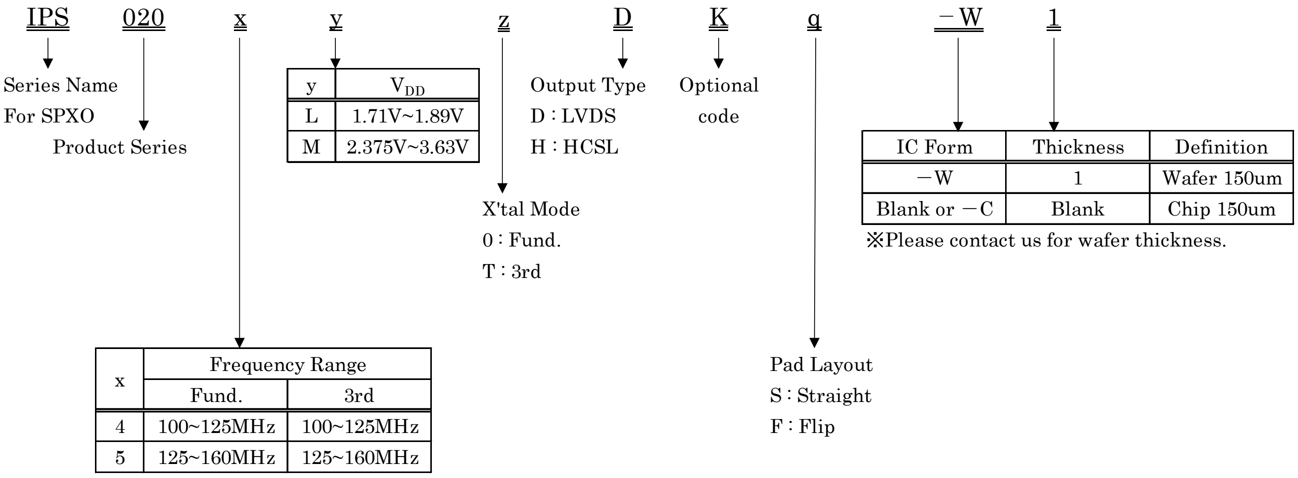
■ Description

IPS020*K is the Noise-improved version of IPS020E Differential output SPXO-IC series. Pad location, Die-size, and ESD-protection circuit etc. were not changed at all from the existing models, so that the customer can use this version easily.

■ Features

• Operation temperature	: -40℃~125℃
• Power supply voltage	: 1.71V~1.89V (L Series) 2.375V~3.63V (M Series)
• Standby function	: Oscillation stop
• Output	: LVDS / HCSL
• Crystal mode	: Fundamental & 3rd overtone
• Small chip size	: 0.65mm × 0.75mm
• Pad layout	: Straight type & Flip type
• Low Phase Jitter	: Around 50fs (typ.) @F0=156MHz,Vdd=1.8V, IPS0205L0D/HK : Around 40fs (typ.) @F0=156MHz,Vdd=2.5V/3.3V, IPS0205M0D/HK

1. Part number rule



IPS: Series Name For SPXO

020: Product Series

y	V_{DD}
L	1.71V~1.89V
M	2.375V~3.63V

z: X'tal Mode
0 : Fund.
T : 3rd

D: Output Type
D : LVDS
H : HCSL

K: Optional code

IC Form	Thickness	Definition
−W	1	Wafer 150um
Blank or −C	Blank	Chip 150um

※Please contact us for wafer thickness.

x	Frequency Range	
	Fund.	3rd
4	100~125MHz	100~125MHz
5	125~160MHz	125~160MHz

q: Pad Layout
S : Straight
F : Flip

2. Series

2-1 LVDS Output

Part Number	Output	Vdd		Crystal Frequency (MHz)			Divide	Remarks
		Min.	Max.	Mode	Min.	Max.		
IPS020 4 L 0 D K S	LVDS	1.71	1.89	Fund.	100	125	1/1	
IPS020 4 L 0 D K F								
IPS020 5 L 0 D K S					125	160		
IPS020 5 L 0 D K F								
IPS020 4 M 0 D K S		2.375	3.63		100	125		
IPS020 4 M 0 D K F								
IPS020 5 M 0 D K S					125	160		
IPS020 5 M 0 D K F								
IPS020 4 L T D K S		1.71	1.89	3rd	100	125		
IPS020 4 L T D K F								
IPS020 5 L T D K S					125	160		
IPS020 5 L T D K F								
IPS020 4 M T D K S		2.375	3.63		100	125		
IPS020 4 M T D K F								
IPS020 5 M T D K S					125	160		
IPS020 5 M T D K F								

2-2 HCSL Output

Part Number	Output	Vdd		Crystal Frequency (MHz)			Divide	Remarks
		Min.	Max.	Mode	Min.	Max.		
IPS020 4 L 0 H K S	HCSL	1.71	1.89	Fund.	100	125	1/1	
IPS020 4 L 0 H K F								
IPS020 5 L 0 H K S					125	160		
IPS020 5 L 0 H K F								
IPS020 4 M 0 H K S		2.375	3.63		100	125		
IPS020 4 M 0 H K F								
IPS020 5 M 0 H K S					125	160		
IPS020 5 M 0 H K F								
IPS020 4 L T H K S		1.71	1.89	3rd	100	125		
IPS020 4 L T H K F								
IPS020 5 L T H K S					125	160		
IPS020 5 L T H K F								
IPS020 4 M T H K S		2.375	3.63		100	125		
IPS020 4 M T H K F								
IPS020 5 M T H K S					125	160		
IPS020 5 M T H K F								

Please contact us for gray color models.

3. Absolute Maximum Ratings

V_{SS}=0V, Ta=25℃± 2℃

Parameter	Symbol	Condition	Ratings		
			Min	Max	Unit
Supply Voltage	V_{DD}		V_{SS}-0.5	5.0	V
Input Voltage	V_{IN}	All Input Pin	V_{SS}-0.5	V_{DD}+0.5	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, Ta=-40℃~125℃

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage	V_{DD}	L Series	1.71		1.89	V	V_{DD}
		M Series	2.375		3.63		
"H" Input Voltage	V_{IH}		V_{DD}×0.7			V	CE
"L" Input Voltage	V_{IL}				V_{DD}×0.3	V	CE
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V	CE
Output Load Resistance	RL	LVDS ※1	99	100	101	Ω	OUT
		HCSL ※2	49.5	50.0	50.5		
Ambient Temperature	Topt		-40		125	℃	

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

※1 Between OUT and OUTN
※2 To GND and Rs=33Ω or 0Ω

5. Electrical Specification

5-1 LVDS Output

5-1-1 DC Characteristics

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

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Output leak current	I_Z	CE=0.3V			10	μA
“L” input current	I_{IL}	V_{IN}=V_{SS}		-10		μA
“H” output voltage	V_{OH}	RL=100Ω(Between OUT & OUTN) CE=Open, OUT/OUTN		1.425	1.60	V
“L” output voltage	V_{OL}		0.90	1.075		V
Differential voltage	V_{OD}		247	350	454	mV
Differential voltage deviation	⊿V_{OD}				50	mV
Offset voltage	V_{OS}		1.125	1.250	1.375	V
Offset voltage deviation	⊿V_{OS}				50	mV
Current consumption *L : Vdd=1.8V M : Vdd=3.3V	I_{DD}	IPS0204L0DK, F0=125MHz			13.0	mA
		IPS0205L0DK, F0=160MHz			15.0	
		IPS0204LTDK, F0=125MHz			15.0	
		IPS0205LTDK, F0=160MHz			20.0	
		IPS0204M0DK, F0=125MHz			18.0	
		IPS0205M0DK, F0=160MHz			20.0	
		IPS0204MTDK, F0=125MHz			23.0	
		IPS0205MTDK, F0=160MHz			25.0	
Current consumption at oscillation stop	I_{DDD}	CE=GND			5.0	uA

5-1-2 Switching Characteristics

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

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Oscillation start up time	Tstart	Fund.			2.0	ms
		3rd			10	
Output Disable Time	Tplz				200	ns
Output Enable Time	Tpzl	Fund.			2.0	ms
		3rd			10	
Rise time / Fall time	Tr / Tf	20%~80% Vopp			0.50	ns
Output Duty Ratio	Duty	1/2Vopp point	45		55	%
Output Swing	Vopp		0.25			V
Freq. V_{DD} deviation	Fvst	V_{DD}=1.8V±5%			±2.0	ppm
		V_{DD}=2.5V±5%			±2.0	
		V_{DD}=3.3V±10%			±1.0	

5-2 HCSL Output

5-2-1 DC Characteristics

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

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Output leak current	I_Z	CE=0.3V			10	μA
“L” input current	I_{IL}	V_{IN}=V_{SS}		-10		μA
“H” output voltage	V_{OH}	RL=50Ω(To GND), Rs=0Ω CE=Open, OUT/OUTN	500		1000	mV
“L” output voltage	V_{OL}		-150		150	mV
Current consumption *L : Vdd=1.8V M : Vdd=3.3V	I_{DD}	IPS0204L0HKS, F0=125MHz			35.0	mA
		IPS0205L0HKS, F0=160MHz			35.0	
		IPS0204LTHKS, F0=125MHz			40.0	
		IPS0205LTHKS, F0=160MHz			40.0	
		IPS0204M0HKS, F0=125MHz			40.0	
		IPS0205M0HKS, F0=160MHz			40.0	
		IPS0204MTHKS, F0=125MHz			45.0	
		IPS0205MTHKS, F0=160MHz			45.0	
Current consumption at oscillation stop	I_{DDD}	CE=GND			5.0	uA

5-2-2 Switching Characteristics

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

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Oscillation start up time	Tstart	Fund.			2.0	ms
		3rd			10	
Output Disable Time	Tplz				200	ns
Output Enable Time	Tpzl	Fund.			2.0	ms
		3rd			10	
Rise time / Fall time	Tr / Tf	20%~80% Vopp, Rs=0Ω			0.60	ns
Output Duty Ratio	Duty	1/2Vopp point	45		55	%
Output Swing	Vopp	Rs=0Ω	0.5		1.1	V
Freq. V_{DD} deviation	Fvst	V_{DD}=1.8V±5%			±2.0	ppm
		V_{DD}=2.5V±5%			±2.0	
		V_{DD}=3.3V±10%			±1.0	

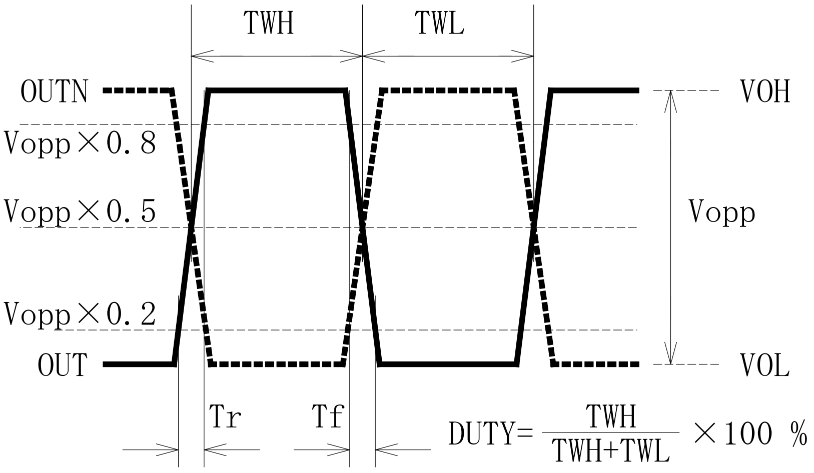


Fig. 5-1　Output Wave Form (Duty, Tr, Tf, V_{OH}, V_{OL}, Vopp) of HCSL

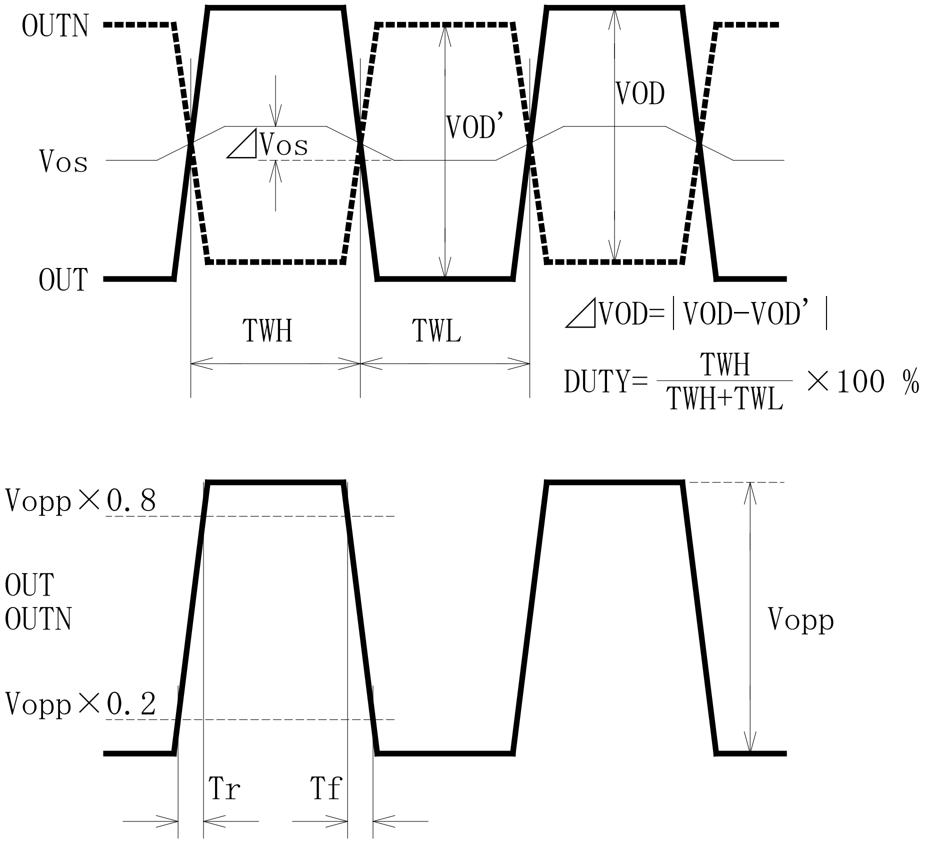
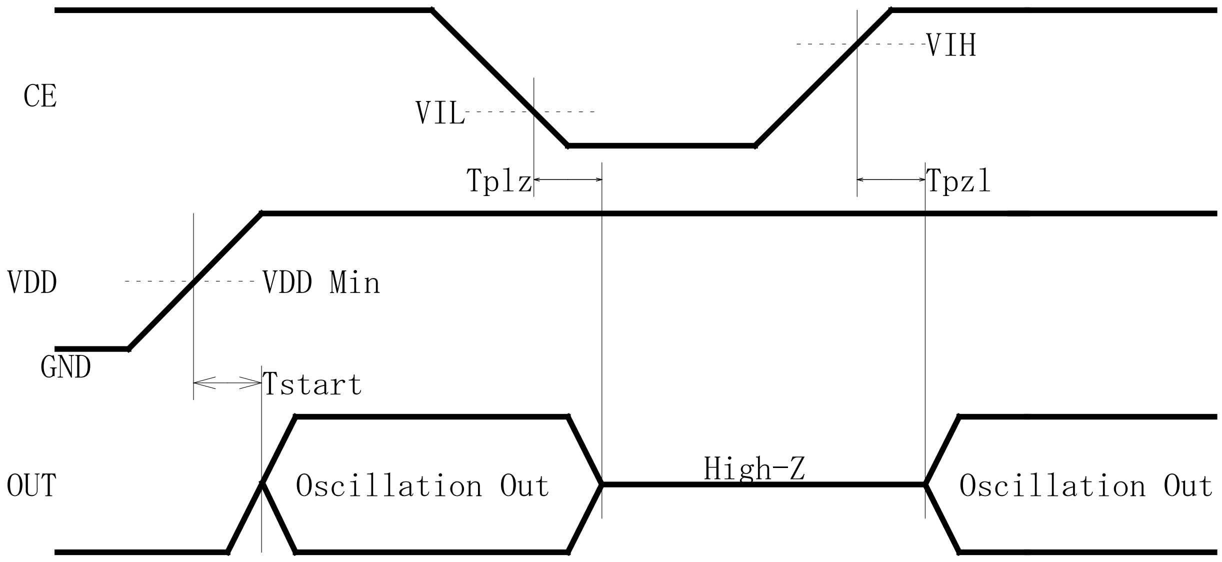


Fig. 5-2　Output Wave Form (Duty, Tr, Tf, V_{OH}, V_{OL}, V_{OD}, V_{OS}, Vopp) of LVDS



V_{IH} : Threshold voltage for Oscillation Start
V_{IL} : Threshold voltage for Oscillation Stop

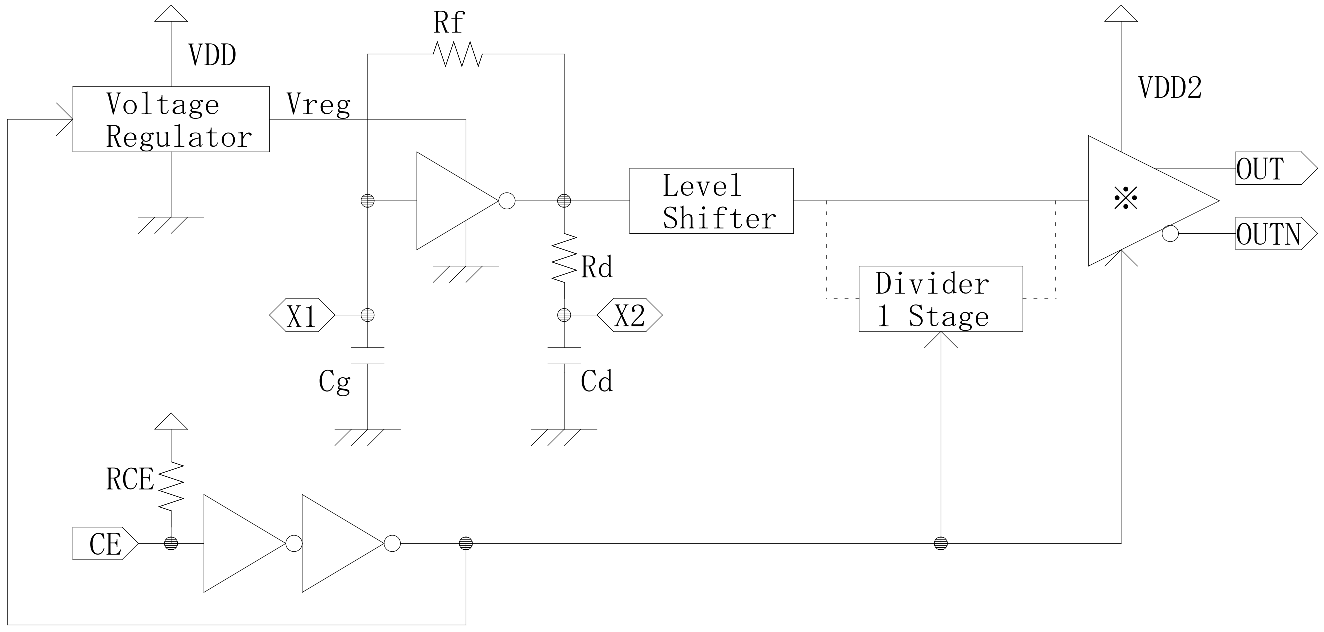
Fig. 5-3　Input output signal timing

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

Ta=25℃

Product	Rf (kΩ)	Rd (kΩ)	Cg (pF)	Cd (pF)	Condition
IPS0204L0 D/H K	200	600	4.0	9.0	Refer to Fig. 6-1
IPS0205L0 D/H K	200	300	4.0	8.0	
IPS0204M0 D/H K	200	600	4.0	9.0	
IPS0205M0 D/H K	200	300	4.0	8.0	
IPS0204LT D/H K	6.0	50	3.0	7.0	
IPS0205LT D/H K	4.0	50	3.0	6.0	
IPS0204MT D/H K	6.0	50	3.0	7.0	
IPS0205MT D/H K	4.0	50	3.0	6.0	

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

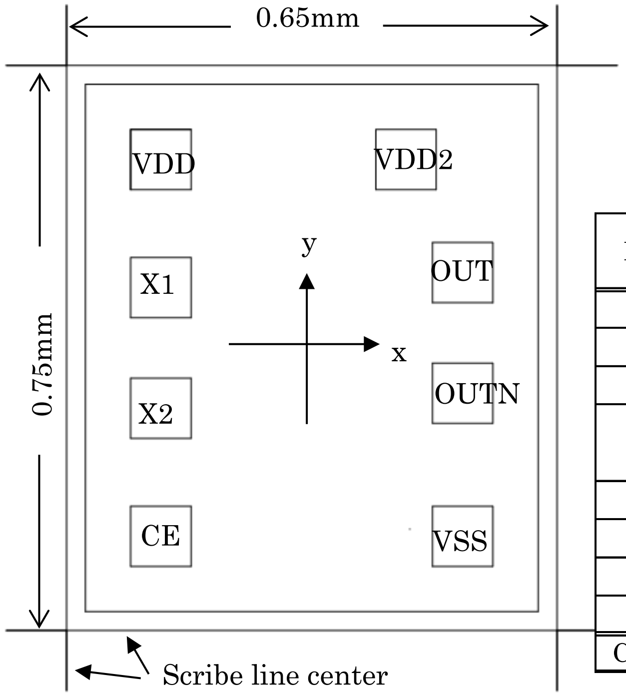


※ Output buffer according to each output waveform format

Fig. 6-1 Block Diagram

7. Pad Layout

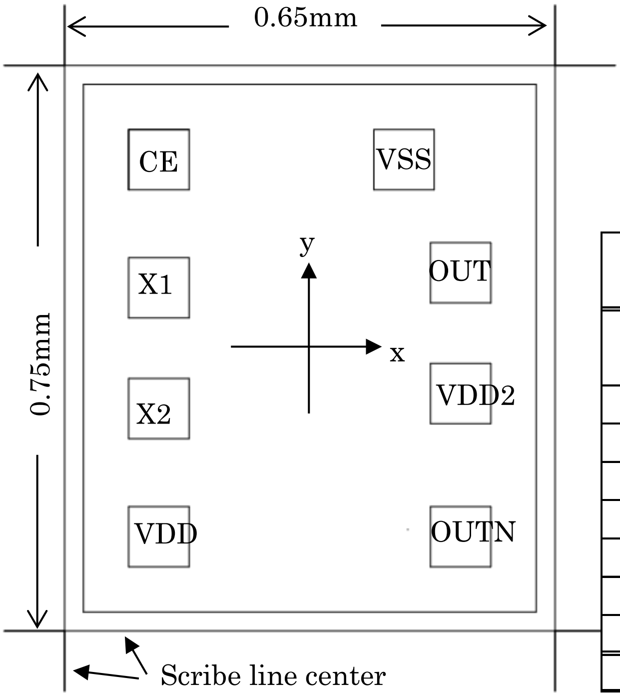
7-1 Straight Type



- Die Size: 0.65mm × 0.75mm
- Pad Size: 80um □
- Thickness: 150um ±20um
- IC Backside: Gnd or Open
- Swapping of OUT/OUTN with wire bond is acceptable

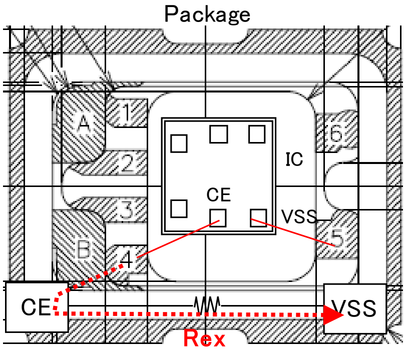
Pad Name	Function	Location (µm)	
		x	y
VDD	(+) Power Supply	-206	256
X1	Crystal Feedback	-206	83
X2	Crystal Drive	-206	-83
CE	Oscillation stop "L": High-Impedance	-206	-256
VSS	(−) Ground	206	-256
OUTN	OUT(Complementary)	206	-65
OUT	OUT(True)	206	108
VDD2	NC is acceptable	113	256
Chip Center		0	0

7-2 Flip Type



- Die Size : 0.65mm × 0.75mm
- Pad Size : 80um □
- Thickness : 150um ±20um
- IC Backside : Gnd or Open
- Swapping of OUT/OUTN with wire bond is acceptable

Pad Name	Function	Location (µm)	
		x	y
CE	Oscillation stop "L": High-Impedance	-206	256
X1	Crystal Feedback	-206	83
X2	Crystal Drive	-206	-83
VDD	(+) Power Supply	-206	-256
OUTN	OUT(Complementary)	206	-256
VDD2	NC is acceptable	206	-65
OUT	OUT(True)	206	108
VSS	(−) Ground	113	256
Chip Center		0	0



IMPORTANT Notice for CE function

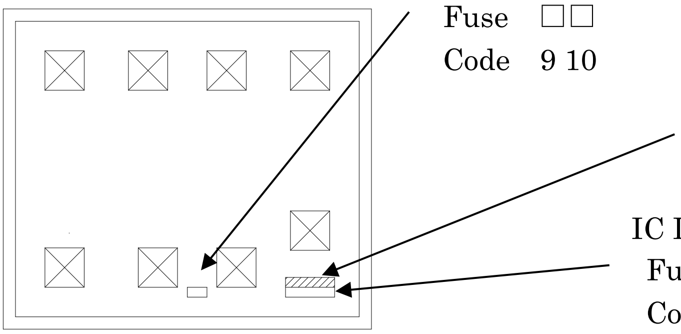
※ Oscillation will not be activated when CE=Open after CE=Low if Rex is not large.

※ Reference value of Rex is over 10MΩ with CE=Open usage.

※ There is no such issue with CE=VDD usage.

Rex : Resistance value between CE and VSS of package

8. IC Part # Identification



IC Identification Code
Fuse □□
Code 9 10

LOGO : IPS020_L_Kq
q = Pad LayOut (S/F)

IC Identification Code
Fuse □□□ □□□ □□
Code 1 2 3 4 5 6 7 8

Part #	Code 1~8	Code 9, 10
IPS0204L0DKq	■□□ □□□ □■	□□
IPS0205L0DKq	■□■ □□□ □■	□□
IPS0204LTDKq	■□□ ■□□ □■	□□
IPS0205LTDKq	■□■ ■□□ □■	□□
IPS0204M0DKq	■□□ □□□ □■	□■
IPS0205M0DKq	■□■ □□□ □■	□■
IPS0204MTDKq	■□□ ■□□ □■	□■
IPS0205MTDKq	■□■ ■□□ □■	□■

Part #	Code 1~8	Code 9, 10
IPS0204L0HKq	■□□ □□□ ■□	□□
IPS0205L0HKq	■□■ □□□ ■□	□□
IPS0204LTHKq	■□□ ■□□ ■□	□□
IPS0205LTHKq	■□■ ■□□ ■□	□□
IPS0204M0HKq	■□□ □□□ ■□	□■
IPS0205M0HKq	■□■ □□□ ■□	□■
IPS0204MTHKq	■□□ ■□□ ■□	□■
IPS0205MTHKq	■□■ ■□□ ■□	□■

□ : Fuse no cut ■ : Fuse cut

9. Revision History

Revision No.	Revision Date	Revised items	Before Revision	After Revision
SD-6.2	2025/11/04	Wafer thickness 100um (Flip)	Listed	As requested
		IPS0204LTDKS	Under Development	Listed
		IPS0204LTDKF	Under Development	Listed
		IPS0205LTDKS	Under Development	Listed
		IPS0205LTDKF	Under Development	Listed
		IPS0205MTDKF	Under Development	Listed
		IPS0205MTHKF	Under Development	Listed
		I_{DDD} Condition	CE≦0.3V	CE=GND