■Description

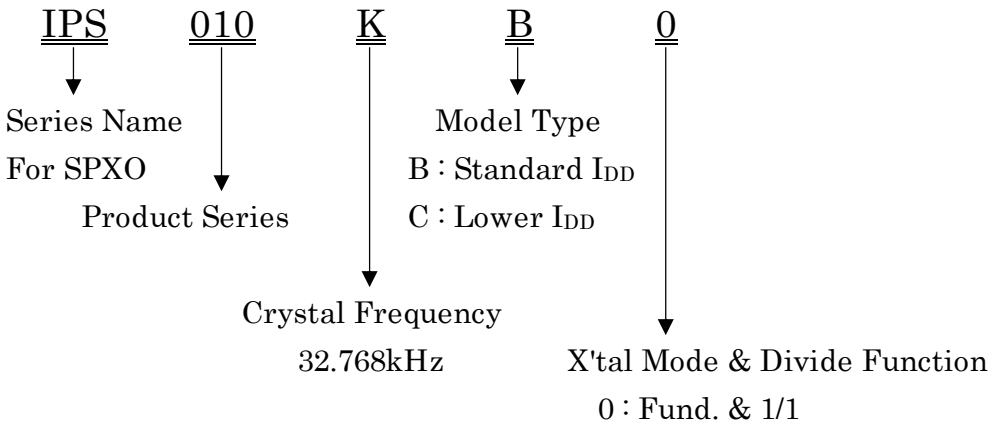
IPS010KB0/KC0 is a CMOS oscillator IC which is specially designed to combine with the 32.768kHz crystal unit.

This product enables ultra low power consumption crystal oscillator by sophisticated design and specially tuned CMOS process. Since the power supply of the output stage can be set up independently, the interface to a receptacle is easy. This IC is small enough to form a micro size oscillator.

■ Features

- Power supply voltage : 1.2V~5.5V
- Crystal frequency : 32.768kHz
- Low power consumption : 0.5μA (V_{DD}=1.8V, No Load)
- Output : CMOS
- Small chip size : 0.74mm × 0.70mm
- Frequency stability to Vdd : Within ±0.5Hz
- Duty cycle : Within 50%±5%

1. Part number rule



2. Series

Part Number	Frequency F0 (kHz)	V_{DD} (V)	Ta	Remarks
IPS010 K B 0	32.768	1.2 ~5.5	-40℃~125℃	·Normally pulled up by internal pull-up register. (OE terminal)
IPS010 K C 0			-40℃~105℃	·Low current consumption type ·No pull up resister (OE terminal)

3. Absolute Maximum Ratings

V_{SS}=0V, Ta=25℃±2℃

Parameter	Symbol	Condition	Ratings		
			Min	Max	Unit
Supply Voltage	V_{DD}	V_{SS}=0V	V_{SS}-0.5	7.0	V
Input Voltage	V_{IO}	V_{SS}=0V	V_{SS}-0.5	7.0	V
Output Voltage	V_{OUT}		V_{SS}-0.5	V_{DD}+0.5	V
Output Current	I_{OUT}			25	mA
Junction Temperature	Tj		-55	150	℃
Storage Temperature	Tstg		-55	125	℃

4. Recommended Operating Condition

V_{SS}=0V

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage	V_{DD}		1.2	3.3	5.5	V	V_{DD}
“H” Input Voltage	V_{IH}		V_{DD}×0.8			V	OE
“L” Input Voltage	V_{IL}				V_{DD}×0.2	V	OE
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V	OE
Crystal Frequency	f			32.768		kHz	X1,X2
Output Load Capacitance	CL	CMOS			15	pF	OUT
Ambient Temperature	Topt	IPS010KB0	-40		125	℃	
		IPS010KC0	-40		105		

This IC has enough immunity against ESD and Latch-up, but handle with care.

5. Electrical Specification

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Unless otherwise stated, V_{DD}=1.2V~5.5V, V_{SS}=0V, Ta=-40℃~125℃

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output leak current	I_Z	V_{DD}=5.5V			10	uA
"H" output voltage	V_{OH}	I_{OH}=-400uA,V_{DD}=1.5V~5.5V	V_{DD}-0.4			V
"L" output voltage	V_{OL}	I_{OL}=400uA, V_{DD}=1.5V~5.5V			V_{SS}+0.4	V
Current Consumption	I_{DD}	No Load, V_{DD}=3.63V		0.8	1.5	uA
		No Load, V_{DD}=5.5V		1.2	2.5	
		CL=15pF, V_{DD}=3.63V		2.6	3.5	
		CL=15pF, V_{DD}=5.5V		4.0	5.0	
Standby Current	I_{DDD}	OE≦0.3V			0.8	uA
Rise Time / Fall Time	Tr/Tf	CL=15pF, V_{DD}=1.2V~1.5V 10%~90%V_{DD}			150	ns
		CL=15pF, V_{DD}=1.5V~5.5V 10%~90%V_{DD}			100	
Output DutyCycle	Duty	CL=15pF, 1/2V_{DD} point	45		55	%
Osc. Start up Time	T_{start}			150	500	ms

Note : Please use a crystal with CI=100kΩ or less.

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Unless otherwise stated, V_{DD}=1.2V~5.5V, V_{SS}=0V, Ta=-40℃~105℃

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output leak current	I_Z	V_{DD}=5.5V			10	uA
"H" output voltage	V_{OH}	I_{OH}=-400uA, V_{DD}=1.5V~5.5V	V_{DD}-0.4			V
"L" output voltage	V_{OL}	I_{OL}=400uA, V_{DD}=1.5V~5.5V			V_{SS}+0.4	V
Current Consumption	I_{DD}	No Load, V_{DD}=1.8V		0.35	0.65	uA
		No Load, V_{DD}=3.3V		0.50	0.80	
		No Load, V_{DD}=5.5V		0.90	1.40	
		CL=15pF, V_{DD}=1.8V		1.25	1.55	
		CL=15pF, V_{DD}=3.3V		2.15	2.45	
		CL=15pF, V_{DD}=5.5V		3.70	4.20	
Standby Current	I_{DDD}	OE≦0.3V			0.6	uA
Rise Time / Fall Time	Tr/Tf	CL=15pF, V_{DD}=1.2V~1.5V 10%~90%V_{DD}			200	ns
		CL=15pF, V_{DD}=1.5V~5.5V 10%~90%V_{DD}			130	
Output Duty Cycle	Duty	CL=15pF, 1/2V_{DD} point	40		60	%
Frequency V_{DD} deviation	F_{VST}	Ta=25℃			±1.0	ppm /V
Osc. Start up Time	T_{start}			150	500	ms

Note : Please use a crystal with CI=100kΩ or less.

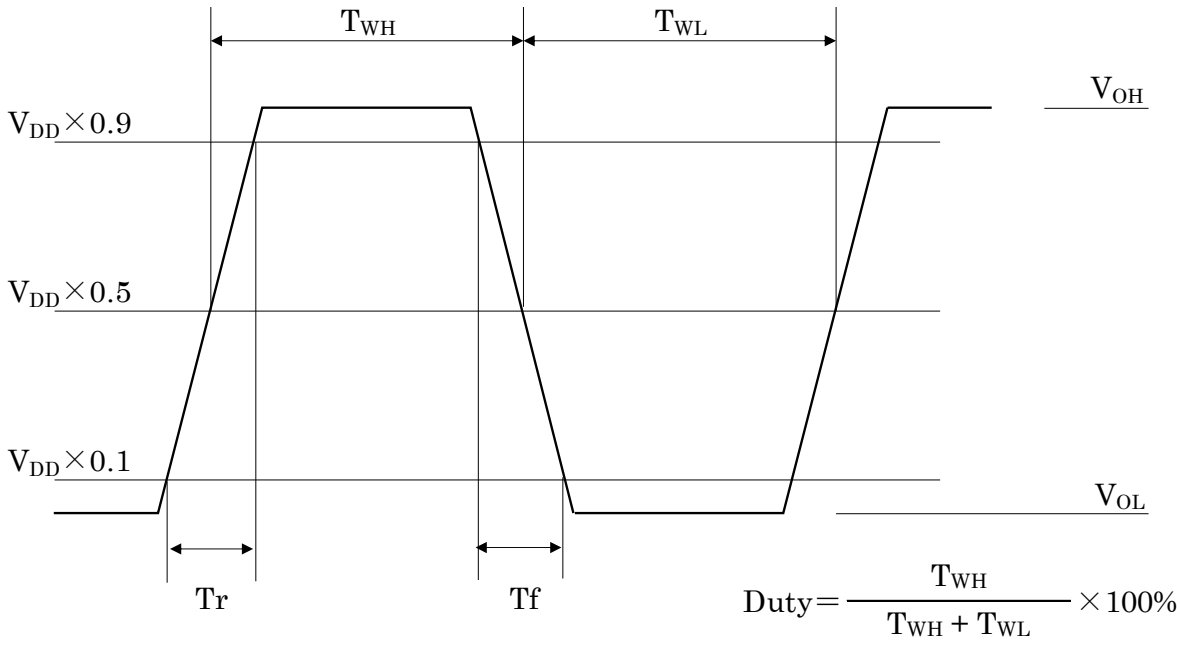


Fig. 5-1 Output Wave Form (Duty, Tr, Tf)

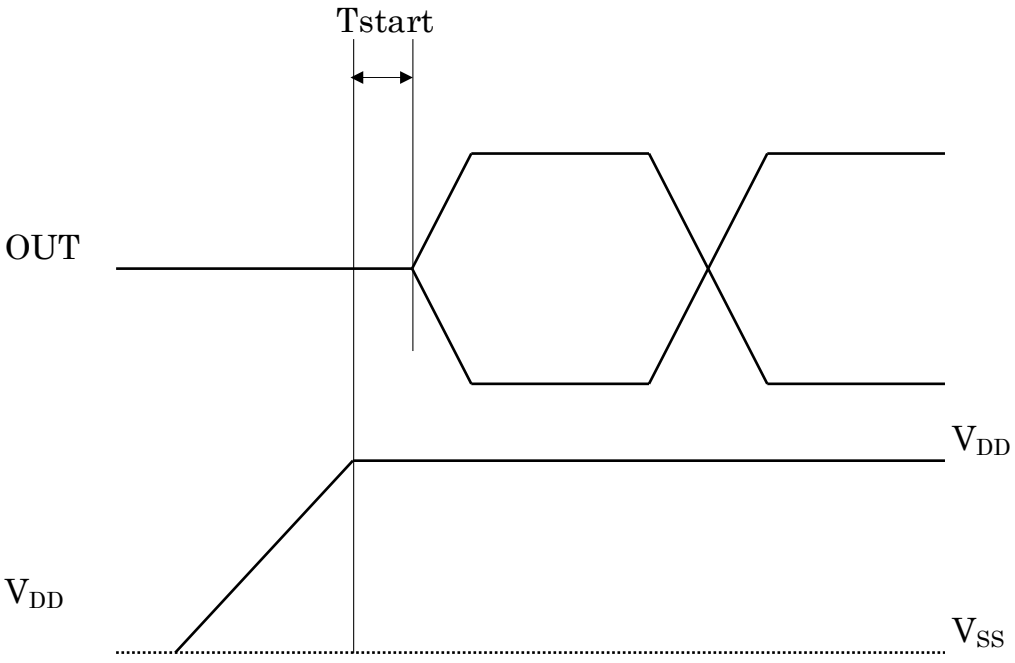


Fig. 5-2 Output Wave Form (Tstart)

6. Circuit Parameters of Oscillator (Reference Data for Circuit Design)

Ta=25℃

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Regulated Voltage	Vreg			0.78		V
Feedback Resistor	Rf			50		MΩ
Driving Resistor	Rd			300		kΩ
Oscillation Capacitor	Cg			5.67		pF
	Cd			11.34		

*The above values are the design values and are not guaranteed by test.

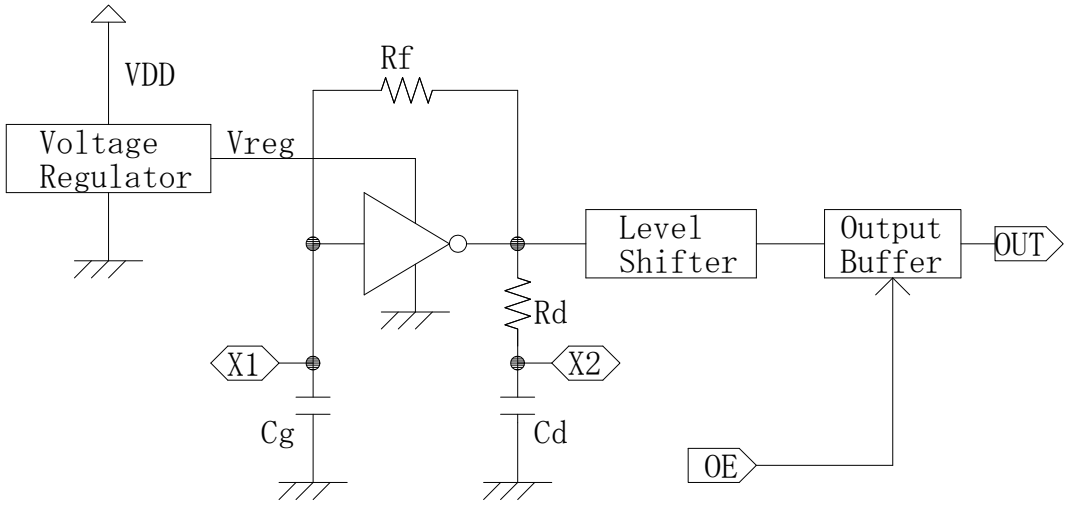


Fig. 6-1 Block Diagram of IPS010KB0

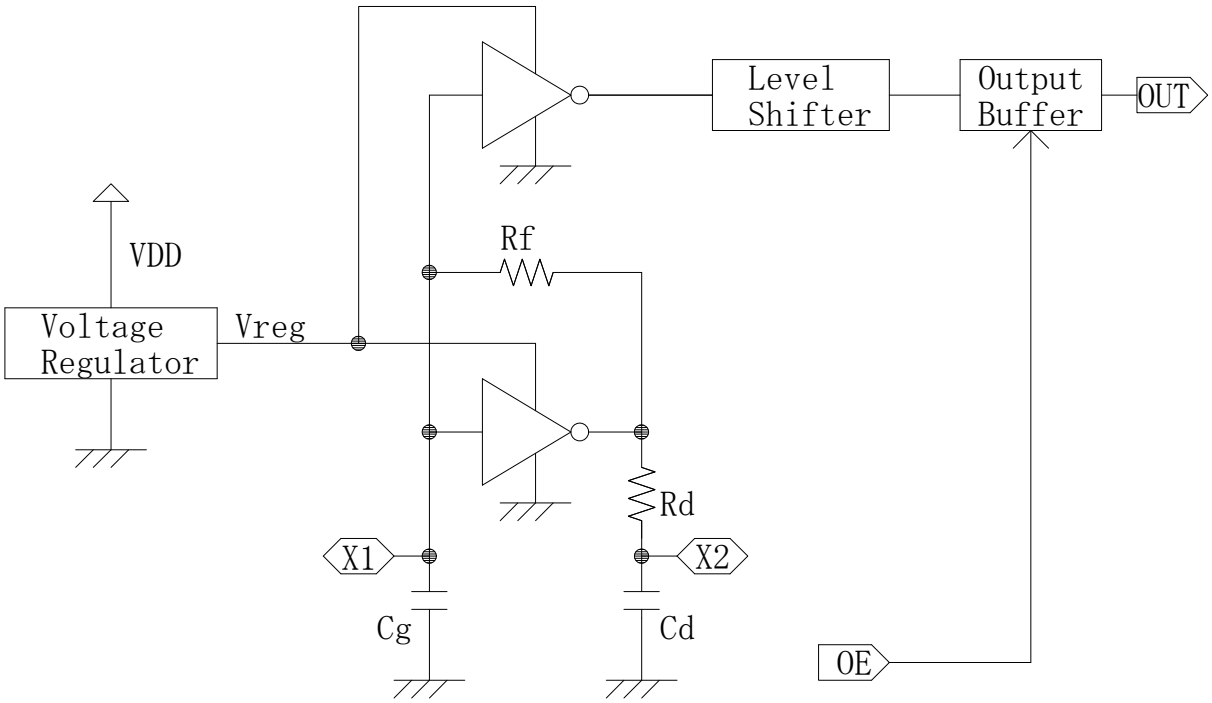
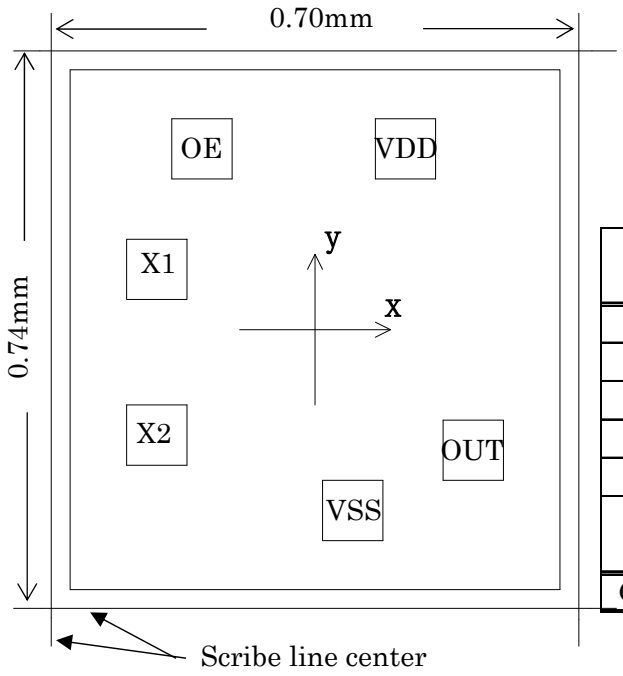


Fig. 6-2 Block Diagram of IPS010KC0

7. Pad Layout



- Die Size : 0.70mm × 0.74mm
- Pad Size : 80um □
- Thickness : 150um±20um
- IC Backside : Gnd or Open

Pad Name	Function	Location (μm)	
		x	y
VDD	(+) Power Supply	119	239
OUT(Q)	Frequency Output	210	-158
VSS	(−) Ground	50	-242
X2	Crystal Drive	-211	-139
X1	Crystal Feedback	-211	84
OE	Output stop "L": High-Impedance	-152	242
Chip Center		0	0

About OE terminal

KB0…Pulled up to V_{DD}.

When OE is “Low”, OUT pad becomes Hi-Z and output disable.
When “High” or “Floating”, OUT pad becomes output enable.
Connect to “High” to ensure output when V_{DD} is lower than 1.6V.
“Floating” is not recommended below 1.6V V_{DD}.

KC0…Not pulled up to V_{DD}. Must be connected to the “High” or “Low”.