Features

- 1.8 to 5.5V operating supply voltage range
- Oscillation frequency range (varies with version)
  - 1.8 to 5.5V: 40MHz to 165MHz
- -40 to 85℃ operating temperature range
- Voltage regulator build-in
- Oscillation capacitors build-in
- Inverter amplifier feedback resistor built-in
- Oscillation detector function built-in
- Standby function
  - High impedance in standby mode, oscillator stops
- Low standby current
  - Power-save pull-up resistor built-in
- CMOS output duty level
- 15pF output load
- 8mA output drive capability(V_{DD}=1.8V)
- Die and Wafer form(PT7C5020ALx)

Application

- Used for crystal oscillator

Description

The PT7C5020AL series are 1.8V operation, high-frequency crystal oscillator module ICs. They support 40MHz to 165MHz (1.8~5.5V) 3rd overtone oscillation modes. The crystal oscillator circuit has voltage regulator drive, significantly reducing current consumption and crystal current, significantly reducing the oscillator characteristics supply voltage dependency. The output circuit comprises a CMOS buffer than can operate at high frequencies and drive a 15pf capacitance load.

Ordering Information

Part no.	Package type
PT7C5020ALx-2GDE	Die form
PT7C5020ALx-2DE	Die form
PT7C5020ALx-5GDE	Die form
PT7C5020ALx-2GWF	Wafer form
PT7C5020ALx-2WF	Wafer form
PT7C5020ALx-5GWF	Wafer form

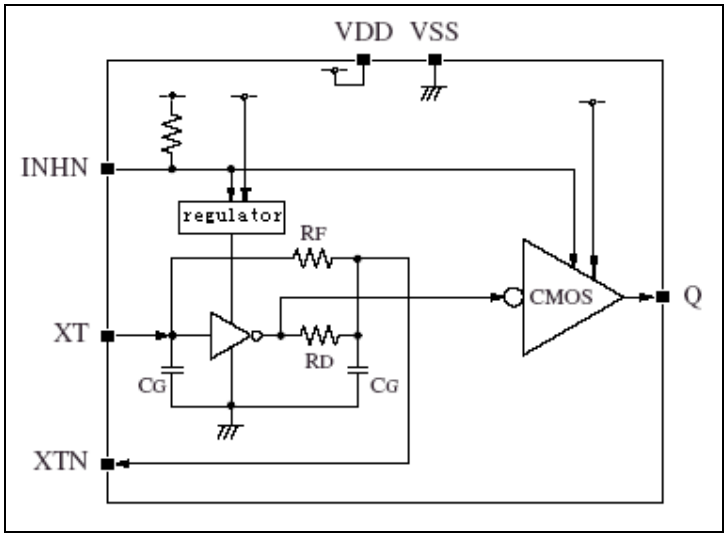
Note: 1. "x" shows the different function. See below table.
2. "-2G" show the die thickness is 220±20μm without coating; "-2" show the die thickness is 220±20μm with coating; "-5G" show the die thickness is 130±10μm without coating;

Series Configuration

Part No	Operation supply Voltage(V)	Recommended operating frequency range(MHz)	Built-in capacitance(pF)	
			C_{IN}	C_{OUT}
PT7C5020ALF	1.8 to 5.5	40 to 60	6	6
PT7C5020ALA		60 to 90	4	4
PT7C5020ALB		90 to 110	4	4
PT7C5020ALC		110 to 135	2	3
PT7C5020ALD		135 to 165	2	3

Note: * 1. The recommended operating frequency is a yardstick value derived from the crystal used for PTI characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.

Block Diagram



Funtion Description

Standby Function
When INHN goes LOW, the device is in standby mode. The Q output becomes high impedance and the oscillator circuit stops.

OE	Q	Oscillator
HIGH(or open)	f0 output frequency	Normal operation
LOW	High impedance	Stopped

Build-in voltage regulator

The voltage regulator generate a stable voltage supplying the oscillator, significantly reducing current consumption and crystal current, significantly reducing the oscillator characteristics supply voltage dependency.

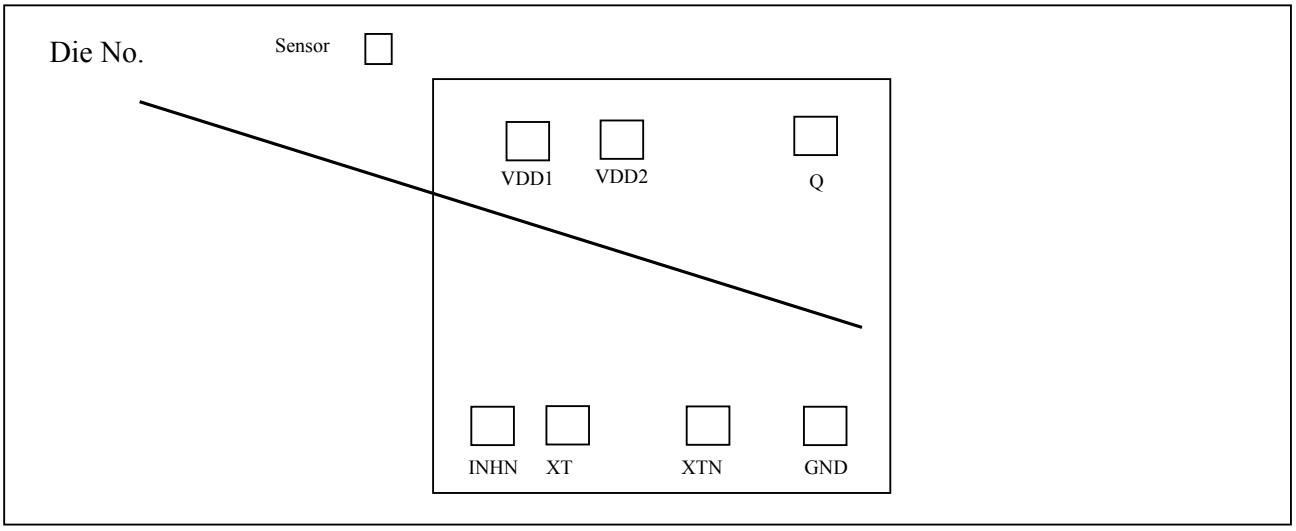
Power-saving Pull-up Resistor

The INHN pin pull-up resistance changes in response to the input level(HIGH or LOW).When OE is tied LOW ,the pull-up resistance becomes large, reducing the current consumed by the resistance. When INHN is left open, pull-up resistance becomes small, such that even if the input is affected by external noise the outputs are stable due to INHN being tied HIGH by the pull-up resistor.

Oscillation Detector Function

The devices also feature an oscillation detector circuit. This circuit function is to disable the outputs until the oscillator circuit starts. This prevents 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	-50	930.00	GND	730.60	92.60
INHN	171.20	92.60	Q	730.60	801.60
XT	301.20	92.60	VDD2	342.00	801.60
XTN	516.40	92.60	VDD1	212.00	801.60

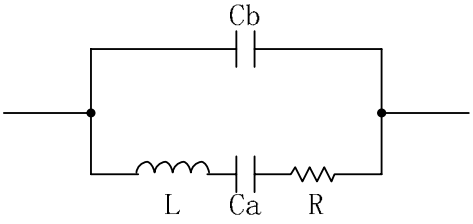
Note1: Substrate is connected to GND for 130μm and 220μm without coating; To 220μm with coating, substrate is connected to GND or VDD or floating.
Note2: VDD1 and VDD2 are both supply voltage and connecting with metal on the chip. Bonding any one is OK.

Die Size: 910μm*980μm (Including scribe line size100μm*100μm.)
Die Thickness: PT7C5020ALx-2G/PT7C5020ALx-2: 220μm±20μm; PT7C5020ALx-5G: 130μm±10μm.
Pad Size: 90μm*90μm

Pad Description

Sym.	Type	Description	
INHN	I	Output state control input. Oscillator stops when Low. Power-saving pull-up resistor built-in	
XT	I	Oscillator input pin.	Crystal connection pins. Crystal is connected between XT and XTN
XTN	O	Oscillator output pin.	
GND	P	Ground (-).	
Q	O	Output. Output frequency. High impedance in standby mode.	
VDD (VDD1 or VDD2)	P	Supply voltage.	

Type	F (MHz)	R (Ω)	L (mH)	Ca (fF)	Cb (pF)
SMD7050 crystal (fundamental)	20MHz	7.4	2.8	13.13	4.97
	40MHz	8.1	2.7	10.95	1.45



Maximum Ratings

Storage Temperature	-65°C to +150°C
Supply Voltage range	-0.5V to +5.0V
Input voltage range	GND-0.5V to V_{DD} +0.5V
Output voltage range	GND-0.5V to V_{DD} +0.5V
Output current	25mA

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

$C_L \leq 15pF$

Sym.	Parameter	Conditions		Min	Typ	Max	Unit
V_{DD}	Supply voltage	40MHz≤f≤60MHz	5020ALF	1.8	-	5.5	V
		60MHz≤f≤90MHz	5020ALA	1.8	-	5.5	
		90MHz≤f≤110MHz	5020ALB	1.8	-	5.5	
		110MHz≤f≤135MHz	5020ALC	1.8	-	5.5	
		135MHz≤f≤165MHz	5020ALD	1.8	-	5.5	
V_{IN}	Input voltage	Input pins		GND	-	V_{DD}	V
T_A	Operating temperature	-		-40	+25	+85	°C

DC Electrical Characteristics

Symbol	Parameter	Condition			Min	Typ	Max	Unit
I_{DD}	Operating current Consumption*1	Measurement cct1, INHN=open or HIGH, CL=15pF	5020ALF f=60MHz	V_{DD}=2.5V	-	8.5	16	mA
				V_{DD}=3.3V	-	11	20	
				V_{DD}=5.0V	-	16	26	
			5020ALA f=90MHz	V_{DD}=2.5V	-	12	20	
				V_{DD}=3.3V	-	14	24	
				V_{DD}=5.0V	-	18	30	
			5020ALB f=110MHz	V_{DD}=2.5V	-	14	24	
				V_{DD}=3.3V	-	18	30	
				V_{DD}=5.0V	-	24	40	
			5020ALC f=135MHz	V_{DD}=2.5V	-	18	30	
				V_{DD}=3.3V	-	24	40	
				V_{DD}=5.0V		28	50	
			5020ALD f=165MHz	V_{DD}=2.5V	-	24	40	
				V_{DD}=3.3V	-	28	50	
				V_{DD}=5.0V	-	32	60	
I_{ST}	Standby current	Measurement cct1, INHN=LOW			-	-	10	µA
V_{OH}	HIGH-level Output voltage	Q: Measurement cct3, V_{DD}=1.8 to 5.5V,I_{OH}=8mA			V_{DD}-0.4	V_{DD}-0.3	-	V
V_{OL}	LOW-level	Q: Measurement cct3, V_{DD}=1.8 to 5.5V,I_{OL}=8mA			-	0.3	0.4	V
I_Z	Output leakage current	Q: Measurement cct5, INHN=LOW, V_{DD}=5.5V		V_{OH}=V_{DD}	-	-	10	µA
				V_{OL}=GND	-	-	10	µA
V_{IH}	HIGH-level	INHN, Measurement cct4			0.7V_{DD}	-	-	V
V_{IL}	LOW-level	INHN, Measurement cct4			-	-	0.3V_{DD}	V
R_{UP1}	INHN pull-up resistance	Measurement cct6		INHN=GND	0.4	-	4	MΩ
R_{UP2}				INHN=0.7V_{DD}	30	-	150	KΩ

Note: *1: The operating current consumption includes the C_L=15pF capacitance load charging current.

AC Electrical Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Duty	Output duty cycle	Measurement cct1, T_A=25℃,C_L=15pF	V_{DD}=2.25 to 5.5V	45	50	55	%
Tr1	Rise time	Measurement cct1, C_L=15pF, V_{DD}=2.25 to 5.5V,0.1V_{DD} to 0.9V_{DD}		-	1	2	ns
Tr2	Rise time	Measurement cct1, C_L=15pF, V_{DD}=1.8 to 2.25V,0.2V_{DD} to 0.8V_{DD}		-	1.5	2.5	
Tf1	Fall time	Measurement cct1, C_L=15pF, V_{DD}=2.25 to 5.5V,0.9V_{DD} to 0.1V_{DD}		-	1	2	
Tf2	Fall time	Measurement cct1, C_L=15pF, V_{DD}=1.8 to 2.25V,0.8V_{DD} to 0.2V_{DD}		-	1.5	2.5	
T_{OE}	Output enable1 delay time	Measurement cct2, C_L≤15pF, T_A=25℃, INHN=LOW to HIGH		-	-	2	ms
T_{OD}	Output disable delay time	Measurement cct2, C_L≤15pF, T_A=25℃, INHN= HIGH to LOW		-	-	200	ns

1. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

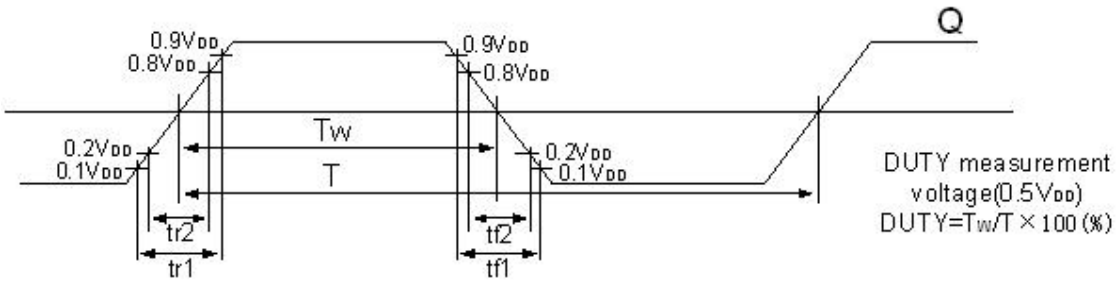


Figure1. Output switching waveform

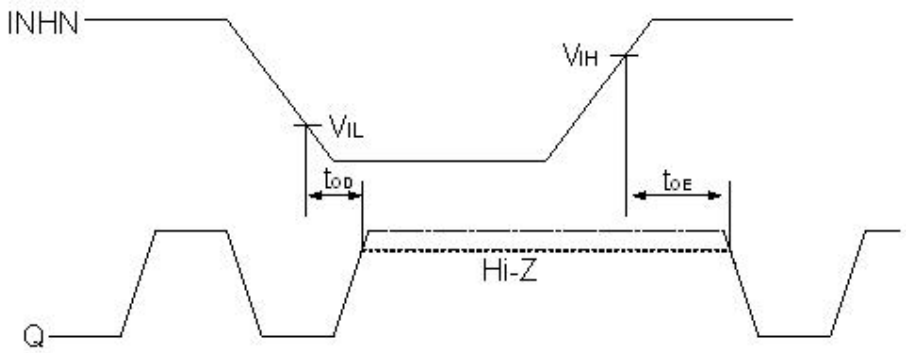
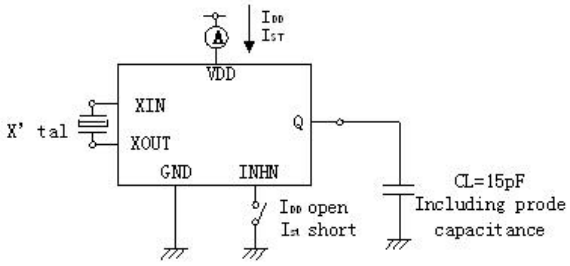


Figure2. Output disable/enable timing chart

Measurement Circuit

Measurement cct1

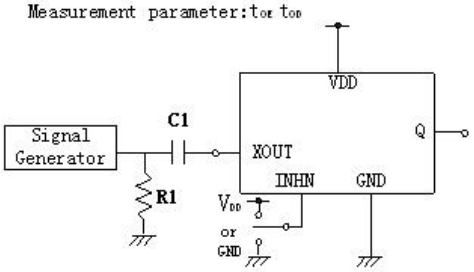
Measurement parameter: I_{DD}, I_{ST}, Duty, t_r, t_f



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

Measurement cct2

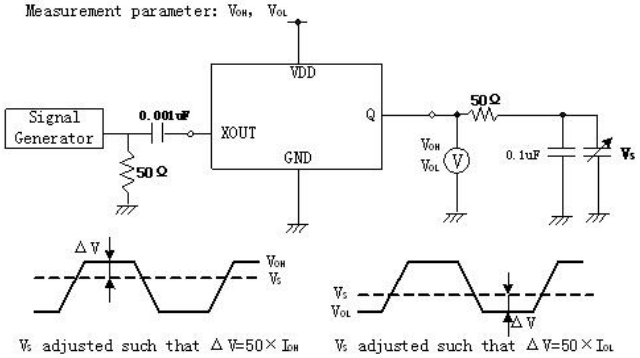
Measurement parameter: t_{OE} t_{OD}



XOUT input signal: 1Vp-p, sine wave
C1: 0.001uF R1: 50Ω

Measurement cct3

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

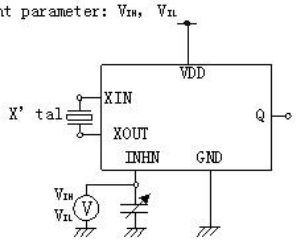


V_S adjusted such that $\Delta V = 50 \times I_{OH}$ V_S adjusted such that $\Delta V = 50 \times I_{OL}$

XOUT input signal: 1Vp-p, sine wave

Measurement cct4

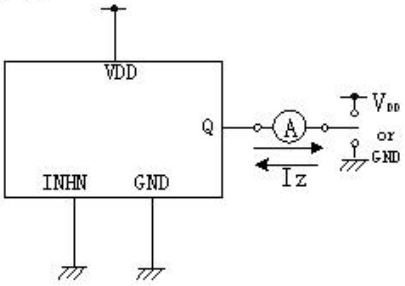
Measurement parameter: V_{IH}, V_{IL}



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

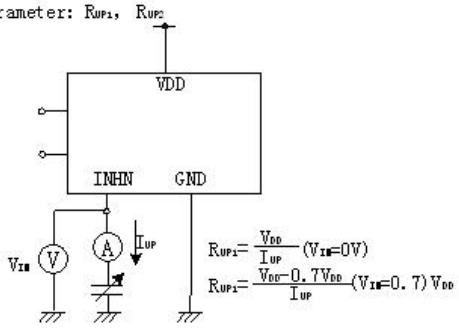
Measurement cct5

Measurement parameter: I_Z



Measurement cct6

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



Notes

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