



## Features

- Wide range of operating supply voltage: 1.6V to 5.5V
- Low crystal drive current oscillation for miniature crystal units
- XO5127C/Bx-V series: for Wire Bonding
- XO5127Cx-V: C type package
- XO5127Bx-V: B type package
- -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
- AEC-Q100 qualified. PPAP capable, and manufactured in IATF 16949 certified facilities.

## Description

The XO5127C/Bx-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
- 7050, 5032, 3225, 2520, 2016 crystal oscillator

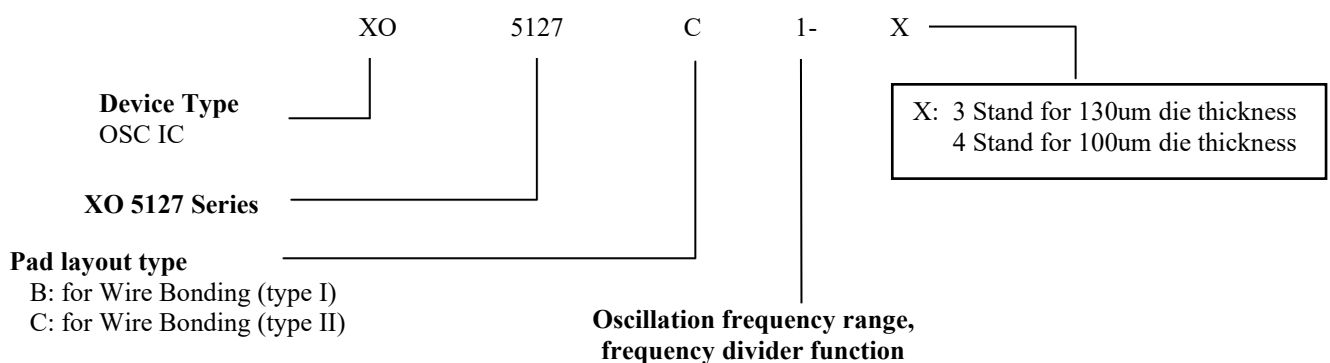
## Ordering Information

| Part No.       | Package type |
|----------------|--------------|
| XO5127xy-zWF-V | Wafer form   |
| XO5127xy-zDE-V | 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)

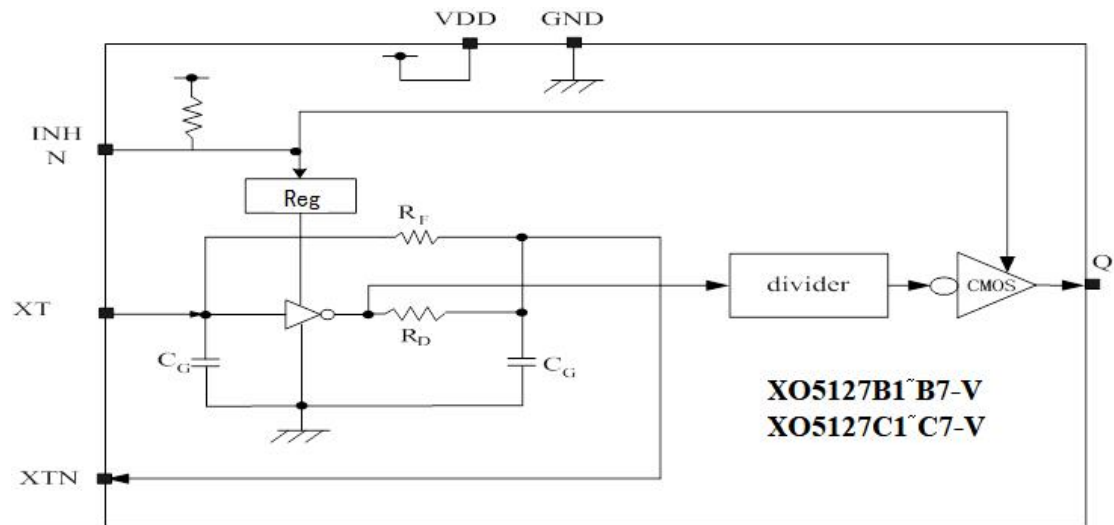
Note 3: z: -3(130um) or -4(100um)



| Suffix | f <sub>output</sub> | Frequency range |
|--------|---------------------|-----------------|
| 1      | f <sub>0</sub>      | 12 to 60MHz     |
| 2      | f <sub>0</sub> /2   |                 |
| 3      | f <sub>0</sub> /4   |                 |
| 4      | f <sub>0</sub> /8   |                 |
| 5      | f <sub>0</sub> /16  |                 |
| 6      | f <sub>0</sub> /32  |                 |
| 7      | f <sub>0</sub> /64  |                 |
| 8      | f <sub>0</sub> /128 |                 |
| 9      | f <sub>0</sub> /256 |                 |



## Block Diagram





## Function Description

### Standby Function

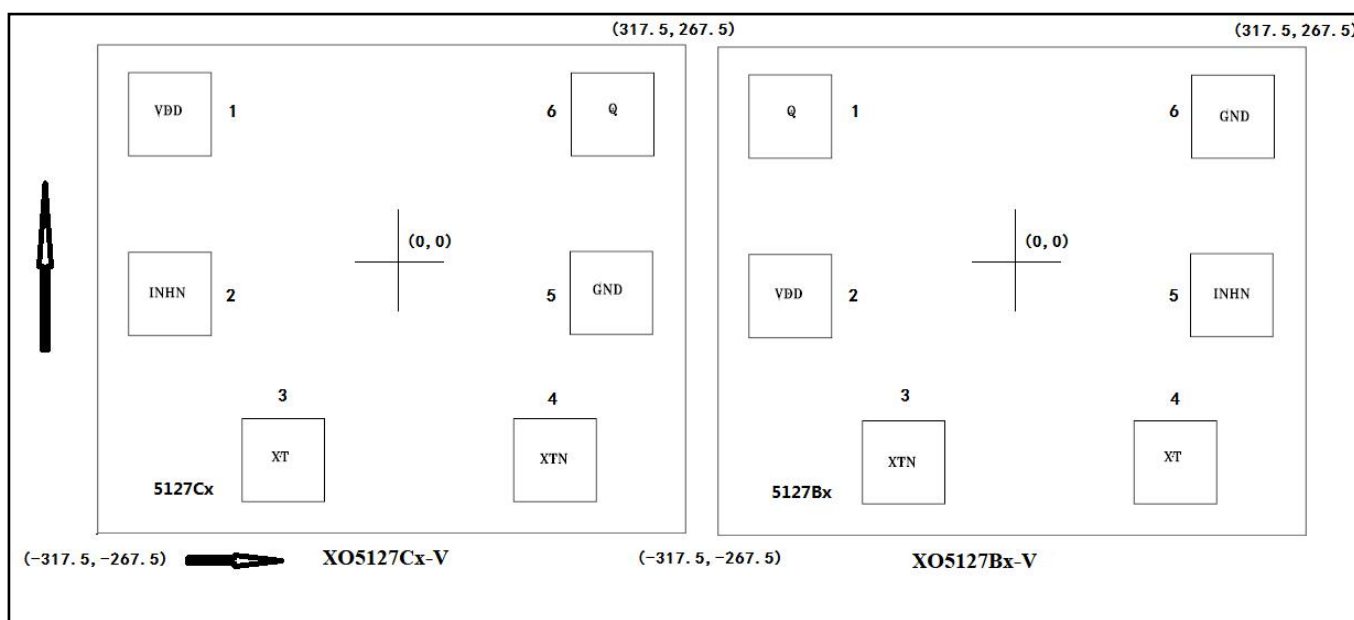
When INHN goes LOW, the oscillator stops and the output on Q becomes high impedance.

| 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        |
| <b>Note:</b> Substrate is connected to GND or floating.  |              |              |                                         |              |              |
| <b>Die Size:</b> 635μm*535μm (Including scribe line)     |              |              |                                         |              |              |
| <b>Die Thickness:</b> 130μm±15μm (-3) or 100μm±15μm (-4) |              |              |                                         |              |              |
| <b>Pad Size:</b> 80μm*80μm                               |              |              | <b>Substrate Level:</b> GND or Floating |              |              |



## Pin Description

| Pin Name        | 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 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* <sup>1</sup> | -          | 12  | -   | 60   | MHz  |



## DC Electrical Characteristics

XO5127C/Bx-V ( $V_{DD} = 1.60$  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

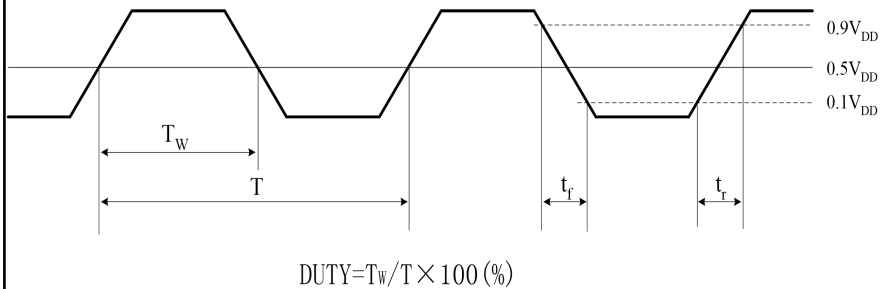
XO5127C/Bx-V,  $T_A=-40$  to  $85^\circ C$  unless otherwise noted

| 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                                        | $t_r$     | $C_L=15Pf$ ,<br>$0.1V_{DD}$ to $0.9V_{DD}$ | $V_{DD}=3.3V$ | -   | 1.85 | 3   | ns   |
| Output fall time                                        | $t_f$     | $C_L=15Pf$ ,<br>$0.1V_{DD}$ 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<br>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  |

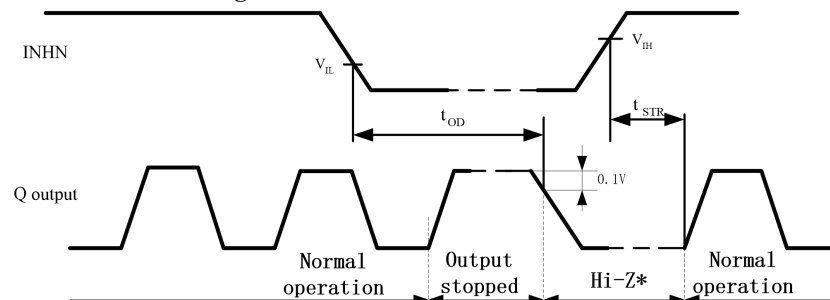


## Output Waveform

**Output switching waveform**



**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)

## Crystal Specifications

| Parameters                                             | Symbol           | Conditions | MIN | TYP | MAX | Unit     |
|--------------------------------------------------------|------------------|------------|-----|-----|-----|----------|
| Fundamental Crystal Resonator Frequency (XO5127C/Bx-V) | 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>0</sub>   | -          | -   | -   | 4   | pF       |
| Effective Series Resistance, Fundamental, 10-50MHz     | ESR              | -          | -   | -   | 30  | $\Omega$ |

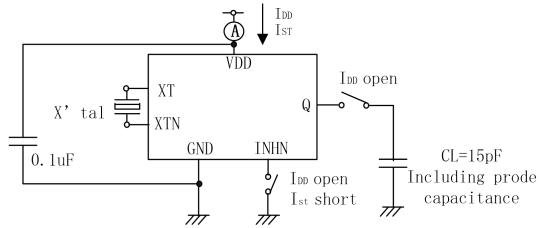
**RSM**

www.raystar-tek.com

**XO5127C/Bx-V series****Ultra-Low Power Consumption Fundamental Crystal**

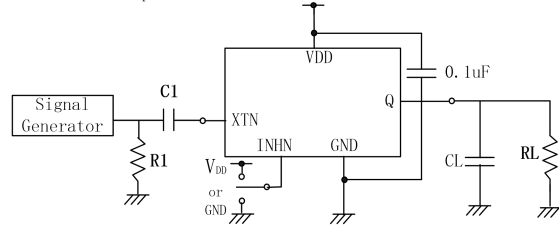
## Measurement Circuit

### 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

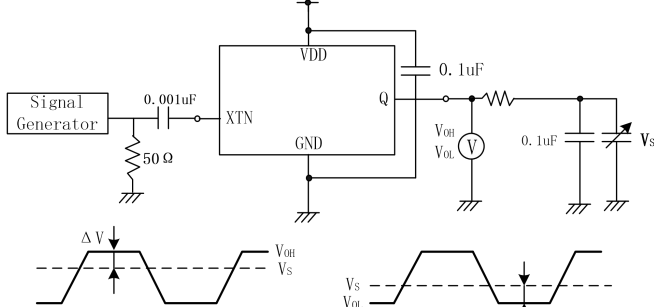
Measurement parameter:  $t_{DD}$ 

XTN input signal: 1Vp-p, sine wave

C1: 0.001uF CL: 15pF

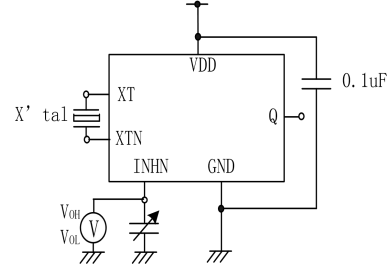
R1: 50Ω RL: 1KΩ

### Measurement cct3

Measurement parameter:  $V_{OH}$ ,  $V_{OL}$  $V_S$  adjusted such that  $\Delta V = 50 \times I_{OH}$  $V_S$  adjusted such that  $\Delta V = 50 \times I_{OL}$ 

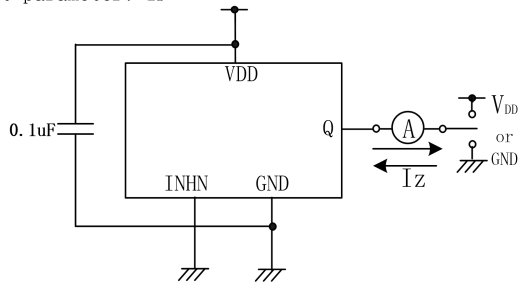
XTN input signal: 1Vp-p, sine wave

### Measurement cct4

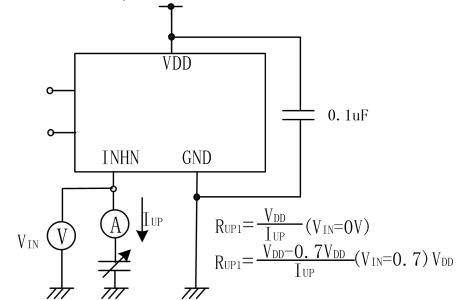
Measurement parameter:  $V_{IH}$ ,  $V_{IL}$  $V_{IH}$ : Voltage is 0V to  $V_{DD}$  transition that changes the output state. $V_{IL}$ : Voltage is  $V_{DD}$  to 0V transition that changes the output state.

INHN has an oscillation stop function

### Measurement cct5

Measurement parameter:  $I_Z$ 

### Measurement cct6

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

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

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



## Revision History

| Revision | Description      | Date       |
|----------|------------------|------------|
| V1.0     | Official release | 2025/12/23 |