



## Features

- Wide range of operating supply voltage: 1.35V to 5.5V
- Operation Frequency Range
  - XO6629CA (10~20MHz)
  - XO6629CB (12~35MHz)
- Low crystal drive current oscillation for miniature crystal units
- Ultra-Low power consumption (35uA/1.5V@XO6629CA)
- XO6629Cx series: for Wire Bonding Type C
- -45 to 125°C operating temperature range
- Crystal frequency 16.777216M(XO6629CA /512)
- Crystal frequency 33.554432M (XO6629CB/1024)
- Output Freq: Crystal Freq divided by /512 or 1024
- Very low standby current
- 50±2% output duty cycle
- 15pF output drive capability
- Die form or Wafer form

## Description

The XO6629 series are miniature crystal oscillator module ICs. The oscillator circuit stage has constant current drive, significantly reducing current consumption and crystal current, compared with existing devices, and significantly reducing the oscillator characteristics supply voltage dependency.

## Application

- 32.768KHz Crystal Oscillator
- 7050, 5032, 3225, 2520, 2016 crystal oscillator

## Ordering Information

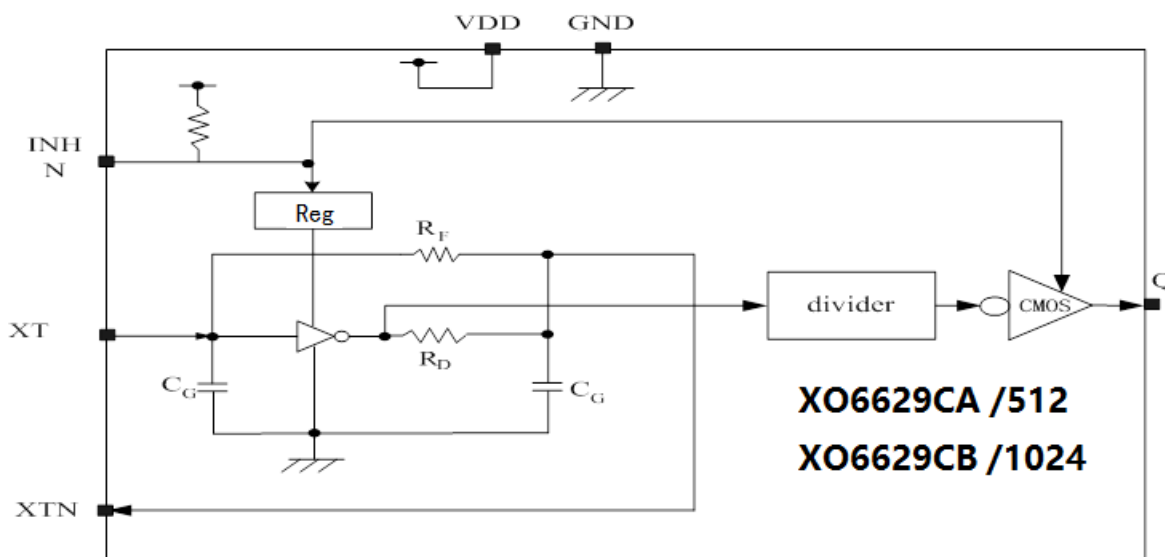
Part no.	Package type
XO6629Cx-yWF	Wafer form
XO6629Cx-yDE	Die form

Note 1: C suitable for C base

Note 2: x: A stand for /512, B stand for /1024

Note 3: y: -8(180um) or -3(130um), -4(100um)

## Block Diagram





## Function Description

### Standby Function

When INHN goes LOW, the oscillator stops and the output on Q becomes high impedance.

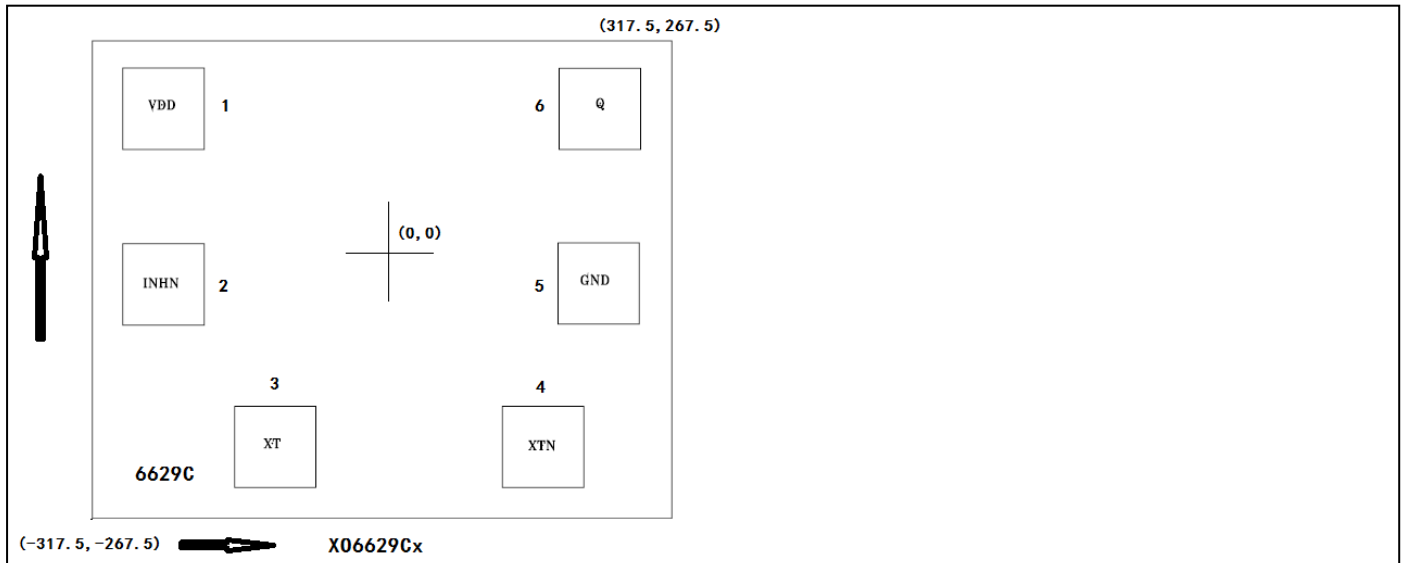
INHN	Q	Oscillator
HIGH (or open)	F0/512 or F0/1024 output frequency	Normal operation
Low	High impedance	Stopped

### Power-saving Pull-up Resistor

The INHN pin pull-up resistance RUP1 or RUP2 changes in response to the input level (HIGH or LOW). When INHN is tied LOW level, the pull-up resistance is large (RUP1), reducing the current consumed by the resistance. When INHN is left open circuit, the pull-up resistance is small (RUP2), which increases the input susceptibility to external noise. However, the pull-up resistance ties the INHN pin HIGH level to prevent external noise from unexpectedly stopping the output.



### Pad Configuration



Pad Coordinate File					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
1	-214.85	168	4	158.35	-164.6
2	-214.85	-4.65	5	213.15	-3.85
3	-105.1	-164.6	6	214.2	167.9

**Note:** Substrate is connected to GND or floating.  
**Die Size:** 635µm\*535µm (Including scribe line)  
**Die Thickness:** 130µm±15µm (-3) or 220µm±20µm (-2), 100µm±15µm (-4), 150µm+/-15µm (-5)  
**Pad Size:** 80µm\*80µm                      **Substrate Level:** GND or Floating

### Pad Description

Sym.	Type	Description	
XTN	O	Amplifier output.	Crystal oscillator connected between XT and XTN
XT	I	Amplifier input.	
INHN	I	Output state control input. Output High when LOW. Power-saving pull-up resistor built in.	
V <sub>DD</sub>	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by fundamental crystal (f0 divided by 512/1024)	



### Maximum Ratings

Storage Temperature .....	-65°C to +150°C
Supply Voltage to Ground Potential (V <sub>DD</sub> to GND) .....	-0.5V to +5.5V
DC Input (All Other Inputs except V <sub>DD</sub> & GND) ...	-0.5V to V <sub>DD</sub> +0.5V
DC Output .....	-0.5V to V <sub>DD</sub> +0.5V
DC Output Current (all outputs).....	20mA

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

(GND=0V, unless otherwise noted.)

Sym.	Parameter	Conditions	Min	Typ.	Max	Unit
V <sub>DD</sub>	Supply voltage	-	1.35	-	5.5	V
T <sub>A</sub>	Operating temperature	-	-45	+25	+125	°C
f <sub>0</sub>	Oscillation frequency*1	XO6629CA	10	16.777216	20	MHz
		XO6629CB	12	33.554432	35	

### DC Electrical Characteristics

XO6629CA/B (V<sub>DD</sub> = 1.50 to 5.5V, T<sub>A</sub> = -40 to 85°C, unless otherwise noted.)

Sym	Parameter	Conditions	Min	Typ.	Max	Unit	
V <sub>OH</sub>	HIGH-level output voltage	I <sub>OH</sub> =1mA	V <sub>DD</sub> -0.4	-	-	V	
V <sub>OL</sub>	LOW-level output voltage	I <sub>OL</sub> =1mA	-	-	0.4		
V <sub>IH</sub>	HIGH-level input voltage	OE Measurement	0.7V <sub>DD</sub>	-	-	V	
V <sub>IL</sub>	LOW-level input voltage	OE Measurement	-	-	0.4		
I <sub>CC</sub>	Operating current	V <sub>DD</sub> =1.5V(XO6629CA)/512	-	35	70	uA	
	Operating Current	V <sub>DD</sub> =3.0V(XO6629CA)/512	-	50	80	uA	
	Operating Current	V <sub>DD</sub> =1.5V(XO6629CB)/1024	-	60	90	uA	
	Operating Current	V <sub>DD</sub> =3.0V(XO6629CB)/1024	-	80	120	uA	
I <sub>sb</sub>	Standby Current	OE=off			10	uA	
R <sub>PULL</sub>	OE pull-up resistance	V <sub>DD</sub> =3.3V	-	2	-	MΩ	
I <sub>Z</sub>	Output leakage current	OE=OFF		V <sub>O</sub> =V <sub>DD</sub>	-	10	μA

### AC Characteristics

XO6629CA/B, T<sub>A</sub>=-40 to 85°C unless otherwise noted

Symbol	Parameter	Condition	Min	Typ	Max	Unit
t <sub>OD</sub>	Output Disable Delay	Output Disable Function (OE)	-	-	100	ns
t <sub>STR</sub>	Output Enable Delay	Output Enable Function (OE)	-	-	10	ms
t <sub>r1</sub>	Output rise time	C <sub>L</sub> =15Pf, 0.1V <sub>DD</sub> to 0.9V <sub>DD</sub>   V <sub>DD</sub> =3.3V	-	10	30	ns
t <sub>f1</sub>	Output fall time	C <sub>L</sub> =15Pf, 0.1V <sub>DD</sub> to 0.9V <sub>DD</sub>   V <sub>DD</sub> =3.3V	-	10	30	ns
Duty	Output duty cycle	T <sub>A</sub> =25°C, C <sub>L</sub> =15pF	48	50	52	%
	V <sub>DD</sub> Sensitivity Frequency vs. V <sub>DD</sub> +/-10%	Frequency vs. V <sub>DD</sub> +/-10%	-1	-	+1	ppm
f <sub>R</sub>	OSC frequency range	Fundamental Crystal: (XO6629CA)	-	16.777216	-	MHz
		Fundamental Crystal: (XO6629CB)	-	33.554432	-	MHz

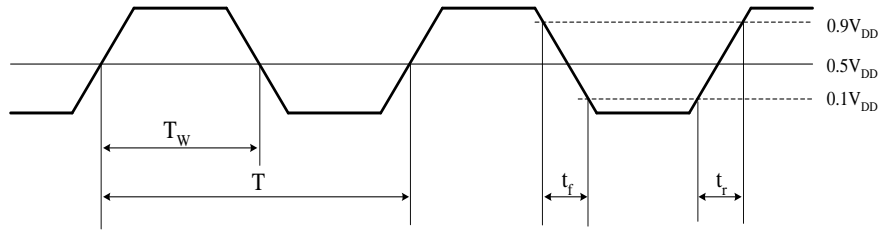


### Crystal Specifications

Parameters	Sym	Conditions	Min	Typ.	Max	Units
Fundamental Crystal Resonator Frequency (XO6629CA)	$F_{XIN}$	-	-	16.777216	-	MHz
Fundamental Crystal Resonator Frequency (XO6629CB)	$F_{XIN}$	-	-	33.554432	-	MHz
Maximum Sustainable Drive Level		-	-	-	100	$\mu$ W
Operating Drive Level		-	-	20	-	$\mu$ W
Crystal Shunt capacitance	$C_O$	-	-	-	4	pF
Effective Series Resistance, Fundamental, 10-50MHz	ESR	-	-	-	30	$\Omega$

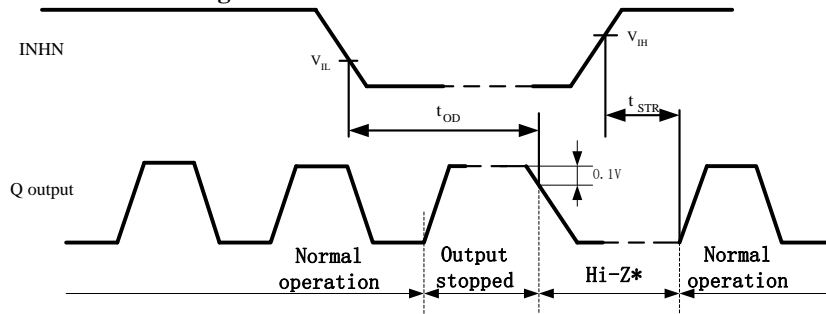
### AC Electrical Characteristics

#### Output switching waveform



$$DUTY = T_W / T \times 100 (\%)$$

#### Output disable and oscillation start timing chart



When INHN goes HIGH to LOW, the Q output goes HIGH once and then becomes high impedance.

When INHN goes LOW to HIGH, the Q output from high impedance to normal output operation when the oscillation starts (oscillation is detected)

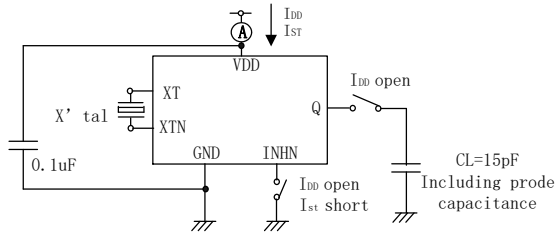
\*: the high –impedance interval in the figure is shown as a LOW level due to the 1K  $\Omega$  pull-down resistor connected to the Q pin(see “Measurement circuit 2” in the “Measurement circuits” section)



## Measurement Circuit

### Measurement cct1

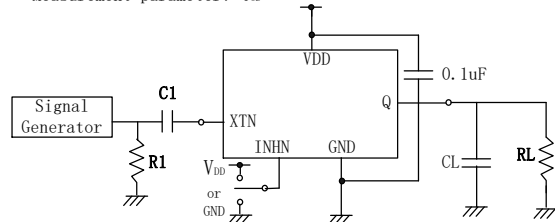
Measurement parameter:  $I_{DD}$ ,  $I_{ST}$ , Duty,  $t_r$ ,  $t_f$



Note: The AC characteristics are observed using an oscilloscope on pin Q

### Measurement cct2

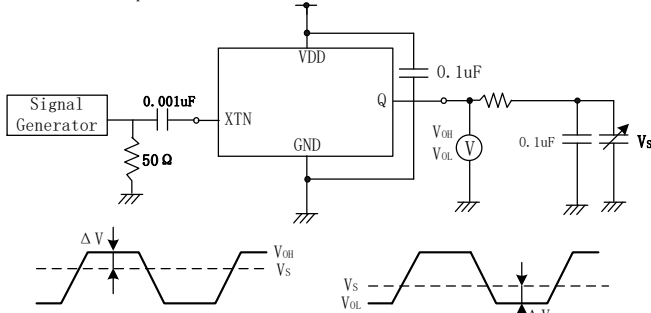
Measurement parameter:  $t_{DD}$



XTN input signal: 1Vp-p, sine wave  
C1: 0.001uF CL: 15pF  
R1: 50 Ohm RL: 1K Ohm

### Measurement cct3

Measurement parameter:  $V_{OH}$ ,  $V_{OL}$



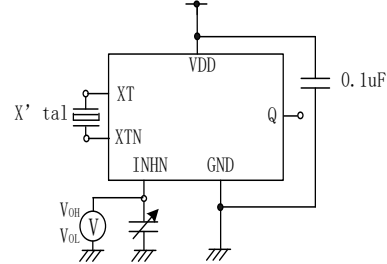
$V_s$  adjusted such that  $\Delta V = 50 \times I_{OH}$

$V_s$  adjusted such that  $\Delta V = 50 \times I_{OL}$

XTN input signal: 1Vp-p, sine wave

### Measurement cct4

Measurement parameter:  $V_{IH}$ ,  $V_{IL}$



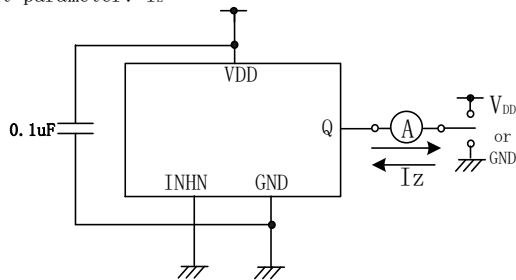
$V_{IH}$ : Voltage is 0V to  $V_{DD}$  transition that changes the output state.

$V_{IL}$ : Voltage is  $V_{DD}$  to 0V transition that changes the output state.

INHN has an oscillation stop function

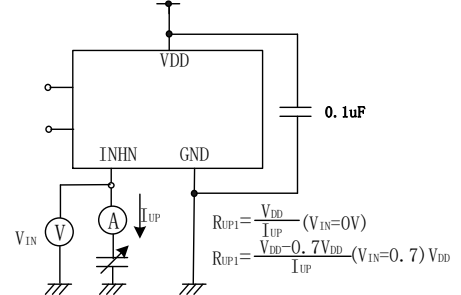
### Measurement cct5

Measurement parameter:  $I_z$



### Measurement cct6

Measurement parameter:  $R_{UP1}$ ,  $R_{UP2}$





## Revision History

Revision	Description	Date
1.3	Release version	2022/12/8
2.0	Updated the datasheet format	2014/3/1