VTC1 series

Voltage Controlled Temperature Compensated Crystal Oscillator

The VTC1, VCTCXO

Features

- Clipped Sine Wave Output
- Output Frequencies to 40 MHz
- Fundamental Crystal Design
- Optional VCXO function available
- Gold over nickel contact pads
- Hermetically Sealed Ceramic SMD package
- Product is compliant to RoHS directive and fully compatible with lead free assembly

Applications

- Wireless Communications
- Base Stations
- Point to point radios
- Broadband Access
- Test Equipment
- Handsets

Description

Vectron's VTC1 Temperature Compensated Crystal Oscillator (TCXO) is a quartz stabilized, clipped sinewave output, temperature compensated oscillator, operating off either a 2.8, 3.0, 3.3 or 5.0 volt supply.

Performance Characteristics

Table 1. Electrical Performance for the Clipped Sine Wave Output Option

Parameter	Symbol	Min	Typical	Maximum	Units
Frequency	f_O	10.000		40.000	MHz
Typical Supply Voltage[1] *Ordering option, see last page*		2.8, 3.0, 3.3 or 5.0			V
Supply Current 10.00 MHz to < 15.00 MHz 15.00 MHz to < 26.00 MHz 26.00 MHz to 40.00 MHz	I_{DD}			 1.5 2.0 2.5	mA
Output Level [2]	Vp/p	0.8			V
Output Load			10K II 10pf		
Control Voltage Impedance	Z_{Vc}	1			Mohm
Control Voltage to reach pull *All options (5.0, 3.3,3.0 and 2.8V)*		0.5		2.5	V
Pull Range *Ordering option, see last page*	TPR	±5, ±8, ±10, ±15			ppm
Temperature Stability *Ordering option, see last page.*		±0.5 to ±5.0			ppm
Initial Accuracy, "No Adjust" option[3]				±1.0	ppm
Power Supply Stability				±0.2	ppm
Load Stability				±0.2	ppm
Aging				±1.0	ppm/year
Operating temperature *Ordering option, see last page*		0/55, -10/60, -20/70, -30/80, -40/85			°C
Phase Noise, 12.800 MHz 10 Hz offset 100 Hz offset 1 kHz offset 10 kHz offset 100 kHz offset			 -85 -115 -130 -143 -152		dBc/Hz
Start-up time				2	ms

1. A 0.01uF and a 0.1uF capacitor should be located as close to the supply as possible (to ground) is recommended.
2. Output is AC coupled.
3. Initial Accuracy is +/-2.0ppm after 2 IR reflows.

Table 2. Electrical Performance for the CMOS Output Option					
Parameter	**Symbol**	**Min**	**Typical**	**Maximum**	**Units**
Frequency	f_O	10.000		40.000	MHz
Supply Voltage			3.3V±5%		V_{DC}
Maximum Supply Voltage				7	V_{DC}
Supply Current	I_{DD}			10.0	mA
Output Level [2] Logic High Logic Low Drive High Drive Low	 V_{OH} V_{OL} I_{OH} I_{OL}	 0.9*V_{DD} 4		 0.1*V_{DD} -4 	 V V mA mA
Rise and Fall Time[3]	t_R/t_F			3	ns
Output Load			15pf		
Duty Cycle, @ 50%				45/55	%
Control Voltage Impedance	Z_{Vc}	100			Kohm
Control Voltage to reach pull		0.5		2.5	V
Pull Range *Ordering option, see last page*	TPR		±5, ±8, ±10		ppm
Temperature Stability *Ordering option, see last page.*			±0.5 to ±5.0		ppm
Initial Accuracy, "No Adjust" option[4]				±1.0	ppm
Power Supply Stability				±0.3	ppm
Load Stability				±0.2	ppm
Aging				±1.0	ppm/year
Operating temperature *Ordering option, see last page*			0/55, -10/60, -20/70, -30/80, -40/85		°C
Phase Noise, 12.800MHz 10 Hz offset 100 Hz offset 1 kHz offset 10 kHz offset 100 kHz offset			 -93 -123 -147 -155 -158		dBc/Hz
Start-up time				2	ms

1. A 0.01uF and a 0.1uF capacitor should be located as close to the supply as possible (to ground) is recommended.
2. Output is DC coupled.
3. Rise and Fall time is measured at 20/80% levels
4. Initial Accuracy is +/-2.0ppm after 2 IR reflows.

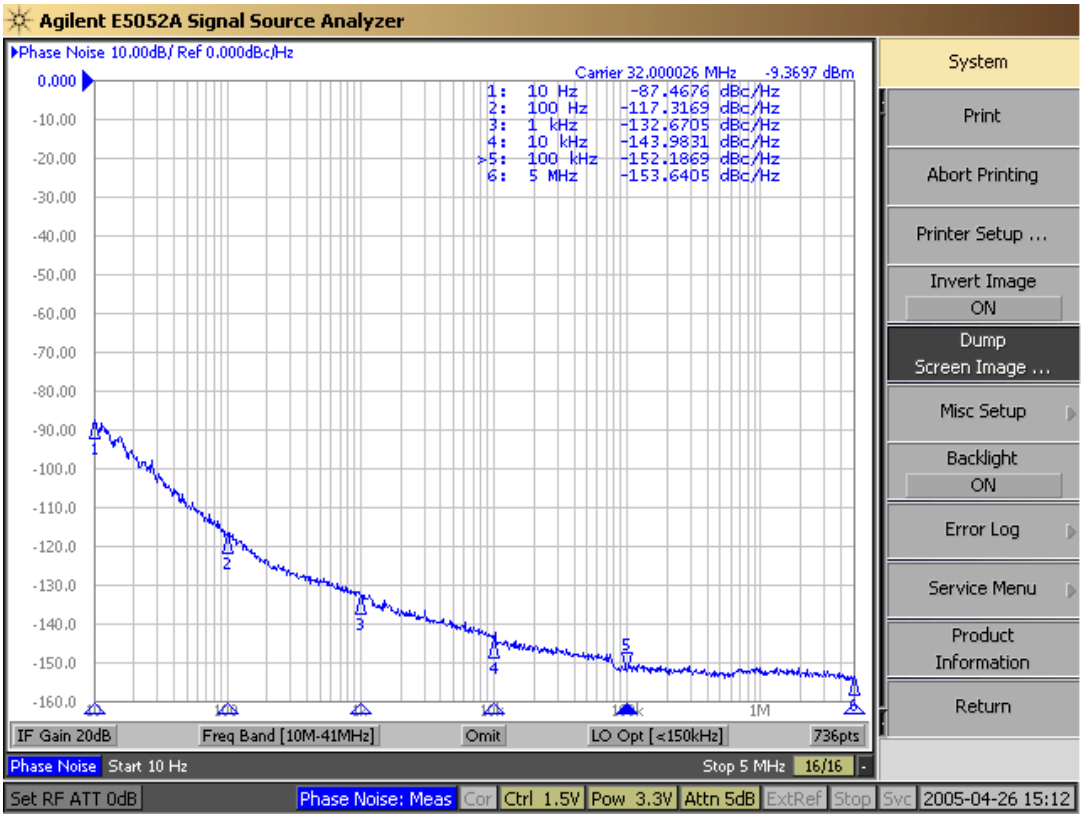


Figure 1 - Typical Phase Noise Plot, Clipped Sine Wave

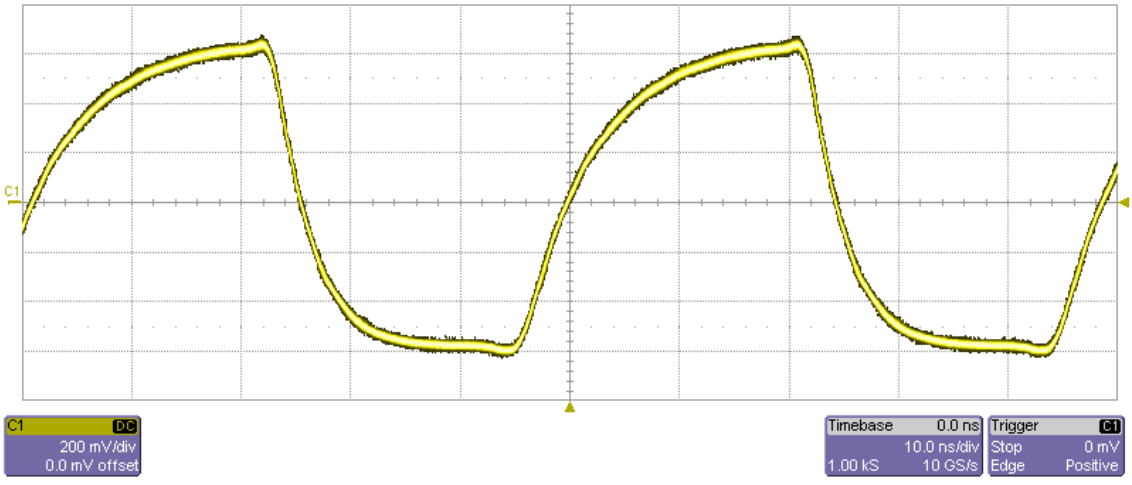


Figure 2 - Clipped Sine Wave Output

VCXO Functional Description

VCXO Feature: The VTC1 can be ordered with a VCXO function for applications where it will be used in a PLL, or the output frequency needs fine tune adjustments. This is high impedance, 1 Mohm, input 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 devices.

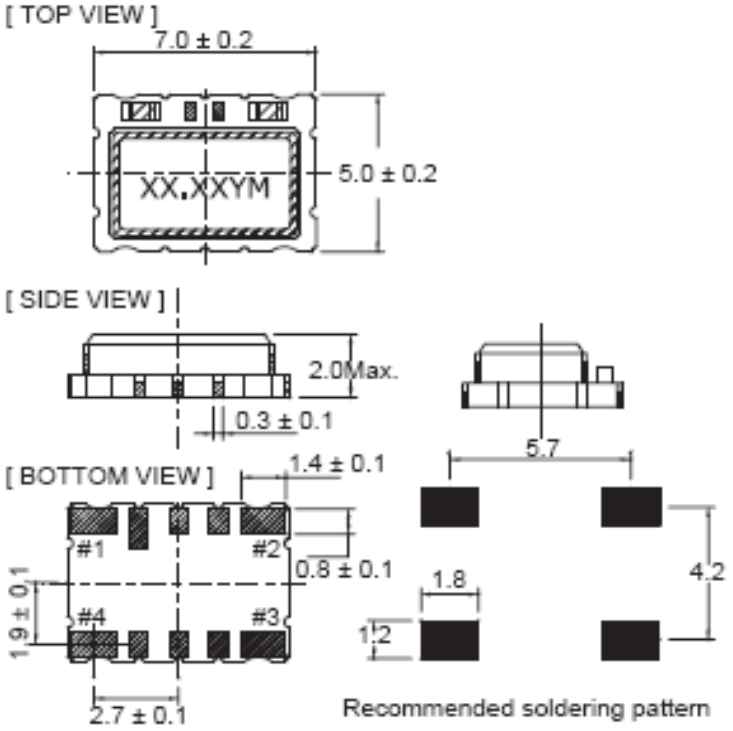
"No Adjust" Feature: In applications where the VTC1 will not be used in a PLL, or the output frequency does not fine tune adjustments, the best device to use would be a VTC1-x0xxx. By using the "no adjust" option, the circuit is simplified as Vc does not need to adjusted or set to a predetermined voltage and **pin 1 should be grounded or left open** (but not set to a voltage such as the supply).

Outline Diagrams, Pad Layout and Pin Out

Table 3. Pinout

Pin #	Symbol	Function
1	N/C *or* V_C	No Connect (VTC1-x0xx) or VCXO Control Voltage
2	GND	Electrical and Case Ground
3	f_O	Output Frequency
4	V_{DD}	Supply Voltage

NOTE: Additional pads are used to program and adjust the TCXO during manufacturing and should be left open; do not terminate these to the supply voltage. Some designs do not include these additional pads. It's recommended to not have traces routed underneath the devices.



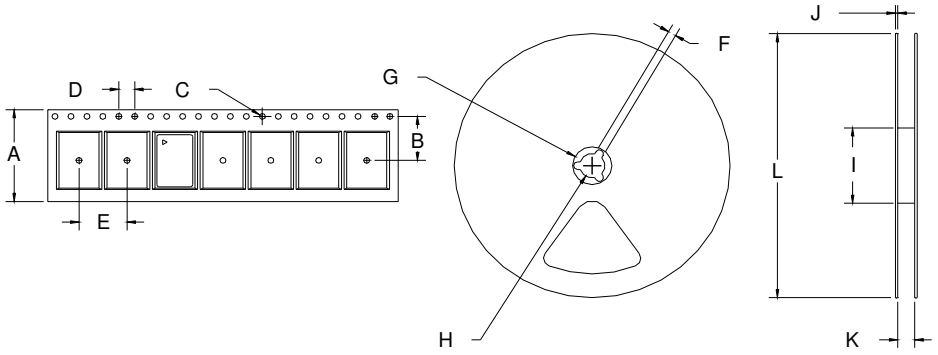
Contact Pads are gold over nickel

Figure 3 - Package drawing

Tape and Reel

Table 4. Tape and Reel Dimensions (mm)

Tape Dimensions						Reel Dimensions							# Per
Product	A	B	C	D	E	F	G	H	I	J	K	L	Reel
VTC1	16	7.5	1.5	4	8	1.5	20.2	13	60	2	16.4	180	1000



Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can permanently damage the device. Functional operation is not implied at these or any other conditions in 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.

Table 5. Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Storage Temperature	Tstorage	-55/125	°C

Reliability

The VTC1 qualification tests have included:

Table 6. Environnemental Compliance

Parameter	Conditions
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
Gross and Fine Leak	MIL-STD-883 Method 1014
Resistance to Solvents	MIL-STD-883 Method 2015
Moisture Sensitivity Level	1
Contact Pads	Gold over Nickel

Handling Precautions

Although ESD protection circuitry has been designed into the VTC1, proper precautions should be taken when handling and mounting. VI employs a Human Body Model and a Charged-Device Model (CDM) for ESD susceptibility testing and design protection evaluation. ESD thresholds are dependent on the circuit parameters used to define the model. Although no industry wide standard has been adopted for the CDM, a standard HBM of resistance = 1.5Kohms and capacitance = 100pF is widely used and therefore can be used for comparison purposes.

Table 7. ESD Ratings

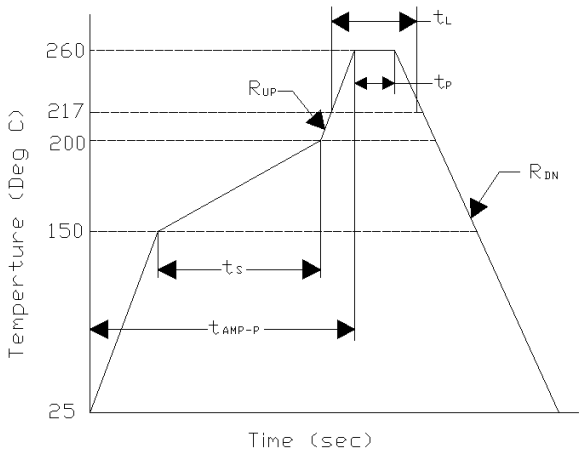
Model	Minimum	Conditions
Human Body Model	1500	MIL-STD-883 Method 3115
Charged Device Model	1000	JESD 22-C101

Suggested IR profile

Devices are built using lead free epoxy and can also be subjected to standard lead free IR reflow conditions, Table 7 shows max temperatures and lower temperatures can also be used e.g. peak temperature of 220C.

Table 8. Reflow Profile (IPC/JEDEC J-STD-020)

Parameter	Symbol	Value
PreHeat Time	t_S	60 sec Min, 180 sec Max
Ramp Up	R_{UP}	3 °C/sec Max
Time Above 217 °C	t_L	60 sec Min, 150 sec Max
Time To Peak Temperature	t_{AMB-P}	480 sec Max
Time At 260 °C (max)	t_P	30 sec Max
Time At 240 °C (max)	t_{p2}	60 sec Max
Ramp Down	R_{DN}	6 °C/sec Max



Ordering Information

Table 9. Standard Frequency List

10.000	10.0001355	10.001355	10.240	10.245	12.250	11.0592	11.2896
12.000	12.288	12.352	12.500	12.504	12.580	12.582912	12.600
12.688375	12.800	13.000	13.560	14.000	14.318	14.400	14.500
14.5888	14.617188	14.7456	14.850	15.000	15.359865	15.360	16.000
16.034950	16.320	16.3676	16.367667	16.36770	16.384	16.368	16.580
16.777216	16.800	17.500	18.000	18.414	18.432	18.601	19.000
19.200	19.440	19.680	19.800	20.000	20.250	20.480	20.91646
21.250	22.000	22.368	23.090	24.000	24.5535	24.576	24.8064
25.000	25.48828	26.000	32.000	33.000	38.400	40.000	

VTC1 - B 0 2 C - 10M00

Product Family

TCXO, 5x7

Voltage Options

A: +5.0 Vdc ±5%, Clipped Sine Output

B: +3.3 Vdc ±5%, Clipped Sine Output

C: +3.0 Vdc ±5%, Clipped Sine Output

D: +2.8 Vdc ±5%, Clipped Sine Output

J: +3.3 Vdc ±5%, CMOS Output

Pulling Range

0: Fixed TCXO, no adjust

1: ±5ppm

2: ±8ppm

3: ±10ppm

4: ±15ppm

Note: Not all combinations are available

Output Frequency

In MHz

Temperature Options

A: 0 to 55°C

B: -10 to 60°C

C: -20 to 70°C

D: -30 to 80°C

E: -40 to 85°C

Stability Options

A: ±0.5ppm

1: ±1.0ppm

B: ±1.5ppm

2: ±2.0ppm

C: ±2.5ppm

3: ±3.0 ppm

D: ±3.5ppm

4: ±4.0ppm

5: ±5.0ppm

Vectron a Krowles company

USA: Vectron International • 267 Lowell Road, Suite 102, Hudson, NH 03051
• Tel: 1-88-VECTRON-1 • Fax: 1-888-FAX-VECTRON

EUROPE: Vectron International •Landstrasse, D-74924, Neckarbischofsheim, Germany •
• Tel: 49 (0) 7268 8010 • Fax: 49 (0) 7268 801281

ASIA: Vectron International • 68 Yin Cheng Road (C), 22nd Floor, One LuJiaZui, Pudong Shanghai 200120, China • Tel: 86 21 6194 6886 • Fax: 86 21 6194 6699

www.vectron.com

Rev: 02/11/2014

Revision	Date	Description
1.6	04/22/08	Changed CMOS ordering information, ok for all frequencies. Add initial accuracy spec after 2 IR reflows
1.7	07/06/09	Add rise and fall time spec, 3ns
1.8	09/13/10	Update VTC1 Picture
1.9	10/0710	Remove 0.5ppm only over 0/55C note, change IR from 10 to 30 seconds
2.0	02/11/14	Added new Vectron Logo and Updated Hudson and China address.

Mouser Electronics

Authorized Distributor

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Vectron:

VTC1-B31C-10M000 VTC1-J1AB-10M000000 VTC1-B01E-10M000000 VTC1-C21C-10M0000000