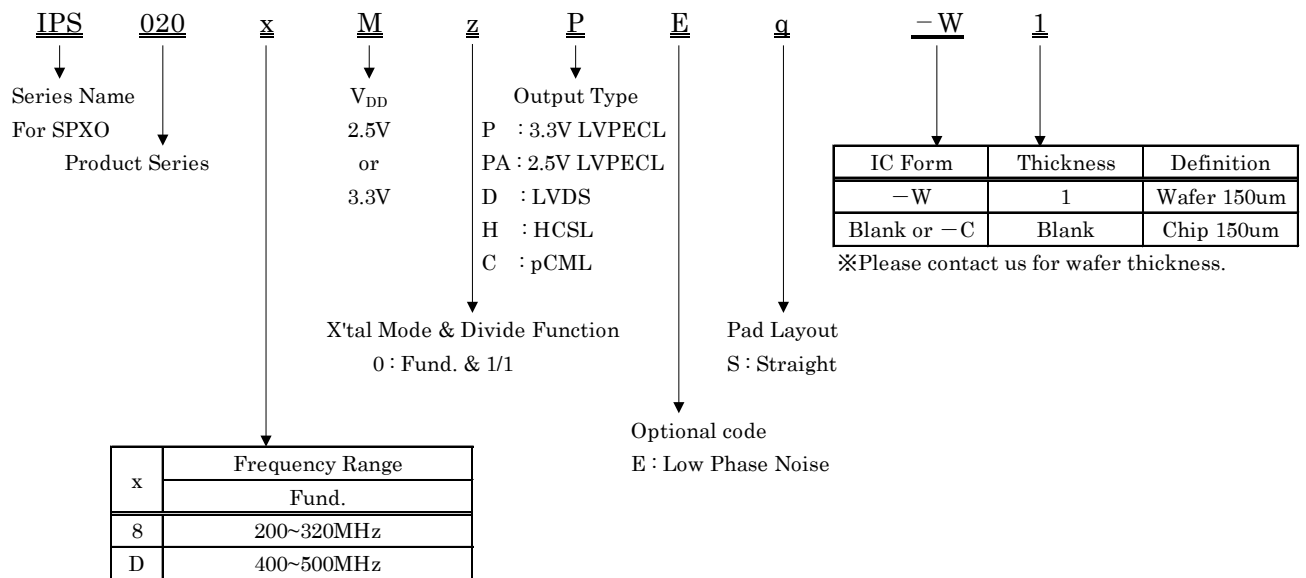


**■ Description**

IPS020 High Frequency Type is the IC for differential output SPXO corresponding to the high frequency from 200MHz to 500MHz, and operation voltage is 2.375V minimum.

**■ Features**

- Operation temperature : -40°C~125°C
- Power supply voltage : 2.375V~3.63V
- Standby function : Oscillation stop
- Crystal frequency : 200MHz~500MHz
- Output : LVPECL / LVDS / HCSL / pCML(HDLVDS)
- Crystal mode : Fundamental
- Small chip size : 0.65mm × 0.75mm
- Pad layout : Straight type
- Duty cycle : Within 50%±5%

**1. Part number rule**


The contents of this sheet are subject to change without notice.

**2. Series**

Part Number	Output	Crystal Frequency (MHz)			Divide	Output Frequency (MHz)		Remarks
		Mode	Min.	Max.		Min.	Max.	
IPS020 8 M 0 P E S	LVPECL	Fund.	200	320	1/1	200	320	$V_{DD}=3.3V\pm 10\%$
IPS020 D M 0 P E S			400	500		400	500	
IPS020 8 M 0 P A E S	LVPECL	Fund.	200	320	1/1	200	320	$V_{DD}=2.5V\pm 5\%$
IPS020 D M 0 P A E S			400	500		400	500	
IPS020 8 M 0 D E S	LVDS	Fund.	200	320	1/1	200	320	
IPS020 D M 0 D E S			400	500		400	500	
IPS020 8 M 0 H E S	HCSL	Fund.	200	320	1/1	200	320	
IPS020 8 M 0 C E S	pCML	Fund.	200	320	1/1	200	320	

**3. Absolute Maximum Ratings**
 $V_{SS}=0V, T_a=25^{\circ}C\pm 2^{\circ}C$ 

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	$T_j$		-55	150	$^{\circ}C$
Storage Temperature	$T_{stg}$		-55	125	$^{\circ}C$

#### 4. Recommended Operating Condition

 $V_{SS}=0V, T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage	$V_{DD}$	2.5V LVPECL	2.375	2.50	2.625	V	$V_{DD}$
		LVDS, HCSL	2.375	3.30	3.63		
		3.3V LVPECL, pCML	2.97	3.30	3.63		
“H” Input Voltage	$V_{IH}$		$V_{DD}\times 0.7$			V	CE
“L” Input Voltage	$V_{IL}$				$V_{DD}\times 0.3$	V	CE
Input Voltage	$V_{IN}$		$V_{SS}$		$V_{DD}$	V	CE
Output Load Resistance	$R_L$	LVPECL ※1	49.5	50.0	50.5	$\Omega$	OUT
		LVDS ※2	99	100	101		
		HCSL ※3	49.5	50.0	50.5		
		pCML ※4	80	100	120		
Ambient Temperature	$T_{opt}$		-40		125	$^{\circ}C$	

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

※1 Terminate to  $V_{DD}-2.0V$  ※2 Between OUT and OUTN ※3 To GND and  $R_s=0\Omega$

※4 Between OUT and OUTN, AC coupling

#### 5. Electrical Specification

##### 5-1 LVPECL Output ( $V_{DD}=3.3V$ Operation)

##### 5-1-1 DC Characteristics

Unless otherwise stated,  $V_{DD}=2.97V\sim 3.63V, V_{SS}=0V, T_a=-40^{\circ}C\sim 125^{\circ}C$

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Output leak current	$I_Z$	CE=0.3V			10	$\mu A$
“L” input current	$I_{IL}$	$V_{IN}=V_{SS}$		-10		$\mu A$
“H” output voltage	$V_{OH}$	$R_L=50\Omega$ (Terminated to $V_{DD}-2.0V$ )	$V_{DD}-1.025$	$V_{DD}-0.950$	$V_{DD}-0.880$	V
“L” output voltage	$V_{OL}$	CE=Open, OUT/OUTN	$V_{DD}-1.810$	$V_{DD}-1.700$	$V_{DD}-1.620$	V
Current consumption	$I_{DD}$	$V_{DD}=3.3V$ CE=Open $R_L=50\Omega$ (Terminated to $V_{DD}-2.0V$ )	IPS0208M0PES F0=314.68MHz	40.0	60.0	mA
			IPS020DM0PES F0=500MHz	42.0	63.0	
Current consumption at oscillation stop	$I_{DDD}$	CE=GND		100	300	$\mu A$

**5-1-2 Switching Characteristics**

 Unless otherwise stated,  $V_{DD}=2.97V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit	
			Min	Typ	Max		
Oscillation start up time	Tstart				2.0	ms	
Output Disable Time	Tplz				200	ns	
Output Enable Time	Tpzl				2.0	ms	
Rise time / Fall time	Tr / Tf	20%~80% Vopp		0.25	0.40	ns	
Output Duty Ratio	Duty	1/2Vopp point	45		55	%	
Output Swing	Vopp		0.4			V	
Freq. $V_{DD}$ deviation	Fvst	$V_{DD}=3.3V\pm 10\%$	IPS0208M			$\pm 2.0$	ppm
			IPS020DM			$\pm 3.0$	

**5-2 LVPECL Output ( $V_{DD}=2.5V$  Operation)**
**5-2-1 DC Characteristics**

 Unless otherwise stated,  $V_{DD}=2.375V\sim 2.625V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit	
			Min	Typ	Max		
Output leak current	$I_Z$	CE=0.3V			10	$\mu A$	
“L” input current	$I_{IL}$	$V_{IN}=V_{SS}$		-10		$\mu A$	
“H” output voltage	$V_{OH}$	RL=50 $\Omega$ (Terminated to $V_{DD}-2.0V$ ) CE=Open, OUT/OUTN	$V_{DD}$ -1.105	$V_{DD}$ -0.985	$V_{DD}$ -0.870	V	
“L” output voltage	$V_{OL}$		$V_{DD}$ -1.810	$V_{DD}$ -1.700	$V_{DD}$ -1.620	V	
Current consumption	$I_{DD}$	$V_{DD}=2.5V$ CE=Open RL=50 $\Omega$ (Terminated to $V_{DD}-2.0V$ )	IPS0208M0PAES F0=314.68MHz		36.0	54.0	mA
			IPS020DM0PAES F0=500MHz		39.0	59.0	
Current consumption at oscillation stop	$I_{DDD}$	CE=GND		100	300	$\mu A$	

**5-2-2 Switching Characteristics**

 Unless otherwise stated,  $V_{DD}=2.375V\sim 2.625V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit	
			Min	Typ	Max		
Oscillation start up time	Tstart				2.0	ms	
Output Disable Time	Tplz				200	ns	
Output Enable Time	Tpzl				2.0	ms	
Rise time / Fall time	Tr / Tf	20%~80% Vopp		0.25	0.40	ns	
Output Duty Ratio	Duty	1/2Vopp point	45		55	%	
Output Swing	Vopp		0.4			V	
Freq. $V_{DD}$ deviation	Fvst	$V_{DD}=2.5V\pm 5\%$	IPS0208M			$\pm 2.0$	ppm
			IPS020DM			$\pm 5.0$	

**5-3 LVDS Output**
**5-3-1 DC Characteristics**

 Unless otherwise stated,  $V_{DD}=2.375V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Output leak current	$I_z$	CE=0.3V			10	$\mu A$
“L” input current	$I_{IL}$	$V_{IN}=V_{SS}$		-10		$\mu A$
“H” output voltage	$V_{OH}$	RL=100 $\Omega$ (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	$\Delta V_{OD}$				50	mV
Offset voltage	$V_{OS}$		1.125	1.250	1.375	V
Offset voltage deviation	$\Delta V_{OS}$				50	mV
Current consumption	$I_{DD}$		$V_{DD}=3.3V$ CE=Open RL=100 $\Omega$ (Between OUT & OUTN)	IPS0208M0DES F0=314.68MHz	15.0	30.0
		IPS020DM0DES F0=500MHz		18.0	36.0	
Current consumption at oscillation stop	$I_{DDD}$	CE=GND		100	300	$\mu A$

**5-3-2 Switching Characteristics**

 Unless otherwise stated,  $V_{DD}=2.375V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit	
			Min	Typ	Max		
Oscillation start up time	Tstart				2.0	ms	
Output Disable Time	Tplz				200	ns	
Output Enable Time	Tpzl				2.0	ms	
Rise time / Fall time	Tr / Tf	20%~80% Vopp			0.40	ns	
Output Duty Ratio	Duty	1/2Vopp point	45		55	%	
Output Swing	Vopp		0.25			V	
Freq. $V_{DD}$ deviation	Fvst	$V_{DD}=3.3V\pm 10\%$	IPS0208M			$\pm 2.0$	ppm
			IPS0208D			$\pm 3.0$	
		$V_{DD}=2.5V\pm 5\%$	IPS0208M			$\pm 2.0$	
			IPS0208D			$\pm 5.0$	

**5-4 HCSL Output**
**5-4-1 DC Characteristics**

 Unless otherwise stated,  $V_{DD}=2.375V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Output leak current	Iz	CE=0.3V			10	$\mu A$
“L” input current	IIL	$V_{IN}=V_{SS}$		-10		$\mu A$
“H” output voltage	VOH	RL=50 $\Omega$ (To GND), Rs=0 $\Omega$	550		900	mV
“L” output voltage	VOL	CE=Open, OUT/OUTN	-150		150	mV
Current consumption	IDD	$V_{DD}=3.3V$ CE=Open RL=50 $\Omega$ (To GND) Rs=0 $\Omega$		26.0	39.0	mA
Current consumption at oscillation stop	IDDD	CE=GND		100	300	$\mu A$

**5-4-2 Switching Characteristics**

 Unless otherwise stated,  $V_{DD}=2.375V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Oscillation start up time	Tstart				2.0	ms
Output Disable Time	Tplz				200	ns
Output Enable Time	Tpzl				2.0	ms
Rise time / Fall time	Tr / Tf	20%~80% Vopp		0.30	0.50	ns
Output Duty Ratio	Duty	1/2Vopp point	45		55	%
Output Swing	Vopp		0.55			V
Freq. $V_{DD}$ deviation	Fvst	$V_{DD}=3.3V\pm 10\%$			$\pm 2.0$	ppm
		$V_{DD}=2.5V\pm 5\%$			$\pm 2.0$	

**5-5 pCML Output**
**5-5-1 DC Characteristics**

 Unless otherwise stated,  $V_{DD}=2.97V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition		Specification			Unit
				Min	Typ	Max	
Output leak current	$I_Z$	CE=0.3V				10	$\mu A$
“L” input current	$I_{IL}$	$V_{IN}=V_{SS}$			-10		$\mu A$
Current consumption	$I_{DD}$	$V_{DD}=3.3V$ CE=Open RL=100 $\Omega$ (Between OUT & OUTN) AC Coupling	IPS0208M0CES F0=314.68MHz		18.5	37.0	mA
Current consumption at oscillation stop	$I_{DDD}$	CE=GND			100	300	$\mu A$

**5-5-2 Switching Characteristics**

 Unless otherwise stated,  $V_{DD}=2.97V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Oscillation start up time	Tstart				2.0	ms
Output Disable Time	Tplz				200	ns
Output Enable Time	Tpzl				2.0	ms
Rise time / Fall time	Tr / Tf	20%~80% Vopp		0.25	0.35	ns
Output Duty Ratio	Duty	1/2Vopp point	45		55	%
Output Swing	Vopp		0.60			V
Freq. $V_{DD}$ deviation	Fvst	$V_{DD}=3.3V\pm 10\%$			$\pm 2.0$	ppm

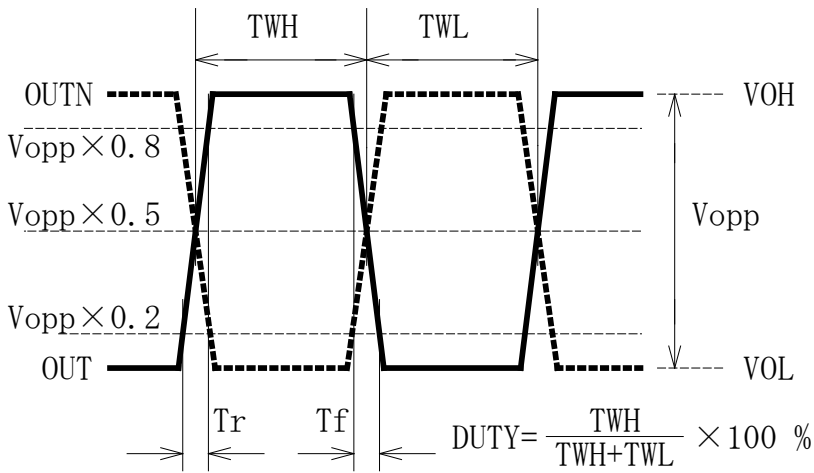


Fig. 5-1 Output Wave Form (Duty, Tr, Tf, VOH, VOL, Vopp) of LVPEL & HCSSL

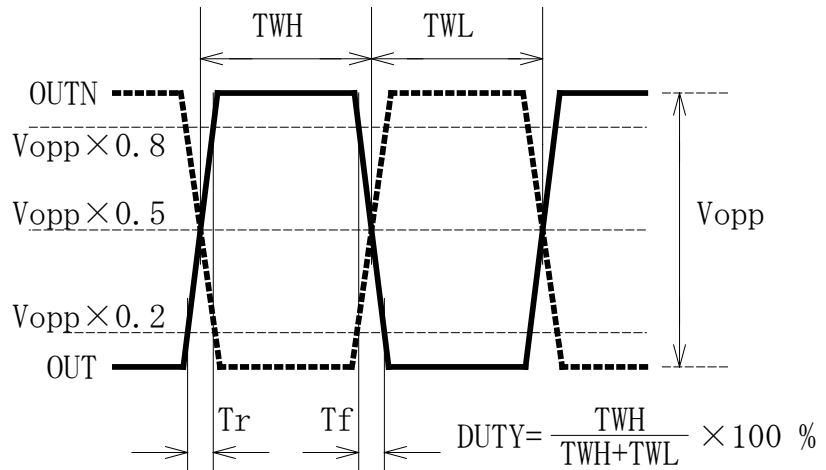


Fig. 5-2 Output Wave Form (Duty, Tr, Tf, Vopp) of pCML

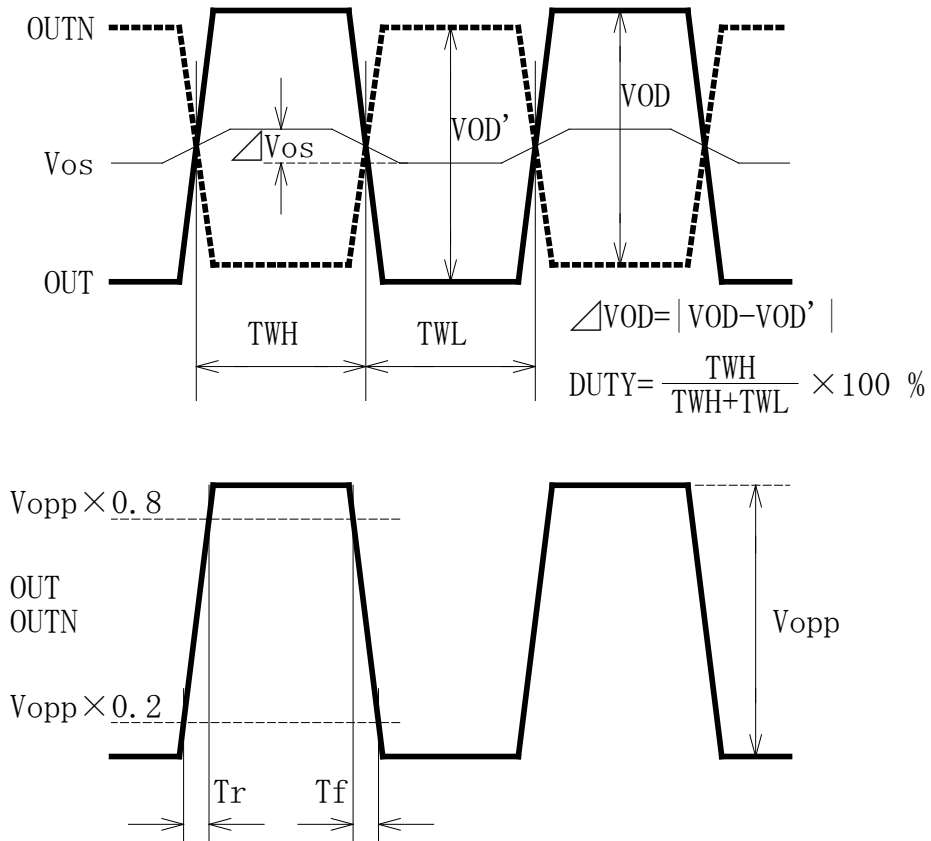
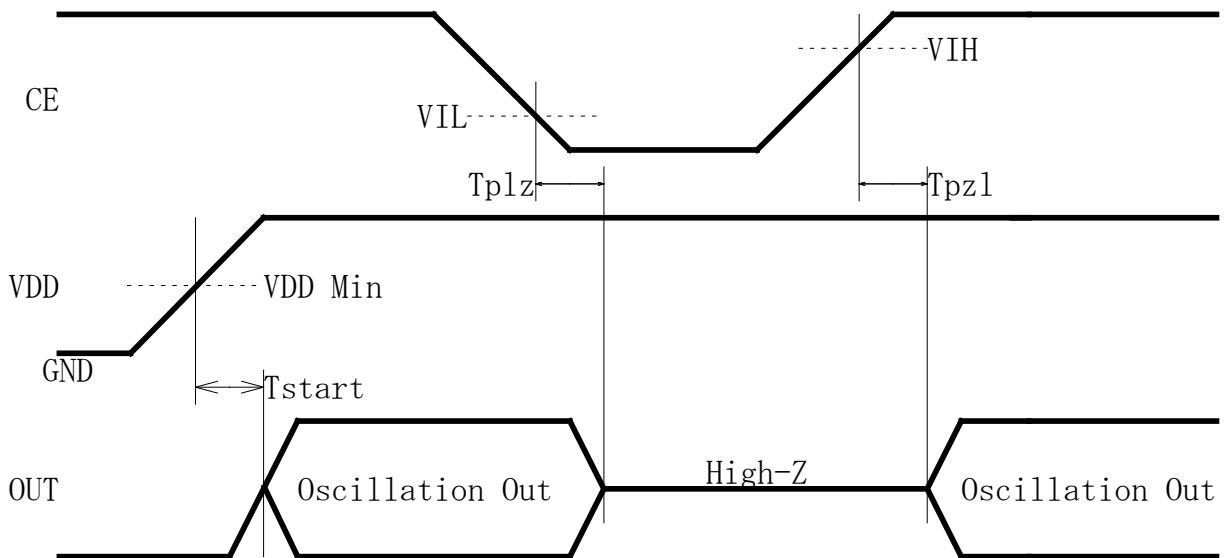


Fig. 5-3 Output Wave Form (Duty, Tr, Tf, \$V\_{OH}\$, \$V\_{OL}\$, \$V\_{OD}\$, \$V\_{OS}\$, \$V\_{opp}\$) of LVDS



\$V\_{IH}\$ : Threshold voltage for Oscillation Start  
 \$V\_{IL}\$ : Threshold voltage for Oscillation Stop

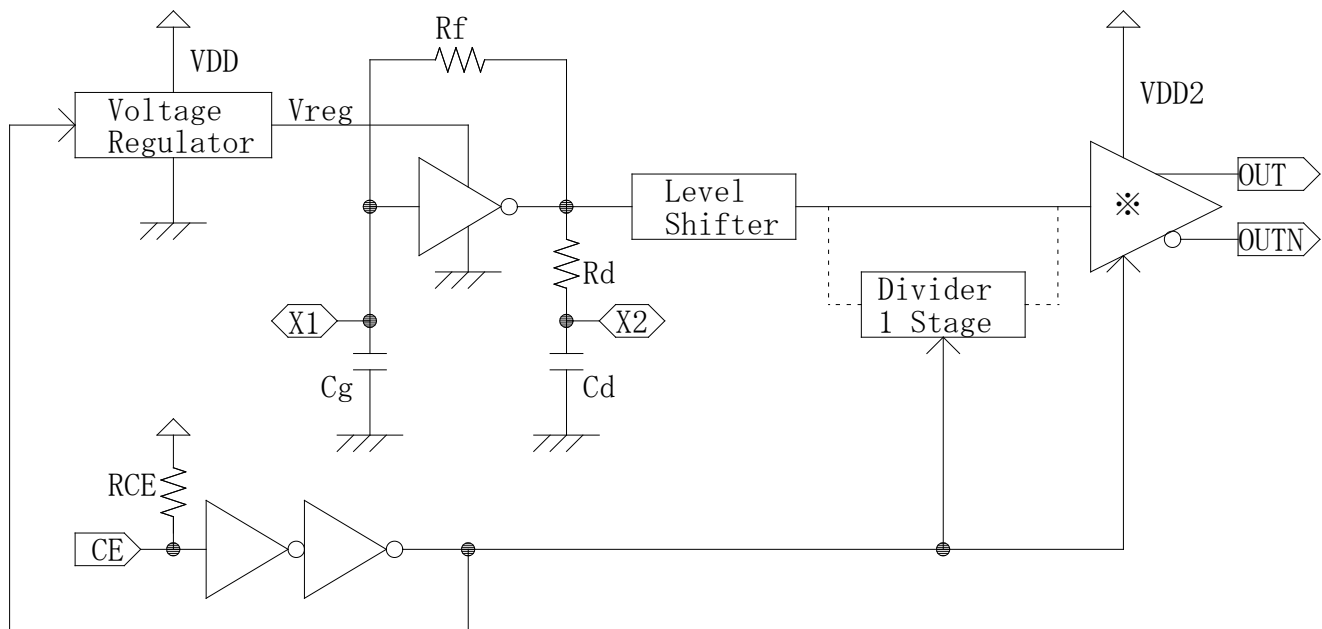
Fig. 5-4 Input output signal timing

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

Ta=25°C

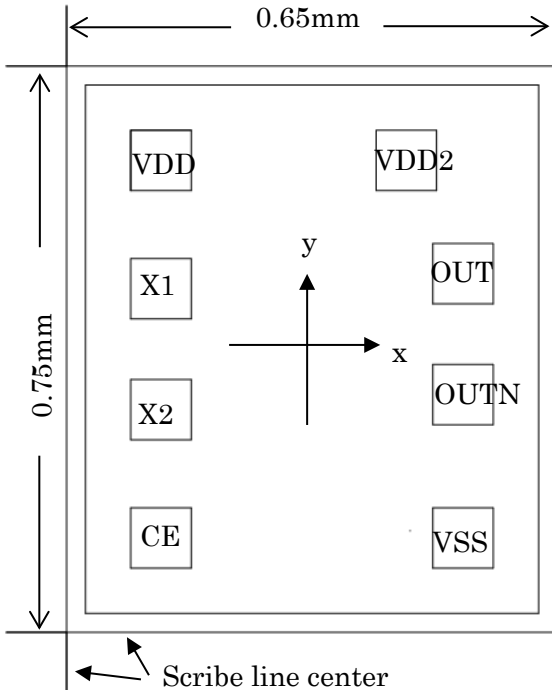
Parameter		Symbol	Condition	Min	Typ	Max	Unit
Feedback Resistor	IPS0208M0	Rf	Refer to Fig. 6-1		200		kΩ
	IPS020DM0				200		
Driving Resistor	IPS0208M0	Rd	Refer to Fig. 6-1		157		Ω
	IPS020DM0				100		
Oscillation Capacitor	IPS0208M0	Cg	Refer to Fig. 6-1		6.0		pF
		Cd			8.0		
	IPS020DM0	Cg			3.0		
		Cd			7.0		

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



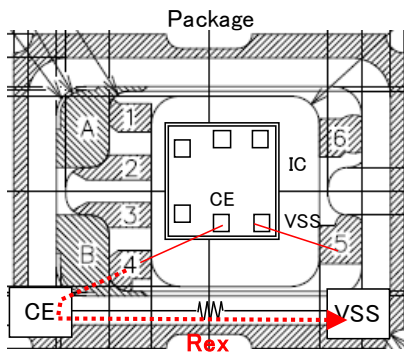
※ Output buffer according to each output waveform format

Fig. 6-1 Block Diagram

**7. Pad Layout**  
 7-1 Straight Type


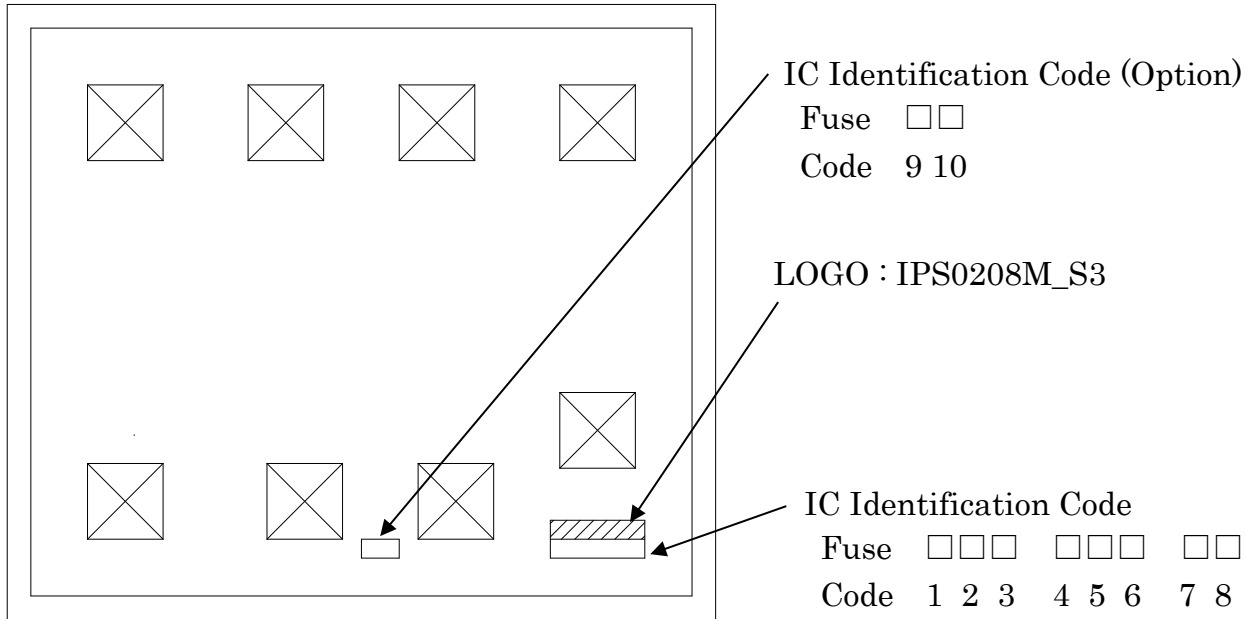
- Die Size: 0.65mm × 0.75mm
- Pad Size: 80um □
- Thickness: 150um ± 20um
- IC Backside: Gnd or Open
- Swapping of OUT/OUTN with wire bond is acceptable

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**


Part #	Code 1~8			Code 9, 10
IPS0208M0PEq	□ □ □	□ □ □	□ □	□ □
IPS020DM0PEq	□ ■ □	□ □ □	□ □	□ □
IPS0208M0PAEq	□ □ □	□ □ □	□ □	□ ■
IPS020DM0PAEq	□ ■ □	□ □ □	□ □	□ ■
IPS0208M0DEq	□ □ □	□ □ □	□ ■	□ □
IPS020DM0DEq	□ ■ □	□ □ □	□ ■	□ □
IPS0208M0HEq	□ □ □	□ □ □	■ □	□ □
IPS0208M0CEq	□ □ □	□ □ □	■ ■	□ □

□ : Fuse no cut

■ : Fuse cut

**9. Revision History**

Revision No.	Revision Date	Revised items	Before Revision	After Revision
SD-4.3	2025/11/04	Wafer thickness 100um	Listed	As requested
		IPS0208MTPES	Under Development	Unlisted
		IPS0208MTPAES	Under Development	Unlisted
		IPS0208MTHES	Under Development	Unlisted
		IPS0208MTCES	Under Development	Unlisted
		IPS0208MTDES	Listed	Unlisted
		I <sub>DDD</sub> Condition	CE ≤ 0.3V	CE=GND

