# Low Phase Noise XO (for 3rd O.T.) For 65-130MHz

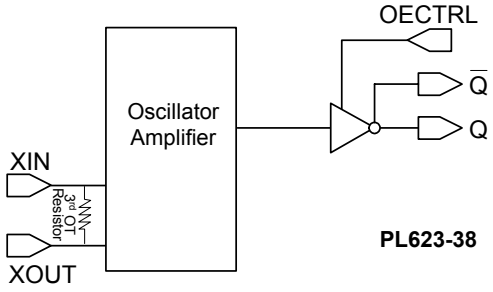
## FEATURES

- Input: 65-130MHz 3rd Overtone or fundamental Crystal
- Output frequency: Up to 130MHz
- Selectable /2, /4, /8 output dividers with 60KΩ pull up resistor on the selector pins
- Available output: PECL
- Supports 2.5V or 3.3V-Power Supply
- Available in die form

## DESCRIPTION

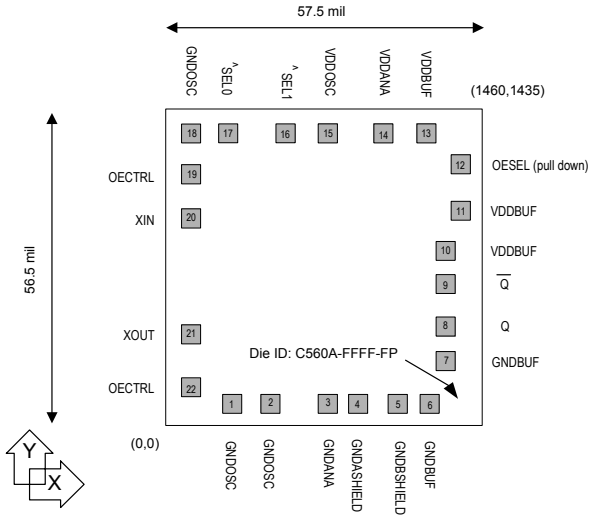
PL623-38 is an XO IC specifically designed to work with high frequency 3rd overtone or fundamental crystals from 65MHz to 135MHz. It requires an external resistor for the 3rd overtone selection. Its design was optimized to tolerate higher limits of inter-electrodes capacitance and bonding capacitance to improve yield. It achieves very low current into the crystal resulting in better overall stability. It is ideal for XO applications requiring PECL output levels at high frequencies.

## BLOCK DIAGRAM




**PL623-38**

## DIE CONFIGURATION




Note: '^' Denotes 60kΩ pull-up resistor

## DIE SPECIFICATIONS

| Name | Value |
|---|---|
| Size | 57.5 x 56.5 mil |
| Reverse side | GND |
| Pad dimensions | 80 micron x 80 micron |
| Thickness | 10 mil |

## OE SELECTION

| Pad #12 OESEL | Pad #22 OECTRL | State |
|---|---|---|
| 1 | 0 | Tri-state |
| | 1 | Output enabled (default) |
| 0 (default) | 0 | Output enabled (default) |
| | 1 | Tri-state |

Pad #12: Bond to VDD to set to "1"
Pad #22: Logical states defined by PECL levels

## OUTPUT DIVIDER SELECTOR LOGIC

| SEL 0 | SEL1 | Output |
|---|---|---|
| 0 | 0 | No Divider |
| 1 | 0 | Divide by 2 |
| 0 | 1 | Divide by 4 |
| 1 | 1 | Divide by 8 |

## DIE PAD ASSIGNMENT

| Pad # | Name | X (μm) | Y (μm) | Pad Description |
|---|---|---|---|---|
| 1 | GNDOSC | 329.6 | 110.1 | GND connection for oscillator circuitry. |
| 2 | GNDOSC | 498.3 | 110.0 | GND connection for oscillator circuitry. |
| 3 | GNDANA | 696.2 | 110.0 | GND connection for analog circuitry. |
| 4 | GNDSHIELD | 825.0 | 110.0 | GND shielding connection. |
| 5 | GNDSHIELD | 973.6 | 110.0 | GND shielding connection. |
| 6 | GNDBUF | 1150.0 | 109.1 | GND connection for output buffer circuitry. |
| 7 | GNDBUF | 1183.6 | 302.2 | GND connection for output buffer circuitry. |
| 8 | Q | 1183.6 | 452.3 | PECL output. |
| 9 | QBAR | 1183.6 | 613.5 | Complementary PECL output. |
| 10 | VDDBUF | 1182.4 | 745.9 | VDD connection for output buffer circuitry. VDDBUF should be separately decoupled from other VDDs whenever possible. |
| 11 | VDDBUF | 1252.4 | 903.6 | VDD connection for output buffer circuitry. VDDBUF should be separately decoupled from other VDDs whenever possible. |
| 12 | OESEL | 1252.4 | 1081.3 | This is the selector input to choose the OE control logic to be applied, as presented on the OE SELECTION TABLE on page '1'. |
| 13 | VDDBUF | 1058.5 | 1221.6 | VDD connection for output buffer circuitry. VDDBUF should be separately decoupled from other VDDs whenever possible. |
| 14 | VDDANA | 864.5 | 1221.6 | VDD connection for analog circuitry. VDDANA should be separately decoupled from other VDDs whenever possible. |
| 15 | VDDOSC | 624.0 | 1222.7 | VDD connection for oscillator circuitry. VDDOSC should be separately decoupled from other VDDs whenever possible. |
| 16 | SEL1 | 467.1 | 1222.6 | Output Divider Selector pin as presented on the DIVIDER SELECTOR TABLE on page '1'. |
| 17 | SEL0 | 271.1 | 1222.6 | Output Divider Selector pin as presented on the DIVIDER SELECTOR TABLE on page '1'. |
| 18 | GNDOSC | 109.4 | 1222.9 | GND connection for oscillator circuitry. |
| 19 | OECTRL | 108.9 | 1062.1 | Output Enable input pad. See OE SELECTION TABLE on page 1. |
| 20 | XIN | 109.0 | 865.8 | Crystal connector pad. This pad is the input of the crystal oscillator circuitry. The crystal should be mounted as close to the IC as possible, with minimum parasitic capacitance. |
| 21 | XOUT | 108.6 | 358.4 | Crystal connector pad. This pad is the input of the crystal oscillator circuitry. The crystal should be mounted as close to the IC as possible, with minimum parasitic capacitance. |
| 22 | OECTRL | 108.6 | 146.5 | Output Enable input pad. See OE SELECTION TABLE on page 1. |

## EXTERNAL COMPONENT VALUES – 3RD OVERTONE RESISTOR SELECTIONS

This resistor is only required when a third overtone crystal is used. The chart below indicates the calculated and the nearest "E12" resistor values versus frequency for PL623-38.

| Frequency (MHz) | R3OT (Ω) | E12 Pick KΩ |
|---|---|---|
| 65 | 2,162 | 2.2 |
| 67.5 | 2,082 | 2.2 |
| 70 | 2,008 | 2.2 |
| 75 | 1,875 | 1.8 |
| 77.5 | 1,815 | 1.8 |
| 80 | 1,758 | 1.8 |
| 82.5 | 1,705 | 1.8 |
| 85 | 1,654 | 1.8 |
| 87.5 | 1,607 | 1.5 |
| 90 | 1,563 | 1.5 |
| 92.5 | 1,520 | 1.5 |
| 95 | 1,480 | 1.5 |
| 97.5 | 1,442 | 1.5 |

| Frequency (MHz) | R3OT (Ω) | E12 Pick KΩ |
|---|---|---|
| 100 | 1,406 | 1.5 |
| 102.5 | 1,372 | 1.5 |
| 105 | 1,339 | 1.2 |
| 107.5 | 1,308 | 1.2 |
| 110 | 1,278 | 1.2 |
| 112.5 | 1,250 | 1.2 |
| 115 | 1,223 | 1.2 |
| 117.5 | 1,197 | 1.2 |
| 120 | 1,172 | 1.2 |
| 122.5 | 1,148 | 1.2 |
| 125 | 1,125 | 1.2 |
| 127.5 | 1,103 | 1.2 |
| 130 | 1,082 | 1.0 |

## ELECTRICAL SPECIFICATIONS

### 1. Absolute Maximum Ratings

| PARAMETERS | SYMBOL | MIN. | MAX. | UNITS |
|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | | 4.6 | V |
| Input Voltage, dc | $V_I$ | $V_{SS}$-0.5 | $V_{DD}$+0.5 | V |
| Output Voltage, dc | $V_O$ | $V_{SS}$-0.5 | $V_{DD}$+0.5 | V |
| Storage Temperature | $T_S$ | -65 | 150 | °C |
| Ambient Operating Temperature | $T_A$ | -40 | +85 | °C |
| Input Static Discharge Voltage Protection | | | 2 | kV |

Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied.

## 2. Crystal Specifications

| Name | Symbol | Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|
| Parallel Resonant mode | | 3rd Overtone | | | N/A |
| Load capacitance (capacitance on built-in on die seen by crystal) | $C_L$ | Die only, no bond wire, no package | | 5 | pF |
| Inter-electrode capacitance | $C_0$ | | | 4 | pF |
| Equivalent Series Resistance | ESR | | | 35 | Ω |
| Oscillation Frequency | | 3rd Overtone | 65 | 130 | MHz |

## 3. General Electrical Specifications

| PARAMETERS | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Supply Current (Loaded Outputs) | $I_{DD}$ | PECL | | | 85/55 | mA |
| Operating Voltage | $V_{DD}$ | | 2.25 | | 3.63 | V |
| Output Clock Duty Cycle | | @ Vdd – 1.3V (PECL) | 45 | 50 | 55 | % |
| Short Circuit Current | | | | ±50 | | mA |

## 4. Jitter Specifications

| PARAMETERS | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|
| Period jitter RMS at 106.25MHz | With capacitive decoupling between VDD and GND. | | 2.0 | | ps |
| Period jitter peak-to-peak at 106.25MHz | | | 17.0 | | |
| Integrated jitter RMS at 106.25MHz | Integrated 12 kHz to 20 MHz | | 0.3* | | ps |

*Measured on Agilent E5500.

## 5. Phase Noise Specifications

| PARAMETERS | FREQUENCY | @10Hz | @100Hz | @1kHz | @10kHz | @100kHz | UNITS |
|---|---|---|---|---|---|---|---|
| Phase Noise vs. carrier with fund. crystal. | 106.25MHz | -55 | -90 | -110 | -135 | -145 | dBc/Hz |

*: Note: Phase noise to be measured. Based on P520-20 product (fundamental 155MHz VCXO).

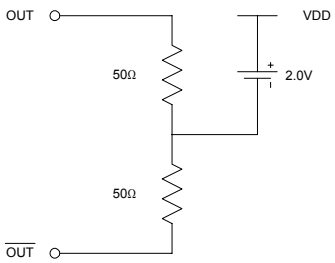
## 8. PECL Electrical Characteristics

| PARAMETERS | SYMBOL | CONDITIONS | MIN. | MAX. | UNITS |
|---|---|---|---|---|---|
| Output High Voltage | $V_{OH}$ | $R_L$ = 50 Ω to ($V_{DD}$ – 2V) (see figure) | $V_{DD}$ – 1.025 | | V |
| Output Low Voltage | $V_{OL}$ | | | $V_{DD}$ – 1.620 | V |

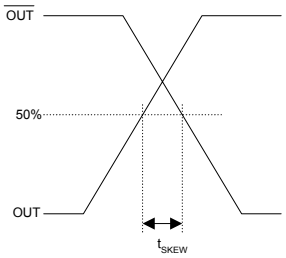
## 9. PECL Switching Characteristics

| PARAMETERS | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Clock Rise Time | $t_r$ | @20/80% - PECL | | 0.2 | 0.4 | ns |
| Clock Fall Time | $t_f$ | @80/20% - PECL | | 0.2 | 0.4 | ns |

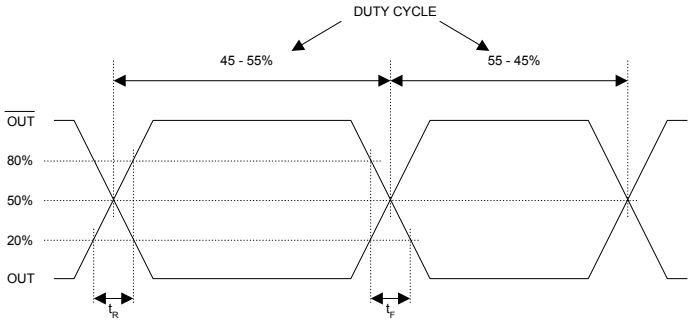
PECL Levels Test Circuit




PECL Output Skew



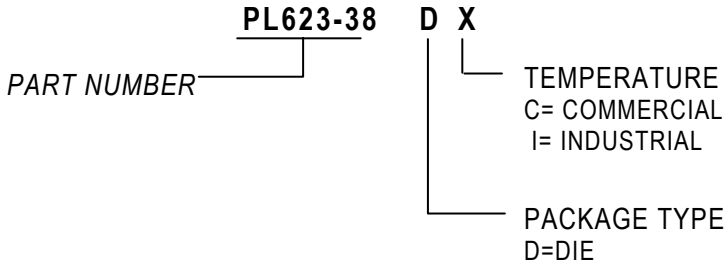

PECL Transistion Time Waveform



## ORDERING INFORMATION

***For part ordering, please contact our Sales Department:***
47745 Fremont Blvd., Fremont, CA 94538, USA
Tel: (510) 492-0990 Fax: (510) 492-0991

***PART NUMBER***
The order number for this device is a combination of the following:
Device number, Package type and Operating temperature range




| Order Number | Marking | Package Option |
|---|---|---|
| PL623-38DC | P623-38 | Waffle Pack |