VECTRON INTERNATIONAL
A DOVER COMPANY

Helping Customers Innovate, Improve & Grow

PX-721

PX-721

Description

The PX-721 is a crystal oscillator, XO, based upon Vectron's HPLL high performance phase locked loop frequency multiplier ASIC, that combines key digital synthesis techniques with VI's proven core analog technology blocks. A standard low frequency crystal provides the reference to the fractional-n synthesizer so that virtually any frequency between 10MHz and 1200 MHz can be factory programmed allowing quick turn manufacturing.

Features

- Industry Standard Package, 5.0 x 7.0 x 1.8 mm
- HPLL High Performance PLL ASIC
- Jitter < 500 fs-rms (12 kHz to 20 MHz)
- Output Frequencies from 10 MHz to 1200 MHz
- Spurious Suppression, 70 dBc Typical
- 2.5V or 3.3V Supply Voltage
- LVCMOS, LVPECL or LVDS Output Configurations
- Output Enable
- Compliant to EC RoHS Directive Pb

Applications

PLL circuits for clock smoothing and frequency translation

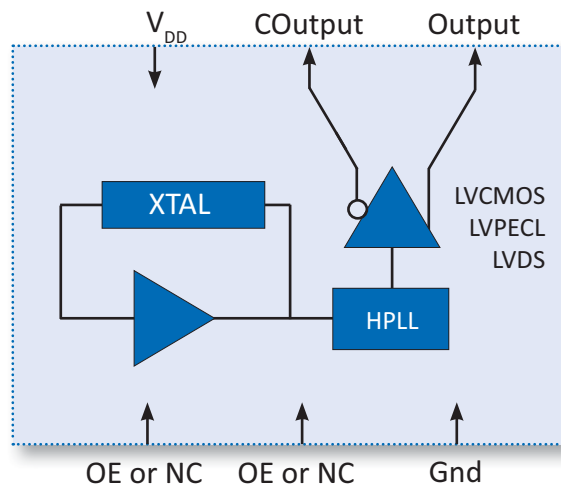| Description	Standard
• 1-2-4 Gigabit Fibre Channel	INCITS 352-2002
• 10 Gigabit Fibre Channel	INCITS 364-2003
• 10GbE LAN / WAN	IEEE 802.3ae
• Synchronous Ethernet	ITU-T G.8262
• OC-192	ITU-T G.709
• SONET / SDH	GR-253-CORE Issue4

Block Diagram

Figure 1 - Block Diagram

Performance Specifications

Electrical Performance						
Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
Supply						
Voltage[1]	3.3V Option 2.5V Option	V_{DD}	2.97 2.25	3.3 2.5	3.63 2.75	V
Current	LVCMOS LVDS LVPECL	I_{DD}	- - -	90 99 120	98 108 130	mA
Operating Temperature [1, 3]		T_{OP}	-40	-	+85	°C
Output Enable (OE)	V_{IH}		$0.75 \times V_{DD}$	-	-	V
	V_{IL}		-	-	0.5	
Frequency						
Nominal Frequency[1]	LVPECL/LVDS LVCMOS	f_N	10 10	- -	1200 160	MHz
Temperature Stability [1, 6]	T_A = -40 to +85°C	f_{STAB}	-	±20	-	ppm
Outputs						
LVPECL Output	mid-level	V_O	V_{DD}-1.42	-	V_{DD}-1.25	V
	swing (diff)	V_{OD}	1.1	-	1.9	V_{PP}
LVDS Output	mid-level	V_O	1.4	1.6	1.8	V
	swing (diff)	V_{OD}	300	450	600	mV_{PP}
LVCMOS Output		V_{OH}	$0.9 \times V_{DD}$	-	V_{DD}	V
		V_{OL}	-	-	$0.1 \times V_{DD}$	V
Rise/Fall Time (20/80%)[2,5]	LVPECL/LVDS LVCMOS with C_L = 15 pF	t_R/t_f	- -	- -	350 1.2	ps ns
Symmetry [2,3]	LVPECL: V_{DD}-1.3 V (diff) LVDS: 1.6 V (diff) LVCMOS: V_{DD}/2	SYM	45	50	55	%
Spurious Suppression [6]			65	70	-	dBc
Jitter [6] (Performance Option N)	12 kHz to 20 MHz	φJ	-	-	1000	fs-rms
Jitter [6] (Performance Option A)	12 kHz to 20 MHz	φJ	-	-	500	fs-rms

1] See Standard Frequencies and Ordering Information (Pg 8).
2] Parameters are tested with production test circuit (See Figure 2 for LVCMOS, Figure 3 for LVPECL and Figure 4 for LVDS).
3] Parameters are tested at ambient temperature with test limits guard-banded for specified operating temperature.
4] Measured as the maximum deviation from the best straight-line fit, per MIL-0-55310.
5] Parameters are described with waveform diagram below (Figure 5).
6] Not tested in production, guaranteed by design, verified at qualification.

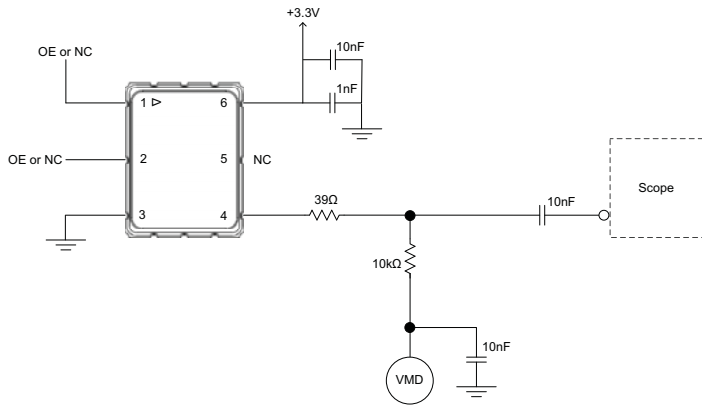# Test Circuits & Output Waveform
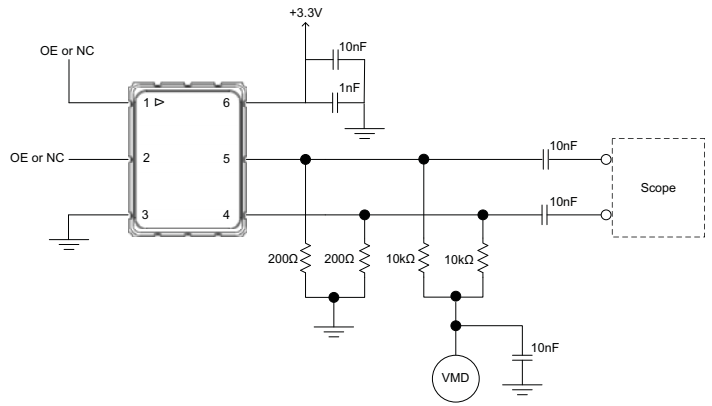

Figure 2 - LVCMOS Production Test Circuit

Figure 3 - LVPECL Production Test Circuit
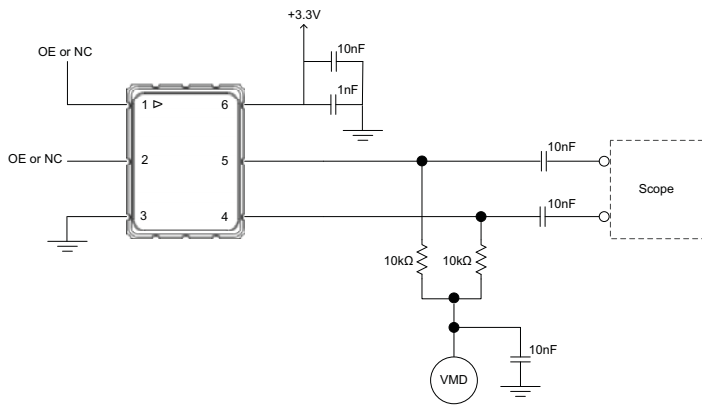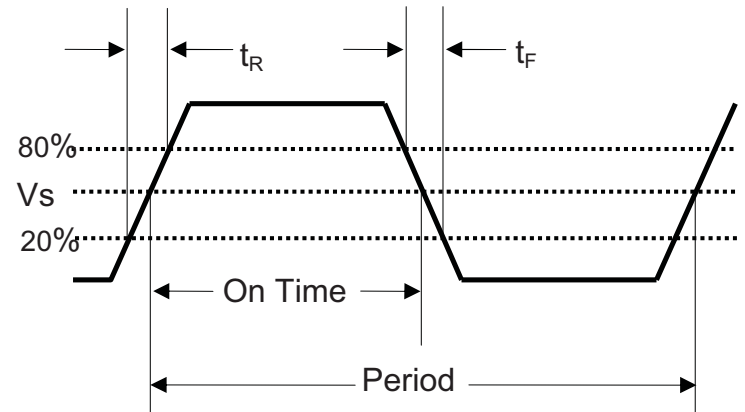

Figure 4 - LVDS Production Test Circuit

Figure 5 - Waveform Diagram

Absolute Maximum Ratings			
Parameter	**Symbol**	**Ratings**	**Unit**
Power Supply	V_{DD}	0 to 3.8	V
Input Current	I_{IN}	100	mA
Output Current	I_{OUT}	25	mA
Output Enable	OE	0 to V_{DD}	V
Storage Temperature	T_{STR}	-55 to 125	°C
Soldering Temperature / Duration	T_{PEAK} / t_P	260 / 40	°C / sec

Rev2: 14 November 2012

PX-721 Single Frequency HPLL XO
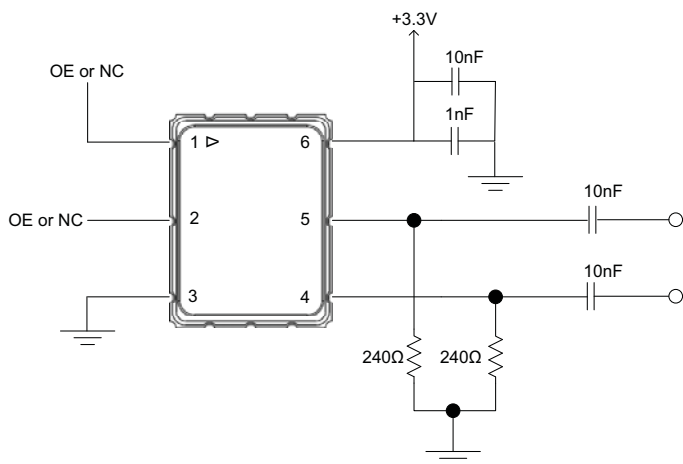
LVPECL Application Diagrams

Figure 6 - Single Resistor Termination Scheme

Resistor values are typically 120 to 240 ohms for 3.3V operation and 82 to 120 ohms for 2.5V operation.
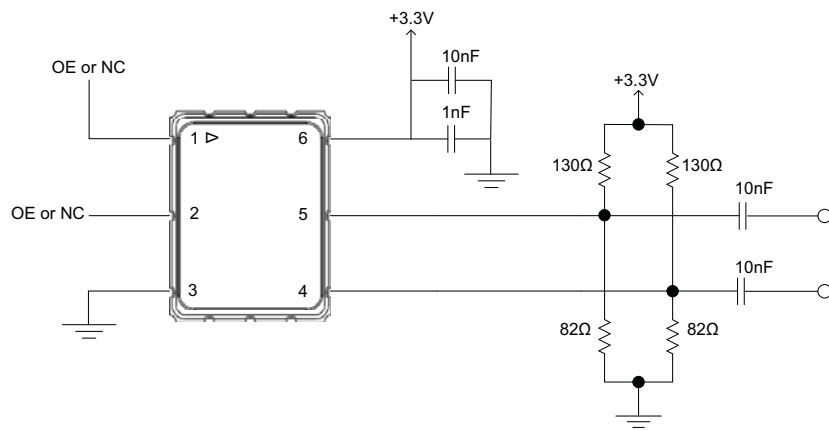

Figure 7 - Pull Up Pull Down Termination

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

There are numerous application notes on terminating and interfacing PECL logic and the two most common methods are a single resistor to ground, Figure 6, and a pull-up/pull-down scheme as shown in Figure 7. 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 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.
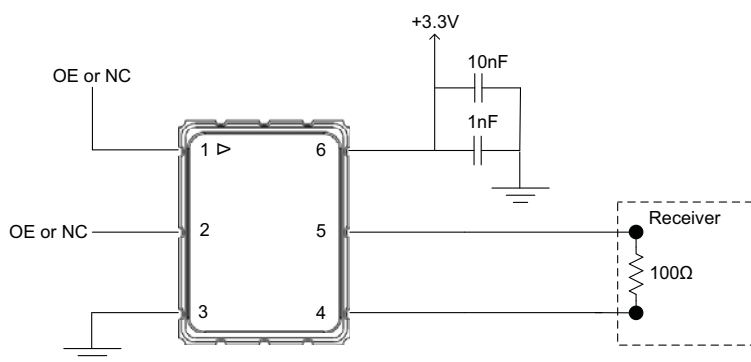
LVDS Application Diagrams

Figure 8 - LVDS to LVDS, internal 100Ω

Some LVDS structures have an internal 100 ohm resistor on the input and do not need additional components.
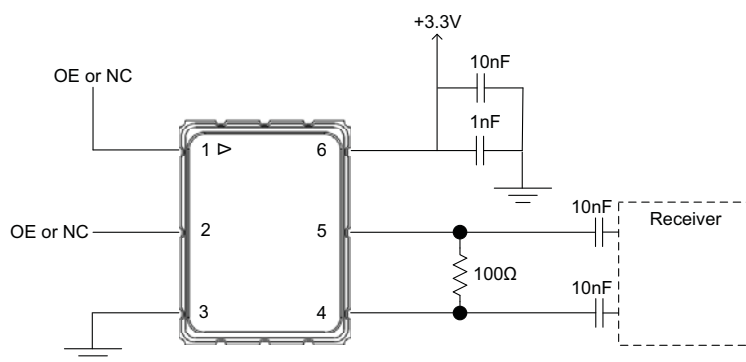
Figure 9 - LVDS to LVDS, External 100Ω and AC block ing caps

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.

Rev2: 14 November 2012

Typical Characteristics

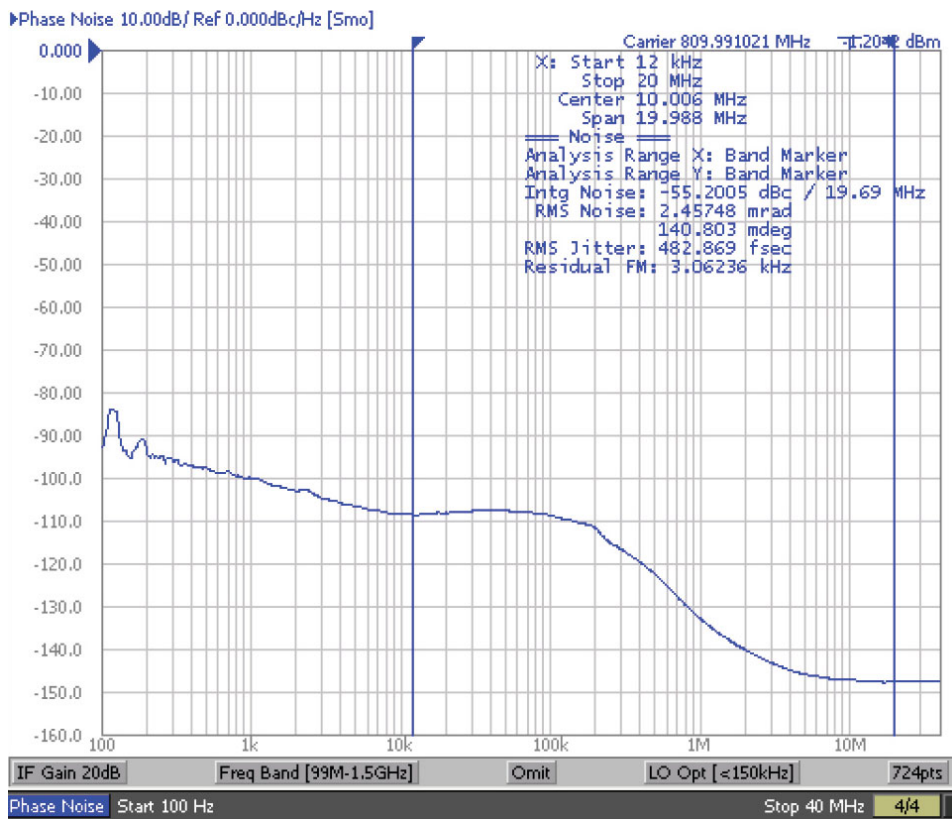Figure 10 - Typical Phase Noise/Jitter Performance - INTEGER Mode

Rev2: 14 November 2012

Reliability

VI qualification includes aging at various extreme temperatures, shock and vibration, temperature cycling, and IR reflow simulation. The PX-721 family is capable of meeting the following qualification tests:

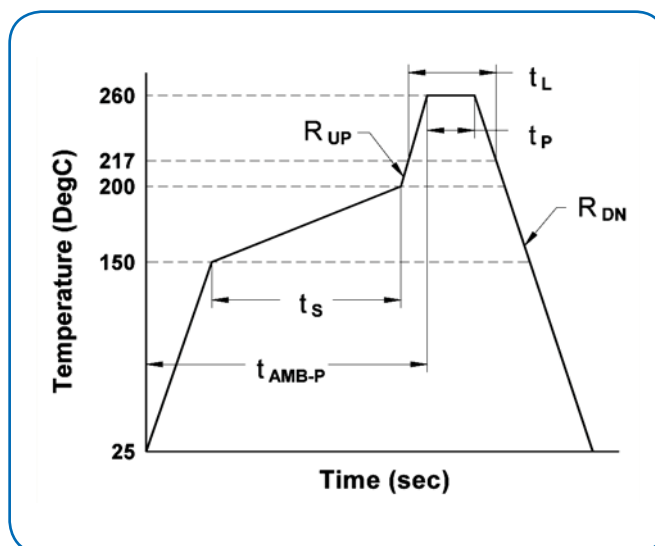| Environmental Compliance	
Parameter	**Conditions**
Mechanical Shock	MIL-STD-883, Method 2002
Mechanical Vibration	MIL-STD-883, Method 2007
Solderability	MIL-STD-883, Method 2003
Gross and Fine Leak	MIL-STD-883, Method 1014
Resistance to Solvents	MIL-STD-883, Method 2016
Moisture Sensitivity Level	IPC/JEDEC J-STD-020, MSL1

Handling Precautions

Although ESD protection circuitry has been designed into the PX-721 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.
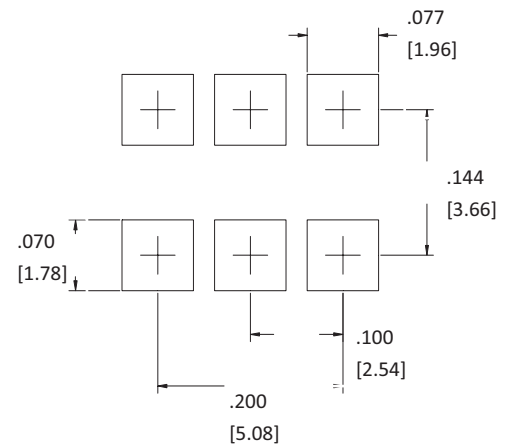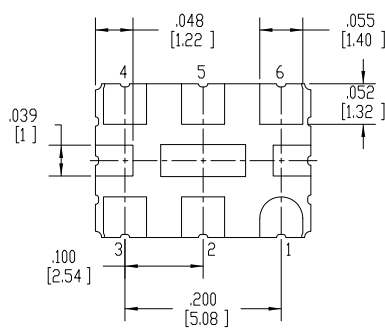
ESD Ratings		
Model	**Minimum**	**Conditions**
Human Body Model	1000V	MIL-STD-883, Method 3015
Charged Device Model	900V	JEDEC, JESD22-C101
Machine Model	200 V	JEDEC, JESD22-A115-A

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	t_P	20 sec Min, 40 sec Max
Ramp Down	R_{DN}	6 °C/sec Max

The device has been 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 temperatures refer to the topside of the package, measured on the package body surface. The PX-721 device is hermetically sealed so an aqueous wash is not an issue.

Terminal Plating: Electrolytic Ni > 1.9μm
                   Electrolytic Au > 0.7μm

Outline & Marking Diagram

.064 ±.007 [1.62 ±0.18]
.276±.006 [7±0.15]
.197 ±.006 [5±0.15]

```
6   5   4
PX-721   YWW
CCC-CCCC
△ XXXMXXX
1   2   3
```

.048 [1.22]
.055 [1.40]
.052 [1.32]
.039 [1]
.100 [2.54]
.200 [5.08]
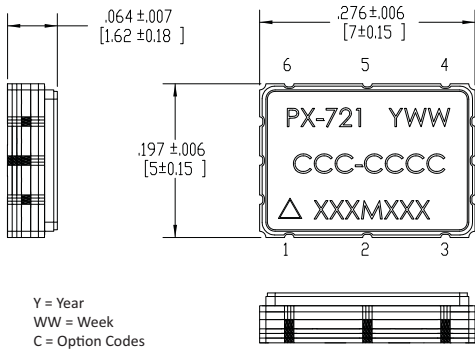
Y = Year
WW = Week
C = Option Codes
XXXMXXX = Frequency
(See Ordering Info)

inch
[mm]

Suggested Pad Layout

.077 [1.96]
.144 [3.66]
.070 [1.78]
.100 [2.54]
.200 [5.08]

Pin Out		
Pin	**Symbol**	**Function**
1	OE or NC[2]	Output Enable or No Connection[1]
2	OE or NC[2]	Output Enable or No Connection[1]
3	GND	Case and Electrical Ground
4	Output	Output
5	COutput (N/A for LVCMOS)	Complementary Output (N/C for LVCMOS)
6	V_{DD}	Power Supply Voltage

Output Enable			
Option	**Symbol**	**Function**	**Result**
A	H	$(3V_{DD}/4)$ to V_{DD}	OE
A	L	Gnd to 0.5 V	OD
C	H	$(3V_{DD}/4)$ to V_{DD}	OD
C	L	Gnd to 0.5 V	OE

OD = Outputs Disabled
OE = Outputs Enabled

1, Output Enable is internally pulled to V_{DD} with a 30 kΩ resistor.
If option C is selected, OE must be pulled low by the user with a
LVCMOS logic device or a 3 kΩ resistor to ground.
2, OE on Pin 1 or Pin 2 is an ordering option (see page 8).

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

Pull Off Direction

Pin ID   Po   ØDo
F   W
P1

W2
A   C   N
W1
D
B
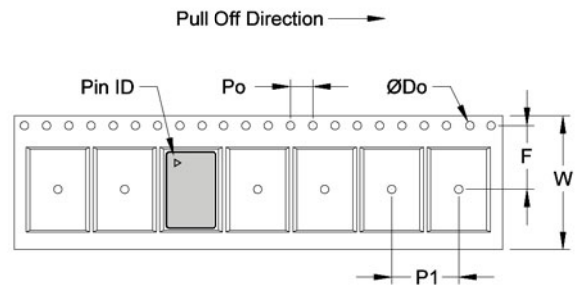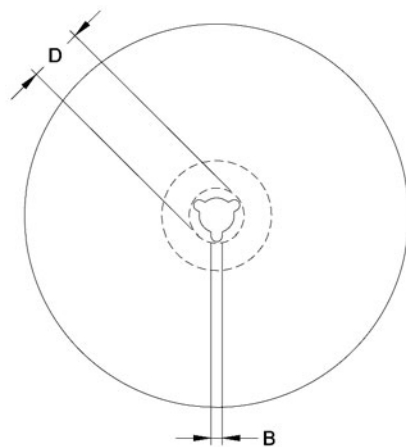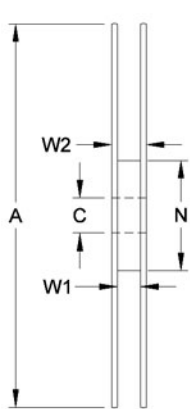
Tape Dimensions (mm)					Reel Dimensions (mm)							
Dimension	**W**	**F**	**Do**	**Po**	**P1**	**A**	**B**	**C**	**D**	**N**	**W1**	**W2**	**# Per Reel**
Tolerance	**Typ**	**Typ**	**Typ**	**Typ**	**Typ**	**Typ**	**Min**	**Typ**	**Min**	**Min**	**Typ**	**Max**	
PX-721	16	7.5	1.5	4	8	178	1.5	13	20.2	50	16.4	22.4	200

Rev2: 14 November 2012

Standard Frequency Table

Standard Factory Configurable Frequencies (MHz)					
18.7500000	39.0625000	73.7280000	173.370748	622.080000	781.250000
19.2000000	39.3216000	74.1250000	173.437500	624.693800	796.875000
19.3926580	39.8437500	74.1758000	176.838175	624.704800	800.000000
19.4400000	40.0000000	74.2500000	182.016000	625.000000	805.664100
19.5312500	40.2830630	75.0000000	182.857142	627.329600	809.063500
19.6608000	40.9600000	76.8000000	184.000000	629.987800	819.200000
19.6989680	41.0888870	77.7600000	184.320000	637.500000	821.777300
19.7190000	41.6571440	78.0000000	187.500000	640.000000	850.000000
19.9218750	41.6600000	78.1250000	195.000000	644.531250	983.400000
20.0000000	41.8329130	78.6432000	200.000000	645.120000	1,000.0000
20.1416000	42.0000000	79.6875000	200.192000	647.239400	
20.4800000	42.0101690	80.0000000	201.416020	647.250800	Recent Adds:
20.5444340	42.5000000	80.5664130	212.500000	649.970300	174.703083
20.7135000	42.6600000	82.1777380	219.429571	657.421875	175.000000
20.8285720	44.2095440	82.9440000	240.000000	665.625600	698.812330
20.8286000	44.4343000	83.3142880	243.000000	666.514286	
20.9165460	44.6218000	83.6658250	245.760000	669.128100	
21.0050840	44.7360000	84.0203380	250.000000	669.326582	
22.0000000	44.9280000	86.6853740	252.571428	669.642900	
22.1047720	45.1584000	88.4190880	256.000000	670.838600	
22.2171000	45.8240000	95.7000000	262.144000	672.000000	
22.5792000	46.0379460	97.5000000	292.571429	672.156250	
24.0000000	46.7200000	100.000000	300.000000	672.162712	
24.5760000	46.8750000	105.000000	307.200000	673.456600	
24.7040000	48.0000000	106.250000	311.040000	684.255400	
25.0000000	49.1520000	108.000000	312.500000	687.700000	
25.1658000	49.4080000	110.000000	318.750000	690.569196	
25.6000000	50.0000000	112.000000	320.000000	693.468750	
25.9200000	50.0480000	114.000000	322.265650	693.482991	
26.0000000	51.2000000	120.000000	328.710950	693.750000	
27.0000000	51.8400000	122.880000	333.257150	696.390625	
27.6480000	52.0000000	124.416000	334.663300	696.421478	
28.7040000	53.3300000	125.000000	336.081350	696.421875	
29.4912000	54.7460000	130.000000	353.676350	704.380600	
29.5000000	55.0000000	131.072000	368.640000	707.352700	
30.0000000	60.0000000	139.264000	375.000000	707.500000	
30.7200000	61.3800000	150.000000	382.800000	710.948600	
30.8800000	61.4400000	150.144000	400.000000	712.520000	
31.2500000	62.2080000	153.600000	409.600000	716.573200	
32.0000000	62.5000000	155.520000	491.520000	718.750000	
32.7680000	62.9145000	156.250000	500.000000	719.734400	
33.0000000	63.3600000	159.375000	505.000000	737.280000	
33.3330000	63.8976000	160.000000	531.000000	739.200000	
34.3680000	64.0000000	161.132813	531.250000	742.500000	
34.5600000	64.1520000	164.355475	568.928600	748.070900	
36.8640000	65.5360000	166.628572	569.196400	750.000000	
37.0560000	66.0000000	167.331646	588.000000	768.000000	
37.1250000	70.0000000	168.040678	595.056000	777.600000	
37.5000000	70.6560000	170.000000	600.000000	779.568600	
38.8800000	71.6100000	172.500000	614.400000	780.881000	

Rev2: 14 November 2012

Ordering Information

PX - 721 - E C E - H C A A - xxxMxxxxxxx

Product Family
PX: XO

Package
721: 5 x 7 x 1.8 mm

Supply
E: 3.3 V
H: 2.5 V

Output
A: LVCMOS
C: LVPECL
D: LVDS

Operating Temperature
T: 0/70°C
J: -20/70°C
E: -40/85 °C

Example: PX-721-HDJ-HABA-156M250000

Frequency
10M0000000 - 1200M00000

Performance Option (Future)
N: N/A
A: < 500 fs-rms Jitter

Output Enable Pin
A: Pin 1
B: Pin 2

Enable/Disable
A: Enable High
C: Enable Low

Stability
E: ±20ppm
G: ±30ppm
H: ±32ppm
K: ±50ppm
S: ±100ppm

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
1589 Century Avenue, the 19th Floor
Chamtime International Financial Center
Shanghai, China
Tel: 86.21.6081.2888
Fax: 86.21.6163.3598

Disclaimer