

SPECIFICATION

[☒] Preliminary Specification
[] Final Specification

Description 13.3” 1920xRGBx1080 TFT-LCD Module
Part Number P1330FHF2MB00

jj

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REVISION HISTORY

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1. Summary

1.1 General Description

This is a 13.3 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, a PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- High resolution
- Interface: eDP
- LED driver integrated
- Surface treatment: Anti-Glare
- This product will comply with UL62368-1/CSA C22.2 No.62368-1-03
- This product will comply 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	13.3 inches	-
	Resolution	1920(RGB)x1080	-
	Pixel Pitch	0.153x0.153	mm
	TFT Active Area	293.76 x 165.24	mm
	Technology Type	a-Si	-
	Pixel Configuration	R.G.B Vertical Stripe	-
	Display Mode	SFT, Normally Black	-
	Surface Treatment	Anti-Glare	-
	Viewing Direction	All direction	-
Mechanical Characteristics	LCM (W x H x D)	300.26×187.74×2.4	mm
	Weight	TBD	g
Optical Characteristics	Luminance	350	cd/m ²
	Contrast Ratio	1800:1	-
	NTSC	72	%
	Viewing Angle	89/89/89/89(SFT)	degree
Electrical Characteristics	Interface	eDP 2lanes (version 1.2)	-
	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	MSAK24025P30 or equivalent
Matching connector	20454-230T (I-PEX) or equivalent

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	NC	N	Keep this pin open	
2	H_GND	P	High Speed Ground	
3	LANE1_N	I	Complement Signal Link Lane 1	
4	LANE1_P	I	True Signal Link Lane 1	
5	H_GND	P	High Speed Ground	
6	LANE0_N	I	Complement Signal Link Lane 0	
7	LANE0_P	I	True Signal Link Lane 0	
8	H_GND	P	High Speed Ground	
9	AUX_CH_P	I/O	True Signal Aux Channel	
10	AUX_CH_N	I/O	Complement Signal Aux Channel	
11	H_GND	P	High Speed Ground	
12	LCD_VCC	P	Power supply for LCD panel(3.3V)	
13	LCD_VCC	P	Power supply for LCD panel(3.3V)	
14	NC	N	Keep this pin open	
15	H_GND	P	Ground	
16	H_GND	P	Ground	
17	HPD	O	Hot Plug Detect Output (3.3V)	
18	BL_GND	P	Backlight ground	
19	BL_GND	P	Backlight ground	
20	BL_GND	P	Backlight ground	
21	BL_GND	P	Backlight ground	
22	BL_ENABLE	I	Backlight ON/OFF control(High: ON; Low: OFF)	
23	BL_PWM	I	PWM signal input for dimming (Luminance control)	
24	NC	N	Keep this pin open, only for Tianma use	
25	NC	N	Keep this pin open, only for Tianma use	
26	BL_POWER	P	Power supply for Backlight(12V)	
27	BL_POWER	P	Power supply for Backlight(12V)	
28	BL_POWER	P	Power supply for Backlight(12V)	
29	BL_POWER	P	Power supply for Backlight(12V)	
30	NC	N	Keep this pin open	

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.

BL_GND and H_GND is connected internally.

Note3: eDP signal needs to comply with CTS testing specifications.

3.2 Positions of socket

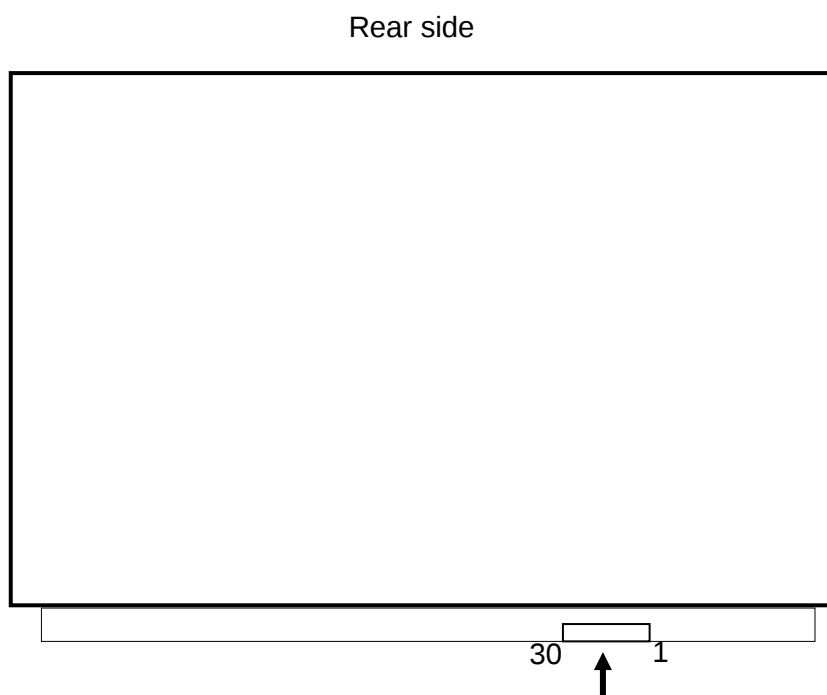


Table 3.2 Positions of Socket

4. Absolute Maximum Ratings

Item		Symbol	Rating	Unit	Remark
Power supply voltage	LCD panel	LCD_VCC	(-0.3 to +4.0)	V	Ta= 25℃
	Backlight	BL_POWER	(-0.3 to +27.0)	V	
Input voltage for signals	Display signals Note1	VD	T.B.D.	V	
	Function signal for Backlight	BL_ENABLE	(-0.3 to +27.0)	V	
		BL_PWM	(-0.3 to +27.0)		
Storage temperature		Tst	-20 to +60	℃	-
Operating temperature	Front surface	TopF	0 to +50	℃	Note2
	Rear surface	TopF	0 to +50	℃	Note3
Relative humidity Note4		RH	≤ 95	%	Ta ≤ 40℃
			≤ 85	%	40℃ < Ta ≤ 50℃
			≤ 55	%	50℃ < Ta ≤ 60℃
Absolute humidity Note4		AH	≤ 70 Note5	g/m3	Ta= 60℃

Table 4.1 Absolute Maximum Ratings

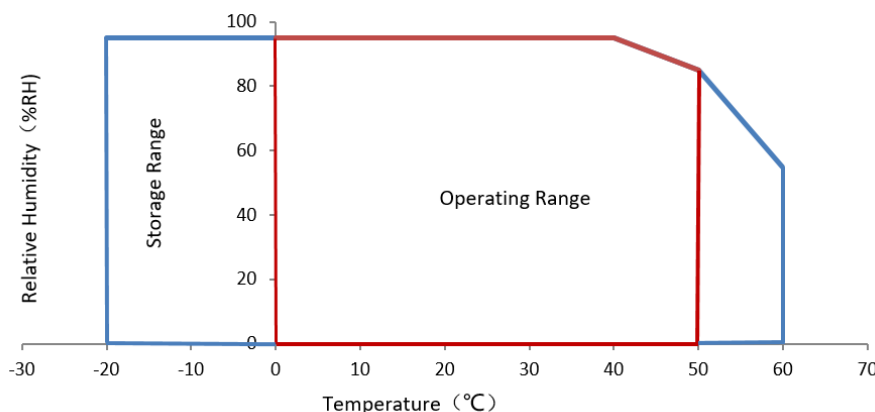


Table 4.2 Absolute Maximum Ratings chart

Note1: Lane1_N, Lane1_P, Lane0_N, Lane0_P, AUX_CH_P, AUX_CH_N

Note2: Measured at LCD panel surface (including self-heat)

Note3: Measured at LCD module's rear shield surface (including self-heat)

Note4: No condensation

Note5: Water amount at Ta= 60°C and RH= 55%

Note6: 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

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage	LCD_VCC	3.0	3.3	3.6	V	Note1
Supply current	I _{LCD_VCC}	-	TBD	TBD	mA	At VCC= 3.3V Note2
Power Consumption	W _{LCD_VCC}	-	TBD	TBD	W	
Inrush Current	Inrush_ LCD_VCC	-	-	1.5	A	-
Permissible ripple voltage	VRPC	-	-	100	mVp-p	for VCC Note3
Output Signal Voltage	High Level	V _{OH}	0.8*VCC	-	V	HPD
	Low Level	V _{OL}	-	0.2*VCC	V	

Table 5.1 Operating Voltages for Panel Driving

Note1: LCD_VCC should be voltage on the LCD module connector, Including ripple.

Note2: Test at White pattern.

Note3: The permissible ripple voltage includes spike noise.

5.2 DC Characteristics for Backlight Driving

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Power supply voltage	BL_POWER	11.2	12.0	12.8	V	Note1, Note2 at BL_POWER = 12.0V Note4
Power supply current	I _{BL_POWER}	-	TBD	TBD	mA	
Power Consumption	W _{BL_POWER}	-	TBD	TBD	W	
Inrush Current	Inrush_ BL_POWER	-	-	1.5	A	-
Permissible ripple voltage	VRPD	-	-	200	mVp-p	for BL_POWER Note2, Note5
Input voltage for BL_PWM, BL_ENABLE signal	VIH	2	-	-	V	
	VIL	-	-	0.5	V	
BL_PWM frequency	f _{PWM}	200	-	2k	Hz	Note6
BL_PWM duty ratio	DR _{PWM}	1.5	-	100	%	Note7, Note8
LED life time	Hr	-	30000	-	Hour	Note 9

Table 5.2.1 LED Backlight Characteristics

Note1: When designing of the power supply, take the measures for the prevention of surge voltage.

Note2: The power supply lines (BL_POWER and BL_GND) may have ripple voltage during luminance control of LED. There is the possibility that the ripple voltage produces acoustic noise and signal wave noise in audio circuit and so on.

Note3: This value excludes peak current such as overshoot current.

Note4: At the maximum luminance control.

Note5: The permissible ripple voltage includes spike noise.

Note6: Depending on the frequency used, some noise may appear on the screen, please conduct a thorough evaluation.

Note7: While the BL_ENABLE signal is high, do not set the tPWH (PWM pulse width) is less than minimum

value. It may cause abnormal working of the backlight. In this case, turn the backlight off and then on again by BL_ENABLE signal.

Note8: Regardless of the PWM frequency, both PWM duty ratio and PWM pulse width must be always more than the minimum values.

Note9: Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$. Only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is an estimated data.

5.3 Power ON/OFF Sequence

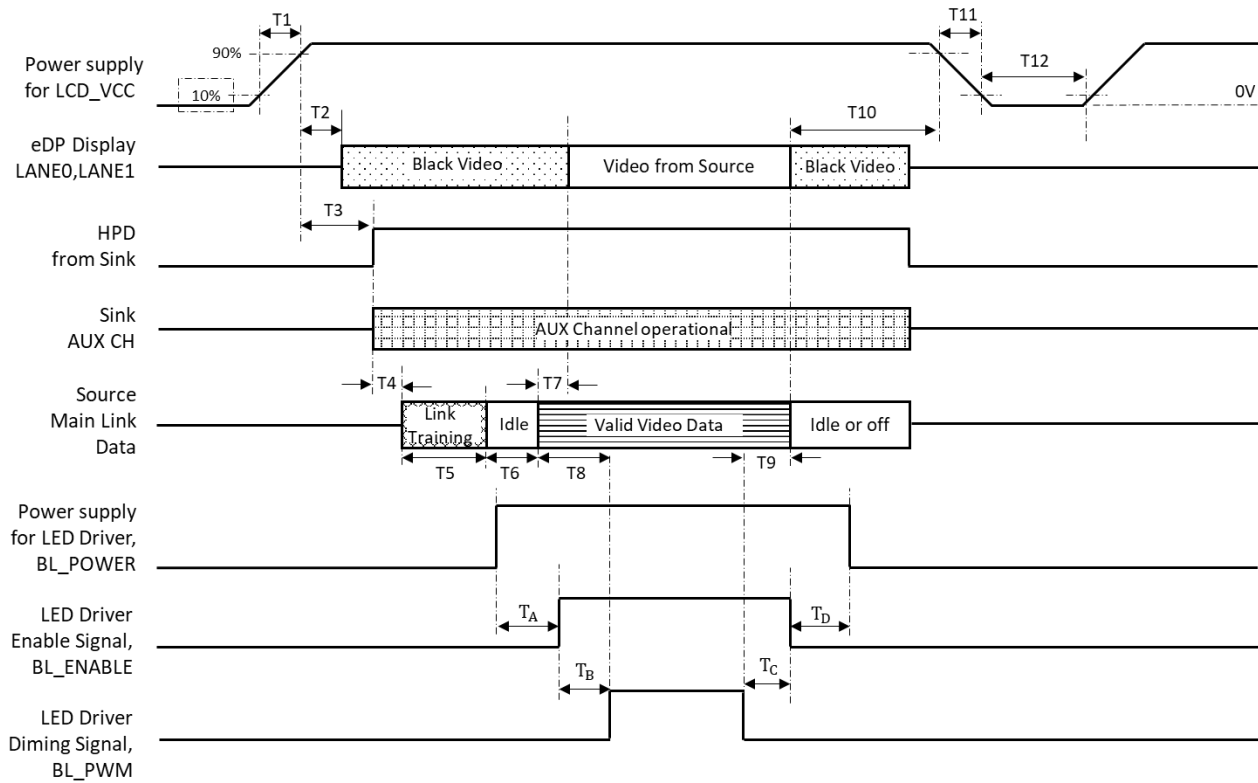


Figure 5.3.1 Power on/off sequence

Professional Display Module

Parameter s	Description	Reqd. by	Value		Unit	Notes
			Min	Max		
T1	Power tail rise time, 10% to 90%	Source	0.5	10	ms	-
T2	Delay from LCD_VCC to black video generation	Sink	0	200	ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source
T3	Delay from LCD_VCC to HPD high	Sink	0	200	ms	Sink AUX Channel must be operational upon HPD high
T4	Delay from HPD high to link training initialization	Source	-	-	ms	Allows for source to read Link capacity and initialize
T5	Link training duration	Source	-	-	ms	Dependent on Source link training Protocol
T6	Link Idle	Source	-	-	ms	Min Accounts for required BS-Idle pattern. Max allows for Source frame synchronization
T7	Delay from valid video Data from Source to video on display	Sink	0	50	ms	Max value allows for Sink to valid video Data and Timing. At the end of T7, Sink will indicate the detection of valid video data by setting SINK_STATUS bit to logic 1(DPCD 00205h, bit 0), and Sink will no longer generate automatic Black video
T8	Delay from valid video Data from Source to Backlight on	Source	0	-	ms	Source must assure display video is stable
T9	Delay from Backlight off to end of valid video Data	Source	0	-	ms	Source must assure backlight is no longer illuminated. At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display Black Video.
T10	Delay from end of valid video data from Source to Power off	Source	0	500	ms	Black video will be displayed after receiving idle or off signals from Source
T11	LCD_VCC power rail fall time, 90% to 10%	Source	-	10	ms	-
T12	LCD_VCC Power off time	Source	1000	-	ms	-
T _A	Delay from BL_POWER on to enable signal BL_ENABLE on	Source	2	5 typ	ms	-
T _B	Delay from enable signal BL_ENABLE on to dimming signal BL_PWM on	Source	2	5 typ	ms	-
T _C	Delay from diming signal BL_PWM off to Enable signal BL_ENABLE off	Source	2	5 typ	ms	-
T _D	Delay from Enable signal BL_ENABLE off to diming signal BL_PWM off	Source	2	5 typ	ms	-

Table 5.3.2 Power On/Off Sequence Table

Note1: If there is a voltage variation (voltage drop) at the rising edge of LCD_VCC below 3.0V, there is a possibility that a product does not work due to a protection circuit.

Note2: Display signals (LANE0_P/N, LANE1_P/N) must be set to Low or High-impedance, except the VALID period (See above sequence diagram), in order to avoid the circuitry damage.

If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If a customer stops the display and function signals, LCD_VCC also must be shut down.

5.4 LCD Module Block Diagram

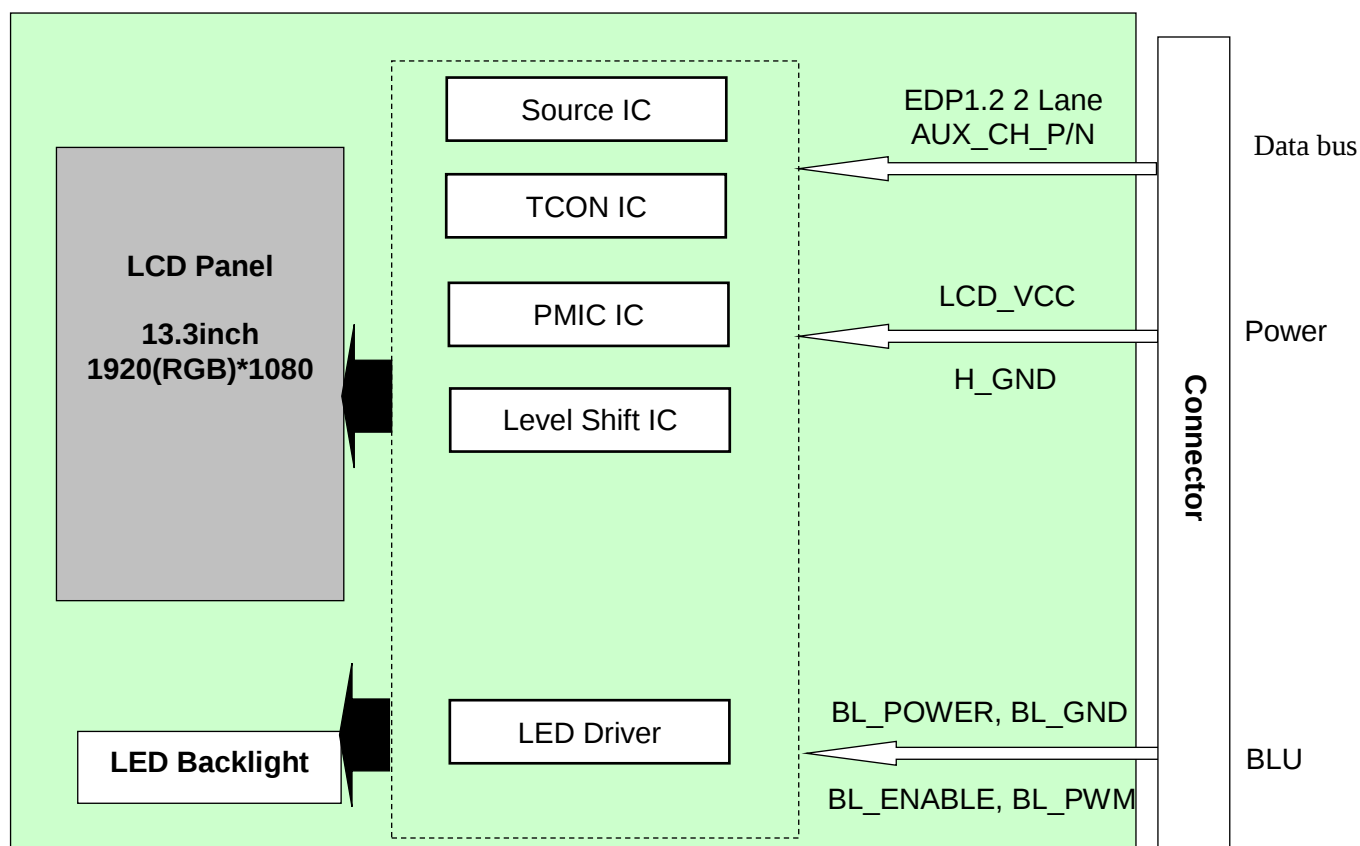


Figure 5.4.1 LCD Module Block Diagram

Note1: H_GND and BL_GND must be connected to customer equipment's ground, and it is recommended that these grounds to be connected together in customer equipment ground.

5.5 Display Positions

The following table is the coordinates per pixel (See following figures)

C (0, 0)

R	G	B
---	---	---

C(0, 0)	C(1, 0)	...	C(X, 0)	...	C(1918, 0)	C(1919, 0)
C(0, 1)	C(1, 1)	...	C(X, 1)	...	C(1918, 1)	C(1919, 1)
⋮	⋮	⋮	⋮	⋮	⋮	⋮
C(0, Y)	C(1, Y)	...	C(X, Y)	...	C(1918, Y)	C(1919, Y)
⋮	⋮	⋮	⋮	⋮	⋮	⋮
C(0, 1078)	C(1, 1078)	...	C(X, 1078)	...	C(1918, 1078)	C(1919, 1078)
C(0, 1079)	C(1, 1079)	...	C(X, 1079)	...	C(1918, 1079)	C(1919, 1079)

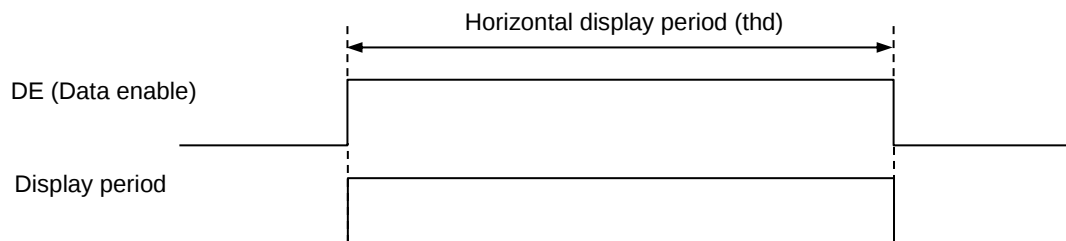
Table 5.5.1 Display Positions

5.6 Input Signal Timings

5.6.1 Outline of input signal timings

- Horizontal signal

Note1



- Vertical signal

Note1

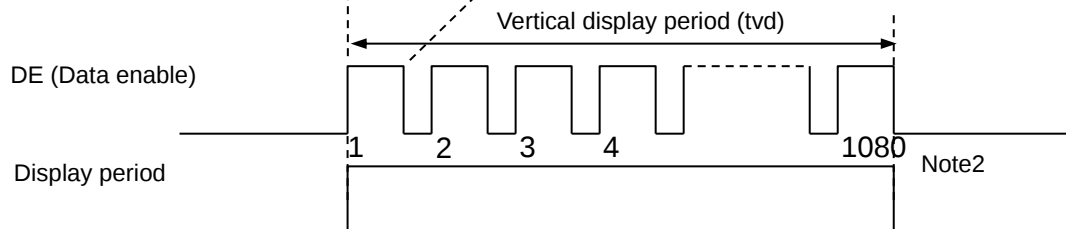


Figure 5.6.1 Outline of Input Signal Timings

Note1: This diagram indicates virtual signal for set up to timing.

Note2: See "5.6.3 Input signal timing chart" for the pulse number.

5.6.2 Timing characteristics

(Note1)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency	1/tc	-	144.8	-	MHz	
	Frame	TV-Total	V total line number	-	1132	-	Line
		TV-Active	Data duration	-	1080	-	Line
		TV-Blank	V-Blank	-	52	-	Line
	Line	TH-Total	H total pixel number	-	2132	-	CLK
		TH-Active	Data duration	-	1920	-	CLK
		TH-Blank	H-Blank	-	212	-	CLK
FR	Frame Rate	FR	60			Hz	

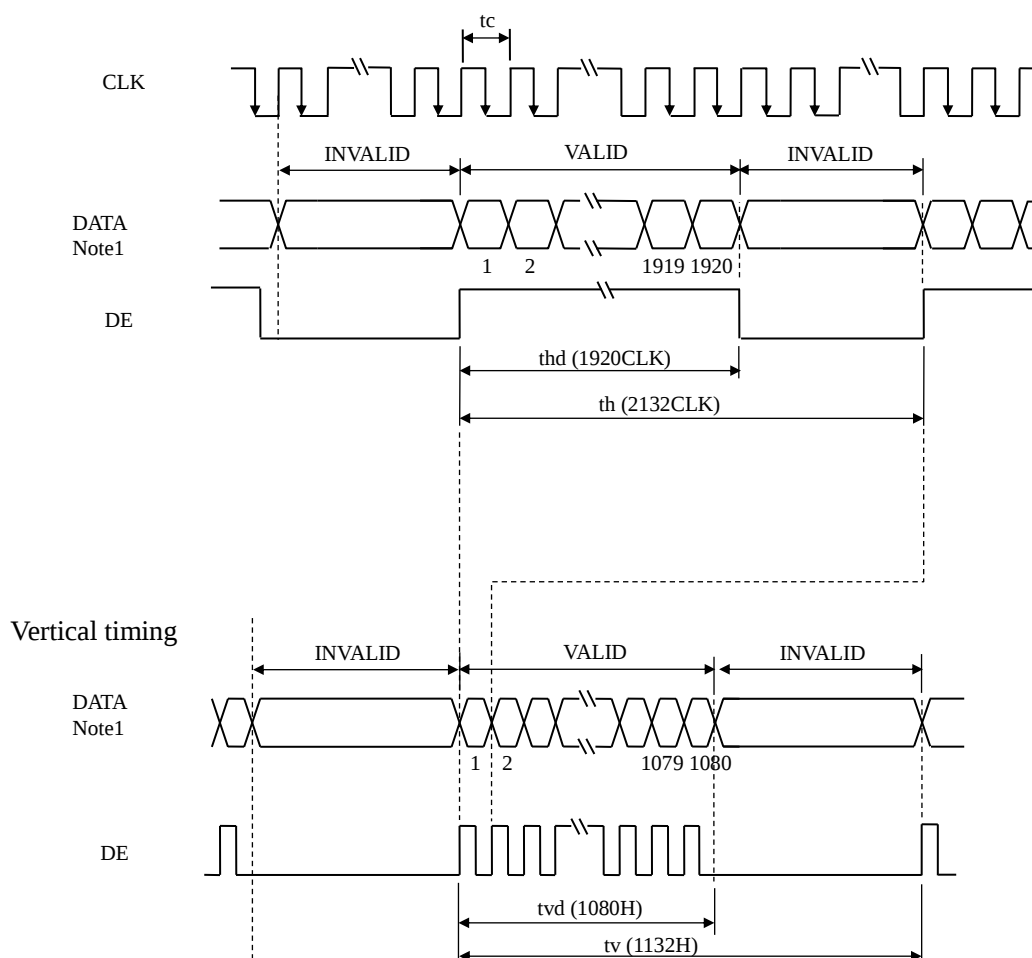
Table 5.6.2 Timing Characteristics

Note1: Definition of parameters is as follows.

tc= 1CLK, th= 1H

5.6.3 Input signal timing chart

Horizontal timing


Figure 5.6.3 Timing Characteristics

Note1: DATA = R0-R7, G0-G7, B0-B7

6. eDP Signal Timing Specification

6.1 Display Port Main Link Signal

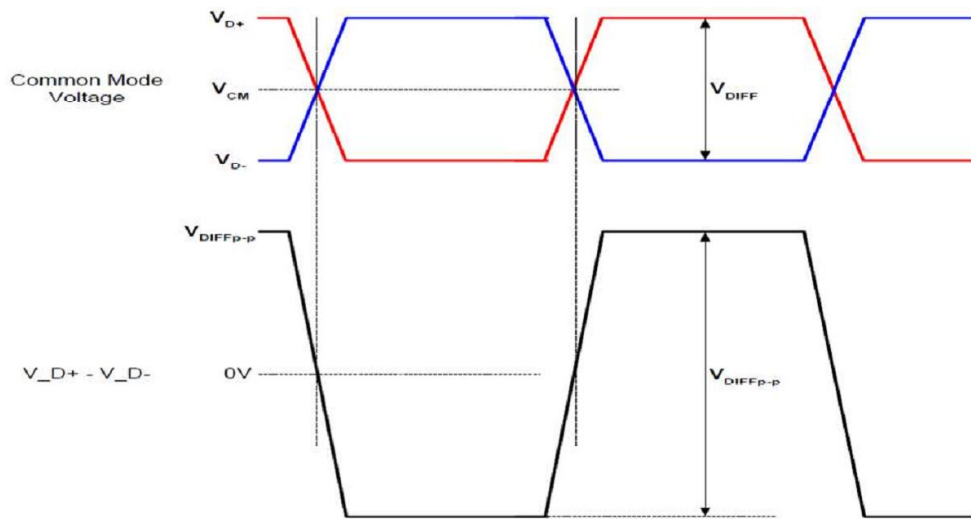


Figure 6.1.1 Timing Specification for Display Port Main Link Signal

DC Specification	Min	Typ	Max	Unit
DC common mode voltage	0		2	V
AC Specification	Min	Typ	Max	Unit
Frequency for high bit rate	2.68569	2.7	2.70081	Gbps
Frequency for reduced bit rate	1.611414	1.62	1.620486	Gbps
Spread spectrum clock (down spreading)	0		0.5	%
SSC modulation frequency	30		33	KHz
Differential peak-to-peak input voltage at package pins	100			mV
Differential termination resistance	80		120	ohm
Rx short circuit current limit			50	mA
Rx intra-pair skew tolerance at HBR			60	ps

Figure 6.1.2 Timing Specification for Display Port Main Link Signa

6.2 Display Port AUX Signal

AC Specification	Min.	Typ.	Max.	Unit
Unit interval	0.4	-	0.6	Us
AUX differential peak to peak voltage at TX	0.18	-	0.8	V
AUX differential peak to peak voltage at RX	0.14	-	1.36	V
Rx sensitivity	0.1	-	-	V

Figure 6.2.1 Timing Specification for Display Port AUX signal

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR ≧ 10	80	89	-	degree	Note2,3
		θB		80	89	-		
		θL		80	89	-		
		θR		80	89	-		
Contrast Ratio		CR	θ=0°	1300	1800	-		Note 3
Response Time		T _r	25℃	-	30	40	ms	Note 4
		T _f						
Chromaticity	White	x		0.259	0.309	0.359		Note 1,5
		y		0.290	0.340	0.390		
	Red	x		0.598	0.648	0.698		Note 1,5
		y		0.295	0.345	0.395		
	Green	x		0.280	0.330	0.380		Note 1,5
		y		0.573	0.623	0.673		
	Blue	x		0.103	0.153	0.203		Note 1,5
		y		0.009	0.059	0.109		
Uniformity		U		75	80		%	Note 6
NTSC		-		68	72		%	Note 5
Luminance		L		280	350		cd/m ²	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. PWM duty ratio: 100%, 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 20 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

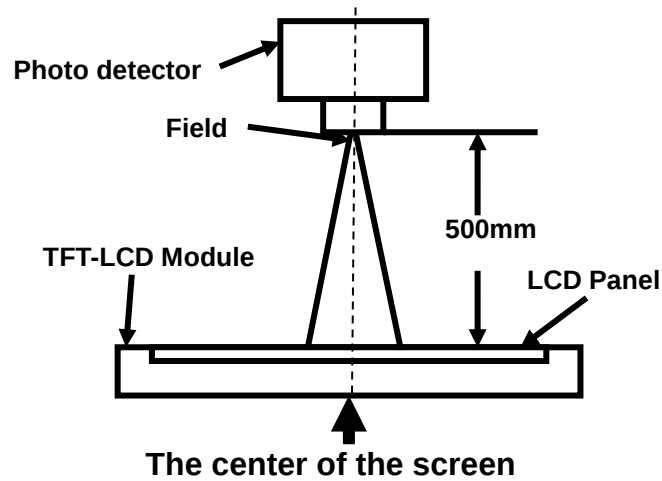


Fig1. Measurement Set Up

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

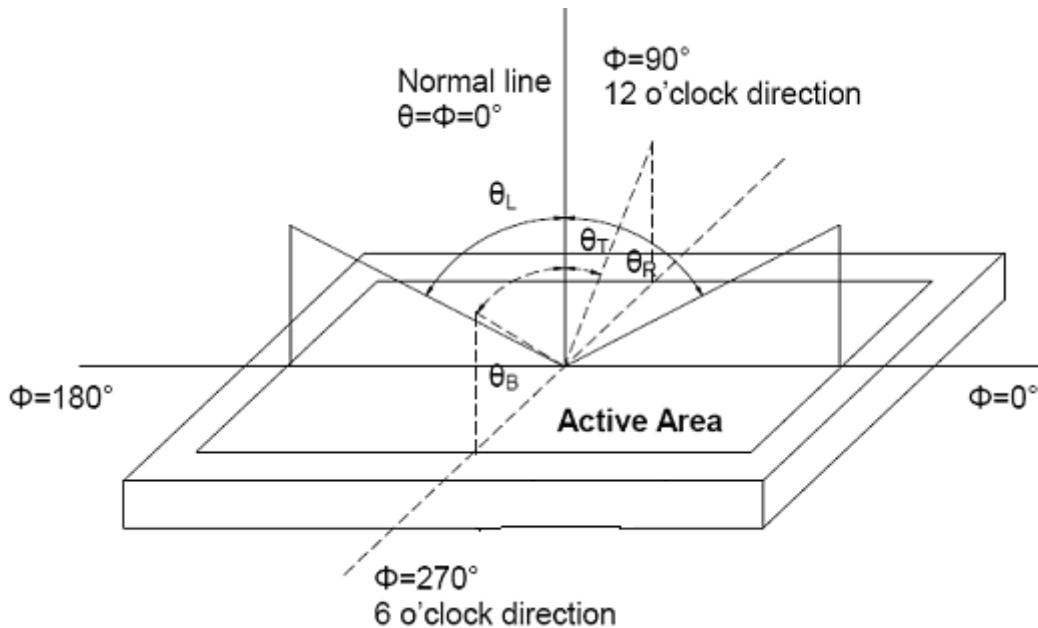


Fig2. Measurement viewing angle

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 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%.

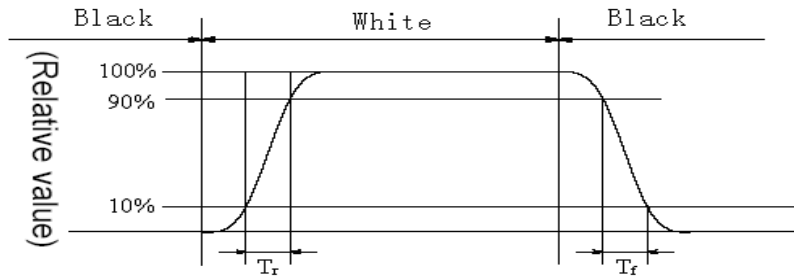


Fig3. Response Time Testing(SFT)

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) = L_{min} / L_{max}

L_{max} : The measured Maximum luminance of all measurement position.

L_{min} : The measured Minimum luminance of all measurement position.

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

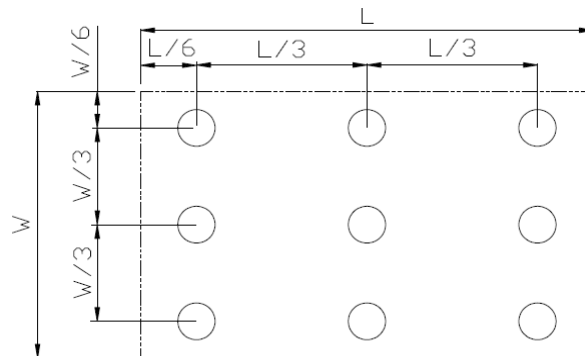


Fig4. Luminance Uniformity Measurement Locations(9 points)

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	+50℃ , 240H	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	0℃ , 240H	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+60℃ , 240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-20℃ , 240H	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity(non-operation)	+50℃ , 80%RH , 240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-20℃ , 30min~60℃ , 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 , 9point/panel Air : ±15kv , 10times ; Contact : ±8kv , 10times ; (Environment : 15℃~35℃ , 30%~60% , 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration (Non-operation)	5 to 100Hz, 11.76m/s ² 1 minute/cycle X, Y, Z directions 10 times each direction	-
9	Shock (Non-operation)	294m/s ² , 11ms ±X, ±Y, ±Z directions 3 times each direction	-
10	Package Vibration	5-20-200HZ , PSD : 0.01-0.01-0.001 Total: 0.781g ² /HZ,x/y/z 30min	-
11	Package Drop Test	Height: 60cm,1 corner, 3edges, 6 surfaces	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.

Note4: See the following figure for discharge points.

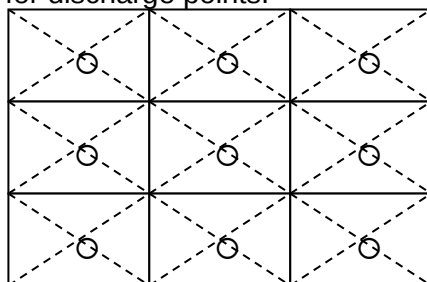
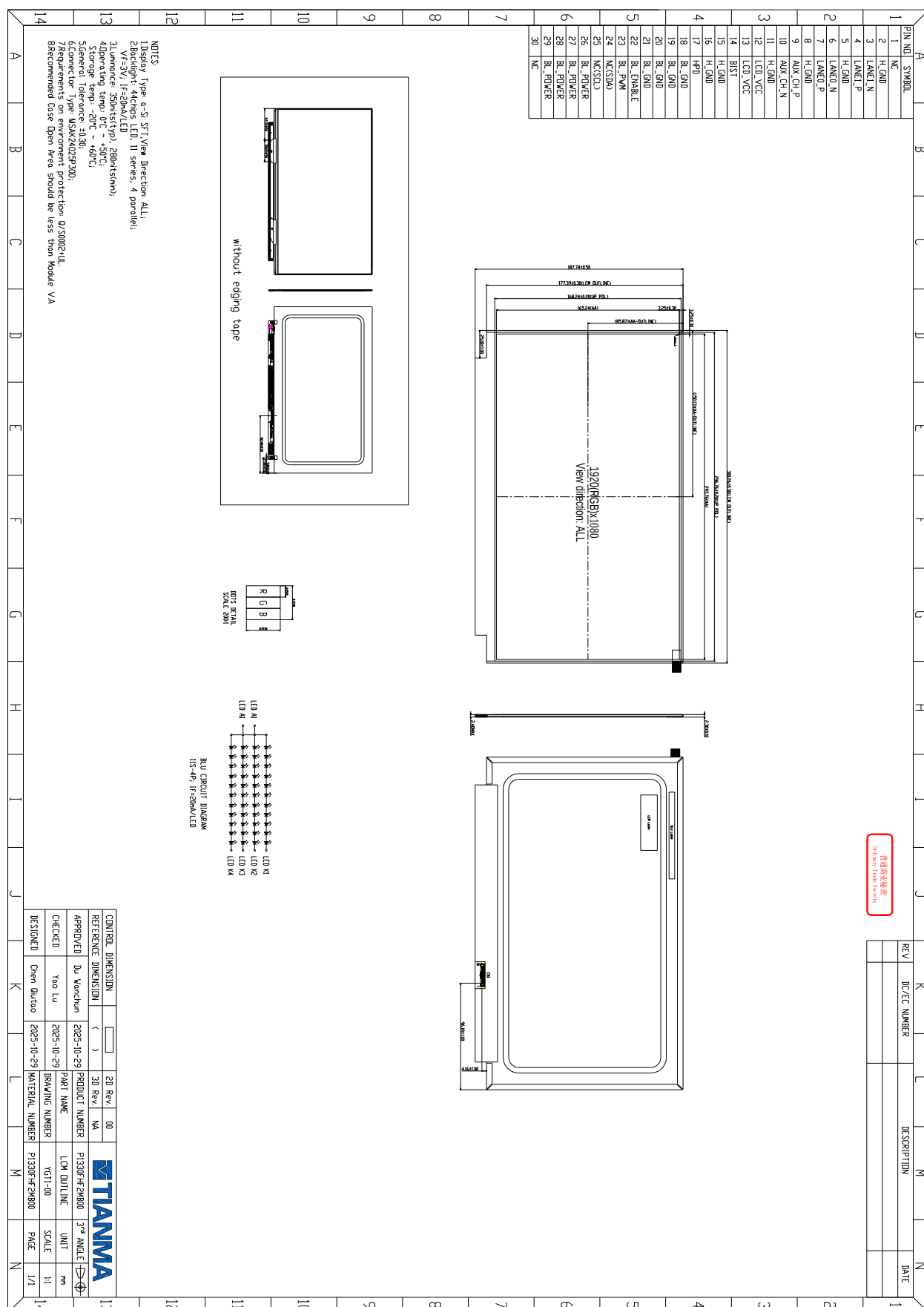


Figure 8.1 ESD position

9.1 Mechanical Drawing Of LCM



9.2 Markings

The marking is attached to this product.

9.2.1 Nameplate label



10. Packing Instruction

Tianma will pack products to deliver to customer in accordance with Tianma 's packing specifications, and will deliver products to customer in such a condition that products will not suffer from a damage during transportation. The delivery conditions are as follows.

Parameter	Packing box type	Unit
Size	300.26(W) x 187.74 (H) x 2.4 (D) (typ.)	mm
Weight	TBD	kg
Total weight	TBD	kg

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 °C 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.