 26.00MHz (12k-5MHz) <sup>7</sup>	$\theta_j$		0.4	1.0	ps

1. Refer to Table 7 for Standard Frequencies. Other Frequencies are available on request. Check with factory.
2. Output DC-cut capacitor is optional.
3. The VT-860 power supply pin (Pin4) should be filtered using a by-pass capacitor of 0.1uF for optimal performance.
4. Referenced to the midpoint between minimum and maximum frequency value over Operating Temperature Range.
5. Frequency measured at 25 °C, 1 hour after 2 IR reflows.
6. Referenced to Mid Control Voltage
7. Measured at ambient temperature using Agilent E5052B Signal Source Analyzer.

# Typical Phase Noise Performance (26MHz)



## Package Outline Drawing & Pad Layout



Dimensions in mm

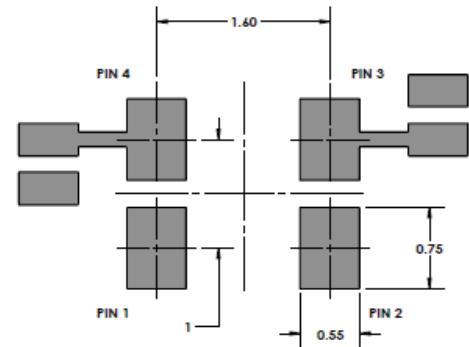


Table 2. Pinout

Pin #	Symbol	Function
1	V <sub>c</sub> or NC	TCXO Control Voltage or No Connect
2	GND	Ground
3	OUT	RF Output
4	V <sub>DD</sub>	Supply Voltage

### Marking Information

- V - Vectron
- XXMXX - Frequency (Example: 26M000)
- YY - Year of Manufacture
- M - Month of the Year (A-Jan, B-Feb.....K-Nov, L-Dec)
- C4 - Manufacturing Location
- - Pin 1 Indicator

### Note:

0.1uF capacitor is a by-pass power supply filter capacitor placed between Pin4 (V<sub>dd</sub>) and Ground for optimal performance. Optional 1000pF DC cut capacitor can be used in the output.

# 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-860, 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 therefor can be used for comparison purposes.

**Table 3. Maximum Ratings**

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

**Table 4. Environmental Compliance**

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

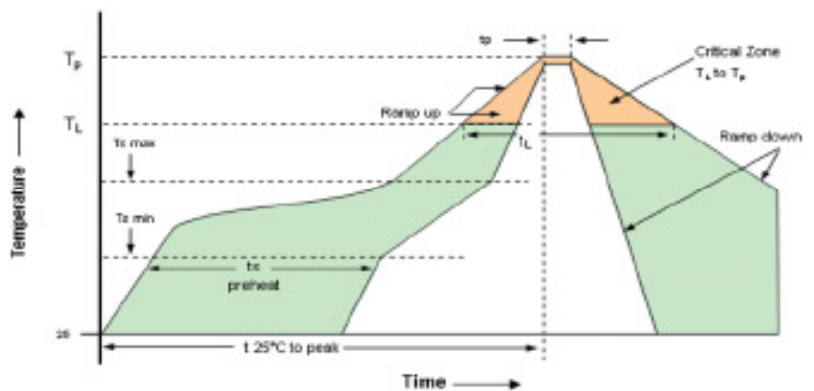
## Suggested IR Profile

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.

**Table 5. Reflow Profile**

Parameter	Symbol	Value
PreHeat Time	$t_s$	200 sec Max
Ts-min		150°C
Ts-max		200°C
Ramp Up	$R_{UP}$	3°C/sec Max
Time above 217C	$t_L$	150 sec Max
Time to Peak Temperature	$t_{25C\ to\ peak}$	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

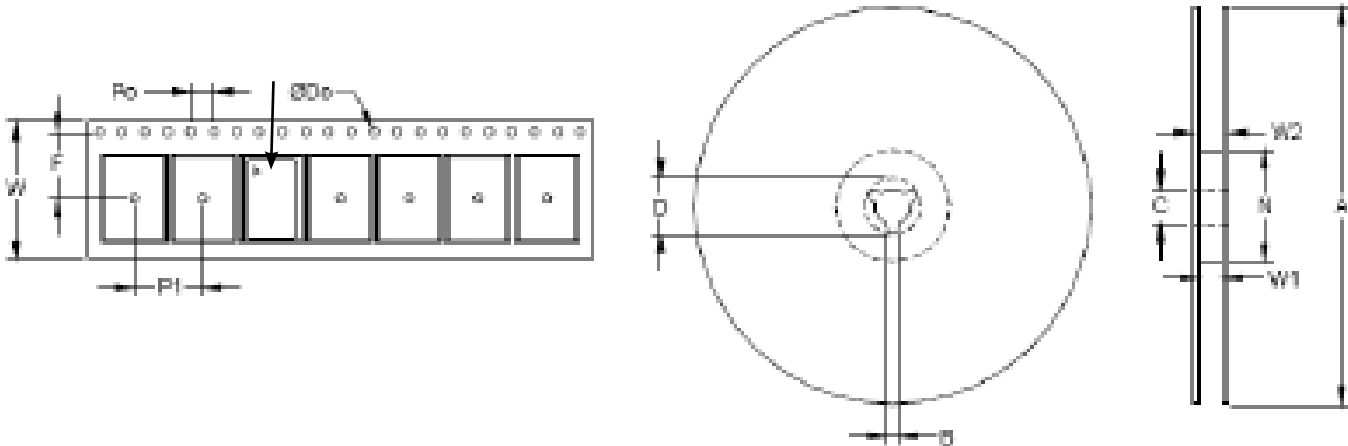
**Solderprofile:**



# Tape & Reel

**Table 6. Tape and Reel Information**

Tape Dimensions (mm)					Reel Dimensions (mm)							
W	F	Do	Po	P1	A	B	C	D	N	W1	W2	#/Reel
8	3.5	1.5	4	4	180	2.0	13	20.2	60	9.0	11.4	1000



## Ordering Information

**VT-860- E F W - 507A- xxMxxxxxxx**

**Product**

TCXO

**Package**

2.0 x 1.6 Package

**Voltage Options**

- E: +3.3 Vdc ± 5%
- F: +3.0Vdc ± 5%
- G: +2.8Vdc ± 5%
- H: +2.5Vdc ± 5%
- J: +1.8Vdc ± 5%

**Output**

F: Clipped Sine Wave

**Temp Range**

- W: -10/70°C
- J: -20/70°C
- G: -30/80°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
- E: ±15ppm
- F: ±20ppm

**Stability**

- 507: ±0.5ppm
- 106: ±1.0ppm
- 156: ±1.5ppm
- 206: ±2.0ppm

\*Note: not all combination of options are available.  
Other specifications may be available upon request.

**Example: VT-860-EFW-507A-26M000000**

\* Add **\_SNPBDIP** for tin lead solder dip

Example: VT-860-EFW-507A- 26M000000\_SNPBDIP

# Standard Frequencies & Capability Chart

**Table 7. Standard Frequencies (MHz)**

12.000	12.288	16.000	16.368	16.369	19.200	20.000	24.000	26.000	32.000
32.736	38.400	40.000	48.000						

Note: Other Frequencies may be available on request.

## Revision History

Revision Date	Approved	Description
May 10, 2016	VN	Rev 0.1 - VT-860 Preliminary Datasheet - Internal Verification, Factory Approval, Product Launch
May 19, 2016	VN	Rev 0.2 - Updated Features and Application section
June 27, 2016	VN	Rev 0.3: Corrected marking information and updated standard frequency table (Table 7)
August 10, 2018	FB	Rev 0.4: Update logo and contact information, update PCB layout, add "SNPBDIP" ordering option



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