



## Features

- 2.97 to 3.63V operating supply voltage range
- Operating frequency range(varies with version)  
Input: 20~40MHz fundamental oscillation  
21.25M/24M/25M/27M/37.125MHz  
Output:  
212.5MHz @21.25MHz XTAL  
300MHz @24MHz XTAL  
100M/125M/156.25M/150M/200M/250M/  
312.5M/625MHz @25MHz XTAL  
162MHz@27MHz XTAL  
74.25M/148.5MHz@37.125MHz XTAL
- Operating Temperature Range: -40 to +125°C
- Differential LVDS/LVPECL output
- Standby function
- Power-saving pull-up resistor built-in (Pin OE)
- Die form and wafer form
- AEC-Q100 qualified. PPAP capable, and manufactured in IATF 16949 certified facilities.

## Applications

- Used for crystal oscillator
- Used for 7050/5032/3225 Package

## Description

The XO5090-V series are multiple frequency differential LVDS/LVPECL output oscillator ICs. They support 20MHz to 40MHz fundamental oscillator. The devices use the Dividers to generate multiple division frequencies from the fundamental frequency, and then multiplies the division signal to the desired frequency Clock based on different multiples.

The XO5090-V series can be used to construct high-frequency LVDS/LVPECL output oscillators.

## Ordering Information

| Part no.     | Package type |
|--------------|--------------|
| XO5090-xDE-V | Die form     |
| XO5090-xWF-V | Wafer form   |

### Note:

1. “-x” shows the die thickness.” “-3” Stand for thickness 130+/- 15um
2. “DE” stands for chip form, “WF” stands for Wafer form



## Block Diagram

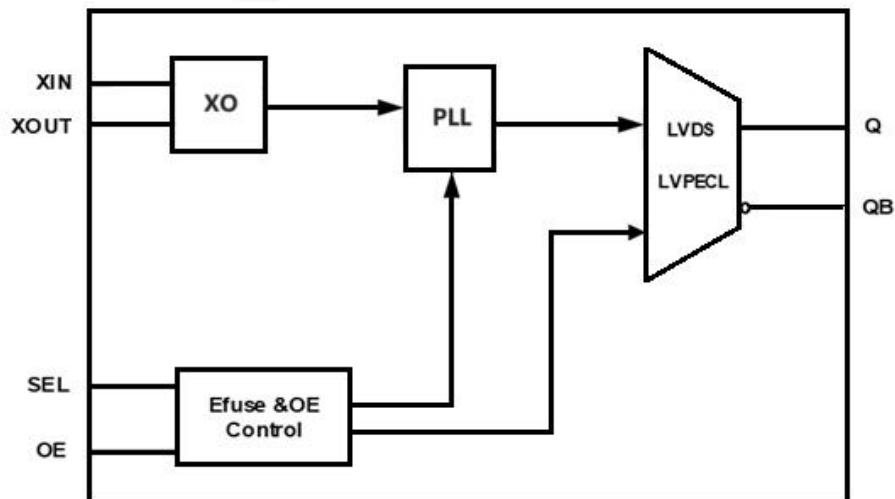


Figure 1 XO5090-V Block Diagram

## Oscillator circuit constant

The XO5090-V series oscillator setting varies with device version to optimize characteristics over the recommended operating frequency range.

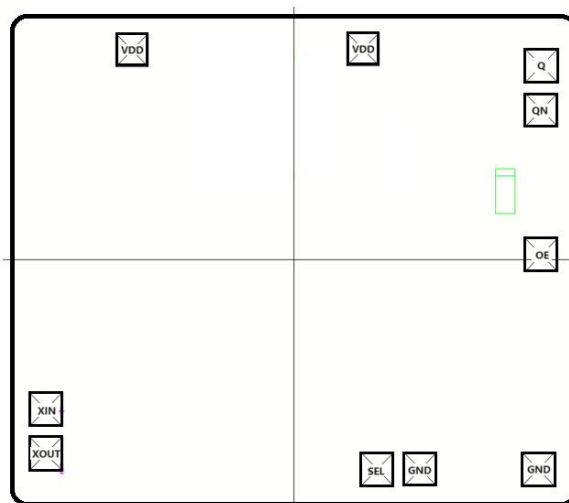
| Part Name | Operating Voltage | $f_{in}^{*1}$ | $f_{output}$ Range                      |
|-----------|-------------------|---------------|-----------------------------------------|
| XO5090-V  | 3.3V              | 21.25MHz      | 212.5MHz                                |
|           |                   | 24MHz         | 300MHz                                  |
|           |                   | 25MHz         | 100/125/150/156.25/200/250/312.5/625MHz |
|           |                   | 27MHz         | 162MHz                                  |
|           |                   | 37.125MHz     | 74.25/148.5MHz                          |

### Note:

\*1: The recommended operating frequency is a yardstick value derived from the crystal used for RSM characteristics authentication. However, the oscillator frequency band is not guaranteed specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.



## Pad Configuration



**Figure 2** XO5090-V Pad Location

| Pad Coordinate File                                                      |              |              |                 |              |              |
|--------------------------------------------------------------------------|--------------|--------------|-----------------|--------------|--------------|
| Pad Name                                                                 | X Coordinate | Y Coordinate | Pad Name        | X Coordinate | Y Coordinate |
| X <sub>IN</sub>                                                          | -458.320     | -269.995     | OE              | 458.320      | 8.910        |
| X <sub>OUT</sub>                                                         | -458.320     | -349.995     | QN              | 458.320      | 270.000      |
| SEL                                                                      | 154.835      | -378.320     | Q               | 458.320      | 350.000      |
| GND                                                                      | 234.835      | -378.320     | V <sub>DD</sub> | 128.180      | 378.320      |
| GND                                                                      | 452.155      | -378.320     | V <sub>DD</sub> | -298.925     | 378.320      |
| <b>Note:</b> Substrate is connected to GND or floating.                  |              |              |                 |              |              |
| <b>Die Size:</b> 1040um*880um (Not-Including scribe line ize:60um*60um.) |              |              |                 |              |              |
| <b>Pad Size:</b> 60um*60um                                               |              |              |                 |              |              |

## Pad Description

| Pin Name         | Type | Description                                                                                                                        |
|------------------|------|------------------------------------------------------------------------------------------------------------------------------------|
| V <sub>DD</sub>  | P    | Supply voltage.                                                                                                                    |
| X <sub>IN</sub>  | I    | Oscillator input pin.                                                                                                              |
| X <sub>OUT</sub> | O    | Oscillator output pin.                                                                                                             |
| OE               | I    | Output enable pin. Outputs are high impedance when LOW (oscillator stopped). Power-saving pull-up resistor built-in. Tri-state pin |
| SEL              | I    | Efuse control pin. Normal work status when LOW and Efuse trimming mode when HIGH Pull-down resistor built-in. Tri-state pin        |
| GND              | P    | Ground (-).                                                                                                                        |
| QN               | O    | Output pin (complementary).                                                                                                        |
| Q                | O    | Output pin (true).                                                                                                                 |



## Mode selection

| SEL | OE      | MODE                |
|-----|---------|---------------------|
| 0   | 0/1     | Normal              |
| M   | 1       | Calibration         |
| M   | M       | Bypass xo to output |
| 1   | Data in | Efuse trimming      |

## Function Description

### Standby Function

When OE goes LOW, the oscillator stops and the output pins (Q, QN) become high impedance.

| OE             | Q/QN           | Oscillator       |
|----------------|----------------|------------------|
| HIGH (or open) | f0             | Normal operation |
| LOW            | High impedance | Stopped          |

### Power-saving Pull-up Resistor

The OE pin pull-up resistance changes in response to the input level (HIGH or LOW). When OE is tied LOW (standby state), the pull-up resistance becomes large, reducing the current consumed by the resistance. When OE is open circuit, the pull-up resistance becomes small, decreasing the susceptibility to the effects of external noise.



## Absolute Maximum Ratings

Storage Temperature .....-55°C to +150°C  
Supply Voltage range.....-0.5V to +4.0V  
Input voltage range.....GND-0.5V to VDD +0.5V  
Output voltage range .....GND-0.5V to VDD +0.5V

### Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## Recommended Operating Conditions

| Symbol           | Parameter             | Conditions | MIN   | TYP | MAX             | Unit |
|------------------|-----------------------|------------|-------|-----|-----------------|------|
| V <sub>DD</sub>  | Supply voltage        | -          | 2.97  | -   | 3.63            | V    |
| V <sub>IN</sub>  | Input voltage         | -          | GND   | -   | V <sub>DD</sub> | V    |
| T <sub>A</sub>   | Operating temperature |            | -40   | +25 | +125            | °C   |
| R <sub>L</sub>   | Output load           | LVPECL     | 49.5  | 50  | 50.5            | Ω    |
|                  |                       | LVDS       | 99    | 100 | 101             | Ω    |
| F <sub>IN</sub>  | Input frequency       |            | 20    | -   | 40              | MHz  |
| F <sub>OUT</sub> | Output frequency      | -          | 74.25 | -   | 625             | MHz  |



## DC Electrical Characteristics

**LVPECL Output 3.3V operation** ( $V_{DD} = 2.97$  to  $3.63V$ ,  $T_A = -40$  to  $+125^\circ C$ ,  $GND = 0V$ , unless otherwise noted.)

| Symbol    | Parameter                  | Conditions                                                 | MIN          | TYP         | MAX          | Unit       |
|-----------|----------------------------|------------------------------------------------------------|--------------|-------------|--------------|------------|
| $I_{EE1}$ | Current consumption1       | Measurement cct.A1, OE=Open or High                        | -            | 70          | 90           | mA         |
| $I_{EE2}$ | Current consumption2       | Measurement cct.A1, OE=LOW                                 | -            | 50          | 70           | mA         |
| $V_{OH}$  | HIGH-level output voltage  | Measurement cct.A2, $V_{DD}=3.3V$ ,<br>OE=open, Q, QN pins | $V_{DD}-1.4$ | -           | $V_{DD}-0.8$ | V          |
| $V_{OL}$  | LOW-level output voltage   |                                                            | $V_{DD}-2$   | -           | $V_{DD}-1.6$ | V          |
| $I_Z$     | Output leakage current     | Measurement cct.A3, OE=LOW, Q/QN pin                       | -            | -           | 10           | $\mu A$    |
| $V_{IH}$  | HIGH-level input voltage   | Measurement cct.A1, OE pin                                 | 2            | -           | $V_{DD}$     | V          |
|           |                            | Measurement cct.A1, SEL pin                                | $V_{DD}-0.7$ | -           | $V_{DD}$     | V          |
| $V_{IL}$  | LOW-level input voltage    | Measurement cct.A1, OE/SEL pin                             | 0            | -           | 0.8          | V          |
|           |                            | Measurement cct.A1, OE/SEL pin                             | 0            | -           | 0.7          | V          |
| $V_{IM}$  | Middle-level input voltage | Measurement cct.A1, OE/SEL pin                             | -            | $1/2V_{DD}$ | -            | V          |
| $I_{IH}$  | HIGH-level input current   | Measurement cct.A1, $V_{IH}=V_{DD}$ , OE/SEL pin           | -            | 30          | -            | $\mu A$    |
| $I_{IL}$  | LOW-level input current1   | Measurement cct.A1, $V_{IL}=0V$ , OE/SEL pin               | -            | 30          | -            | $\mu A$    |
| $R_f$     | Feedback resistance        |                                                            | 80           |             | 120          | K $\Omega$ |

**LVDS Output 3.3V operation** ( $V_{DD} = 2.97$  to  $3.63V$ ,  $T_A = -40$  to  $+125^\circ C$ ,  $GND = 0V$ , unless otherwise noted.)

| Symbol    | Parameter                  | Conditions                                                 | MIN          | TYP         | MAX      | Unit       |
|-----------|----------------------------|------------------------------------------------------------|--------------|-------------|----------|------------|
| $I_{EE1}$ | Current consumption1       | Measurement cct.B1, OE=Open or High                        | -            | 70          | 90       | mA         |
| $I_{EE2}$ | Current consumption2       | Measurement cct.B1, OE=LOW                                 | -            | 50          | 70       | mA         |
| $V_{OH}$  | HIGH-level output voltage  | Measurement cct.B2, $V_{DD}=3.3V$ ,<br>OE=open, Q, QN pins |              | 1.4         |          | V          |
| $V_{OL}$  | LOW-level output voltage   |                                                            |              | 1.0         |          | V          |
| $I_Z$     | Output leakage current     | Measurement cct.B3, OE=LOW, Q/QN pin                       | -            | -           | 10       | $\mu A$    |
| $V_{IH}$  | HIGH-level input voltage   | Measurement cct.B1, OE pin                                 | 2            | -           | $V_{DD}$ | V          |
|           |                            | Measurement cct.B1, SEL pin                                | $V_{DD}-0.7$ | -           | $V_{DD}$ | V          |
| $V_{IL}$  | LOW-level input voltage    | Measurement cct.B1, OE pin                                 | 0            | -           | 0.8      | V          |
|           |                            | Measurement cct.B1, SEL pin                                | 0            | -           | 0.7      | V          |
| $V_{IM}$  | Middle-level input voltage | Measurement cct.B1, OE/SEL pin                             | -            | $1/2V_{DD}$ | -        | V          |
| $I_{IH}$  | HIGH-level input current   | Measurement cct.B1, $V_{IH}=V_{DD}$ , OE/SEL pin           | -            | 30          | -        | $\mu A$    |
| $I_{IL}$  | LOW-level input current1   | Measurement cct.A1, $V_{IL}=0V$ , OE/SEL pin               | -            | 30          | -        | $\mu A$    |
| $R_f$     | Feedback resistance        |                                                            | 80           |             | 120      | K $\Omega$ |



## AC Electrical Characteristics

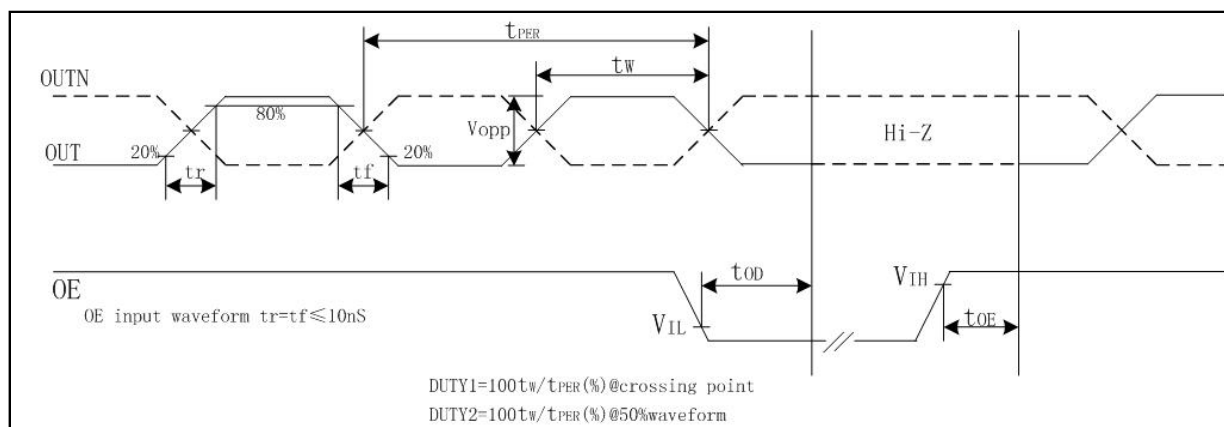
**LVPECL Output 3.3V operation** ( $V_{DD} = 2.97$  to  $3.63V$ ,  $T_A = -40$  to  $+125^\circ C$ ,  $GND = 0V$ , unless otherwise noted.)

| Symbol           | Parameter                        | Conditions                                                                         | MIN | TYP | MAX | Unit |
|------------------|----------------------------------|------------------------------------------------------------------------------------|-----|-----|-----|------|
| Duty             | Output duty cycle                | Measurement cct.A4, measured at 50% output swing, $T_A=25^\circ C$ , $V_{DD}=3.3V$ | 45  | -   | 55  | %    |
| V <sub>opp</sub> | Output swing                     | Measurement cct.A4, Peak to Peak of single output wave                             | 0.6 | -   | 1   | V    |
| T <sub>R</sub>   | Output rise time                 | Measurement cct.A4, 20 to 80% output swing                                         | -   | 0.2 | 0.4 | ns   |
| T <sub>F</sub>   | Output fall time                 | Measurement cct.A4, 80 to 20% output swing                                         | -   | 0.2 | 0.4 | ns   |
| T <sub>OE</sub>  | Output enable time <sup>*1</sup> | Measurement cct.A5, $T_A=25^\circ C$                                               | -   | -   | 5   | us   |
| T <sub>OD</sub>  | Output disable time              | Measurement cct.A5, $T_A=25^\circ C$                                               | -   | -   | 200 | ns   |
| Jitter           | RMS Phase Jitter                 | 100MHz@12K~20M, $T_A=25^\circ C$                                                   | -   | 0.3 | 0.5 | ps   |

**LVDS Output 3.3V operation** ( $V_{DD} = 2.97$  to  $3.63V$ ,  $T_A = -40$  to  $+125^\circ C$ ,  $GND = 0V$ , unless otherwise noted.)

| Symbol           | Parameter                        | Conditions                                                                         | MIN | TYP | MAX | Unit |
|------------------|----------------------------------|------------------------------------------------------------------------------------|-----|-----|-----|------|
| Duty             | Output duty cycle                | Measurement cct.B4, measured at 50% output swing, $T_A=25^\circ C$ , $V_{DD}=3.3V$ | 45  | -   | 55  | %    |
| V <sub>opp</sub> | Output swing                     | Measurement cct.B4, Peak to Peak of single output wave                             | -   | 0.4 | -   | V    |
| T <sub>R</sub>   | Output rise time                 | Measurement cct.B4, 20 to 80% output swing                                         | -   | 0.2 | 0.4 | ns   |
| T <sub>F</sub>   | Output fall time                 | Measurement cct.B4, 80 to 20% output swing                                         | -   | 0.2 | 0.4 | ns   |
| T <sub>OE</sub>  | Output enable time <sup>*1</sup> | Measurement cct.B5, $T_A=25^\circ C$                                               | -   | -   | 5   | us   |
| T <sub>OD</sub>  | Output disable time              | Measurement cct.B5, $T_A=25^\circ C$                                               | -   | -   | 200 | ns   |
| Jitter           | RMS Phase Jitter                 | 100MHz@12K~20M, $T_A=25^\circ C$                                                   | -   | 0.3 | 0.5 | ps   |

## Timing chart



**Figure 3** Timing chart

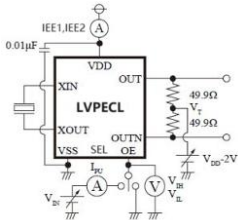


## Measurement Information

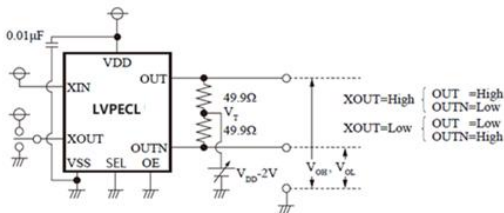
### Measurement Circuit: LVPECL

Measurement Circuit A1:

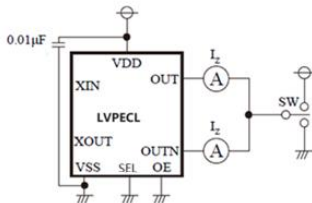
$I_{EE1}$ ,  $I_{EE2}$ ,  $V_{IH}$ ,  $V_{IL}$ ,  $V_{IM}$ ,  $I_{IH}$ ,  $I_{IL}$



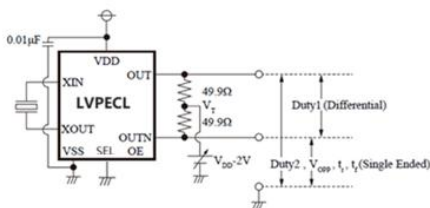
Measurement Circuit A2:  $V_{OL}$ ,  $V_{OH}$



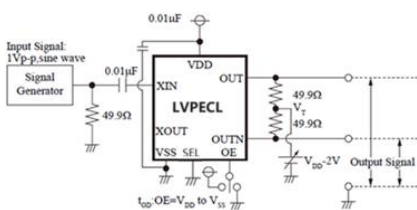
Measurement Circuit A3:  $I_Z$



Measurement Circuit A4: Duty,  $V_{OPP}$ ,  $T_R$ ,  $T_F$



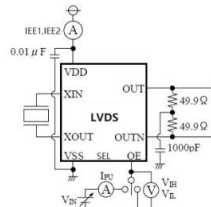
Measurement Circuit A5:  $T_{OE}$ ,  $T_{OD}$



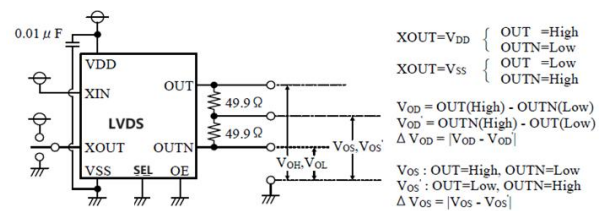
### Measurement Circuit: LVDS

Measurement Circuit B1:

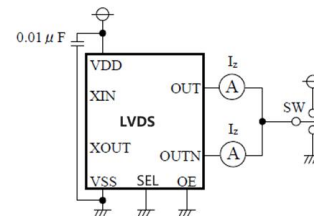
$I_{EE1}$ ,  $I_{EE2}$ ,  $V_{IH}$ ,  $V_{IL}$ ,  $V_{IM}$ ,  $I_{IH}$ ,  $I_{IL}$



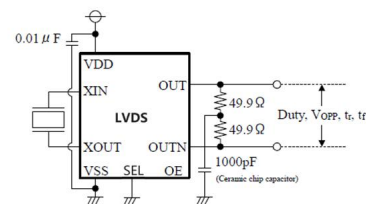
Measurement Circuit B2:  $V_{OL}$ ,  $V_{OH}$



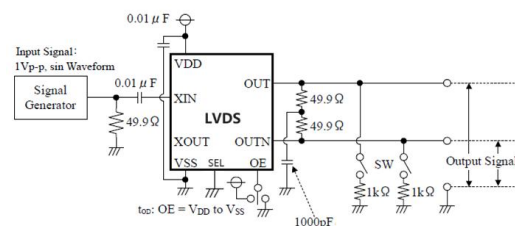
Measurement Circuit B3:  $I_Z$



Measurement Circuit B4: Duty,  $V_{OPP}$ ,  $T_R$ ,  $T_F$



Measurement Circuit B5:  $T_{OE}$ ,  $T_{OD}$





## Revision History

| Revision | Description      | Date       |
|----------|------------------|------------|
| V1.0     | Official release | 2025/12/16 |