

Helping Customers Innovate, Improve & Grow




VT-706

## Description

Vectron's VT-706 Temperature Compensated Crystal Oscillator (TCXO) is a quartz stabilized, Clipped sine wave or CMOS output, analog temperature compensated oscillator, operating off a 5.0 or 3.3 volt supply in a hermetically sealed 7.0 x 5.0 mm ceramic package.

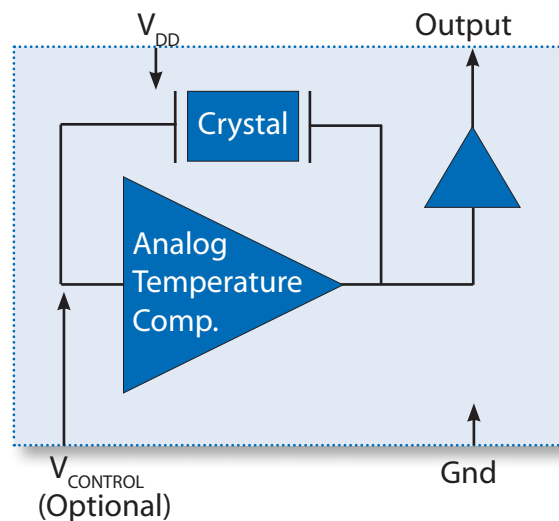
## Features

- 5.000 - 52.000MHz Output Frequency
- $\pm 0.2$ ppm Temperature Stability
- Optional Frequency Tuning
- Fundamental Crystal Design
- Stratum 3 version available as a custom part number
- 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
- Global Positioning Systems
- Point to Point Radio
- Manpack Radio
- Test and Measurement

## Block Diagram



# Specifications

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

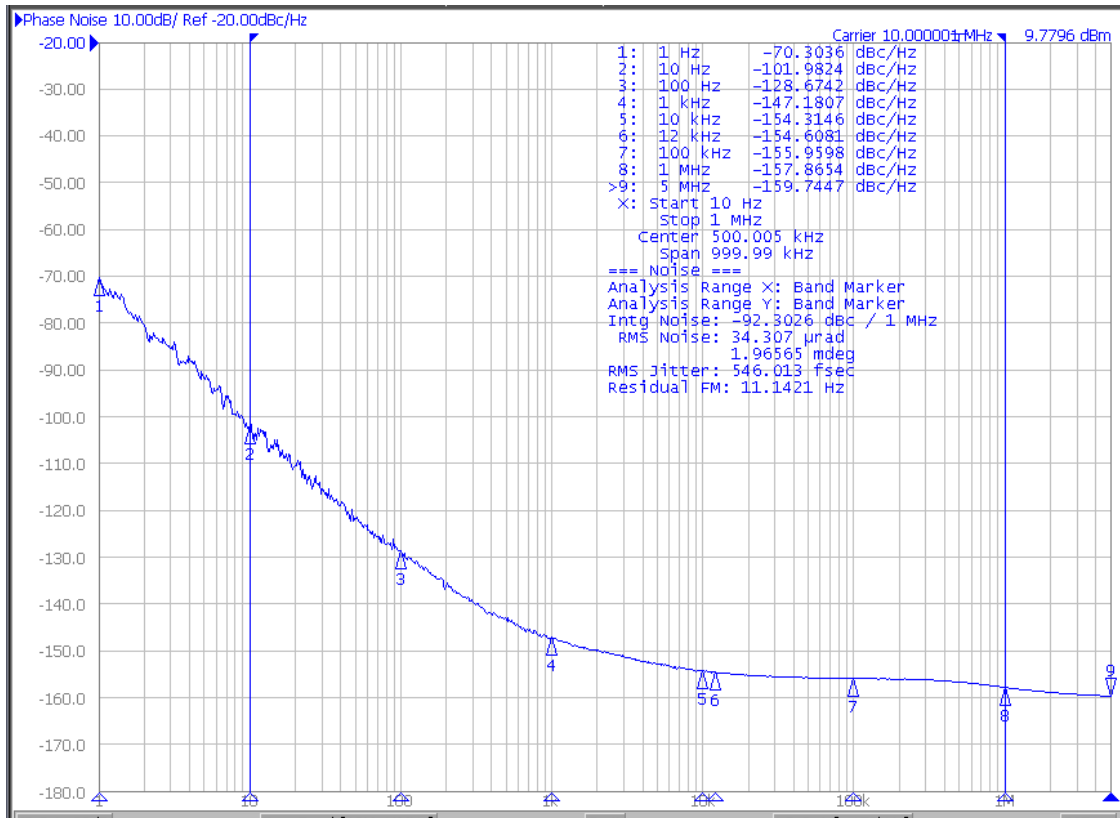
Parameter	Symbol	Min.	Typ	Max	Units
Output Frequency <sup>1</sup> , <i>Ordering Option</i>	$f_o$	5		52	MHz
Supply Voltage <sup>3</sup> , <i>Ordering Option</i>	$V_{DD}$	+2.8, +3.0, +3.3, +5.0			V
Supply Current	$I_{DD}$			3.5	mA
Operating Temperature, <i>Ordering Option</i>	$T_{OP}$	0/55, -10/70, -20/70, -30/80, -30/85, -40/85			°C
<b>Frequency Stability</b>					
Stability Over $T_{OP}$ <sup>4</sup> , <i>Ordering Option</i>	$F_{STAB}$	±0.05, ±0.10, ±0.20, ±0.28, ±0.50			ppm
Frequency Tolerance <sup>5</sup>	$F_{TOL}$			±2.0	ppm
Power Supply Stability, ±5%	$F_{PWR}$			±0.1	ppm
Load Stability, ±10%	$F_{LOAD}$			±0.05	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			ppm
Tuning Slope		Positive			
Control Voltage to reach Pull Range	$V_C$	0.5	1.5	2.5	V
Control Voltage Impedance		100			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, 10.00MHz <sup>7</sup>	$\emptyset_N$				dBc/Hz
10Hz			-99		
100Hz			-126		
1kHz			-145		
10kHz			-152		
100kHz			-155		

1. Refer to Table 8 for Standard Frequencies. Other Frequencies are available on request. Check with factory.
2. Output DC-cut capacitor is optional.
3. The VT-706 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.

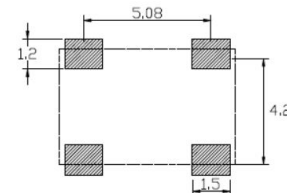
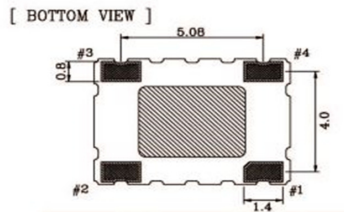
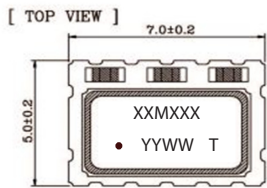
Table 2. Electrical Performance, CMOS Option					
Parameter	Symbol	Min.	Typ	Max	Units
Output Frequency <sup>1</sup> , <i>Ordering Option</i>	$f_o$	5		52	MHz
Supply Voltage <sup>3</sup> , <i>Ordering Option</i>	$V_{DD}$	+2.8, +3.0, +3.3, +5.0			V
Supply Current	$I_{DD}$			6.0	mA
Operating Temperature, <i>Ordering Option</i>	$T_{OP}$	0/55, -10/70, -20/70, -30/80, -30/85, -40/85			°C
Frequency Stability					
Stability Over $T_{OP}$ <sup>4</sup> , <i>Ordering Option</i>	$F_{STAB}$	±0.05, ±0.10, ±0.20, ±0.28, ±0.50			ppm
Frequency Tolerance <sup>5</sup>	$F_{TOL}$			±2.0	ppm
Power Supply Stability, ±5%	$F_{PWR}$			±0.1	ppm
Load Stability, ±10%	$F_{LOAD}$			±0.05	ppm
Aging / 1st year	$F_{AGE}$			±1.0	ppm
Frequency Tuning (EFC), <i>Ordering Option</i>					
Tuning Range <sup>6</sup>	PR	±5.0, ±8.0, ±10.0, ±12.0			ppm
Tuning Slope		Positive			
Control Voltage to reach Pull Range	$V_C$	0.5	1.5	2.5	V
Control Voltage Impedance		100			Kohm
RF Output (CMOS), <i>Ordering Option</i>					
Output Level High Output Level Low	$V_{OH}$ $V_{OL}$	$0.9 * V_{DD}$		$0.1 * V_{DD}$	V
Output Load	$C_L$			15	pF
Duty Cycle		45		55	%
Start Up Time	$t_{SU}$			2	ms
Rise & Fall Times				4	ns
Phase Noise <sup>7</sup>					
Phase Noise, 10.00MHz <sup>7</sup> 10Hz 100Hz 1kHz 10kHz 100kHz	$\phi_N$		-102 -128 -147 -154 -156		dBc/Hz

1. Refer to Table 8 for Standard Frequencies. Other Frequencies are available on request. Check with factory.
2. Output DC-cut capacitor is optional.
3. The VT-706 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.
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6. Referenced to Mid Control Voltage.
7. Measured at ambient temperature using Agilent E5052B Signal Source Analyzer

# Phase Noise Performance for 10MHz CMOS



## Package Outline Drawing & Pad Layout



Dimensions in mm

### Marking Information

XXMXXX - Frequency (Example: 10M000)

YY - Year of Manufacture

WW - Week of the Year

T - Manufacturing Location

• - Pin 1 Indicator

Table 3. 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

Note:

0.1 $\mu$ F capacitor is a by-pass power supply filter capacitor placed between Pin4 (V<sub>DD</sub>) and Ground for optimal performance.

# 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-706, 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 4. 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 5. 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

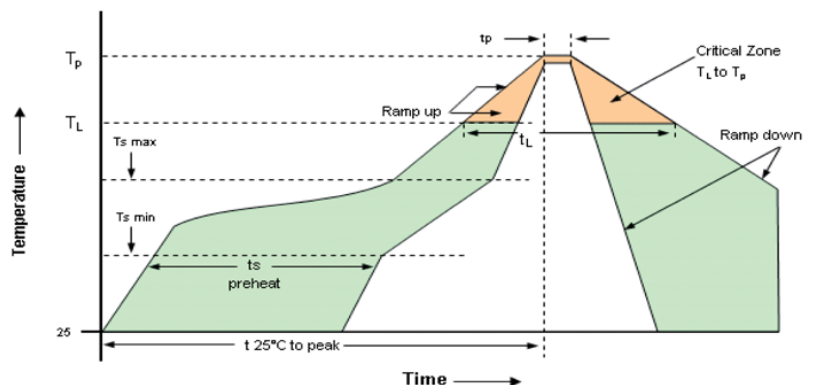
## Suggested IR Profile

Devices are built using lead free epoxy and can be subjected to standard lead free IR reflow conditions shown in Table 6. Contact pads are gold over nickel and lower maximum temperatures can also be used, such as 220°C.

**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	$t_{25C\ to\ peak}$	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:



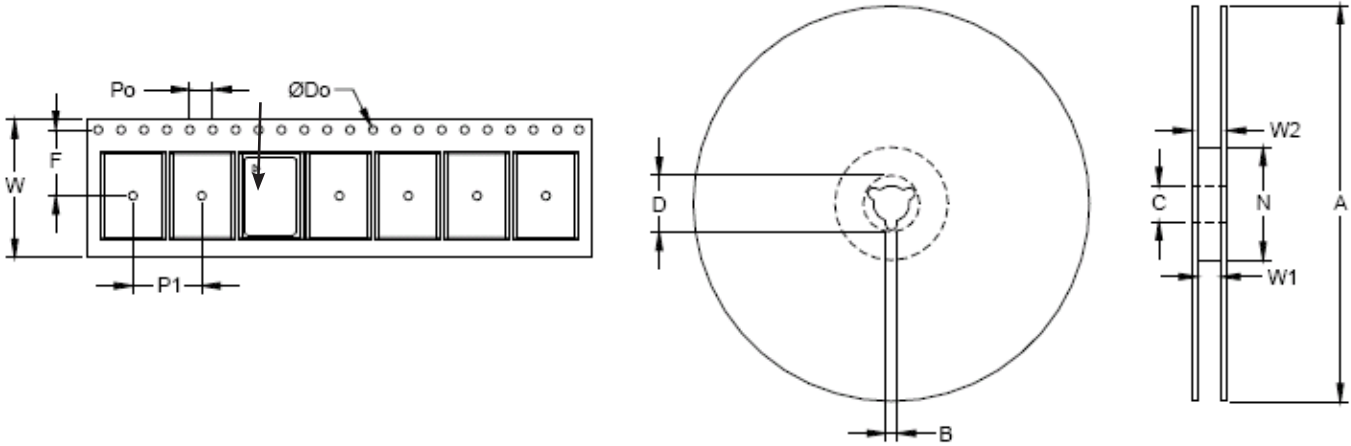
# VCXO Function

**VCXO Feature:** The VT-706 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, 100kOhm, and can be driven with an op-amp or terminated with adjustable resistors etc. **Pin1 should not be left floating on the VCXO optional device.**

# 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
16	7.5	1.5	4	8	180	1.5	13	20.2	60	16.4	20.4	1000



# Ordering Information

## VT-706- E F W - 207A- xxMxxxxxxx

**Product**

TCXO

**Package**

7.0 x 5.0 Package

**Voltage Options**

D: +5.0 Vdc ± 5%

E: +3.3 Vdc ± 5%

F: +3.0Vdc ± 5%

G: +2.8Vdc ± 5%

**Output**

A: CMOS

F: Clipped Sine Wave

**Temp Range**

R: 0/55°C

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

**Stability**

508: ±0.05ppm

107: ±0.10ppm

207: ±0.20ppm

287: ±0.28ppm

507: ±0.50ppm

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

**Example: VT-706-EFW-207A-19M2000000**

# Standard Frequencies & Capability Chart

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

10.000	12.800	16.384	19.200	19.440	20.000	25.000	26.000	40.000	50.000

Note: Other Frequencies are available on request.

**Table 9. Capability Chart [Clipped Sine & CMOS Output]**

	±0.05ppm	±0.10ppm	±0.20ppm	±0.28ppm	±0.50ppm
0/55°C	●	●	●	●	●
-10/70°C	●	●	●	●	●
-20/70°C	●	●	●	●	●
-30/85°C	●	●	●	●	●
-40/85°C	●	●	●	●	●

- = Can be provided.
- = Under development. Please consult with factory.
- = Cannot be provided.

## Revision History

Revision Date	Approved	Description
Sept 10, 2015	VN	Rev 0.0: VT-706 Preliminary Datasheet - Internal Verification (Factory Approval)
Sept 17, 2015	VN	Rev 0.1: VT-706 Preliminary Datasheet for Product Launch.
Sept 19, 2016	VN	Rev 0.2: Removed "Preliminary" from datasheet

## For Additional Information, Please Contact

### USA:

Vectron International  
267 Lowell Road, Suite 102  
Hudson, NH 03051  
Tel: 1.888.328.7661  
Fax: 1.888.329.8328

### Europe:

Vectron International  
Landstrasse, D-74924  
Neckarbischofsheim, Germany  
Tel: +49 (0) 3328.4784.17  
Fax: +49 (0) 3328.4784.30

### Asia:

Vectron International  
68, Yin Cheng Road (C), 22<sup>nd</sup> Floor  
One LuJiaZui  
Pudong, Shanghai 200120, China  
Tel: 86.21.6194.6886  
Fax: 86.21.6194.6699

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Rev 0.2: 09/19/2016 VN