

SPECIFICATION

PRODUCT NO. : TCX050DTLN-13G

VERSION : Ver 1.4

ISSUED DATE : 2022-12-26

This module uses ROHS material

FOR CUSTOMER: _____

☐ : APPROVAL FOR SPECIFICATION

☐ : APPROVAL FOR SAMPLE

DATE	APPROVED BY

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Note:

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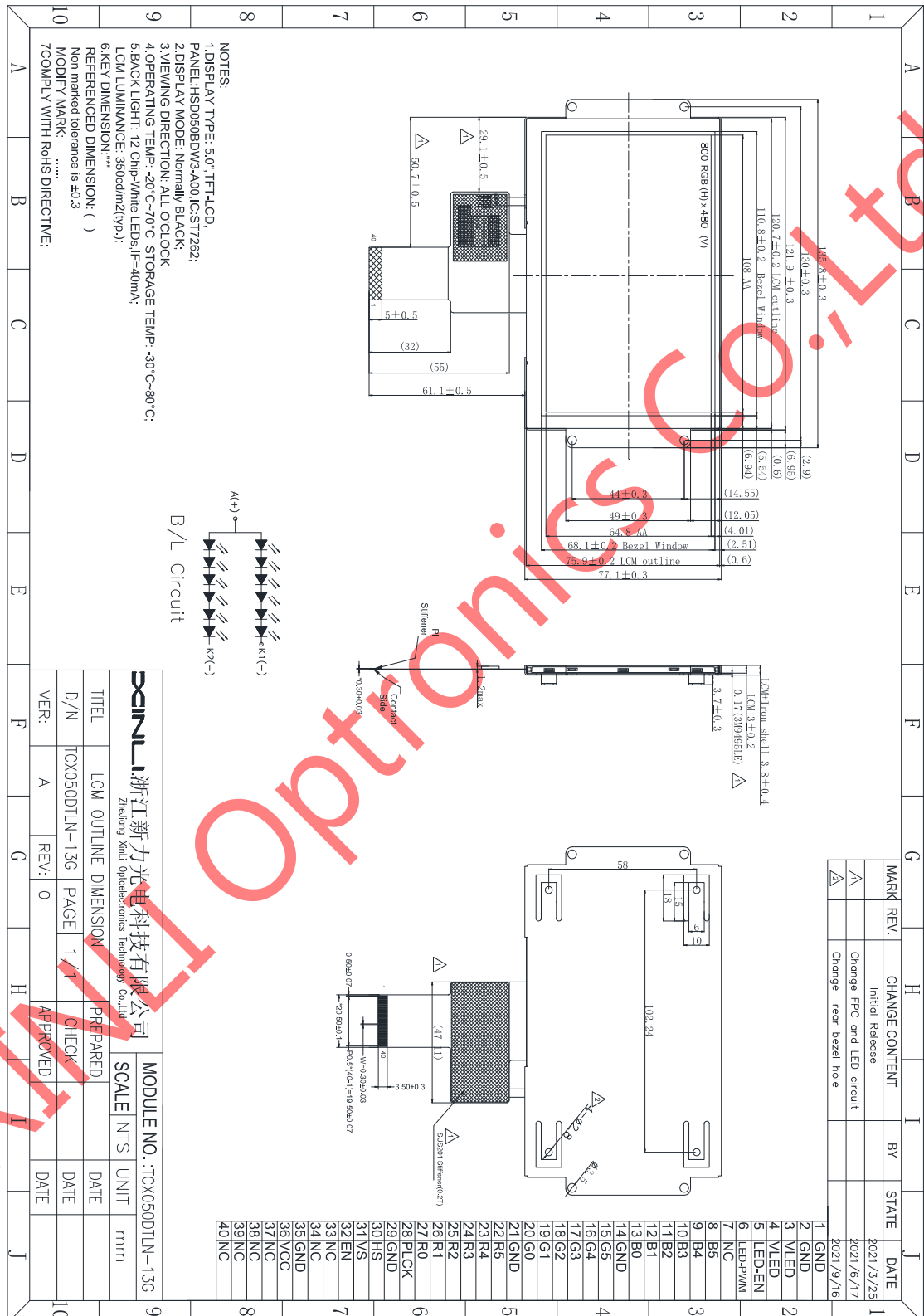
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2. General Description and Features

The 5.0 inch Module named TCX050DTLN-13G is a-Si TFT-LCD module, which is the type of transmissive. It is consisted of TFT-LCD Panel, Driver IC, FPC and Back-Light unit. Features of this product are listed in the following table.

NO	Item	Contents	Unit
(1)	Module Outline	135.8 × 77.1 × 3.8	mm
(2)	LCD Active area	108 × 64.8	mm
(3)	Dot Number	800 × 3(RGB) × 480	/
(4)	Dot size	0.135(H)*0.135(V)	mm
(5)	LCD type	TFT Transmissive	/
(6)	Display Color	262K	/
(7)	Viewing direction	ALL	/
(8)	Backlight Type	12-chip	/
(9)	Power Supply	3.3(TYP)	V
(10)	Interface	FPC 0.5mm Pitch 40pin	/
(11)	Interface type	RGB interface(18 Bit)	/
(12)	Module weight	90	g

3. Mechanical Dimension



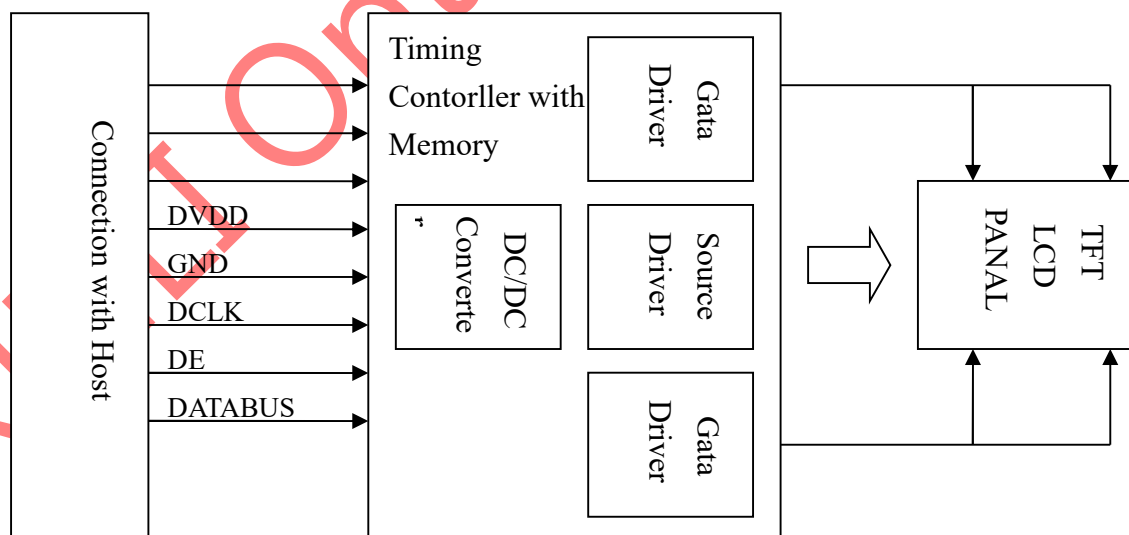
4. Interface Pin Connection

FPC Connector is used for the module electronics interface. The recommended model is FH28D-40S-0.5SH manufactured by Hirose.

NO	Symbol	Level	Description
1	GND	P	Ground
2	GND	P	Ground
3	LED_12V	P	LED power supply
4	LED_12V	P	LED power supply
5	LEN_EN	P	On/Off control signal for backlight H:On
6	LEN_PWM	P	PWM signal for backlight dimming
7	NC	-	Not connect.
8	B5	I	Blue Data Input
9	B4	I	Blue Data Input
10	B3	I	Blue Data Input
11	B2	I	Blue Data Input
12	B1	I	Blue Data Input
13	B0	I	Blue Data Input
14	GND	P	Ground
15	G5	I	Green Data Input
16	G4	I	Green Data Input
17	G3	I	Green Data Input
18	G2	I	Green Data Input
19	G1	I	Green Data Input
20	G0	I	Green Data Input
21	GND	P	Ground
22	R5	I	Red Data input
23	R4	I	Red Data input
24	R3	I	Red Data input
25	R2	I	Red Data input
26	R1	I	Red Data input
27	R0	I	Red Data input
28	PCLK	I	Clock signal for data latching. Default negative

			polarity.
29	GND	I	Ground
30	HS	I	Horizontal sync signal. Default negative polarity. When not used, user should connect it to “Low”.
31	VS	I	Vertical sync signal. Default negative polarity. When not used, user should connect it to “Low”
32	DEN	I	Data input enable. Active high to enable the data input bus under “DE Mode “. Normally pull low.
33	NC	-	Not connect.
34	NC	-	Not connect.
35	GND	P	Ground
36	VCC	P	Power Supply
37	NC	-	Not connect.
38	NC	-	Not connect.
39	NC	-	Not connect.
40	NC	-	Not connect.

5. Block Diagram



6. Maximum Rating

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	°C
Storage temperature	Tst	-30 to 80	°C
Power Voltage	DVDD	-0.5~5.0	V

NOTE:

If the module was used these absolute maximum ratings as above, it may be damaged permanently. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability. VDD>GND must be maintained.

7. Electrical Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Power Voltage		DVDD	3.0	3.3	3.6	V
Logic input signal Voltage	H level	V _{ih}	0.7*DVDD	-	DVDD	V
	L level	V _{il}	0	-	0.3*DVDD	V

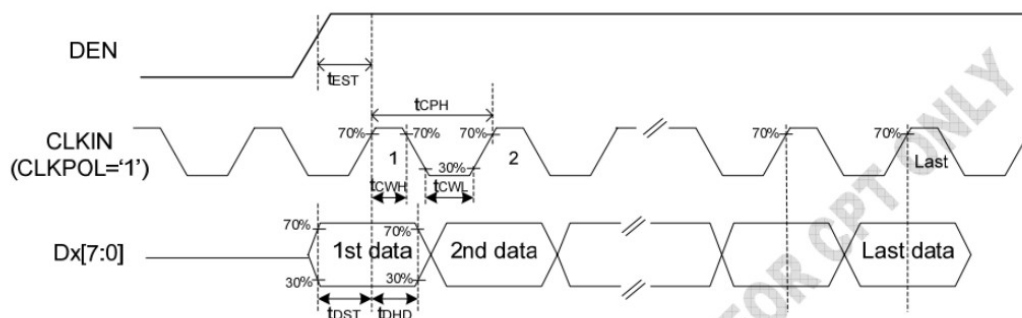
8. Backlight Characteristics

Item	syb	Min	Typ	Max	Unit	Condition
Voltage (LED_VCC)	-	2.5	12	24	V	
Number of LED	-	12			pcs	-
Power Consumption	PWF	720	-	960	mW	-
LED Forward Current		19.4	20	20.6	mA	Per string
EN, PWM Input Voltage	High	1.3	--	24	V	
	Low	--	--	0.5		
Input PWM Frequency	-	100	-	20000	Hz	
LED Life Time	LT	20000	-	-	Hours	

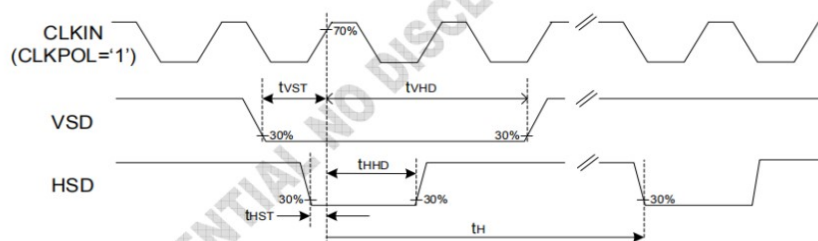
9. Timing Characteristics

9.1. AC Timing characteristics

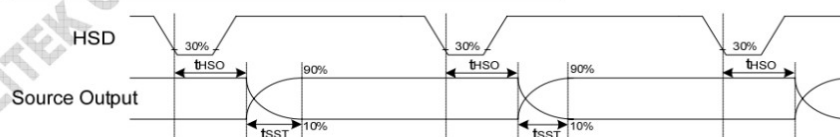
DE Mode (MODE='1')



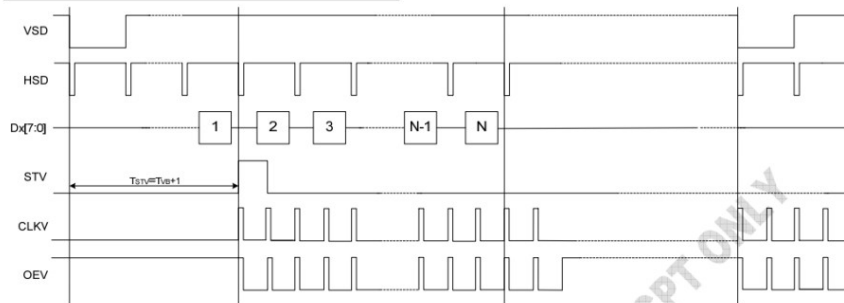
SYNC Mode (MODE='0')



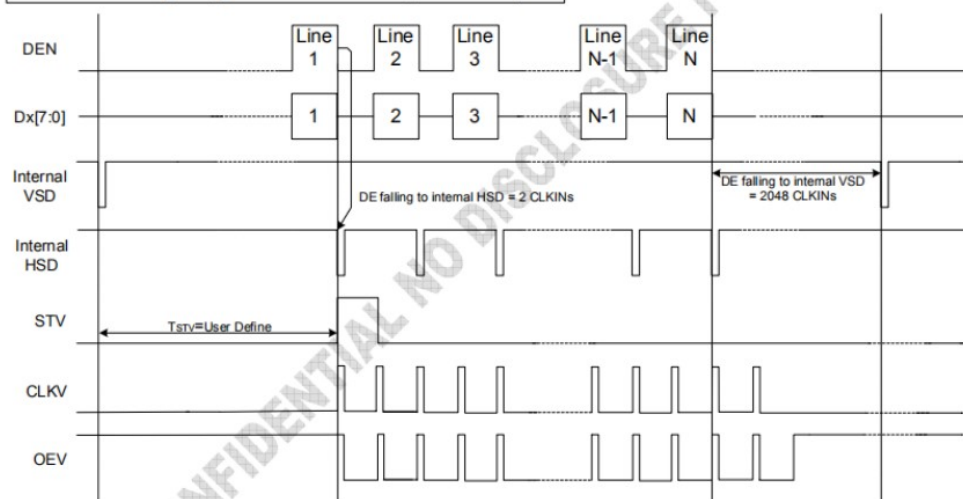
Source Output timing Diagram (Cascade)



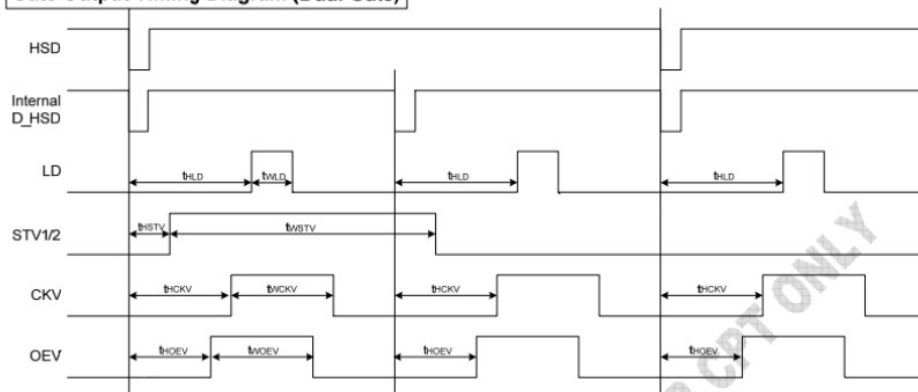
Vertical Timing Diagram of SYNC Mode (Dual Gate)



Vertical Timing Diagram of DE Mode (Dual Gate)



Gate Output Timing Diagram (Dual Gate)



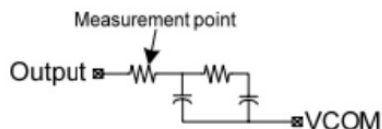
Parameter	Symbol	Spec			Unit	Conditions
		Min.	Typ.	Max.		
VDD Power ON slew rate	t_{POR}	--	--	20	ms	0V ~ 0.9VDD
RSTB pulse width	t_{RST}	10	--	--	us	CLKIN=50MHz
CLKIN cycle time	t_{CPH}	20	--	--	ns	
CLKIN pulse duty	t_{CWH}	40	50	60	%	
VSD setup time	t_{VST}	8	--	--	ns	
VSD hold time	t_{VHD}	8	--	--	ns	
HSD setup time	t_{HST}	8	--	--	ns	
HSD hold time	t_{HHD}	8	--	--	ns	
Data setup time	t_{DST}	8	--	--	ns	D0[7:0], D1[7:0], D2[7:0] to CLKIN
Data hold time	t_{DHD}	8	--	--	ns	D0[7:0], D1[7:0], D2[7:0] to CLKIN
DE setup time	t_{EST}	8	--	--	ns	
DE hold time	t_{EHD}	8	--	--	ns	
Output stable time	t_{SST}	--	--	6	us	10% to 90% target voltage. CL=120pF, R=10K Ω
CLKIN frequency	f_{CLK}	--	40	50	MHz	VDD=3.0 ~ 3.6V
CLKIN cycle time	t_{CLK}	20	25	--	ns	
CLKIN pulse duty	t_{CWH}	40	50	60	%	T_{CLK}
Time from HSD to Source output	t_{HSO}	--	20	--	CLKIN	
Time from HSD to LD	t_{HLD}	--	20	--	CLKIN	Note (2)
Time from HSD to STV	t_{HSTV}	--	2	--	CLKIN	
Time from HSD to CKV	t_{HCKV}	--	20	--	CLKIN	
Time from HSD to OEV	t_{HOEV}	--	4	--	CLKIN	
LD pulse width	t_{WLD}	--	10	--	CLKIN	Note (2)
CKV pulse width	t_{WCKV}	--	66	--	CLKIN	
OEV pulse width	t_{WOEV}	--	74	--	CLKIN	

Note: (1) VDD=3.0 ~ 3.6V, VDDA=6.5~13.5V, DGND=AGND=0V, Ta=-20~70°C

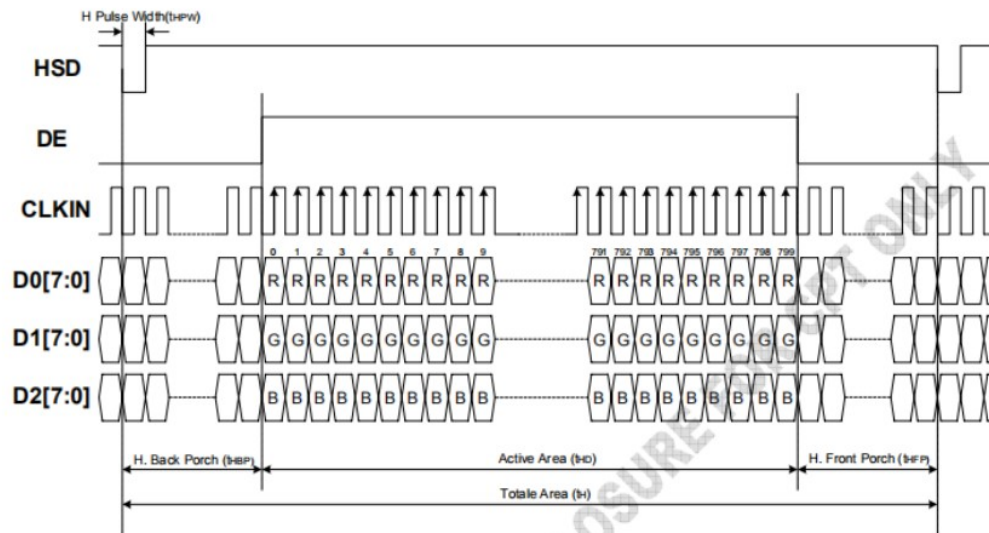
(2) The contents of the data register are transferred to the latch circuit at the rising edge of LD. Then the

gray scale voltage is output from the device at the falling edge of LD.

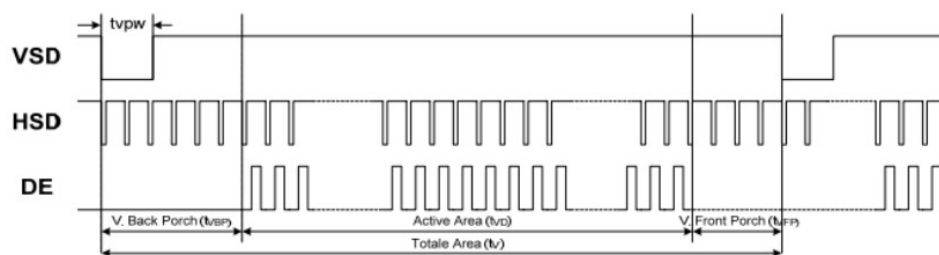
(3) Output loading condition :



9.2. Display Timing characteristics



Horizontal Input Timing						
Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Horizontal display area		t _{HD}	--	800	--	CLKIN
CLKIN frequency		f _{CLK}	--	33.3	50	MHz
1 Horizontal line period		t _H	862	1056	1200	CLKIN
HSD pulse width	Min.	t _{HPW}	--	1	--	CLKIN
	Typ.		--	--	--	CLKIN
	Max.		--	40	--	CLKIN
HSD back porch	SYNC	t _{HBP}	46	46	46	CLKIN
HSD front porch	SYNC	t _{HFP}	16	210	354	CLKIN



Vertical Input Timing					
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	t_{VD}	--	480	--	HSD
VSD period time	t_V	510	525	650	HSD
VSD pulse width	t_{VPW}	1	--	20	HSD
VSD back porch	t_{VBP}	23	23	23	HSD
VSD front porch	t_{VFP}	7	22	147	HSD

10. Application Circuit

Please consult our technical department for detail information.

11. Initial Code

Please consult our technical department for detail information.

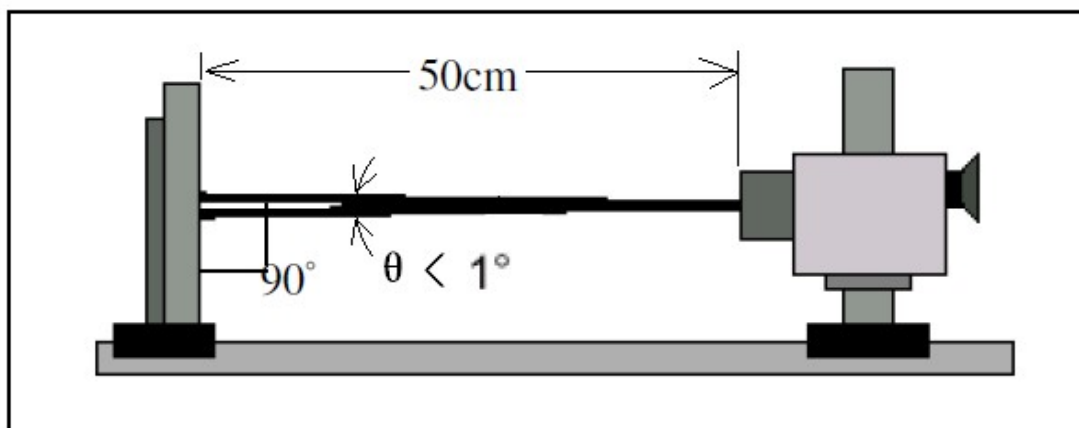
12. Electro-Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Transmission (with pol)		T		4.36	4.95	-	%	
Response time		Tr	$\theta=0^{\circ}$	-	10	-	ms	4
		Tf	$\phi=0^{\circ}$	-	15	-	ms	
Uniformity (Five point)		δ WHITE	Ta=25℃	-	75	-	%	7
Contrast ratio		Cr		800	1000	-	-	3,5
Surface Luminance		Lv		-	350	-	-	3,7
Viewing angle range		θ	$\phi=90^{\circ}$	-	85	-	deg	6
			$\phi=270^{\circ}$	-	85	-	deg	
			$\phi=0^{\circ}$	-	85	-	deg	
			$\phi=180^{\circ}$	-	85	-	deg	
Color filter chromaticity (x, y)	White	X	$\theta=\phi=0^{\circ}$	TBD	TBD	TBD		7
		Y		TBD	TBD	TBD		
	Red	X	$\theta=\phi=0^{\circ}$	TBD	TBD	TBD		
		Y		TBD	TBD	TBD		
	Green	X	$\theta=\phi=0^{\circ}$	TBD	TBD	TBD		
		Y		TBD	TBD	TBD		
	Blue	X	$\theta=\phi=0^{\circ}$	TBD	TBD	TBD		
		Y		TBD	TBD	TBD		

Note 1: Ambient temperature= $25^\circ\text{C} \pm 2^\circ\text{C}$

Note 2: To be measured in the dark room with backlight unit.

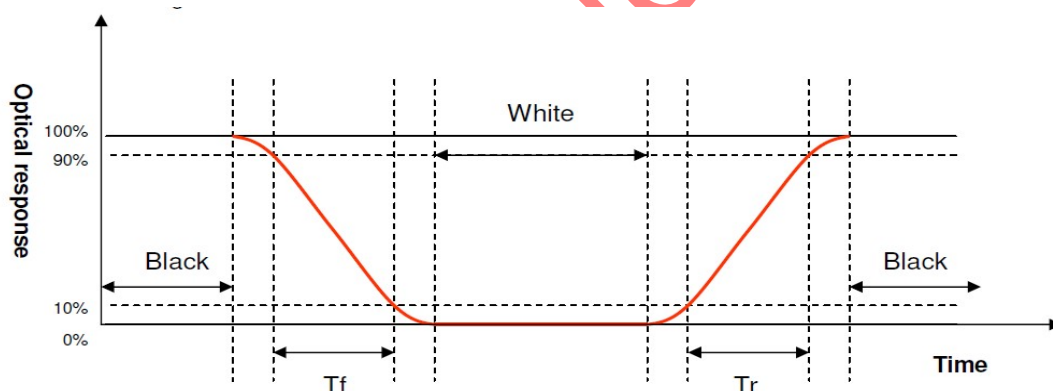
Note 3: To be measured at the center area of panel with a viewing cone of 1 by Topcon luminance meter BM-7A, after 10 minutes operation (module).



Note 4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white” (rising time) and from “white” to “black” (falling time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.

Refer to figure as below.



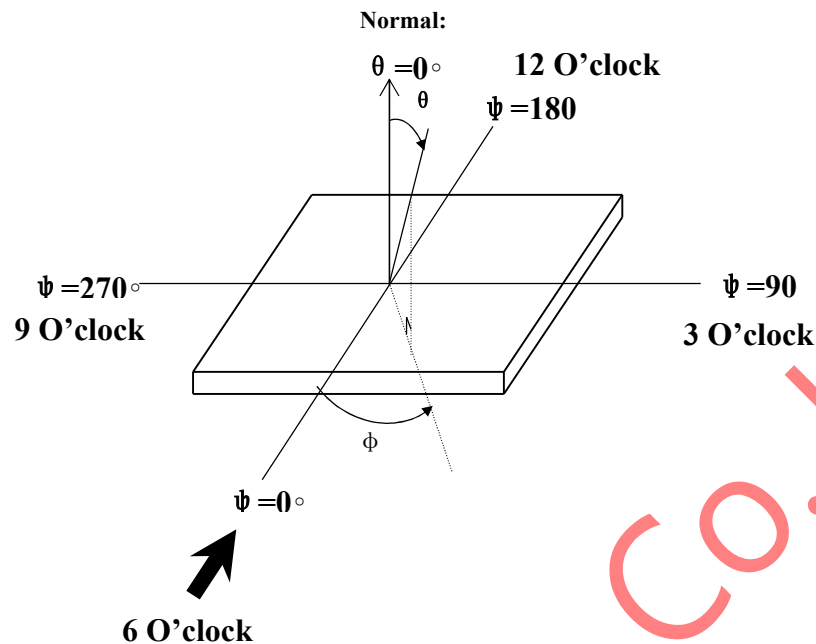
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

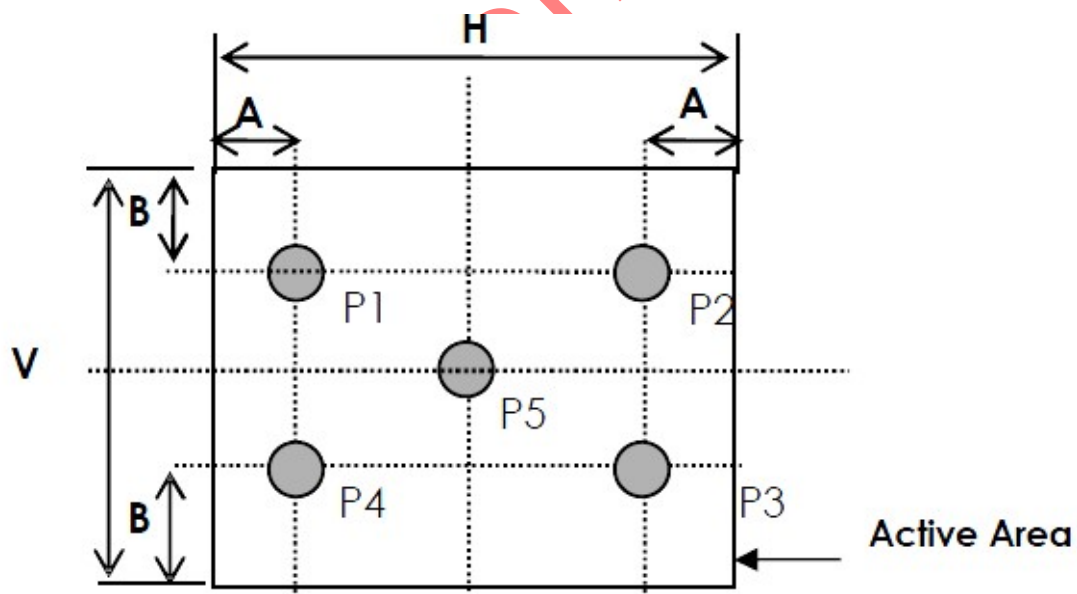
Note 6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 2, for TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.



Note 7. Surface luminance is the LCD surface from the surface with all pixels displaying white. Refer to figure as below.

Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity



A : 5 mm B : 5 mm H,V : Active Area

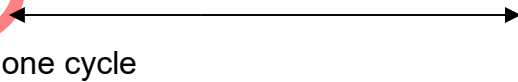
Light spot size $\varnothing=7\text{mm}$, 500mm distance from the LCD surface to detector lens
 measurement instrument is TOPCON's luminance meter BM-7A

Uniformity definition= [min of 5point/max of 5points]x100%

L_v = Average Surface Luminance with all white pixels (P₁, P₂, P₃, P₄, P₅)

13. Reliability Test

This standard reliability test is done only for the first lot of MP products. Customer and supplier must hold a discussion if other reliability test is requested by customer.

NO.	Test Item	Description	Test Condition
1	High temperature storage	Endurance test applying the high storage temperature for a long time	80°C, 240 H
2	Low temperature storage	Endurance test applying the low storage temperature for a long time	-30°C, 240H
3	High temperature operation	Endurance test applying the electric stress under high temperature for a long time	70°C, 240H
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time	-20°C, 240H
5	High temperature /humidity storage	Endurance test applying the high temperature and high humidity storage for a long time	60°C, 90% RH, 240H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $-20^{\circ}\text{C} \leftarrow \rightarrow 20^{\circ}\text{C} \leftarrow \rightarrow 70^{\circ}\text{C}$ $30\text{min} \leftarrow \rightarrow 5\text{min} \leftarrow \rightarrow 30\text{min}$  one cycle	-20°C/70°C, 100 cycles

14. Precautions for Operation and Storage

1. Precautions for Operation

- (1) Since LCD panel made of glass, in order to prevent from glass broken or color tone change, please do not apply any mechanical shock or impact or excessive force to it when installing the LCD module.
- (2) If LCD panel is broken and liquid crystal substance leaks out and contact your skin or clothes, please immediately wash it off by using soap and water.
- (3) The polarizer on the LCD surface is soft and easily scratched. Please be careful when handling.
- (4) If LCD surface becomes contaminated, please wipe it off gently by using moist cloth.

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ten soft cloth with normal hexane,do not use acetone,ketone,ethanol, alcohol or water.If there is saliva or water on the LCD surface,please wipe it off immediately.

(5)When handing LCD module,please be sure that the body and the tools are properly grounded.And do not touch I/F pins with bare hands or contaminate I/F pins.

(6)Do not attempt to disassemble or process the LCD module.

(7)LCD module should be used under recommended operating conditions shown in chapter 6 and 7.

(8)Response time will be extremely slower at lower temperature than at specified temperature and LCD will show different color when at higher temperature.The phenomenon will disappear when returning to specified condition.

(9)Foggy dew,moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage,the deteriorated display quality and electrochemical reaction then leads to the shorter life time and permanent damage to the module probably.Please pay attention to the environmental temperature and humidity.

2. Precautions for Storage

(1)Please store LCD module in a dark place,avoid exposure to sunlight,the light of fluorescent lamp or any ultraviolet ray.

(2)Keep the environment temperature at between 10°C and 35 °C and at normal humidity.Avoid high temperature,high humidity or temperature below 0°C.

(3)That keeps the LCD modules stored in the container shipped from supplier before using them is recommended.

(4)Do not leave any article on the LCD module surface for an extended period of time.

3. Warranty period

Warrants for a period of 12 Months from the shipping date when stored or used under normal condition.

[illegible]