


Helping Customers Innovate, Improve & Grow



## Description

Vectron's VCC6 Crystal Oscillator is a quartz stabilized, differential output oscillator, operating off either a 2.5 or 3.3 volt supply, hermetically sealed 5x7 ceramic package.

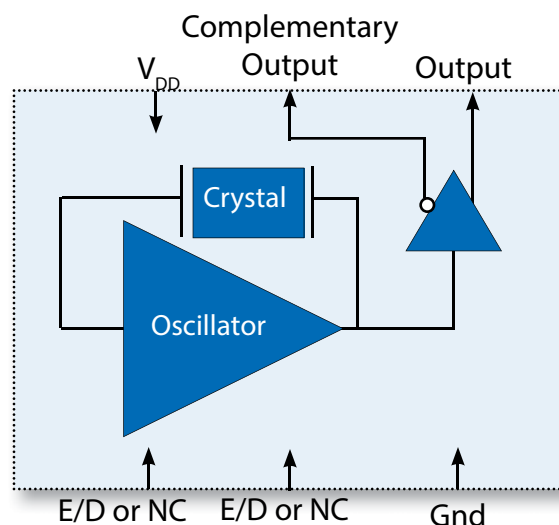
## Features

- Ultra Low Jitter Performance, Fundamental or 3rd OT Crystal Design
- Output Frequencies to 275.000MHz
- 0.3 ps typical RMS jitter, 12k-20MHz
- Differential Output
- Enable/Disable
- -10/70°C, -40/85°C or -55/125°C Operation
- Hermetically Sealed 5x7 Ceramic Package
- Product is compliant to RoHS directive  and fully compatible with lead free assembly

## Applications

- Ethernet, GbE, Synchronous Ethernet
- Fiber Channel
- Enterprise Servers
- Telecom
- Clock source for A/D's, D/A's
- Driving FPGA's
- Test and Measurement
- PON
- Medical
- COTS

## Block Diagram

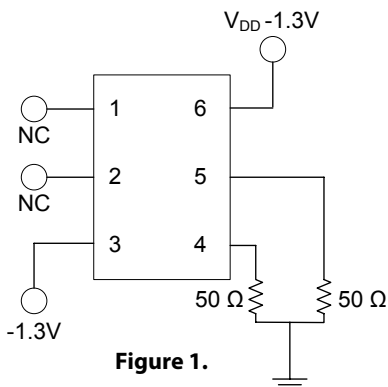


# Performance Specifications

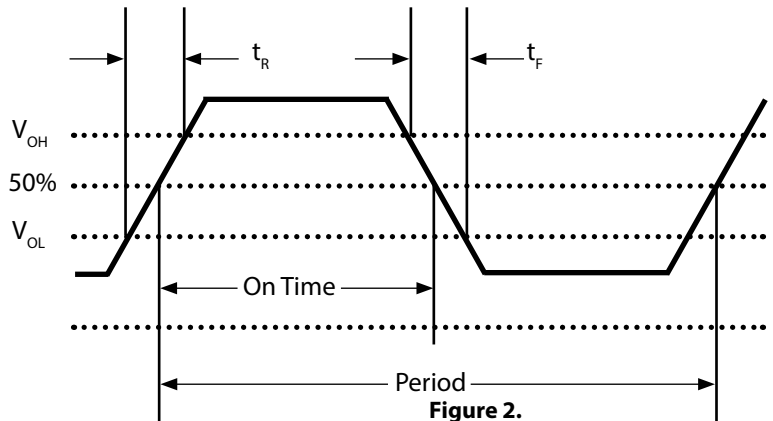
**Table 1. Electrical Performance, LVPECL Option**

| Parameter                                          | Symbol               | Min                        | Typical        | Maximum        | Units |      |
|----------------------------------------------------|----------------------|----------------------------|----------------|----------------|-------|------|
| <b>Supply</b>                                      |                      |                            |                |                |       |      |
| Voltage <sup>1</sup>                               | $V_{DD}$             | 3.135                      | 3.3            | 3.465          | V     |      |
|                                                    |                      | 2.375                      | 2.5            | 2.625          | V     |      |
| Current (No Load)                                  | $I_{DD}$             |                            | 50             | 98             | mA    |      |
| <b>Frequency</b>                                   |                      |                            |                |                |       |      |
| Nominal Frequency <sup>2</sup>                     | $f_N$                | 25                         |                | 275.000        | MHz   |      |
| Stability <sup>2,3</sup> (Ordering Option)         |                      | ±20, ±25, ±50, ±100        |                |                | ppm   |      |
| <b>Outputs</b>                                     |                      |                            |                |                |       |      |
| Output Logic Levels <sup>4</sup> , -10/70°C        | $V_{OH}$<br>$V_{OL}$ | $V_{DD}-1.025$             |                | $V_{DD}-0.880$ | V     |      |
|                                                    |                      | $V_{DD}-1.810$             |                | $V_{DD}-1.620$ | V     |      |
| Output Logic Levels <sup>4</sup> , -40/85°C        | $V_{OH}$<br>$V_{OL}$ | $V_{DD}-1.085$             |                | $V_{DD}-0.880$ | V     |      |
|                                                    |                      | $V_{DD}-1.830$             |                | $V_{DD}-1.555$ | V     |      |
| Output Rise and Fall Time <sup>4</sup>             | $t_R/t_F$            |                            |                | 600            | ps    |      |
| Load                                               |                      | 50 ohms into $V_{DD}-1.3V$ |                |                |       |      |
| Duty Cycle <sup>5</sup>                            |                      | 45                         | 50             | 55             | %     |      |
| Jitter (12 kHz - 20 MHz BW) 155.52MHz <sup>6</sup> | $\phi J$             |                            | 0.3            | 0.7            | ps    |      |
| Period Jitter <sup>7</sup>                         | $\phi J$             |                            |                |                |       |      |
|                                                    |                      |                            | RMS            |                | 2.3   | ps   |
|                                                    |                      |                            | P/P            |                | 20    | ps   |
|                                                    |                      |                            | Random Jitter  |                | 2.4   | ps   |
| Deterministic Jitter                               |                      |                            | 0              | ps             |       |      |
| <b>Enable/Disable</b>                              |                      |                            |                |                |       |      |
| Output Enabled <sup>8</sup>                        | $V_{IH}$             | $0.7*V_{DD}$               |                |                | V     |      |
| Output Disabled                                    | $V_{IL}$             |                            |                | $0.3*V_{DD}$   | V     |      |
| Disable Time                                       | $t_D$                |                            |                | 200            | ns    |      |
| Enable/Disable Leakage Current                     |                      |                            |                | ±200           | uA    |      |
| Enable Pull-Up Resistor                            |                      |                            |                |                |       |      |
|                                                    |                      |                            | Output Enabled |                | 33    | KOhm |
| Output Disabled                                    |                      |                            | 1              |                | MOhm  |      |
| Start-Up Time                                      | $t_{SU}$             |                            |                | 10             | ms    |      |
| Operating Temp. (Ordering Option)                  | $T_{OP}$             | -10/70, -40/85 or -55/125  |                |                | °C    |      |

1. The VCC6 power supply pin should be filtered, eg, a 0.1 and 0.01uf capacitor.
2. See Standard Frequencies and Ordering Information for more information.
3. Includes calibration tolerance, operating temperature, supply voltage variations, aging and IR reflow.
4. Figure 1 defines the test circuit and Figure 2 defines these parameters.
5. Duty Cycle is defined as the On/Time Period.
6. Measured using an Agilent E5052, 155.520MHz. Please see "Typical Phase Noise and Jitter Report for the VCC6 series".
7. Measured using a Wavecrest SIA3300C, 90K samples.
8. Outputs will be Enabled if Enable/Disable is left open.



**Figure 1.**



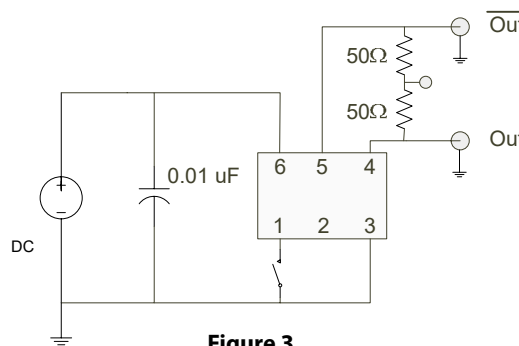
**Figure 2.**

# Performance Specifications

**Table 2. Electrical Performance, LVDS Option**

| Parameter                                                                 | Symbol               | Min                       | Typical | Maximum            | Units |
|---------------------------------------------------------------------------|----------------------|---------------------------|---------|--------------------|-------|
| <b>Supply</b>                                                             |                      |                           |         |                    |       |
| Voltage <sup>1</sup>                                                      | $V_{DD}$             | 3.135                     | 3.3     | 3.465              | V     |
|                                                                           |                      | 2.375                     | 2.5     | 2.625              | V     |
| Current (No Load)                                                         | $I_{DD}$             |                           |         | 60                 | mA    |
| <b>Frequency</b>                                                          |                      |                           |         |                    |       |
| Nominal Frequency <sup>2</sup>                                            | $f_N$                | 80                        |         | 275.000            | MHz   |
| Stability <sup>2,3</sup> (Ordering Option)                                |                      | ±20, ±25, ±50, ±100       |         |                    | ppm   |
| <b>Outputs</b>                                                            |                      |                           |         |                    |       |
| Output Logic Levels <sup>4</sup><br>Output Logic High<br>Output Logic Low | $V_{OH}$<br>$V_{OL}$ |                           | 1.43    | 1.6                | V     |
|                                                                           |                      | 0.9                       | 1.10    |                    | V     |
| Differential Output Amplitude                                             |                      | 247                       | 330     | 454                | mV    |
| Differential Output Error                                                 |                      |                           |         | 50                 | mV    |
| Offset Voltage                                                            |                      | 1.125                     | 1.25    | 1.375              | V     |
| Offset Voltage Error                                                      |                      |                           |         | 50                 | mV    |
| Output Leakage Current                                                    |                      |                           |         | 10                 | uA    |
| Output Rise and Fall Time <sup>4</sup>                                    | $t_R/t_F$            |                           |         | 600                | ps    |
| Load                                                                      |                      | 100 ohms differential     |         |                    |       |
| Duty Cycle <sup>5</sup>                                                   |                      | 45                        | 50      | 55                 | %     |
| Jitter (12 kHz - 20 MHz BW) 155.52MHz <sup>6</sup>                        | $\phi J$             |                           | 0.3     | 0.7                | ps    |
| Period Jitter <sup>7</sup><br>RMS<br>P/P                                  | $\phi J$             |                           | 2.5     |                    | ps    |
|                                                                           |                      |                           | 22      |                    | ps    |
| Random Jitter                                                             |                      |                           | 2.6     |                    | ps    |
| Deterministic Jitter                                                      |                      |                           | 0       |                    | ps    |
| <b>Enable/Disable</b>                                                     |                      |                           |         |                    |       |
| Output Enabled <sup>8</sup>                                               | $V_{IH}$             | $0.7 \cdot V_{DD}$        |         |                    | V     |
| Output Disabled                                                           | $V_{IL}$             |                           |         | $0.3 \cdot V_{DD}$ | V     |
| Disable Time                                                              | $t_D$                |                           |         | 200                | ns    |
| Enable/Disable Leakage Current                                            |                      |                           |         | ±200               | uA    |
| Enable Pull-Up Resistor<br>Output Enabled<br>Output Disabled              |                      |                           | 33      |                    | KOhm  |
|                                                                           |                      |                           | 1       |                    | MOhm  |
| Start-Up Time                                                             | $t_{SU}$             |                           |         | 10                 | ms    |
| Operating Temp. (Ordering Option)                                         | $T_{OP}$             | -10/70, -40/85 or -55/125 |         |                    | °C    |

1. The VCC6 power supply pin should be filtered, eg, a 0.1 and 0.01 uf capacitor.
2. See Standard Frequencies and Ordering Information for more information.
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**Figure 3.**

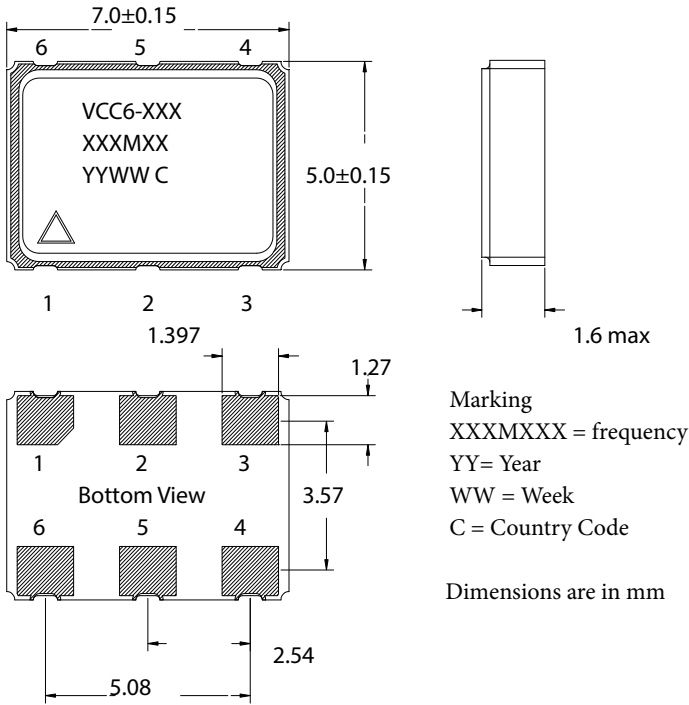
# Package and Pinout

**Table 3. Pinout**

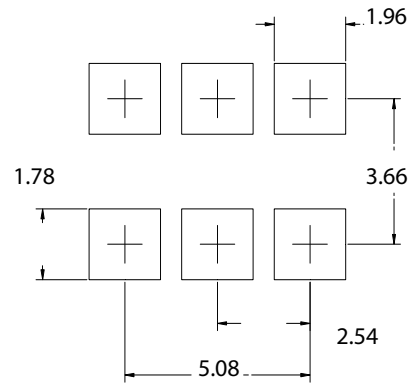
| Pin # | Symbol    | Function                        |
|-------|-----------|---------------------------------|
| 1     | E/D or NC | Enable Disable or No Connection |
| 2     | E/D or NC | Enable Disable or No Connection |
| 3     | GND       | Electrical and Lid Ground       |
| 4     | $f_o$     | Output Frequency                |
| 5     | $Cf_o$    | Complementary Output Frequency  |
| 6     | $V_{DD}$  | Supply Voltage                  |

**Table 4. Enable Disable Function (optional on pin 1 or pin2)**

| E/D Pin | Output         |
|---------|----------------|
| High    | Clock Output   |
| Open    | Clock Output   |
| Low     | High Impedance |

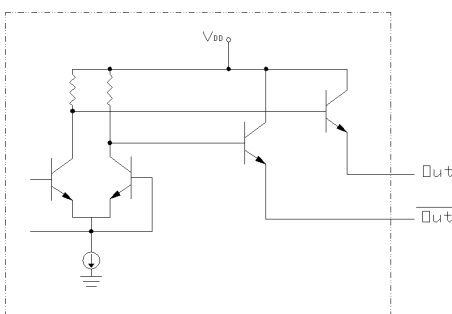


**Figure 4. Package Outline Drawing**

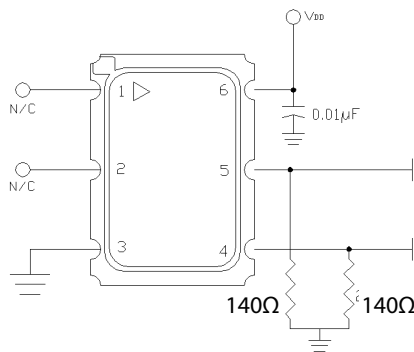


**Figure 5. Pad Layout**

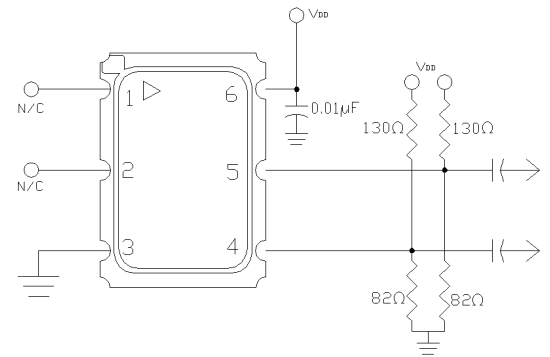
## LVPECL Application Diagrams



**Figure 6. Standard PECL Output Configuration**



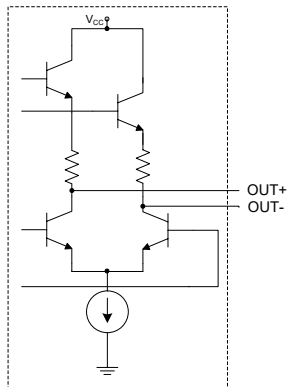
**Figure 7. Single Resistor Termination Scheme**  
 Resistor values are typically 140 ohms for 3.3V operation and 84 ohms for 2.5V operation.



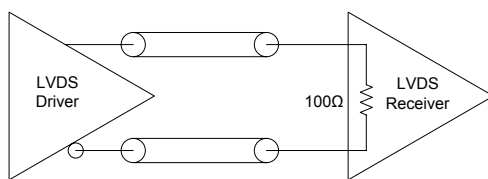
**Figure 8. Pull-Up Pull Down Termination**  
 Resistor values are typically for 3.3V operation. For 2.5V operation, the resistor to ground is 62 ohms and the resistor to supply is 240 ohms

The VCC6 incorporates a standard PECL output scheme, which are un-terminated emitters as shown in Figure 6. There are numerous application notes on terminating and interfacing PECL logic and the two most common methods are a single resistor to ground, Figure 7, and a pull-up/pull-down scheme as shown in Figure 8. An AC coupling capacitor is optional, depending on the application and the input logic requirements of the next stage.

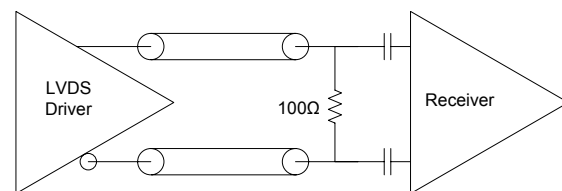
# LVDS Application Diagrams



**Figure 9. Standard LVDS Output Configuration**



**Figure 10. LVDS to LVDS Connection, Internal 100ohm**  
Some LVDS structures have an internal 100 ohm resistor on the input and do not need additional components.



**Figure 11. LVDS to LVDS Connection External 100ohm and AC blocking caps**  
Some input structures may not have an internal 100 ohm resistor on the input and will need an external 100ohm resistor for impedance matching. Also, the input may have an internal DC bias which may not be compatible with LVDS levels, AC blocking capacitors can be used.

One of the most important considerations is terminating the Output and Complementary Outputs equally. An unused output should not be left un-terminated, and if one of the two outputs is left open it will result in excessive jitter on both. PC board layout must take this and 50 ohm impedance matching into account. Load matching and power supply noise are the main contributors to jitter related problems.

## Environmental and IR Compliance

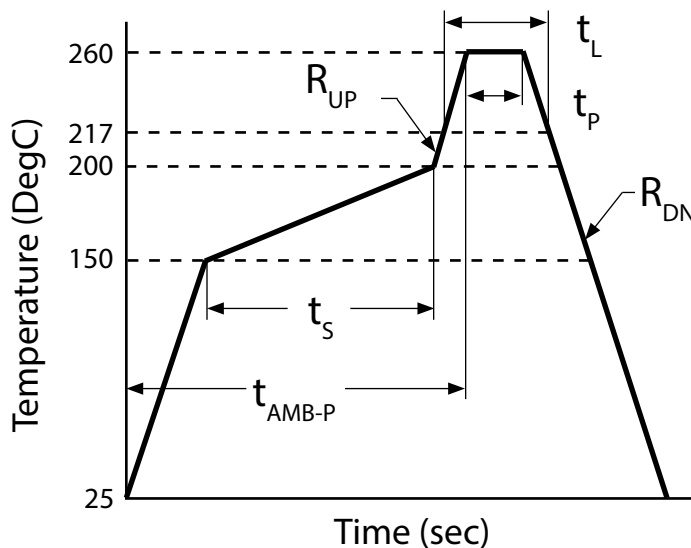
| Table 5. Environmental Compliance |                                            |
|-----------------------------------|--------------------------------------------|
| Parameter                         | Condition                                  |
| Mechanical Shock                  | MIL-STD-883 Method 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 (0.3 um min - 1.0 um max) over Nickel |
| ThetaJC (bottom of package)       | 13 °C/W                                    |
| Weight                            | 170 mg                                     |

## IR Compliance

### 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 220C.

| Table 6. Reflow Profile  |             |             |
|--------------------------|-------------|-------------|
| Parameter                | Symbol      | Value       |
| PreHeat Time             | $t_s$       | 200 sec Max |
| Ramp Up                  | $R_{UP}$    | 3°C/sec Max |
| Time above 217°C         | $t_L$       | 150 sec Max |
| Time to Peak Temperature | $t_{AMB-P}$ | 480 sec Max |
| Time at 260°C            | $t_P$       | 30 sec Max  |
| Time at 240°C            | $t_{P2}$    | 60 sec Max  |
| Ramp down                | $R_{DN}$    | 6°C/sec Max |



# Maximum Ratings, Tape & Reel

## 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.

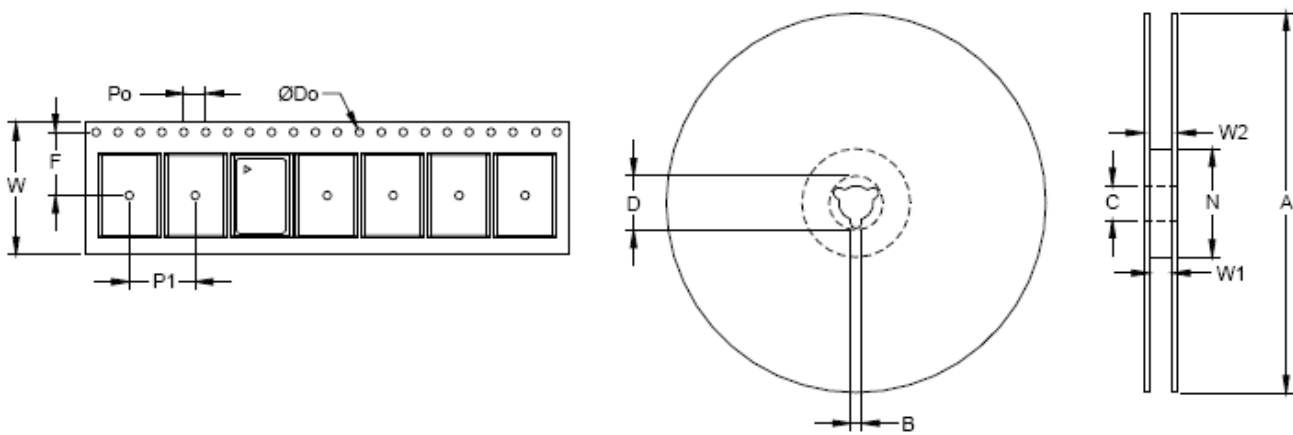
Although ESD protection circuitry has been designed into the VCC6, proper precautions should be taken when handling and mounting. VI employs a Human Body Model and Charged Device Model for ESD susceptibility testing and design evaluation.

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.

| Parameter                 | Symbol      | Rating               | Unit |
|---------------------------|-------------|----------------------|------|
| Storage Temperature       | $T_{STORE}$ | -55/125              | °C   |
| Supply Voltage            |             | -0.5 to 5.0          | V    |
| Enable/Disable Voltage    |             | -0.5 to $V_{DD}+0.5$ | V    |
| ESD, Human Body Model     |             | 1500                 | V    |
| ESD, Charged Device Model |             | 1000                 | V    |

**Table 8. 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                  | 2 | 13 | 21 | 55 | 17 | 21 | 250    |



**Table 9. Standard Frequencies (MHz)**

|          |            |            |          |          |          |          |            |            |          |          |
|----------|------------|------------|----------|----------|----------|----------|------------|------------|----------|----------|
| 19.4400  | 25.0000    | 27.1200    | 30.7200  | 33.0000  | 33.3330  | 35.0000  | 35.5000    | 38.8800    | 40.0000  | 40.6800  |
| 43.7500  | 48.0000    | 50.0000    | 53.1250  | 56.0000  | 61.440   | 62.2080  | 62.5000    | 66.0000    | 68.0000  | 70.0000  |
| 71.5000  | 74.1758    | 74.2500    | 75.0000  | 75.4000  | 77.7600  | 78.1250  | 80.0000    | 81.2500    | 83.3330  | 84.0000  |
| 86.0000  | 87.5000    | 90.0000    | 95.0000  | 99.1440  | 100.0000 | 105.0000 | 106.2500   | 110.0000   | 112.0000 | 112.5000 |
| 114.2850 | 120.0000   | 122.8800   | 124.4160 | 125.0000 | 125.0093 | 128.0000 | 130.0000   | 130.5882   | 132.8125 | 133.0000 |
| 135.0000 | 136.0000   | 140.0000   | 142.5408 | 143.0000 | 148.7500 | 150.0000 | 153.6000   | 153.8500   | 155.5200 | 156.1734 |
| 156.2500 | 156.253906 | 156.261718 | 156.2740 | 156.2930 | 159.3750 | 160.0000 | 161.1300   | 161.1328   | 162.3250 | 164.3555 |
| 165.0000 | 166.0000   | 166.5600   | 166.6286 | 166.6667 | 167.3300 | 167.3317 | 167.328125 | 167.4100   | 168.2009 | 168.6997 |
| 172.6423 | 173.3700   | 173.3708   | 173.4380 | 175.000  | 176.0950 | 176.8382 | 177.3437   | 178.018970 | 178.1250 | 178.5000 |
| 180.0000 | 187.0177   | 187.5000   | 190.0000 | 192.4560 | 195.3125 | 200.0000 | 210.0000   | 212.4840   | 212.5000 | 218.7500 |
| 225.0000 | 250.0000   | 260.0000   | 266.0000 | 275.0000 |          |          |            |            |          |          |

# Ordering Information

## VCC6 - X X X - XXMXXXXXX \*

### Product

XO, 5x7 Package

### Output and Voltage

Q: +3.3 Vdc ±5%, LVPECL

R: +2.5 Vdc ±5%, LVPECL

L: +3.3 Vdc ±5%, LVDS

V: +2.5 Vdc ±5%, LVDS

### Enable/Disable

A: E/D is on Pin 2

C: E/D is on Pin 1

Frequency in MHz

### Stability/Temp Range

A: ±100 ppm over -10/70°C

B: ±50 ppm over -10/70°C

C: ±100 ppm over -40/85°C

D: ±50 ppm over -40/85°C

E: ±25 ppm over -10/70°C

F: ±25 ppm over -40/85°C

G: ±20 ppm over -10/70°C, excludes aging

P: ±100 ppm over -55/125°C

R: ±50 ppm over -55/125°C

*\*Note: not all combination of options are available.  
P code is available ≤ 156M250, R code is available ≤ 125M000  
Other specifications may be available upon request.*

## ±20ppm Options

|                    |        |       |                                                            |
|--------------------|--------|-------|------------------------------------------------------------|
| VCC6-107-frequency | LVPECL | +3.3V | ±20ppm over -10/70°C, includes 10 years aging, E/D on Pin1 |
| VCC6-109-frequency | LVDS   | +3.3V | ±20ppm over -10/70°C, includes 10 years aging, E/D on Pin1 |
| VCC6-110-frequency | LVPECL | +2.5V | ±20ppm over -10/70°C, includes 10 years aging, E/D on Pin1 |
| VCC6-111-frequency | LVDS   | +2.5V | ±20ppm over -10/70°C, includes 10 years aging, E/D on Pin1 |
| VCC6-119-frequency | LVPECL | +3.3V | ±20ppm over -40/85°C, includes 10 years aging, E/D on Pin1 |
| VCC6-120-frequency | LVPECL | +2.5V | ±20ppm over -40/85°C, includes 10 years aging, E/D on Pin1 |
| VCC6-121-frequency | LVDS   | +3.3V | ±20ppm over -40/85°C, includes 10 years aging, E/D on Pin1 |
| VCC6-122-frequency | LVDS   | +2.5V | ±20ppm over -40/85°C, includes 10 years aging, E/D on Pin1 |

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

**Example: VCC6-QAD-125M000000\_SNPB**

## Revision History

| Revision Date  | Approved | Description                                                                                                                |
|----------------|----------|----------------------------------------------------------------------------------------------------------------------------|
| Feb 12, 2014   | TG       | Updated Vectron Logo, Hudson & Asia Contact Address                                                                        |
| Aug 04, 2014   | VN       | Frequency range Limited to 275MHz. Removed Optional 7.5x5.08mm package.                                                    |
| Aug 10, 2018   | FB       | Update logo and contact information, added SNPB DIP ordering option                                                        |
| March 19, 2019 | FB       | Update logo and contact information, change SNPB DIP to SNPB, add E/D logic Table 4, weight, thetaJC and R ordering option |

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- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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