

SPECIFICATION

☐ Preliminary Specification

☒ Final Specification

Description

12.3” 1920xRGBx720 TFT-LCD Module

Part Number

P1230FHF1MAAA

Customer		Industrial Product Dept, PDBU Tianma Microelectronics Co., Ltd.	
Signatures	Date	Approved By	Date
		Kevin	2023-10-18
		Reviewed By	
		Longping.Deng	2023-10-18
		Prepared By	
		Lixian.Xu	2023-10-18
Comments:			

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

REVISION HISTORY

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1. Summary

1.1 General Description

This is a 12.3 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, FPC, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle: Super Fine TFT
- High luminance: 1000 nits(typ)
- Wide temperature range: -30~85°C
- Interface: 2-port LVDS
- Surface treatment: HC
- 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	12.3 inch	
	Resolution	1920(RGB)x720	
	Pixel Pitch	0.15225x0.15225	mm
	TFT Active Area	292.32x109.62	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	HC	
	Viewing Direction	ALL	
Mechanical Characteristics	LCM (W x H x D)	305.92x123.67x7.00	mm
	Weight	319	g
Optical Characteristics	Luminance	Min:1000	cd/m ²
	Contrast Ratio	Typ:1100:1	
	NTSC	Typ:85	%
	Viewing Angle	Typ:88/88/88/88	degree
Electrical Characteristics	Interface	2-port LVDS(VESA)	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:1120; Backlight:11900	mW

Table 2.1 General TFT Specifications

Note 1: Requirements on Environmental Protection: Q/S0002.

Note 2: LCM weight tolerance: ± 5%

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	FH41-50S-0.5SH

Table 3.1.1 CN1 Connector information

No.	Symbol	I/O	Description	Remark
1	GND	P	GND	
2	GND	P	GND	
3	VLCD	P	Power supply for LCD (3.3V)	
4	VLCD	P	Power supply for LCD (3.3V)	
5	VLCD	P	Power supply for LCD (3.3V)	
6	VLCD	P	Power supply for LCD (3.3V)	
7	GND	P	GND	
8	GND	P	GND	
9	NC	N	Tianma internal used Custom must floating	Note 2
10	NC	N	Tianma internal used Custom must floating	
11	GND	P	GND	
12	GND	P	GND	
13	OLV0N	I	Odd LVDS data input 0-	
14	OLV0P	I	Odd LVDS data input 0+	
15	GND	P	GND	
16	OLV1N	I	Odd LVDS data input 1-	
17	OLV1P	I	Odd LVDS data input 1+	
18	GND	P	GND	
19	OLV2N	I	Odd LVDS data input 2-	
20	OLV2P	I	Odd LVDS data input 2+	
21	GND	P	GND	
22	OCLKN	I	Odd LVDS Clock input -	
23	OCLKP	I	Odd LVDS Clock input +	
24	GND	P	GND	
25	OLV3N	I	Odd LVDS data input 3-	
26	OLV3P	I	Odd LVDS data input 3+	
27	GND	P	GND	
28	ELV0N	I	Even LVDS data input 0-	
29	ELV0P	I	Even LVDS data input 0+	
30	GND	P	GND	
31	ELV1N	I	Even LVDS data input 1-	
32	ELV1P	I	Even LVDS data input 1+	
33	GND	P	GND	
34	ELV2N	I	Even LVDS data input 2-	
35	ELV2P	I	Even LVDS data input 2+	
36	GND	P	GND	
37	ECLKN	I	Even LVDS Clock input -	
38	ECLKP	I	Even LVDS Clock input +	
39	GND	P	GND	

40	ELV3N	I	Even LVDS data input 3-	
41	ELV3P	I	Even LVDS data input 3+	
42	GND	P	GND	
43	NC(CSB)	N	Tianma internal used Custom must floating	Note 2
44	RESET	I	Global reset pin, RESET=H,normal operation. RESET=L,The controller is in reset state.	
45	NC	N	Tianma internal used Custom must floating	
46	NC	N	Tianma internal used Custom must floating	
47	HVR	I	Horisontally and Vertically Inverted	Note 3
48	STYB	I	Standby mode control STB="H", Normal operation. STB="L", Source output GNDA level.	
49	ASIL	O	Output for fail detection	Note 4
50	NC(VDD_OTP)	N	Tianma internal used Custom must floating	Note 2

Table 3.1.2 CN1 Pin Assignment for LCD Interface

Note1: I/O definition: I---Input, O---Output, I/O----Input/Output, P---Power/Ground, N---No connection.

Note2: Custom must floating.

Note3: HVR controlled by customer.

HVR	Function	Remark
H	Left→Right, Top→Bottom	Default
L	Right→Left, Bottom→Top	-



Type 1 (Default HVR="H")



Type 2 (HVR="L")

Note4: ASIL: normally pull L in IC, active “H”(when Hsync or Vsync or Clk miss, this pin will pull “H”

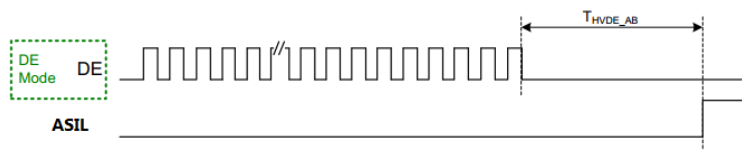


Figure 2.1.3 DE Mode ASIL Operation

Note: For 1920RGBx720 resolution, $T_{HVDS_AB} \approx 10.7\text{ms}$ for DE and HS detection; $\sim 60\text{ms}$ for VS detection.

The Clock Error Detection function monitors the Clock signal, if the clock pulse stopped longer than the criterion, ASIL will output High for error indication.

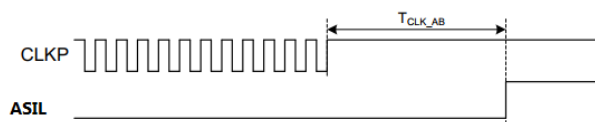


Figure 2.1.4 Clock Error ASIL Operation

Note: For 1920RGBx720 resolution, $T_{CLK_AB} \approx 234\mu\text{s}$

When CLK lost, T_{sp_det} is about 234us.

When DE/HS lost, T_{sp_det} is about 10.7ms.

When HV lost, T_{sp_det} is about 60ms.

Don't connect this pin to an output pin in customer system, it may be connected to input pin or NC.

Please keep no any pull up or pull low resistor connect to this pin on your system when this pin is used for fail detection.

3.2 CN2 Pin assignment (Backlight Interface)

Connector Information	
LCD Module connector	FH52-10S-0.5SH

Table 3.2.1 CN2 Connector information

No.	Symbol	I/O	Description	Remark
1	A1/A2	P	LED positive1/2	
2	A3/A4	P	LED positive3/4	
3	NC	N	No connection	
4	C1	P	LED negative1	
5	C2	P	LED negative2	
6	C3	P	LED negative3	
7	C4	P	LED negative4	
8	NC	N	No connection	
9	NTC-	O	Connector Thermistor Resistor	
10	NTC+	O	Connector Thermistor Resistor	

Table 3.2.2 CN2 Pin Assignment for Backlight Interface

Note1: I/O definition: I---Input, O---Output, I/O----Input/Output, P---Power/Ground, N---No connection.

4. Absolute Maximum Ratings

GND=0V, Ta=25℃

Item	Symbol	Min	Max	Unit	Remark
Logic supply voltage	VLCD	-0.5	5	V	
Operating Temperature	Top	-30	85	℃	
Storage Temperature	Tst	-40	95	℃	

Table 4.1 Absolute Maximum Ratings

Note1: 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.

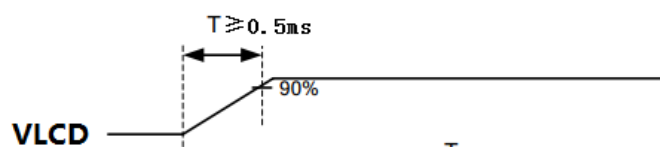
5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Logic Supply Voltage	VLCD	3.2	3.3	3.4	V	
Permissible Inrush current of VLCD	I _{vlcd}	--	400		mA	Note 1
Input High Voltage	V _{IH}	0.7*VLCD	--	VLCD	V	Note 2
Input Low Voltage	V _{IL}	GND	--	0.3*VLCD	V	
Output High Voltage	V _{OH}	VLCD-0.4	--	VLCD	V	Note 3
Output Low Voltage	V _{OL}	GND	--	0.4	V	
Power Consumption	White mode (60Hz)		1120		mW	Note 4

Table 5.1.1 Operating Voltages

Note1:



Note2: Contain RESET, STYB,HVR.

Note3: VLCD=3.3V.

LVDS Interface DC Characteristic

Parameter	Symbol	Condition	Spec			Unit
			Min	Typ	Max	
Differential input high threshold voltage	R _{XVTH}		-	-	+0.2	V
Differential input low threshold voltage	R _{XVTL}		-0.2-	-	-	V
Differential input common mode voltage	R _{XVCM}	-	1	1.2	1.7- V _{id} /2	V
Differential input voltage	V _{id}	-	0.2	-	0.6	V
Differential input leakage current	I _{lvleak}		-10	-	10	uA
LVDS terminal match resistor	R _{LVDS}			100		Ω

Table 5.1.2 LVDS Interface DC Characteristic

Single-end Signal:

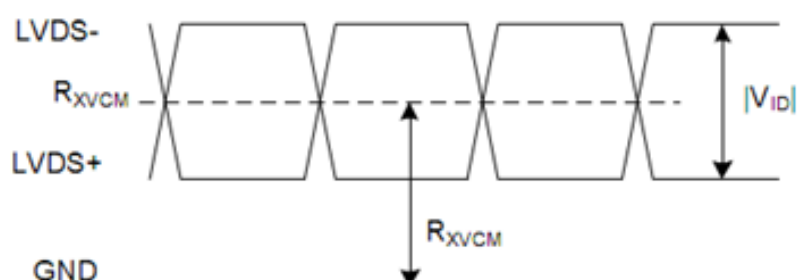


Figure5.1.1 Single-end Signal

Differential Signal:

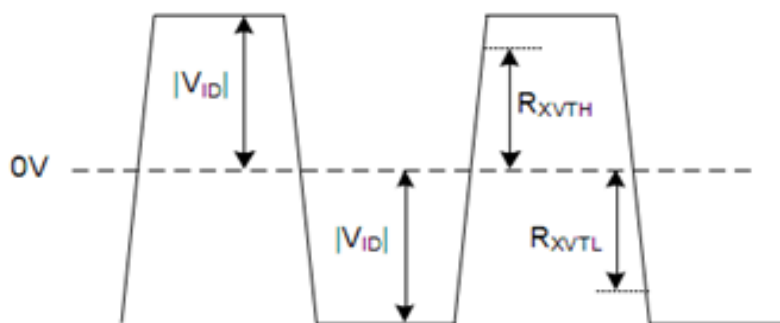


Figure 5.1.2 Differential Signal

5.2 DC Characteristics for Backlight Driving

Item		Symbol	Min	Typ	Max	Unit	Remark
Forward Current	+ 25°C	I_F		120		mA	Note1
Forward voltage	+ 25°C	V_{BL}		24.8		V	$I_F=120mA$
Backlight Power Consumption	+ 25°C	W_{BL}		11.9		W	$I_F=120mA$
Life Time		-	30000	-	-	Hrs	Note2

Table 5.2.1 LED Backlight Characteristics

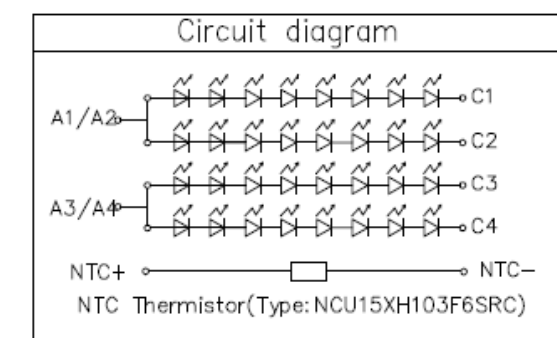


Figure 5.2.1 LED Connection of Backlight

Note1: $I_F=120mA$ is defined for one channel LED, There are total 4 LED channels in back light unit Under LCM operating, the stable forward current should be inputted.

Note2: Optical performance should be evaluated at $T_a=25^\circ C$ 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 original brightness.

Note3: It is suggested Customer to make sure the LCM module in the system is well heatdissipation.

Note4: The NTC thermistor Part No.is NCU15XH103F6SRC. NTC thermistor is included in LED circuit. pls refer to appendix for NTC temperature behavior.

Note5: The LED circuit de-rating curve evaluated as below,LED forward current should follow the De-rating curve.

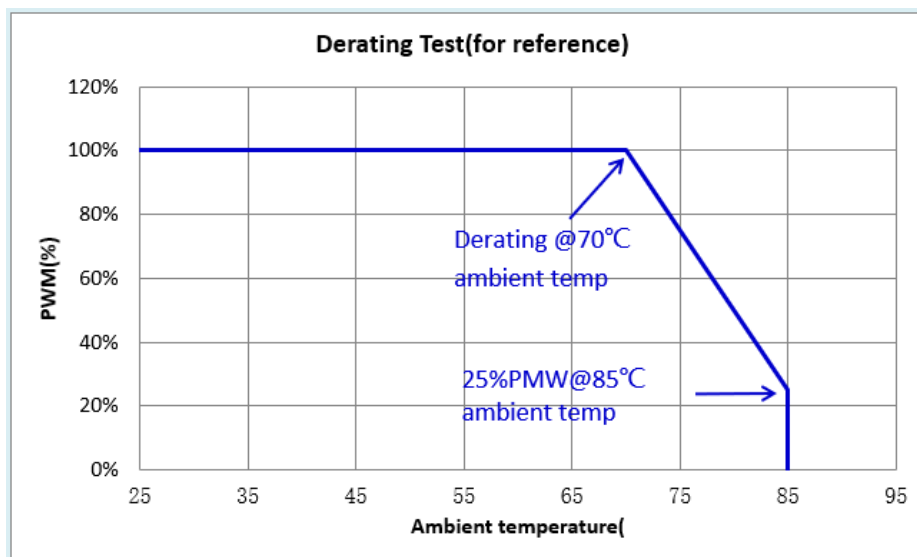


Figure 5.2.2 PWM vs. Ambient Temperature

5.3 LCD Module Block Diagram

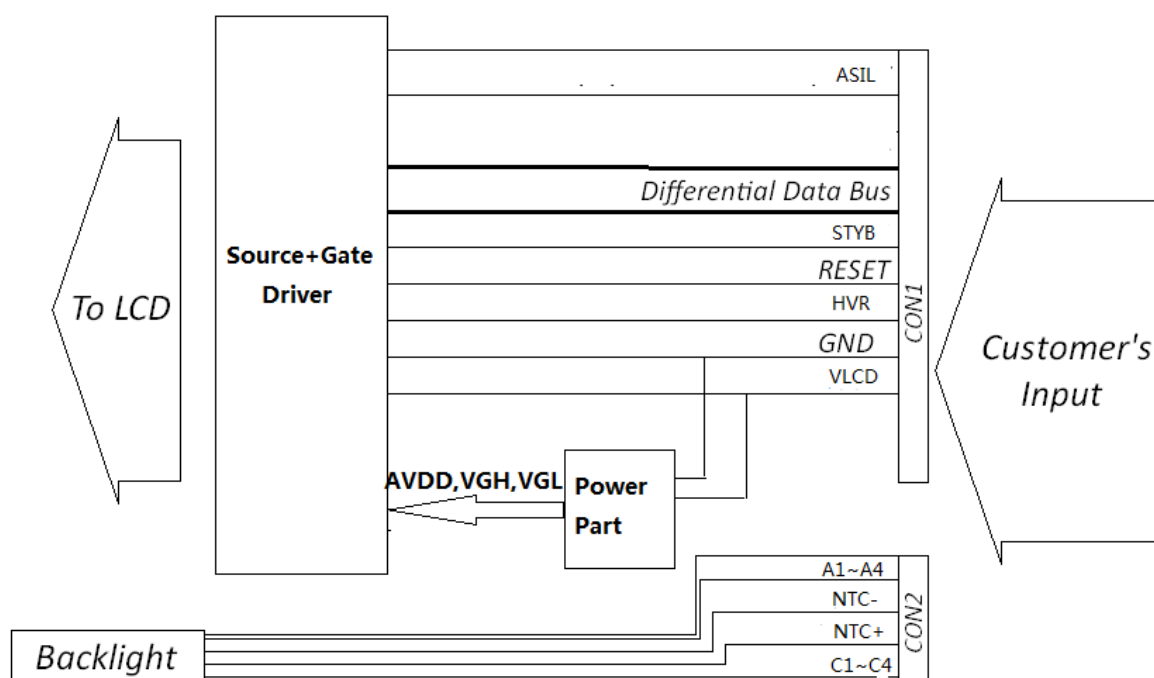


Figure 5.3.1 LCD Module Block Diagram

6. Interface Timing Characteristics

6.1 Input Timing

6.1.1 Input Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Dclk frequency (Frame rate=60HZ)		Fclk	44.6	44.7	50.2	MHz	$T_{clk}=1/F_{clk}$
Horizontal section	HS period time	TH	1023	1024	1060	Tclk	
	Horizontal blanking	THB	60	64	190	Tclk	
	Horizontal display area	THD	-	960	-	Tclk	
Vertical section	VS period time	TV	726	728	849	TH	
	Vertical blanking	TVB	6	8	129	TH	
	Vertical display area	TVD	-	720	-	TH	
Frame rate		Fv	60			Hz	

Table 6.1.1 Input Timing Characteristics

6.1.2 LVDS InputTiming Format

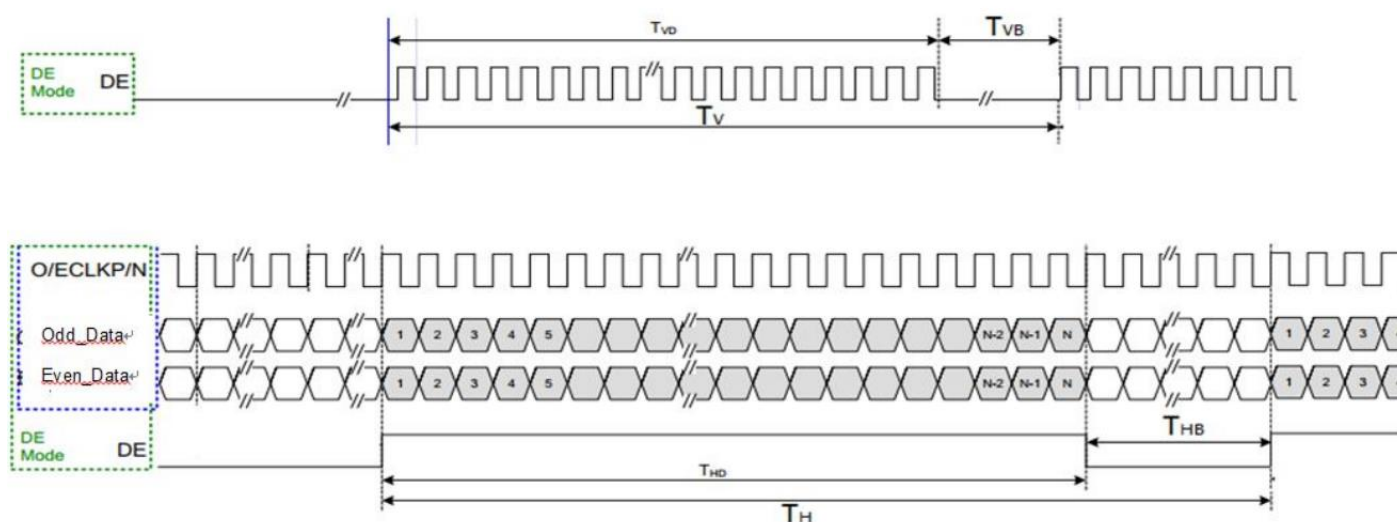


Figure 6.1.2.1 LVDS Input Timing Format

6.2 LVDS Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock high time	TLVCH	-	4/(7* TLVCLK)	-	ns	
Clock low time	TLVCL	-	3/(7* TLVCLK)	-	ns	
Input data skew margin	TRSKM	-	-	0.25	UI	VCC_IF=1.8V w/o SSC
Strobe width	TSW	0.5	-	-	UI	
1 data bit time	UI	-	1/7	-	TLV CLK	
Position 1	TPOS1	-0.25	0	0.25	UI	
Position 0	TPOS0	0.75	1	1.25	UI	
Position 6	TPOS6	1.75	2	2.25	UI	
Position 5	TPOS5	2.75	3	3.25	UI	
Position 4	TPOS4	3.75	4	4.25	UI	
Position 3	TPOS3	4.75	5	5.25	UI	
Position 2	TPOS2	5.75	6	6.25	UI	

Table 6.2.1 LVDS Timing

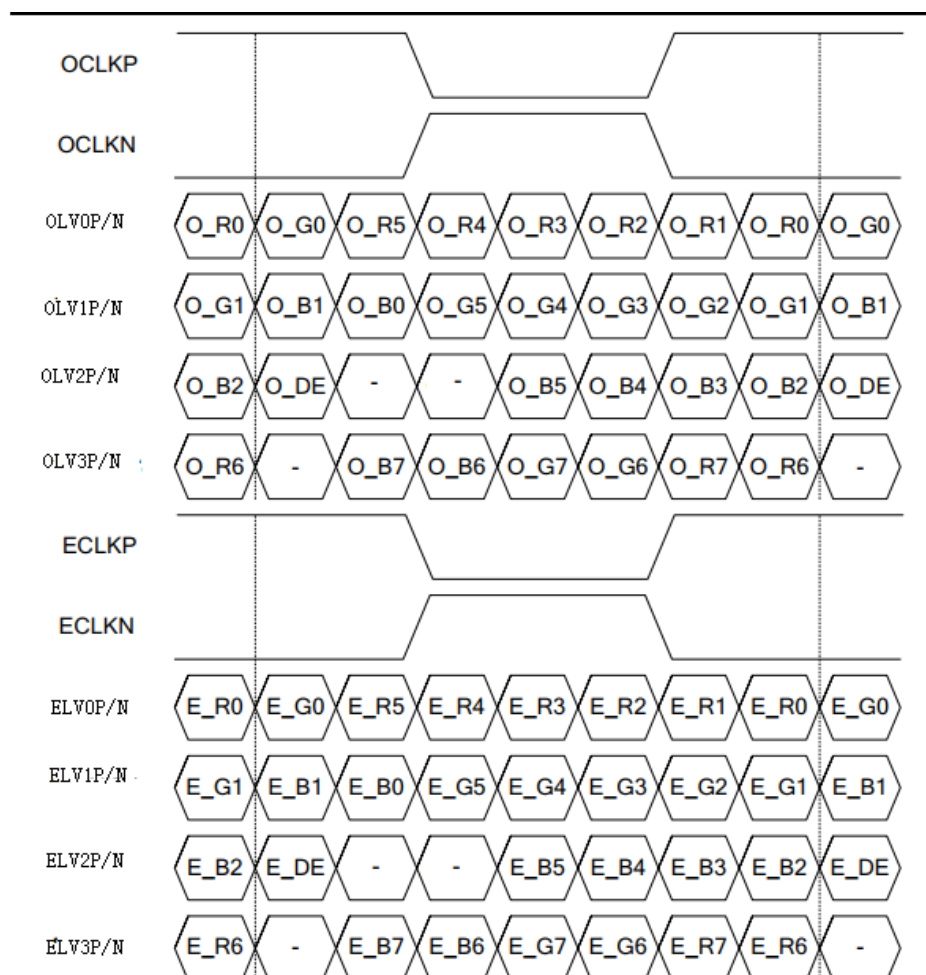


Figure 6.2.1 8-bit LVDS Dual Link VESA

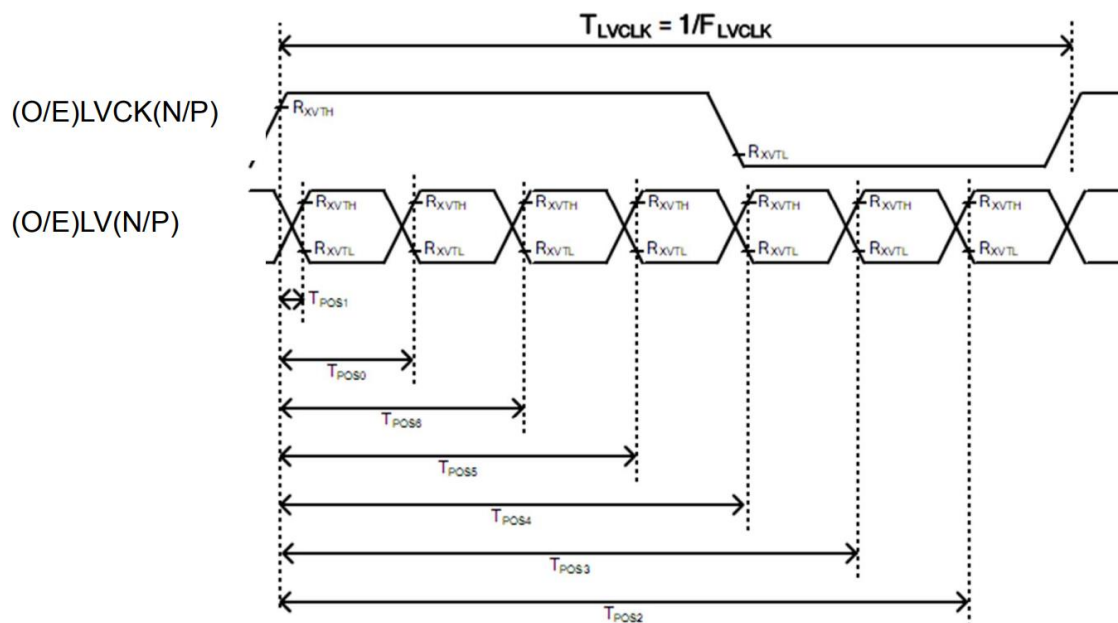


Figure 6.2.2 LVDS Input Timing

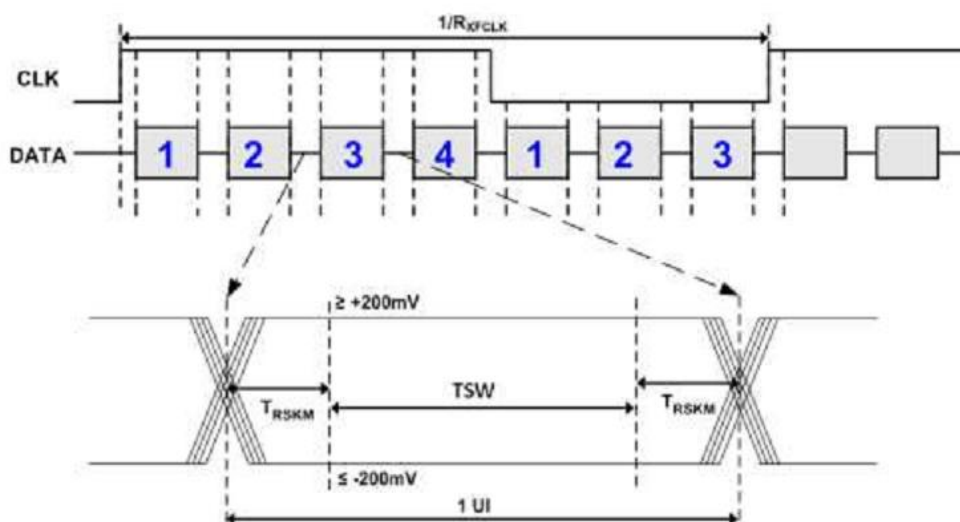


Figure 6.2.3 LVDS Data Skew

6.3 Power On/Off Sequence

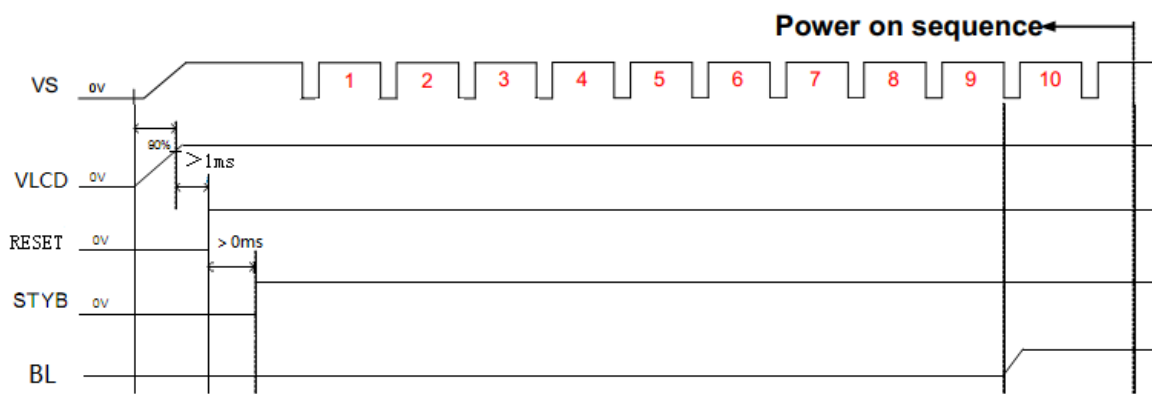


Figure 6.3.1 Power On Sequence

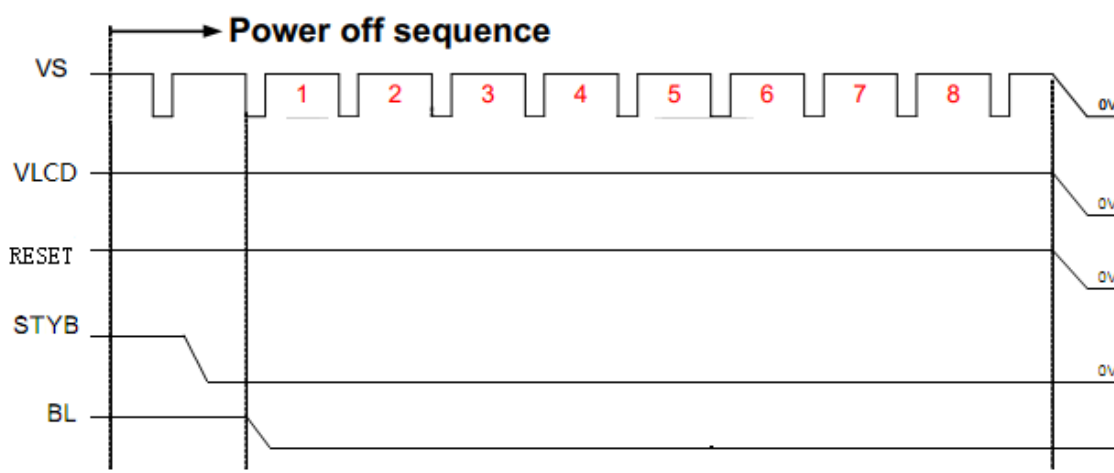


Figure 6.3.2 Power Off Sequence

6.4 VDD/RESET Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
VLCD power source slew time	T_{POR}	-	-	20	ms	From 0V to 90% VLCD
RESET active pulse width	T_{GRB}	1	-	-	ms	VDDIO = 3.3V

Table 6.4.1 VDD/RESET Timing

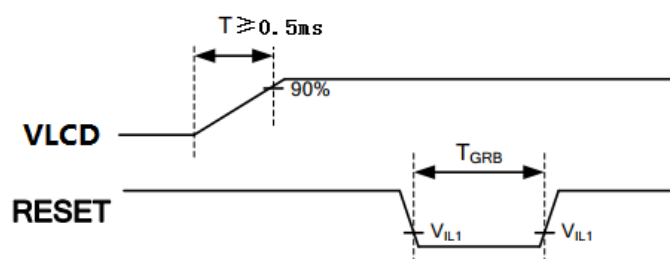


Figure 6.4.1 VLCD/RESET Timing

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR ≧ 10	80	88	--	degree	Note2,3
		θB		80	88	--		
		θL		80	88	--		
		θR		80	88	--		
Contrast Ratio		CR	θ=0 ⁰	900	1100	--		Note 3
Response Time		T _{ON}	25℃	--	--	20	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	CIE1931-XYZ	0.245	0.295	0.345		Note 1,5
		y		0.262	0.312	0.362		
	Red	x		0.600	0.650	0.700		Note 1,5
		y		0.259	0.309	0.359		
	Green	x		0.230	0.280	0.330		Note 1,5
		y		0.623	0.673	0.723		
	Blue	x		0.105	0.155	0.205		Note 1,5
		y		0.002	0.052	0.102		
Uniformity		White		75	80	--	%	Note 6
		Black		45	--	--	%	
NTSC		-	Perpendicular	80	85	--	%	Note 5
Luminance		L	Perpendicular, 25℃	--	1400	--	cd/m ²	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. $I_F = 80$ 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.

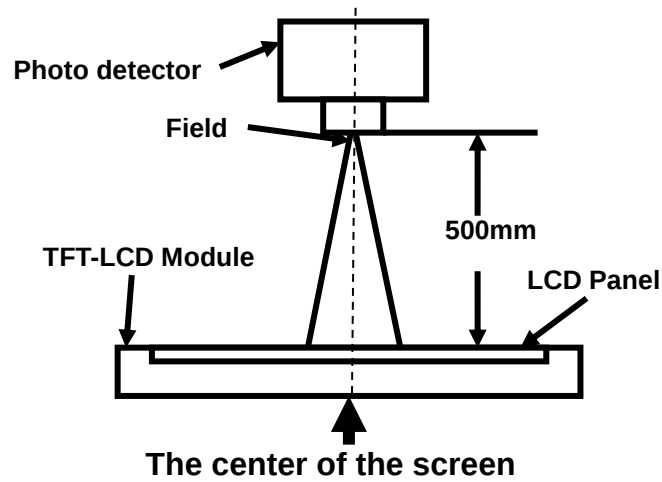


Fig1.Measurement Set Up

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

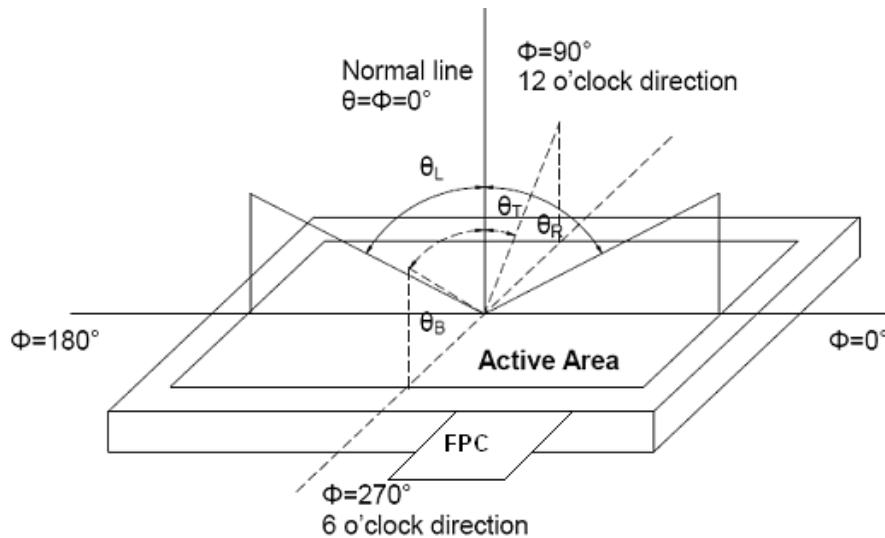


Fig2. Measurement viewing angle

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 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%.

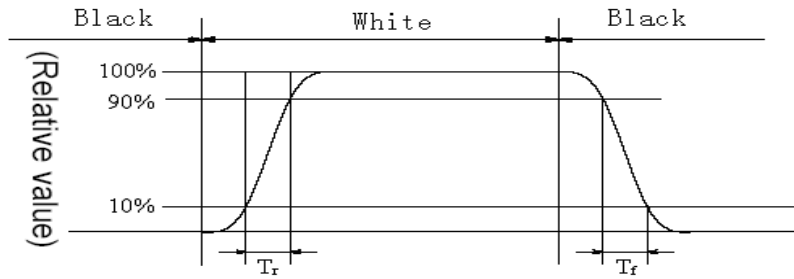


Fig4.Response Time Testing(SFT)

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) = 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

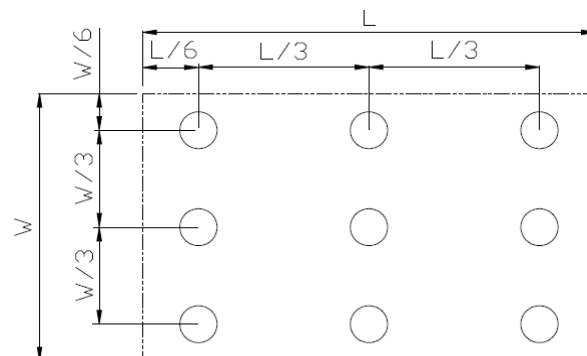


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Reliability Test

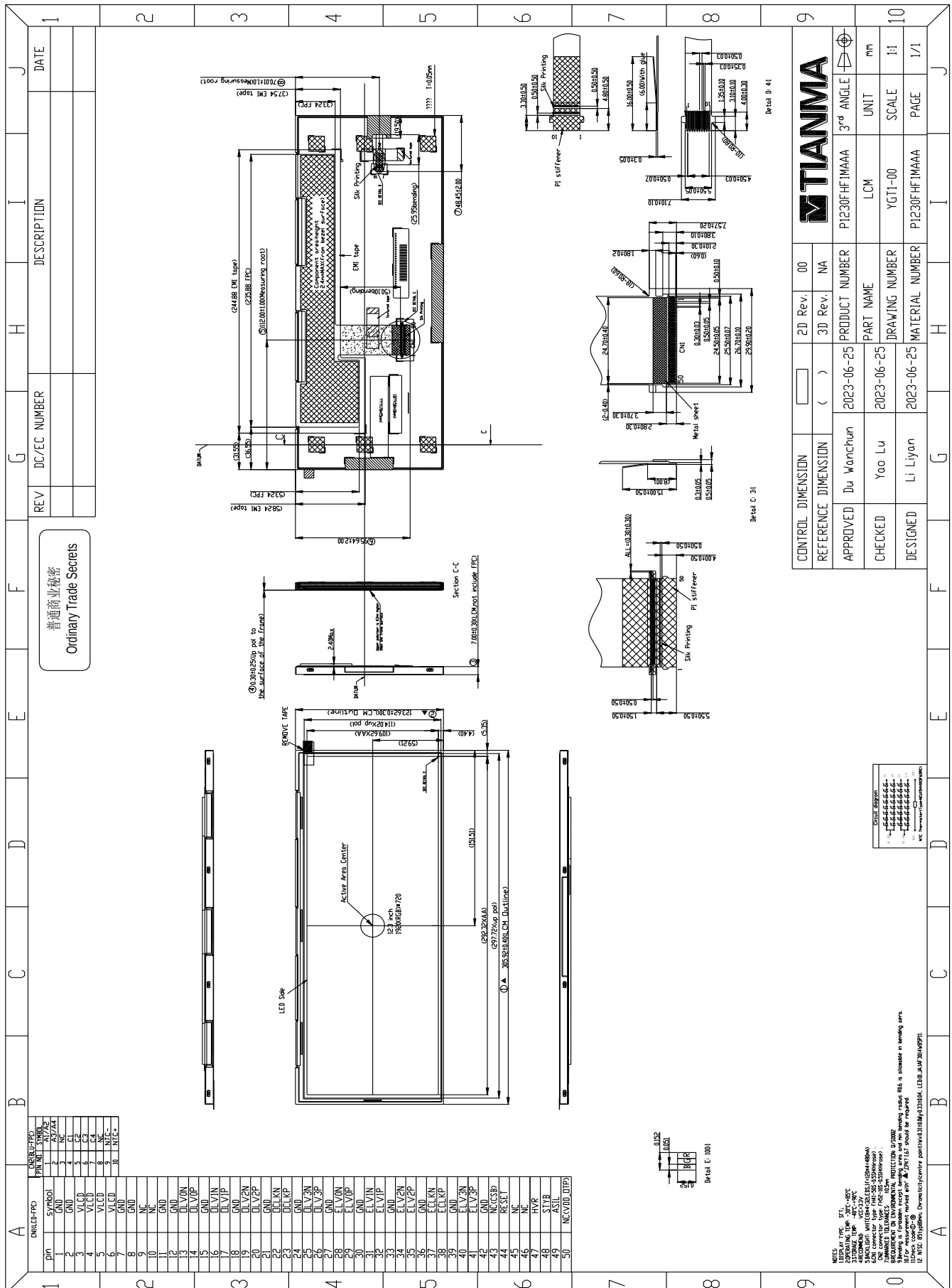
No.	Test Item	Test condition	Criterion
1	High Temperature Storage	95℃ 240H RH≤45% Restore 24H at 25℃ Power off	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Storage	-40℃ 240H Restore 24H at 25℃ Power off	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Operation	+85 240H RH≤45% Restore 24H at 25℃ Power on	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Operation	-30℃ 240H Restore 24H at 25℃ Power on	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & Humidity Operation	60℃, 90%RH 240H Restore 24H at 25℃ Power on	IEC60068-2-78 :2001 GB/T2423.3—2016
6	Thermal Shock (non-operation)	-40℃→ change→+85℃ 30min 5min 30min, 100cycle Restore 24H at 25℃	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, GB2423.22-2012
7	Vibration (Non-operation)	Frequency: 10~55Hz Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 120min for each direction of X.Y.Z.	IEC600682-6:1982 GB2423.10-2019
8	Shock (Non-operation)	Half Sine Wave 60G ,6ms,±X,±Y,±Z 3times for each direction	IEC60068-2-27:1987 GB/T2423.5—2019
9	ESD	C=150 pF、R=330 Ω, 5point/panel Air V=±8kV; Contact V=±4kV, 5 times/ each point	IEC61000-4-2:2001 GB/T 17626.6-2006
10	Package Vibration	Frequency range: 5-20-200HZ, PSD : 0.01-0.01-0.001 Total:0.781g ² /Hz, 30min for each direction of X.Y.Z.	GB/T 4857.23-2012
11	Package Drop	Height: TBD cm, 1corner,3edges,6surfaces Total weight≤10Kg , Height:80cm; Total weight > 10Kg, , Height:60cm;	GB/T 4857.5-1992

Table 8.1 RA test condition

Note 1: Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

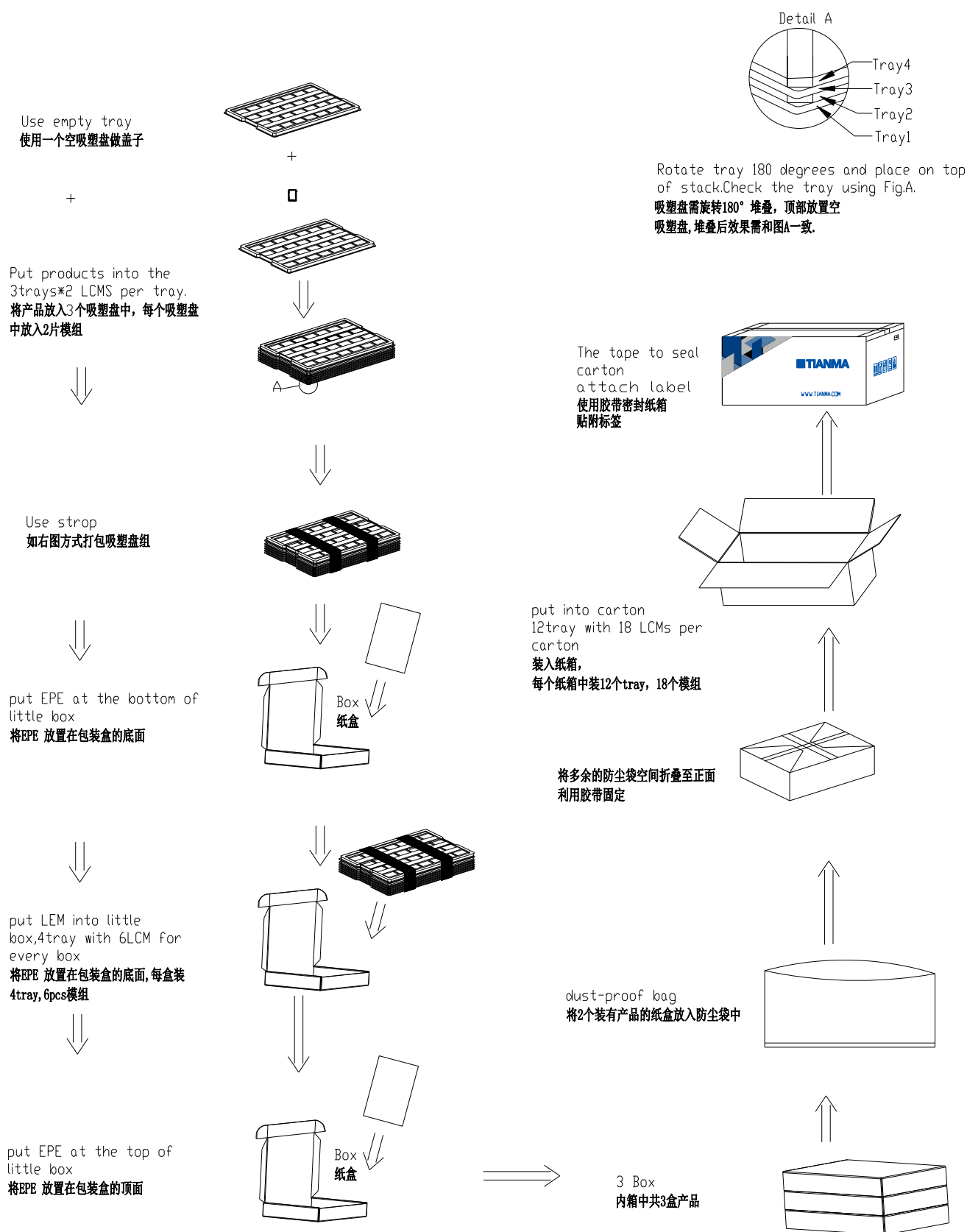
Note 2: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

9. Mechanical Drawing



10. Packing Instruction

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Q'ty	Remark
1	LCM module	P1230FHF1MAAA	305.92×123.62×7.00	0.319	18	
2	Tray	PET	485×330×35	0.215	12	
3	Dust-proof Bag	PE	700×545×0.05	0.021	1	
4	Carton	Corrugated Paper	544×365×250	1.01	1	
5	EPE	EPE	485×330×5mm	0.016	6	
6	BOX	Corrugated Paper	520×345×74mm	0.38	3	
7	Label		100×52	0.001	1	
8	Total weight	10.59 Kg ± 10%				



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 alcoholSolvents 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 carefully to limit or stop its function when over current is detected on the LED.