



## Features

- Wide range of operating supply voltage: 1.6V to 5.5V
- Low crystal drive current oscillation for miniature crystal units
- XO5127C/B series: for Wire Bonding
- XO5127Cx: C type package
- XO5127Bx: B type package (2016)
- -45 to 125°C operating temperature range
- Crystal frequency (12MHz~60MHz)
- Output Freq: Crystal Freq divided by 1/2/4/8/16/32/64/128/256
- Very low standby current
- 50±5% output duty cycle
- 15pF output drive capability(C1/C2/C3/C4)
- 50pF output drive capability(C5/C6/C7/C8/C9)
- Die form or Wafer form

## Description

The XO5127 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
- 7050, 5032, 3225, 2520, 2016 (XO5127B1-4) crystal oscillator

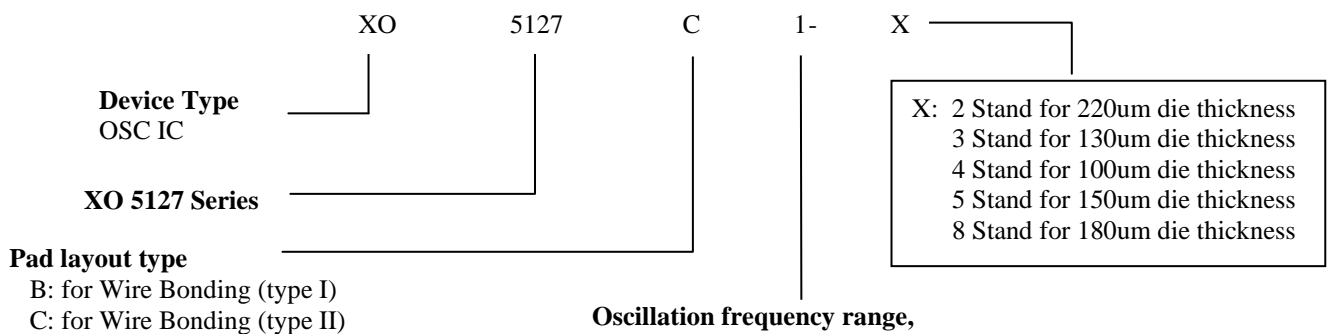
## Ordering Information

Part No.	Package type
XO5127xy-zWF	Wafer form
XO5127xy-zDE	Die form

Note 1: x: B suitable for B Base, C suitable for C base

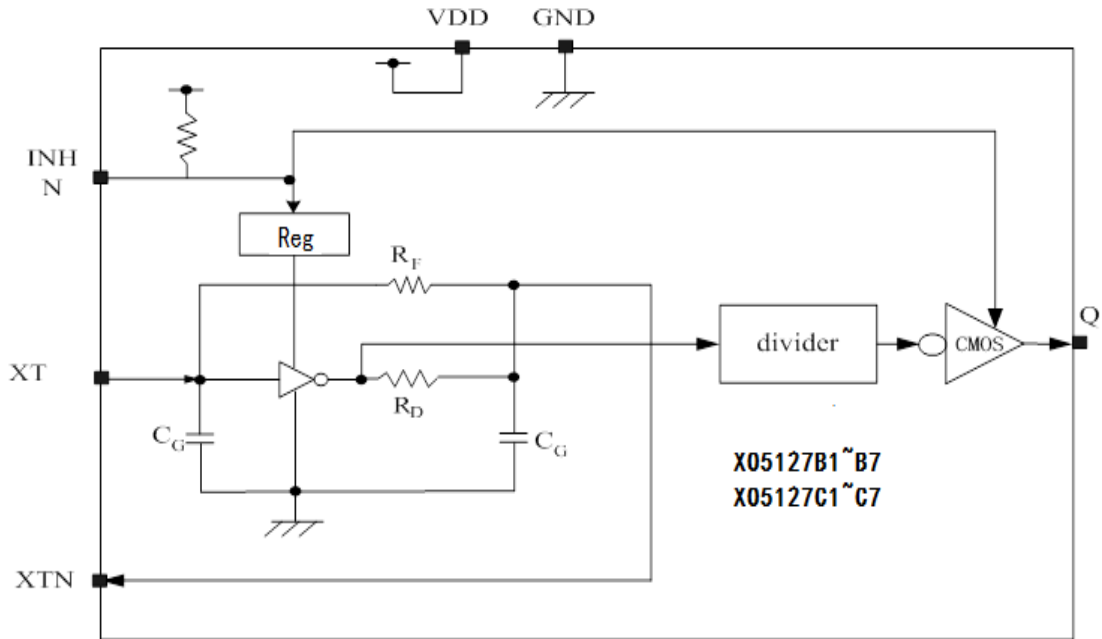
Note 2: y: 1/2/3/4/5/6/7/8/(1/2/4/8/16/32/64/128)

Note 3: z: -2(220um) or -3(130um), -4(100um), -5(150)





## Block Diagram





## Function Description

### Standby Function

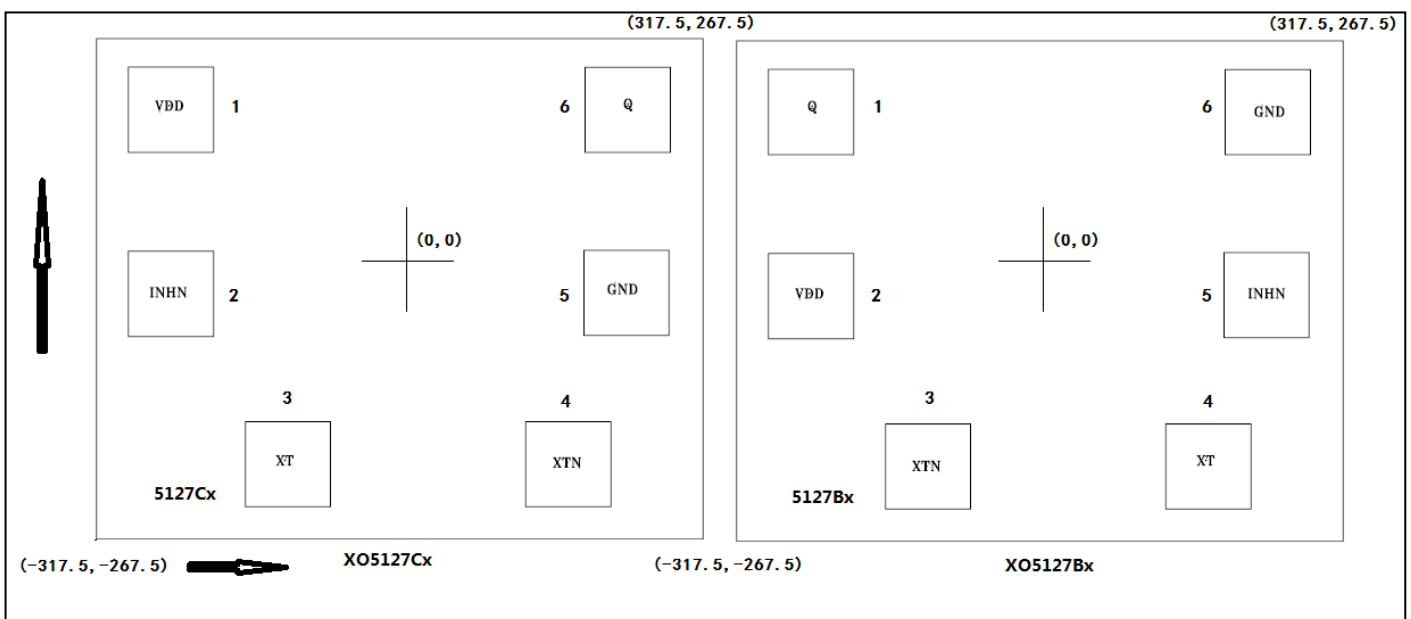
When INHN goes LOW, the oscillator stops and the output on Q becomes high impedance.

INHN	Q	Oscillator
HIGH (or open)	F0/1/2/4/8/16/32/64/128 output frequency	Normal operation
Low	High impedance	Stopped

### Power-saving Pull-up Resistor

The INHN pin pull-up resistance  $R_{UP1}$  or  $R_{UP2}$  changes in response to the input level (HIGH or LOW). When INHN is tied LOW level, the pull-up resistance is large ( $R_{UP1}$ ), reducing the current consumed by the resistance. When INHN is left open circuit, the pull-up resistance is small ( $R_{UP2}$ ), 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.

## Pin 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:** 635 $\mu$ m\*535 $\mu$ m (Including scribe line)  
**Die Thickness:** 130 $\mu$ m $\pm$ 15 $\mu$ m (-3) or 220 $\mu$ m $\pm$ 20 $\mu$ m (-2), 100 $\mu$ m $\pm$ 15 $\mu$ m (-4), 150 $\mu$ m $\pm$ 15 $\mu$ m (-5)  
**Pad Size:** 80 $\mu$ m\*80 $\mu$ m      **Substrate Level:** GND or Floating



### Pin Description

Pin Name	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 <sub>DD</sub>	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by fundamental crystal (f <sub>0</sub> divided by 1/2/4/8/16/.../256)	

### Absolute Maximum Ratings

Storage Temperature.....	-65°C to +150°C
Supply Voltage to Ground Potential (V <sub>DD</sub> to GND).....	-0.5V to +7.0V
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.)

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
V <sub>DD</sub>	Supply voltage	-	1.6	-	5.5	V
T <sub>A</sub>	Operating temperature	-	-45		+125	°C
f <sub>0</sub>	Oscillation frequency*1	-	12		60	MHz



## DC Electrical Characteristics

XO5127( $V_{DD} = 1.60$  to  $5.5V$ ,  $T_A = -40$  to  $85^\circ C$ , unless otherwise noted.)

Parameter	Symbol	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	$0.7V_{DD}$	-	-	V	
LOW-level input voltage	$V_{IL}$	OE Measurement	-	-	$0.3V_{DD}$		
Operating current	$I_{CC}$	$V_{DD} = 1.8V(25MHz)$ , no loading	-	0.5	0.75	mA	
		$V_{DD} = 3.0V(25MHz)$ , no loading	-	0.7	1.0	mA	
		$V_{DD} = 1.8V(40MHz)$ , no loading	-	0.7	1.0	mA	
		$V_{DD} = 3.0V(40MHz)$ , no loading	-	1.0	1.3	mA	
Standby Current	$I_{sb}$	OE=off			10	$\mu A$	
OE pull-up resistance	$R_{PULL}$	$V_{DD} = 3.3V$	-	2	-	$M\Omega$	
Output leakage current	$I_Z$	OE=OFF	$V_O = V_{DD}$	-	-	10	$\mu A$

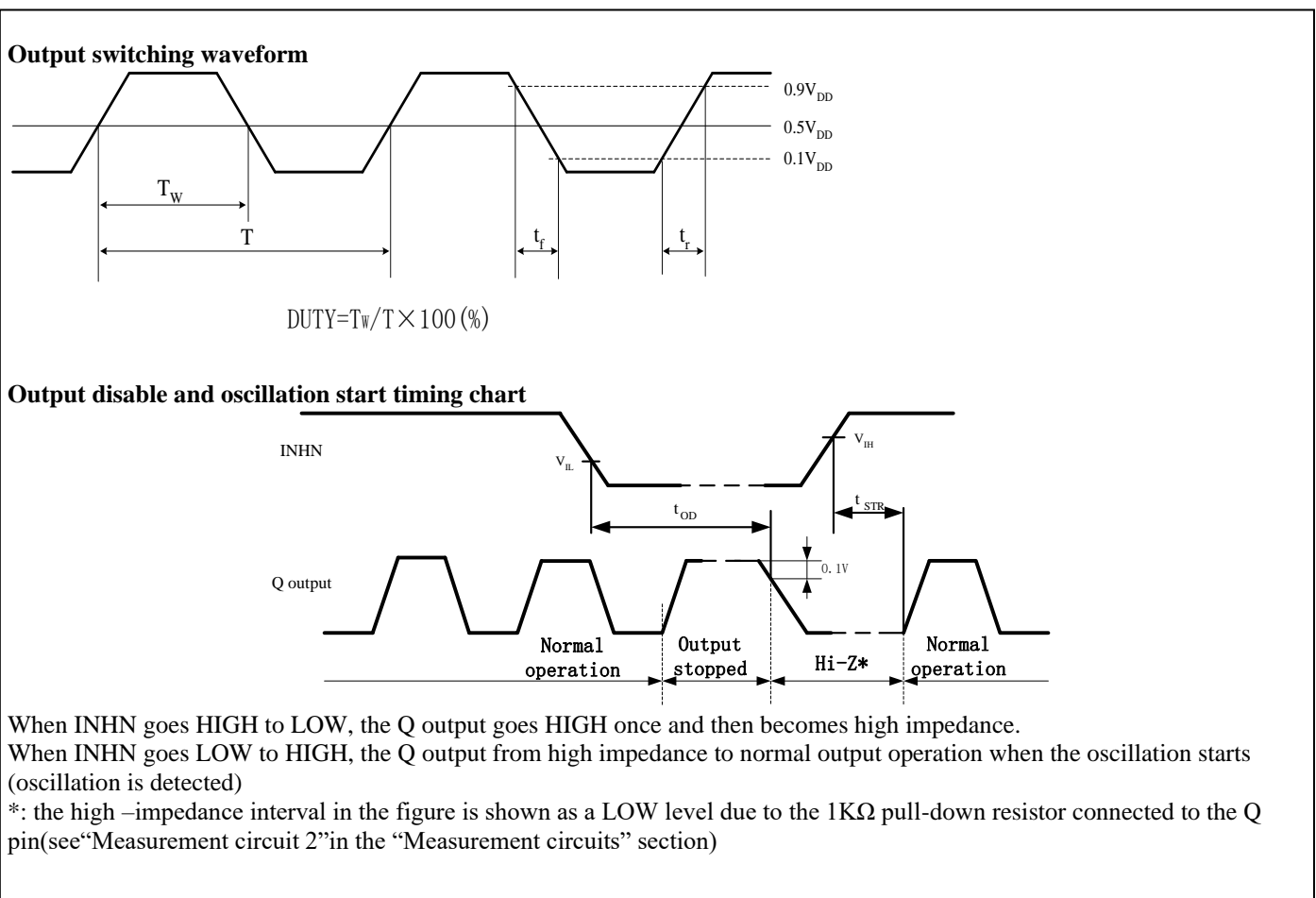
## AC Electrical Characteristics

XO5127C/B,  $T_A = -40$  to  $85^\circ C$  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)	-	-	2	ms
Output rise time	$t_r$	$C_L=15Pf$ , $0.1V_{DD}$ to $0.9V_{DD}$   $V_{DD}=3.3V$	-	1.85	3	ns
Output fall time	$t_f$	$C_L=15Pf$ , $0.1V_{DD}$ to $0.9V_{DD}$   $V_{DD}=3.3V$	-	1.85	3	ns
Output duty cycle	Duty	$T_A=25^\circ C$ , $C_L=15pF$	45	50	55	%
$V_{DD}$ Sensitivity Frequency vs. $V_{DD} \pm 10\%$		Frequency vs. $V_{DD} \pm 10\%$	-1	-	+1	ppm
OSC frequency range	$f_R$	Fundamental Crystal	12		60	MHz



## Output Waveform



## Crystal Specifications

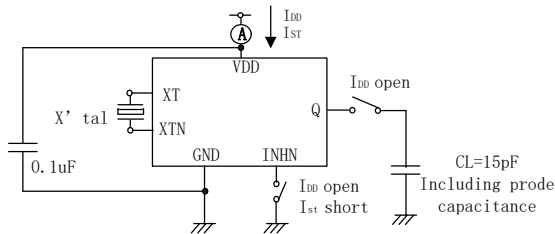
Parameters	Symbol	Conditions	MIN	TYP	MAX	Unit
Fundamental Crystal Resonator Frequency (XO5127)	F <sub>XIN</sub>	-	12		60	MHz
Maximum Sustainable Drive Level		-	-	-	200	$\mu$ W
Operating Drive Level		-	-	50	-	$\mu$ W
Crystal Shunt capacitance	C <sub>O</sub>	-	-	-	4	pF
Effective Series Resistance, Fundamental, 10-50MHz	ESR	-	-	-	30	$\Omega$



## Measurement Circuit

### Measurement cct1

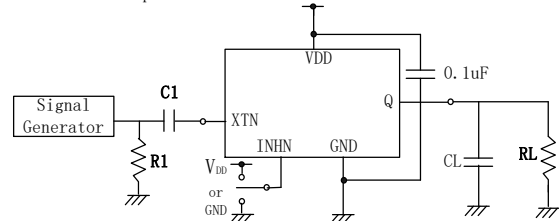
Measurement parameter:  $I_{DD}$ ,  $I_{st}$ , Duty,  $t_r$ ,  $t_f$



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

### Measurement cct2

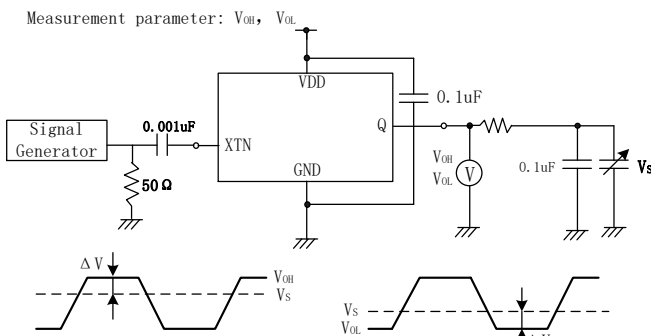
Measurement parameter:  $t_{\omega}$



XTN input signal: 1V<sub>p-p</sub>, sine wave  
C1: 0.001uF CL: 15pF  
R1: 50Ω RL: 1KΩ

### Measurement cct3

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



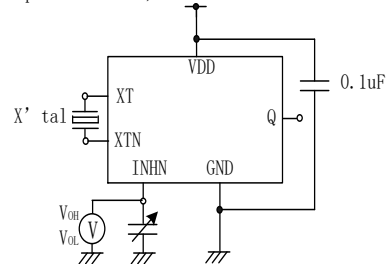
$V_S$  adjusted such that  $\Delta V = 50 \times I_{OH}$

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

XTN input signal: 1V<sub>p-p</sub>, sine wave

### Measurement cct4

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



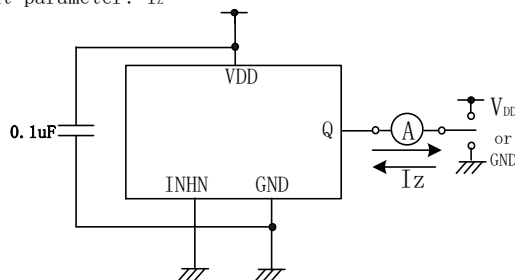
$V_{IH}$ : Voltage is 0V to  $V_{DD}$  transition that changes the output state.

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

INHN has an oscillation stop function

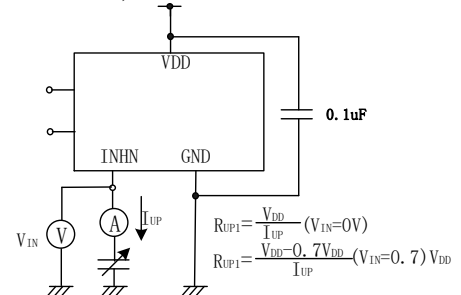
### Measurement cct5

Measurement parameter:  $I_z$



### Measurement cct6

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



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

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



## Revision History

Revision	Description	Date
V1.9	1. Updated 15pF output drive capability(C1/C2/C3/C4) 2. Updated 50pF output drive capability(C5/C6/C7/C8/C9)	2023/6/21
V2.0	1. Updated T <sub>STR</sub> max value from 10ms to 2ms;	2023/10/12
V2.1	1. Updated Operating supply voltage from 1.35V~5.5V to 1.6V to 5.5V	2024/7/2