



Features

- Wide range of operating supply voltage: 1.2V to 3.63V
- Low crystal drive current oscillation
- Ultra-Low power consumption(0.5uA/1.8V)
- Output independent VIO: XO5032CA
- Output Enable/Disable :XO5032CB
- XO5032C series: for Wire Bonding Type C
- -45 to 85°C operating temperature range
- Tuning Fork Crystal frequency 32.768KHz
- Output Freq: Crystal Freq 32.768KHz
- Very low standby current
- 15pF output drive capability
- Die form or Wafer form

Description

The XO5032 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

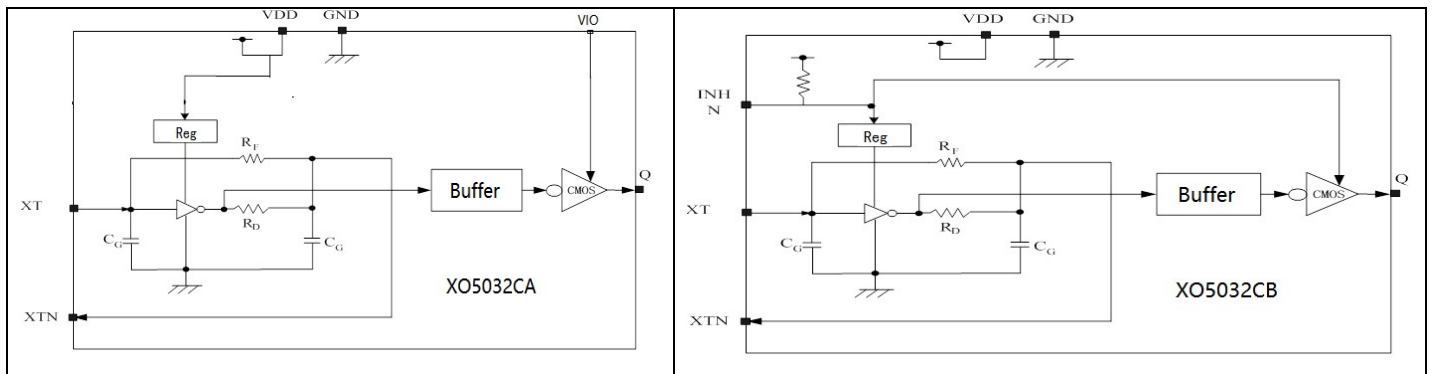
Part no.	Package type
XO5032Cy-zWF	Wafer form
XO5032Cy-zDE	Die form

Note 1:y: A stand for output VIO, B stand for Output E/D

Note 2:Z: -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.

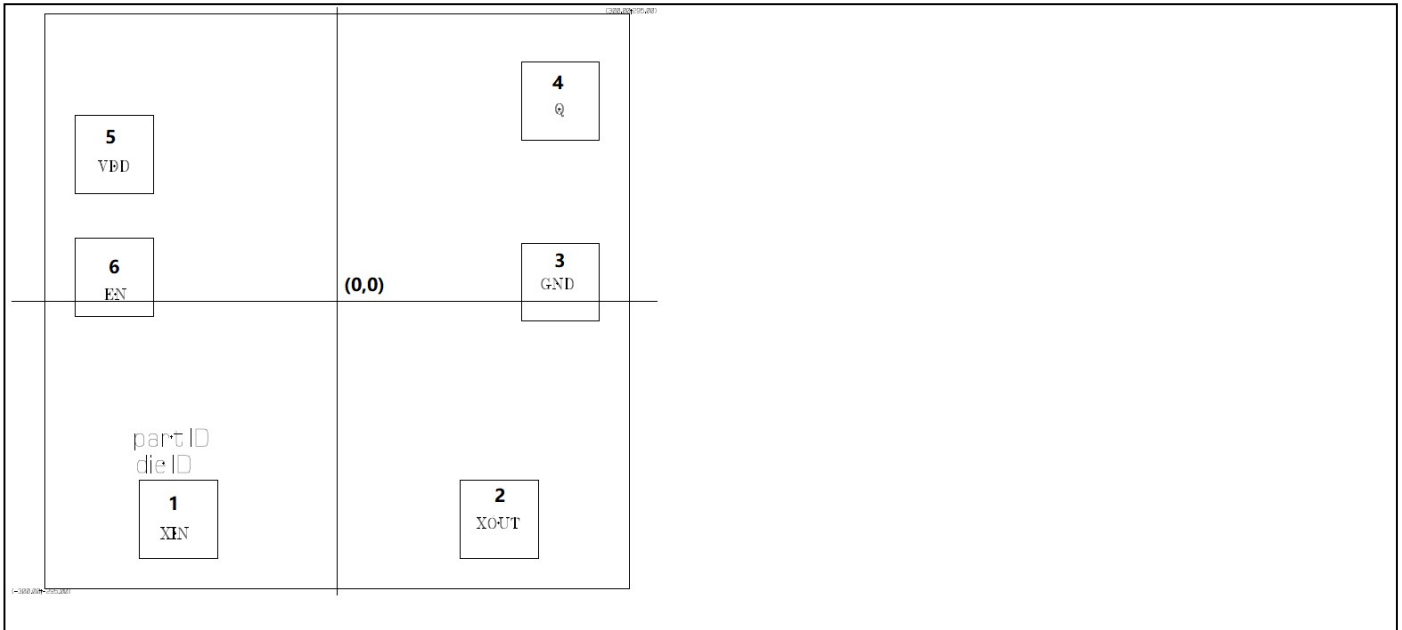
INHN	Q	Oscillator
HIGH (or open)	output frequency	Normal operation
Low	High impedance	Stopped

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	-162.5	-224	4	228.9	205.4
2	166.5	-224	5	-228.6	151
3	229.2	19.5	6	-228.6	24.8

Note: Substrate is connected to GND or floating.

Die Size: 660 μ m*650 μ m (Including scribe line: 60 μ m)

Die Thickness: 130 μ m \pm 15 μ m(-3) , 100 μ m \pm 15 μ m(-4)

Pad Size: 80 μ m*80 μ m **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.	
INH / VIO	I	XO5032CB: Output state control input. Output High when LOW. Power-saving pull-up resistor built in. XO5032CA: Output used for clock input compliant level,	
V _{DD}	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by Tuning fork crystal	



Maximum Ratings

Storage Temperature.....	-65°C to +150°C
Supply Voltage to Ground Potential (V _{DD} to GND).....	-0.5V to +6.5V
DC Input (All Other Inputs except V _{DD} & GND) ...	-0.5V to V _{DD} +0.5V
DC Output.....	-0.5V to V _{DD} +0.5V
DC Output Current (all outputs)	20mA

Recommended Operating Conditions

(GND=0V, unless otherwise noted.)

Sym.	Parameter	Conditions	Min	Typ	Max	Unit
V _{DD}	Supply voltage	-	1.2	-	3.63	V
T _A	Operating temperature	-	-45	+25	+85	°C
f ₀	Oscillation frequency*1	-	-	32.768	-	kHz



DC Electrical Characteristics

XO5032(V_{DD} = 1.2 to 3.63V, T_A = -40 to 85°C, unless otherwise noted.)

Parameter	Sym	Conditions	Min	Typ	Max	Unit	
HIGH-level output voltage	V _{OH}	I _{OH} =1mA	V _{DD} -0.4	-	-	V	
LOW-level output voltage	V _{OL}	I _{OL} =1mA	-	-	0.4		
HIGH-level input voltage	V _{IH}	OE Measurement	0.7V _{cc}	-	-	V	
LOW-level input voltage	V _{IL}	OE Measurement	-	-	0.4		
Operating current	I _{CC}	V _{dd} =1.8V(XO5032CA) No Loading	-	0.25	0.35	uA	
Operating Current	I _{cc}	V _{dd} =3.0V(XO5032CA) No Loading	-	0.3	0.4	uA	
Operating current	I _{CC}	V _{dd} =1.8V(XO5032CB) No Loading	-	0.5	1.5	uA	
Operating Current	I _{cc}	V _{dd} =3.0V(XO5032CB) No Loading	-	2	4	uA	
Standby Current	I _{sb}	OE=off			1.5	uA	
OE pull-up resistance			-		-		
	R _{PULL}	V _{DD} = 3.3V	5	-	-	MΩ	
Output leakage current	I _Z	OE=OFF	V _O =V _{DD}	-	-	10	μA

AC Characteristics

XO5032CA/B, T_A=-40 to 85°C unless otherwise noted

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Disable Delay	t _{OD}	Output Disable Function (OE)	-	-	100	ns
Output Enable Delay	t _{STR}	Output Enable Function (OE)	-	-	1	s
Output rise time	t _{ri}	C _L =15Pf, 0.1V _{DD} to 0.9V _{DD} V _{DD} =3.3V	-	50	100	ns
Output fall time	t _{fi}	C _L =15Pf, 0.1V _{DD} to 0.9V _{DD} V _{DD} =3.3V	-	50	100	ns
Output duty cycle	Duty	T _A =25°C, C _L =15pF	40	50	60	%
V _{DD} Sensitivity Frequency vs. V _{DD} +/-10%		Frequency vs. V _{DD} +/-10%	-2	-	+2	ppm
OSC frequency range	f _r	Tuning Fork Crystal	-	32.768	-	kHz

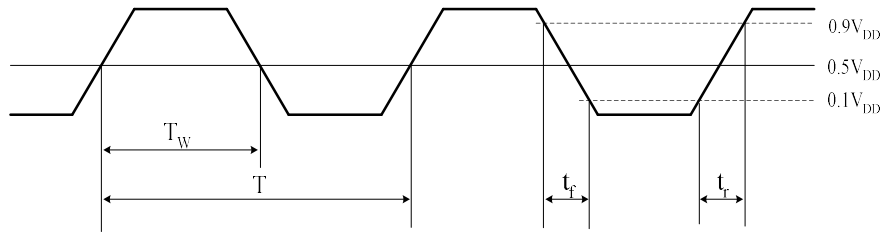
Crystal Specifications

Parameters	Sym	Conditions	Min	Typ	Max	Units
Fundamental Crystal Resonator Frequency	F _{XIN}	-	-	32.768	-	kHz
Crystal Shunt capacitance	C _O	-	-	-	3	pF
Effective Series Resistance, Fundamental	ESR	-	-	-	70	kΩ



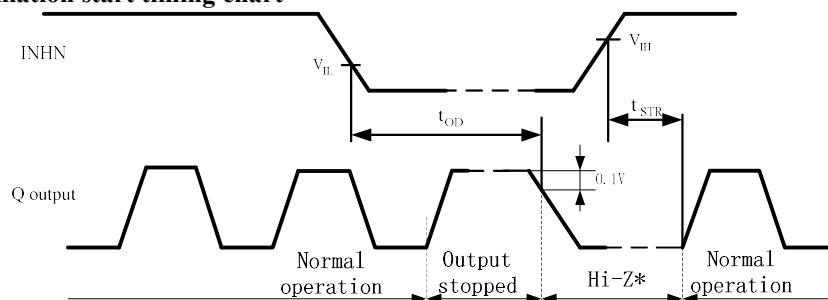
AC Electrical Characteristics

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)

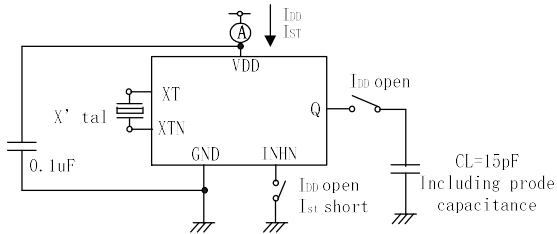
*: the high -impedance interval in the figure is shown as a LOW level due to the $1K \Omega$ pull-down resistor connected to the Q pin (see "Measurement circuit 2" in the "Measurement circuits" section)



Measurement Circuit

Measurement cct1

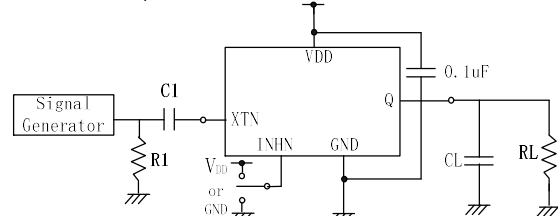
Measurement parameter: I_{DD} , I_{ST} , Duty, t_r , t_f



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

Measurement cct2

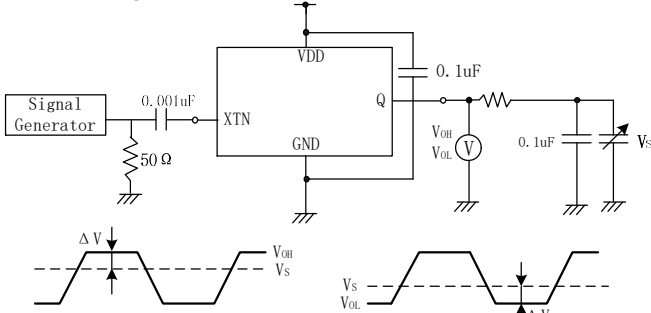
Measurement parameter: t_{DD}



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

Measurement cct3

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

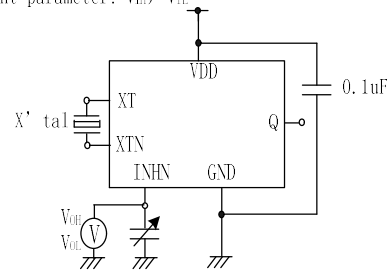


V_s adjusted such that $\Delta V = 50 \times I_{OH}$ V_s adjusted such that $\Delta V = 50 \times I_{OL}$

XTN input signal: 1Vp-p, sine wave

Measurement cct4

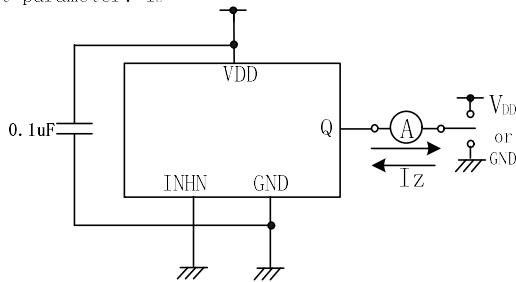
Measurement parameter: V_{IH} , V_{IL}



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

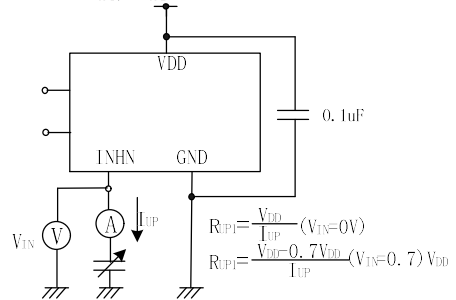
Measurement cct5

Measurement parameter: I_z



Measurement cct6

Measurement parameter: R_{PI1} , R_{PI2}



$$R_{PI1} = \frac{V_{DD}}{I_{IP}} \quad (V_{IN} = 0V)$$

$$R_{PI2} = \frac{V_{DD} - 0.7V_{DD}}{I_{IP}} \quad (V_{IN} = 0.7V_{DD})$$



Revision History

Revision	Description	Date
V1.0	1. Initial release	2024/9/13