■ Description

IPS020*L is the IC for differential output SPXO corresponding to the fundamental crystal from 27MHz to 220MHz, and operation voltage is 1.71V minimum. 3rd overtone oscillation is also available.

■ Features

- Operation temperature : -40℃~125℃
- Power supply voltage : 1.71V~1.89V
- Standby function : Oscillation stop
- Crystal frequency : 27MHz~220MHz
- Output : LVDS & HCSL
- Crystal mode : Fundamental & 3rd overtone
- Small chip size : 0.65mm × 0.75mm
- Pad layout : Straight type
- Duty cycle : Within 50%±5%

1. Part number rule

IPS 020 x L z D q －W 1

- IPS: Series Name For SPXO
- 020: Product Series
- x: Frequency Range (see table)
- L: V_{DD} 1.8V
- z: X'tal Mode & Divide Function
  - 0 : Fund. & 1/1
  - 1 : Fund. & 1/2
  - T : 3rd & 1/1
- D: Output Type
  - D : LVDS
  - H : HCSL
- q: Pad Layout
  - S : Straight
- －W 1:

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
3	27~100MHz	
4	80~130MHz	70~100MHz
5	120~170MHz	95~140MHz
6	160~220MHz	135~180MHz
7		175~220MHz

2. Series

Part Number	Output	Crystal Frequency (MHz)			Divide	Output Frequency (MHz)		Remarks
		Mode	Min.	Max.		Min.	Max.	
IPS020 3 L 0 D S	LVDS	Fund.	27	100	1/1	27	100	
IPS020 3 L 1 D S					1/2	13.5	50	
IPS020 4 L 0 D S			80	130	1/1	80	130	
IPS020 5 L 0 D S			120	170		120	170	
IPS020 6 L 0 D S			160	220		160	220	
IPS020 3 L 0 H S	HCSL	Fund.	27	100	1/1	27	100	
IPS020 3 L 1 H S					1/2	13.5	50	
IPS020 4 L 0 H S			80	130	1/1	80	130	
IPS020 5 L 0 H S			120	170		120	170	
IPS020 6 L 0 H S			160	220		160	220	
IPS020 4 L T D S	LVDS	3rd	70	100	1/1	70	100	
IPS020 5 L T D S			95	140		95	140	
IPS020 6 L T D S			135	180		135	180	
IPS020 7 L T D S			175	200		175	200	Ta=-40℃~125℃
			175	220		175	220	Ta=-40℃~85℃
IPS020 4 L T H S	HCSL	3rd	70	100	1/1	70	100	
IPS020 5 L T H S			95	140		95	140	
IPS020 6 L T H S			135	180		135	180	
IPS020 7 L T H S			175	200		175	200	Ta=-40℃~125℃
			175	220		175	220	Ta=-40℃~85℃

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}		1.71	1.80	1.89	V	V_{DD}
"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	℃	
		IPS0207MT, ~220MHz	-40		85		

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

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

5. Electrical Specification

5-1 LVDS Output

5-1-1 DC Characteristics

Unless otherwise stated, V_{DD}=1.71V~1.89V, 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		1.43	1.60	V
"L" output voltage	V_{OL}		0.90	1.10		V
Differential voltage	V_{OD}		247	330	454	mV
Differential voltage deviation	ΔV_{OD}				50	mV
Offset voltage	V_{OS}		1.125	1.250	1.375	V
Offset voltage deviation	ΔV_{OS}				50	mV
Current consumption※	I_{DD}	IPS0203L0DS, F0=100MHz		5.5	11.0	mA
		IPS0204L0DS, F0=122.88MHz		6.0	12.0	
		IPS0205L0DS, F0=170MHz		7.0	14.0	
		IPS0206L0DS, F0=212.5MHz		7.0	14.0	
		IPS0204LTDS, F0=92.17MHz		6.5	13.0	
		IPS0205LTDS, F0=125MHz		7.0	14.0	
		IPS0206LTDS, F0=156.25MHz		7.5	15.0	
		IPS0207LTDS, F0=200MHz		9.0	18.0	
Current consumption at oscillation stop	I_{DDD}	CE=GND			10	uA

※Condition : V_{DD}=1.8V, CE=Open, RL=100Ω (Between OUT & OUTN)

5-1-2 Switching Characteristics

Unless otherwise stated, V_{DD}=1.71V~1.89V, V_{SS}=0V, Ta=-40℃~125℃

Parameter	Symbol	Condition		Specification			Unit
				Min	Typ	Max	
Oscillation start up time	Tstart	IPS020xL0, IPS0203L1				2.0	ms
		IPS020xLT				10	
Output Disable Time	Tplz					200	ns
Output Enable Time	Tpzl	IPS020xL0, IPS0203L1				2.0	ms
		IPS020xLT				10	
Rise time / Fall time	Tr / Tf	20%~80% Vopp				0.50	ns
Output Duty Ratio	Duty	1/2Vopp point	IPS020xL0 IPS0203L1 IPS020xLT (Except x=7)	45		55	%
			IPS0207LT Ta=-40℃~85℃	45		55	
			IPS0207LT Ta=85℃~125℃	40		60	
Output Swing	Vopp			0.25			V
Freq. V_{DD} deviation	Fvst	V_{DD}=1.8±5%				±2.0	ppm

5-2 HCSL Output

5-2-1 DC Characteristics

Unless otherwise stated, V_{DD}=1.71V~1.89V, 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※	I_{DD}	IPS0203L0HS, F0=100MHz		16.5	25.0	mA
		IPS0204L0HS, F0=122.88MHz		17.0	26.0	
		IPS0205L0HS, F0=170MHz		17.5	27.0	
		IPS0206L0HS, F0=212.5MHz		18.0	27.0	
		IPS0204LTHS, F0=92.17MHz		17.0	26.0	
		IPS0205LTHS, F0=125MHz		18.0	27.0	
		IPS0206LTHS, F0=156.25MHz		18.5	28.0	
		IPS0207LTHS, F0=200MHz		19.0	29.0	
Current consumption at oscillation stop	I_{DDD}	CE=GND			10	uA

※Condition : V_{DD}=1.8V, CE=Open, RL=50Ω (To GND), Rs=0Ω

5-2-2 Switching Characteristics

Unless otherwise stated, V_{DD}=1.71V~1.89V, V_{SS}=0V, Ta=-40℃~125℃

Parameter	Symbol	Condition		Specification			Unit
				Min	Typ	Max	
Oscillation start up time	Tstart	IPS020xL0				2.0	ms
		IPS020xLT				10	
Output Disable Time	Tplz					200	ns
Output Enable Time	Tpzl	IPS020xL0				2.0	ms
		IPS020xLT				10	
Rise time / Fall time	Tr / Tf	20%~80% Vopp			0.30	0.60	ns
Output Duty Ratio	Duty	1/2Vopp point	IPS020xL0 IPS020xLT (Except x=7)	45		55	%
			IPS0207LT Ta=-40℃~85℃	45		55	
			IPS0207LT Ta=85℃~125℃	40		60	
Output Swing	Vopp			0.5			V
Freq. V_{DD} deviation	Fvst	V_{DD}=1.8V±5%				±2.0	ppm

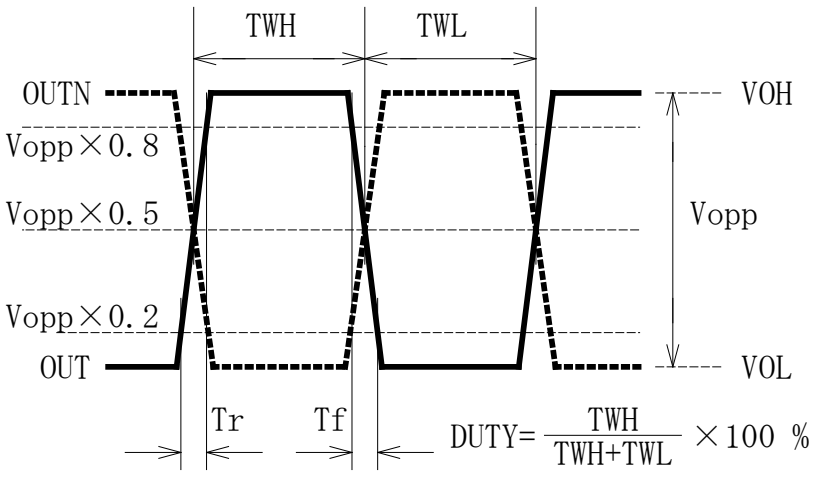


Fig. 5-1 Output Wave Form (Duty, Tr, Tf, V_{OH}, V_{OL}, Vopp) of HCSL

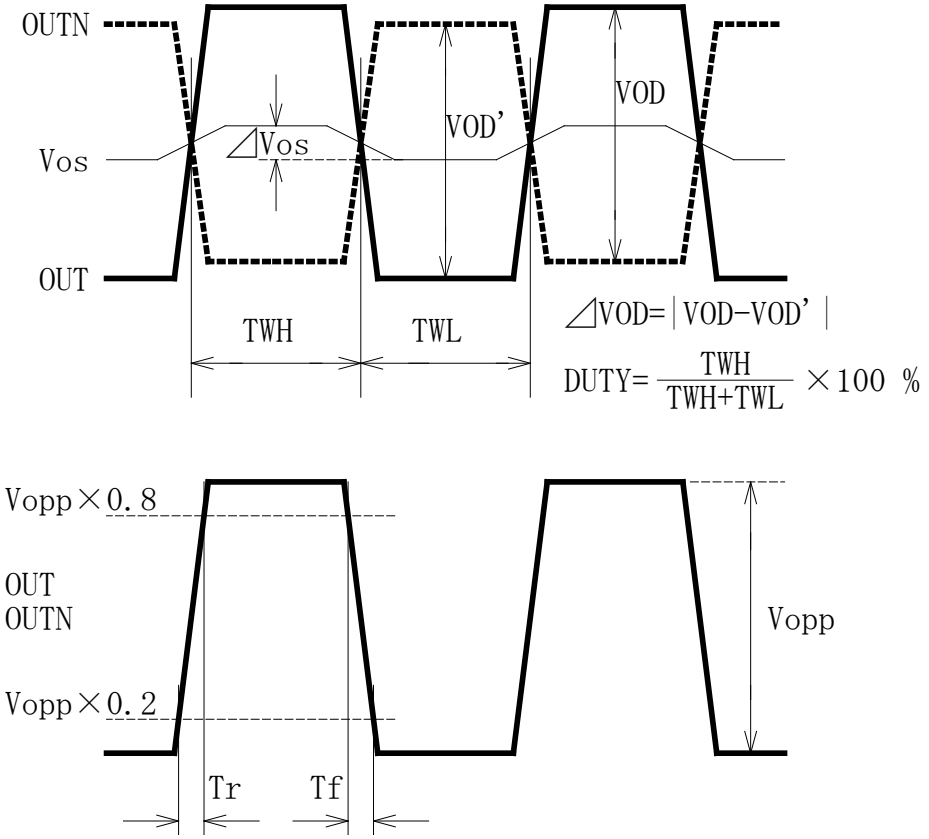
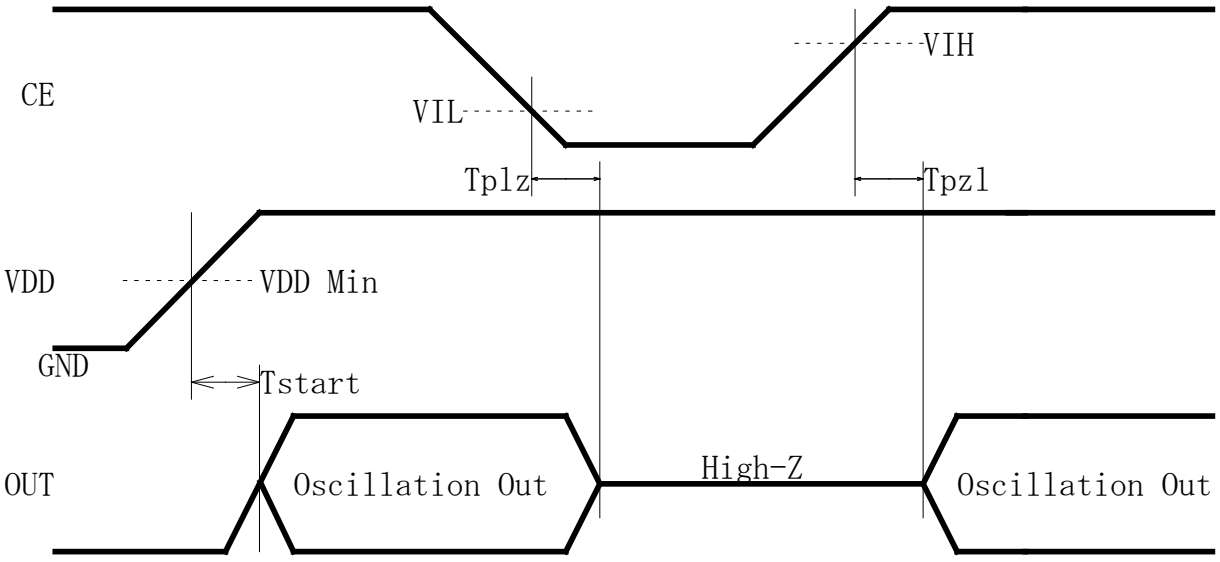


Fig. 5-2 Output Wave Form (Duty, Tr, Tf, V_{OH}, V_{OL},V_{OD},V_{OS}, Vopp) of LVDS



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

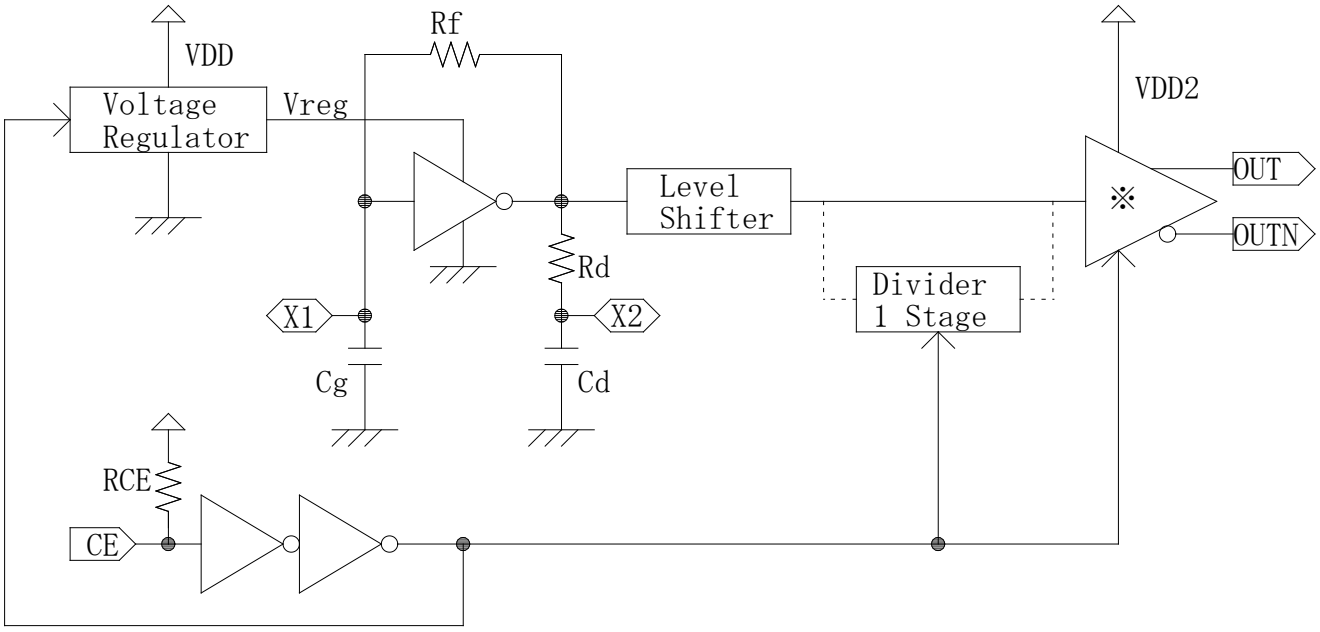
Fig. 5-3 Input output signal timing

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

Ta=25℃

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Feedback Resistor	IPS020xL0 IPS0203L1	Rf	Refer to Fig. 6-1		200		kΩ
	IPS0204LT				2.50		
	IPS0205LT				1.75		
	IPS0206LT				0.75		
	IPS0207LT				0.50		
Driving Resistor	IPS0203L0 IPS0203L1	Rd	Refer to Fig. 6-1		1000		Ω
	IPS0204L0				800		
	IPS0205L0				500		
	IPS0206L0				300		
	IPS0204LT				500		
	IPS0205LT				300		
	IPS0206LT				200		
	IPS0207LT				200		
Oscillation Capacitor	IPS0203L0 IPS0203L1	Cg	Refer to Fig. 6-1		6.0		pF
		Cd			9.0		
	IPS0204L0	Cg			5.0		
		Cd			8.0		
	IPS0205L0	Cg			5.0		
		Cd			7.0		
	IPS0206L0	Cg			4.0		
		Cd			5.0		
	IPS0204LT	Cg			5.0		
		Cd			7.0		
	IPS0205LT	Cg			4.0		
		Cd			7.0		
	IPS0206LT	Cg			3.0		
		Cd			7.0		
	IPS0207LT	Cg			3.0		
		Cd			7.0		

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

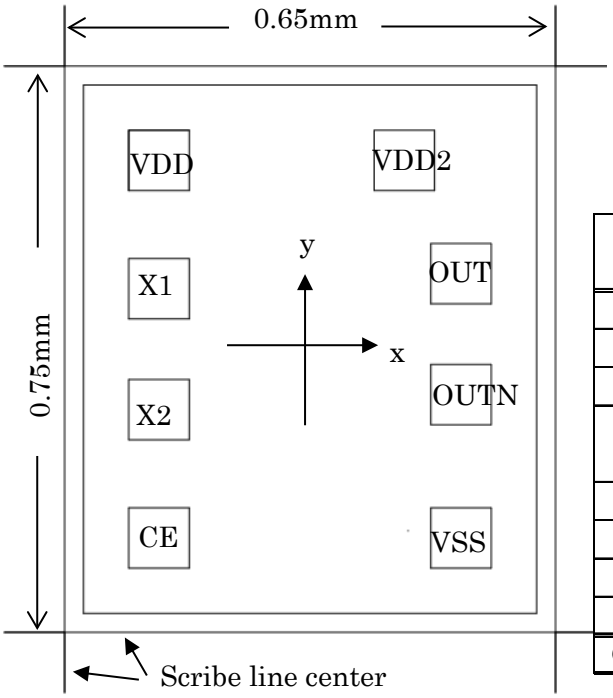


※ Output buffer according to each output waveform format

Fig. 6-1 Block Diagram

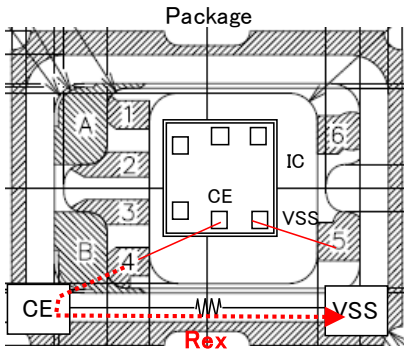
7. Pad Layout

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



IMPORTANT Notice for CE function

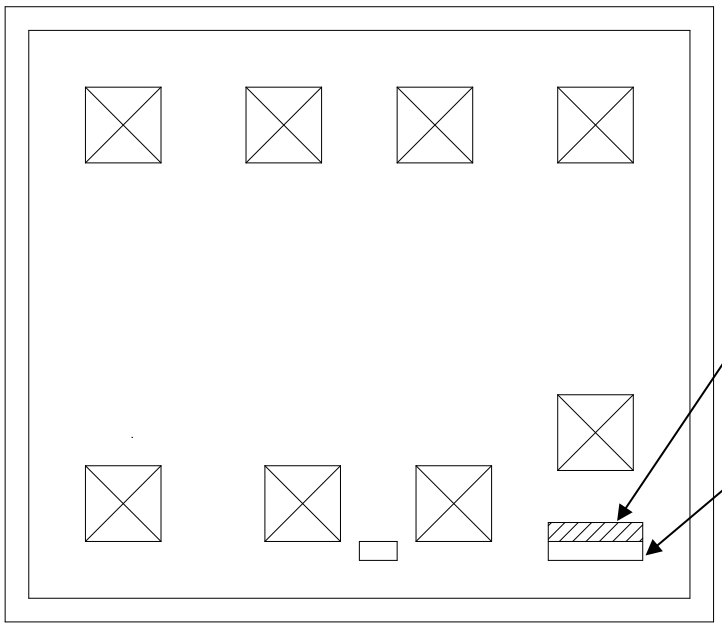
※ Oscillation will not be activated when CE=Open after CE=Low if Rex is not large.

※ 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



LOGO：IPS020_L__S

IC Identification Code

Fuse □□□ □□□ □□

Code 1 2 3 4 5 6 7 8

□ ：Fuse no cut

■ ：Fuse cut

Part #	Code 1~8
IPS0203L0Dq	□■■ □□□ □■
IPS0204L0Dq	■□□ □□□ □■
IPS0205L0Dq	■□■ □□□ □■
IPS0206L0Dq	■■□ □□□ □■
IPS0203L1Dq	□■■ □□■ □■
IPS0204LTDq	■□□ ■□□ □■
IPS0205LTDq	■□■ ■□□ □■
IPS0206LTDq	■■□ ■□□ □■
IPS0207LTDq	■■■ ■□□ □■

Part #	Code 1~8
IPS0203L0Hq	□■■ □□□ ■□
IPS0204L0Hq	■□□ □□□ ■□
IPS0205L0Hq	■□■ □□□ ■□
IPS0206L0Hq	■■□ □□□ ■□
IPS0203L1Hq	□■■ □□■ ■□
IPS0204LTHq	■□□ ■□□ ■□
IPS0205LTHq	■□■ ■□□ ■□
IPS0206LTHq	■■□ ■□□ ■□
IPS0207LTHq	■■■ ■□□ ■□

9. Revision History

Revision No.	Revision Date	Revised items	Before Revision	After Revision
SD-3.3	2025/11/04	Wafer thickness 100um	Listed	As requested
		IPS203L1HS	Unlisted	Listed
		I_{DDD} Condition	CE≦0.3V	CE=GND