



Features

- Wide range of operating supply voltage: 1.35V to 5.5V
- Operation Frequency Range
 - XO6629CA-C(10~24MHz)
 - XO6629CZ-C(12~33MHz)
- Low crystal drive current oscillation for miniature crystal units
- Ultra-Low power consumption
(35uA/1.5V@XO6629CZ-C)
- XO6629CA(Z) series: for Wire Bonding Type C
- -45 to 125°C operating temperature range
- Crystal frequency 16.777216M
(XO6629CA-C /512)
- Crystal frequency 25.165824M
(XO6629CZ-C/768)
- Output Freq: Crystal Freq divided by 512 or 768
- Very low standby current
- 50±5% output duty cycle
- 15pF output drive capability
- Die form or Wafer form

Description

The XO6629CA(Z)-C 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

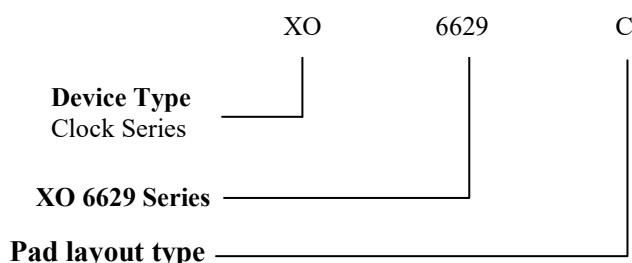
- 32.768KHz Crystal Oscillator
- 7050, 5032, 3225, 2520, 2016 crystal oscillator

Ordering Information

Part no.	Package type
XO6629CA-zWF-C	Wafer form
XO6629CZ-zWF-C	Wafer form
XO6629CA-zDE-C	Die form
XO6629CZ-zDE-C	Die form

Note 1: C suitable for C base

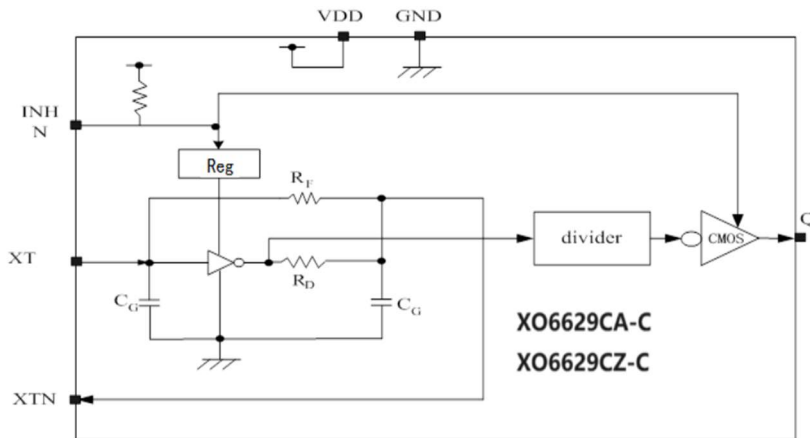
Note 2: z: -3(130um), -4(100um)



Oscillation frequency range, frequency divider function		
Suffix	f _{OUTPUT}	Frequency range
A	F ₀ /512	10~24MHz
Z	F ₀ /768	12~33MHz



Block Diagram



Function Description

Standby Function

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

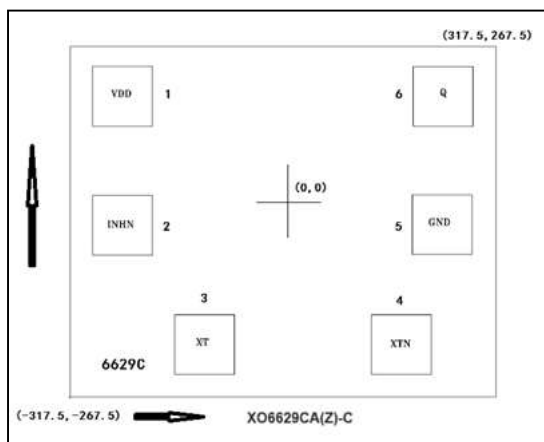
INHN	Q	Oscillator
HIGH (or open)	Output frequency	Normal operation
Low	High impedance	Stopped

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	-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: 570μm*470μm (Not include scribe line), scribe line: 60μm

Die Thickness: 130μm±15μm (-3), 100μm±15μm (-4)

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 _{DD}	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by fundamental crystal	



Maximum Ratings

Storage Temperature	-65°C to +150°C
Supply Voltage to Ground Potential (V _{DD} to GND)	-0.5V to +5.5V
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

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 _{DD}	Supply voltage	-	1.35	-	5.5	V
T _A	Operating temperature	-	-45	+25	+125	°C
f ₀	Oscillation frequency*1	-	-	XO6629CA-C (10~24MHz) XO6629CZ-C (12~33MHz)	-	MHz

DC Electrical Characteristics

XO6629(V_{DD} = 1.50 to 5.5V, T_A = -45 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 _{DD1}	V _{DD} =1.8V(XO6629CA-C)/512, no load		-	45	70	uA
	I _{DD2}	V _{DD} =3.3V(XO6629CA-C)/512, no load		-	50	80	uA
	I _{DD3}	V _{DD} =1.8V(XO6629CZ-C)/768, no load		-	45	70	uA
	I _{DD4}	V _{DD} =3.3V(XO6629CZ-C)/768, no load		-	50	80	uA
Standby Current	I _{SB}	OE=GND				10	uA
OE pull-up resistance	R _{PULL}	V _{DD} = 3.3V		-	2	-	MΩ
Output leakage current	I _Z	OE=GND	V _O =0 or V _{DD}	-	-	10	μA

AC Characteristics

XO6629CA(Z), T_A=-45 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)	-	-	2	ms
Output rise time	Tr1	1.8V/15pf, 0.2V _{DD} to 0.8V _{DD}	-	15	25	ns
Output fall time	Tf1	1.8V/15pf, 0.8V _{DD} to 0.2V _{DD}	-	15	25	ns
Output rise time	Tr2	3.3V/15pf, 0.1V _{DD} to 0.9V _{DD}	-	12	25	ns
Output fall time	Tf2	3.3V/ 15pf, 0.9V _{DD} to 0.1V _{DD}	-	12	25	ns
Output duty cycle	Duty	T _A =25°C, C _L =15pF	45	50	55	%
Sensitivity of Frequency vs. V _{DD}		Frequency vs. V _{DD} +/-10%	-1	-	+1	ppm
OSC frequency range	F _R	Fundamental Crystal	10		33	MHz

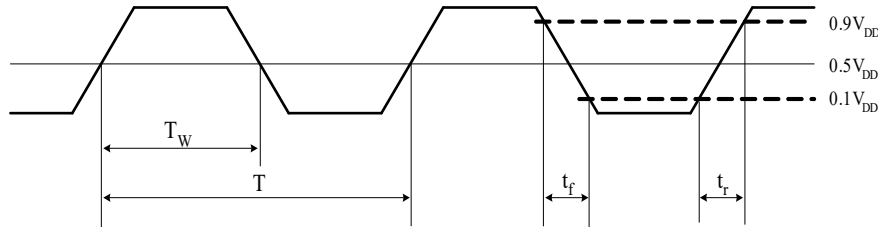


Crystal Specifications

Parameters	Sym	Conditions	Min	Typ	Max	Units
Fundamental Crystal Resonator Frequency (XO6629CA-C)	F _{XIN}	-	-	16.777216	-	MHz
Fundamental Crystal Resonator Frequency (XO6629CZ-C)	F _{XIN}	-	-	25.165824	-	MHz
Maximum Sustainable Drive Level		-	-	-	100	μW
Operating Drive Level		-	-	20	-	μW
Crystal Shunt capacitance	C _O	-	-	-	4	pF
Effective Series Resistance, Fundamental, 10-33MHz	ESR	-	-	-	30	Ω

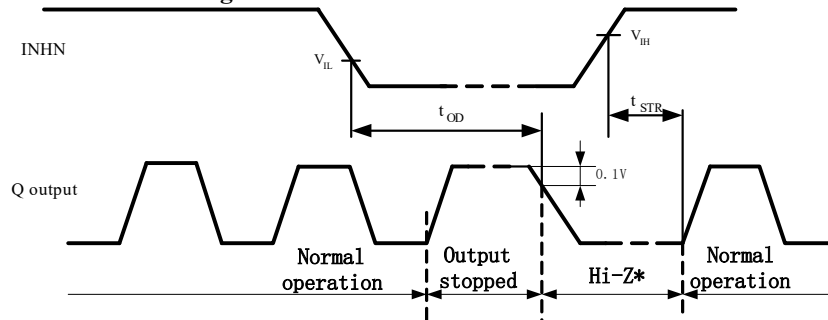
AC Electrical Characteristics

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)

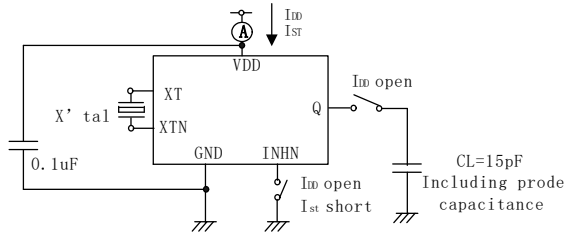
*: the high-impedance interval in the figure is shown as a LOW level due to the $1K\Omega$ pull-down resistor connected to the Q pin (see "Measurement circuit 2" in the "Measurement circuits" section)



Measurement Circuit

Measurement cct1

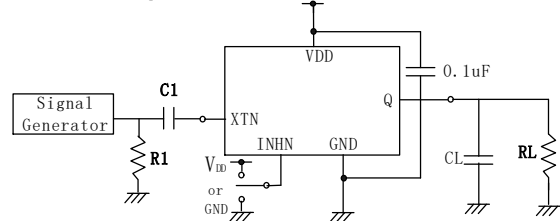
Measurement parameter: I_{DD} , I_{ST} , Duty, t_r , t_f



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

Measurement cct2

Measurement parameter: t_{ω}

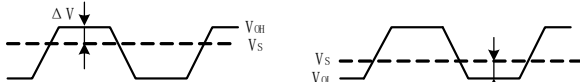
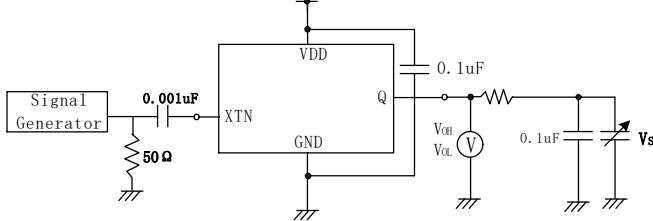


XTN input signal: 1Vp-p, sine wave

C1: 0.001uF CL: 15pF
R1: 50 Ω RL: 1K Ω

Measurement cct3

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



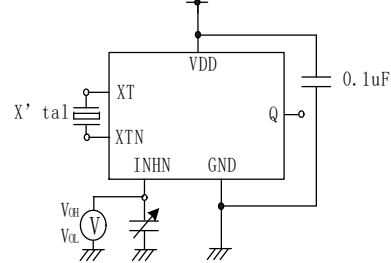
V_S adjusted such that $\Delta V = 50 \times \Delta V$

V_S adjusted such that $\Delta V = 50 \times \Delta V$

XTN input signal: 1Vp-p, sine wave

Measurement cct4

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



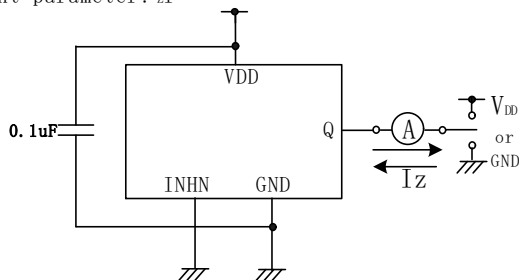
V_{IH} : Voltage is 0V to V_{DD} transition that changes the output state.

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

INHN has an oscillation stop function

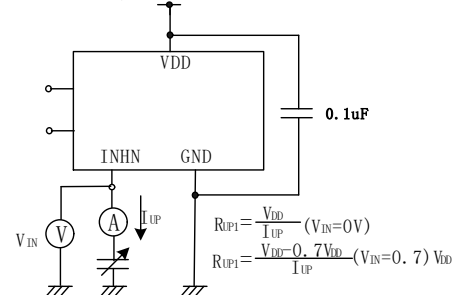
Measurement cct5

Measurement parameter: Z_I



Measurement cct6

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



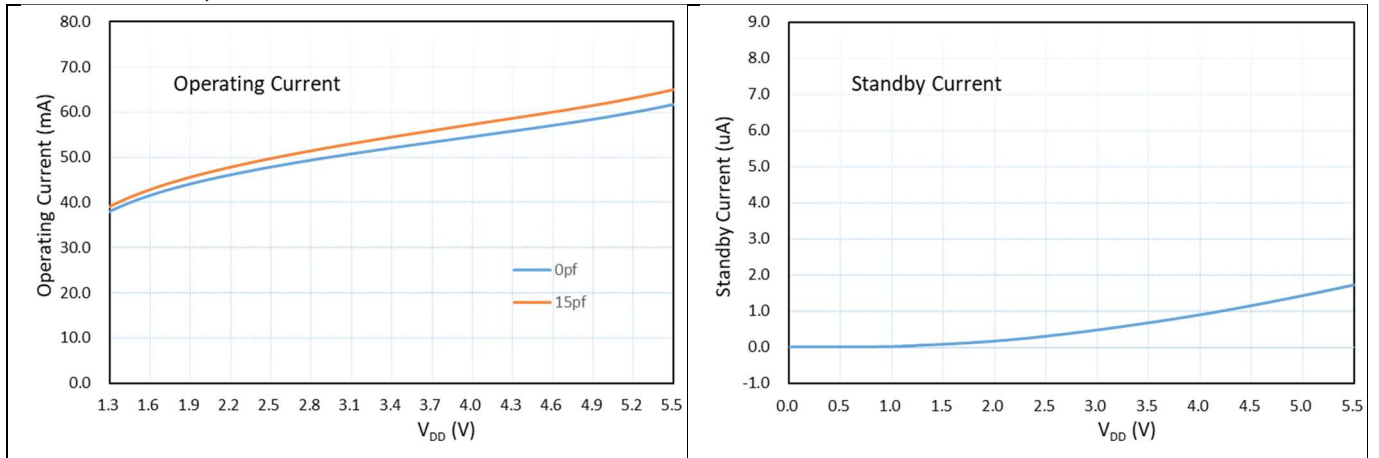
$$R_{UP1} = \frac{V_{DD}}{I_{UP}} \quad (V_{IN} = 0V)$$

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

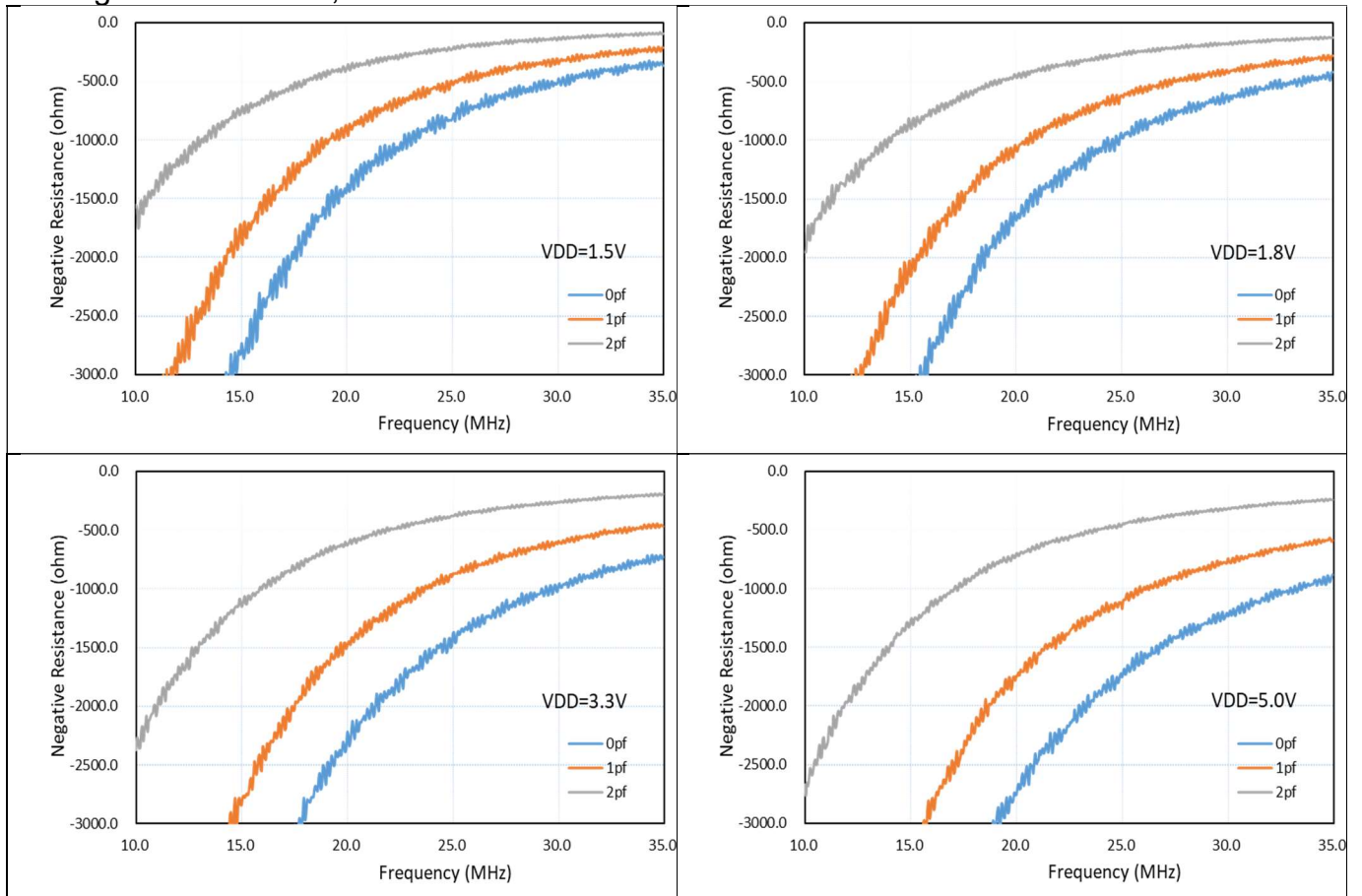


Test figure: XO6629CA-C

1. I_{DD} and I_{SB} , $T_a=25^\circ\text{C}$



2. Negative resistance, $T_a=25^\circ\text{C}$





Revision History:

Revision	Description	Date
VA.0	Initiated	2022/12/8
V1.0	Add XO6629C1~C5 -C	2023/12/7
V2.0	Delete XO6629C1~C5 -C	2024/4/26
V2.1	Updated Part No. and Tr/Tf	2024/11/21