SPECIFICATION

[◉] Preliminary Specification
[ ] Final Specification

Description **14.0” 1920(RGB) × 1080 TFT-LCD Module**

Part Number **P1400FHF1MA00**

Customer			Product Dept, PDBU Tianma Microelectronics Co., Ltd.	
Signatures	Date		Approved By	Date
			S_Ebi	2023/11/17
			Reviewed By	
			Longping Deng	2023/11/17
			Prepared By	
			Hongwei Liu	2023/11/17
Comments:				

* This cover page is for your Comments and Signatures back to TIANMA.

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1. Summary

1.1 General Description

This is a 14.0 inch a-Si TFT-LCD module with Normal-Black technology. It is composed of a TFT-LCD panel, a driver circuit, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- High resolution
- High luminance
- Interface: 2 port LVDS
- LED driver integrated
- Acquisition product for UL62368-1/CSA C22.2 No.62368-1-03 (File number: E170632)
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	14.0 inch	
	Resolution	1920RGB*1080	
	Pixel Pitch	0.1611*0.1611mm	mm
	TFT Active Area	309.312*173.988	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	TN, Normally Black	
	Surface Treatment	Anti-Glare	
	Viewing Direction	All viewing angle	
	Gray Scale Inversion Direction	NA	
Mechanical Characteristics	LCM (W x H x D)	315.31*184.49*3.11	mm
	Weight	TBD	g
Optical Characteristics	Luminance	800	cd/m^2
	Contrast Ratio	2200:1	
	NTSC	75	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	2 port LVDS	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:TBD; Backlight:TBD	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	MSBKT2407P30HB
Matching connector	PFSKX10001N30A/ PF10001PS-00TA （ or equivalent ）

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	GND	P	Power Ground	
2	OLVDS0_N	I	-LVDS differential data input	
3	OLVDS0_P	I	+LVDS differential data input	
4	OLVDS1_N	I	-LVDS differential data input	
5	OLVDS1_P	I	+LVDS differential data input	
6	OLVDS2_N	I	-LVDS differential data input	
7	OLVDS2_P	I	+LVDS differential data input	
8	GND	P	Power Ground	
9	OLVDSC_N	I	-LVDS differential data input	
10	OLVDSC_P	I	+LVDS differential data input	
11	GND	P	Power Ground	
12	OLVDS3_N	I	-LVDS differential data input	
13	OLVDS3_P	I	+LVDS differential data input	
14	GND	P	Power Ground	
15	ELVDS0_N	I	-LVDS differential data input	
16	ELVDS0_P	I	+LVDS differential data input	
17	ELVDS1_N	I	-LVDS differential data input	
18	ELVDS1_P	I	+LVDS differential data input	
19	ELVDS2_N	I	-LVDS differential data input	
20	ELVDS2_P	I	+LVDS differential data input	
21	GND	P	Power Ground	
22	ELVDSC_N	I	-LVDS differential data input	
23	ELVDSC_P	I	+LVDS differential data input	
24	GND	P	Power Ground	
25	ELVDS3_N	I	-LVDS differential data input	
26	ELVDS3_P	I	+LVDS differential data input	
27	GND	P	Power Ground	
28	VLCD_5V	P	Power supply（5V）	
29	VLCD_5V	P	Power supply（5V）	
30	VLCD_5V	P	Power supply（5V）	

Table 3.1.2 Pin Assignment for LCD Interface

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection
Note2: All of the GND pins should be connected to the system ground.
Note3: This LCD module supports DE mode, LVDS data format selection VESA..

3.2 CN2 Pin assignment (Back Light)

Connector Information	
LCD Module connector	KW30-8S-1H(800)
Matching connector	KW30-8P-1C(800)/ KW30A-2830PCFA(800) 28AWG or equivalent

Table 3.2.1 Connector information

No	Symbol	I/O	Description	Wire Color
1	LED_EN	I	EN for Backlight	
2	LED_PWM	I	PWM for Backlight	
3	GND	P	Ground	
4	GND	P	Ground	
5	GND	P	Ground	
6	VLED	P	Power supply（12V）	
7	VLED	P	Power supply（12V）	
8	VLED	P	Power supply（12V）	

Table 3.2.2 Pin Assignment for Back Light Interface

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection
Note2: All of the GND pins should be connected to the system ground.

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage for LCD	VLCD_5V	-0.3	6	V	
Power Voltage for Backlight	VLED	0	20	V	
Interface Power supply voltage for LCD	VDDRX	-0.3	4.0	V	Note1
Interface Power supply voltage for Backlight	VIN1	-0.3	20	V	included LED_EN、LED_PWM
Operating Temperature	Top	-20	70	℃	
Storage Temperature	Tst	-30	80	℃	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40℃
		--	≤85	%	40℃＜Ta≤50℃
		--	≤55	%	50℃＜Ta≤60℃
		--	≤36	%	60℃＜Ta≤70℃
		--	≤24	%	70℃＜Ta≤80℃
Absolute Humidity	AH	--	≤70	g/m³	Ta＞70℃

Table 4.1 Absolute Maximum Ratings

Note1: VDDRX included OLVDS0_N/P、OLVDS1_N/P、OLVDS2_N/P、OLVDS3_N/P、OLVDSC_N/P、ELVDS0_N/P、ELVDS1_N/P、ELVDS2_N/P、ELVDS3_N/P、ELVDSC_N/P.

Note2: Ta means the ambient temperature. It is necessary to limit the relative humidity to the specified temperature range. Condensation on the module is not allowed.

Note3: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Power Voltage for LCD	VLCD_5V	4.9	5	5.1	V	
Power Consumption	White Mode (60Hz)	-	(750)	-	mW	
Inrush	VLCD_5V			(1.5)	A	

Table 5.1.1 Operating Voltages

Note1: Indicated the subsequent version may be updated.

5.2 DC Characteristics for Backlight Driving

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Power Voltage for Backlight	VLED	10.8	12	13.2	V	
LED driver current	I_VLED	-	TBD	-	mA	
Power consumption	P_VLED	-	TBD	-	mW	
Logic-High Input Voltage for Backlight	VIH_BL	1.6	-	-	V	Note 1
Logic-Low Input Voltage for Backlight	VIL_BL	-	-	0.7	V	Note 1
LED_PWM frequency	FPWM	100		20K	Hz	
LED_PWM duty	D	1		100	%	Note 2
Inrush	VLED			(1.5)	A	

Table 5.2.1 Backlight drive Characteristics

Note 1: VIH_BL and VIL_BL included LED_EN、LED_PWM
Note2:Without considering linearity:

LED_PWM frequency	LED_PWM Duty
100Hz~1KHz	0.1%~100%
1KHz~10KHz	1%~100%
10KHz~30KHz	3%~100%

Consider linearity:

LED_PWM frequency	LED_PWM Duty
100Hz~1KHz	1%~100%
1KHz~5KHz	5%~100%
5KHz~30KHz	15%~100%

5.3 Backlight Unit

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF		19		mA	One LED
Forward Voltage	VF	5.6	6.0	6.4	V	One LED
Backlight Power Consumption	WBL		114		mW	One LED

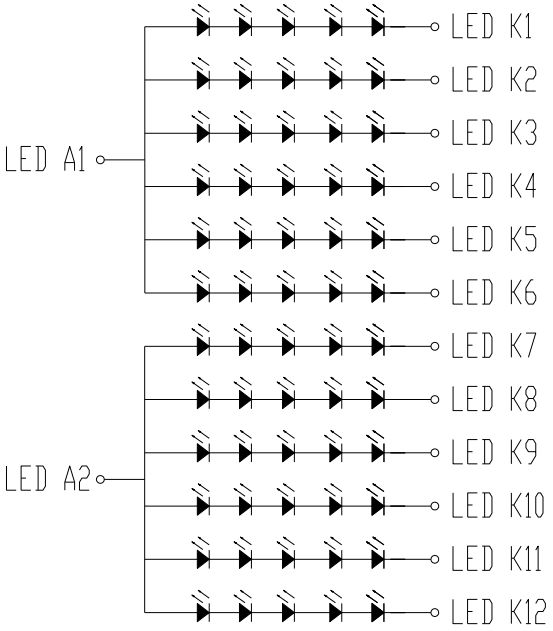
Table 5.3.1 Backlight Voltages

Note1: I_F is defined for each channel.

Note2: Optical performance should be evaluated at Ta=25℃ only.

Note3: If LED is driven by high current, high ambient temperature & humidity condition, The life time of LED will be reduced.

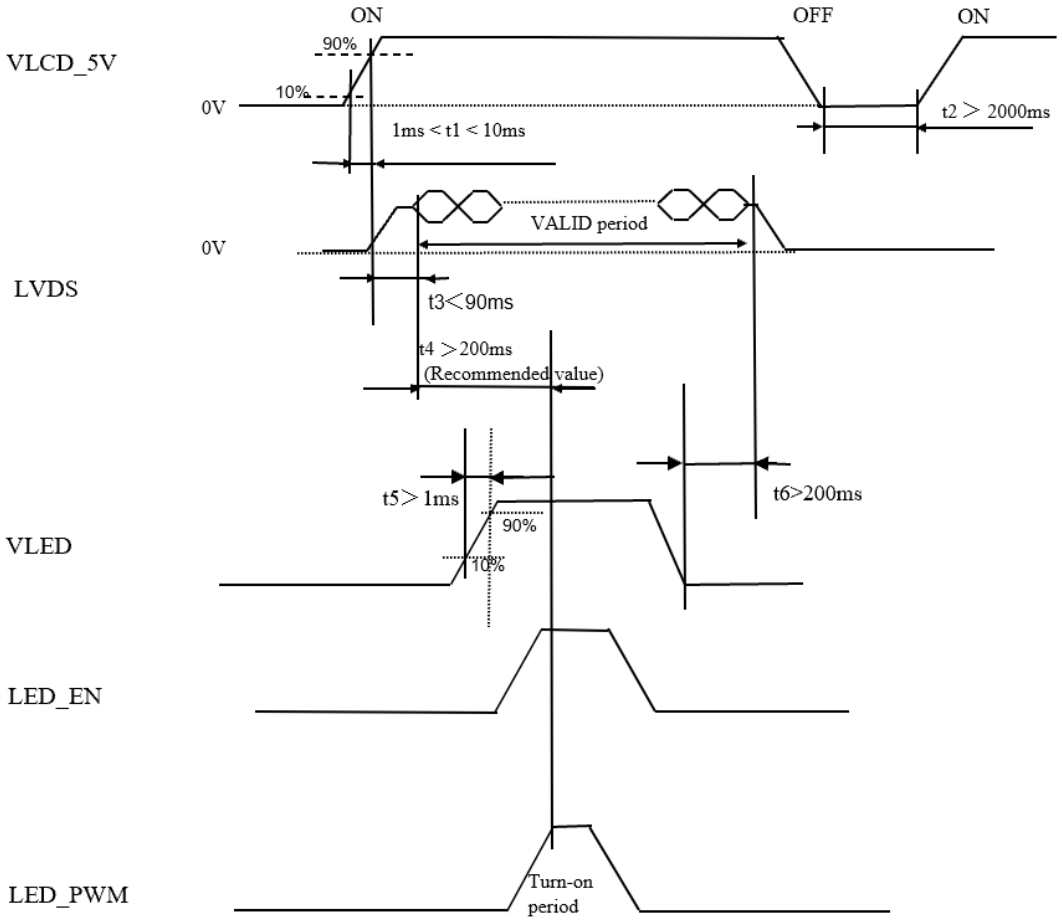
Note4: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.



5.4 Recommended Power ON/OFF Sequence

Item	Sym bol	MIN	Typ	MAX	Unit	Remark
VLCD_5V on to VLCD_5V stable	t1	1	-	10	ms	
VLCD_5V off to next VLCD_5V on	t2	2000	-	-	ms	
VLCD_5V stable to signal on	t3	-	-	90	ms	
Signal stable to Backlight on	t4	200	-	-	ms	
VLED on to VLED stable	t5	1	-	-	ms	
Signal off before VLED off	t6	200	-	-	ms	

Table 5.4 Power on/off sequence



Note1: The low level of these signals and analog powers are GND level.
Note2: The voltage applied to backlight, Keep it turned off until the display has stabilized.

5.5 LCD Module Block Diagram

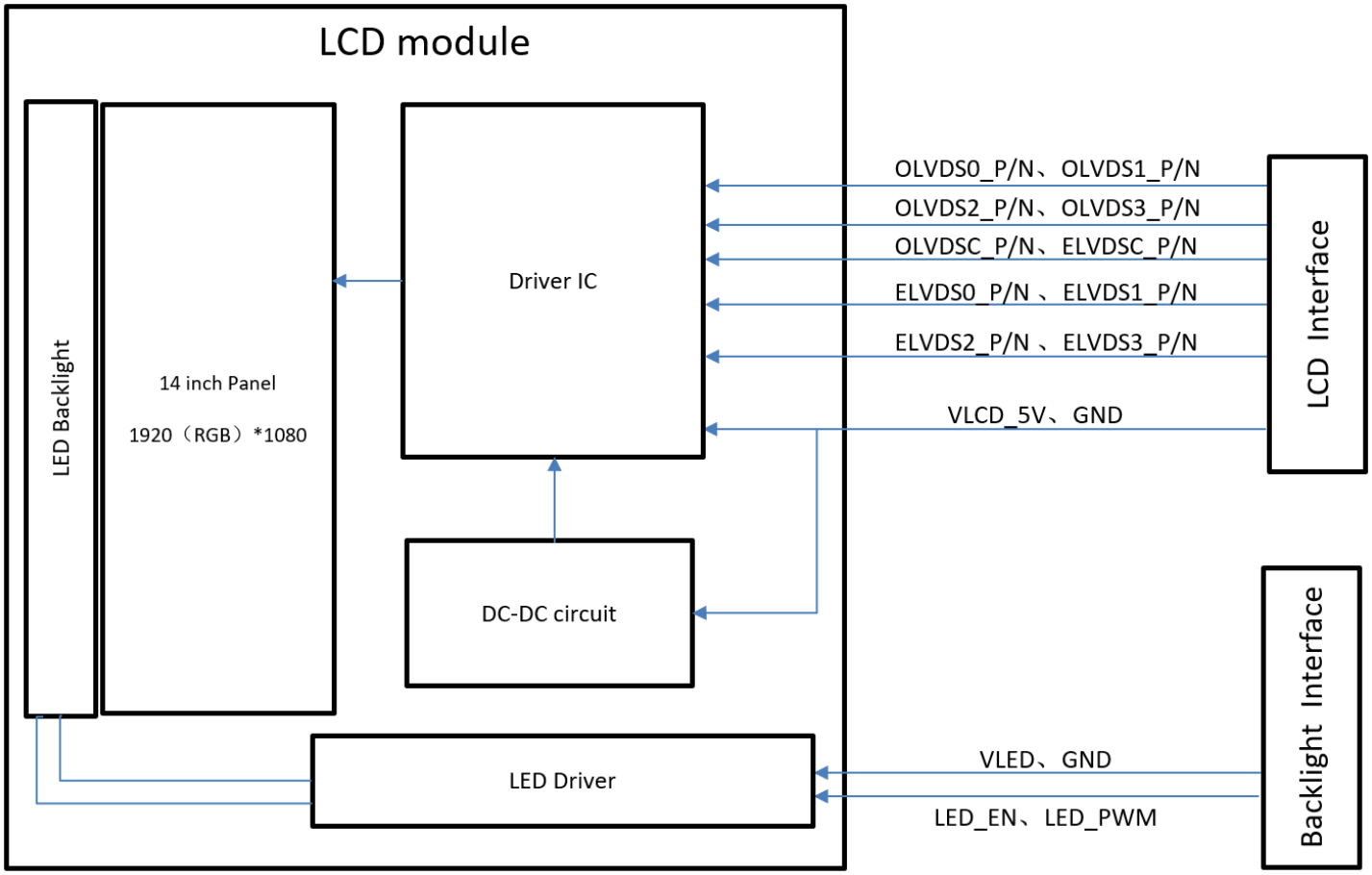


Figure 5.5.1 LCD Module Block Diagram

6. Timing Characteristics

6.1 LVDS DC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Differential input high Threshold voltage	R_{XVTH}			0.1	V	
Differential input Low Threshold voltage	R_{XVTL}	-0.1			V	
Input voltage range(single-end)	R_{XVIN}	0		VCC-1.0	V	VCC=3.3V
Differential input common Mode voltage	R_{XVCM}	0.6	1.2	2.4-|VID|/2	V	
Differential input voltage	$\|V_{ID}\|$	0.2	0.4	0.6	V	
Differential input leakage current	RVxliz	-10		10	uA	

Table 6.1.1 LVDS DC Electrical Characteristics

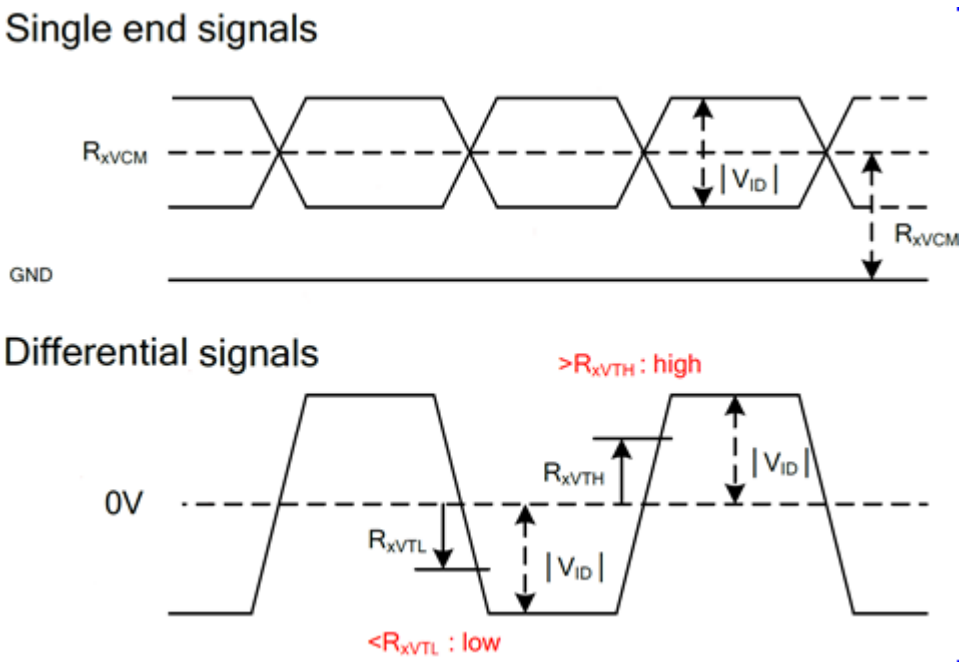
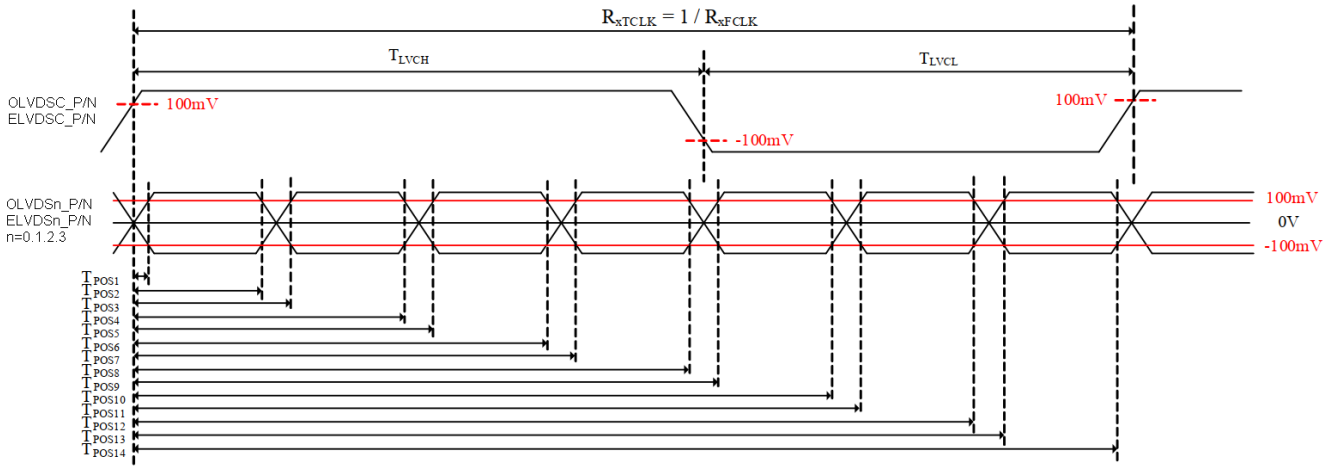


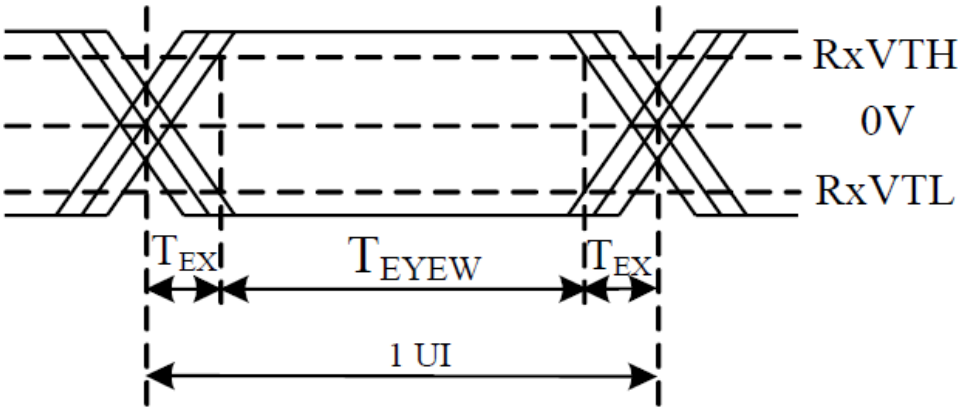
Figure 6.1.1 Clock and Data Input Timing Diagram

6.2 LVDS AC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
1 data bit time	UI	-	1/7	-	R_{xTCLK}	
Clock high time	T_{LVCH}		4		UI	
Clock low time	T_{LVCL}		3		UI	
Position 1	T_{POS1}	-0.25	0	0.25	UI	
Position 2	T_{POS2}	0.75	-	1.25	UI	
Position 3	T_{POS3}	0.75	1	1.25	UI	
Position 4	T_{POS4}	1.75	-	2.25	UI	
Position 5	T_{POS5}	1.75	2	2.25	UI	
Position 6	T_{POS6}	2.75	-	3.25	UI	
Position 7	T_{POS7}	2.75	3	3.25	UI	
Position 8	T_{POS8}	3.75	-	4.25	UI	
Position 9	T_{POS9}	3.75	4	4.25	UI	
Position 10	T_{POS10}	4.75	-	5.25	UI	
Position 11	T_{POS11}	4.75	5	5.25	UI	
Position 12	T_{POS12}	5.75	-	6.25	UI	
Position 13	T_{POS13}	5.75	6	6.25	UI	
Position 14	T_{POS14}	6.75	-	7.25	UI	
Input eye width	T_{EYEW}	0.5	-	-	UI	
Input eye border	T_{EX}	-	-	0.25	UI	

Table 6.2.1 LVDS AC Electrical Characteristics

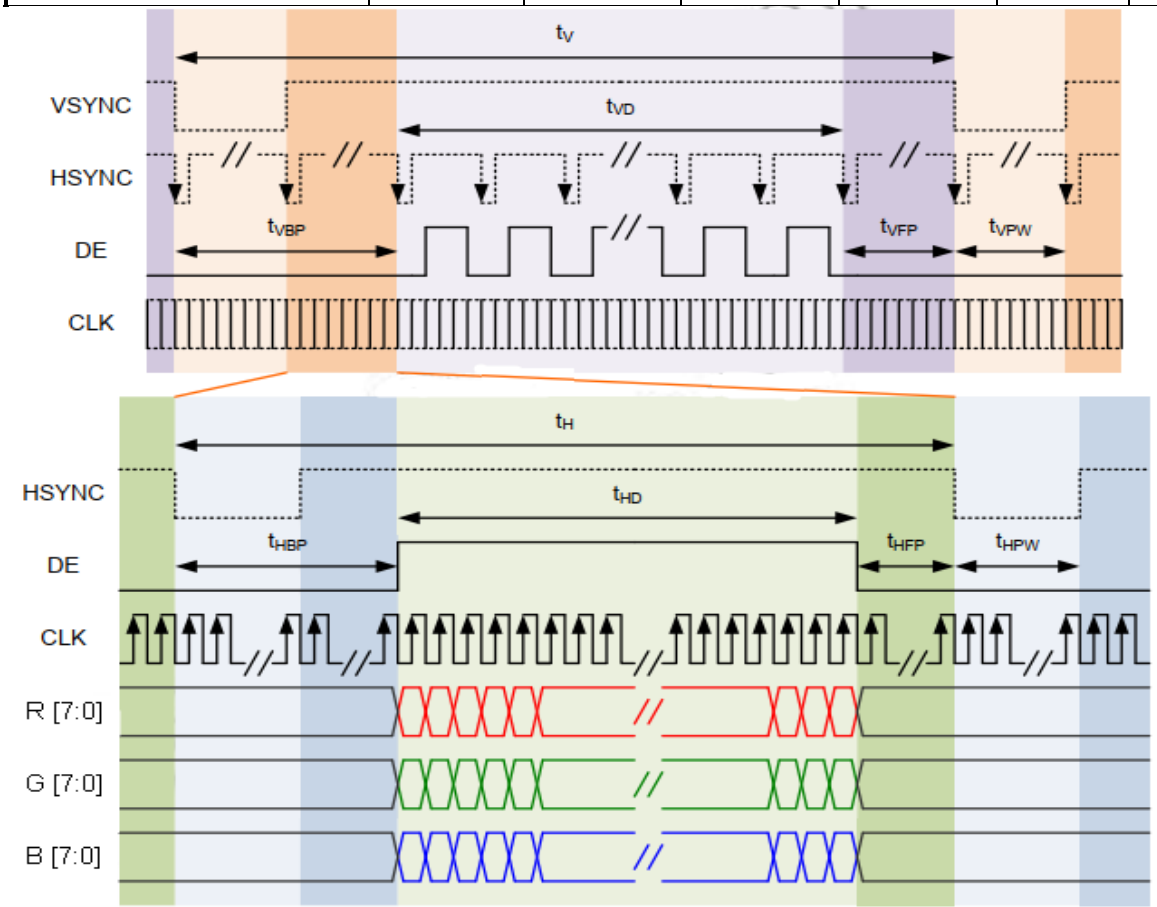




6.3 Input Timing Diagram

1920 x 1080 (Only 2-Port) DE MODE

Parameter	Symbol	MIN	Typ	MAX	Unit	Remark
CLK frequency	tclk	67.5	67.87	73.1	MHz	
Horizontal display area	thd		960		tclk	
Horizontal Blanking time	thbt	48	50	99	tclk	
HSYNC period	th	1008	1010	1059	tclk	
Vertical display area	tvd		1080		th	
Vertical Blanking time	tvbt	36	40	100	th	
VSYNC period	tv	1116	1120	1180	th	
Frame rate	FR	60	60	60	Hz	



6.4 Data Input Format

VESA Data Mapping

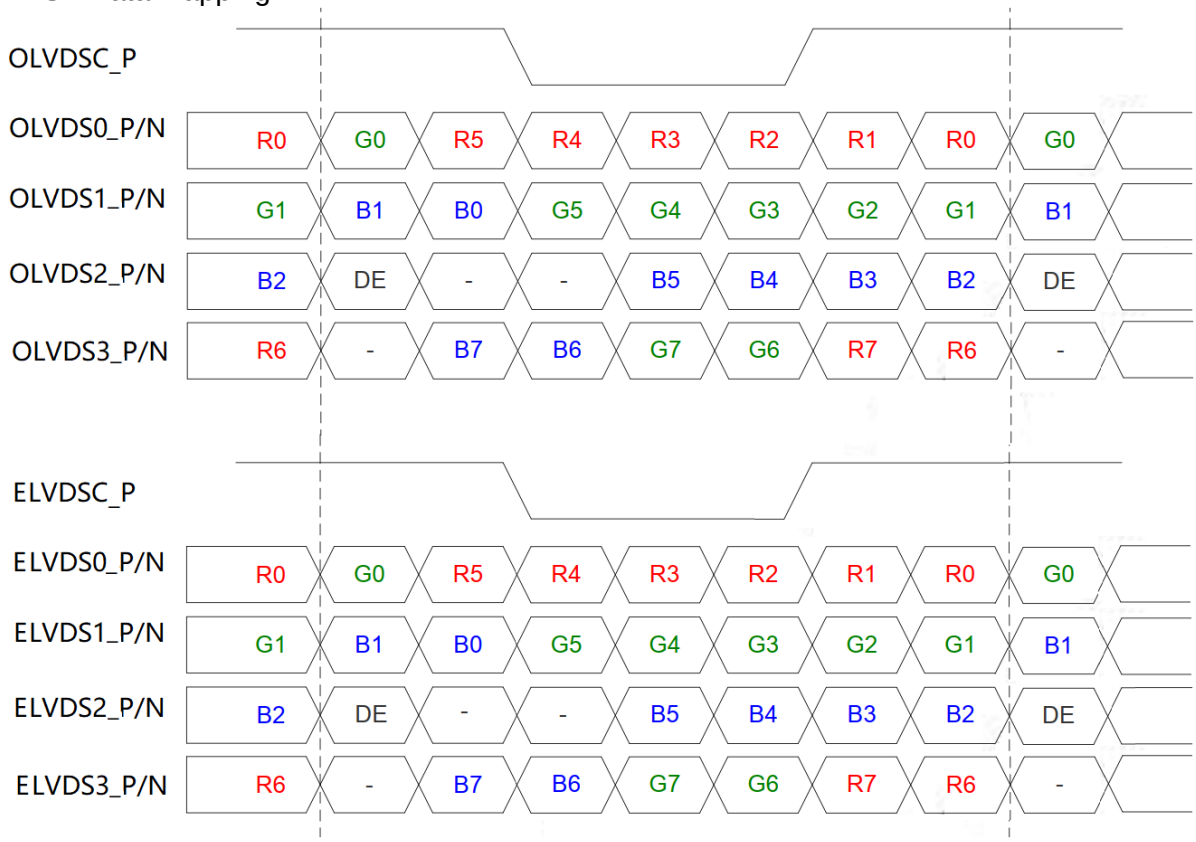


Figure 6.4.1 Data Input Format

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	85	88		degree	Note2,3
		θB		85	88			
		θL		85	88			
		θR		85	88			
Contrast Ratio		CR	θ=0°	2000	2200			Note 3
Response Time		T_{ON}	25℃		35	40	ms	Note 4
		T_{OFF}						
Chromaticity	**White**	x	Backlight is on	(0.246)	(0.296)	(0.346)		Note 1,5
		y		(0.268)	(0.318)	(0.368)		
	Red	x		(0.591)	(0.641)	(0.691)		Note 1,5
		y		(0.300)	(0.350)	(0.400)		
	Green	x		(0.275)	(0.325)	(0.375)		Note 1,5
		y		(0.575)	(0.625)	(0.675)		
	Blue	x		(0.104)	(0.154)	(0.204)		Note 1,5
		y		（0.001）	(0.047)	(0.097)		
Uniformity		U		75%	85%		%	Note 6
NTSC		-		70%	75%		%	Note 5
Luminance		L		650	800		cd/m^2	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. I_F= **19** mA, and the ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

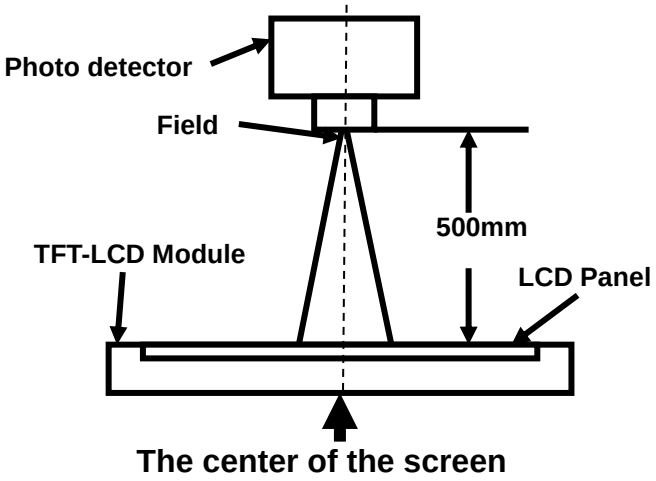


Fig1. Measurement Set Up

Note2: Definition of viewing angle range and measurement system. Viewing angle is measured at the center point of the LCD 。

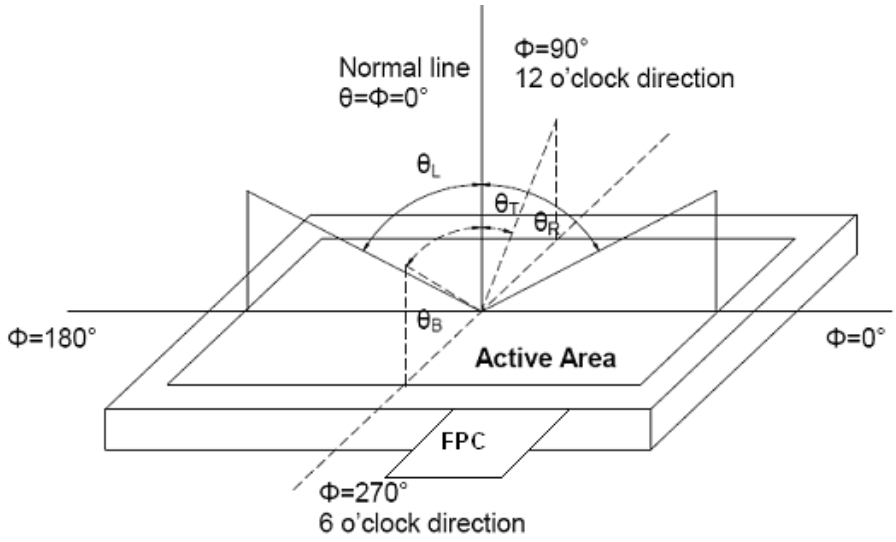


Fig2. Measurement viewing angle

Note3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

Note4: Definition of Response time

For TN LCM,the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_r) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_f) is the time between photo detector output intensity changed from 10% to 90%.

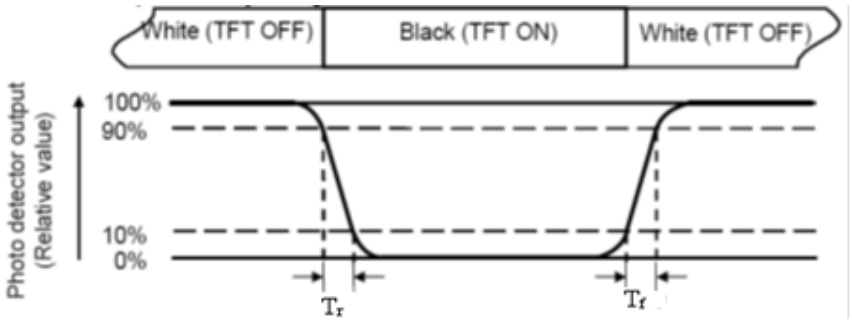


Fig3. Response Time Testing(TN)

For SFT LCM, the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_r) is the time between photo detector output intensity changed from 10% to 90%. And fall time (T_f) is the time between photo detector output intensity changed from 90% to 10%.

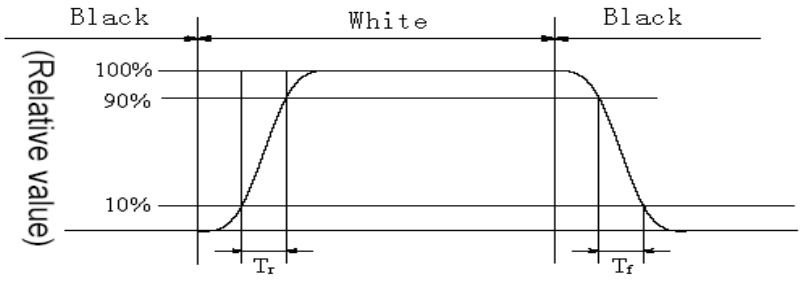


Fig4. Response Time Testing(SFT)

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

L-------Active area length; W----- Active area width

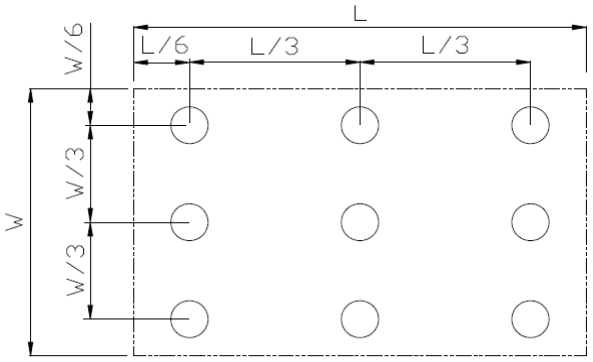


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

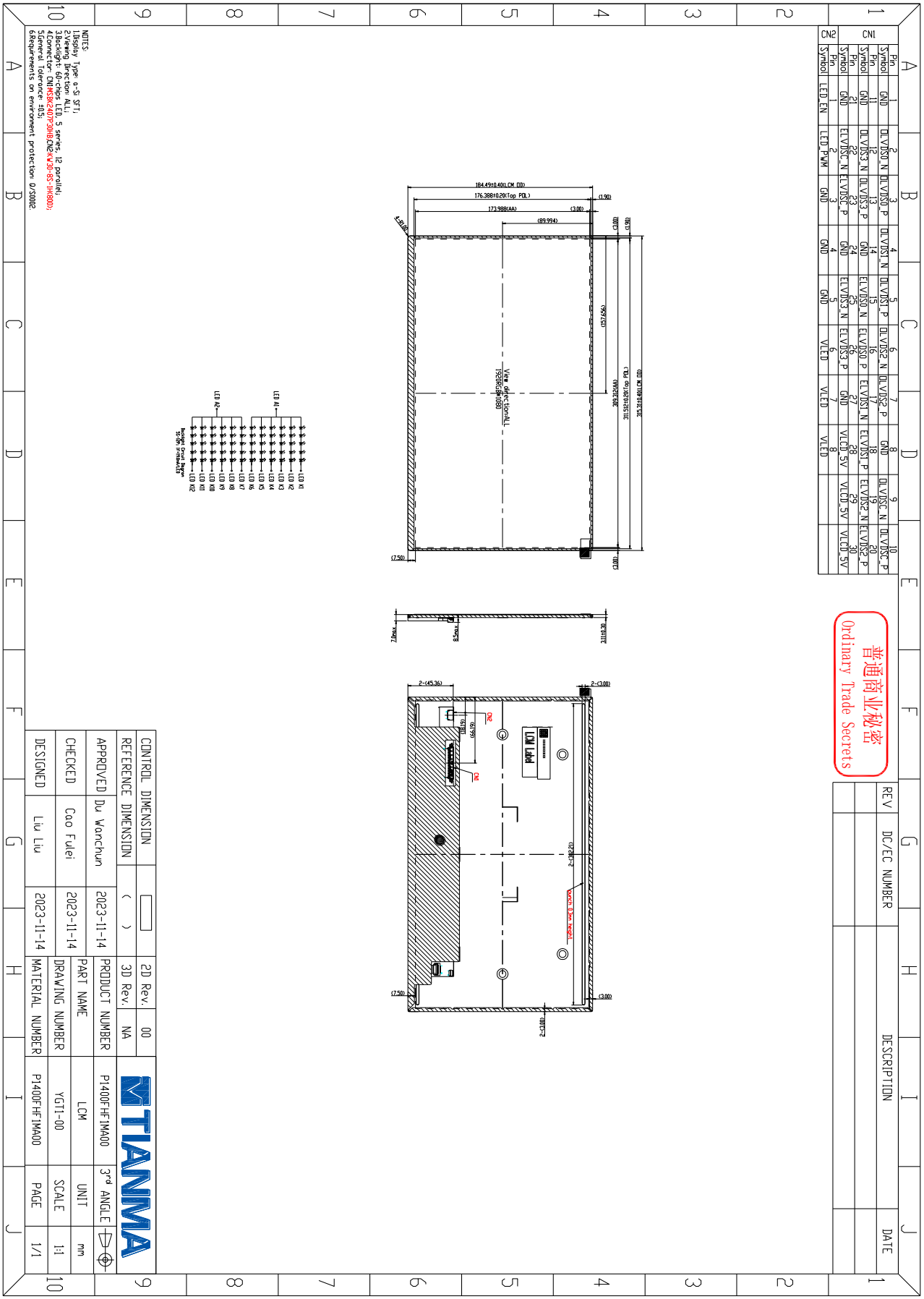
8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+70℃，240H	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃，240H	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+80℃，240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃，240H	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity(non-operation)	+60℃，90%RH，240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃，30min~80℃，30min，change time：5min，100cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	ESD	C=150pF，R=330Ω，5point/panel Air：±8kv，5times； Contact：±4kv，5times； （Environment：15℃~35℃，30%~60%，86Kpa~106Kpa）	IEC61000-4-2:2001 GB/T17626.2-2006
8	Package Vibration	5-20-200HZ，PSD：0.01-0.01-0.001 Total:0.781g2/HZ,x/y/z 30min）	
9	Package Drop Test	Height: X cm,1 corner, 3edges, 6 surfaces Note：X＞10Kg:60cm；≤10Kg:80cm	IEC60068-2-32:1990 GB/T2423.8—1995

Table 8.1 RA test condition

Note1: Temperature is the ambient temperature of sample
Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.
Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product's function only be guaranteed, but not for all of the cosmetic specification.

9. Mechanical Drawing



10. Packing Instruction

TBD

11. Precautions for Use of LCD Modules

11.1 Handling Precautions

(1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
(2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
(3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
(5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
   - Isopropyl alcohol
   - Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:

- Water
- Ketone
- Aromatic solvents

(6) Do not disassemble the LCD Module.
(7) If powered off, do not apply the input signals.
(8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
(9) Be sure to ground your body when handling the LCD Modules.
(10) Tools used for assembly, must be properly grounded.
(11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
(12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

11.2 Storage precautions

(1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
(2) The LCD modules should be stored within the rated storage temperature range. The recommend condition is: Temperature: 0 ~ 35 ℃ at normal humidity.
(3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

11.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

11.4 Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

11.5 Safety Precautions

(1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
(2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.
(3) LED driver should be designed to limit or stop its function when over current is detected on the LED.