# VX-700

Voltage Controlled Crystal Oscillator
Previous Vectron Model VC-710


## Description

The VX-700 is a Voltage Controlled Crystal Oscillator that operates at the fundamental frequency of the internal HFF crystal. The HFF crystal is a high-Q quartz device that enables the circuit to achieve low phase jitter performance over a wide operating temperature range. The VX-700 is housed in an industry standard hermetically sealed LCC package and available in tape and reel.

## Features

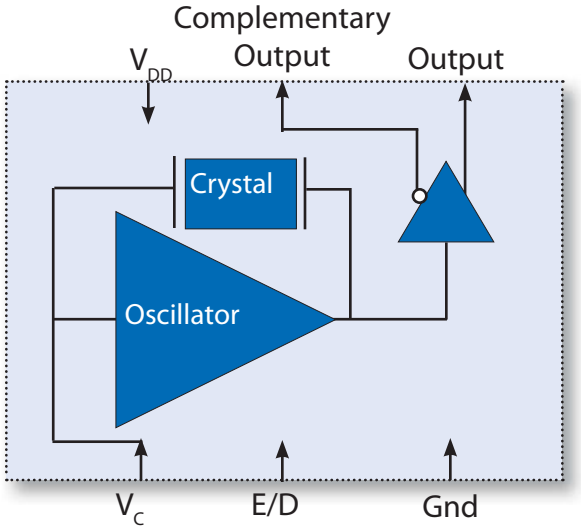
- Fundamental VCXO with no subharmonics or spurs
- Low Jitter, sub 1pS performance
- Output Frequencies from 77.76 MHz to 200 MHz
- 3.3 V Operation
- LVPECL Output
- Output Disable Feature
- Excellent ±20ppm temperature stability,
- 0/70°C or -40/85°C operating temperature
- Small Industry Standard Package, 5.0x7.5x1.8mm
- Product is free of lead and compliant to EC RoHS Directive

## Applications

Ideal for PLL circuits for clock smoothing and frequency translation

- SONET, SDH
- Synchronous Ethernet
- Fiber Channel
- LAN / WAN
- Test and Measurement

## Block Diagram



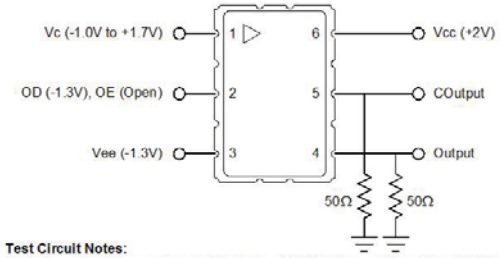
# Performance Specifications

**Table 1. Electrical Performance**

| Parameter | Symbol | Min | Typical | Maximum | Units |
|---|---|---|---|---|---|
| **Supply** | | | | | |
| Voltage[1] | $V_{DD}$ | 3.135 | 3.3 | 3.465 | V |
| Current (No Load) | $I_{DD}$ | | 50 | 90 | mA |
| **Frequency** | | | | | |
| Nominal Frequency[2] | $f_N$ | 77.7600 | | 200 | MHz |
| Absolute Pull Range [3,6] | APR | ±50 | | | ppm |
| Linearity[3] | Lin | | 5 | 10 | % |
| Gain Transfer Positive[3] (See pg 5) | $K_V$ | +30 | | +150 | ppm/V |
| Temperature Stability[3] | $f_{STAB}$ | | ±20 | | ppm |
| **Outputs** | | | | | |
| Output Logic Levels[3]<br>Output Logic High<br>Output Logic Low | <br>$V_{OH}$<br>$V_{OL}$ | <br>$V_{DD}$-1.025<br>$V_{DD}$-1.810 | <br>$V_{DD}$-0.950<br>$V_{DD}$-1.700 | <br>$V_{DD}$-0.880<br>$V_{DD}$-1.620 | V |
| Current | $I_{OUT}$ | | | 20 | mA |
| Rise Time[4]<br>Fall Time | $t_R$<br>$t_F$ | | | 1<br>1 | ns<br>ns |
| Symmetry[3] | SYM | 45 | 50 | 55 | % |
| Jitter (12 kHz - 20 MHz BW)155.52MHz[5] | ϕJ | | 0.3 | 0.5 | ps |
| Jitter (50 kHz - 80 MHz BW)155.52MHz[5] | ϕJ | | 0.5 | 0.7 | ps |
| Period Jitter, RMS (155.520 MHz)[7] | ϕJ | | 3.0 | | ps |
| Period Jitter, Peak - Peak (155.520MHz)[7] | ϕJ | | 20 | | ps |
| Spurious Suppression[2] | | | -80 | | dBc |
| **Control Voltage** | | | | | |
| Control Voltage Range for APR | $V_C$ | 0.3 | | 3.0 | V |
| Control Voltage Input Impedance | $Z_{IN}$ | 10 | | | MΩ |
| Control Voltage Modulation BW | $_{BW}$ | 10 | 20 | | kHz |
| **Enable/Disable** | | | | | |
| Output Enabled, Option A [8]<br>Output Disabled, Option A | $V_{IH}$<br>$V_{IL}$ | 0.7*$V_{DD}$ | | <br>0.3*$V_{DD}$ | V<br>V |
| Output Enabled, Option C [8]<br>Output Disabled, Option C | $V_{IL}$<br>$V_{IH}$ | <br>0.7*$V_{DD}$ | | 0.2*$V_{DD}$ | |
| Start-Up Time | | | | 10 | ms |
| Operating Temperature | $T_{OP}$ | 0/70, -20/85 or -40/85 | | | °C |
| Package Size | | 5.0 x 7.5 x 1.8 | | | mm |

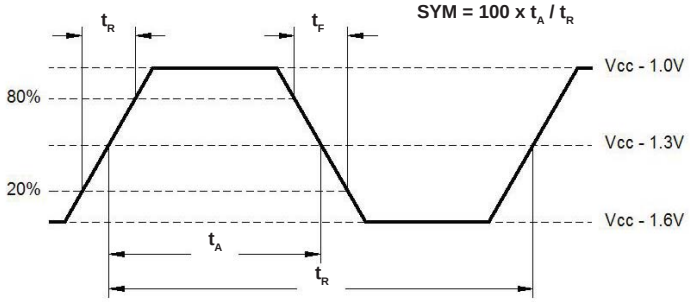
1] The VX-700 power supply should be filtered, eg, 0.1 and 0.01uF to ground
2] See Standard Frequencies and Ordering Information tables for more specific information
3] Parameters are tested with production test circuit below (Fig 1).
4] Measured from 20% to 80% of a full output swing (Fig 2).
5] Integrated across stated bandwidth.
6] Tested with Vc = 0.3V to 3.0V unless otherwise stated in part description
7] Broadband Period Jitter measured using Lecroy Wavemaster 8600A 6 GHz Oscilloscope, 25K samples taken. See application note.
8] Output is Enabled if E/D is left floating

**Fig 1: Test Circuit**

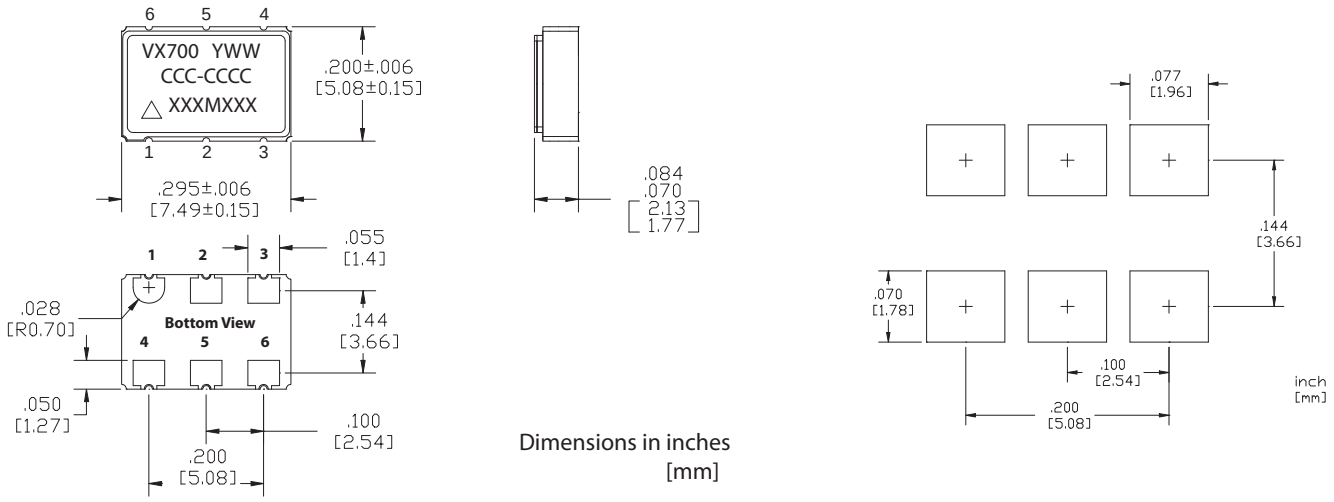



**Test Circuit Notes:**
1) To Permit 50Ω Measurement of Outputs, all DC Inputs are Biased Down 1.3V.
2) All Voltage Sources Contain Bypass Capacitors to Minimize Supply Noise.
3) 50Ω Terminations are Within Test Equipment.

**Fig 2: LVPECL Waveform**



# Outline Drawing & Pad Layout

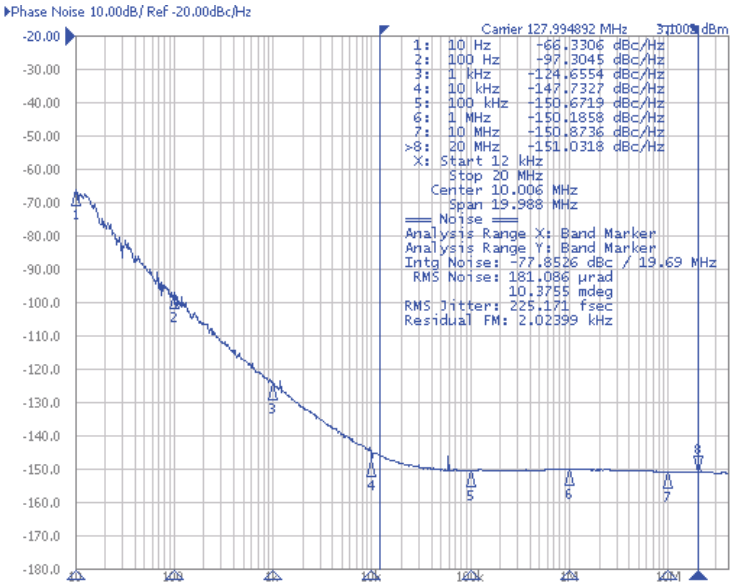



Dimensions in inches
[mm]

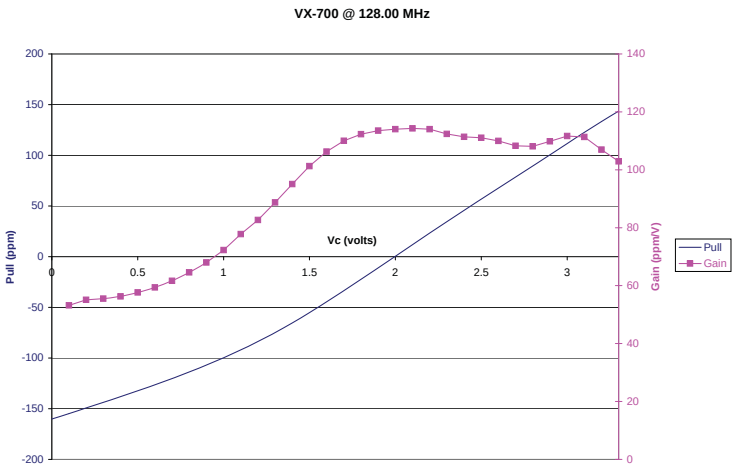
**Table 2. Pin Out**

| Pin | Symbol | Function |
|---|---|---|
| 1 | $V_C$ | VCXO Control Voltage |
| 2 | OE | Enable/Disable<br>**See Ordering Options** |
| 3 | GND | Case and Electrical Ground |
| 4 | Output | Output |
| 5 | COutput | Complementary Output |
| 6 | $V_{DD}$ | Power Supply Voltage (3.3V ±10%) |

## Typical Phase Noise




## Typical Gain



# Suggested Output Load Configurations

The VX-700 incorporates a standard PECL output scheme, which are un-terminated emitters as shown in Figure 3. There are numerous application notes on terminating and interfacing PECL logic and the two most common methods are a single resistor to ground, Figure 4, and a pull-up/pull-down scheme as shown in Figure 5. An AC coupling capacitor is optional, depending on the application and the input logic requirements of the next stage.

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 it 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.

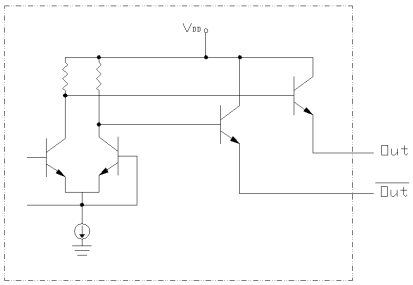



**Figure 3 Standard PECL Output Configuration**

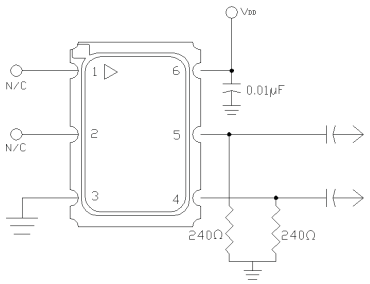



**Figure 4 Single Resistor Termination Scheme**
Resistor values are typically 120 to 240 ohms

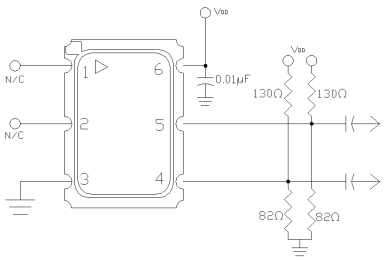



**Figure 5 Pull-Up Pull-Down Termination**

# Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The VX-700 family is capable of meeting the following qualification tests:

**Table 3. Environmental Compliance**

| Parameter | Conditions |
|---|---|
| Mechanical Shock | MIL-STD-883, Method 2002 |
| Mechanical Vibration | MIL-STD-883, Method 2007 |
| 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 | MSL 1 |
| Contact Pads | Gold over Nickel |

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 datasheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability. Permanent damage is also possible if OD or Vc is applied before Vcc.

**Table 4. Absolute Maximum Ratings**

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Power Supply | $V_{DD}$ | 0 to 6 | V |
| Output Current | $I_{OUT}$ | 25 | mA |
| Voltage Control Range | $V_C$ | 0 to $V_{CC}$ | V |
| Storage Temperature | TS | -55 to 125 | °C |
| Soldering Temp/Time | $T_{LS}$ | 260 / 40 | °C / sec |

Although ESD protection circuitry has been designed into the VX-700 proper precautions should be taken when handling and mounting. VI employs a human body model (HBM) and a charged device model (CDM) for ESD susceptibility testing and design protection evaluation.

**Table 5. ESD Ratings**

| Model | Minimum | Conditions |
|---|---|---|
| Human Body Model | 500V | MIL-STD-883, Method 3015 |
| Charged Device Model | 500V | JESD22-C101 |

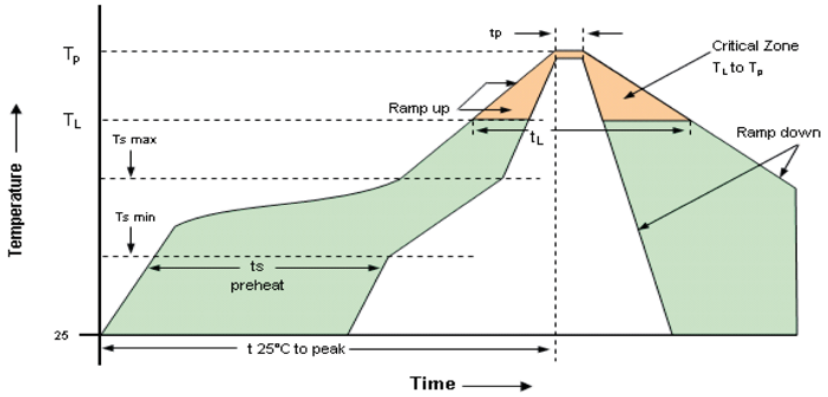
# IR Reflow

| Table 6. Reflow Profile (IPC/JEDEC J-STD-020C) | | |
|---|---|---|
| **Parameter** | **Symbol** | **Value** |
| PreHeat Time<br>Ts-min<br>Ts-max | $t_S$ | 60 sec Min, 180 sec Max<br>150°C<br>200°C |
| Ramp Up | $R_{UP}$ | 3 °C/sec Max |
| Time Above 217 °C | $t_L$ | 60 sec Min, 150 sec Max |
| Time To Peak Temperature | $T_{25C\ to\ peak}$ | 480 sec Max |
| Time at 260 °C | $t_P$ | 20 sec Min, 40 sec Max |
| Ramp Down | $R_{DN}$ | 6 °C/sec Max |

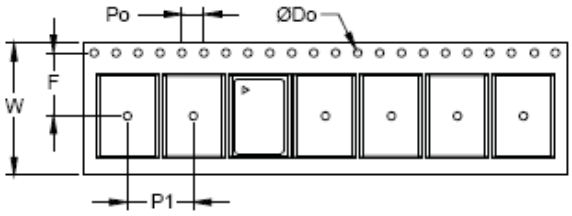
The device is qualified to meet the JEDEC standard for Pb-Free assembly. The temperatures and time intervals listed are based on the Pb-Free small body requirements. The VX-700 device is hermetically sealed so an aqueous wash is not an issue.

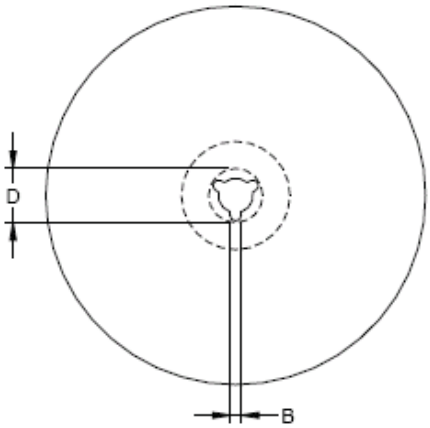
Termination Plating:
Electroless Gold Plate over Nickel Plate

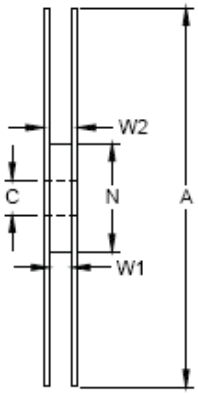
Solderprofile:




# Tape & Reel (EIA-481-2-A)




| Table 7. Tape and Reel Information | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tape Dimensions (mm)** | | | | | | **Reel Dimensions (mm)** | | | | | | | |
| **Dimension** | **W** | **F** | **Do** | **Po** | **P1** | **A** | **B** | **C** | **D** | **N** | **W1** | **W2** | **# Per Reel** |
| **Tolerance** | **Typ** | **Typ** | **Typ** | **Typ** | **Typ** | **Typ** | **Min** | **Typ** | **Min** | **Min** | **Typ** | **Max** | |
| VX-700 | 16 | 7.5 | 1.5 | 4 | 8 | 178 | 1.5 | 13 | 20.2 | 50 | 16.4 | 22.4 | 200 |

| Table 8. Standard Output Frequencies (MHz) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 77.76000 | 80.00000 | 81.00000 | 88.47360 | 91.08000 | 92.16000 | 93.31200 | 96.00000 |
| 100.00000 | 101.99200 | 102.40000 | 106.25000 | 108.00000 | 110.00000 | 112.00000 | 112.64000 |
| 120.00000 | 122.80000 | 122.88000 | 124.41600 | 125.00000 | 128.00000 | 133.33000 | 134.21770 |
| 134.40000 | 135.00000 | 138.04860 | 139.23000 | 139.26400 | 139.50000 | 143.36000 | 144.00000 |
| 148.35160 | 148.50000 | 150.00000 | 153.60000 | 154.00000 | 155.52000 | 156.25000 | 157.50000 |
| 160.00000 | 161.13280 | 162.00000 | 166.62700 | 166.62860 | 167.33160 | 168.04067 | 175.00000 |
| 175.59375 | 180.00000 | 184.00000 | 184.32000 | 186.66600 | 187.50000 | 192.00000 | 192.45600 |
| 200.0000 | | | | | | | |

## Ordering Information

**VX-700- E C E - K X A N - xxxMxxxxxx**

**Product**
VCXO, 5x7 Package

**Voltage Options**
E: +3.3 Vdc ±5%,

**Output**
C: LVPECL

**Temp Range**
T: 0/070°C
I: -20/+85°C
E: -40/+85°C

**Absolute Pull Range**
G: ±30ppm
K: ±50ppm

Frequency in MHz

**Other (Future Use)**
N: Standard

**Enable/Disable**
A: Enable High
C: Enable Low
X: No Enable/Disable Feature
(No Internal Connection)

**Stability**
X: Standard
E: ±20ppm Temperature Stability

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

**Example: VX-700-ECE-KXAN-155M520000**

## For Additional Information, Please Contact


***USA:***
Vectron International
267 Lowell Road
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
1F-2F, No 8 Workshop, No 308 Fenju Road
WaiGaoQiao Free Trade Zone
Pudong, Shanghai, China 200131
Tel: 86.21.5048.0777
Fax: 86.21.5048.1881



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