



Features

- Wide range of operating supply voltage: 1.62V to 3.63V
- Low crystal drive current oscillation for miniature crystal units
- XO5052HCx-V series: for Wire Bonding
XO5052HCx-V : C type package
- -40 to 125°C operating temperature range
- Crystal frequency (50MHz~100MHz)
- Output Freq: Crystal Freq divided by 1/2/4
- Very low standby current
- 50±5% output duty cycle
- 15pF output drive capability
- Die form or Wafer form
- AEC-Q 100 qualified. PPAP capable, and manufactured in IATF 16949 certified facilities

Description

The XO5052HCx-V 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.

Applications

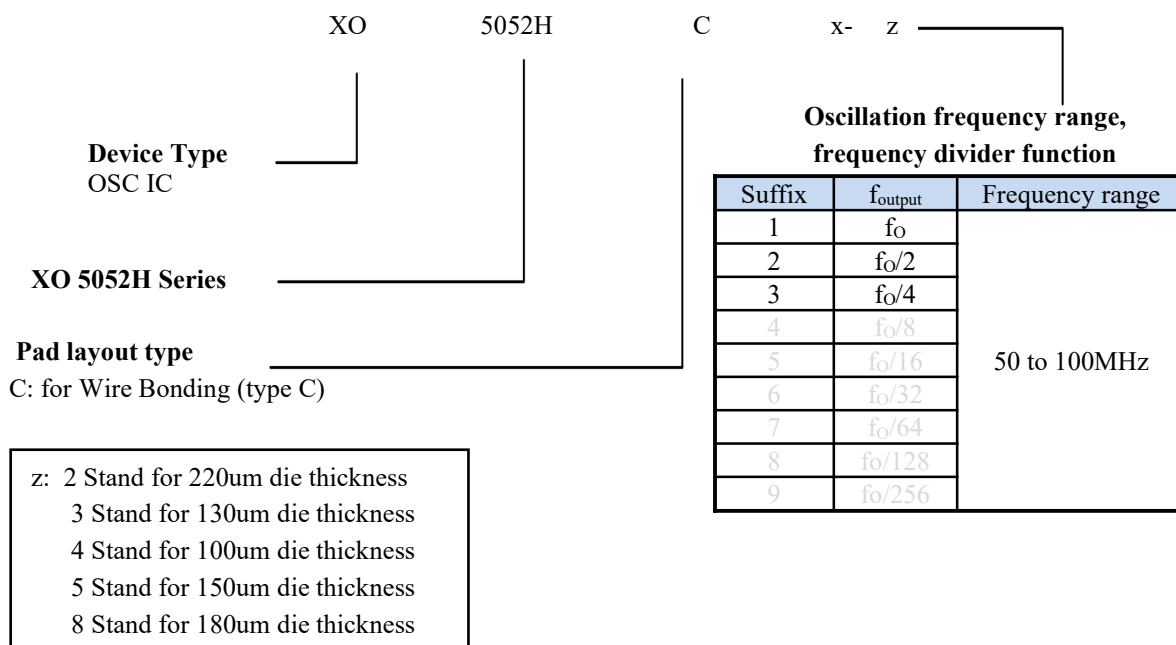
- Fundamental Crystal Oscillator
- 3225, 2520, 2016 crystal oscillator

Ordering Information

Part no.	Package type
XO5052HCx-zWF-V	Wafer form
XO5052HCx-zDE-V	Die form

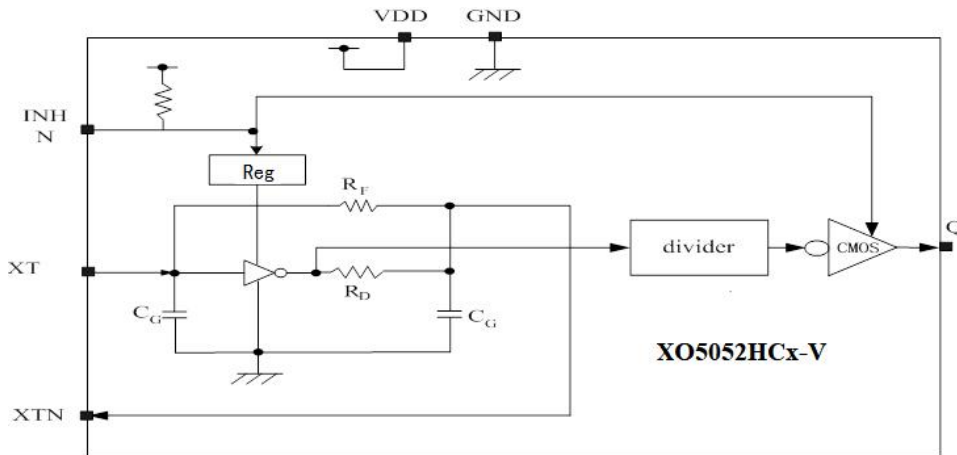
Note 1: x: y: 1/2/3/4(1/1/2/4)

Note 2: -8(180um) or -3(130um), -4(100um), -5(150)





Block Diagram



Function Description

Standby Function

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

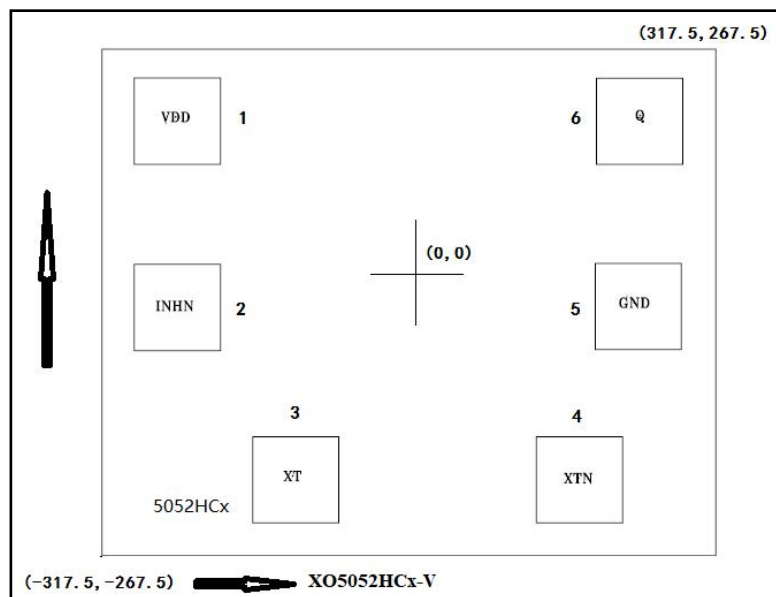
INHN	Q	Oscillator
HIGH (or open)	F0/1/2/4/8 output frequency	Normal operation
Low	High impedance	Stopped

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.	
INH	I	Output state control input. Output High when LOW. Power-saving pull-up resistor built in.	
V _{DD}	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by fundamental crystal(f0 divided by 1/2/4)	



Absolute Maximum Ratings

Parameter	MIN	TYP.	MAX	Unit
Storage Temperature	-65	-	+150	°C
Supply Voltage Range	-0.5	-	5.0	V
Input Voltage Range	-0.5	-	V _{DD} +0.5	V
Output Voltage Range	-0.5	-	V _{DD} +0.5	V
DC Output Current (Q output)			20	mA

Note:

1. 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 _{DD}	Supply voltage	-	1.62	-	3.63	V
T _A	Operating temperature	-	-40		+125	°C
f ₀	Oscillation frequency ^{*1}	-	50		100	MHz



DC Electrical Characteristics

XO5052HCx-V (VDD = 1.6 to 3.63V, TA = -40 to 125° 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 _{DD}	VDD=1.8V(50MHz), no loading		-		3	mA
Operating Current	I _{DD}	VDD=3.0V(50MHz), no loading		-		6	mA
Operating Current	I _{DD}	VDD=1.8V(50MHz), 15pf loading		-		6	mA
Operating Current	I _{DD}	VDD=3.0V(50MHz), 15pf loading		-		8	mA
Standby Current	I _{sb}	OE=off				10	uA
OE pull-up resistance	R _{PULL}	V _{DD} = 3.3V		-	2	-	MΩ
Output leakage current	I _Z	OE=OFF	V _O =V _{DD}	-	-	10	μA

AC Characteristics

XO5052HCx-V, TA=-40 to 125°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)		-	-	10	ms
Output rise time	t _{rl}	C _L =15Pf, 0.1V _{DD} to 0.9V _{DD}	V _{DD} =3.3V	-	1.2	2.0	ns
Output fall time	t _{fl}	C _L =15Pf, 0.1V _{DD} to 0.9V _{DD}	V _{DD} =3.3V	-	1.2	2.0	ns
Output duty cycle	Duty	T _A =25°C, C _L =15pF		45	50	55	%
V _{DD} Sensitivity Frequency vs. VDD+/-10% -2 2 ppm		Frequency vs. V _{DD} +/-10%		-1.5	-	+1.5	ppm
OSC frequency range	f _R	Fundamental Crystal		50		100	MHz

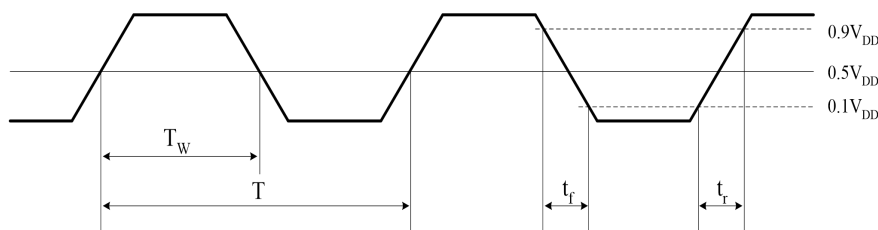


Crystal Specifications

Parameters	Sym	Conditions	Min	Typ	Max	Units
Fundamental Crystal Resonator Frequency(XO5052HCx-V)	F _{XIN}	-	50		100	MHz
Maximum Sustainable Drive Level		-	-	-	200	μW
Operating Drive Level		-	-	40	-	μW
Crystal Shunt capacitance	C _O	-	-	-	2	pF
Effective Series Resistance, Fundamental, 50-100MHz	ESR	-	-	-	40	Ω

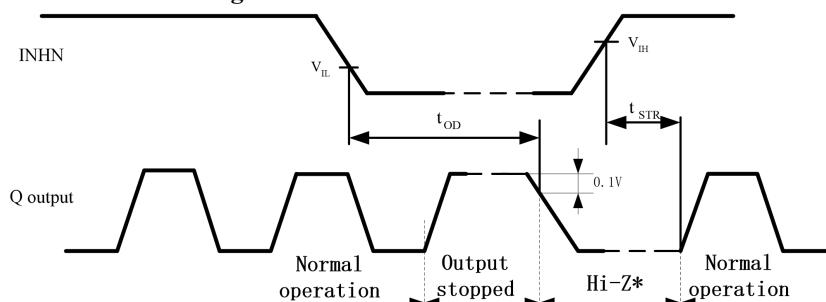
AC Electrical Characteristics

Output switching waveform



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

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)

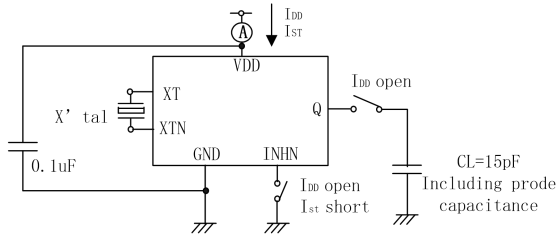
*: the high-impedance interval in the figure is shown as a LOW level due to the $1K\Omega$ pull-down resistor connected to the Q pin(see "Measurement circuit 2" in the "Measurement circuits" section)



Measurement Circuit

Measurement cct1

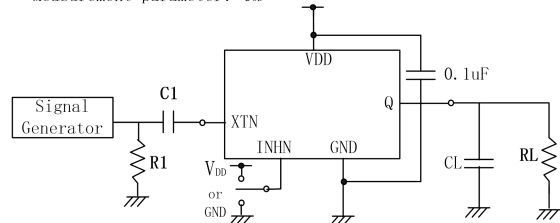
Measurement parameter: I_{DD} , I_{ST} , Duty, t_r , t_f



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

Measurement cct2

Measurement parameter: t_{on}



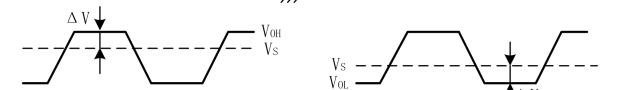
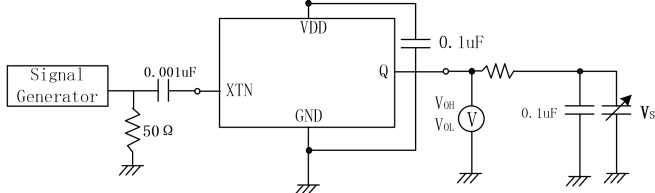
XTN input signal: 1Vp-p, sine wave

C1: 0.001uF CL: 15pF

R1: 50 Ω RL: 1K Ω

Measurement cct3

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



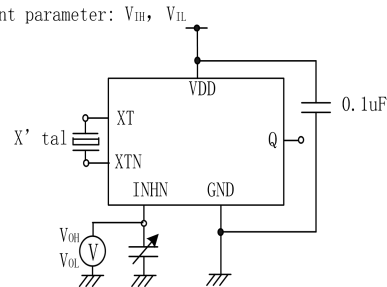
V_S adjusted such that $\Delta V = 50 \times I_{OH}$

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}



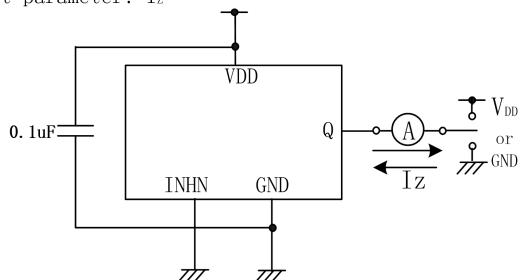
V_{IH} : Voltage is 0V to V_{DD} transition that changes the output state.

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

INHN has an oscillation stop function

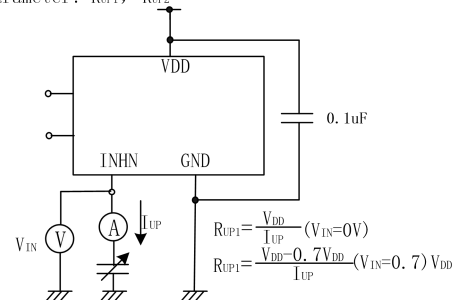
Measurement cct5

Measurement parameter: I_Z



Measurement cct6

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



$$R_{UP1} = \frac{V_{DD}}{I_{UP}} (V_{IN} = 0V)$$

$$R_{UP1} = \frac{V_{DD} - 0.7V_{DD}}{I_{UP}} (V_{IN} = 0.7V_{DD})$$



History Log:

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