SPECIFICATION

PRODUCT NO. : **TCXD022MWLON-2**
VERSION : **Ver 1.0**
ISSUED DATE : **2020-07-02**

This module uses ROHS material

FOR CUSTOMER: _____

□: APPROVAL FOR SPECIFICATION
■: APPROVAL FOR SAMPLE

DATE	APPROVED BY

Xinli Optoelectronics :

Presented by	Reviewed by	Organized by

Note:

1.Xinli Optoelectronics reserves the right to make changes without further notice to any products herein to improve reliability, function or design.

1. Record of Revisions

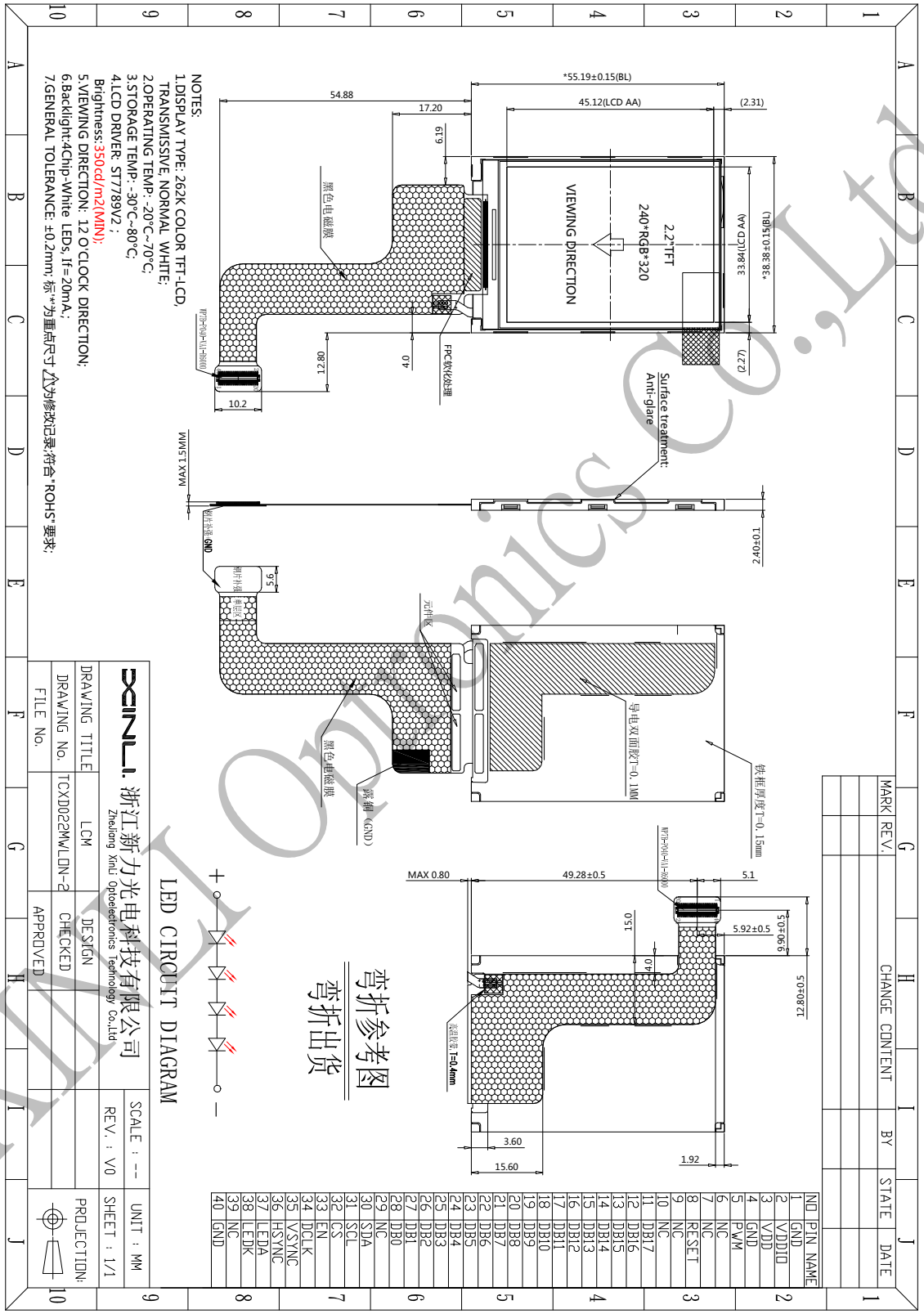
Revision	Description	Date
1.0	Initial Release	2020/07/02

2. General Description and Features

The 2.2 inch Module named TCXD022MWLON-2is a-Si TFT-LCD module, which is the type of transmissive. It is consisted of TFT-LCD Panel, one Driver IC, one FPC and one Back-Light unit. Features of this product are listed in the following table.

NO	Item	Contents	Unit
(1)	Module Outline	38.38*55.19*2.40	mm
(2)	LCD Active area	33.84*45.12	mm
(3)	Dot Number	240*3(RGB)*320	/
(4)	LCD type	a–Si TFT	/
(5)	Display Color	262K	/
(6)	Viewing direction	12	O'clock
(7)	Backlight Type	4-chip LEDs, Serial	/
(8)	Power Supply	2.8(TYP)	V
(9)	Drive IC	ST7789V2	/
(10)	Interface	FPC 0. 4mm_Pitch_40pin	/
(11)	Interface type	SPI+RGB Interface	/
(12)	Surface type	Anti-glare	/

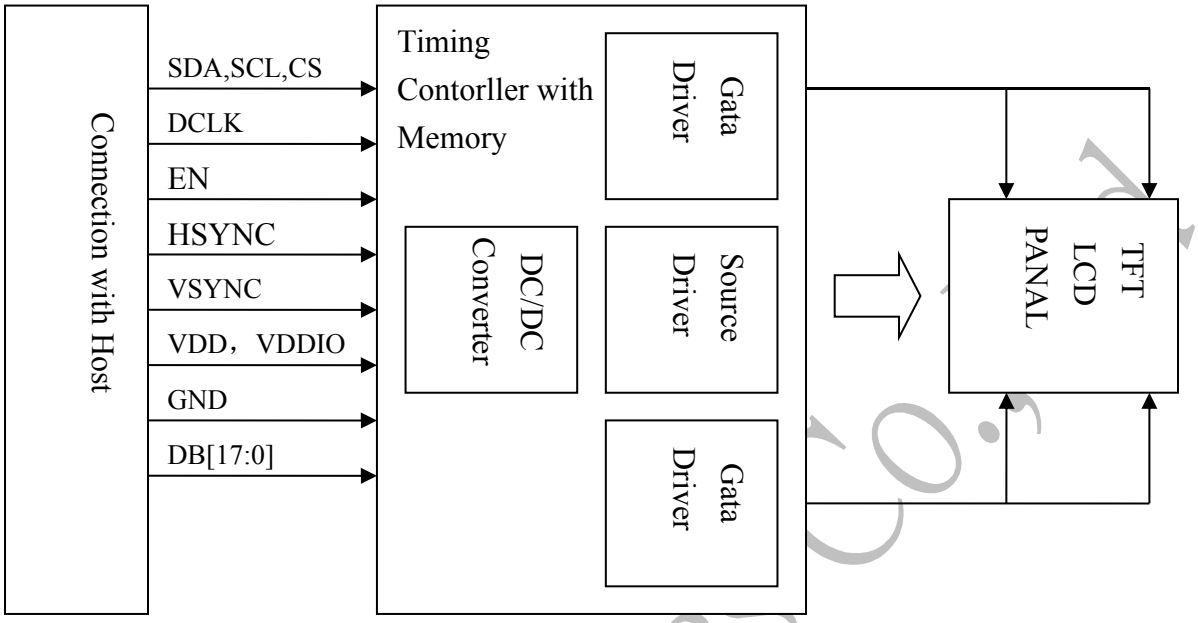
3. Mechanical Dimension

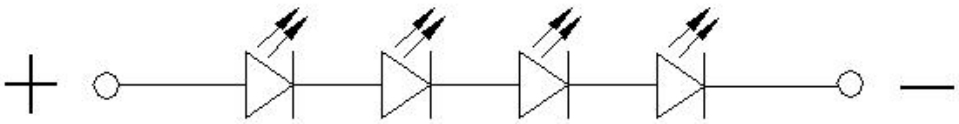


4. Interface Pin Connection

NO	Symbol	Level	Description
1	GND	P	Ground
2	VDDIO	P	Power Supply for I/O System.
3	VDD	P	Power supply for LCD
4	GND	P	Ground
5	PWM	H/L	Back-light control output
6	NC	/	Not Connect
7	NC	/	Not Connect
8	RESET	H/L	pin Reset signal input pin
9	NC	-	Not connect
10	NC	-	Not connect
11~28	DB17~DB0	H/L	Data Bus
29	NC	-	Not Connect
30	SDA	H/L	Data input pin in serial mode
31	SCL	H/L	Clock pin of serial interface
32	CS	H/L	Chip select pin of serial interface
33	EN	H/L	Enable pin
34	DCLK	H/L	Pixel data clock input
35	VSYNC	H/L	Vertical sync input
36	HSYNC	H/L	Horizontal sync input
37	LEDA	P	Backlight LED+
38	LEDK	P	Backlight LED-
39	NC	-	Not Connect
40	GND	P	Ground

5. Block Diagram





LED CIRCUIT DIAGRAM

6. Maximum Rating

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	℃
Storage temperature	Tst	-30 to 80	℃
Power supply for LCD	VDDIO	0.3 to 4.6	V
	VDD	0.3 to 4.6	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

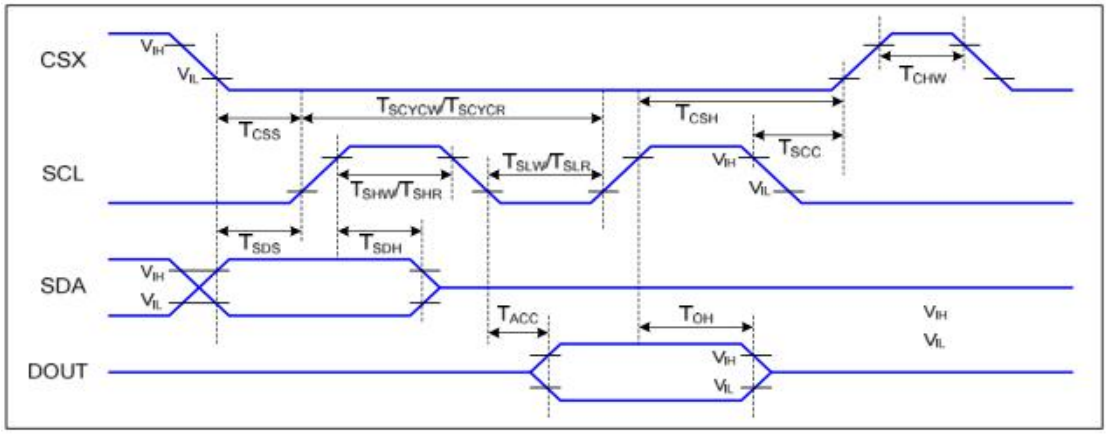
Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply for LCD		VDD	-	2.4	2.8	3.3	V
		VDDIO		1.65	1.8	3.3	V
Logic input signal Voltage	H level	V_{IH}		0.7*VDDIO	-	VDDIO	V
	L level	V_{IL}		GND	-	0.3*VDDIO	V
Logic output signal Voltage	H level	V_{OH}		0.8*VDDIO	-	VDDIO	V
	L level	V_{OL}		GND	-	0.2*VDDIO	V

8. Backlight Characteristics

Item	syb	Min	Typ	Max	Unit	Condition
Voltage	Vf	-	12.8	-	V	IF=20mA
Number of LED	-	4			pcs	-
Power Consumption	PWF	-	256	-	mW	-
Connection mode	-	Serial			-	-
LED life-span	-	-	(20000)	-	Hrs	-

9. Timing Characteristics

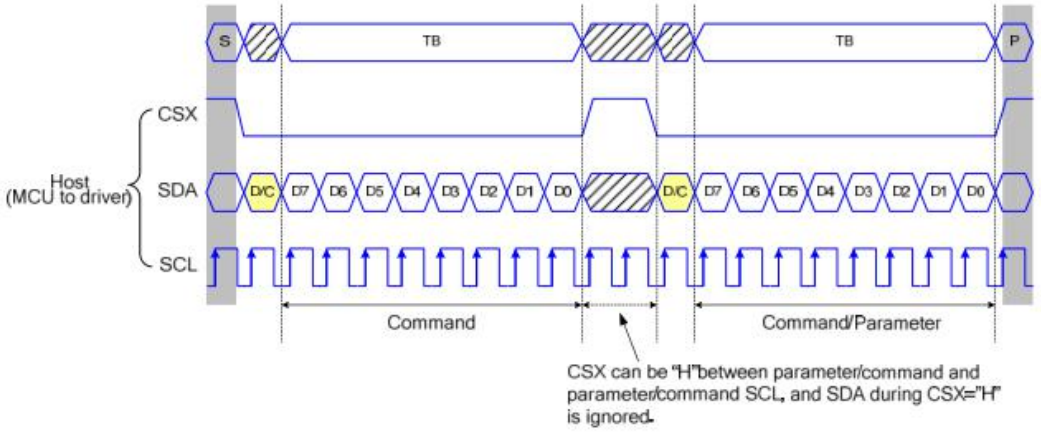
3-lineSerial Interface Characteristics



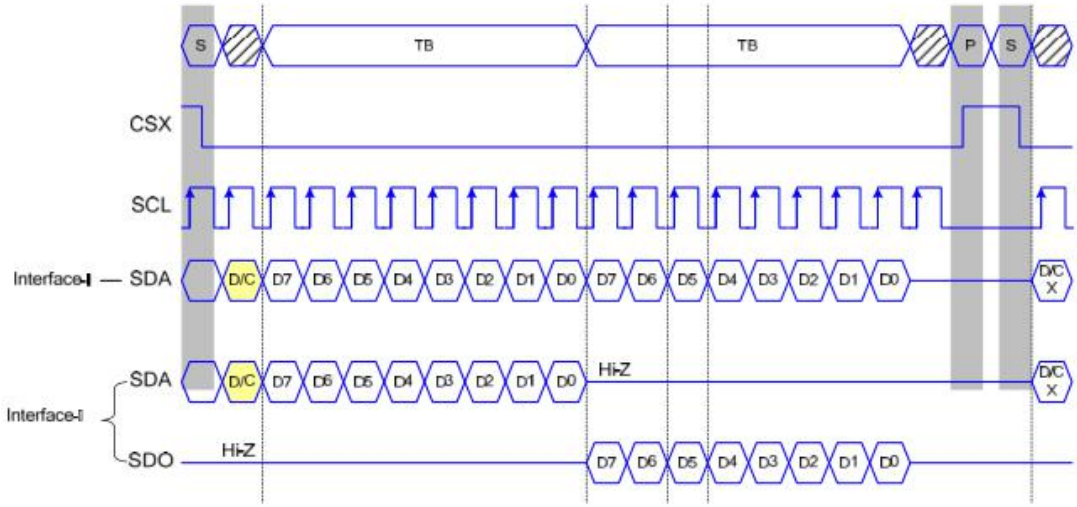
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	16		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

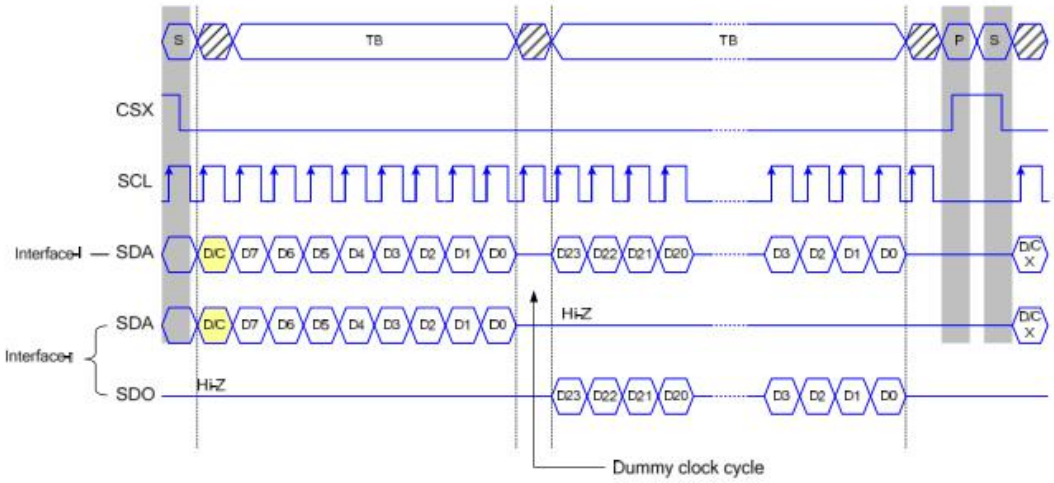
3-Wire 9-bit data serial interface write mode



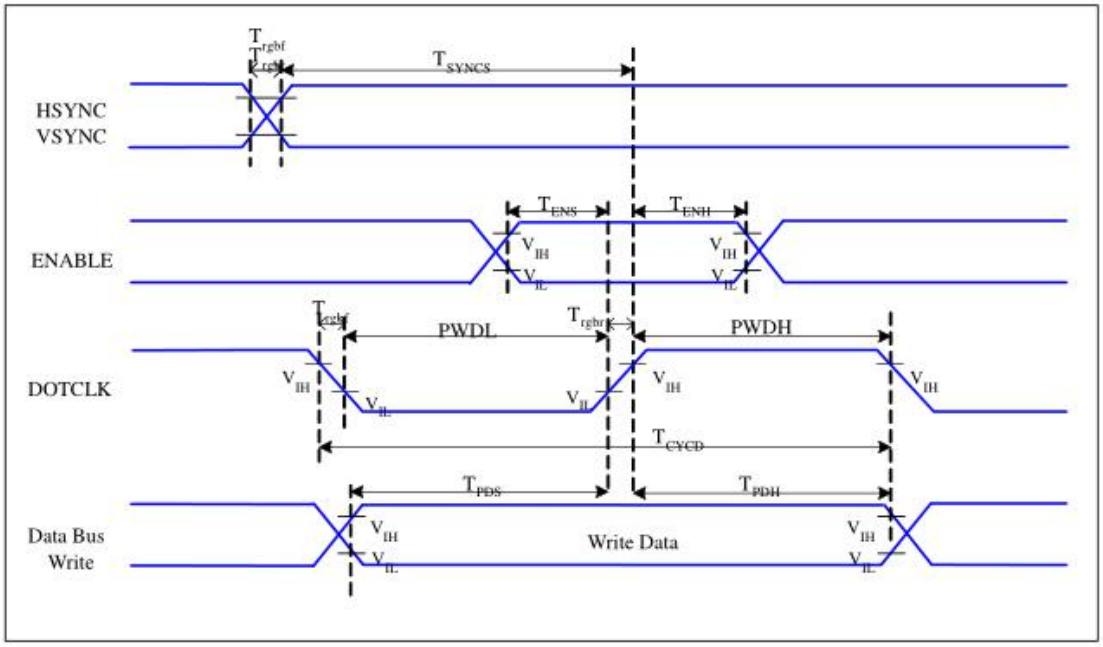
3-line serial protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read):



3-line serial protocol (for RDDID command: 24-bit read)



RGB Interface Characteristics



RGB Interface Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

18/16 Bits RGB Interface Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	35	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	35	-	ns	
	T_{ENH}	Enable Hold Time	35	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	35	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	35	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	80	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	10	ns	
DB	T_{PDS}	PD Data Setup Time	35	-	ns	
	T_{PDH}	PD Data Hold Time	35	-	ns	

6 Bits RGB Interface Timing Characteristics

10. Application Circuit

Please consult our technical department for detail information.

11. Initial Code

Please consult our technical department for detail information.

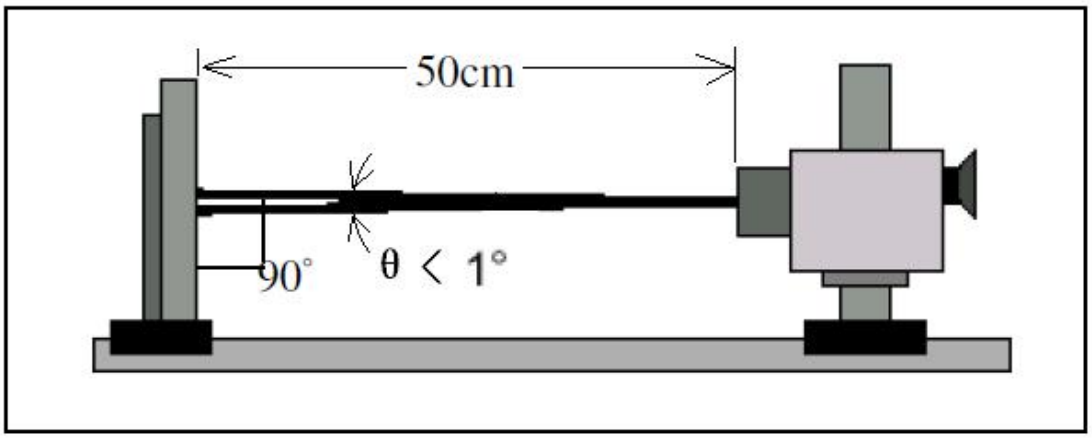
12. Electro-Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Response time		Tf+Tr		-	25	30	ms	
Uniformity (Five point)		δ WHITE		-	80	-	%	7
Contrast ratio		Cr			400	-	-	3 ,5
Surface Luminance		Lv		350	-	-	-	3 ,7
Viewing angle range		∅	∅ = 90°	-	60	-	deg	6
			∅ = 270°	-	60	-	deg	
			∅ = 0°	-	40	-	deg	
			∅ = 180°	-	60	-	deg	
Color filter chromaticity (x, y)	White	X	θ = Φ = 0°	0.2828	0.3228	0.3628		7
		Y		0.2993	0.3393	0.3793		
	Red	X	θ = Φ = 0°	0.5703	0.6103	0.6503		
		Y		0.2830	0.3230	0.3630		
	Green	X	θ = Φ = 0°	0.3271	0.3671	0.4071		
		Y		0.5004	0.5404	0.5804		
	Blue	X	θ = Φ = 0°	0.1162	0.1562	0.1962		
		Y		0.0663	0.1063	0.1463		

Note 1: Ambient temperature=25℃±2℃

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

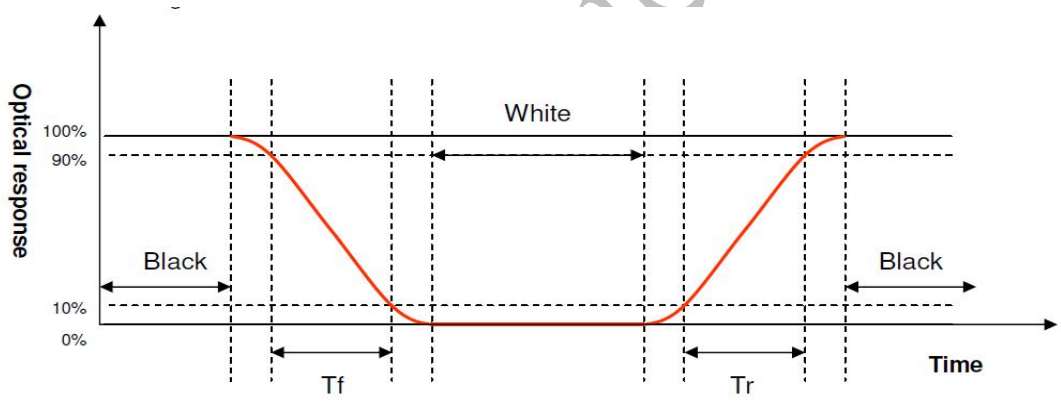
Note 3: To be measured at the center area of panel with a viewing cone of 1 by Topcon luminance meter BM-7A, after 10 minutes operation (module).



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.



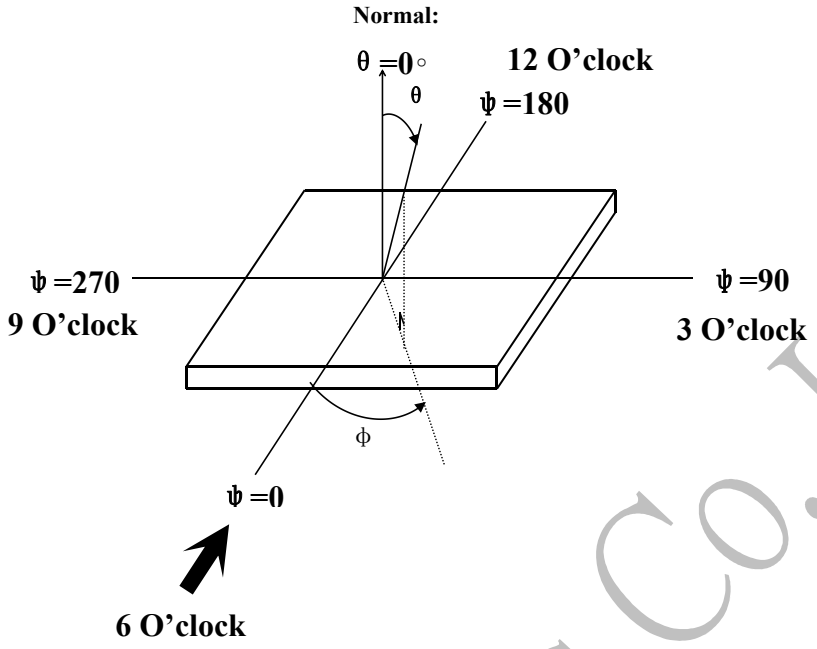
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

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

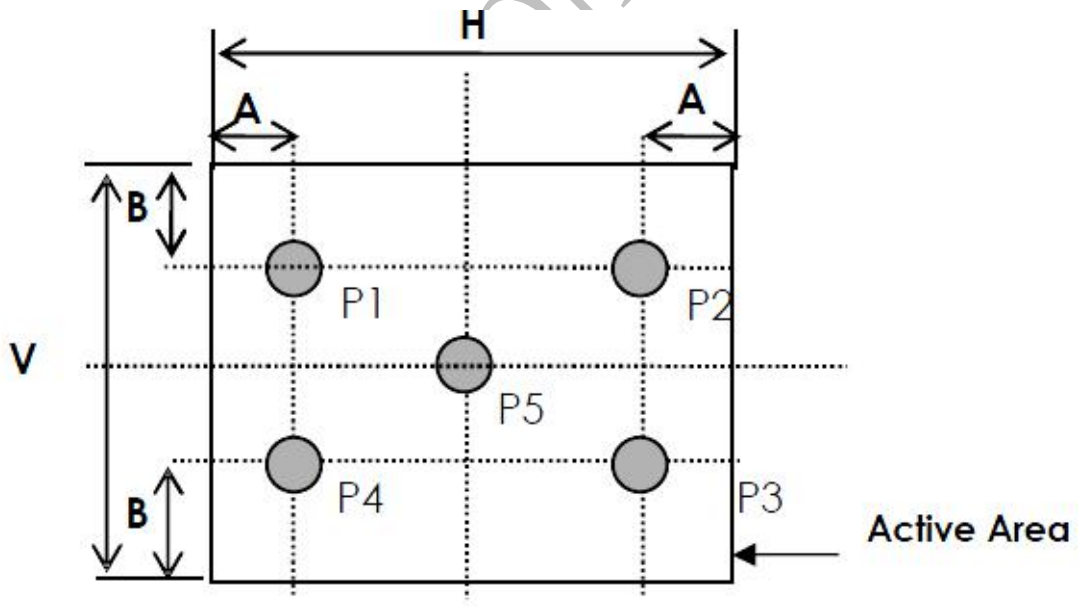
Note 6. Definition of viewing angle

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 Æ=7mm, 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%

Lv = Average Surface Luminance with all white pixels (P_1, P_2, P_3, P_4, P_5)

13. Quality Assurance

TBD.

14. 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℃,96 H
2	Low temperature storage	Endurance test applying the low storage temperature for a long time	-30℃,96H
3	High temperature operation	Endurance test applying the electric stress under high temperature for a long time	70℃,96H
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time	-20℃,96H
5	High temperature /humidity storage	Endurance test applying the high temperature and high humidity storage for a long time	40℃，90% RH 96H
7	Temperature Cycle	Endurance test applying the low and high temperature cycle -30℃← →80℃ ← →-3 0℃ 30min←→30min←→30min one cycle	-30℃/80℃ 5 cycles
8	Vibration test	Endurance test applying the vibration during transportation and using	10Hz~55Hz~10Hz, Swing: 0.75mm
9	Fall test	Endurance test dropping the LCM from a high place	800mm height

10	Static electricity test	Endurance test applying static electric stress to terminal	Voltage: ± 4KV(contact discharge); ±6 KV(air discharge)

15. 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 mois 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 immediate ly.

(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 enviro nmental temperature and humidity.

1. 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℃and 35 ℃ and at normal humidity.Avoid high temperature,high humidity or temperature below 0℃.

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

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

2. Warranty period

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

16. Package Specification