Features

- Wide range of operating supply voltage:
  - 1.62~5.50V(30~135MHz)
  - 1.62~3.63V(120~160MHz)
- Operating temperature range
  - XO5054Cx-DE/WF-Q: -40 to 125℃
- High Performance (Low Phase Noise/Low Jitter)
- High Frequency VS Vdd Stability <+/-1.5ppm
- Ultra-Low Drive Level
- Standby function
- High impedance in standby mode, oscillator stops
- CMOS output duty level(1/2VDD)
- 50±5% output duty
- 15/30pF output drive capability
- Die form or Wafer form
- AEC-Q 100 qualified. PPAP capable, and manufactured in IATF 16949 certified facilities.

Description

The XO5054Cx-Q series are miniature crystal oscillator module ICs. The oscillator circuit stage has Voltage regulator, significantly reducing current consumption and crystal current, compared with existing devices, and significantly reducing the oscillator characteristics supply voltage dependency.

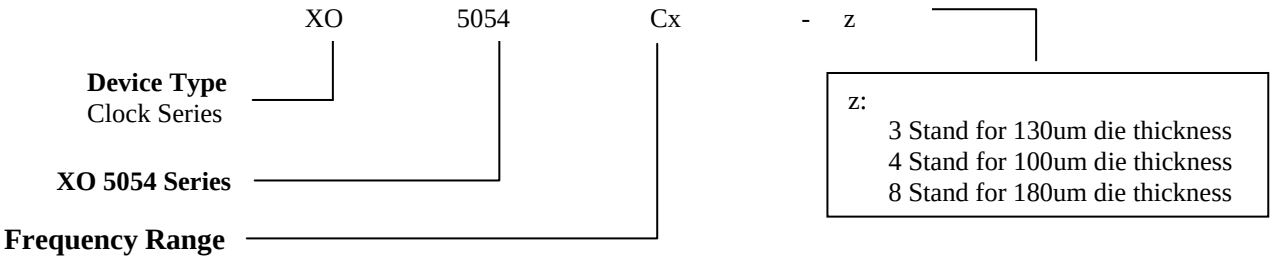
Application

- Used for crystal oscillator
- 7050, 5032 Crystal Oscillator (XO5054Cx-2/8)
- 3225, 2520, Crystal Oscillator (XO5054Cx-3/5)
- 2016 crystal Oscillator (XO5054Cx-4)

Ordering Information

Part no.	Package type
XO5054Cx-zWF-Q	Wafer form
XO5054Cx-zDE-Q	Die form

Note: 1. Below is the detailed definition of part no.
Note: 2. x: B/C/D/E, z: -3(130um)， -4(100um), -8(180um)



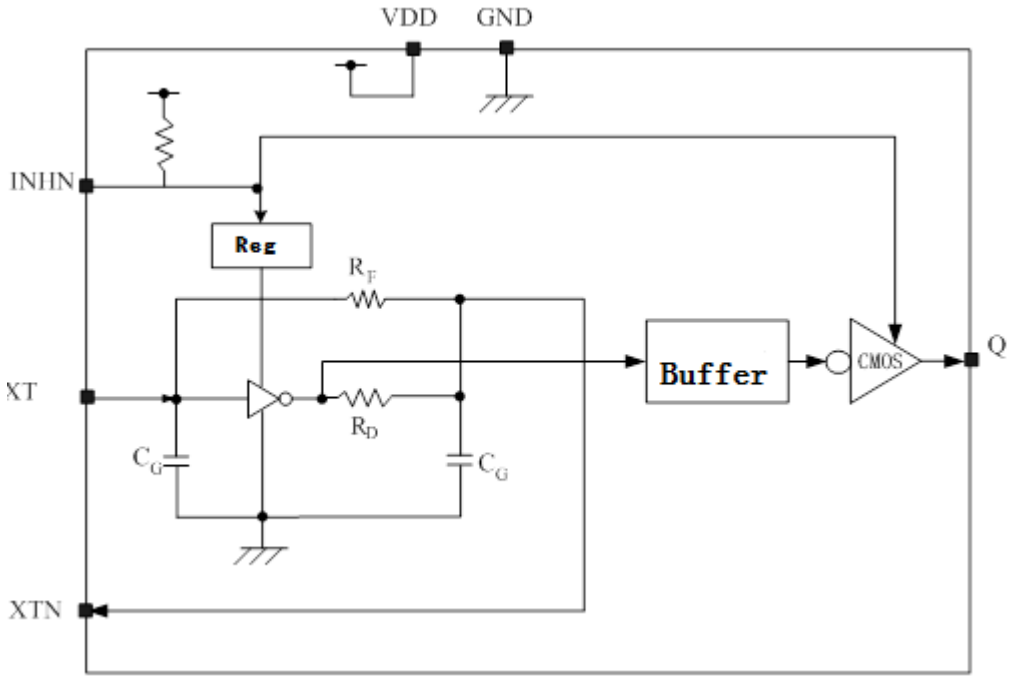
Oscillation frequency range, frequency divider function

Suffix	Foutput	Frequency range
5054CB	30~40MHz	30 to 160MHz
5054CZ	40~50 MHz	
5054CC	50~80 MHz	
5054CF	80~135 MHz	
5054CE	120~160 MHz	

Series Configuration

Part No.	Output frequency	Operating supply voltage range(V)	Oscillation mode	Recommended oscillation frequency range (MHz)	Output drive capability(mA)	Standby mode	
						Oscillator stop function	Output state
XO5054CB	30~40MHz	1.62 ~5.50	3rd Overtone	30 to 160	16	Yes	Hi-Z
XO5054CZ	40~50MHz	1.62~ 5.50					
XO5054CC	50~80MHz	1.62~ 5.50					
XO5054CE	120~160MHz	1.62~ 3.63					
XO5054CF	80~135MHz	1.62~ 5.50					

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

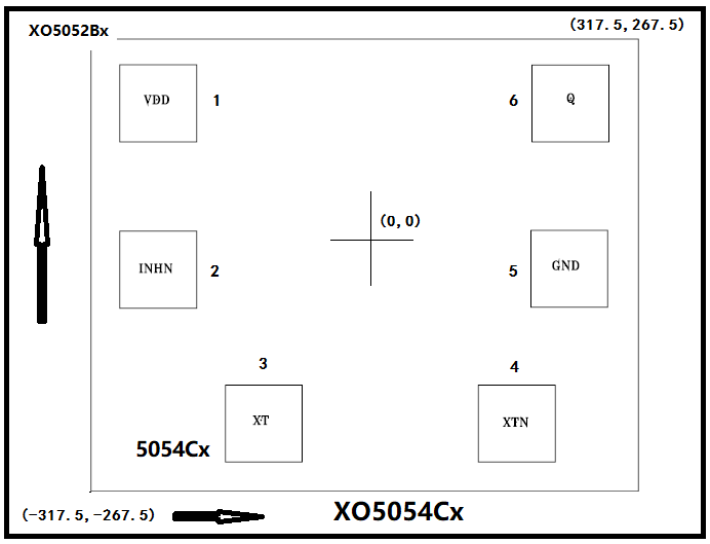
Power-saving Pull-up Resistor

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.

Oscillation Detector Function

The XO5054Cx-Q series also feature an oscillation detector circuit. This circuit functions make the outputs disable until the oscillator circuit starts and oscillation becomes stable. This alleviates the danger of abnormal oscillator output at oscillator start-up when power is applied or when INHN is switched.

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: 630μm*530μm (Including scribe line, Scribe Line Width 60um) **Die Thickness**: 180um±20um (-8),130μm±15μm (-3) or 100um±15um (-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. High impedance when LOW. Power-saving pull-up resistor built in.	
V_{DD}	P	Supply voltage	
GND	P	Ground	
Q	O	Output. Output frequency determined by external crystal	

Maximum Rating

Storage Temperature ..... -65°C to +150°C
Supply Voltage to Ground Potential (V_{DD} to GND) ..... -0.5V to +7.0V
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) 16mA

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	Series	Conditions	Min	Typ	Max	Unit
V_{DD}	Supply voltage	XO5054CB/CZCC/CF	30MHz~135MHz	1.62	-	5.50	V
V_{DD}	Supply voltage	XO5054CE	120~160MHz	1.62	-	3.63	V
V_{IN}	Input voltage	All series		GND	-	VDD	V
T_A	Operating temperature	All series		-40	-	+125	°C
f_{OUT}	Output frequency	XO5054Cx-Q		30	-	160	MHz

Reliability Data

Sym.	Parameter	Series	Conditions	Min	Typ	Max	Unit
ESD	Human Body Model	All series	MIL-STD-883H Method 3015.8	+/-3000	+/-5500		V

Note：Industrial Standard ESD：HBM Model +/-2000V

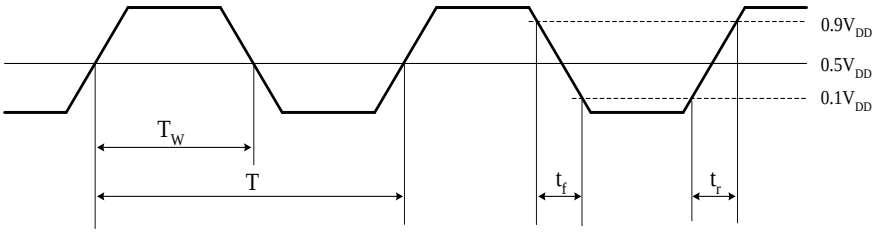
DC Electrical Characteristics

XO5054Cx-Q (V_{DD} = 1.62 to 5.50V, T_A = -40 to 125°C, unless otherwise noted.)

Sym.	Parameter	Condition		Rating			Unit
				Min	Typ.	Max	
V_{OH}	HIGH-level output voltage	Q: Measurement cct3, I_{OH}=8mA		V_{DD}-0.4	-	-	V
V_{OL}	LOW-level output voltage	Q: Measurement cct3, I_{OL}=8mA		-	-	0.4	V
V_{IH}	HIGH-level input voltage	INHN, Measurement cct4		0.7V_{DD}	-	-	V
V_{IL}	LOW-level input voltage	INHN, Measurement cct4		--	-	0.3V_{DD}	V
I_Z	Output leakage current	Q: Measurement cct5, IHNH=LOW	V_{OH} =V_{DD}	-	-	10	uA
			V_{OL}=GND	-	-	10	uA
I_{DD}	Current consumption	Measurement cct 1, 5054CZ-Q Fout=40MHz, No load	V_{DD} =1.8V			8	mA
			V_{DD} =3.3V			10	mA
		Measurement cct 1, 5054CC-Q Fout=50MHz, No load	V_{DD} =1.8V			10	mA
			V_{DD} =3.3V			12	mA
		Measurement cct 1, 5054CD-Q Fout=70MHz, No load	V_{DD} =1.8V	-		15	mA
			V_{DD} =3.3V			18	mA
		Measurement cct 1, 5054CE-Q Fout=125MHz, No load	V_{DD} =1.8V	-		20	mA
			V_{DD} =3.3V			25	mA
		Measurement cct 1, 5054CE-Q Fout=156.25MHz, No load	V_{DD} =1.8V	-		25	mA
			V_{DD} =3.3V			40	mA
I_{ST}	Standby current	Measurement cct1, INHN=LOW		-	-	10	uA
R_{UP1}	INHN pull-up resistance	Measurement cct6		0.4	1.5	8	MΩ
R_{UP2}				30	70	150	KΩ
C_G	Oscillator capacitance	XO5054CB/CZ-Q			5		pF
C_D					6		pF
CG		XO5054CC-Q			3		pF
CD					4		pF
CG		XO5054CF-Q			2		pF
CD					2		pF
CG		XO5054CE-Q			2		pF
CD					2		pF

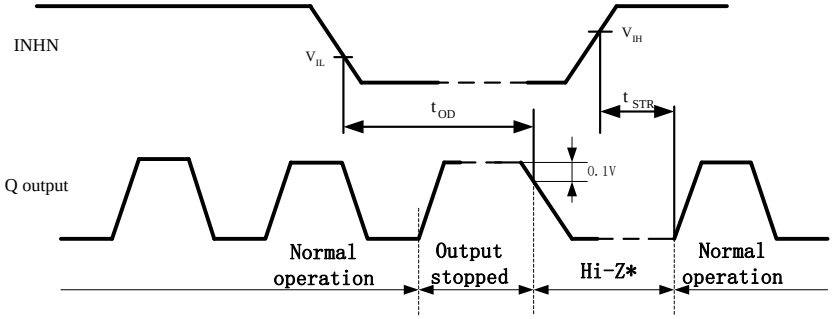
AC Electrical Characteristics

Output switching waveform



DUTY=Tw/T×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 1KΩ pull-down resistor connected to the Q pin(see "Measurement circuit 2" in the "Measurement circuits" section)

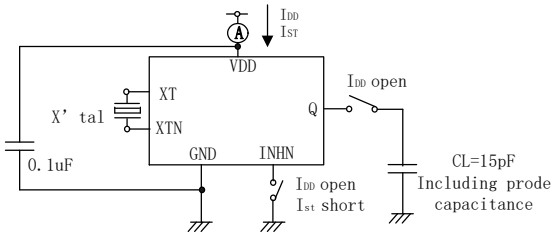
XO5054Cx-Q Series (VDD=1.62 to 5.5V, Ta=-40 to 125°C unless otherwise noted)

Parameter	Symbol	Condition		Min	Typ.	Max	Unit
Output rise time Output fall time (XO5054CB/CC-Q)	t_{r1}/t_{f1}	CL=15pF, $0.2V_{DD}$ ~$0.8V_{DD}$	V_{DD}=1.62 to 1.98V	-	2.5	3.5	ns
	t_{r2}/t_{f2}	CL=15pF, $0.1V_{DD}$ ~$0.9V_{DD}$	V_{DD}= 2.97 to 3.63 V	-	1.5	2.5	
	t_{r3}/t_{f3}	CL=15pF, $0.1V_{DD}$ ~$0.9V_{DD}$	V_{DD}= 4.5 to 5.50 V		1.2	2	
Output rise time Output fall time (XO5054CD/CE-Q)	t_{r1}/t_{f1}	CL=15pF, $0.2V_{DD}$ ~$0.8V_{DD}$	V_{DD}=1.62 to 1.98V	-	2.0	3.0	ns
	t_{r2}/t_{f2}	CL=15pF, $0.1V_{DD}$ ~$0.9V_{DD}$	V_{DD}=2.97 to 3.63 V	-	1.0	2.0	
	t_{r3}/t_{f3}	CL=15pF, $0.1V_{DD}$ ~$0.9V_{DD}$	V_{DD}=4.5 to 5.50V		0.7	1.5	
Output duty cycle	Duty	Measurement cct 1, T_A=25℃,C_L=15pF		40	50	60	%
Output disable delay time	t_{OD}	Measurement cct 1, T_A=25℃,C_L≤15pF		-	-	50	us

Measurement Circuit

Measurement cct1

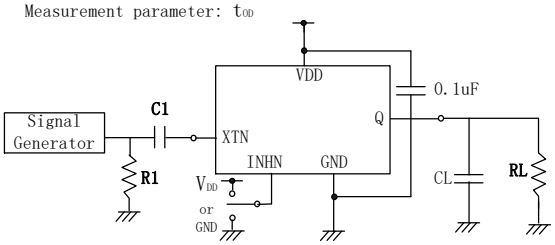
Measurement parameter: I_{DD}, I_{ST}, Duty, t_r, t_f



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

Measurement cct2

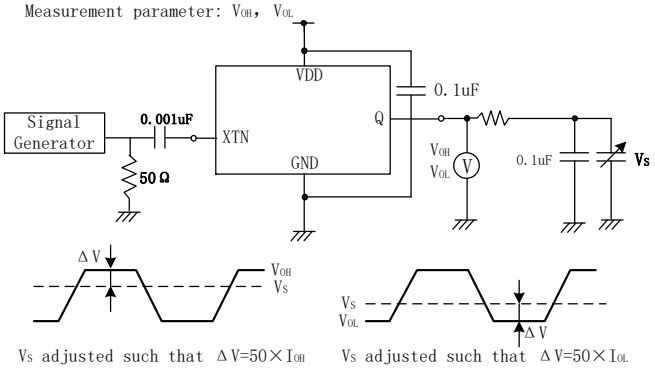
Measurement parameter: t_{OD}



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

Measurement cct3

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

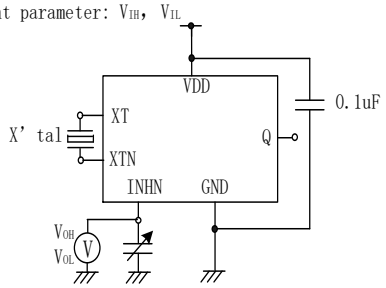


Vs adjusted such that ΔV=50×I_{OH} Vs adjusted such that ΔV=50×I_{OL}

XTN input signal:1Vp-p,sina wave

Measurement cct4

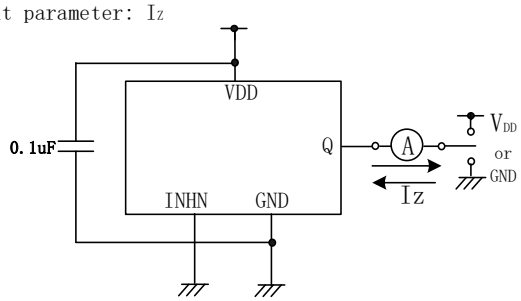
Measurement parameter: V_{IH}, V_{IL}



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

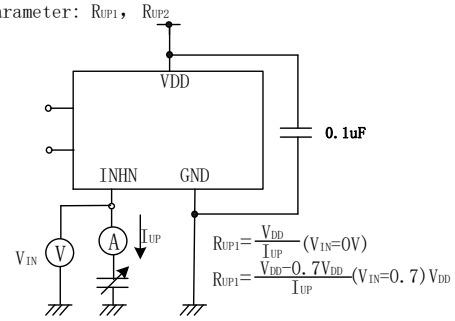
Measurement cct5

Measurement parameter: I_Z



Measurement cct6

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



Revision History

Revision	Description	Date
V0.9	Initiated	2023/11/9