SPECIFICATION

[◉] Preliminary Specification
[ ] Final Specification

Description **15” 1024xRGBx768 TFT-LCD Module**

Part Number **P1500XGF2MB01**

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

Rev	Date	Page	Revision Items	Editor
1.0	2024/07/04	-	First Pre-spec release	Hongwei Liu
1.1	2024/07/04	3	Update connector CN1	Hongwei Liu
1.2	2024/10/08	-	Revise date of Spec	Hongwei Liu
1.3	2025/02/20	3	Update Pin Assignment for LCD Interface	Hongwei Liu
1.3	2025/02/20	9	Update Block Diagram	Hongwei Liu
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1.3	2025/02/20	19	Update LCM drawing	Hongwei Liu
1.4	2025/08/12	-	Update Part Number. P1500XGF1MB01→P1500XGF2MB01	Hongwei Liu

CONTENTS

1. Summary

1.1 General Description

This is a 15 inch a-Si TFT-LCD module with Normal- black technology. It is composed of a TFT-LCD panel, a driver circuit, PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- Interface: LVDS
- LED driver integrated

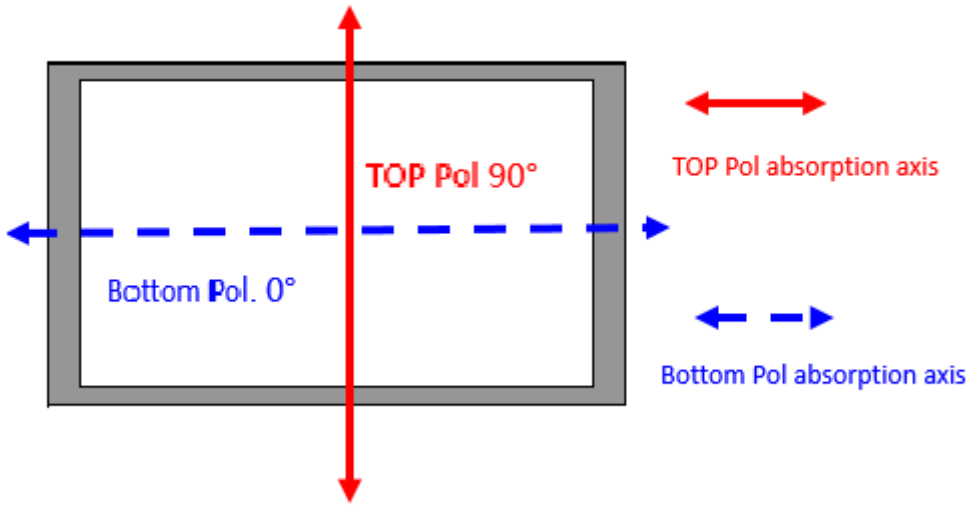
- Acquisition product for UL62368-1/CSA C22.2 No.62368-1-03 (File number: E250878)
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	15 inches	
	Resolution	1024(RGB)x768	
	Pixel Pitch	0.297 x 0.297	mm
	TFT Active Area	304.128 x 228.096	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT	
	Surface Treatment	Anti-Glare，2H	
	Viewing Direction	All direction	
	Gray Scale Inversion Direction	NA	
Mechanical Characteristics	LCM (W x H x D)	326.5 x 253.5 x 11.8	mm
	Weight	TBD	g
Optical Characteristics	Luminance	400	cd/m^2
	Contrast Ratio	1500:1	
	NTSC	60	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	1port LVDS	
	Color Depth	16,194,277 colors	color
	Power Consumption	LCD:TBD Backlight:TBD	mW

Table 2.1 General TFT Specifications

Note: Polarizer absorption axis as follow:



3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	185083-20121-3 (P-TWO) or equivalent
Matching connector	DF14-20S-1.25C (Hirose) or equivalent

Table 3.1.1 Connector information

No	Symbol	I/O	Description		Comment
1	VCC	P	Power supply +3.3V		
2	VCC	P	Power supply +3.3V		
3	GND	P	Power ground		
4	GND	P	Power ground		
5	D0-	I/O	-LVDS differential data input	MAP A : R2~R7,G2 MAP B: R0~R5,G0	
6	D0+	I/O	+LVDS differential data input		
7	GND	P	Power ground		
8	D1-	I/O	-LVDS differential data input	MAP A : G3~G7,B2~ B3 MAP B: G1~G5,B0~B1	
9	D1+	I/O	+LVDS differential data input		
10	GND	P	Power ground		
11	D2-	I/O	-LVDS differential data input	MAP A : B4~B7,DE MAP B: B2~B5,,DE	
12	D2+	I/O	+LVDS differential data input		
13	GND	P	Power ground		
14	CLK-	I/O	LVDS receiver signal CK(-)		
15	CLK+	I/O	LVDS receiver signal CK(+)		
16	GND	P	Power ground		
17	D3-	I/O	-LVDS differential data input	MAP A : R0-R1,G0-G1,B0-B1 MAP B: R6-R7,G6-G7,B6-B7	
18	D3+	I/O	+LVDS differential data input		
19	MSL	I/O	Low or open: MAP B	High: MAP A	
20	NC	/	NC		

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.

3.2 CN2 Pin assignment (Back Light)

Connector Information	
LCD Module connector	MSB24038P5 (STM) or equivalent
Matching connector	P24038P5 (STM) or equivalent

Table 3.2.1 Connector information

No	Symbol	I/O	Description	Remark
1	NC	N	No connection	Keep this pin Open
2	PWM	I	LED PWM signal pin	PWM Dimming
3	BRTC	I	Backlight ON-OFF (H : ON , L : OFF)	
4	GND	P	GND for LED backlight	-
5	VDD	P	Power supply for LED backlight	-

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
TFT Panel Power Voltage	VCC	-0.3	4.0	V	Note1
BL Input voltage	VDD	-0.3	33.0	V	
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: Input voltage include all in put data.
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

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage		VCC	3.0	3.3	3.6	V	
Power supply current		ICC		TBD	TBD		
Permissible ripple voltage		VRP			100	mV	for VCC
Input Signal Voltage	Low Level	VIL	DGND	--	0.3×VCC	V	
	High Level	VIH	0.7×VCC	--	VCC	V	
Output Signal Voltage	Low Level	VOL	DGND	--	DGND+0.4	V	
	High Level	VOH	VCC-0.4	--	VCC	V	
Power Consumption	60Hz	P	--	TBD	--	mW	White pattern

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	Remarks
Power supply voltage		VDD	10.8	12.0	13.2	V	Note1
Power supply current		IDD	-	TBD	TBD	mA	At the maximum luminance control
Permissible ripple voltage		VRPD	-	-	200	mVp-p	for VDD Note3,Note4,Note5
Input voltage for PWM signal	High	VDFH1	1.2	-	5.3	V	Note6
	Low	VDFL1	0	-	0.35	V	
Input voltage for BRTC signal	High	VDFH2	1.5	-	5.3	V	
	Low	VDFL2	0	-	0.8	V	
Input current for PWM signal	High	IDFH1	-	-	800	μA	
	Low	IDFL1	-800	-	-	μA	
Input current for BRTC signal	High	IDFH2	-	-	800	μA	
	Low	IDFL2	-800	-	-	μA	
PWM frequency		f_{PWM}	200	-	20k	Hz	Note7, Note9
PWM duty ratio		DR_{PWM}	1	-	100	%	Note8, Note10,Note11
PWM pulse width		tPWH	5	-	-	μs	Note10,Note11
LED life time		Hr		50000		Hour	Note 12

Table 5.2.1 LED Backlight Characteristics

Note1: When designing of the power supply, take the measures for the prevention of surge voltage.
Note2: This value excludes peak current such as overshoot current.
Note3: The power supply lines (VDD and 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.
Note4: The permissible ripple voltage includes spike noise.
Note5: This product works if the ripple voltage levels are over the permissible values, but there might be noise on the display image.

Note6: See "**5.4 BLOCK DIAGRAM**".
Note7: A recommended f_{PWM} value is as follows.

$$f_{PWM} = \frac{2n-1}{4} \times fv$$

(n = integer, fv = frame frequency of LCD module)

Note8

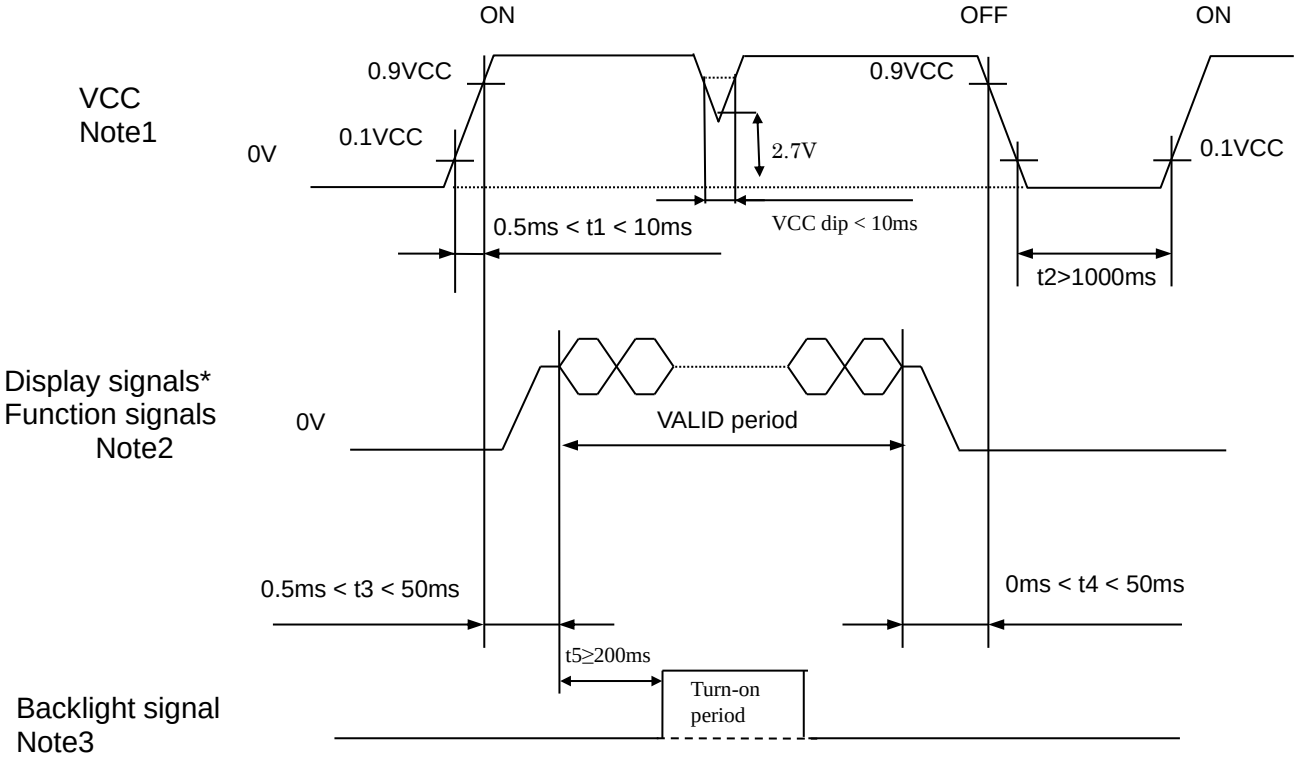
$$DR_{PWM} = \frac{tPWH}{tPW}$$

tPWH: PWM pulse width, tPW: PWM dimming cycle (= $1/f_{PWM}$)

Note9: Depending on the frequency used, some noise may appear on the screen, please conduct a thorough evaluation.
Note10: While the BRTC 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 BRTC signal.
Note11: Regardless of the PWM frequency, both PWM duty ratio and PWM pulse width must be always more than the minimum values.
Note12: Optical performance should be evaluated at Ta=25℃.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

LCD panel signal processing board



* These signals should be measured at the terminal of 100Ω resistances.

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

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CLK+/-) and function signals (MSL) 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, VCC also must be shut down.

Note3: In order to avoid unstable data display, the backlight is recommended to turn on within the VALID period of display. Recommended value: t5 ≥ 200ms.

5.4 LCD Module Block Diagram

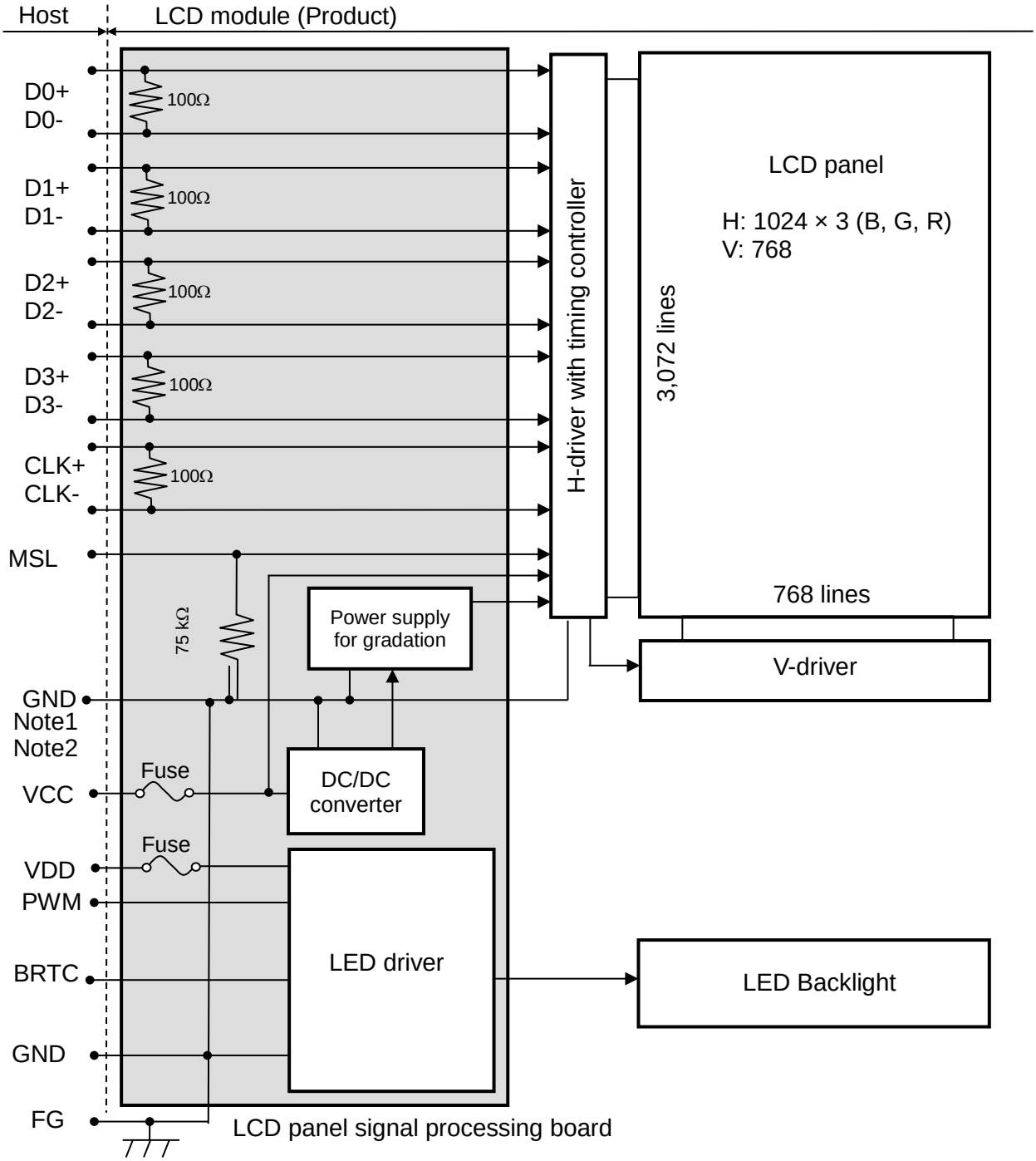


Figure 5.5.1 LCD Module Block Diagram

Note1: Relations between GND (Signal ground) and FG (Frame ground) in the LCD module are as follows.

GND - FG	Connected

Note2: GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds be connected together in customer equipment.

5.5 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	TBD	TBD	1.5A 36V	3.0A	Note1
VDD	TBD	TBD	2.0A 36V	4.0A	

Note1: The power supply's rated current must be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

6. Timing Characteristics

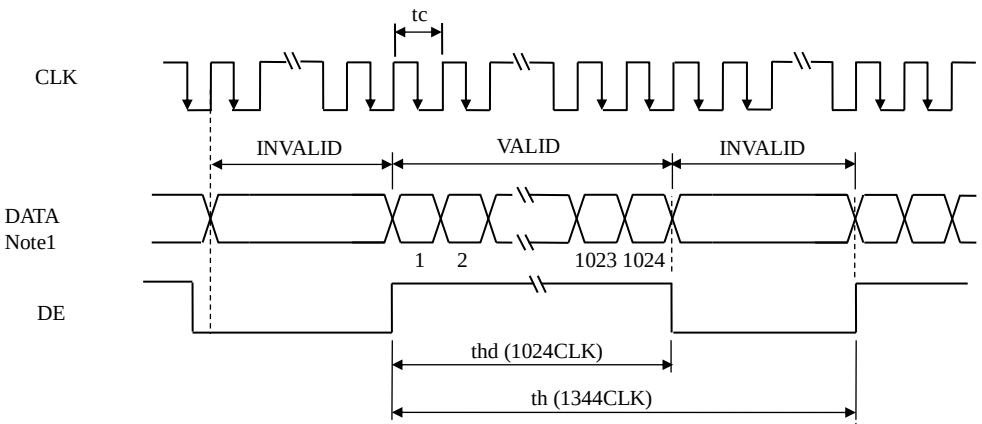
6.1 Timing characteristics

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	52.0	65.0	71.0	MHz	15.385 ns (typ.)
	Duty ratio		-	-			-	-
	Rise time, Fall time		-				ns	
DATA	CLK-DATA	Setup time	-	-			ns	-
		Hold time	-				ns	
	Rise time, Fall time		-				ns	
DE	Horizontal	Cycle	th	16.542	20.676	26.88	μs	48.363 kHz (typ.)
				1,114	1,344	1,400	CLK	
		Display period	thd	1024			CLK	-
	Vertical (One frame)	Cycle	tv	13.34	16.666	20.0	ms	60.0 Hz (typ.)
				780	806	845	H	
		Display period	tvd	768			H	
	CLK-DE	Setup time	-	-			ns	-
		Hold time	-				ns	
	Rise time, Fall time		-				ns	

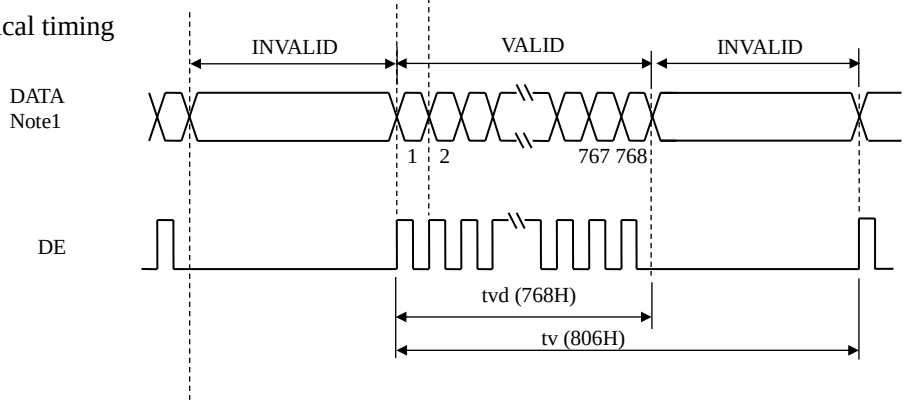
Note1: Definition of parameters is as follows.
tc= 1CLK, th= 1H
Note2: See the data sheet of LVDS transmitter.
Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

6.2 Input Signal Timing Chart

Horizontal timing



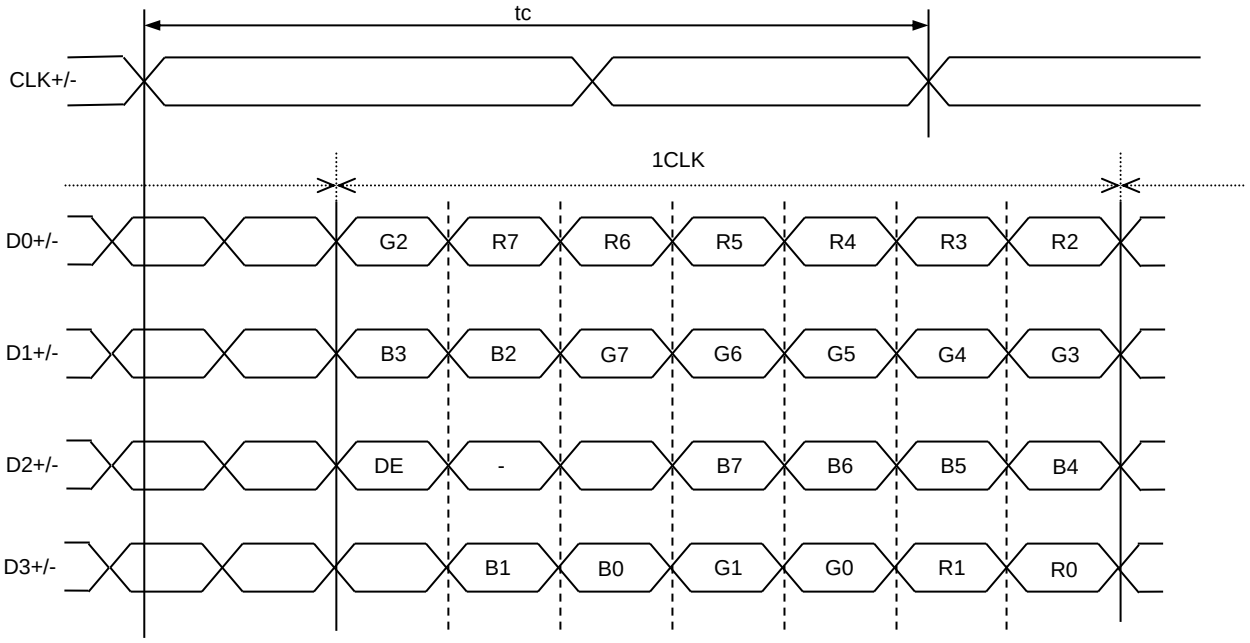
Vertical timing



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

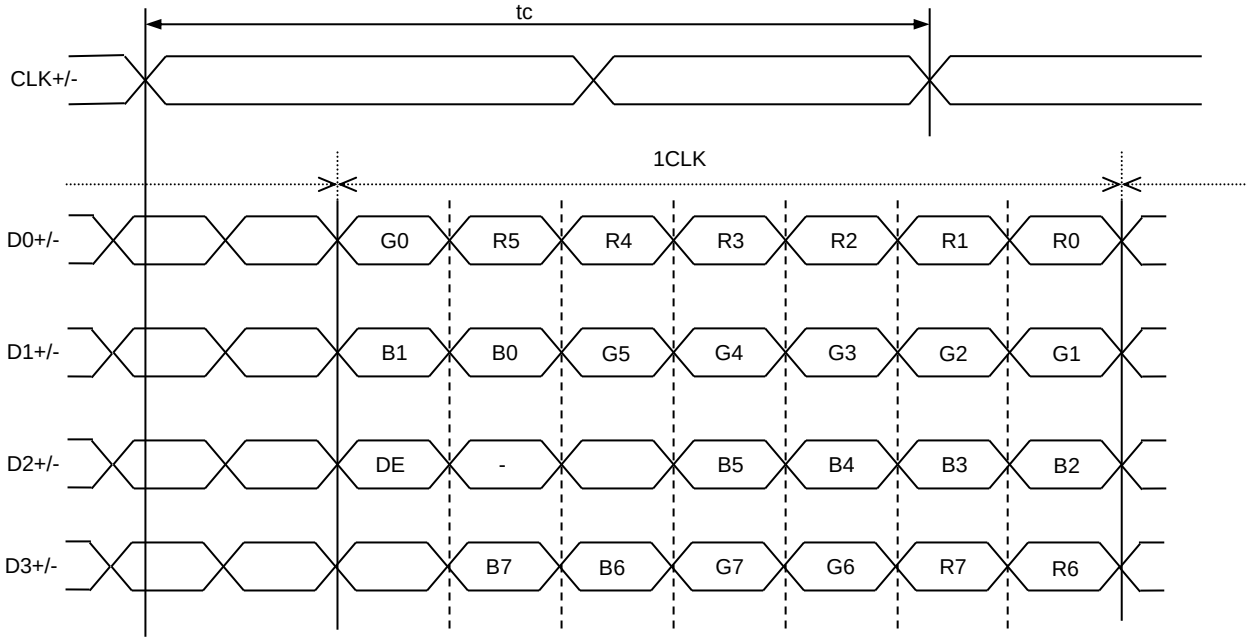
6.3 Input Date Mapping

(1) Input data signal: 8-bit Map A



Note1: LSB (Least Significant Bit) - R0, G0, B0. MSB (Most Significant Bit) – R7, G7, B7
Note2: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

(2) Input data signal : 8-bit Map B



Note1: LSB (Least Significant Bit) - R0, G0, B0. MSB (Most Significant Bit) – R7, G7, B7
Note2: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

6.4 Display Colors and Input Data Signals

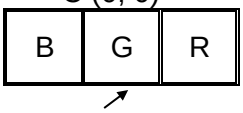
This product can display 16,194,277 colors with 253 gray scales.
Also the relation between display colors and input data signals is as follows.

Display colors		Data signal (0: Low level, 1: High level)																									
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0
	Yellow	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0
Red gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑					:							:								:				
						:							:								:				
		1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bright	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑					:							:								:				
						:							:								:				
		0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0
	↓	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Blue gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑					:							:								:				
						:							:								:				
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0

6.5 Display Positions

The following table is the coordinates per pixel (See **"6.6 SCANNING DIRECTIONS"**.).

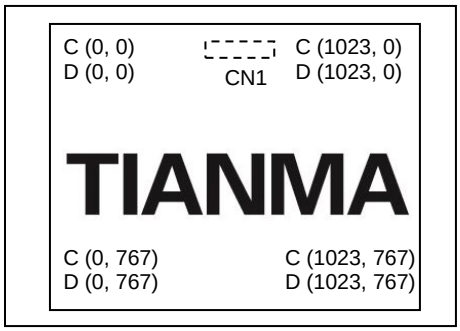
C (0, 0)



C(0, 0)	C(1, 0)	• • •	C(X, 0)	• • •	C(1022, 0)	C(1023, 0)
C(0, 1)	C(1, 1)	• • •	C(X, 1)	• • •	C(1022, 1)	C(1023, 1)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(0, Y)	C(1, Y)	• • •	C(X, Y)	• • •	C(1022, Y)	C(1023, Y)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(0, 766)	C(1, 766)	• • •	C(X, 766)	• • •	C(1022, 766)	C(1023, 766)
C(0, 767)	C(1, 767)	• • •	C(X, 767)	• • •	C(1022, 767)	C(1023, 767)

6.6 Scanning Directions

The following figures are seen from a front view.



Note1

Figure1.Scanning directions

Note1: Meaning of C (X, Y) and D (X, Y)
C (X, Y): The coordinates of the display position (See "**6.5 DISPLAY POSITIONS**".)
D (X, Y): The data number of input signal for LCD panel signal processing board

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=0º	1000	1500			Note 3
Response Time		T_{ON}	25℃		25	40	ms	Note 4
		T_{OFF}						
Chromaticity	**White**	x	Backlight is on	0.263	0.313	0.363		Note 1,5
		y		0.279	0.329	0.379		
	Red	x		0.584	0.634	0.684		Note 1,5
		y		0.281	0.331	0.381		
	Green	x		0.280	0.330	0.380		Note 1,5
		y		0.533	0.583	0.633		
	Blue	x		0.101	0.151	0.201		Note 1,5
		y		0.014	0.064	0.114		
Uniformity		U		75	80		%	Note 6
NTSC		-		55	60		%	Note 5
Luminance		L			400		cd/m^2	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. 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.

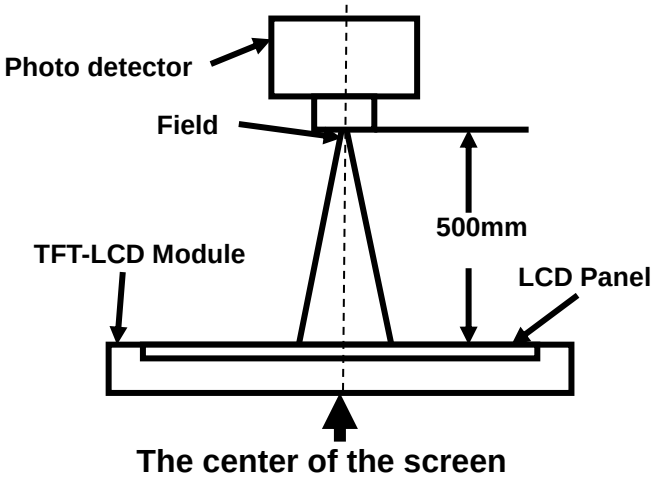


Fig1. Measurement Set Up

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

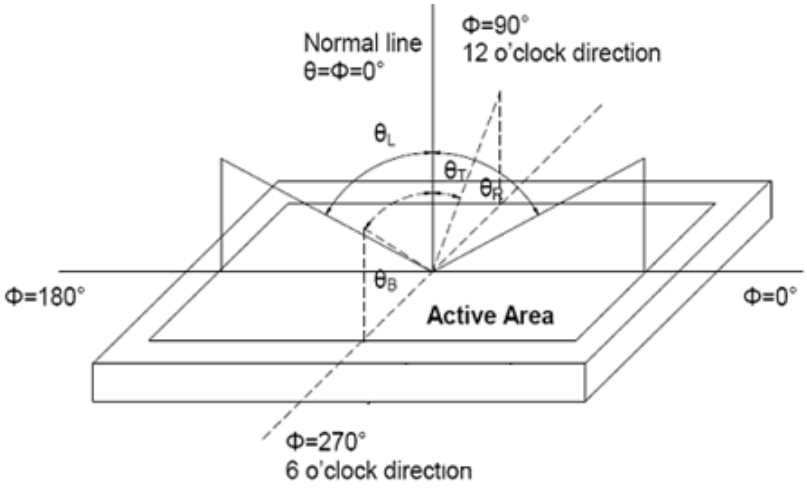


Fig2. Measurement viewing angle

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%.

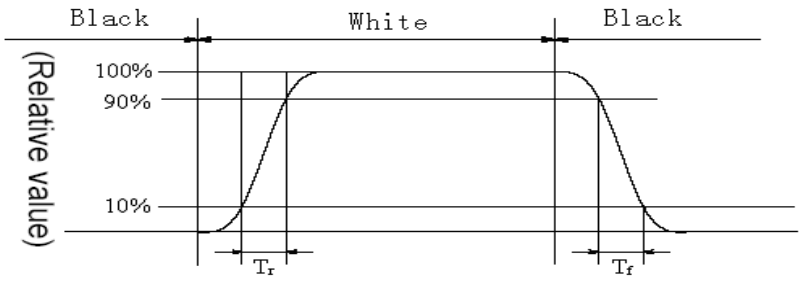


Fig4. Response Time Testing(SFT)

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) = 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

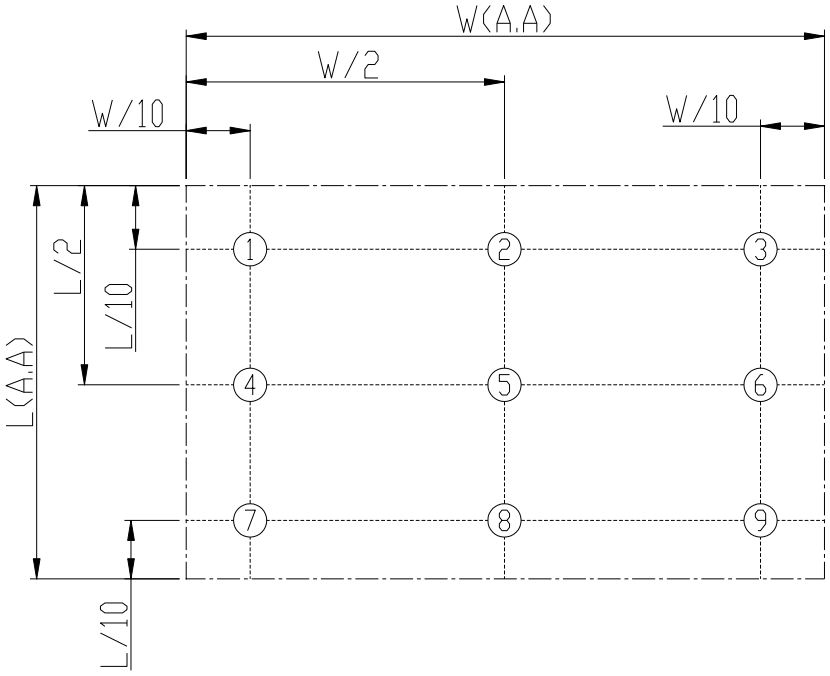


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

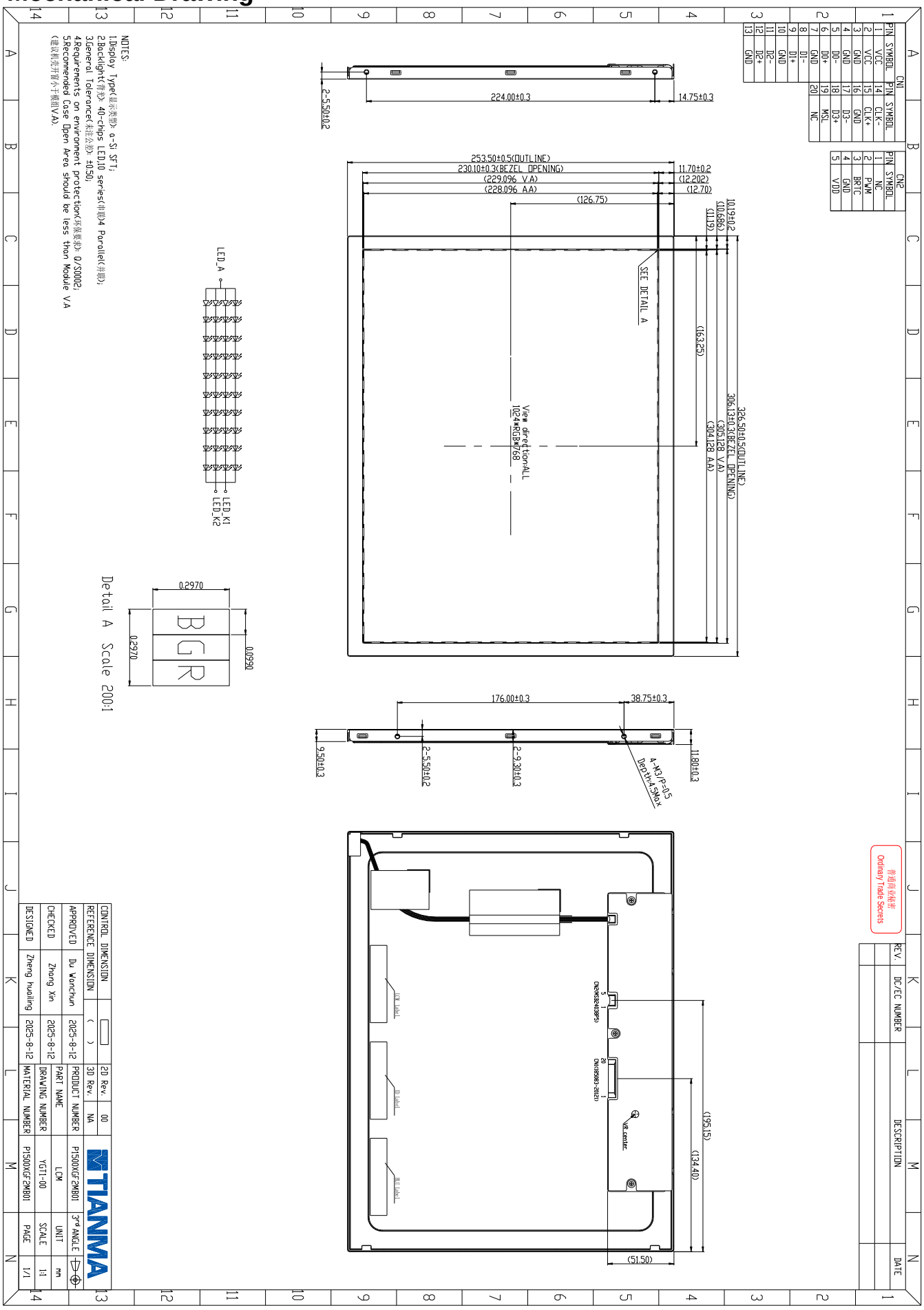
8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+70℃，240H	IEC60068-2-2:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃，240H	IEC60068-2-2:2007 GB2423.1-2008
3	High Temperature Storage	+80℃，240H	IEC60068-2-2:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃，240H	IEC60068-2-2:2007 GB2423.1-2008
5	High Temperature and Humidity （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， Air：±15kv； Contact：±8kv； 9point/panel，25 times each places at 1 sec interval （Environment：15℃~35℃， 30%~60%，86Kpa~106Kpa）	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration (Non operation)	① 5 to 100Hz, 11.76m/s2 ② 1 minute/cycle ③ X, Y, Z directions ④ 50 times each directions	GB_T2423.56-2006
9	Mechanical shock (Non operation)	① 294m/s2, 11ms ② X, Y, Z directions ③ 3 times each directions	GB_T2423.5-1995
10	Package Vibration	5-20-200HZ，PSD：0.01-0.01-0.001 Total:0.781g2/HZ,x/y/z 30min）	GB/T 4857.23-2012
11	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

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Q'ty	Remark
1	LCM module					
2	Tray					
3	Dust Proof Bag					
4	BOX					
5	Carton					
6	Total weight	Kg				

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.