XO5027 series
Fundamental Crystal Oscillator IC

Features

- Wide range of operating supply voltage: 1.40V to 5.5V(XO5027C1~XO5027C5)
  - 1.6V~5.5V(XO5027C6~XO5027C9)
- Regulated voltage drive oscillator circuit for reduced power consumption and crystal drive current
- Optimized low crystal drive current oscillation for miniature crystal units
- XO5027Bxseries: for Wire Bonding (type Ⅰ)
- XO5027Cxseries: for Wire Bonding (type Ⅱ)
- Recommended oscillation frequency range
- Low frequency Fundamental: 10MHz to 60MHz
- Multi-stage frequency divider for low-frequency output support: 50kHz(min)
- Frequency divider built-in:
  -Selectable by version: f0, f0/2, f0/4, f0/8, f0/16, f0/32, f0/64, f0/128, f0/256
- -45 to 125℃ operating temperature range
- Standby function
- High impedance in standby mode, oscillator stops
- CMOS output duty level(1/2VDD)
  -50±5% output duty
- Die form or Wafer form

Description

The XO5027 series are miniature crystal oscillator module ICs. The oscillator circuit stage has voltage regulator drive, 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(XO5027Cx-2DE)
- 3225, 2520,Crystal Oscillator(XO5027Cx-3/5DE)
- 2016 Crystal Oscillator(XO5027Cx-4DE)

Ordering Information

Part no.	Package type
XO50xxxxx-zWF	Wafer form
XO50xxyy-zDE	Die form

Note: 1.Below is the detailed definition of part no.
Note: 2. xx:27 , yy:Bx or Cx, z: -2(220um) or -3(130um)， -4(100um), -5(150um), -8(180um)

XO 5027 C 1- X

Device Type
OSC IC Series

XO 5027 Series

Pad layout type

B: for Wire Bonding(type I)
C: for Wire Bonding(type II)

X: 2 Stand for 220um die thickness
3 Stand for 130um die thickness
4 Stand for 100um die thickness
5 Stand for 150um die thickness
8 Stand for 180um die thickness

Oscillation frequency range, frequency divider function

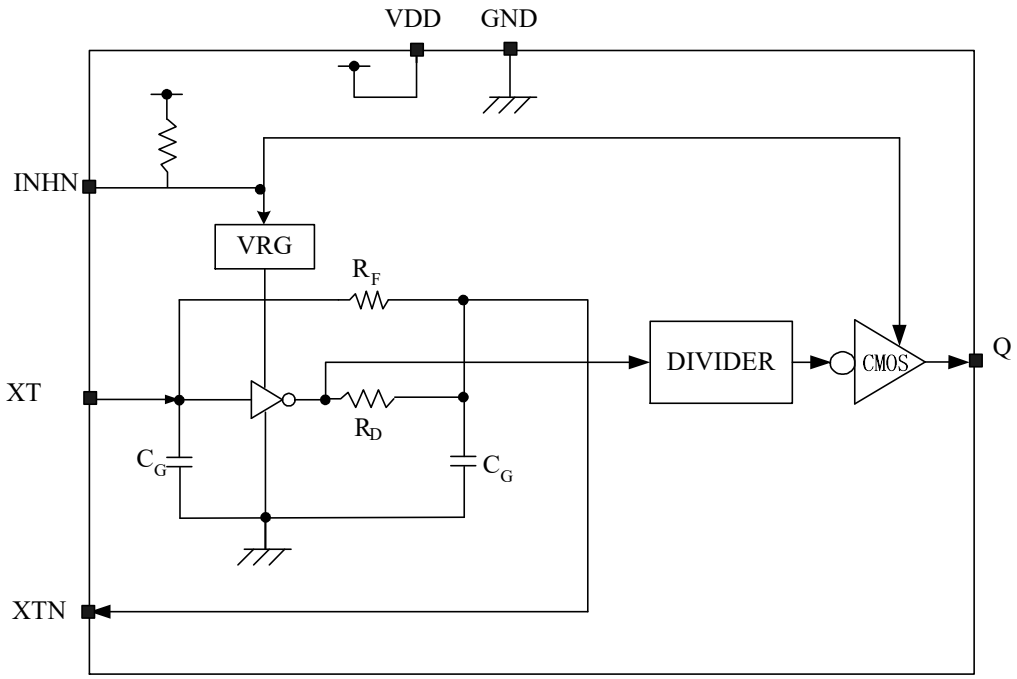
Suffix	f_{output}	Frequency range
1	f_O	10 to 60MHz
2	$f_O/2$	
3	$f_O/4$	
4	$f_O/8$	
5	$f_O/16$	
6	$f_O/32$	
7	$f_O/64$	
8	fo/128	
9	fo/256	

Series Configuration

Part No.	Output frequency	Operating supply voltage range(V)	Oscillation mode	Recommended oscillation frequency ragne*1(MHz)	Output drive capability(mA)	Standby mode	
						Oscillator stop function	Output state
XO5027x1*2	f0*2	1.4~5.5	Fundamental	10 to 60	4	Yes	Hi-Z
XO5027x2*2	f0/2						
XO5027x3*2	f0/4						
XO5027x4*2	f0/8						
XO5027x5*2	f0/16						
XO5027x6*2	f0/32						
XO5027x7*2	f0/64						
XO5027C8	f0/128						
XO5027C9	f0/256						

Note2; "x" means B or C of different Pad layout type.

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)	fo output frequency	Normal operation
Low	High impedance	Stopped

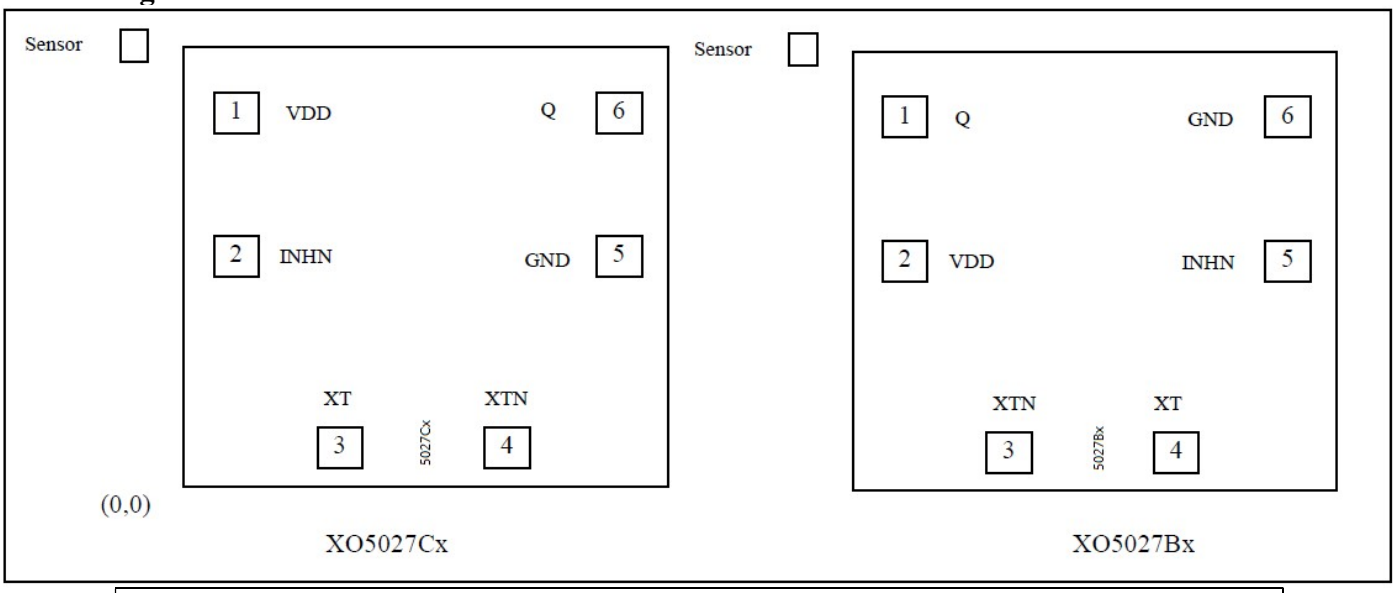
Power-saving Pull-up Resistor

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 XO5027 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
sensor	0	760.00	4	525	119
1	118	584	5	641	303
2	118	301	6	641	584
3	221	119			
Note: .					
Die Size: 760µm*700µm (Including scribe line size 80µm*80µm.) **Die Thickness:** 220um±20um(-2), 130µm±15µm(-3), 100µm±15µm(-4), 150um+/-15um(-5) **Pad Size:** 90µm*90µm **Substrate Level**: GND or Floating					

Pad Description

Sym.	Type	Description

XTN	O	Amplifier output.	Crystal 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 internal circuit to one of f0,f0/2,f0/4,f0/8,f0/16,f0/32,f0/64, f0/128, f0/256	

Maximum Ratings

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) 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	Series	Conditions	Min	Typ	Max	Unit
V_{DD}	Supply voltage	All series	C_L = 15pF	1.40	-	5.5	V
V_{IN}	Input voltage	All series	-	GND	-	VDD	V
T_A	Operating temperature	All series	-	-45	-	+125	°C
f0	Oscillation frequency*1	5027x1-5027x9	Vdd=1.4V~5.5V -	10	-	60	MHz
f_{OUT}	Output frequency	5027x1-5027x9	Vdd=1.4V~5.5V	0.05	- -	60	MHz

Reliability Data

Sym.	Parameter	Series	Conditions	Min	Typ	Max	Unit
ESD	Human Body Model	All series	MIL-STD-883H Method 3015.8	+/-3000	+/-6500		V
					-		

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

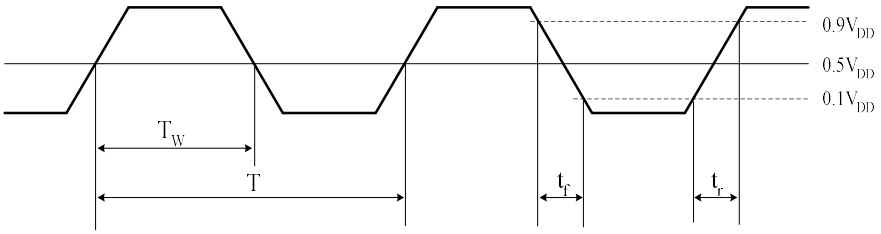
DC Electrical Characteristics

XO5027x1 to XO5027x9 (V_{DD} = 1.40 to 5.5V, T_A = -40 to 85°C, unless otherwise noted.)

Sym.	Parameter	Condition		Rating			Unit
				min	typ	max	
V_{OH}	HIGH-level output voltage	Q: Measurement cct3, I_{OH}=4mA		V_{DD}-0.4	-	-	V
V_{OL}	LOW-level output voltage	Q: Measurement cct3, I_{OL}=4mA		-	-	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, 5027C1(f0),no load INHN=open,f0=48MHz f_{OUT}=48MHz	V_{DD} =3.3V	-	1.6	2.4	mA
			V_{DD} =2.5V	-	1.3	2.0	mA
			V_{DD} =1.8V	-	1.0	1.5	mA
		Measurement cct 1, 5027C1(f0/2),no load INHN=open,f0=48MHz f_{OUT}=24MHz	V_{DD} =3.3V	-	1.5	2.3	mA
			V_{DD} =2.5V	-	1.2	1.8	mA
			V_{DD} =1.8V	-	0.9	1.4	mA
		Measurement cct 1, 5027C1(f0/4),no load INHN=open,f0=48MHz f_{OUT}=12MHz	V_{DD} =3.3V	-	1.3	2.0	mA
			V_{DD} =2.5V	-	1.0	1.5	mA
			V_{DD} =1.8V	-	0.8	1.2	mA
		Measurement cct 1, 5027C1(f0/8),no load INHN=open,f0=48MHz f_{OUT}=6MHz	V_{DD} =3.3V	-	1.1	1.7	mA
			V_{DD} =2.5V	-	0.9	1.4	mA
			V_{DD} =1.8V	-	0.75	1.15	mA
		Measurement cct 1, 5027C1(f0/16),no load INHN=open,f0=48MHz f_{OUT}=3MHz	V_{DD} =3.3V	-	1.05	1.6	mA
			V_{DD} =2.5V	-	0.85	1.3	mA
			V_{DD} =1.8V	-	0.7	1.1	mA
		Measurement cct 1, 5027C1(f0/32),no load INHN=open,f0=48MHz f_{OUT}=1.5MHz	V_{DD} =3.3V	-	1.0	1.5	mA
			V_{DD} =2.5V	-	0.85	1.3	mA
			V_{DD} =1.8V	-	0.7	1.1	mA
		Measurement cct 1, 5027C1(f0/64),no load INHN=open,f0=48MHz f_{OUT}=0.94MHz	V_{DD} =3.3V	-	1.0	1.5	mA
			V_{DD} =2.5V	-	0.85	1.3	mA
			V_{DD} =1.8V	-	0.7	1.1	mA
I_{ST}	Standby current	Measurement cct1, INHN=LOW		-	-	10	uA
R_{UP1}	INHN pull-up resistance	Measurement cct6		0.4	1.5	8	M Ω
R_{UP2}				30	70	150	K Ω
R_f	Oscillator feedback resistance	-		50	100	200	K Ω
C_G	Oscillator capacitance	Design value(a monitor pattern on a wafer is tested),Excluding parasitic capacitance		4.8	6	7.2	pF
C_D				8	10	12	pF

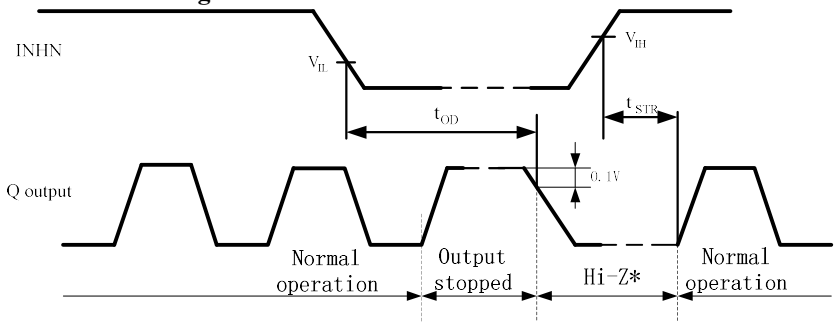
AC Electrical Characteristics

Output switching waveform



DUTY=$T_W/T\times100(\%)$

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)

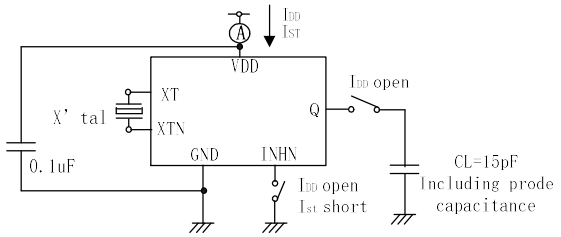
XO5027 Series(V_{DD}=1.40 to 5.5, Ta=-40 to 85℃ unless otherwise noted)

Parameter	Symbol	Condition		Min	Type	Max	Unit
Output rise time	t_{r1}	Measurement cct1,CL=15Pf, 0.1V_{DD} to 0.9V_{DD}	V_{DD}=2.25 to 3.36 V	-	2.0	4.5	ns
	t_{r2}		V_{DD}=1.60 to 2.25V	-	3.0	5.0	ns
Output fall time	t_{f1}	Measurement cct1,CL=15Pf, 0.1V_{DD} to 0.9V_{DD}	V_{DD}=2.25 to 3.36 V	-	2.0	4.5	ns
	t_{f2}		V_{DD}=1.60 to 2.25 V	-	3.0	5.0	ns
Output rise time	t_{r1}	Measurement cct1,CL=50Pf, 0.1V_{DD} to 0.9V_{DD}	V_{DD}=2.25 to 3.36 V	-	4.8	9.6	ns
	t_{r2}		V_{DD}=4.5 to 5.5V	-	3.8	7.6	ns
Output fall time	t_{f1}	Measurement cct1,CL=50Pf, 0.1V_{DD} to 0.9V_{DD}	V_{DD}=2.25 to 3.36 V	-	4.8	9.6	ns
	t_{f2}		V_{DD}=4.5 to 5.5 V	-	3.8	7.6	ns
Output duty cycle	Duty	Measurement cct 1, T_A=25℃,C_L=15pF		45	50	55	%
Output disable delay time	t_{OD}	Measurement cct 1, T_A=25℃,C_L≤15pF		-	-	50	us

Measurement Circuit

Measurement cct1

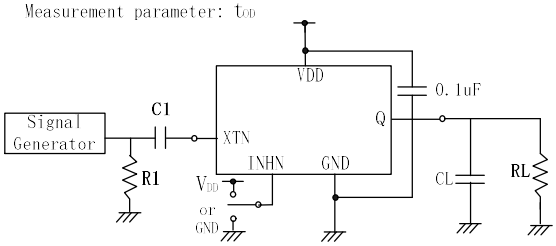
Measurement parameter: I_{DD}, I_{ST}, Duty, t_r, t_f



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

Measurement cct2

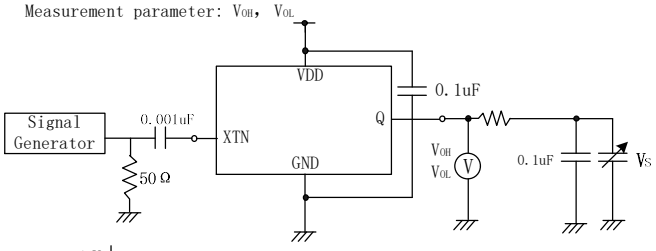
Measurement parameter: t_{OD}



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

Measurement cct3

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

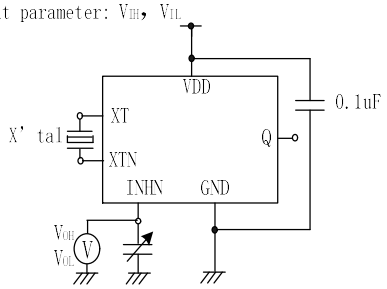


Vs adjusted such that $\Delta V=50\times I_{OH}$ Vs adjusted such that $\Delta V=50\times I_{OL}$

XTN input signal:1Vp-p,sina wave

Measurement cct4

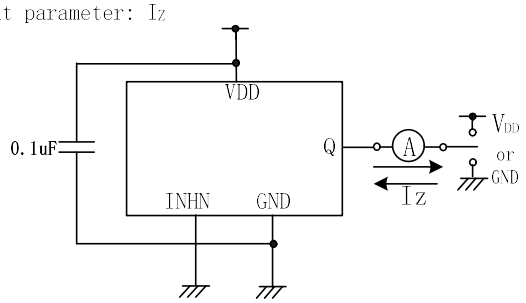
Measurement parameter: V_{IH}, V_{IL}



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: Iz



Measurement cct6

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