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1. Summary

1.1 General Description

This is a 7 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 (Min)
- Wide temperature range: -30~85°C
- Interface: 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	7 inch	
	Resolution	1280(RGB)x768	
	Pixel Pitch	0.1191x0.11191	mm
	TFT Active Area	152.448x91.4688	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)	168.36x109.10x6.03	mm
	Weight	TBD	g
Optical Characteristics	Luminance	Min:1000	cd/m ²
	Contrast Ratio	Typ:1000:1	
	NTSC	Typ:80	%
	Viewing Angle	Typ:85/85/85/85	degree
Electrical Characteristics	Interface	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	
Matching connector	FH52-40S-0.5SH or equivalent

Table 3.1.1 Connector information

PIN #	Symbol	P/I/O	Description	Remark
1	A1	P	LED A1	--
2	A2	P	LED A1	--
3	A3	P	LED A1	--
4	NC	N	Keep this pin open	--
5	K1	P	LED K1	--
6	K2	P	LED K1	--
7	K3	P	LED K1	--
8	NC	N	Keep this pin open	--
9	NTC+	O	Thermistor	--
10	NTC-	O	Thermistor	--
11	NC	N	Keep this pin open, TIANMA Test pin(VDDOTP)	--
12	VCC	P	Power supply 3.3+/-0.1V	--
13	VCC	P	Power supply 3.3+/-0.1V	--
14	GND	P	Ground	--
15	GND	P	Ground(TIANMA Test pin: SCL)	--
16	GND	P	Ground(TIANMA Test pin SDA)	--
17	STBYB	I	Standby mode setting pin. Active low	--
18	LR	I	Horizontally Inverted	Note3
19	UD	I	Vertically Inverted	
20	NC	N	Keep this pin open, TIANMA Test pin(CS)	--
21	GND	P	Ground	--
22	LVDS_RX_IN3+	I	LVDS Data input 3+ (R6-R7,G6-G7,B6-B7)	--
23	LVDS_RX_IN3-	I	LVDS Data input 3- (R6-R7,G6-G7,B6-B7)	--
24	GND	P	Ground	--
25	LVDS_CLK_IN+	I	Positive LVDS CLK input	--
26	LVDS_CLK_IN-	I	Negative LVDS CLK input	--
27	GND	P	Ground	--

PIN #	Symbol	P/I/O	Description	Remark
28	LVDS_RX_IN2+	I	LVDS Data input 2+ (B2-B5,HS,VS,DE)	--
29	LVDS_RX_IN2-	I	LVDS Data input 2- (B2-B5,HS,VS,DE)	--
30	GND	P	Ground	--
31	LVDS_RX_IN1+	I	LVDS Data input 1+ (G1-G5,B0-B1)	--
32	LVDS_RX_IN1-	I	LVDS Data input 1- (G1-G5,B0-B1)	--
33	GND	P	Ground	--
34	LVDS_RX_IN0+	I	LVDS Data input 0+ (R0-R5,G0)	--
35	LVDS_RX_IN0-	I	LVDS Data input 0- (R0-R5,G0)	--
36	GND	P	Ground	--
37	RST	I	Reset pin.	--
38	GND	P	Ground	--
39	NC	N	Keep this pin OPEN	--
40	GND	P	Ground	--

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: Description of scan direction

UD	LR	Description
L	L	Case1
	H	Case2
H	L	Case3
	H	Case4

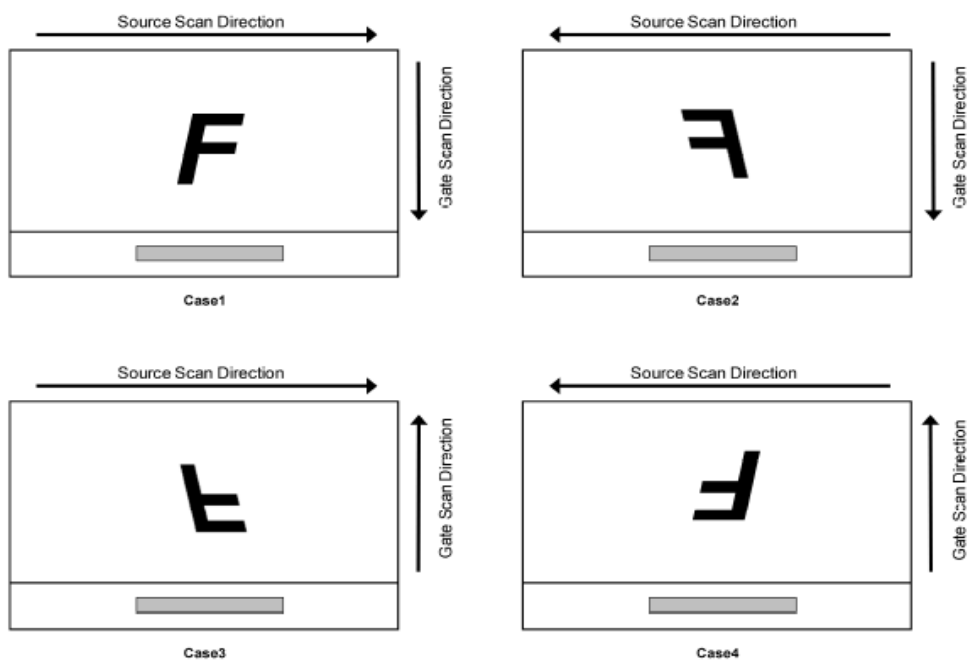


Figure3.1.1 Description of Scan Direction

4. Absolute Maximum Ratings

GND=0V

Item	Symbol	Min	Max	Unit	Remark
Logic supply voltage	VCC	-0.5	5.0	V	
Digital I/O input signals	VI/O	-0.5	5.0	V	Note1
LVDS signals supply voltage	VLVDS	-0.5	2.0	V	Note2
Operating Temperature	Top	-30	+85	°C	Note3/4
Storage Temperature	Tst	-40	+90	°C	

Table 4.1 Absolute Maximum Ratings

Note1: Digital I/O input signals include LR, UD, RST, STBYB.

Note2: LVDS Signals include LVDS_RX_IN[3:0]+, LVDS_RX_IN[3:0]-, LVDS_CLK_IN+, LVDS_CLK_IN-.

Note3: The temperature is the ambient temperature of module.

Note4: 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

VCC=3.3V, GND=0V, Top=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Main and I/O Power Supply	VCC	3.2	3.3	3.4	V	
VCC Current	IVCC		TBD		mA	Note5
Low level input voltage	Vil	0	-	0.3*VCC	V	Note1
High level input voltage	Vih	0.7*VCC	-	VCC	V	
Differential input low common mode voltage	Rxvcm	1	1.2	1.4	V	Note2
Differential input voltage	Vid	0.1	-	(1.5-Rxvcm)*2	V	
Differential input high threshold voltage	Vth	0.1				Note3
Differential input low threshold voltage	Vtl			-0.1		
LVDS input voltage	Vinlv	0.5	-	1.5		
Pull High/Low Resistor	Ri	-	100	-	Kohm	
Inrush current	Irush	-	-	TBD	A	Note4
LCD Power Consumption	P _{VCC}	-	TBD		W	Note5

Table 5.1.1 Operating Voltages

Note1: I/O powers are include LR, UD, RST, STBYB.

Note2: Differential input low common mode voltage.

Single-end signals

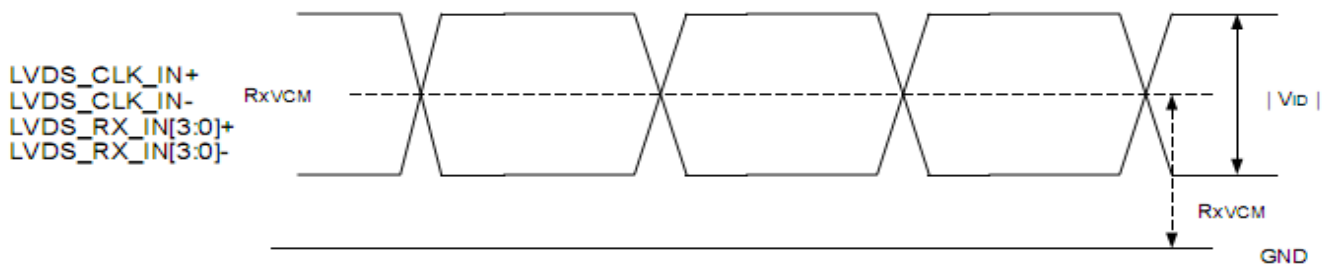


Figure 5.1.1 LVDS Interface Waveform

Note3: Differential input high threshold voltage.

Different signals

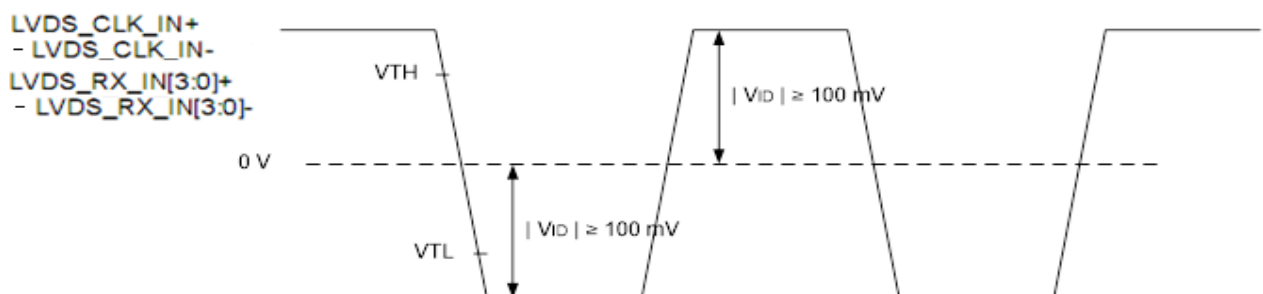


Figure 5.1.2 LVDS Interface Waveform

Note4: Inrush current should be tested under VCC rising time 470us.

VCC rising time is 470μs

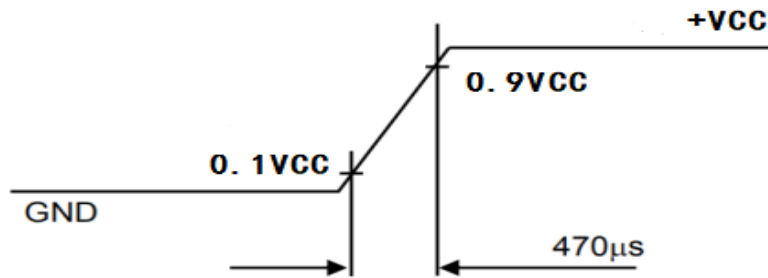


Figure5.1.3 VCC rising timing

Note5: VDD current and LCD power consumption data are tested under VCC=3.3V, white pattern condition. LCD power consumption does not include the backlight power consumption.

5.2 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I _F	-	76	90	mA	Each String.Note1
		-	228	270	mA	Totally 3 strings. Note1
Forward Voltage	V _{BL}	-	24.8	26.4	V	Note2
Backlight Power Consumption	W _{BL}	-	TBD	-	W	Note2
Lifetime	-	-	50,000	-	Hrs	Note3

Table 5.2.1 LED Backlight Characteristics

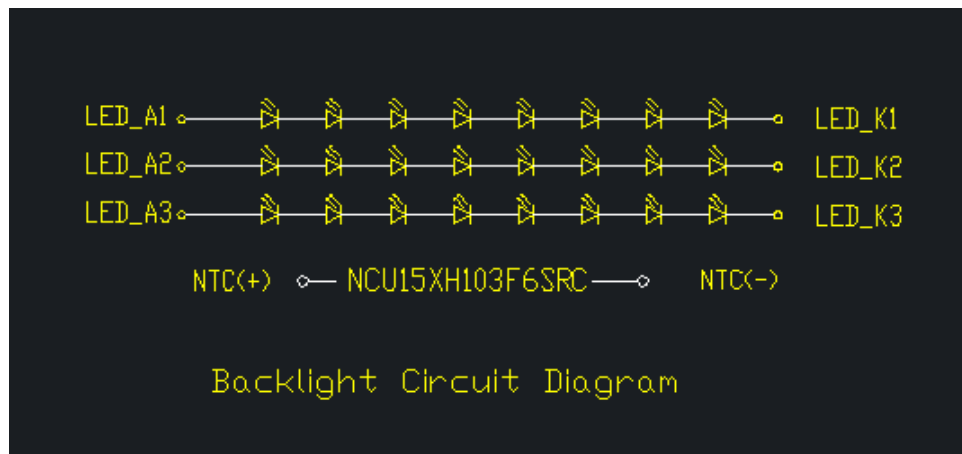


Figure 5.2.2 LED Connection of Backlight

Note1: I_F is defined for one channel LEDs. There are 7 LEDs in the each channel, totally 21pcs LEDs as there are 3 channels . While the LCM is operating, a stable forward current should be supplied. The forward current max value is only for inrush current.

Note2: I_F =80mA.

Note3: Optical performance should be evaluated at Ta=25°C only. Operating lifetime means the brightness will decrease to 50% of the original brightness.

Note4: An NTC thermistor is included in the LED circuit. It is used to measure the LED temperature and it located in the LED circuit on the backlight.

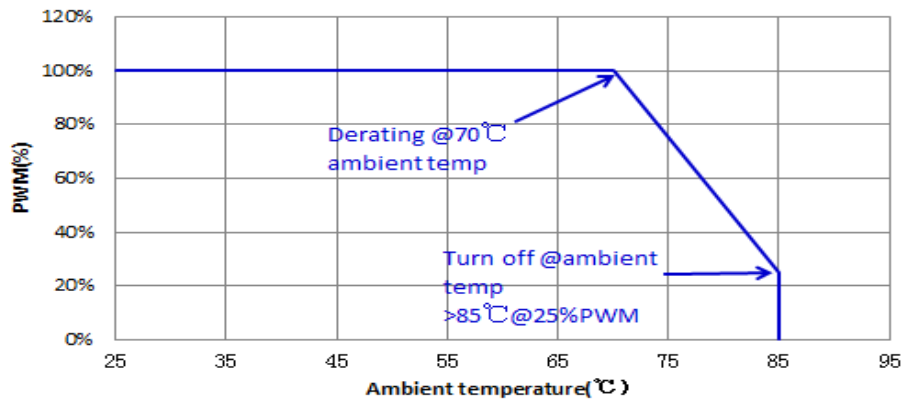


Figure 5.2.2 PWM vs. Ambient Temperature

Note5: To reduce the influence of NTC self-heating and improve the measurement accuracy, suggest the operating current of NTC is 0.01mA.

5.3 Recommended Power ON/OFF Sequence

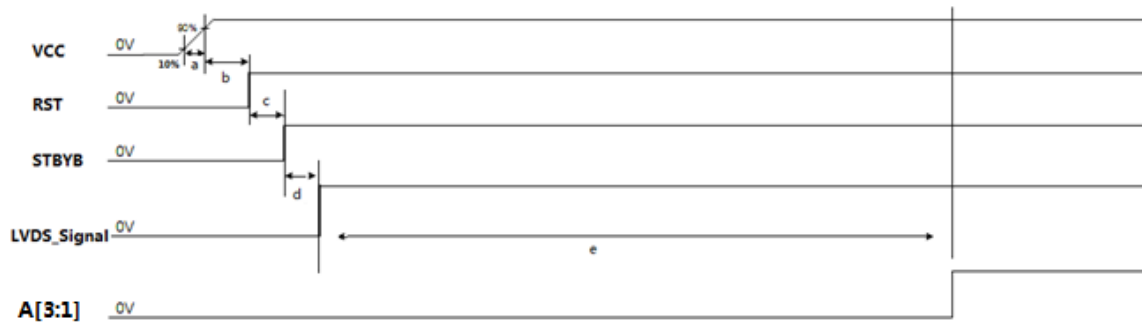


Figure 5.3.1 Power ON Sequence

Parameter	Min	Typ	Max	Unit
Ta	1	-	20	ms
Tb	1	-	-	ms
Tc	1	-	-	ms
Td	0	-	-	ms
Te	300	-	-	ms

Table 5.3.1 Power ON Sequence

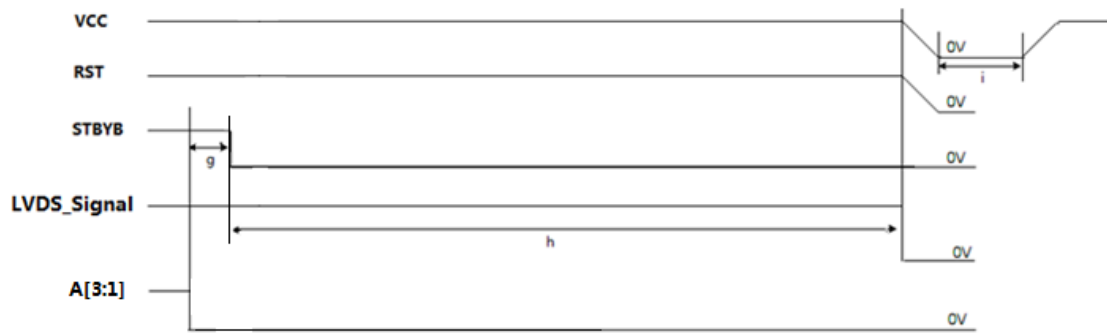


Figure 5.3.2 Power OFF Sequence

Parameter	Min	Typ	Max	Unit
Tg	20	-	-	ms
Th	200	-	-	ms
Ti	1	-	-	s

Table 5.3.1 Power OFF Sequence

Note1: The low level of these signals and analog powers are GND level.

Note2: All of the power and signals should be kept at GND level before power on. If there are residual voltages on them, the LCD might not work properly.

Note3 A[3:1] is the voltage applied to backlight. Keep it turned off until the display has stabilized.

5.4 Reset Timing

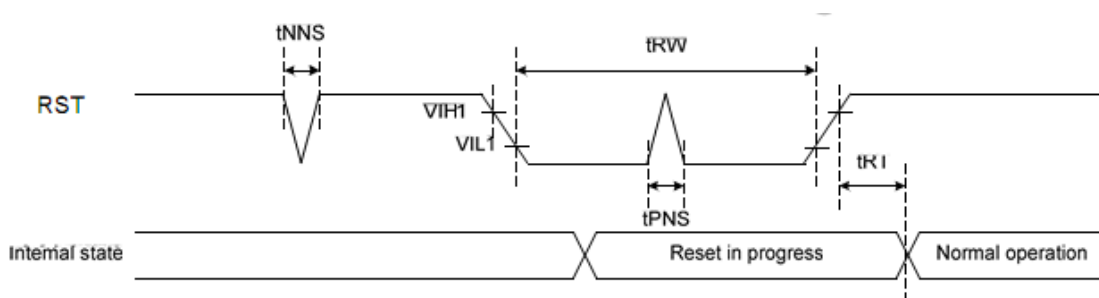


Figure 5.4.1 Reset Timing

Signal	Paramete	Symbol	Min	Typ	Max	Unit	Remark
RST	Reset pulse width	tRW	150	-	-	us	
	Reset complete time	tRT	-	-	150	us	
	Positive spike noise width	tPNS	-	-	40	ns	
	Negative spike noise width	tNNS	-	-	40	ns	

Table 5.4.1 Reset Timing

5.5 LCD Module Block Diagram

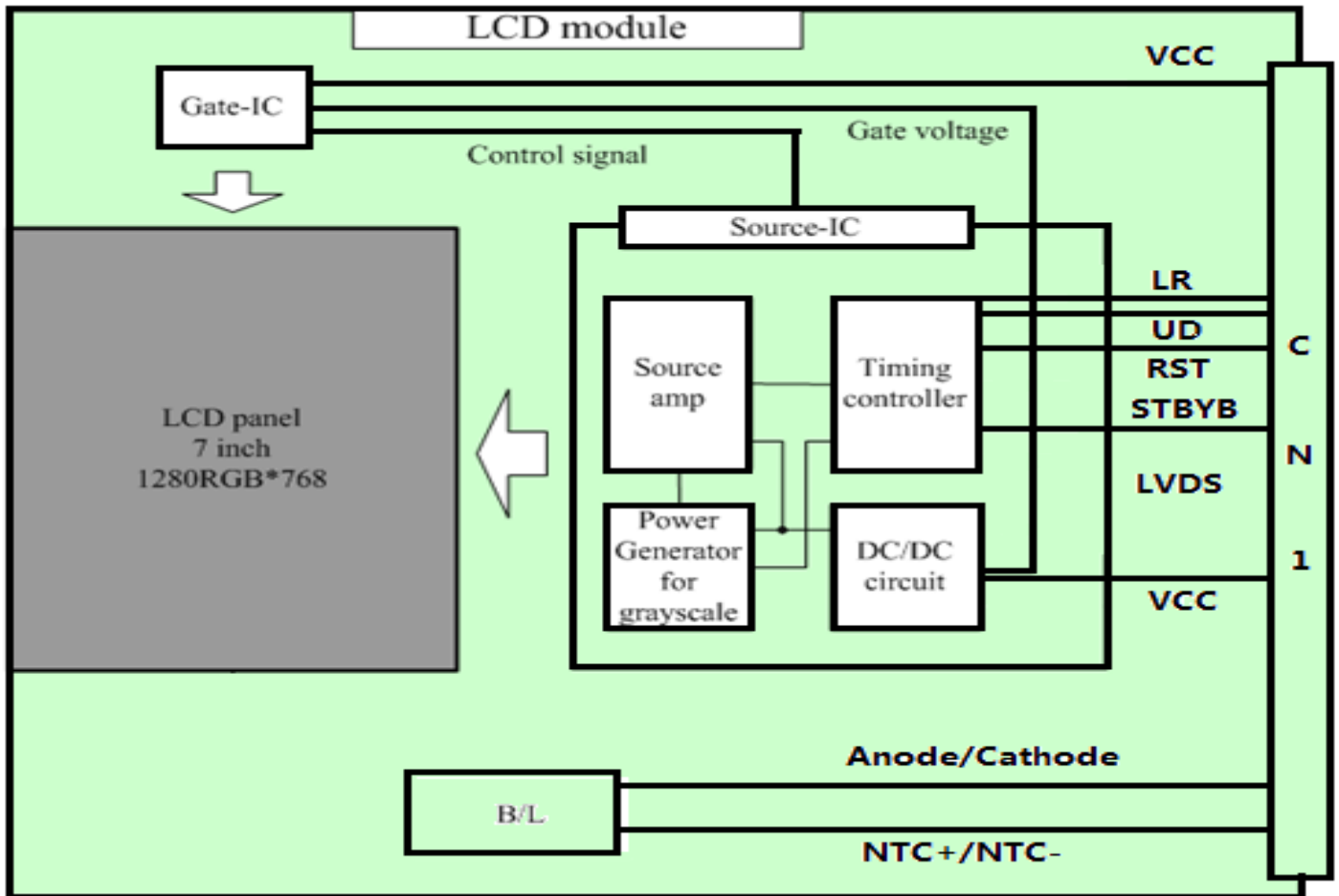


Figure 5.5.1 LCD Module Block Diagram

6. Interface Timing Characteristics

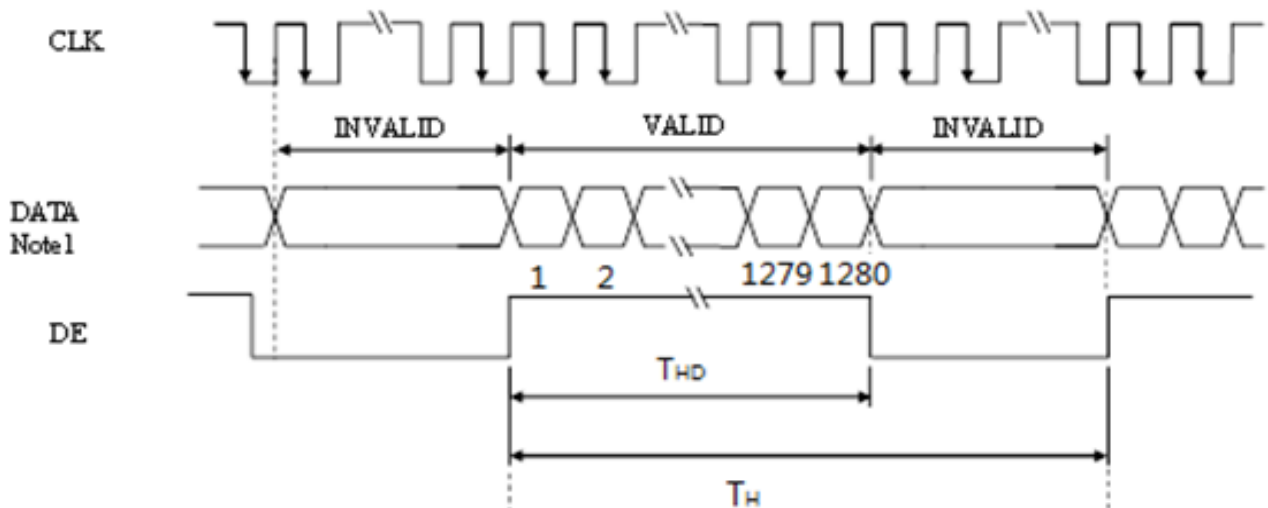
6.1 RGB Timing at DE mode

LVDS Interface Timing Characteristics

Parameter	Symbol	Unit	Min.	Typ.	Max.	Remarks
DClock Frequency	F_{DCLK}	MHz	62.23	62.58	79.12	
Horizontal valid data	T_{HD}	DCLK	1280			
1 horizontal line	T_h	DCLK	1340	1344	1470	
Vertical valid data	T_{VD}	H	768			
1 vertical field	T_v	H	774	776	897	
Frame Rate	FR	Hz	60			

Table 6.1.1 Input Timing

Horizontal timing



Vertical timing

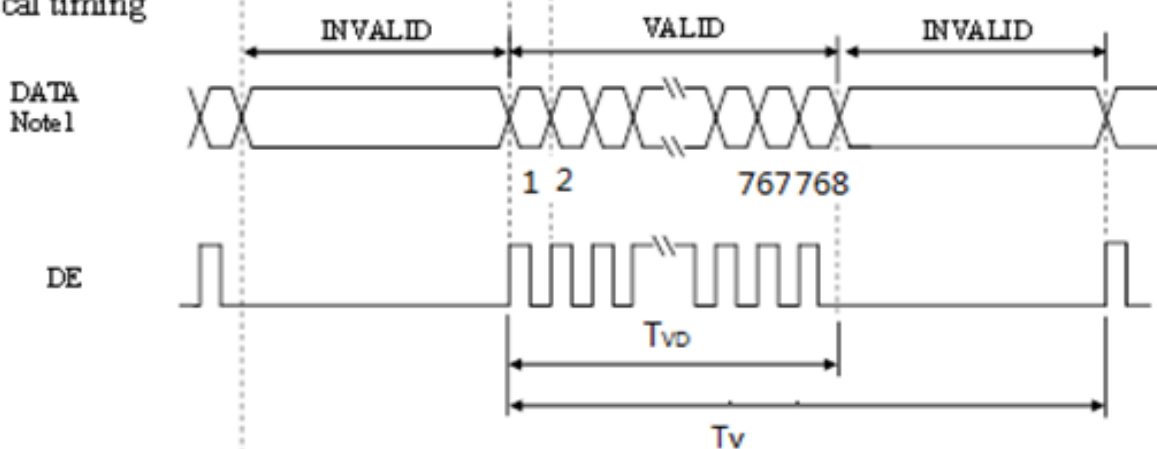


Figure 6.1.1 Clock and Data Input Timing Diagram

6.2 RGB Timing Parameter Setting

6.2.1 LVDS data mapping

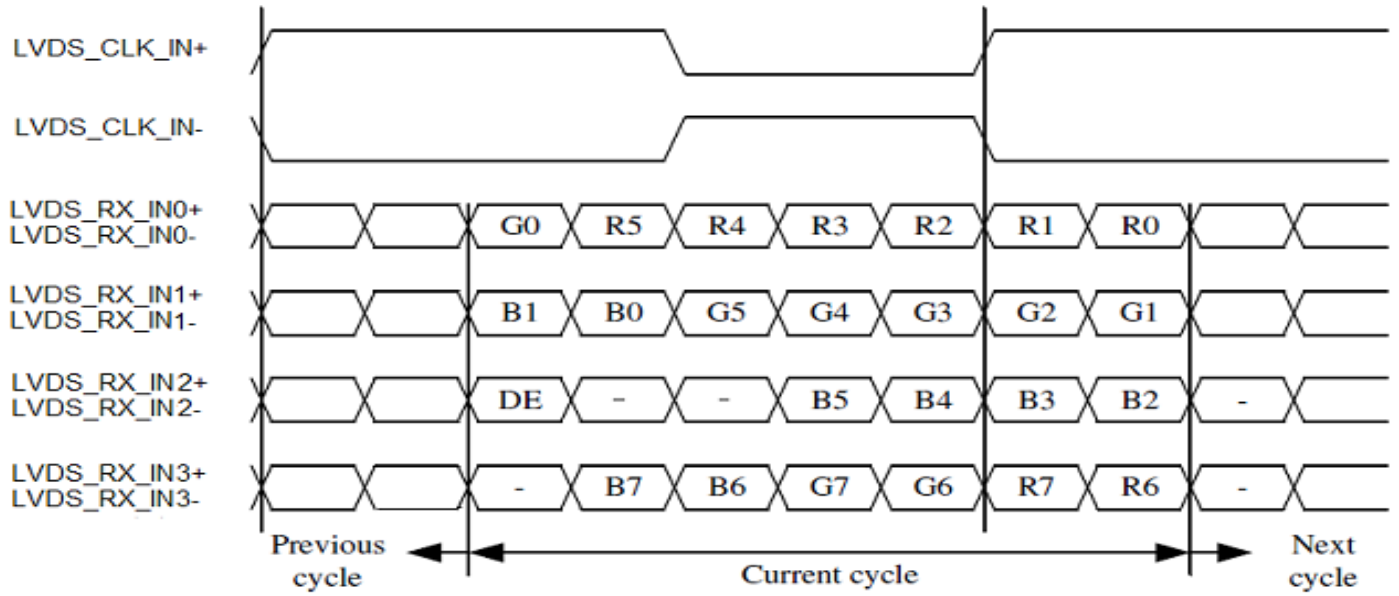


Figure 6.2.1.1 LVDS 8-bit data VESA mapping

6.2.2 LVDS data mapping

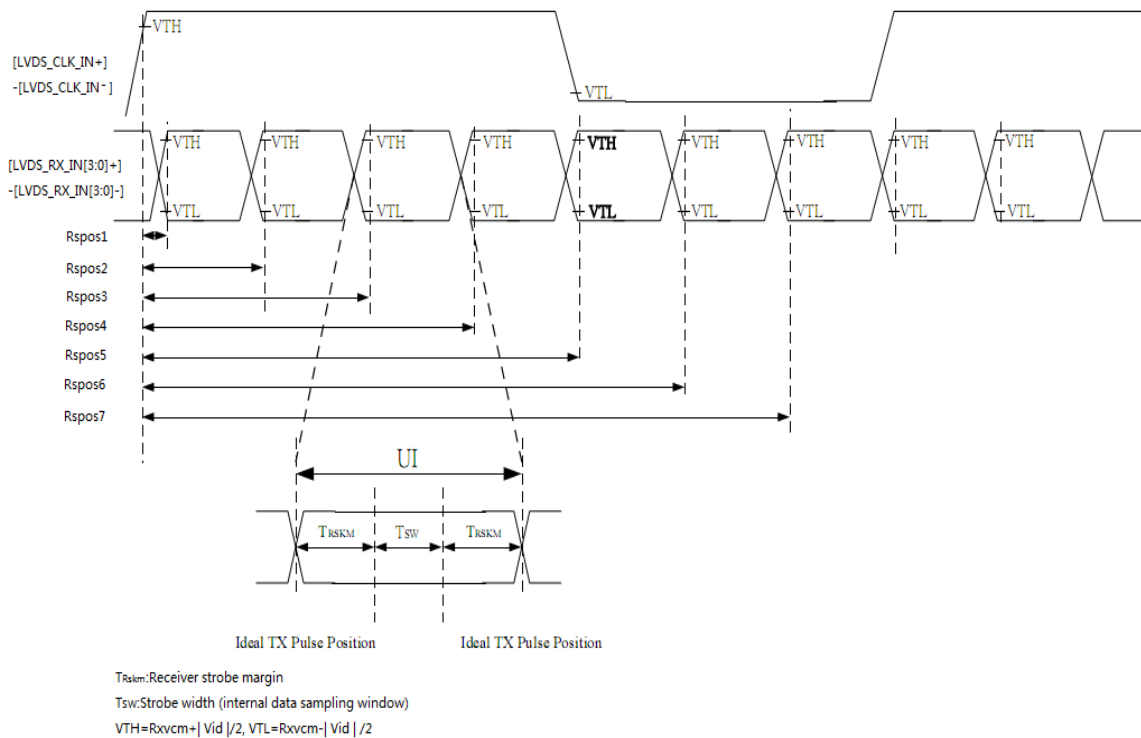


Figure 6.2.2.1 LVDS Input Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	R_{XFCLK}	10	-	110	MHz
1 data bit time	UI	-	1/7	-	1/ R_{XFCLK}
Position 1	Rspos1	-0.2	0	0.2	UI
Position 2	Rspos2	0.8	1	1.2	UI
Position 3	Rspos3	1.8	2	2.2	UI
Position 4	Rspos4	2.8	3	3.2	UI
Position 5	Rspos5	3.8	4	4.2	UI
Position 6	Rspos6	4.8	5	5.2	UI
Position 7	Rspos7	5.8	6	6.2	UI
Input data skew margin	T_{RSKM}	-	-	0.2	UI
Clock high time	T_{LVCH}	-	$4/(7 * R_{XFCLK})$	-	ns
Clock low time	T_{LVCL}	-	$3/(7 * R_{XFCLK})$	-	ns
Input eye width	TEYEW	0.6			UI
Input eye border	TEX			0.2	UI

Table 6.2.2.1 LVDS Input Timing Parameters

7. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark		
View Angles	θT	$CR \geq 10$	75	85	--	degree	Note2,3		
	θB		75	85	--				
	θL		75	85	--				
	θR		75	85	--				
Contrast Ratio	CR	$\theta=0^\circ$	800	1000	--		Note 3		
Response Time	T_{ON}	25°C	--	20	30	ms	Note 4		
	T_{OFF}								
Chromaticity	White	CIE1931-XY Z					Note 1,5		
								x	TBD
	y							TBD	
	Red							x	TBD
								y	TBD
	Green							x	TBD
								y	TBD
	Blue							x	TBD
y		TBD							
Uniformity	U		--	--	--	%	Note 6		
NTSC	-		65	70	--	%	Note 5		
Luminance	L		1000	TBD	--	cd/m ²	Note 7		

Table 7.1 Optical Parameters

Test Conditions:

1. $I_F= 80$ mA, and the ambient temperature is 25°C.
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.

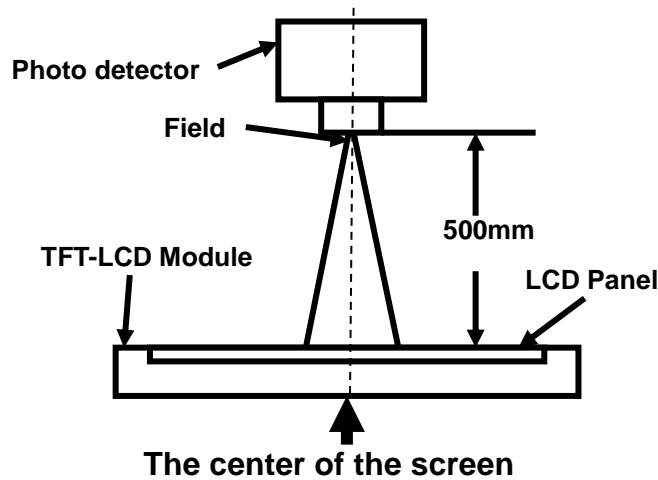


Fig1.Measurement Set Up

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

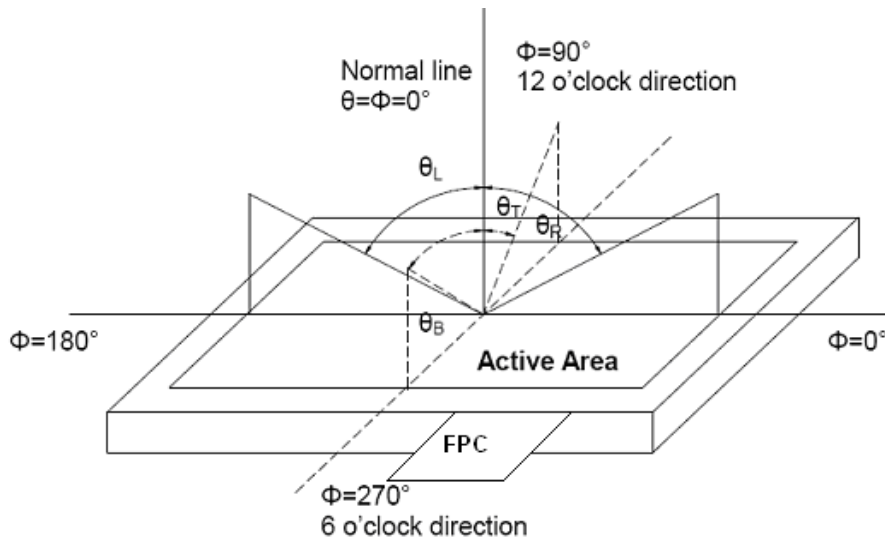


Fig2. Measurement viewing angle

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%.

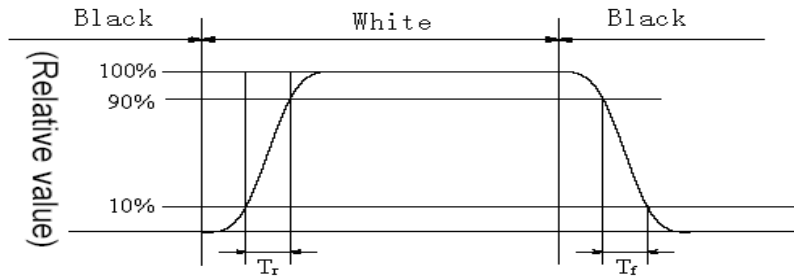


Fig4.Response Time Testing(SFT)

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

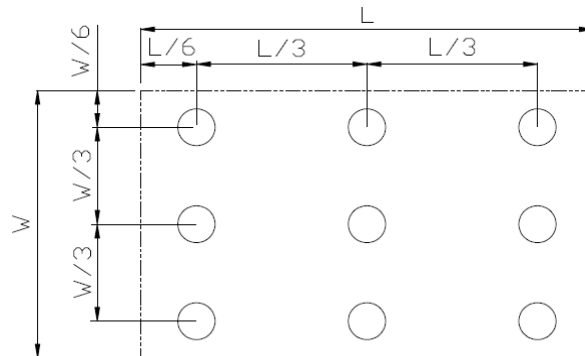


Fig5. Luminance Uniformity Measurement Locations(9 points)

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	90°C, 500hrs Restore 2hrs or more at 25°C	Note1, Note2, Note4, Note5, IEC60068-2-2,GB2423.2
2	Low Temperature Storage	-40°C 500hrs Restore 2hrs or more at 25°C	Note1, Note2, Note4, IEC60068-2-1,GB2423.1
3	High Temperature Operation	80°C±2°C, 500hrs, Restore 2hrs or more at 25°C	Note1, Note2, Note4, Note5, IEC60068-2-2,GB2423.2
4	Low Temperature Operation	-30°C 500hrs Restore 2hrs or more at 25°C	Note1, Note2, Note4 IEC60068-2-1,GB2423.1
5	High Temperature & Humidity Operation	60°C±2°C, 90±2%RH 500hrs Restore 2hrs or more at 25°C	Note1, Note2, Note4 IEC60068-2-78,GB/T2423.3
6	Thermal Shock (non-operational)	-30°C→ change→+80°C 30min 5min 30min 200cycle, Restore 2hrs or more at 25°C	Note1, Note2, Note4 Start with cold temperature End with high temperature, IEC60068-2-14,GB2423.22
7	Vibration Test (non-operational)	TBD (Tianma suggest OLA check the Vibration performance in Cluster, Tianma will cooperate to improve if have any issue)	Note1, Note2 IEC 60068-2-6
8	Shock Test (non-operational)	100G, 6ms, ±X, ±Y, ±Z, 3times for each direction	Note1, Note2 IEC 60068-2-27
9	ESD (operational)	TBD	Note1, Note2, Note3 IEC61000-4-2
10	Package Vibration	Frequency range: 5~20-200Hz, PSD:0.01-0.01-0.001 Total:0.781g ² /Hz, Time: X/Y/Z 30min for each direction	Note1, Note2 GB/T 4857.23-2012
11	Package Drop Test	Height: X cm, 1 corner, 3edges, 6 surfaces Ps: if ≥10Kg X=60cm; <10Kg X=80cm	Note1, Note2 GB/T 4857.5-1992

Table 8.1 RA test condition

Note 1: After completion of the test, the sample shall be free from the following defects:

- 1) Air bubble in the LCD
- 2) Seal leak
- 3) Non-display
- 4) Missing segments
- 5) Glass crack
- 6) Yellowish or reddish appearance and will not be taken into consideration after RA tests
- 7) Tiny bright dot and dense tiny highlights will not be accepted under ND 2% filter after RA tests

Note 2: Use sample for only one reliability test.

Note 3: In case of an abnormal display caused by discharge, if it can recover to normal state after reset, it is considered "PASS". The use of an ionizer (antistatic blower) is recommended during this test. When removing the protection film from LCM panel, do it at a slow speed (preferably more than one second) and blow with ionizer toward the peeling face to minimize ESD which may damage the electrical circuit.

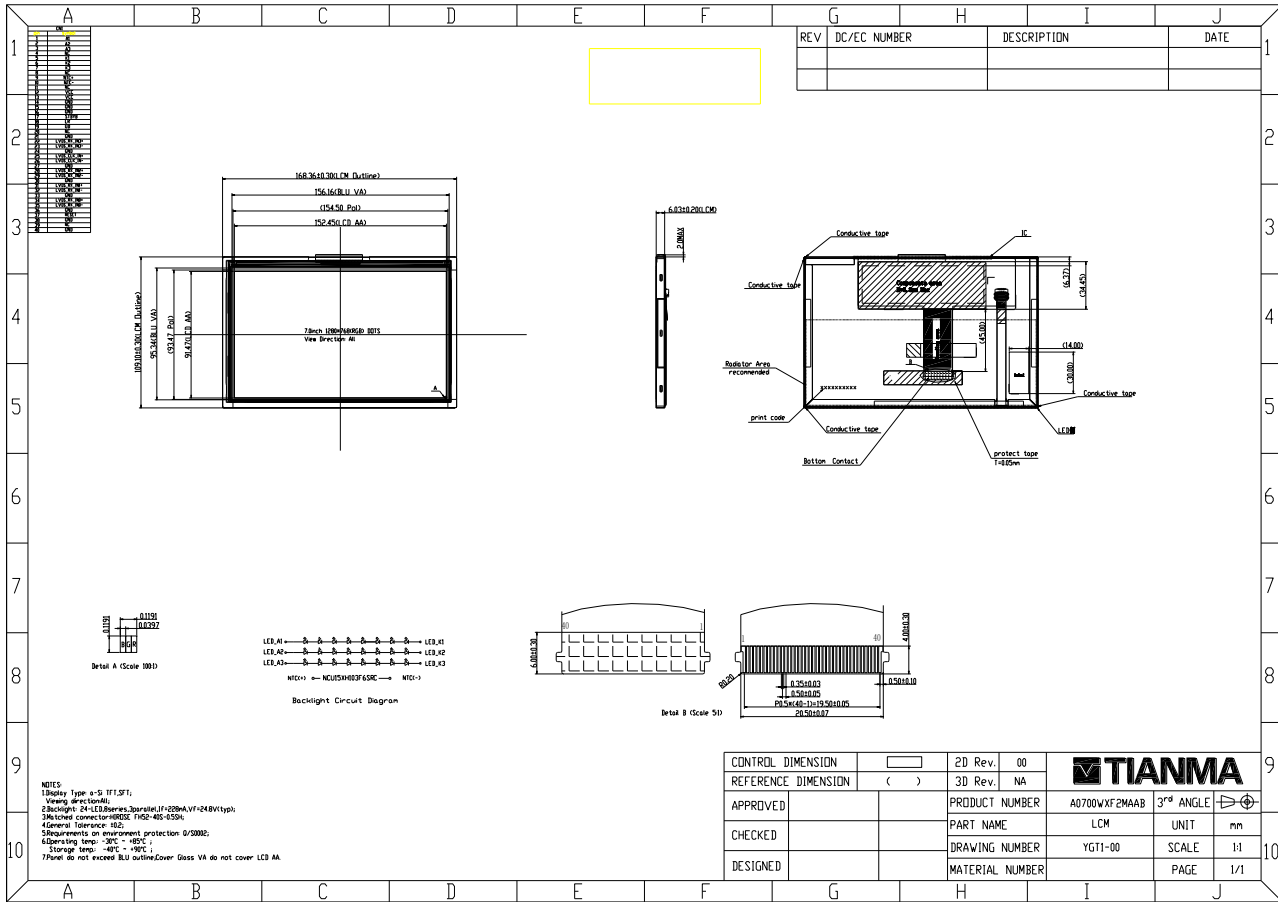
Note 4: For duration test in the chamber

- a. Keep a small distance between each sample and don't place the samples close to the wall or the wick. Don't open the chamber unless absolutely necessary.
- b. During the test, avoid moisture condensation on the polarizer.
- c. After taking the samples out of the chamber and returning to room temperature and humidity, wait at least two hours before inspecting and measuring data.
- d. The temperature is the ambient temperature of sample.

Note 5: Polarizer color minor change (Such as reddish) will consider as pass if the optical test data is within spec.

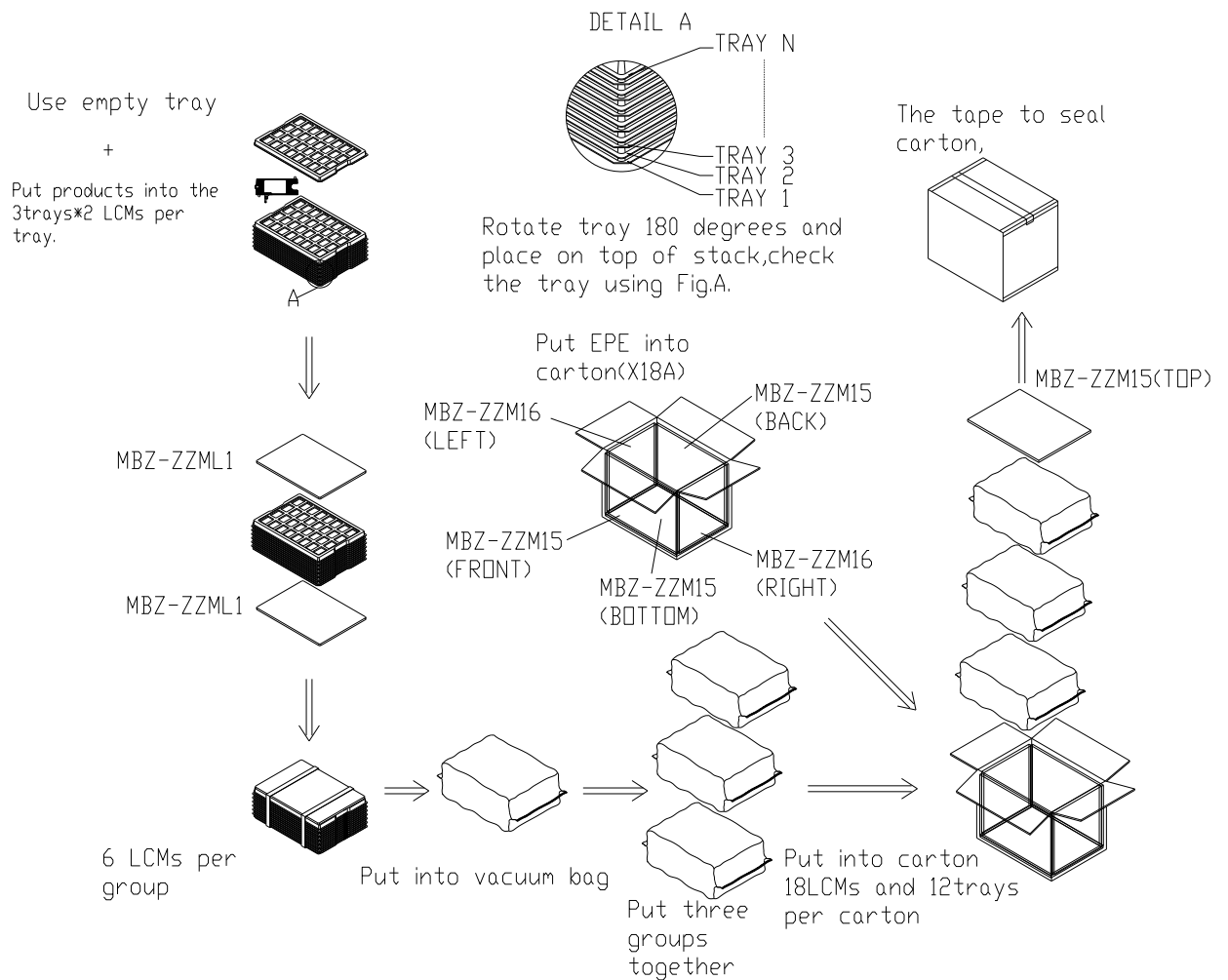
Note 6: Tianma suggests that EMC related test to be carried out on customer's unit and Tianma will assist to improve EMC performance if required

9. Mechanical Drawing



10. Packing Instruction

No	Item	Model (Material)	Dimensions(m m)	Unit Weight(Kg)	Q'ty	Remark
1	LCM module		TBD	TBD	144	
2	Tray	PET (Transmit)	TBD	TBD	27	
3	Dust Proof Bag	PE	TBD	TBD	1	
4	BOX	CORRUGATED PAPER	TBD	TBD	3	
5	Carton	CORRUGATED PAPER	TBD	TBD	1	
6	Total weight	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 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.