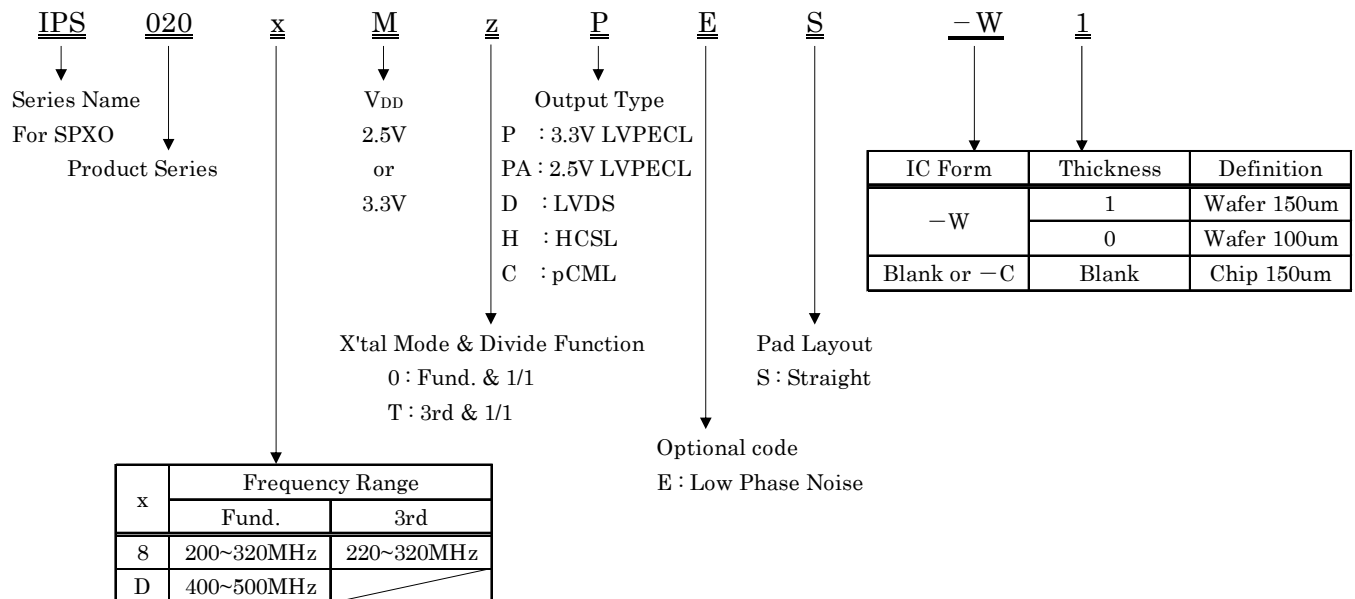


■ Description

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. 3rd overtone oscillation is also available.

■ 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 & 3rd overtone
- 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±10%
IPS020 D M 0 P E S			400	500		400	500	
IPS020 8 M T P E S			3rd	220		320	220	
IPS020 8 M 0 P A E S	LVPECL	Fund.	200	320	1/1	200	320	V _{DD} =2.5V±5%
IPS020 D M 0 P A E S			400	500		400	500	
IPS020 8 M T P A E S			3rd	220		320	220	
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 T D E S			3rd	220		320	220	
IPS020 8 M 0 H E S	HCSL	Fund.	200	320	1/1	200	320	
IPS020 8 M T H E S		3rd	220	320		220	320	
IPS020 8 M 0 C E S	pCML	Fund.	200	320	1/1	200	320	
IPS020 8 M T C E S		3rd	220	320		220	320	

Please contact us for other models.

3. Absolute Maximum Ratings

V_{SS}=0V, T_a=25°C±2°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	°C
Storage Temperature	T _{stg}		-55	125	°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	Ω	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	μA
“L” input current	I_{IL}	$V_{IN}=V_{SS}$		-10		μA
“H” output voltage	V_{OH}	RL=50 Ω (Terminated to $V_{DD}-2.0V$) CE=Open, OUT/OUTN	V_{DD} -1.025	V_{DD} -0.950	V_{DD} -0.880	V
“L” output voltage	V_{OL}		V_{DD} -1.810	V_{DD} -1.700	V_{DD} -1.620	V
Current consumption	I_{DD}	$V_{DD}=3.3V$ CE=Open RL=50 Ω (Terminated to $V_{DD}-2.0V$)	IPS0208M0PES F0=314.68MHz	40.0	60.0	mA
			IPS020DM0PES F0=500MHz	42.0	63.0	
			IPS0208MT0PES F0=250MHz	39.0	59.0	
Current consumption at oscillation stop	I_{DDD}	CE $\leq 0.3V$		100	300	μA

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	IPS0208M0, IPS020DM0				2.0	ms
		IPS0208MT				10.0	
Output Disable Time	Tplz					200	ns
Output Enable Time	Tpzl	IPS0208M0, IPS020DM0				2.0	ms
		IPS0208MT				10.0	
Rise time / Fall time	Tr / Tf	20%~80% Vopp			0.25	0.40	ns
Output Duty Ratio	Duty	1/2Vopp point	IPS0208M0 IPS020DM0	45		55	%
			IPS0208MT $T_a=-40^{\circ}C\sim 85^{\circ}C$	45		55	
			IPS0208MT $T_a=85^{\circ}C\sim 125^{\circ}C$	40		60	
Output Swing	Vopp		0.4				V
Freq. V_{DD} deviation	Fvst	$V_{DD}=3.3V\pm 10\%$	IPS0208M			± 2.0	ppm
			IPS020DM			± 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	Iz	CE=0.3V			10	μA	
“L” input current	IIL	$V_{IN}=V_{SS}$		-10		μA	
“H” output voltage	V _{OH}	RL=50Ω(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	IDD	$V_{DD}=2.5V$ CE=Open RL=50Ω (Terminated to $V_{DD}-2.0V$)	IPS0208M0PAES F0=314.68MHz		36.0	54.0	mA
			IPS020DM0PAES F0=500MHz		39.0	59.0	
			IPS0208MTPAES F0=250MHz		36.0	54.0	
Current consumption at oscillation stop	IDDD	CE \leq 0.3V		100	300	μA	

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	IPS0208M0, IPS020DM0			2.0	ms	
		IPS0208MT			10		
Output Disable Time	Tplz				200	ns	
Output Enable Time	Tpzl	IPS0208M0, IPS020DM0			2.0	ms	
		IPS0208MT			10		
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			± 2.0	ppm
			IPS020DM			± 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	μA	
“L” input current	I_{IL}	$V_{IN}=V_{SS}$		-10		μA	
“H” output voltage	V_{OH}	RL=100 Ω (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}		$V_{DD}=3.3V$ CE=Open RL=100 Ω (Between OUT & OUTN)	IPS0208MODES F0=314.68MHz	15.0	30.0	mA
				IPS020DMODES F0=500MHz	18.0	36.0	
		IPS0208MTDES F0=250MHz		16.0	32.0		
Current consumption at oscillation stop	I_{DDD}	CE \leq 0.3V		100	300	μA	

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	IPS0208M0, IPS020DM0			2.0	ms	
		IPS0208MT			10		
Output Disable Time	Tplz				200	ns	
Output Enable Time	Tpzl	IPS0208M0, IPS020DM0			2.0	ms	
		IPS0208MT			10		
Rise time / Fall time	Tr / Tf	20%~80% Vopp			0.40	ns	
Output Duty Ratio	Duty	1/2Vopp point	IPS0208M0 IPS020DM0	45		55	%
			IPS0208MT $T_a=-40^{\circ}C\sim 85^{\circ}C$	45		55	
			IPS0208MT $T_a=85^{\circ}C\sim 125^{\circ}C$	40		60	
Output Swing	Vopp		0.25			V	
Freq. V_{DD} deviation	Fvst	$V_{DD}=3.3V\pm 10\%$	IPS0208M			± 2.0	ppm
			IPS0208D			± 3.0	
		$V_{DD}=2.5V\pm 5\%$	IPS0208M			± 2.0	
			IPS0208D			± 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	μA	
“L” input current	IIL	$V_{IN}=V_{SS}$		-10		μA	
“H” output voltage	VOH	$R_L=50\Omega$ (To GND), $R_s=0\Omega$	550		900	mV	
“L” output voltage	VOL	CE=Open, OUT/OUTN	-150		150	mV	
Current consumption	IDD	$V_{DD}=3.3V$ CE=Open $R_L=50\Omega$ (To GND) $R_s=0\Omega$	IPS0208M0HES F0=314.68MHz		26.0	39.0	mA
			IPS0208MTHES F0=250MHz		25.0	38.0	
Current consumption at oscillation stop	IDDD	CE \leq 0.3V		100	300	μA	

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	IPS0208M0			2.0	ms	
		IPS0208MT			10		
Output Disable Time	Tplz				200	ns	
Output Enable Time	Tpzl	IPS0208M0			2.0	ms	
		IPS0208MT			10		
Rise time / Fall time	Tr / Tf	20%~80% Vopp		0.30	0.50	ns	
Output Duty Ratio	Duty	1/2Vopp point	IPS0208M0	45		55	%
			IPS0208MT $T_a=-40^{\circ}C\sim 85^{\circ}C$	45		55	
			IPS0208MT $T_a=85^{\circ}C\sim 125^{\circ}C$	40		60	
Output Swing	Vopp		0.55			V	
Freq. V_{DD} deviation	Fvst	$V_{DD}=3.3V\pm 10\%$			± 2.0	ppm	
		$V_{DD}=2.5V\pm 5\%$			± 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	Iz	CE=0.3V			10	μA	
"L" input current	IIL	$V_{IN}=V_{SS}$		-10		μA	
Current consumption	IDD	$V_{DD}=3.3V$ CE=Open RL=100 Ω (Between OUT & OUTN) AC Coupling	IPS0208M0CES F0=314.68MHz		18.5	37.0	mA
			IPS0208MTCES F0=250MHz		19.5	39.0	
Current consumption at oscillation stop	IDDD	CE \leq 0.3V		100	300	μA	

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	IPS0208M0			2.0	ms
		IPS0208MT			10	
Output Disable Time	Tplz				200	ns
Output Enable Time	Tpzl	IPS0208M0			2.0	ms
		IPS0208MT			10	
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. VDD deviation	Fvst	$V_{DD}=3.3V\pm 10\%$			± 2.0	ppm

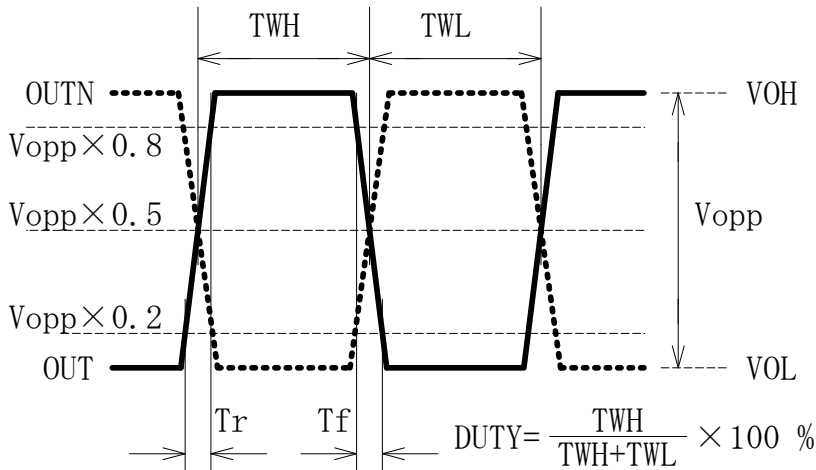


Fig. 5-1 Output Wave Form (Duty, Tr, Tf, VOH, VOL, Vopp) of LVPEL & HCSSL

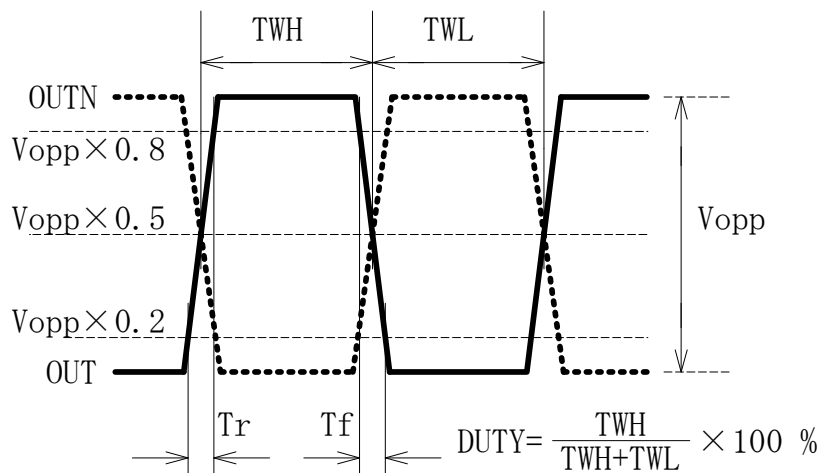


Fig. 5-2 Output Wave Form (Duty, Tr, Tf, Vopp) of pCML

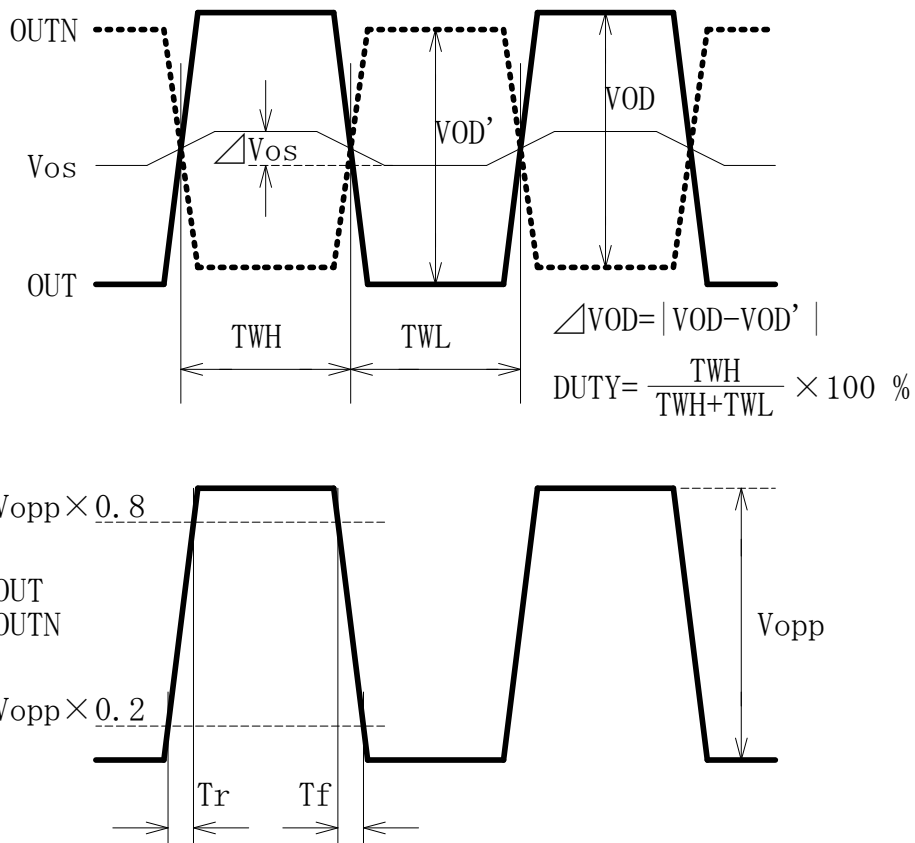
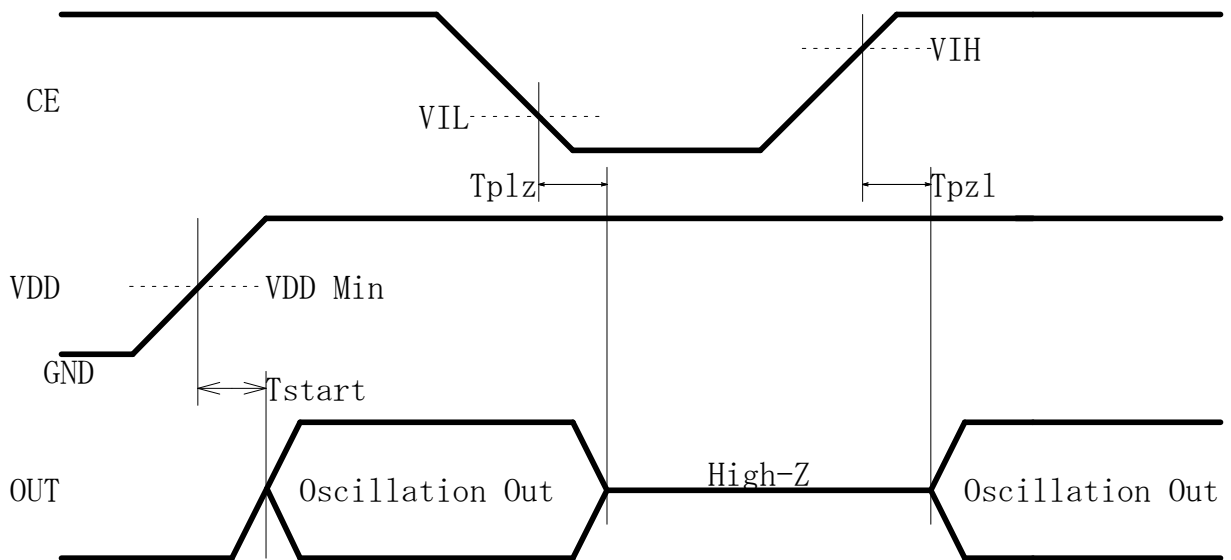


Fig. 5-3 Output Wave Form (Duty, Tr, Tf, VOH, VOL, VOD, Vos, Vopp) of LVDS



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

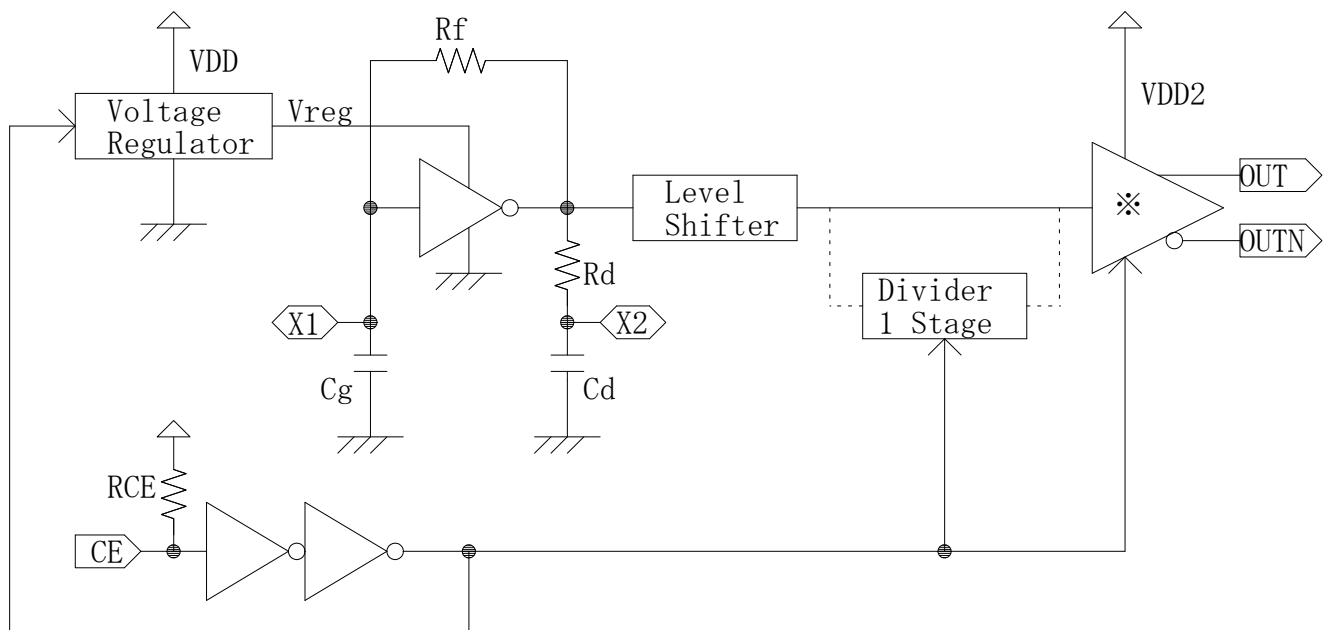
Fig. 5-4 Input output signal timing

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

Ta=25°C

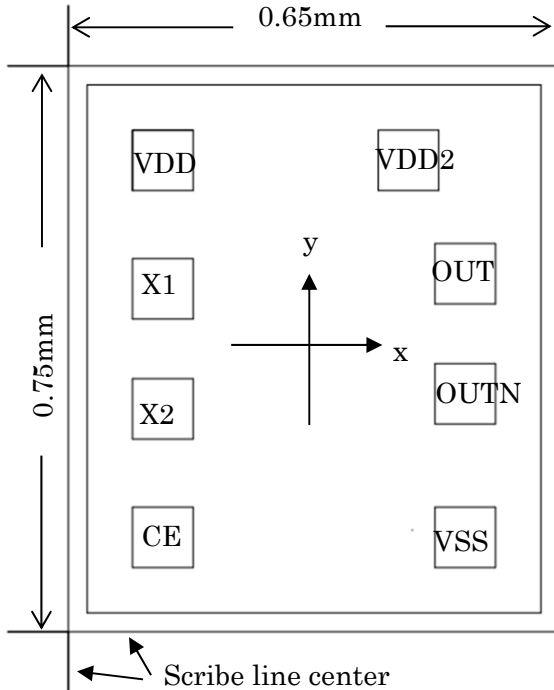
Parameter		Symbol	Condition	Min	Typ	Max	Unit
Feedback Resistor	IPS0208M0	Rf	Refer to Fig. 6-1		200		kΩ
	IPS020DM0				200		
	IPS0208MT				1.0		
Driving Resistor	IPS0208M0	Rd	Refer to Fig. 6-1		157		Ω
	IPS020DM0				100		
	IPS0208MT				400		
Oscillation Capacitor	IPS0208M0	Cg	Refer to Fig. 6-1		6.0		pF
		Cd			8.0		
	IPS020DM0	Cg			3.0		
		Cd			7.0		
	IPS0208MT	Cg			3.0		
		Cd			8.0		

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



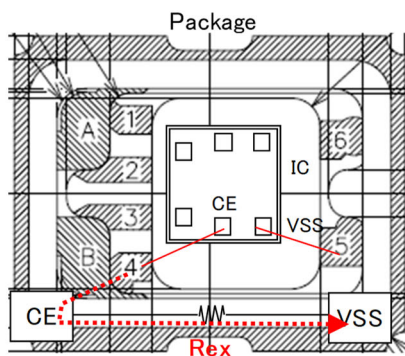
※ Output buffer according to each output waveform format

Fig. 6-1 Block Diagram

7. Pad Layout
 7-1 Straight Type


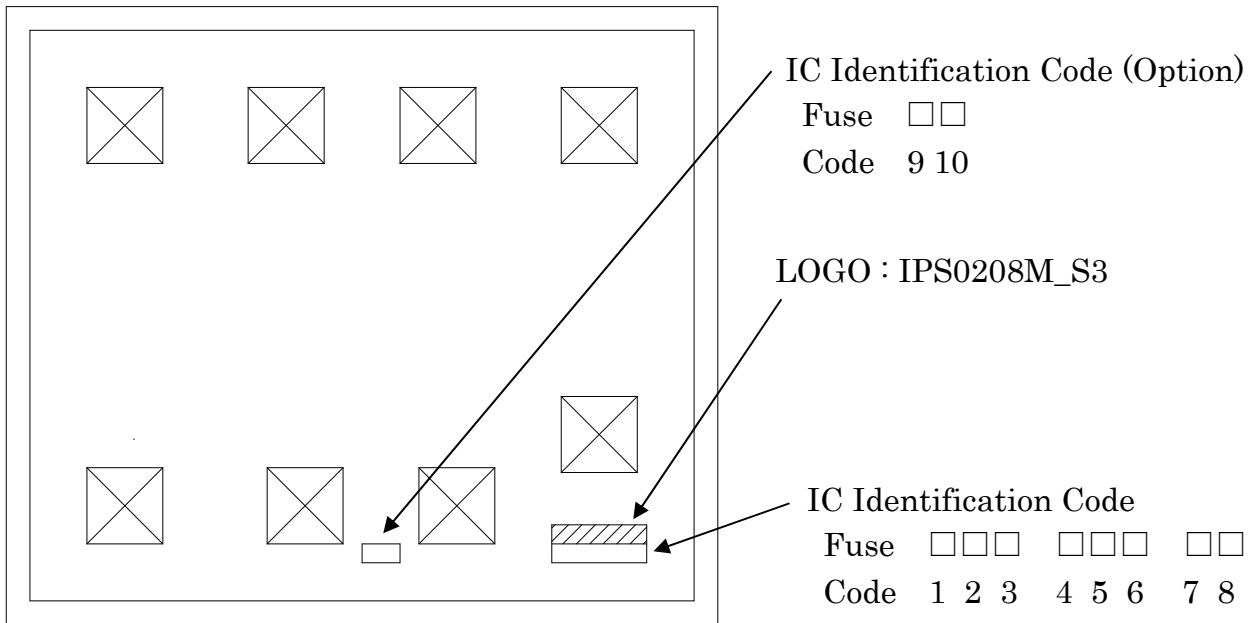
- Die Size: 0.65mm × 0.75mm
- Pad Size: 80um □
- Thickness: 150um ± 20um
- IC Backside: Gnd or Open
- Swapping of OUT/OUTN with wire bond is acceptable

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
IPS0208M0PEF	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS020DM0PES	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208MTPES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208M0PAEF	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>
IPS020DM0PAES	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>
IPS0208MTPAES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>
IPS0208M0DEF	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS020DM0DES	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208MTDES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208M0HES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208MTHES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208M0CES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
IPS0208MTCES	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

: Fuse no cut
 : Fuse cut