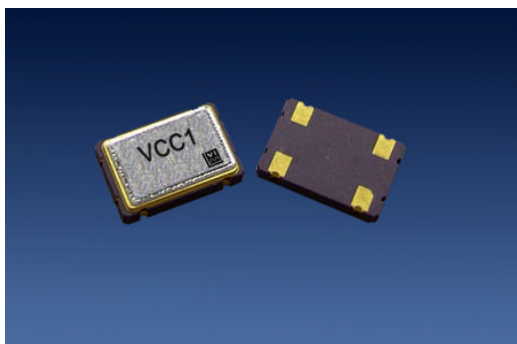



## VCC1 series

### 1.8, 2.5, 3.3, 5.0 volt CMOS Oscillator



The VCC1 Crystal Oscillator

#### Features

- CMOS output
- Output frequencies to 190 MHz
- Low jitter, Fundamental or 3<sup>rd</sup> OT Crystal
- Tristate output for board test and debug
- -10/70 or -40/85 °C operating temperature
- Gold over nickel contact pads
- Hermetically sealed ceramic SMD package
- Product is compliant to RoHS directive  and fully compatible with lead free assembly

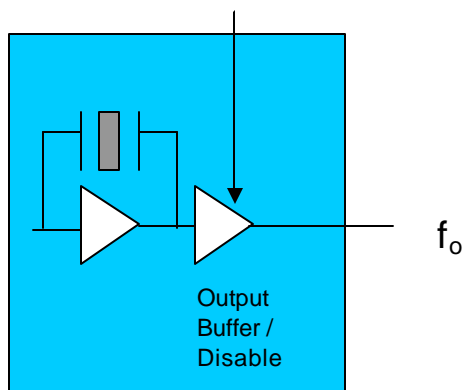
#### Applications

- SONET/SDH/DWDM
- Ethernet, Gigabit Ethernet
- Storage Area Network
- Digital Video
- Broadband Access
- Microprocessors/DSP/FPGA

#### Description

Vectron's VCC1 Crystal Oscillator (XO) is quartz stabilized square wave generator with a CMOS output, operating off either a 1.8, 2.5, 3.3 or a 5.0 volt supply.

The VCC1 is uses fundamental or 3<sup>rd</sup> overtone crystals resulting in low jitter performance, typically 0.5pS rms in the 12 kHz to 20MHz band. Also a monolithic IC, which improves reliability and reduces cost, is hermitically sealed.



## Performance Characteristics

**Table 1. Electrical Performance, 5V option**

Parameter	Symbol	Min	Typical	Maximum	Units
Frequency	$f_o$	0.012		125.000	MHz
Operating Supply Voltage <sup>1</sup>	$V_{DD}$	4.5		5.5	V
Absolute Maximum Supply Voltage		-0.7		7.0	V
Supply Current, Output Enabled	$I_{DD}$				mA
<1.5 MHz				7	
1.5 to 20 MHz				10	
20.01 to 50 MHz				30	
50.00 to 85 MHz				50	
85.01 to 125 MHz				60	
Supply Current, Out disabled	$I_{DD}$			30	uA
Output Logic Levels					
Output Logic High <sup>2</sup>	$V_{OH}$	$0.9 \cdot V_{DD}$		$0.1 \cdot V_{DD}$	V
Output Logic Low <sup>2</sup>	$V_{OL}$				V
Output Logic High Drive	$I_{OH}$	16			mA
Output Logic Low Drive	$I_{OL}$	16			mA
Output Rise/Fall Time <sup>2</sup>	$t_R/t_F$				ns
< 1.00 MHz				200	
1.0 to 20.00 MHz				8	
20.01 to 50.00 MHz				5	
50.01 to 125.00 MHz				2	
Duty Cycle <sup>3</sup> (ordering option)	SYM		45/55		%
Operating temperature (ordering option)			-10/70 or -40/85		°C
Stability <sup>4</sup> (ordering option)			$\pm 20, \pm 25, \pm 32, \pm 50, \pm 100$		ppm
RMS Jitter, 12kHz to 20 MHz			0.5	1	ps
Period Jitter, RMS			2.5		ps
Output Enable/Disable <sup>5</sup>					V
Output Enabled		4.0			
Output Disabled				0.8	
Internal Enable Pull-Up resistor <sup>5</sup>			100		Kohm
Start-up time				10	ms

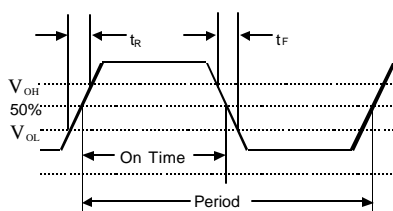
1. A 0.01uF and a 0.1uF capacitor should be located as close to the supply as possible (to ground) is recommended.

2. Figure 1 defines these parameters. Figure 2 illustrates the operating conditions under which these parameters are tested and specified.

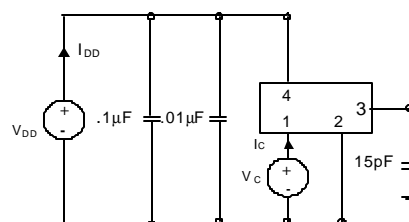
3. Symmetry is measured defined as  $V_s$ , On Time/Period.

4. Includes calibration tolerance, operating temperature, supply voltage variations, aging and shock and vibration (not under operation).

5. Output will be enabled if enable/disable is left open.



**Figure 1. Output Waveform**



**Figure 2. Typical Output Test Conditions (25±5°C)**

## VCC1 Data sheet

Table 2. Electrical Performance, 3.3V option					
Parameter	Symbol	Min	Typical	Maximum	Units
Frequency	f <sub>O</sub>	0.012		189.000	MHz
Operating Supply Voltage <sup>1</sup>	V <sub>DD</sub>	2.97	3.3	3.63	V
Absolute Maximum Operating Voltage		-0.5		5.0	V
Supply Current, Output Enabled	I <sub>DD</sub>				mA
< 1.500 MHz				5	
1.5 to 20 MHz				7	
20.01 to 50 MHz				20	
50.00 to 85 MHz				30	
85.01 to 189 MHz				50	
Supply Current, Output disabled	I <sub>DD</sub>			30	uA
Output Logic Levels	V <sub>OH</sub> V <sub>OL</sub> I <sub>OH</sub> I <sub>OL</sub>	0.9*V <sub>DD</sub>		0.1*V <sub>DD</sub>	V V mA mA
Output Logic High <sup>2</sup>					
Output Logic Low <sup>2</sup>					
Output Logic High Drive					
Output Logic Low Drive					
Output Rise/Fall Time <sup>2</sup>	t <sub>R</sub> /t <sub>F</sub>				ns
< 1.00 MHz				200	
1.00 to 20.00 MHz				6	
20.01 to 50.00 MHz				4	
50.01 to 90.00 MHz				3	
90.01 to 189.00 MHz				2	
Duty Cycle <sup>3</sup> (ordering option)	SYM	45/55			%
Operating temperature (ordering option)		-10/70 or -40/85			°C
Stability <sup>4</sup> (ordering option)		±20, ±25, ±32, ±50, ±100			ppm
RMS Jitter, 12kHz to 20 MHz			0.5	1	ps
RMS Jitter			2.5		ps
Output Enable/Disable <sup>5</sup>		2.0			V
Output Enabled					
Output Disabled				0.5	
Internal Enable Pull-Up resistor <sup>5</sup>			100		Kohm
Start-up time				10	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. Figure 3 defines these parameters. Figure 4 illustrates the operating conditions under which these parameters are tested and specified. For  $f_o > 90\text{MHz}$ , rise and fall time is measured 20 to 80%.

3. Symmetry is measured defined as  $V_s$ , On Time/Period.

4. Includes calibration tolerance, operating temperature, supply voltage variations, aging and shock and vibration (not under operation).

5. Output will be enabled if enable/disable is left open.

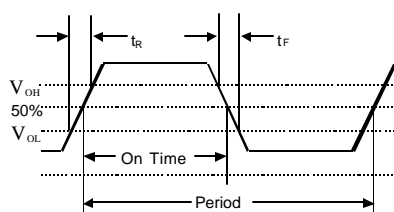


Figure 3. Output Waveform

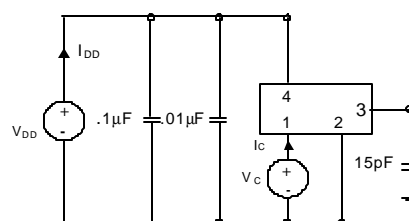


Figure 4. Typical Output Test Conditions (25±5°C)

## VCC1 Data sheet

Table 3. Electrical Performance, 2.5V option					
Parameter	Symbol	Min	Typical	Maximum	Units
Frequency	$f_o$	0.012		172.000	MHz
Operating Supply Voltage <sup>1</sup>	$V_{DD}$	2.25	2.5	2.75	V
Absolute Maximum Voltage		-0.5		5.0	V
Supply Current, Output Enabled < 20 MHz 20.01 to 50 MHz 50.00 to 110 MHz 110.1 to 172 MHz	$I_{DD}$			7.0 15.0 20.0 30.0	mA
Supply Current, Out disabled	$I_{DD}$			30	uA
Output Logic Levels Output Logic High <sup>2</sup> Output Logic Low <sup>2</sup> Output Logic High Drive Output Logic Low Drive Output Logic High Drive <sup>3</sup> Output Logic Low Drive <sup>3</sup>	$V_{OH}$ $V_{OL}$ $I_{OH}$ $I_{OL}$ $I_{OH}$ $I_{OL}$	0.9* $V_{DD}$  4 4 8 8		0.1* $V_{DD}$	V V mA mA mA mA
Output Rise/Fall Time <sup>2</sup> <1.00 MHz 1.00 to 20.00 MHz 20.01 to 50.00 MHz 50.01 to 90.00 MHz 90.01 to 172.00 MHz	$t_R/t_F$			200 10 6 3 2	ns
Duty Cycle <sup>4</sup> (ordering option)	SYM	45/55			%
Operating temperature (ordering option)		-10/70 or -40/85			°C
Stability <sup>5</sup> (ordering option)		±20, ±25, ±32, ±50, ±100			ppm
RMS Jitter, 12kHz to 20 MHz			0.5	1	ps
RMS Jitter			2.5		ps
Output Enable/Disable <sup>6</sup> Output Enabled Output Disabled		1.75		0.5	V
Internal Enable Pull-Up resistor <sup>6</sup>			100		Kohm
Start-up time				10	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. Figure 5 defines these parameters. Figure 6 illustrates the operating conditions under which these parameters are tested and specified.

3. Overtone designs, output frequencies>35MHz.

4. Symmetry is measured defined as Vs, On Time/Period.

5. Includes calibration tolerance, operating temperature, supply voltage variations, aging and shock and vibration (not under operation).

6. Output will be enabled if enable/disable is left open.

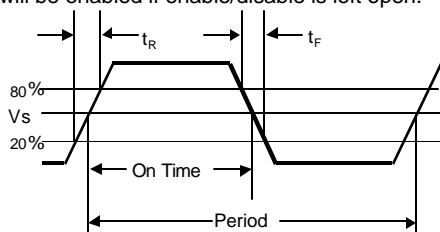


Figure 5. Output Waveform

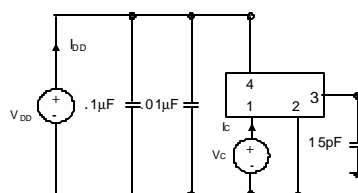


Figure 6. Typical Output Test Conditions (25±5°C)

## VCC1 Data sheet

Table 4. Electrical Performance, 1.8V option					
Parameter	Symbol	Min	Typical	Maximum	Units
Frequency	f <sub>O</sub>	0.048		172.000	MHz
Operating Supply Voltage <sup>1</sup>	V <sub>DD</sub>	1.71	1.8	1.89	V
Absolute Maximum Voltage		-0.5		3.6	V
Supply Current, Output Enabled	I <sub>DD</sub>				mA
< 20 MHz				5	
20.01 to 70 MHz				15	
70.01 to 96 MHz				20	
96.01 to 125 MHz				25	
125.01 to 172 MHz				30	
Supply Current, Out disabled	I <sub>DD</sub>			30	uA
Output Logic Levels	V <sub>OH</sub> V <sub>OL</sub> I <sub>OH</sub> I <sub>OL</sub> I <sub>OH</sub> I <sub>OL</sub>	0.9*V <sub>DD</sub>  2.8 2.8 8 8		0.1*V <sub>DD</sub>	V V mA mA mA mA
Output Logic High <sup>2</sup>					
Output Logic Low <sup>2</sup>					
Output Logic High Drive					
Output Logic Low Drive					
Output Logic High Drive <sup>3</sup>					
Output Logic Low Drive <sup>3</sup>					
Output Rise/Fall Time <sup>2</sup>	t <sub>R</sub> /t <sub>F</sub>				ns
< 1.00 MHz				200	
1.000 to 20.00 MHz				4	
20.01 to 50.00 MHz				4	
50.00 to 90.00 MHz				3	
90.01 to 172.00 MHz				2	
Duty Cycle <sup>4</sup> (ordering option)	SYM	45/55			%
Operating temperature (ordering option)		-10/70 or -40/85			°C
Stability <sup>5</sup> (ordering option)		±20, ±25, ±32, ±50, ±100			ppm
RMS Jitter, 12kHz to 20 MHz			0.5		ps
RMS Jitter			2.2		ps
Output Enable/Disable <sup>6</sup>		1.26			V
Output Enabled					
Output Disabled				0.5	
Internal Enable Pull-Up resistor <sup>6</sup>			1		Mohm
Start-up time				10	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. Figure 7 defines these parameters. Figure 8 illustrates the operating conditions under which these parameters are tested and specified.

3. Overtone designs, output frequencies > 35MHz.

4. Symmetry is measured defined as  $V_s$ , On Time/Period.

5. Includes calibration tolerance, operating temperature, supply voltage variations, aging and shock and vibration (not under operation).

6. Output will be enabled if enable/disable is left open.

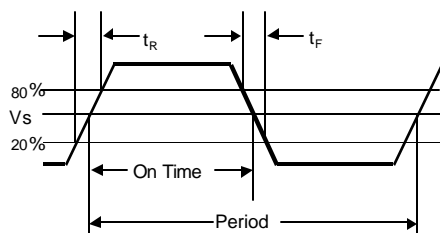


Figure 7. Output Waveform

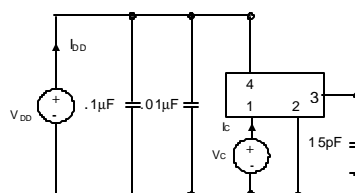


Figure 8. Typical Output Test Conditions (25±5°C)

### Enable/Disable Functional Description

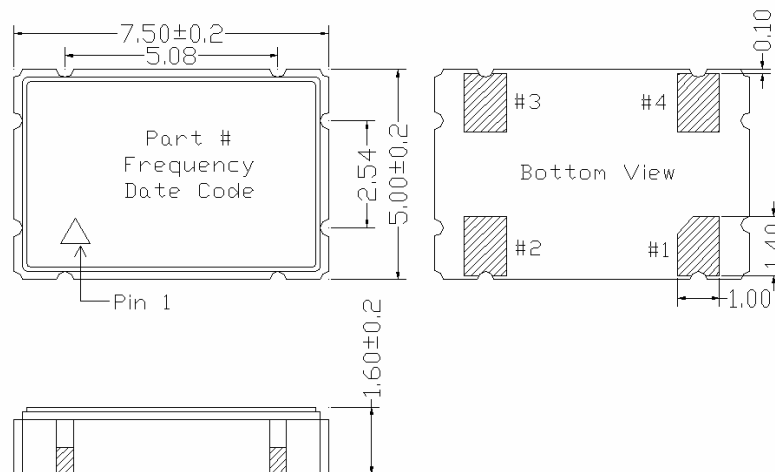
Under normal operation the Enable/Disable is left open or set to a logic high state. When the E/D is set to a logic low, the oscillator stops and the output is in a high impedance state. This helps reduce power consumption as well as facilitating board testing and troubleshooting.

### TriState Functional Description

Under normal operation the Tristate is left open or set to a logic high state. When the Tri-State is set to a logic low, the oscillator remains active but the output buffer is in a high impedance state. This helps facilitate board testing and troubleshooting.

### Outline Diagrams, Pad Layout and Pin Out

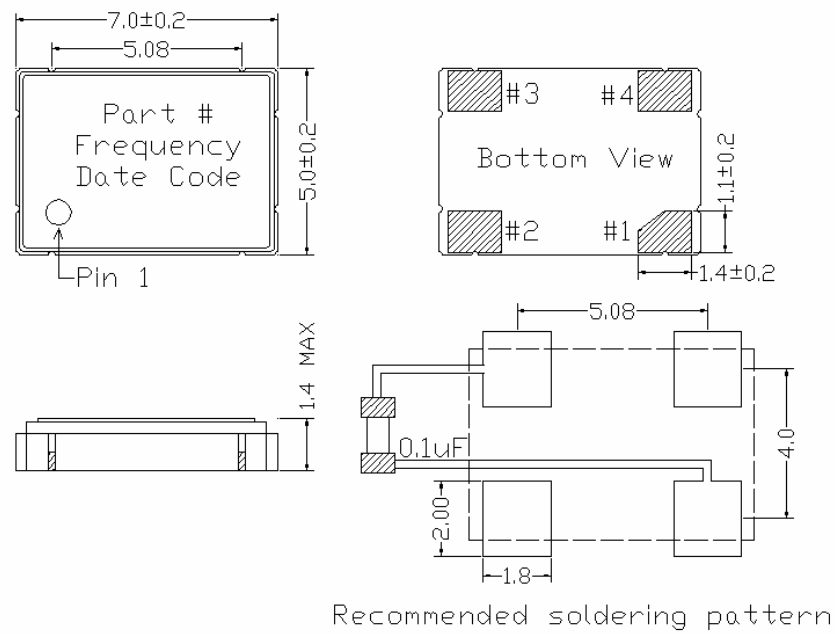
Pin #	Symbol	Function
1	E/D or NC	Tristate, Enable/Disable or NC
2	GND	Electrical and Case Ground
3	$f_o$	Output Frequency
4	$V_{DD}$	Supply Voltage



Contact Pads are gold over nickel

**Figure 9, Package drawing**

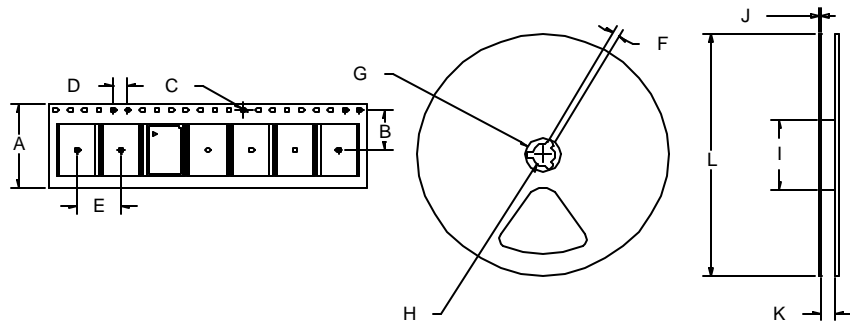
VCC1 Data sheet



Contact Pads are gold over nickel  
**Figure 10, Alternate Package drawing**

Tape and Reel

Table 5: Tape and Reel Dimensions (mm)



Tape Dimensions						Reel Dimensions							# Per
Product	A	B	C	D	E	F	G	H	I	J	K	L	Reel
VCC1	12	5.5	1.5	4	8	1.78	20.6	13	55	6	12.4	178	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 6. Absolute Maximum Ratings**

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

### Reliability

The VCC1 qualification tests have included:

**Table 7. Environmental Compliance**

Parameter	Conditions
Mechanical Shock	MIL-STD-883 Method 2022
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

### Handling Precautions

Although ESD protection circuitry has been designed into the the VCC1, 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 8. ESD Ratings**

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

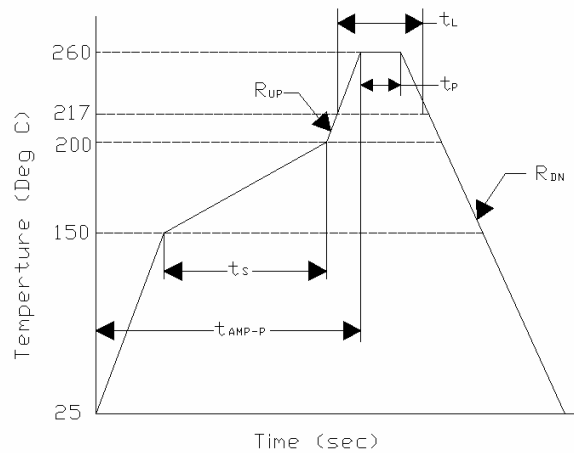


## VCC1 Data Sheet

### Suggested IR profile

Devices are built using lead free epoxy and can also be subjected to standard lead free IR reflow conditions, Table 9 shows max temperatures and lower temperatures can also be used e.g. peak temperature of 220C.

Table 9. Reflow Profile (IPC/JEDEC J-STD-020B)		
Parameter	Symbol	Value
PreHeat Time	$t_s$	150 sec Min, 200 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)	$t_P$	10 sec Max
Time At 240 °C (max)	$t_{p2}$	60 sec Max
Ramp Down	$R_{DN}$	6 °C/sec Max



## Ordering Information

<b>VCC1 -</b>		<b>B</b>	<b>3</b>	<b>B</b>	-	<b>125M00</b>
<b>Product Family</b> Crystal Oscillator						<b>Output Frequency</b> In MHZ
<b>Voltage Options</b>		<b>Electrical Options</b>		<b>Stability Options</b>		
A: +5.0 Vdc +/-10% , 15pF		<b>3: Tristate, 45/55% Duty</b>		A: ±100ppm, -10 to 70C		
B: +3.3 Vdc +/-10%, 15pF		<i>The following codes are not recommended for new designs</i>		C: ±100ppm, -40 to 85C		
C: +3.0 Vdc +/-10%, 15pF		0: No tristate, 40/60% Duty		B: ±50ppm, -10 to 70C		
E: +5.0 Vdc +/-10%, 50pF		1: Tristate, 40/60% Duty		D: ±50ppm, -40 to 85C		
F: +3.3Vdc +/-10%, 50pF		2: No tristate, 45/55%Duty		K: ±32ppm, -10 to 70C		
G: +2.5Vdc +/-10%, 15pF		5: Enable, 40/60% Duty		O: ±32ppm, -40 to 85C		
H: +1.8Vdc +/-10%, 15pF		6: Enable, 45/55% Duty		E: ±25ppm, -10 to 70C		
				F: ±25ppm, -40 to 85C		
				G: ±20ppm, -10 to 70C		

*Note: Not all combinations are available. Tristate with a 45/55% is the most common Electrical code and is recommended for most applications.*

**For Additional Information, Please Contact:**



**www.vectron.com**

April 19, 2005

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