

SPECIFICATION

PRODUCT NO. : TCXD040IBLON-10

VERSION : Ver 1.0

ISSUED DATE : 2021-1-18

This module uses ROHS material

FOR CUSTOMER : _____

☐: APPROVAL FOR SPECIFICATION

☒: APPROVAL FOR SAMPLE

DATE	APPROVED BY

Xinli Optronics :

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1. Record of Revision

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2. General Description and Features

The 3.97 inch Module named TCXD040IBLON-10 is 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. FPC and one Back-Light unit. Features of this product are listed in the following table. listed in the following table.

NO	Item	Contents	Unit
(1)	Module Outline	55.74(H)*97.00 (V)*2.1max(T)	mm
(2)	LCD Active area	51.84*86.40	mm
(3)	Dot Number	480*3(RGB)*800	/
(4)	Dot pitch	0.108 (H)*0.108 (V)	um
(5)	LCD type	Normally Black,Transmissive	/
(6)	Display Color	16.7M	/
(7)	Viewing direction	All	O'clock
(8)	Backlight Type	10-chip LEDs 5S2P	/
(9)	Power Supply	3.3(TYP)	V
(10)	Drive IC	ILI9806E-2C	/
(11)	Interface	FPC0.5mm_Pitch 40pin	/
(12)	Interface type	SPI+RGB Interface	/
(13)	Surface treatment	Clear	/
(14)	Module weight	24(TYP)	g

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4. Interface Pin Connection

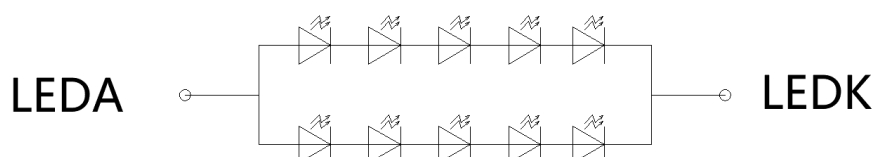
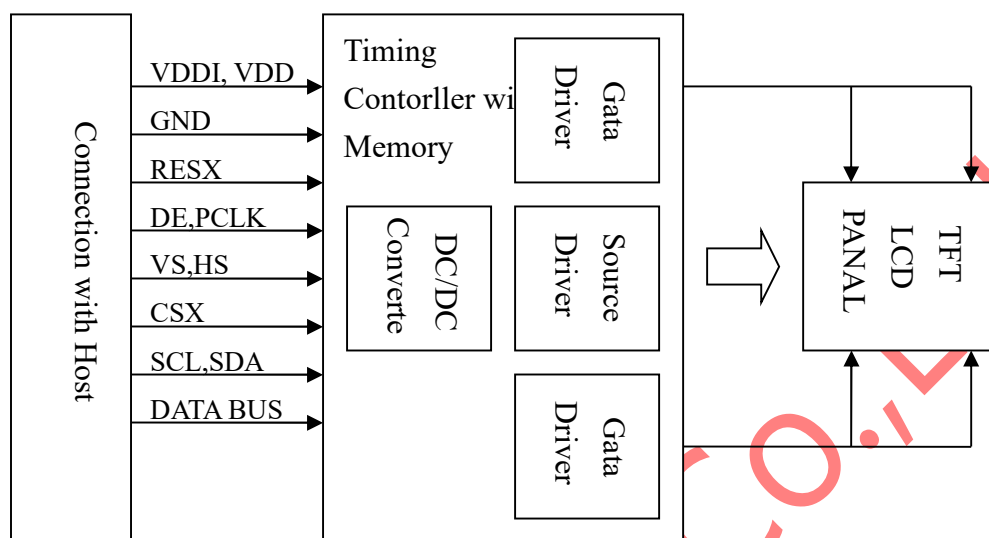
FPC Connector is used for the module electronics interface. The recommended model is 04 6844 751 002 846+manufactured by KYOCERA.

NO	Symbol	Level	Description
1	LED_K	P	LED Anode
2	LED_A	P	LED Cathode
3	NC	-	Not connect
4	NC	-	Not connect
5	NC	-	Not connect
6	NC	-	Not connect
7	VDD	P	Power supply for the analogy circuit.
8	VDDI	P	Power supply for the logic circuit.
9	IM3	I	Select the interface mode
10	IM2	I	
11	IM1	I	
12	IM0	I	
13	SDO	O	Serial data output pin used for the SPI Interface.
14	SDA	I	Serial data input pin used for the SPI Interface.
15	DCX	-	Not connect
16	SCL	I	Serial clock input
17	NC	-	Not connect
18	CSX	I	A chip select signal. Low: the chip is selected and accessible High: the chip is not selected and not accessible
19	RESX	I	The external reset input. Initializes the chip with a low input. Be sure to execute a power-on reset after supplying power.
20	DB23	I	Red data Pin.
21	DB22	I	Red data Pin.
22	DB21	I	Red data Pin.
23	DB20	I	Red data Pin.
24	DB19	I	Red data Pin.
25	DB18	I	Red data Pin.
26	DB17	I	Red data Pin.
27	DB16	I	Red data Pin.
28	DB15	I	Green data Pin

29	DB14	I	Green data Pin
30	DB13	I	Green data Pin
31	DB12	I	Green data Pin
32	DB11	I	Green data Pin
33	DB10	I	Green data Pin
34	DB9	I	Green data Pin
35	DB8	I	Green data Pin
36	DB7	I	Blue data Pin.
37	DB6	I	Blue data Pin.
38	DB5	I	Blue data Pin.
39	DB4	I	Blue data Pin.
40	DB3	I	Blue data Pin.
41	DB2	I	Blue data Pin.
42	DB1	I	Blue data Pin.
43	DB0	I	Blue data Pin.
44	DE	I	Data enable signal for DPI (RGB) interface operation. Low : access enabled. High : access inhibited.
45	GND	P	Power Ground
46	PCLK	I	Dot clock signal for DPI (RGB) interface operation.
47	GND	P	Power Ground
48	HS	I	Line synchronizing signal for DPI (RGB) interface operation.
49	VS	I	Frame synchronizing signal for DPI (RGB) interface operation.
50	TE	O	Tearing effect output
51	LED_PWM	O	The PWM frequency output for LED driver control.

IM3	IM2	IM1	IM0	Interface
0	0	1	1	DPI with SPI 3-line (SCL rising edge)
1	0	0	1	
1	0	1	0	
1	0	1	1	DPI with SPI 3-line (SCL falling edge)

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 supply for the analogy circuit.	VDD	-0.3~4.6	V
Power supply for the logic circuit.	VDDI	-0.3~4.6	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 the analogy circuit.		VDD	-	2.5	2.8	3.6	V
Power supply for the logic circuit.		VDDI	-	1.65	1.8	3.6	V
Logic input signal Voltage	H level	V_{IH}	-	$0.7 \cdot V_{DDI}$	-	V_{DDI}	V
	L level	V_{IL}		GND	-	$0.3 \cdot V_{DDI}$	V
Logic output signal Voltage	H level	V_{OH}	-	$0.8 \cdot V_{DDI}$	-	V_{DDI}	V
	L level	V_{OL}	-	GND	-	$0.2 \cdot V_{DDI}$	V

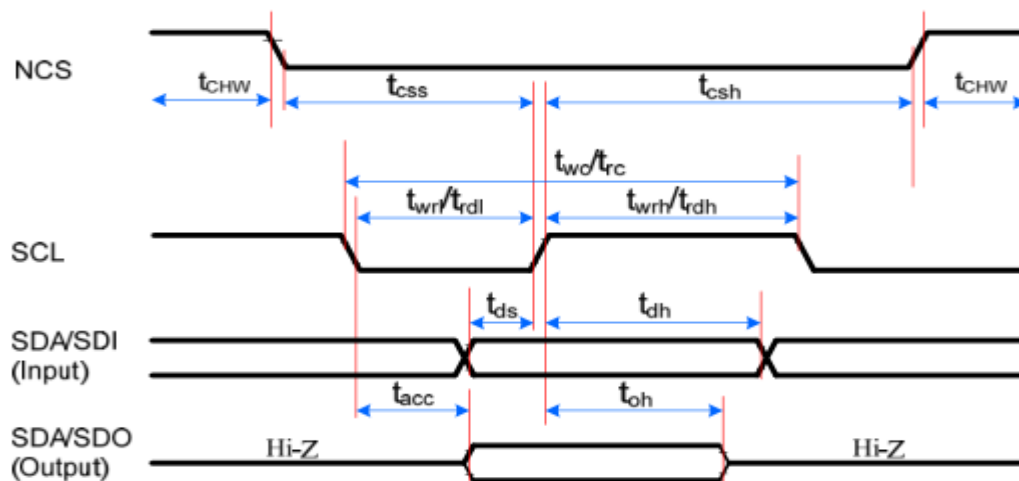
8. Backlight Characteristics

Item	syb	Min	Typ	Max	Unit	Condition
Voltage	Vf	13.5	15	17	V	IF=40mA
Number of LED	-	10			pcs	-
Power Consumption	PWF	-	600	-	mW	-
LED life-span	-	(20000)	-	-	Hrs	-

9. AC Characteristics

9.1 SPI Interface Timing Characteristics

Display Serial Interface Timing Characteristics (3-line SPI system)



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t _{css}	Chip select time (Write)	15	-	ns	
	t _{csH}	Chip select hold time (Read)	15	-	ns	
	t _{CHW}	CS "H" pulse width	40	-	ns	
SCL	t _{wc}	Serial clock cycle (Write)	30	-	ns	
	t _{wrh}	SCL "H" pulse width (Write)	10	-	ns	
	t _{wrl}	SCL "L" pulse width (Write)	10	-	ns	
	t _{rc}	Serial clock cycle (Read)	150	-	ns	
	t _{rdh}	SCL "H" pulse width (Read)	60	-	ns	
	t _{rdl}	SCL "L" pulse width (Read)	60	-	ns	
SDA/SDO (Output)	t _{acc}	Access time (Read)	10	100	ns	For maximum CL=30pF
	t _{oh}	Output disable time (Read)	15	100	ns	For minimum CL=8pF
SDA/SDI (Input)	t _{ds}	Data setup time (Write)	10	-	ns	
	t _{dh}	Data hold time (Write)	10	-	ns	

Note:

1. Ta = -30 to 70 °C, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.6V, T=10+/-0.5ns.
2. Does not include signal rise and fall times.

9.2 3-line Serial Interface Protocol

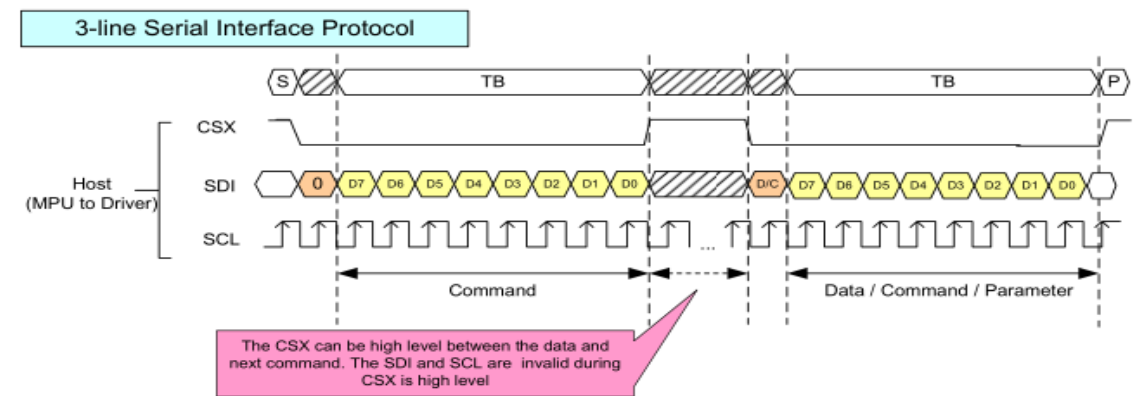
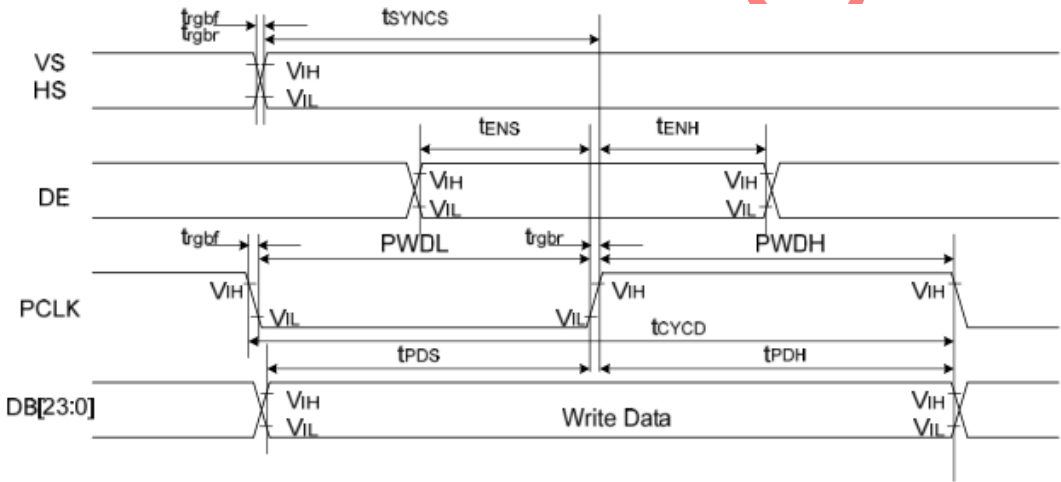


Figure 3 SPI protocol (SCL rising edge example)

9.3 Parallel 24/18/16-bit RGB Interface Timing Characteristics

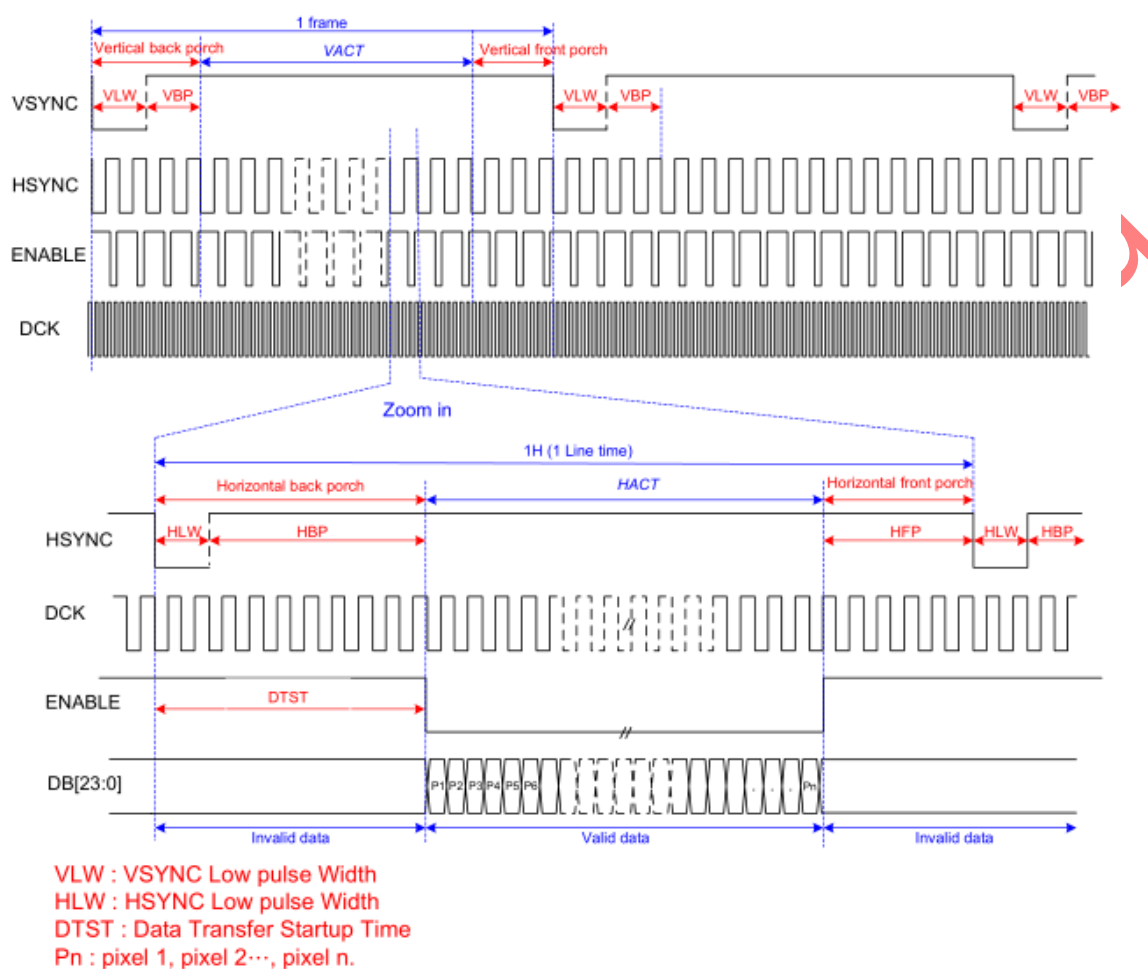


Signal	Symbol	Parameter	min	max	Unit	Description
VS/ HS	t_{SYNCS}	VS/HS setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	t_{SYNCH}	VS/HS hold time	5	-	ns	
DE	t_{ENS}	DE setup time	5	-	ns	
	t_{ENH}	DE hold time	5	-	ns	
DB[23:0]	t_{POS}	Data setup time	5	-	ns	
	t_{PDH}	Data hold time	5	-	ns	
PCLK	PWDH	PCLK high-level period	13	-	ns	
	PWDL	PCLK low-level period	13	-	ns	
	t_{CYCD}	PCLK cycle time	28	-	ns	
	t_{rgbr}, t_{rgbf}	PCLK,HS,VS rise/fall time	-	15	ns	

Note: Ta = -30 to 70 °C, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.6V, DGND=0V

9.4 DPI Interface Timing

The timing chart of 24-/18-/16-bit DPI (RGB) interface mode is illustrated in Figure 12.



RGB interface characteristics

Parameter	Symbols	Condition	Min.	Typ.	Max.	Units
Frame Rate	FR		54		66	fps
Horizontal Low Pulse width	HLW		1		-	DOTCLK
Horizontal Back Porch	HBP		2		126	DOTCLK
Horizontal Address	HACT			480		DOTCLK
Horizontal Front Porch	HFP		2		-	DOTCLK
Vertical Low Pulse width	VLW		1		126	Line
Vertical Back Porch	VBP		1		126	Line
Vertical Address	VACT				864	Line
Vertical Front Porch	VFP		1		255	Line
Data Clock	DCLK		16.6		35.7	MHz

10. Application Circuit

Please consult our technical department for detail information.

11. Initial Code

Please consult our technical department for detail information.

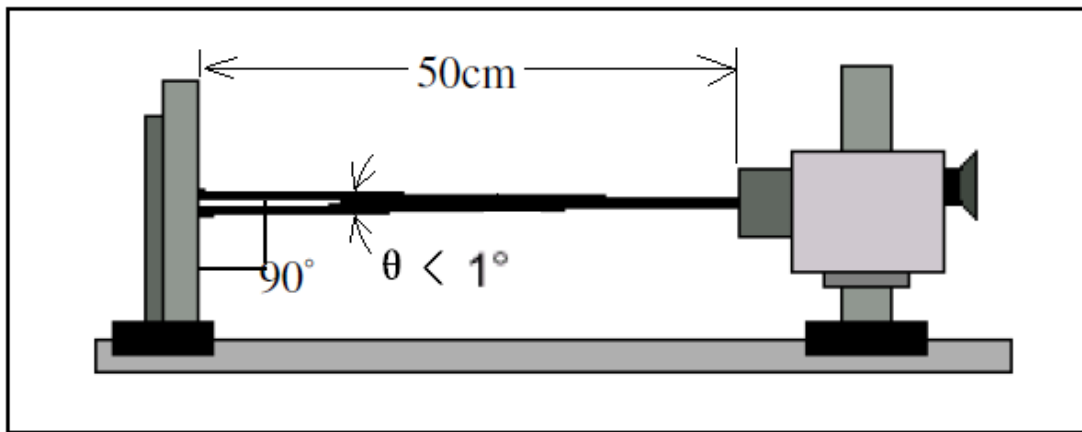
12. Electro-Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Response time		Tr+Tf	$\theta = 0^\circ$ $\Delta E = 0^\circ$ Ta=25℃	-	16	32	ms	4
Contrast ratio		Cr		-	900	-	-	3,5
Surface Luminance		Lv		400	500	-	-	3,7
Uniformity (Five point)		δ WHITE		80	-	-	%	7
Viewing angle range		q	$\Delta E = 90^\circ$	70	80	-	deg	6
			$\Delta E = 270^\circ$	70	80	-	deg	
			$\Delta E = 0^\circ$	70	80	-	deg	
			$\Delta E = 180^\circ$	70	80	-	deg	
Color filter chromaticity (x, y)	White	X	$\theta = \phi = 0^\circ$	-0.04	0.336	+0.04		7
		Y			0.350			
	Red	X	$\theta = \phi = 0^\circ$		0.634			
		Y			0.344			
	Green	X	$\theta = \phi = 0^\circ$		0.352			
		Y			0.609			
	Blue	X	$\theta = \phi = 0^\circ$		0.147			
		Y			0.048			

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.

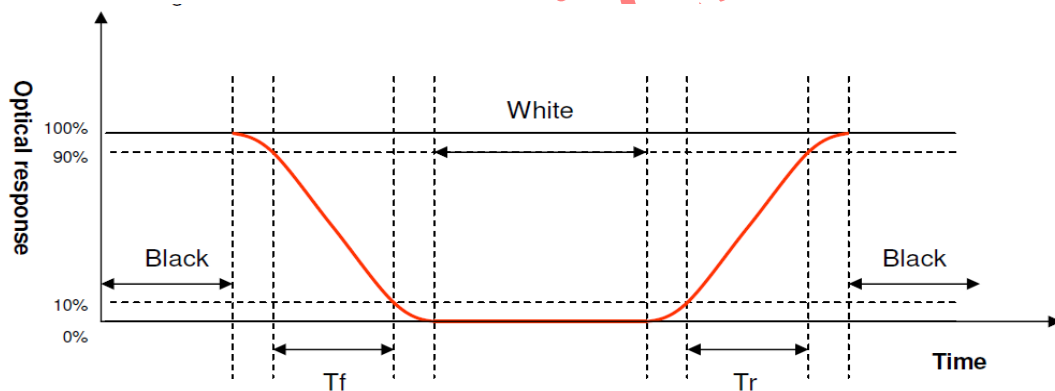
Note 3: To be measured at the center area of panel with a viewing cone of 1 by Topcon luminance meter BM-7A, after 10 minutes operation (module).



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.



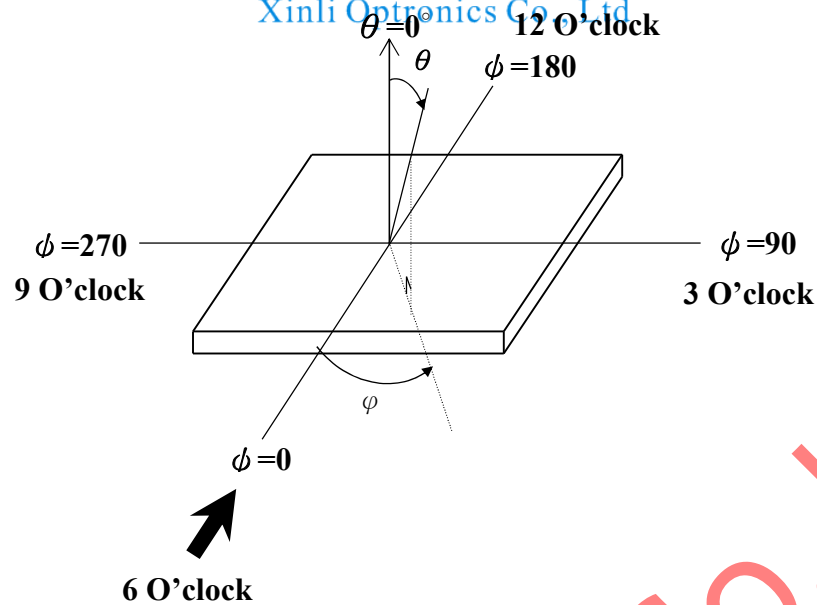
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

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

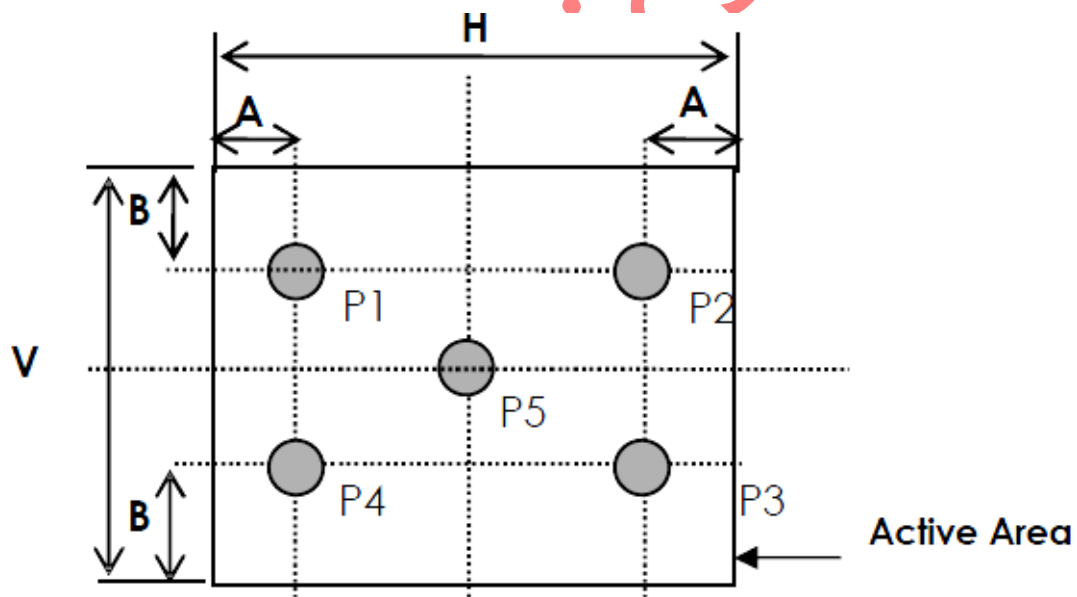
Note 6. Definition of viewing angle

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



$A : 5 \text{ mm}$ $B : 5 \text{ mm}$ $H, V : \text{Active Area}$

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	Test Condition	Remarks
1	High temperature storage	80°C , 240H	Note1 IEC60068-2-1:2007,GB2423.2-2008
2	Low temperature storage	-30°C , 240H	IEC60068-2-1:2007 GB2423.1-2008
3	Hight temperature operation	70°C , 240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low temperature operation	-20°C , 240H	IEC60068-2-1:2007 GB2423.1-2008
5	Hight temperature /humidity storage	60°C , 90%RH 240H	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Temperature Cycle (Non-operation)	-30°C-25°C-80°C 30min-5min-30min 100 cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	Drop Test (package)	Height:1 m, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995
8	Vibration test (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (3 hours for total)(Package condition)	IEC60068-2-6:1982 GB/T2423.10—1995

9	Electro Static Discharge (Operation)	C=150pF, R=330Ω , 5points/panel Air:± 4KV, 5 times; Contact:±2KV, 5 times; (Environment: 15°C~35°C, 30%~60%, 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
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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 moisten 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 handling 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.

15. Package Specification

TBD