

SPECIFICATION

PRODUCT NO. : TCXD022IBLON-5

VERSION: Ver 1.0

ISSUED DATE : 2021-5-13

This module uses ROHS material

FOR CUSTOMER :

: APPROVAL FOR SPECIFICATION

: APPROVAL FOR SAMPLE

DATE	APPROVED BY

Xinli Optoelectronics :

Presented by	Reviewed by	Organized by

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1. Revision Recode

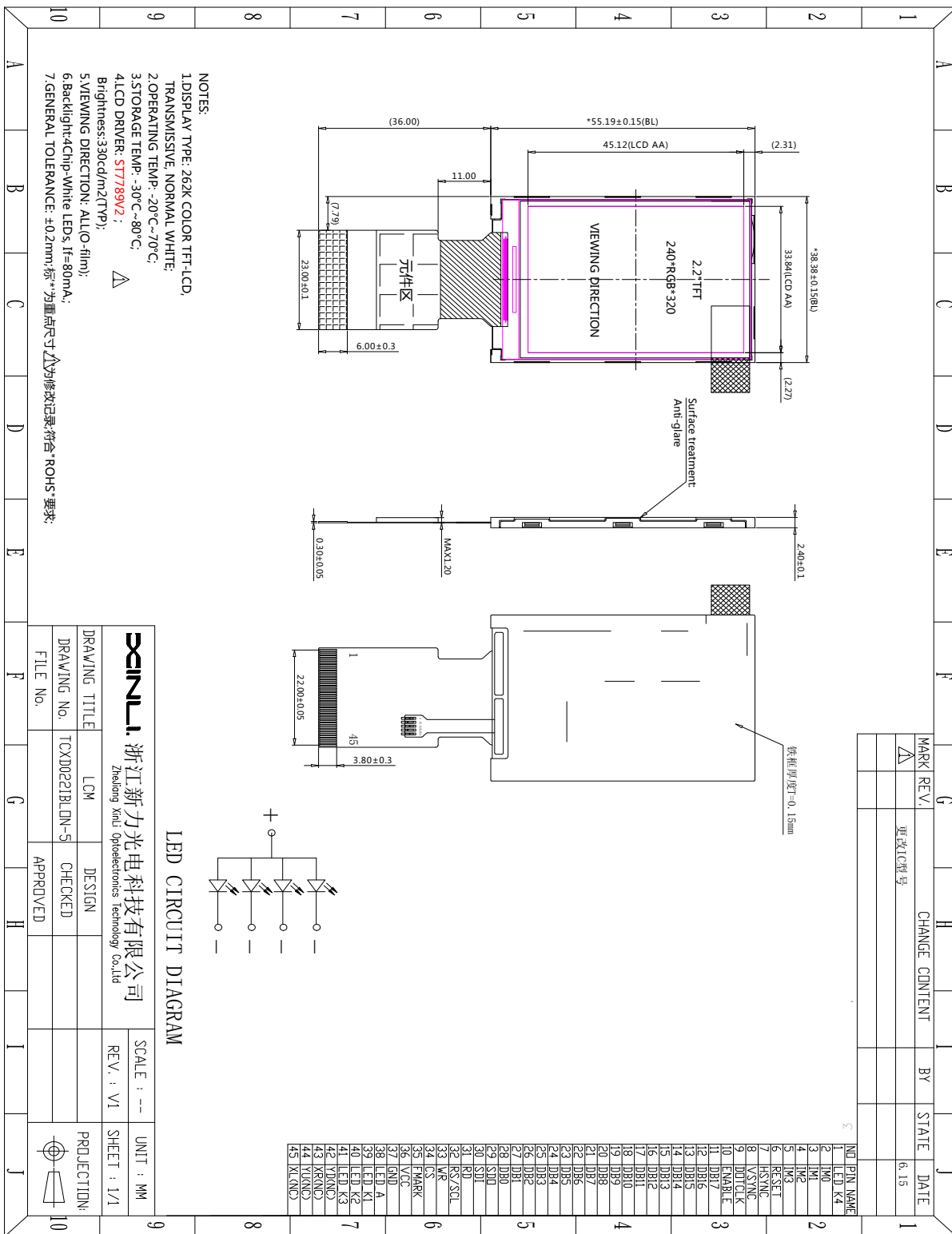
Revision	Description	Date
1.0	Initial Release	2021/5/13
1.1	更改驱动IC型号	2021/6/15

2. General Description and Features

The 2.2 inch Module named TCXD022IBLON-5 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. Features of this product are listed in the following table.

NO	Item	Contents	Unit
(1)	Module Outsize	38.38*55.19*2.4	Mm
(2)	LCD Active area	33.84*45.12	Mm
(3)	Dot Number	240*3(RGB)*320	/
(4)	Dot size	0.141*0.141	Mm
(5)	LCD type	TFT Transmissive	/
(6)	Display Color	262k	/
(7)	Viewing direction	12(contrast peak)	O'clock
(8)	Backlight Type	4-chip LED, Parallel	/
(9)	Power Supply	2.8 (TYP)	V
(10)	Drive IC	ST7789V	/
(11)	Interface	FPC0.5mm_Pitch 45pin	/
(12)	Interface type	RGB+SPI/MCU interface	/
(13)	Module weight	TBD	g

3. Mechanical Dimension

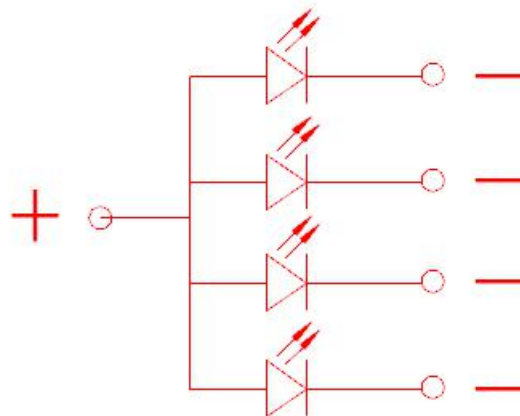
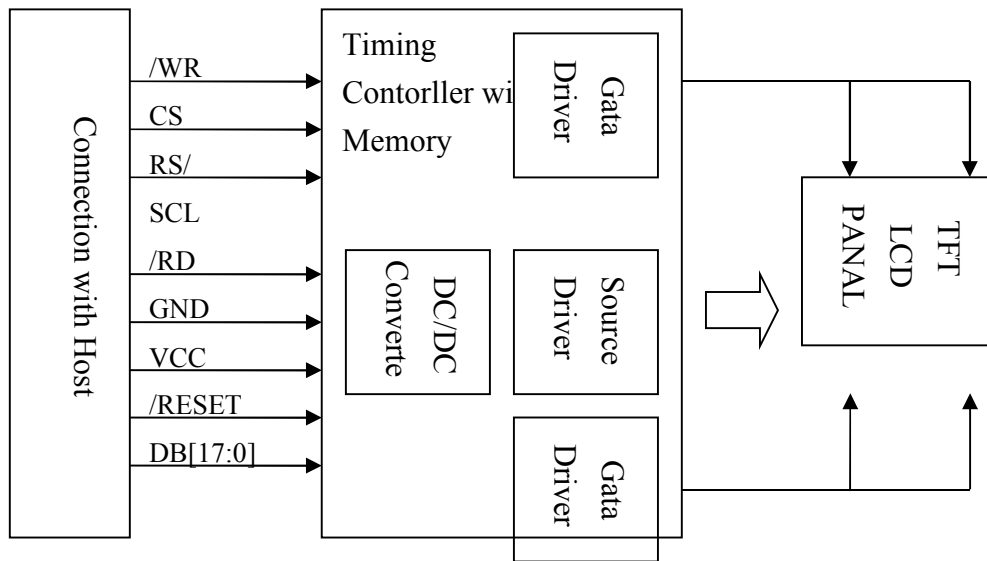


4. Interface Pin Connection

NO	Symbol	Level	Description																																																							
1	LED_K4	P	Backlight-																																																							
2	IM0	I	- Select the MCU interface mode																																																							
3	IM1	I	<table border="1"> <thead> <tr> <th>IM3</th> <th>IM2</th> <th>IM1</th> <th>IM0</th> <th>MCU-Interface Mode</th> <th colspan="2">DB Pin in use</th> </tr> <tr> <th colspan="4"></th> <th>Register/Content</th> <th>GRAM</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>80 MCU 8-bit bus interface I</td> <td>D[7:0]</td> <td>D[7:0]</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>80 MCU 16-bit bus interface I</td> <td>D[7:0]</td> <td>D[15:0]</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>80 MCU 9-bit bus interface I</td> <td>D[7:0]</td> <td>D[8:0]</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>80 MCU 18-bit bus interface I</td> <td>D[7:0]</td> <td>D[17:0]</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>3-wire 9-bit data serial interface I</td> <td colspan="2">SDA: In/OUT</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>4-wire 8-bit data serial interface I</td> <td colspan="2">SDA: In/OUT</td> </tr> </tbody> </table>	IM3	IM2	IM1	IM0	MCU-Interface Mode	DB Pin in use						Register/Content	GRAM	0	0	0	0	80 MCU 8-bit bus interface I	D[7:0]	D[7:0]	0	0	0	1	80 MCU 16-bit bus interface I	D[7:0]	D[15:0]	0	0	1	0	80 MCU 9-bit bus interface I	D[7:0]	D[8:0]	0	0	1	1	80 MCU 18-bit bus interface I	D[7:0]	D[17:0]	0	1	0	1	3-wire 9-bit data serial interface I	SDA: In/OUT		0	1	1	0	4-wire 8-bit data serial interface I	SDA: In/OUT	
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MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface.																																																										
6	RESET	I	Reset signal, Active low																																																							
7	HSYNC	I	Line sync signal for RGB interface operation																																																							
8	VSYNC	I	Frame sync signal for RGB interface operation																																																							
9	DCLK	I	Dot clock signal for RGB interface operation																																																							
10	EN	I	Data enable signal for RGB interface operation																																																							
11	DB17	I/O	Data bus																																																							
12	DB16	I/O	Data bus																																																							
13	DB15	I/O	Data bus																																																							
14	DB14	I/O	Data bus																																																							
15	DB13	I/O	Data bus																																																							
16	DB12	I/O	Data bus																																																							
17	DB11	I/O	Data bus																																																							
18	DB10	I/O	Data bus																																																							

19	DB9	I/O	Data bus
20	DB8	I/O	Data bus
21	DB7	I/O	Data bus
22	DB6	I/O	Data bus
23	DB5	I/O	Data bus
24	DB4	I/O	Data bus
25	DB3	I/O	Data bus
26	DB2	I/O	Data bus
27	DB1	I/O	Data bus
28	DB0	I/O	Data bus
29	SDO	O	Serial data output in serial bus system interface
30	SDI	I/O	Serial data Input in serial bus system interface
31	RD	I/O	Read enable pin I80 parallel bus system interface
32	RS/SCL	I	RS: Data or Command select pin in parallel interface When RS="1", data is selected When RS="0", command is selected SCL: Serial data clock in serial bus system
33	WR	I	Write enable pin in I80 parallel bus system interface
34	CS	I	Chip select signal
35	FMARK	O	Tearing effect output pin to synchronize MPU to frame writing
36	VCC	P	Power supply
37	GND	P	Ground
38	LED_A	P	Backlight+
39	LED_K1	P	Backlight-
40	LED_K2	P	Backlight-
41	LED_K3	P	Backlight-
42	YD(NC)	-	Not connect
43	XR(NC)	-	Not connect
44	YU(NC)	-	Not connect
45	XL(NC)	-	Not connect

5. Block Diagram



LED CIRCUIT DIAGRAM

6. Maximum Rating

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	°C
Storage temperature	Tst	-30 to 80	°C
Logic power supply	IOVCC	-0.3V ~ 4.6	V
Supply voltage for analog	VCC	-0.3V ~ 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
Analog power supply		VCC	-	2.5	2.8	3.3	V
I/O pin Power Supply Voltage		IOVCC	-	1.65	2.8	3.3	V
Logic input signal Voltage	H level	V_{IH}		0.7*IOVCC	-	IOVCC	V
	L level	V_{IL}		GND	-	0.3*IOVCC	V
Logic output signal Voltage	H level	V_{OH}		0.8*IOVCC	-	IOVCC	V
	L level	V_{OL}		GND	-	0.2*IOVCC	V

Items		MIN.	TYP.	Max.	Unit
Electric current(I _{dd})	Standby	-	0.08	0.1	mA
	Full (BLACK)	-	8.0	8.5	
Frame frequency		-	60	-	HZ

8. Backlight Characteristics

Item	syb	Min	Typ	Max	Unit	Condition
Voltage	Vf	-	2.8	-	V	IF=80mA
Number of LED	-	4			pcs	-
Power Consumption	PWF	-	224	-	mW	-
Connection mode	P	Parallel			-	-
LED life-span	-	-	(20000)	-	Hrs	-
LED type	-	-			-	-
LED color RANK	-	-			-	-
luminance range	-	-			-	-

9. Timing Characteristics

9.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- I system)

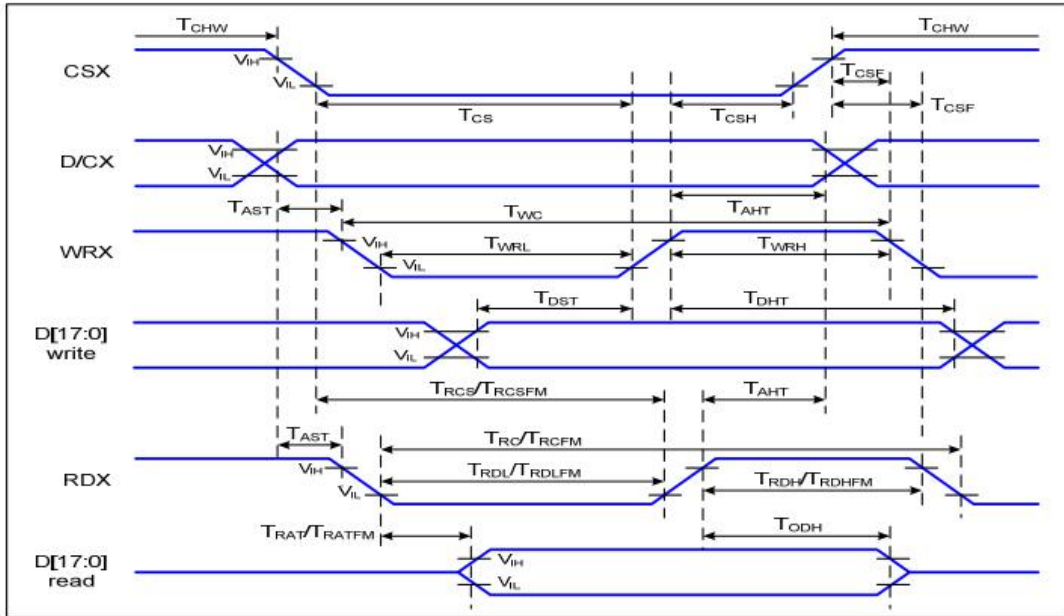


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T _{AST}	Address setup time	0		ns	-
	T _{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T _{CHW}	Chip select "H" pulse width	0		ns	-
	T _{CS}	Chip select setup time (Write)	15		ns	
	T _{RCS}	Chip select setup time (Read ID)	45		ns	
	T _{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T _{CSF}	Chip select wait time (Write/Read)	10		ns	
	T _{CSH}	Chip select hold time	10		ns	
WRX	T _{WC}	Write cycle	66		ns	-
	T _{WRH}	Control pulse "H" duration	15		ns	
	T _{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T _{RC}	Read cycle (ID)	160		ns	When read ID data
	T _{RDH}	Control pulse "H" duration (ID)	90		ns	
	T _{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T _{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T _{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T _{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T _{DST}	Data setup time	10		ns	For CL=30pF

T_{DHT}	Data hold time	10		ns
T_{RAT}	Read access time (ID)		40	ns
T_{RATFM}	Read access time (FM)		340	ns
T_{ODH}	Output disable time	20	80	ns

Table 4 8080 Parallel Interface Characteristics



Figure 2 Rising and Falling Timing for I/O Signal

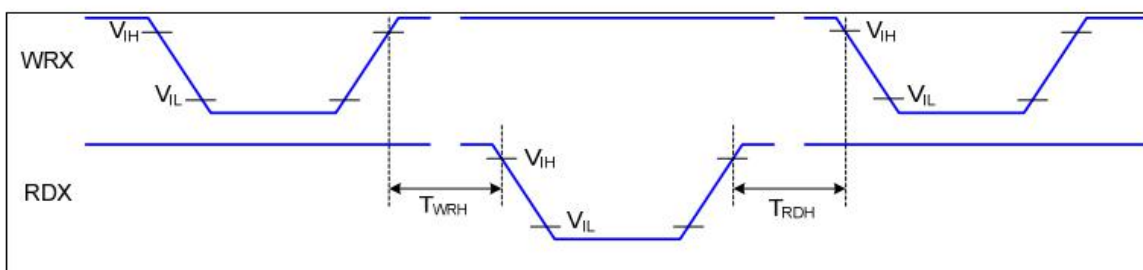


Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (T_r , T_f) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

9.2 RGB Interface Characteristics:

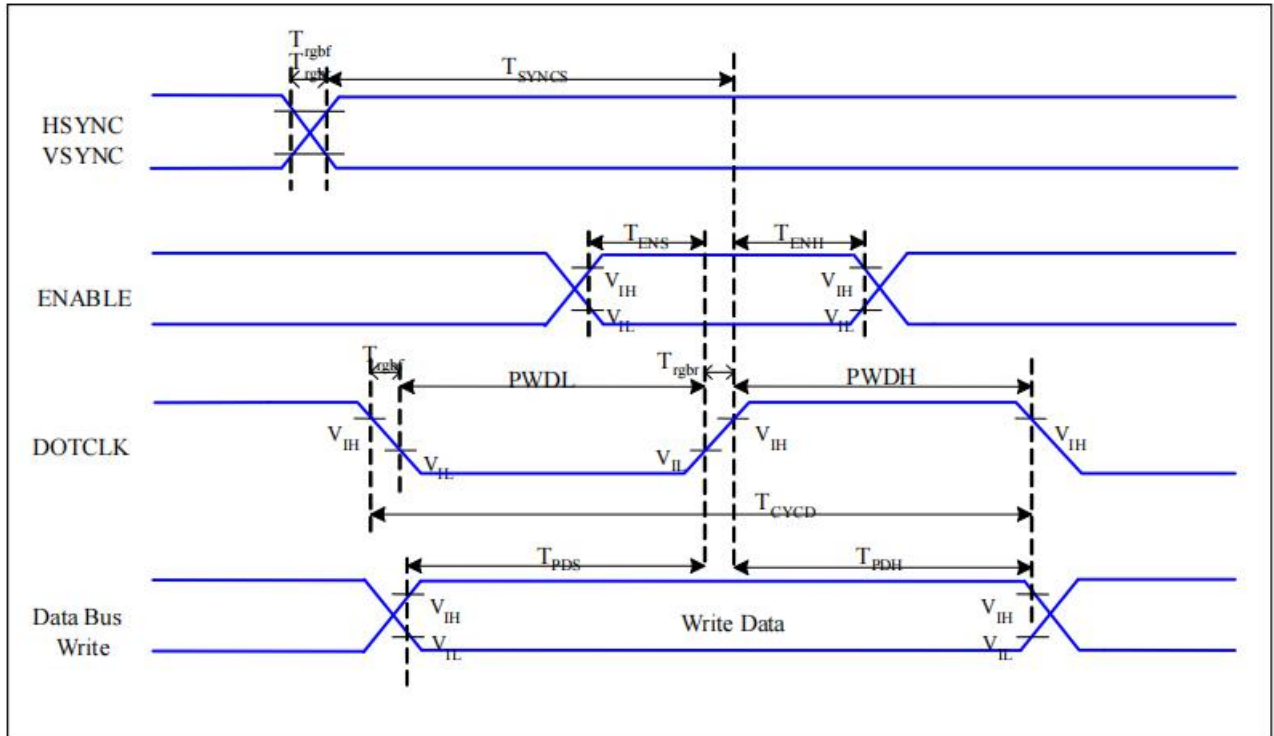


Figure 6 RGB Interface Timing Characteristics

$VDDI=1.65$ to $3.3V$, $VDD=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30 \sim 70 \text{ }^\circ\text{C}$

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	

Table 7 18/16 Bits RGB Interface Timing Characteristics

9.3 Reset Timing:

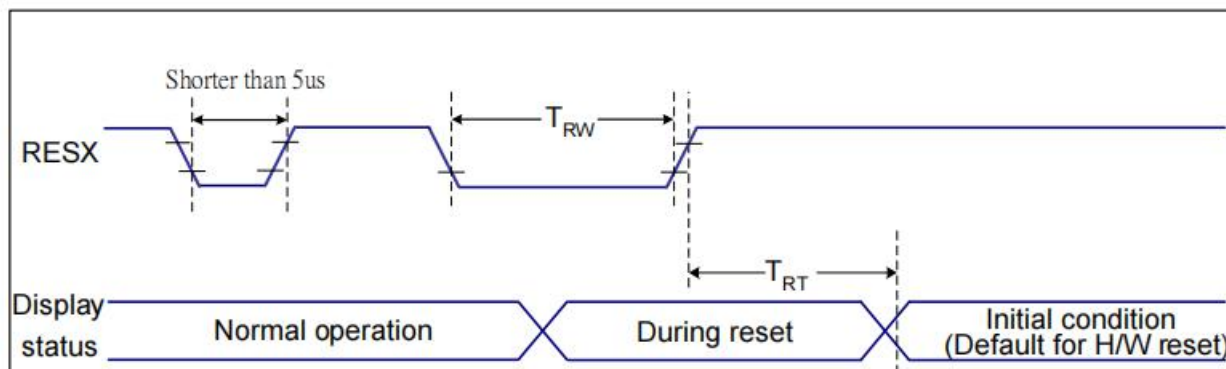


Figure 7 Reset Timing

$V_{DD1}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30 \sim 70 \text{ } ^\circ\text{C}$

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

Table 8 Reset Timing

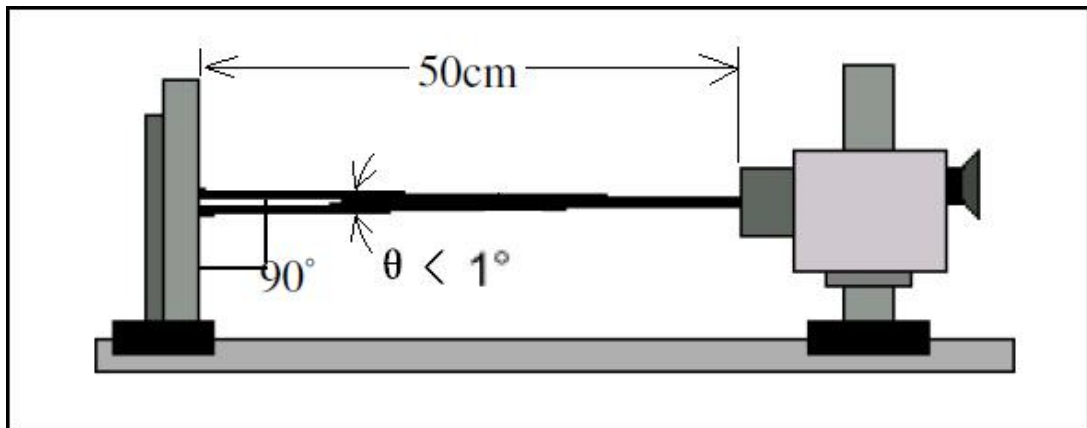
10. Electro-Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Transmission (whit pol)	T		4.7	5.1	-	%	
Response time	Tr	$\theta = 0^\circ$	-	10	20	ms	4
	Tf	$\gamma = 0^\circ$	-	20	30	ms	
Uniformity (Five point)	δ	Ta=25°C	70	80	-	%	7
	WHITE						
Contrast ratio	Cr		300	400	-	-	3,5
Surface Luminance	Lv		-	330	-	Cd/m ²	3,7
Viewing angle range	0	$\gamma = 90^\circ$	40	45	-	deg	6
		$\gamma = 270^\circ$	40	45	-	deg	
		$\gamma = 0^\circ$	15	20	-	deg	
		$\gamma = 180^\circ$	45	50	-	deg	
Color filter chromaticity (x, y)	White	X	$\theta = \phi =$	-	-	-	7
		Y	0°	-	-	-	
	Red	X	$\theta = \phi =$	-	-	-	
		Y	0°	-	-	-	
	Green	X	$\theta = \phi =$	-	-	-	
		Y	0°	-	-	-	
Blue	X	$\theta = \phi =$	-	-	-		
	Y	0°	-	-	-		

Note 1: Ambient temperature=25°C±2°C

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

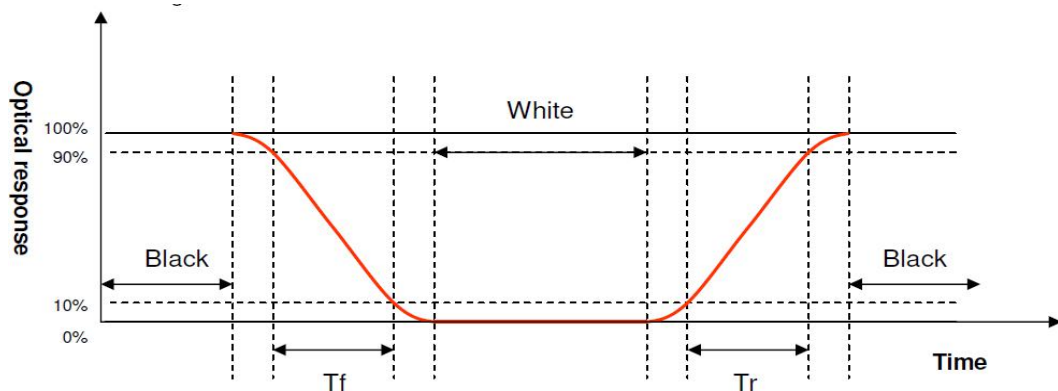
Note 3: To be measured at the center area of panel with a viewing cone of 1 by Topcon luminance meter BM-7A, after 10 minutes operation (module).



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.



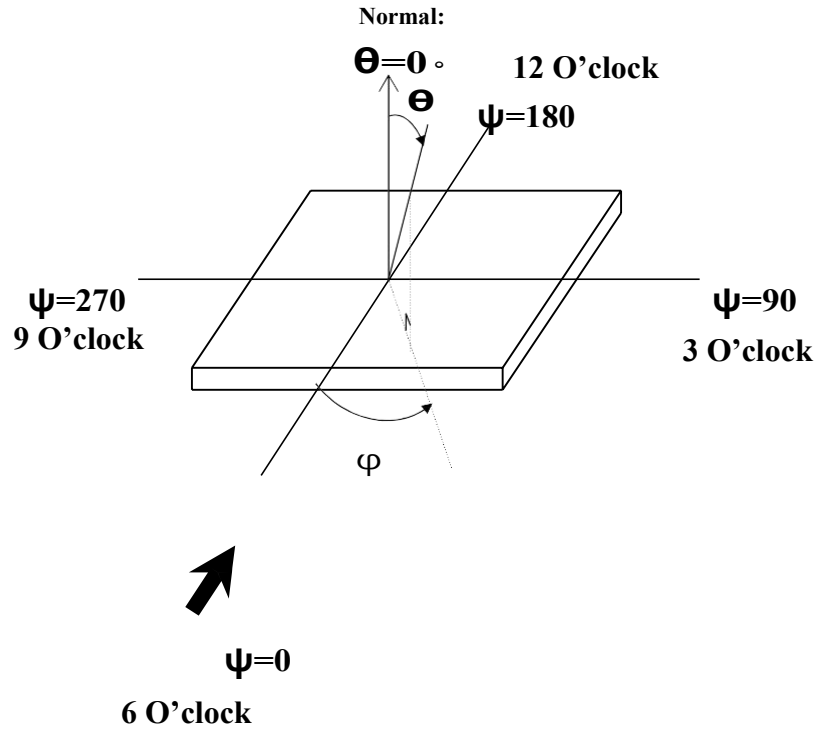
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

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

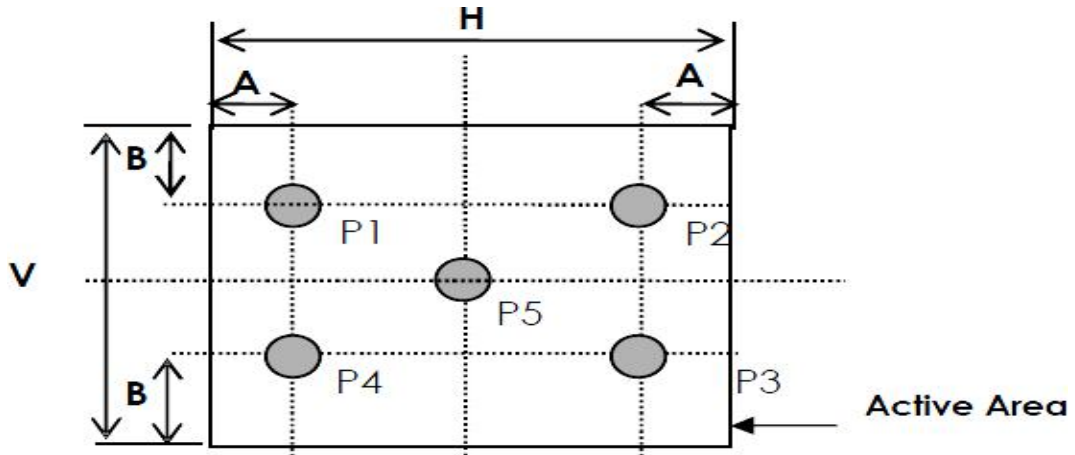
Note 6. Definition of viewing angle

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 $\Phi = 7\text{mm}$, 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)

11. 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, 240 H	Note1 IEC60068-2-1:2007, GB2423.2-2008
2	Low temperature storage	-30°C, 240H	IEC60068-2-1:2007 GB2423.1-2008
3	High 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	High temperature /humidity storage	40°C, 90% RH, 240H	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Temperature Cycle (Non operation)	-30°C/80°C, 10 cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, GB2423.22-2002
7	Temperature shock (Non operation)	-20°C ← → 70°C 30min ← → 30min 20 cycles	Check after placed at normal temperature for 1 hour
8	Drop Test (package)	Height: 100 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995
9	Vibration test (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)(Package condition)	IEC60068-2-6:1982 GB/T2423.10—1995

10	Electro Static Discharge (Operation)	C=150pF, R=330Ω · 5points/panel Air:± 4KV, 5times; Contact:± 2KV, 5 times; (Environment: 15℃ ~ 35℃, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
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12. 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.
- (S) 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

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