

3. Mechanical Specifications

ITEM	SPECIFICATION	UNIT
Outline dimensions	73.0 (W) × 94.0 (H) × 6.7 (D)	mm
Effective viewing area	59.6 (W) × 78.8 (H)	mm
Dot number	(240×R. G. B) (W) × 320 (H)	Dots
Dot size	0.06 (W) × 0.22 (H)	mm
Dot pitch	0.08 (W) × 0.24 (H)	mm
Display color *1	White *2	—
Base color *1	Black *2	—
Mass	(65)	g

*1 Due to the characteristics of the LC material, the color vary with environmental temperature.

*2 Negative-type display

Display data "H" :R, G, B Dots ON : White
 Display data "L" :R, G, B Dots OFF : Black

4. Absolute Maximum Ratings

4-1. Electrical absolute maximum ratings

ITEM	SYMBOL	MIN.	MAX.	UNIT
Supply voltage for logic	VDD	0	7.0	V
Supply voltage for LCD driving *1	V0-V5	0	38.0	V
Input signal voltage *2	Vin	0	VDD	V

*1 $V_0 \geq V_1 \geq V_2 \geq V_3 \geq V_4 \geq V_5 = 0$ (V)

*2 Input signal : CP, LOAD, FRM, DF, DISP, D0~D7

4-2. Environmental absolute maximum ratings

ITEM	SYMBOL	MIN	MAX	UNIT
Operating temperature *1	Top	-20	70	°C
Storage temperature *2	T _{STO}	-30	80	°C
Operating humidity *3	H _{OP}	10	*4	%RH
Storage humidity *3	H _{STO}	10	*4	%RH
Vibration	—	*5	*5	—
Shock	—	*6	*6	—

*1 Kyocera warrants its LCD operates functionally in operating temp. from -20°C to +70°C. On the other hand, it is required to examine display quality on your side beforehand.

*2 Temp. = -30°C < 24 h. , Temp = 80°C < 24 h.
Store LCD panel at normal temperature/humidity. Keep it free from vibration and shock. LCD panel that is kept at low or high temperature for a long time can be defective due to the other conditions, even if the temperature satisfies standard.

*3 Non-condensation.

*4 Temp. ≤ 40°C, 85% RH Max.
Temp. > 40°C, Absolute Humidity shall be less than 85%RH at 40°C.

*5

Frequency	10~55 Hz	Converted to acceleration value : (0.3~9m/s ²)
Vibration width	0.15 mm	
Interval	10-55-10 Hz 1 minute	

2 hours in each direction X/Y/Z (6 hours as total)
EIAJ ED-2531.

*6 Acceleration: 490m/s²
Pulse width : 11 ms
3 times in each direction : ±X/±Y/±Z.
EIAJ ED-2531.

5. Electrical Characteristics

Temp. = 25°C, VDD = +3.3V±0.3V

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage for logic	VDD	—	3.0	3.3	3.6	V
LCD driving voltage *1	Vop =V0-V5	0 °C	(30.4)	(31.4)	(32.4)	V
		25 °C	(29.2)	(30.2)	(31.2)	V
		50 °C	(28.6)	(29.6)	(30.6)	V
Input voltage	Vin	"H" level	0.8VDD	—	VDD	V
		"L" level	0	—	0.2VDD	V
Clock frequency	f _{CP}	—	2.02	2.16	10.0	MHz
Frame frequency *2	f _{FRM}	—	70	75	80	Hz
Randomizing frequency *3	f _{DF}	—	300	—	800	Hz
Current consumption for logic	IDD	*5	—	(0.8)	(1.0)	mA
		*6	—	(0.6)	(0.8)	mA
Current consumption for LCD driving *4	IEE	*5	—	(2.4)	(3.1)	mA
		*6	—	(1.1)	(1.4)	mA
Power consumption *4	Pdisp	*5	—	(75)	(100)	mW
		*6	—	(35)	(46)	mW

- *1 Maximum contrast ratio is obtained by adjusting the LCD supply voltage (Vop= V0-V5) for driving LCD.
- *2 In consideration of display quality, it is recommended that frame frequency is set in the range of 70-80 Hz. When you have to use higher frame and clock frequencies, confirm the LCD's performance and quality prior to finalizing the frequency values: Generally, as frame and clock frequencies become higher, current consumption will get bigger and display quality will be degraded.
- *3 It is recommended that randomizing frequency be set in the range of 300-800 Hz. At finalizing the frequency, confirm with actual tests that phenomena like flickering and/or horizontal lines do not appear on screen.
- *4 Include recommended circuit. Refer 18. recommended additional circuit.

6. Optical Characteristics

6-1. Reflective mode

Measuring Spot = ϕ 6mm , Temp. = 25°C

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Response time	Rise	Tr	$\theta = \phi = 0^\circ$	—	(250)	(350)	ms
	Down	Td	$\theta = \phi = 0^\circ$	—	(150)	(250)	ms
Contrast ratio		CR	$\theta = \phi = 0^\circ$	(3.0)	(6.0)	—	—
Reflectance		ρ	—	(4.0)	(6.0)	—	%

Optimum contrast is obtained by adjusting the LCD driving voltage(Vop) while at the viewing angle of $\theta = \phi = 0^\circ$.

* Definition of Reflectance:

$$\rho \text{ (Reflectance)} = \frac{\text{Measured Reflection Brightness}}{\text{Reflection Brightness against Standard White Board}}$$

* Definition of Contrast

$$\text{C R (Contrast)} = \frac{\text{Reflectance at all pixels "White"}}{\text{Reflectance at all pixels "Black"}}$$

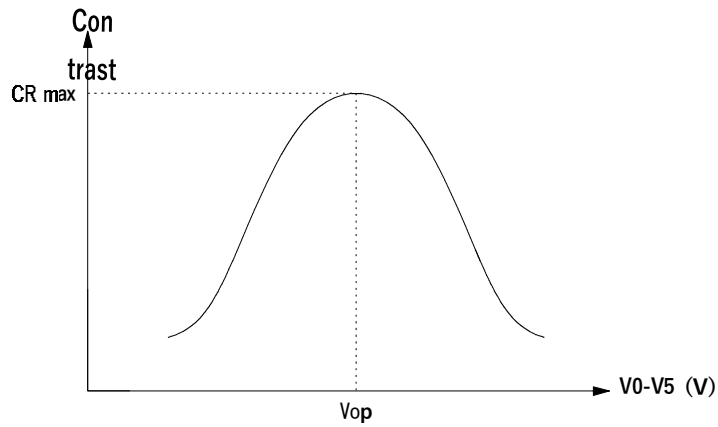
6-2. Transmissive mode

Measuring Spot = ϕ 6mm , Temp. = 25°C

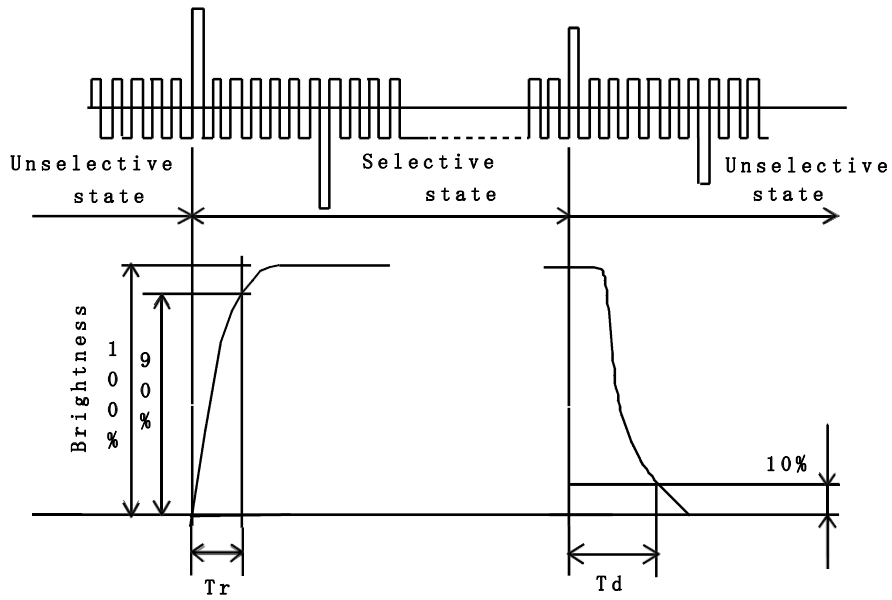
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Response time	Rise	Tr	$\theta = \phi = 0^\circ$	-20°C	—	(6810)	(8510)	ms
				25°C	—	(250)	(350)	
				70°C	—	(150)	(250)	
	Down	Td	$\theta = \phi = 0^\circ$	-20°C	—	(3300)	(4120)	ms
				25°C	—	(150)	(250)	
				70°C	—	(40)	(140)	
Viewing angle range		θ	CR ≥ 2	$\phi = 0^\circ$	(-20)	—	(30)	deg.
		ϕ		$\theta = 0^\circ$	(-50)	—	(45)	deg.
Contrast ratio		CR	$\theta = \phi = 0^\circ$	-20°C	(5.0)	(10.0)	—	—
				25°C	(7.5)	(15.0)	—	
				70°C	(2.0)	(3.0)	—	
Brightness (I1=4mA)		L	—	(15)	(25)	—	cd/m2	
Chromaticity coordinates	Red	x	$\theta = \phi = 0^\circ$	(0.32)	(0.37)	(0.42)	—	
		y		(0.24)	(0.29)	(0.34)		
	Green	x	$\theta = \phi = 0^\circ$	(0.25)	(0.30)	(0.35)		
		y		(0.32)	(0.37)	(0.42)		
	Blue	x	$\theta = \phi = 0^\circ$	(0.18)	(0.23)	(0.28)		
		y		(0.19)	(0.24)	(0.29)		
	White	x	$\theta = \phi = 0^\circ$	(0.27)	(0.32)	(0.37)		
		y		(0.29)	(0.34)	(0.39)		

Optimum contrast is obtained by adjusting the LCD driving voltage(Vop) while at the viewing angle of $\theta = \phi = 0^\circ$.

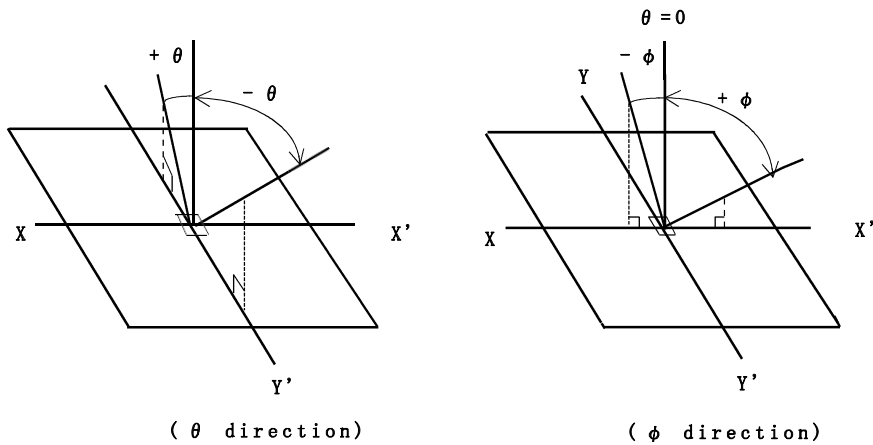
6-3. Definition of Vop



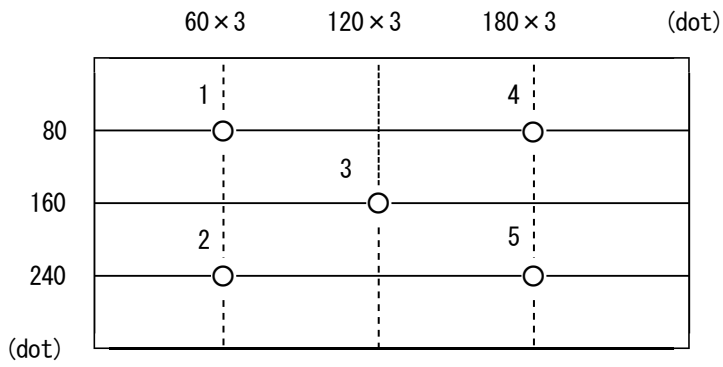
6-4. Definition of response time



6-5. Definition of viewing angle

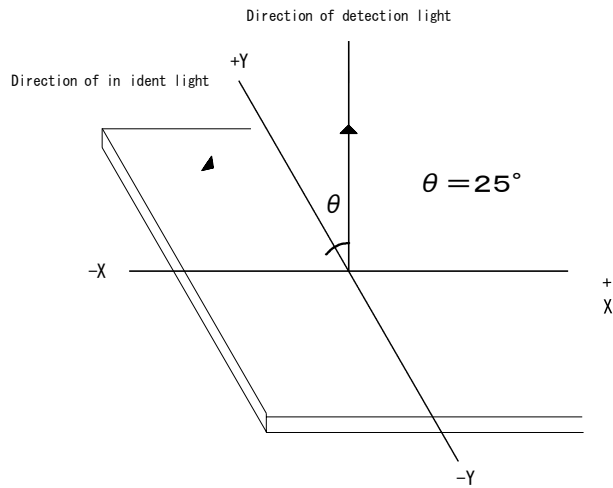


6-6. Measuring points

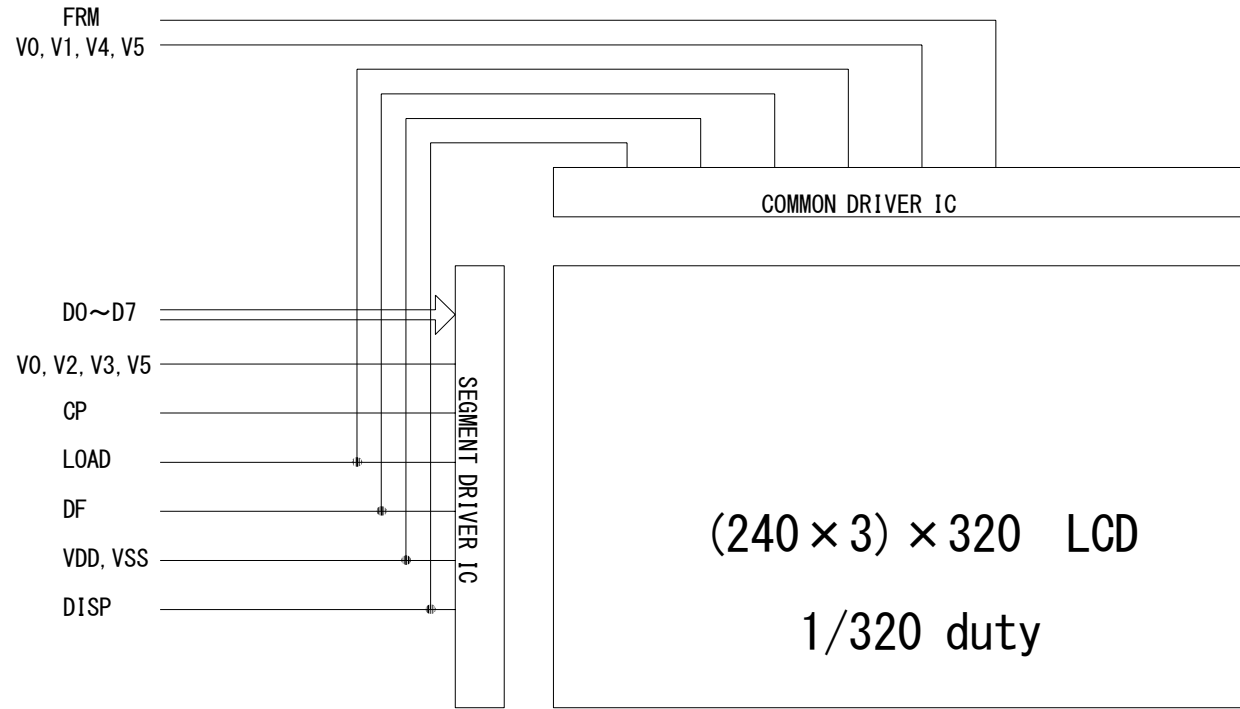


- 1) Rating is defined as the average brightness inside the viewing area.
- 2) 30 minutes after CFL is turned on. (Ambient Temp.=25°C)
- 3) The inverter should meet the eccentric conditions:
 - Sine, symmetric waveform without spike in positive and negative.

6-7. Measurement method of reflectance



7. Circuit Block Diagram



8. Interface signals

8-1. LCD

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	FRM	Synchronous signal for driving scanning line	H
2	LOAD	Data signal latch clock	H → L
3	CP	Data signal shift clock	H → L
4	DISP	Display control signal	H(ON), L(OFF)
5	VDD	Power supply for logic	—
6	VDD	Power supply for logic	—
7	VSS	GND	—
8	DF	AC signal for driving	—
9	V0	*	—
10	V1	*	—
11	V2	*	—
12	V3	*	—
13	V4	*	—
14	V5	*	—
15	D7	Display data	H(ON), L(OFF)
16	D6		
17	D5		
18	D4		
19	D3		
20	D2		
21	D1		
22	D0		

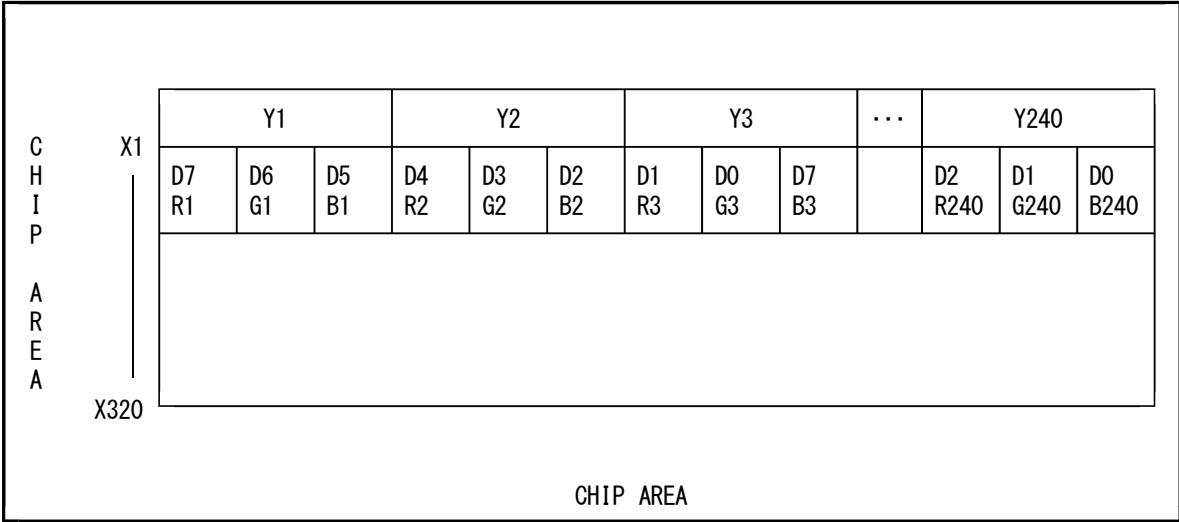
*V0 ~ V5 : Refer 18. Recommended Bias Voltage Circuit for driving LCD.

8-2. CFL

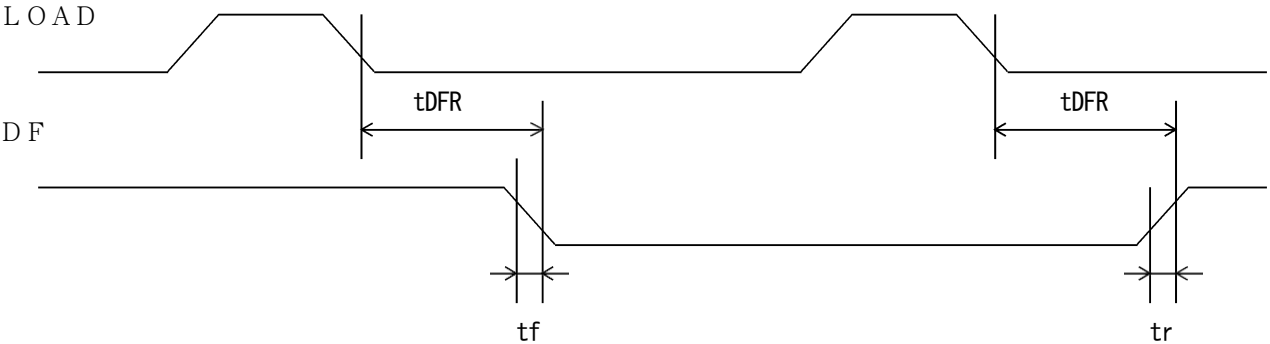
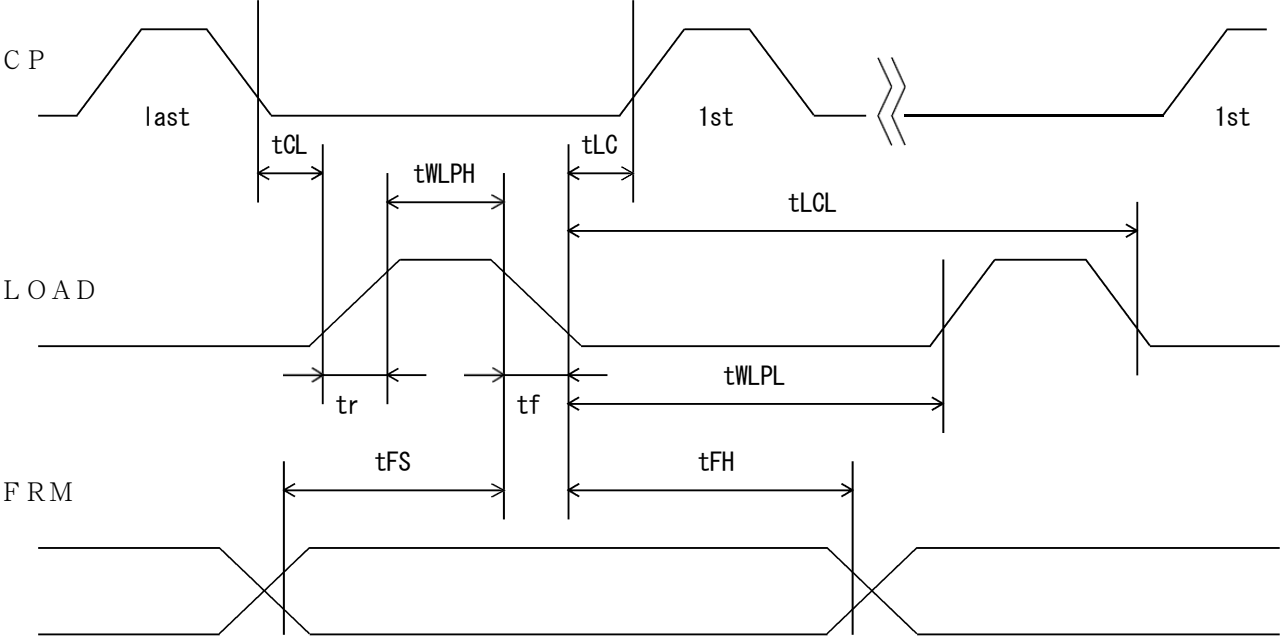
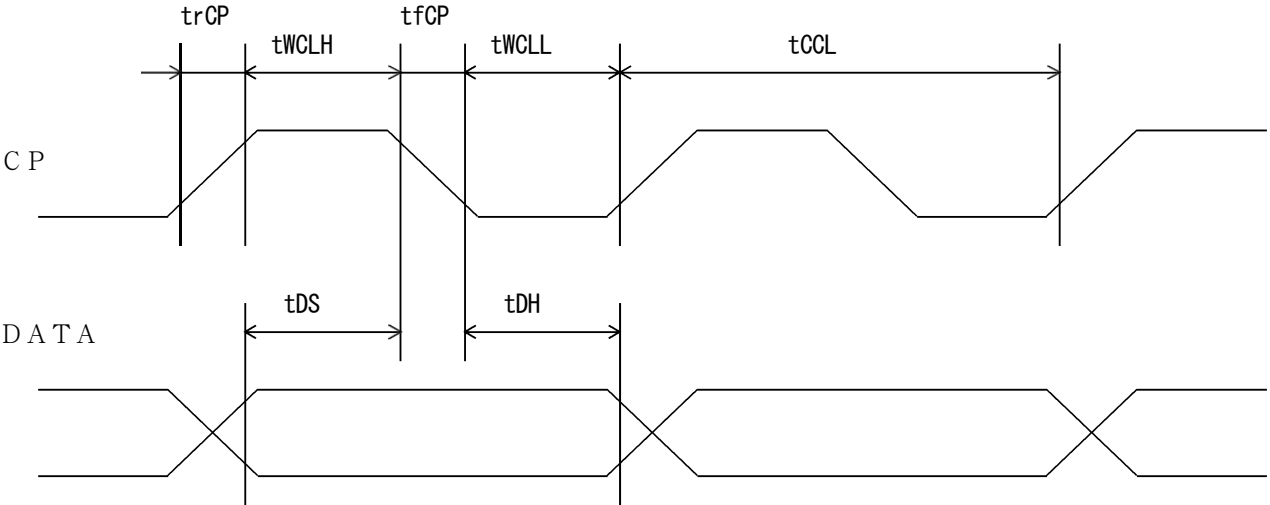
PIN No	SYMBOL	DESCRIPTION	LEVEL
1	HV	Power supply for CFL	AC
2	NC	—	—
3	GND	Ground line (from inverter)	—

LCD side connector : BHR-03VS-1 (JST)
 Recommended matching connector : SM02-(8.0)B-BHS-1 (JST)

10. Data and Screen



11. Input Timing Characteristics



11-1. Switching characteristics

Input Characteristics ; VDD = +3.3V ± 0.3V, Temp. = 25 °C

ITEM	SYMBOL	MIN.	MAX.	UNIT
CP Cycle *1, *2	tCCL	100	—	ns
CP "H" Pulse Width *2	tWCLH	40	—	ns
CP "L" Pulse Width *2	tWCLL	40	—	ns
CP Rise Up Time *2	trCP	—	30	ns
CP Fall Down Time *2	tfCP	—	30	ns
Data Set Up Time	tDS	25	—	ns
Data Hold Time	tDH	20	—	ns
LOAD "H" Pulse Width	tWLPH	100	—	ns
LOAD "L" Pulse Width	tWLPL	4900	—	ns
LOAD Cycle *3	tLCL	5000	—	ns
CP→LOAD Delay Time	tCL	0	—	ns
LOAD→CP Delay Time *4	tLC	200-tWLPH	—	ns
Input Signal Rise Up Time	tr	—	30	ns
Input Signal Fall Down Time	tf	—	30	ns
FRM Data Set Up Time	tFS	100	—	ns
FRM Data Hold Time	tFH	30	—	ns
DF Delay Time	tDFR	0	300	ns

*1 CP Cycle is adjust so that FRM signal is 75 Hz.

*2 The formula of condition

$$\textcircled{1} tr_{CP} + tf_{CP} \leq t_{CCL} - (t_{WCLH} + t_{WCLL})$$

$$\textcircled{2} tr_{CP}, tf_{CP} \leq 30 \text{ ns}$$

Please use on condition that $\textcircled{1}$, $\textcircled{2}$ are filled.

*3 LOAD Cycle is const.

*4 $t_{LC} \geq 0$

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