



## Features

- 2.97 to 3.63V operating supply voltage range
- Operating frequency range(varies with version)  
**Input:** 20~40MHz fundamental oscillation  
21.25M/25M/27M/37.125MHz  
**Output:**  
212.5MHz @21.25MHz 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-Q 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 multiples the division signal to the desired frequency Clock based on different multiples.

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

## Ordering Information

Part no.	Package type
XO5090-xDE-Q	Die form
XO5090-xWF-Q	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

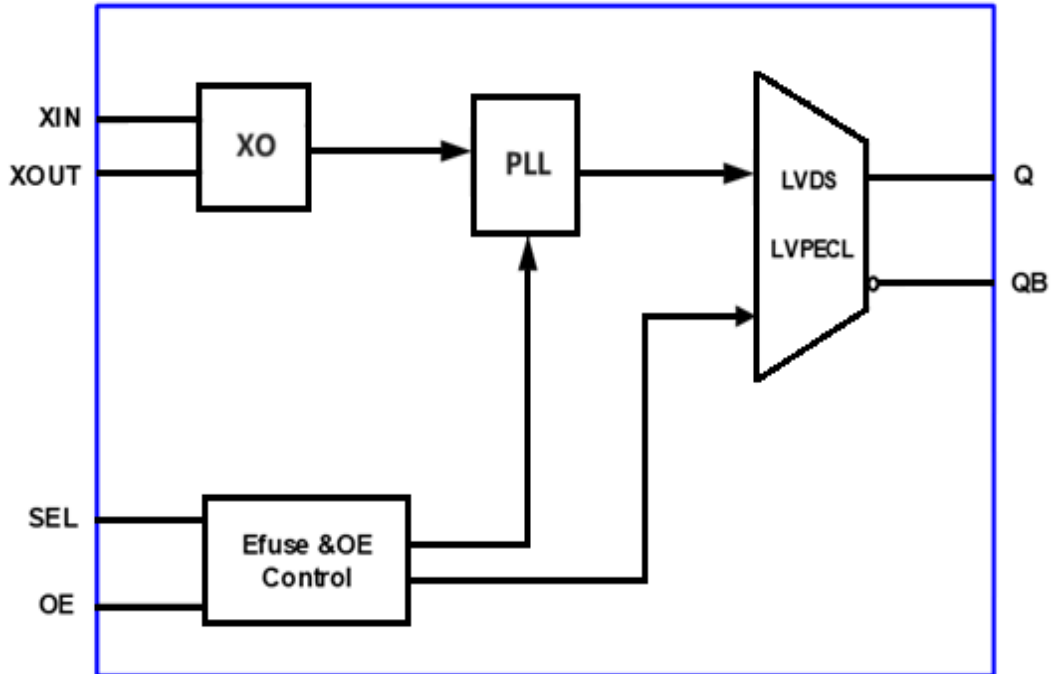


Figure 1 XO5090-Q Block Diagram

## Oscillator circuit constant

The XO5090-Q 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	3.3V	21.25MHz	212.5MHz
		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

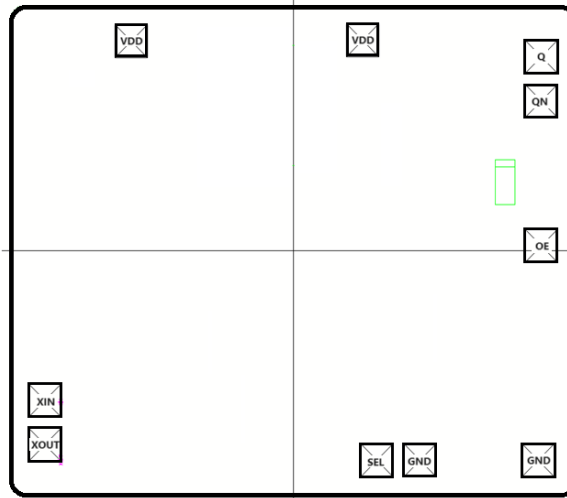


Figure 2 XO5090-Q Pad Location

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

**Note:** Substrate is connected to GND or floating.

**Die Size:** 1040um\*880um (Not-Including scribe line ize:60um\*60um.)  
**Pad Size:** 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 V <sub>DD</sub> +0.5V
Output voltage range .....	GND-0.5V to V <sub>DD</sub> +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, $V_{DD}=3.3V$ , 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, $V_{DD}=3.3V$ , OE=open, Q, QN pins		1.4		V
$V_{OL}$	LOW-level output voltage				1.0	
$I_Z$	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

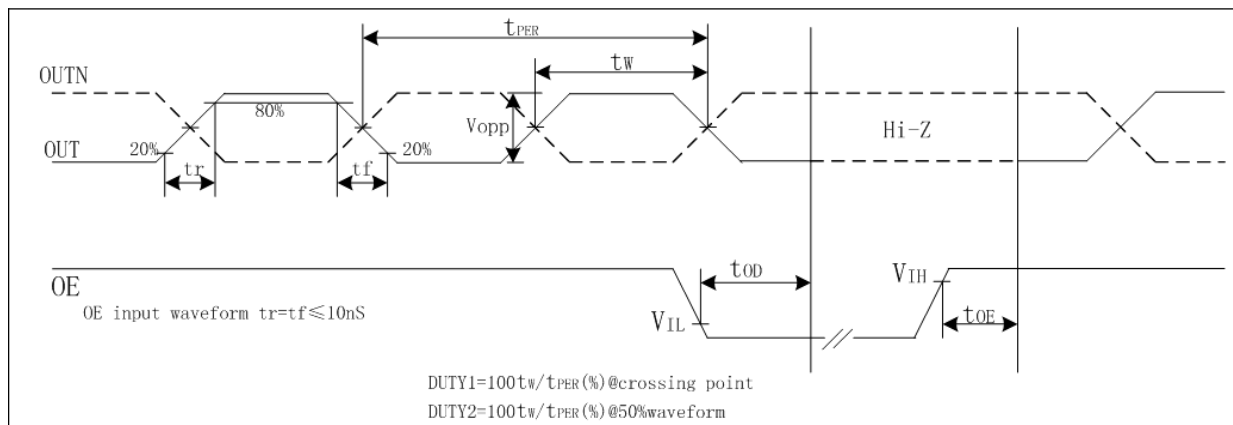
**LVPECL Output 3.3V operation** ( $V_{DD} = 2.97$  to  $3.63V$ ,  $T_A = -40$  to  $+125^\circ C$ ,  $GND = 0V$ , unless otherwise noted.)

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	%
Vopp	Output swing	Measurement cct.A4, Peak to Peak of single output wave	0.6	-	1	V
TR	Output rise time	Measurement cct.A4, 20 to 80% output swing	-	0.2	0.4	ns
TF	Output fall time	Measurement cct.A4, 80 to 20% output swing	-	0.2	0.4	ns
TOE	Output enable time <sup>*1</sup>	Measurement cct.A5, $T_A=25^\circ C$	-	-	5	us
TOD	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	%
Vopp	Output swing	Measurement cct.B4, Peak to Peak of single output wave	-	0.4	-	V
TR	Output rise time	Measurement cct.B4, 20 to 80% output swing	-	0.2	0.4	ns
TF	Output fall time	Measurement cct.B4, 80 to 20% output swing	-	0.2	0.4	ns
TOE	Output enable time <sup>*1</sup>	Measurement cct.B5, $T_A=25^\circ C$	-	-	5	us
TOD	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

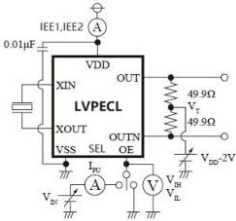


## Measurement Information

### Measurement Circuit: LVPECL

#### Measurement Circuit A1:

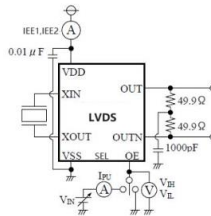
IEE1, IEE2, VIH, VIL, VIM, IiH, IiL



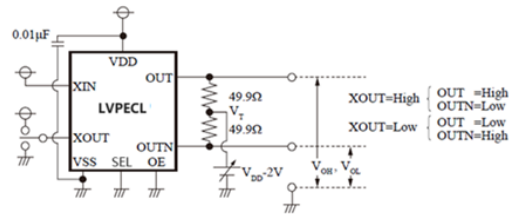
### Measurement Circuit: LVDS

#### Measurement Circuit B1:

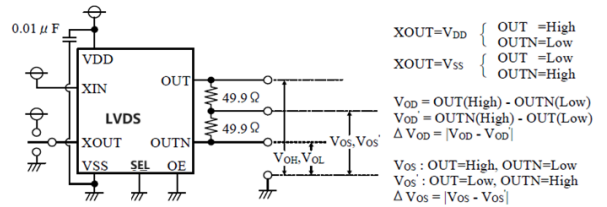
IEE1, IEE2, VIH, VIL, VIM, IiH, IiL



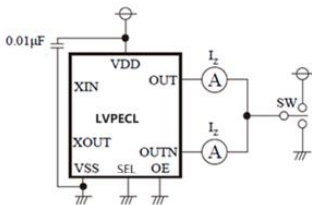
### Measurement Circuit A2: VOL, VOH



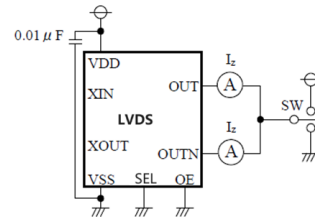
### Measurement Circuit B2: VOL, VOH



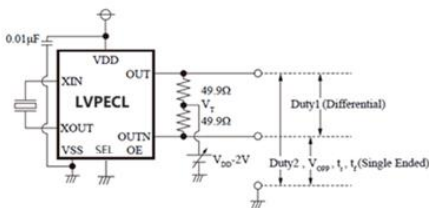
### Measurement Circuit A3: Iz



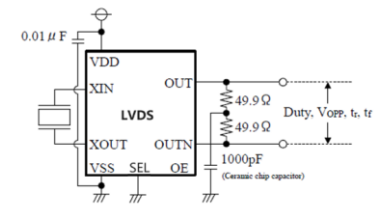
### Measurement Circuit B3: Iz



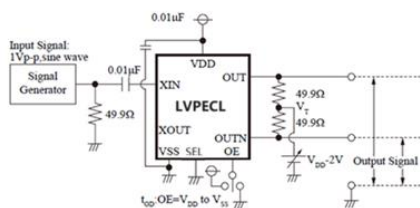
### Measurement Circuit A4: Duty, VOPP, TR, TF



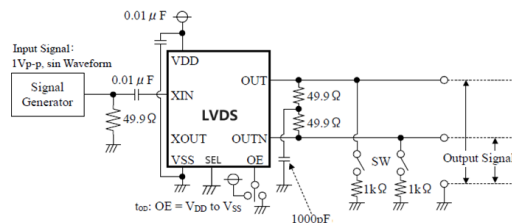
### Measurement Circuit B4: Duty, VOPP, TR, TF



### Measurement Circuit A5: ToE, ToD



### Measurement Circuit B5: ToE, ToD







## Revision History

Revision	Description	Date
1.0	1. Official release	2024/6/24