VECTRON INTERNATIONAL A DOVER COMPANY

VCC1 series

1.8, 2.5, 3.3, 5.0 volt CMOS Oscillator

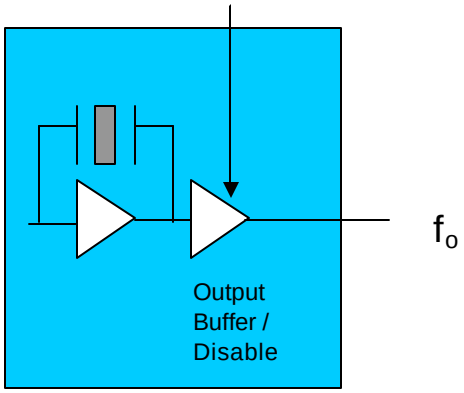
The VCC1 Crystal Oscillator

Features

- CMOS output
- Output frequencies to 190 MHz
- Low jitter, Fundamental or 3rd OT Crystal
- Tri-state 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 a 1.8, 2.5, 3.3, or 5.0 volt supply.

The VCC1 uses fundamental or 3rd 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 [1]	V_{DD}	4.5	5.0	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	
50.01 to 85 MHz				50	
85.01 to 125 MHz				60	
Supply Current, Out disabled	I_{DD}			30	uA
Output Logic Levels					
Output Logic High[2]	V_{OH}	0.9*V_{DD}			V
Output Logic Low[2]	V_{OL}			0.1*V_{DD}	V
Output Logic High Drive	I_{OH}	16			mA
Output Logic Low Drive	I_{OL}	16			mA
Output Rise/Fall Time[2]	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[3] *(ordering option)*	SYM	45/55			%
Operating Temperature (*ordering option*)		-10/70 or -40/85			°C
Storage Temperature		-55		125	°C
Stability[4] (*ordering option)*		±20, ±25, ±32, ±50, ±100			ppm
RMS Jitter, 12kHz to 20 MHz			0.5	1	ps
Period Jitter, RMS			2.5		ps
Output Enable/Disable[5]					V
Output Enabled		4.0			
Output Disabled				0.8	
Internal Enable Pull-Up resistor[5]			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 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.

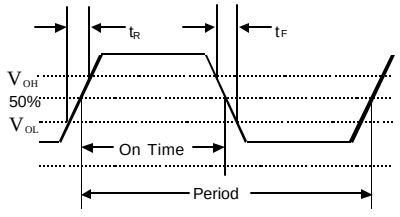


Figure 1. Output Waveform

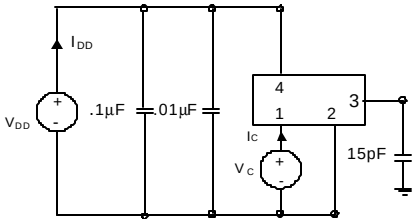


Figure 2. Typical Output Test Conditions (25±5°C)

Table 2. Electrical Performance, 3.3V option					
Parameter	**Symbol**	**Min**	**Typical**	**Maximum**	**Units**
Frequency	f_O	0.012		190.000	MHz
Operating Supply Voltage [1]	V_{DD}	2.97	3.3	3.63	V
Absolute Maximum Operating Voltage		-0.5		5.0	V
Supply Current, Output Enabled	I_{DD}				mA
< 1.500 MHz				5	
1.5 to 20 MHz				7	
20.01 to 50 MHz				20	
50.01 to 85 MHz				30	
85.01 to 190 MHz				50	
Supply Current, Output disabled	I_{DD}			30	uA
Output Logic Levels					
Output Logic High[2]	V_{OH}	0.9*V_{DD}			V
Output Logic Low[2]	V_{OL}			0.1*V_{DD}	V
Output Logic High Drive	I_{OH}	8			mA
Output Logic Low Drive	I_{OL}	8			mA
Output Rise/Fall Time[2]	t_R/t_F				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 190.00 MHz				2	
Duty Cycle[3] *(ordering option)*	SYM	45/55			%
Operating Temperature (*ordering option*)		-10/70 or –40/85			°C
Storage Temperature		-55		125	°C
Stability[4] (*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[5]					V
Output Enabled		2.0			
Output Disabled				0.5	
Internal Enable Pull-Up resistor[5]			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 Fo>90MHz, rise and fall time is measured 20 to 80%.
3. Symmetry is measured defined as 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.

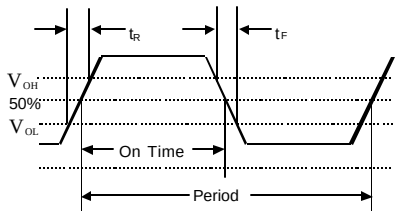


Figure 3. Output Waveform

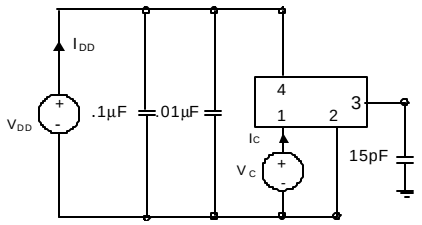


Figure 4. Typical Output Test Conditions (25±5°C)

Table 3. Electrical Performance, 2.5V option					
Parameter	**Symbol**	**Min**	**Typical**	**Maximum**	**Units**
Frequency	f_O	0.012		190.000	MHz
Operating Supply Voltage [1]	V_{DD}	2.25	2.5	2.75	V
Absolute Maximum Voltage		-0.5		5.0	V
Supply Current, Output Enabled	I_{DD}				mA
< 20 MHz				7.0	
20.01 to 50 MHz				15.0	
50.01 to 110 MHz				20.0	
110.1 to 190 MHz				30.0	
Supply Current, Out disabled	I_{DD}			30	uA
Output Logic Levels					
Output Logic High[2]	V_{OH}	0.9*V_{DD}			V
Output Logic Low[2]	V_{OL}			0.1*V_{DD}	V
Output Logic High Drive	I_{OH}	4			mA
Output Logic Low Drive	I_{OL}	4			mA
Output Logic High Drive[3]	I_{OH}	8			mA
Output Logic Low Drive[3]	I_{OL}	8			mA
Output Rise/Fall Time[2]	t_R/t_F				ns
<1.00 MHz				200	
1.00 to 20.00 MHz				10	
20.01 to 50.00 MHz				6	
50.01 to 90.00 MHz				3	
90.01 to 190.00 MHz				2	
Duty Cycle[4] *(ordering option)*	SYM	45/55			%
Operating Temperature (*ordering option*)		-10/70 or –40/85			°C
Storage Temperature		-55		125	°C
Stability[5] (*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[6]					V
Output Enabled		1.75			
Output Disabled				0.5	
Internal Enable Pull-Up resistor[6]			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 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.

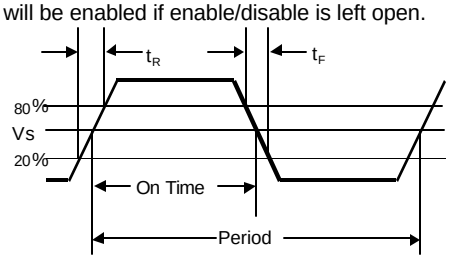


Figure 5. Output Waveform

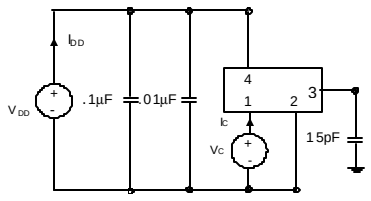


Figure 6. Typical Output Test Conditions (25±5°C)

Table 4. Electrical Performance, 1.8V option					
Parameter	**Symbol**	**Min**	**Typical**	**Maximum**	**Units**
Frequency	f_O	0.048		172.000	MHz
Operating Supply Voltage [1]	V_{DD}	1.71	1.8	1.89	V
Absolute Maximum Voltage		-0.5		3.6	V
Supply Current, Output Enabled	I_{DD}				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_{DD}			30	uA
Output Logic Levels					
Output Logic High [2]	V_{OH}	0.9*V_{DD}			V
Output Logic Low [2]	V_{OL}			0.1*V_{DD}	V
Output Logic High Drive	I_{OH}	2.8			mA
Output Logic Low Drive	I_{OL}	2.8			mA
Output Logic High Drive [3]	I_{OH}	8			mA
Output Logic Low Drive [3]	I_{OL}	8			mA
Output Rise/Fall Time [2]	t_R/t_F				ns
< 1.00 MHz				200	
1.000 to 20.00 MHz				4	
20.01 to 50.00 MHz				4	
50.01 to 90.00 MHz				3	
90.01 to 172.00 MHz				2	
Duty Cycle [4] (*ordering option*)	SYM	45/55			%
Operating temperature (*ordering option*)		-10/70 or –40/85			°C
Storage Temperature		-55		125	°C
Stability [5] (*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 [6]					V
Output Enabled		1.26			
Output Disabled				0.5	
Internal Enable Pull-Up resistor [6]			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 parameters are tested/specified.
3. Overtone designs, output frequencies>35MHz.
4. Symmetry is measured defined as 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.

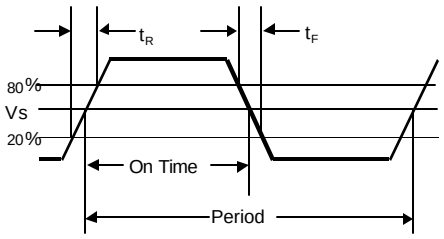


Figure 7. Output Waveform

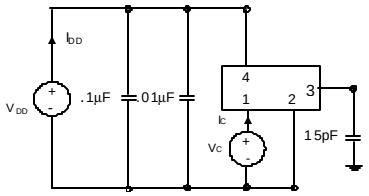


Figure 8. Typical Output Test Conditions (25±5°C)

Enable/Disable Functional Description

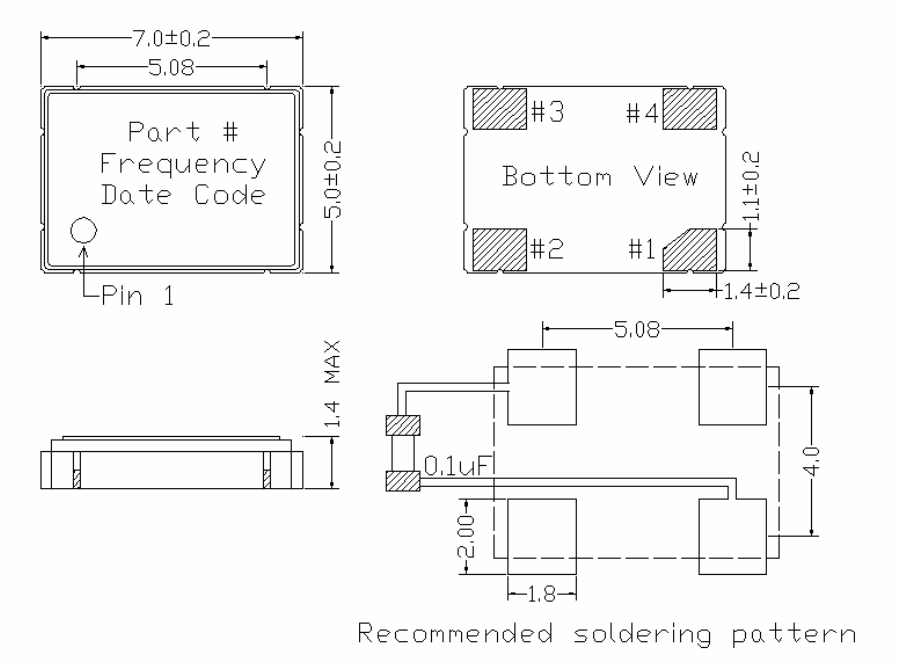
Under normal operation the Enable/Disable is left open or set to a logic high state. When the E/D is set to a logic low, the oscillator stops and the output is in a high impedance state. This helps reduce power consumption as well as facilitating board testing and troubleshooting.

Tri-state Functional Description

Under normal operation the tri-state 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.

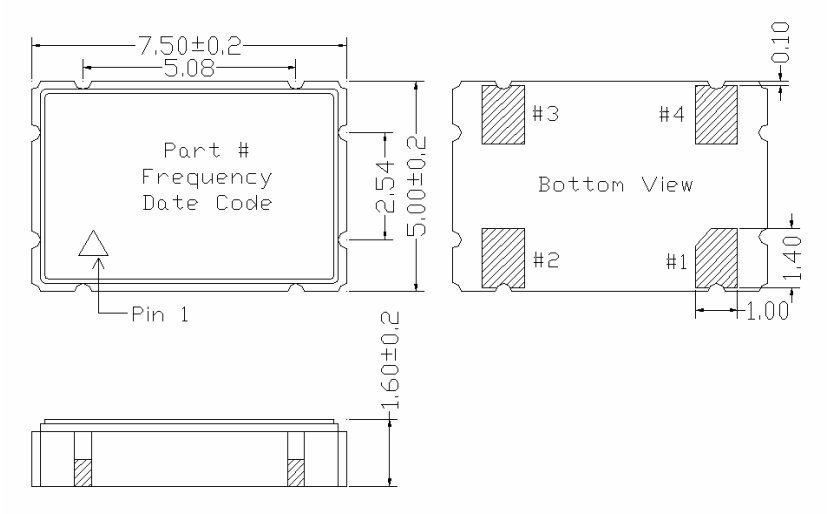
Table 5. Outline Diagrams, Pad Layout and Pin Out

Pin #	Symbol	Function
1	E/D or NC	Tri-state, 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

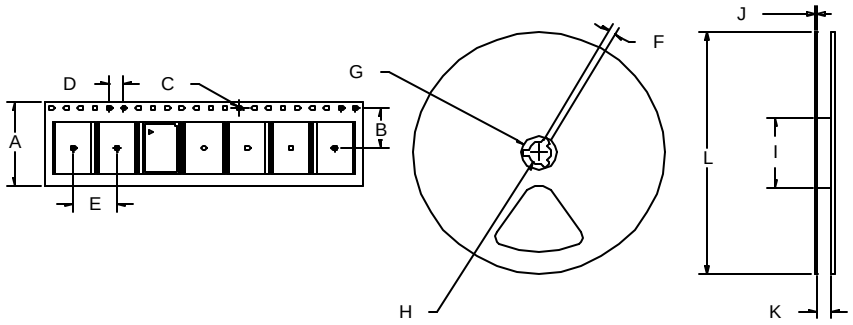


Contact Pads are gold over nickel

Figure 10, Alternate Package drawing

Tape and Reel

Table 6: 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	16	7.5	1.5	4	8	2	21	13	60	2	17	180	1000

Reliability

The VCC1 qualification tests have included:

Table 7. Environnemental 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

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

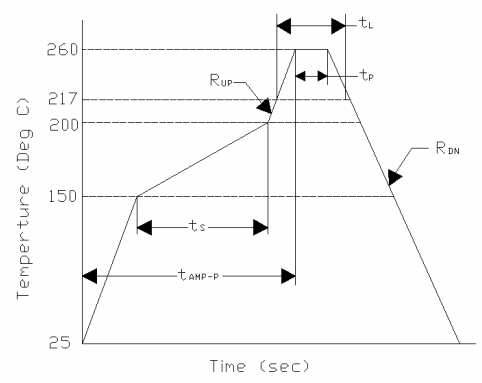


Table 10. Standard Frequencies (MHz)

1.544	1.843	2.000	2.048	2.560	3.080	3.686	4.000	4.032	4.096
4.9152	5.000	6.000	6.176	7.3728	7.680	8.000	8.192	9.216	9.600
9.830	10.000	10.240	10.486	12.000	12.222	12.2725	12.288	12.352	12.500
12.544	12.624	12.729	12.800	12.81089	12.960	13.000	13.070	13.107	13.200
13.248	13.400	13.401	13.500	13.560	13.711	13.824	14.000	14.284	14.2848
14.285	14.318	14.31818	14.336	14.400	14.500	14.5152	14.720	14.736	14.745
14.746	15.000	15.211	15.360	15.555	15.625	15.748	15.74886	15.974	16.000
16.016	16.128	16.368	16.384	16.388	16.500	16.588	16.610	16.660	16.666
16.667	16.670	16.776	16.780	16.896	16.9344	17.000	17.0664	17.37476	17.408
17.600	17.664	17.734	17.73448	17.920	17.992	18.000	18.333	18.400	18.432
18.688	18.750	19.000	19.022	19.200	19.268	19.286	19.392	19.440	19.456
19.530	19.654	19.660	19.6608	19.752	19.774	19.872	19.968	20.000	20.00271
20.141	20.200	20.2752	20.480	20.516	20.712	20.736	20.769	20.7692	20.800
20.828	20.829	20.829	20.830	20.875	20.950	20.971	21.000	21.333	21.400
21.500	21.504	21.616	21.71055	21.711	22.000	22.118	22.174	22.184	22.217
22.500	22.579	22.5792	22.600	22.855	22.85568	23.000	23.040	23.732	24.000
24.431	24.444	24.540	24.545	24.5454	24.576	24.704	24.832	25.000	25.088
25.175	25.180	25.272	25.920	26.000	26.25641	26.664	26.6649	26.666	27.000
27.120	27.500	28.000	28.224	28.60489	28.636	28.63636	28.65645	28.672	28.800
29.000	29.265	29.491	29.49893	29.500	30.000	30.150	30.200	30.720	30.880
31.000	31.104	31.250	31.307	31.500	31.680	31.948	31.949	32.000	32.250
32.256	32.270	32.500	32.764	32.768	32.768	32.800	33.000	33.1776	33.300
33.333	33.792	33.810	33.860	33.8688	34.368	34.450	34.560	34.816	35.000
35.280	35.46895	35.500	35.600	35.840	35.984	36.000	36.500	36.666	36.860
36.864	36.923	37.000	37.056	37.140	37.376	37.500	37.643	38.000	38.3107
38.800	38.810	38.880	38.912	39.0625	39.497	39.9278	40.000	40.010	40.079
40.500	40.550	40.632	40.63232	40.920	40.960	41.472	41.500	41.657	41.660
41.670	41.750	41.895	41.931	42.000	42.400	42.500	42.620	43.000	43.560
44.000	44.137	44.236	44.250	44.267	44.330	44.434	44.539	44.732	44.736
44.928	45.000	45.135	45.158	45.818	46.080	46.232	46.2321	46.320	46.796
46.864	47.13333	47.16602	47.197	47.404	47.40437	48.000	48.33008	48.587	48.58736
48.600	48.81441	49.127	49.152	49.36221	49.408	49.512	49.58632	49.867	49.980
50.000	51.156	51.200	51.840	51.840	52.000	52.416	52.500	52.560	53.125
53.330	54.000	54.072	54.125	54.2174	54.500	55.000	55.289	55.500	56.000
56.064	56.446	56.448	56.666	57.272	57.344	57.600	57.800	58.000	58.250
58.320	58.982	58.982	59.000	60.000	60.480	61.000	61.250	61.440	62.000
62.208	62.500	62.800	63.000	63.8976	64.000	64.512	65.000	65.520	65.536
66.000	66.600	66.660	66.666	66.667	66.670	67.500	67.584	68.000	68.680
68.736	69.632	70.000	70.626	70.656	70.660	70.676	70.833	71.680	72.000
73.728	74.176	74.250	75.000	76.800	77.680	77.760	78.000	78.336	79.452
80.000	81.000	81.920	83.000	83.300	83.333	85.000	87.040	87.182	87.472
89.472	89.512	89.97804	90.000	91.008	92.000	95.000	96.000	97.776	98.304
100.000	102.400	103.680	104.000	106.250	110.000	112.500	114.000	115.200	116.640
120.000	125.000	125.010	127.000	128.000	133.000	135.000	144.600	150.000	155.520
156.250	157.000	166.000	167.000	189.000	190.000				

Other frequencies may be available upon request. Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

Ordering Information

VCC1 - [B] [3] [B] - [125M00]

Product Family

Crystal Oscillator

Output Frequency

In MHZ

Voltage Options

A: +5.0 Vdc +/-10%, 15pF
B: +3.3 Vdc +/-10%, 15pF
C: +3.0 Vdc +/-10%, 15pF
E: +5.0 Vdc +/-10%, 50pF
F: +3.3Vdc +/-10%, 50pF
G: +2.5Vdc +/-10%, 15pF
H: +1.8Vdc +/-10%, 15pF

Electrical Options

3: Tri-state, 45/55% Duty

The following codes are not recommended for new designs

0: No tri-state, 40/60% Duty
1: Tri-state, 40/60% Duty
2: No tri-state, 45/55%Duty
5: Enable, 40/60% Duty
6: Enable, 45/55% Duty

Stability Options

A: ±100ppm, -10 to 70°C
C: ±100ppm, -40 to 85°C
B: ±50ppm, -10 to 70°C
D: ±50ppm, -40 to 85°C
K: ±32ppm, -10 to 70°C
O: ±32ppm, -40 to 85°C
E: ±25ppm, -10 to 70°C
F: ±25ppm, -40 to 85°C
VCC1-103= ±20ppm, -10 to 70C

Note: Not all combinations are available.

Tri-state with a 45/55% is the most common Electrical code and is recommended for most applications.

For Additional Information, Please Contact:

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USA: Vectron International • 267 Lowell Road, Hudson, NH 03051 • Tel: 1-88-VECTRON-1 • Fax: 1-888-FAX-VECTRON
EUROPE: Landstrasse, D-74924, Neckarbischofsheim, Germany • Tel: 49 (0) 7268 8010 • Fax: 49 (0) 7268 801281
ASIA: Vectron Asia Pacific Sales 1F~2F. No.8 Workshop No.308 Fenju Rd., WaiGaoQiao Free Trade Zone, Pudong New Area Shanghai, China 200131 •Tel: 8621 50480777 • Fax: 8621 50481881

www.vectron.com

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