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SPECIFICATION

[☒] Preliminary Specification
[] Final Specification

Description 23.8” 1920xRGBx1080 TFT-LCD Module
Part Number P2380FHF1MB00

Customer		Industrial Product Dept, PDBU Tianma Microelectronics Co., Ltd.	
Signatures	Date	Approved By	Date
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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 23.8 inch a-Si TFT-LCD module with normal-black technology. It is composed of a TFT-LCD panel, PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- High contrast ratio
- Interface: 2 port LVDS

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	23.8 inches	
	Resolution	1920(RGB)x1080	
	Pixel Pitch	0.2754(H)×0.2754(V)	mm
	TFT Active Area	527.04(H)×296.46(V)	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT	
	Surface Treatment	AG 25%	
Mechanical Characteristics	LCM (W x H x D)	(535) (W) X(313) (H) X(7) (D) mm (typ.)without PCB (495.6) (W) X(292.2) (H) X(12.2) (D) mm (typ.)with PCB	mm
	Weight	TBD	g
Optical Characteristics	Luminance	250	cd/m2
	Contrast Ratio	1800:1	
	NTCS	72	%
	Viewing Angle	89/89/89/89	degree
Electrical Characteristics	Interface	LVDS interface (2 port)	
	Color Depth	16.7M	color
	Power Consumption	LCD:TBD; Backlight: 7.44	W

Table 2.1 General Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	Hirose: 1961029-30CD1N001

Table 3.1.1 Connector information

Pin No.	Symbol	Signal	Remarks
1	RX00-	Negative Transmission data of Pixel 0 (ODD)	
2	RX00+	Positive Transmission data of Pixel 0 (ODD)	
3	RX01-	Negative Transmission data of Pixel 1(ODD)	
4	RX01+	Positive Transmission data of Pixel 1(ODD)	
5	RX02-	Negative Transmission data of Pixel 2(ODD)	
6	RX02+	Positive Transmission data of Pixel 2(ODD)	
7	NC	NO Connect	
8	RXOCLK-	Negative Transmission Clock (ODD)	
9	RXOCLK+	Positive Transmission Clock (ODD)	
10	RX03-	Negative Transmission data of Pixel 3(ODD)	
11	RX03+	Positive Transmission data of Pixel 3(ODD)	
12	RXE0-	Negative Transmission data of Pixel 0(EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0(EVEN)	
14	GND	Power Ground	Note1
15	RXE1-	Negative Transmission data of Pixel 1(EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1(EVEN)	
17	GND	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2(EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2(EVEN)	
20	RXECLK-	Negative Transmission Clock (EVEN)	
21	RXECLK+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3(EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3(EVEN)	
24	GND	Power Ground	
25	SCL	Reserved for LCD manufacturer's use(SCL)	
26	SDA	Reserved for LCD manufacturer's use(SDA)	
27	WP	Write protect	
28	VDD	Power Supply: +5V	
29	VDD		
30	VDD		

Table 3.1.2 Pin Assignment for LCD Interface

Note1: All of the GND pins should be connected to the system ground.

3.2 CN2 Pin assignment (Back Light)

Connector Information	
BLU Module connector	Molex: CI1406SL000-NH
Matching connector	Molex: CI14T011PE0 or equivalent

Table 3.2.1 Connector information

Pin No.	Symbol	Function	Description
1	Ch1	LED Current Feedback Terminal(Channel1)	
2	Ch2	LED Current Feedback Terminal(Channel2)	
3	VSLED	LED Power Supply Voltage Input Terminal	
4	VSLED	LED Power Supply Voltage Input Terminal	
5	Ch3	LED Current Feedback Terminal(Channel3)	
6	Ch4	LED Current Feedback Terminal(Channel4)	

Table 3.2.2 Pin Assignment for Back Light Interface

3.3 Display direction

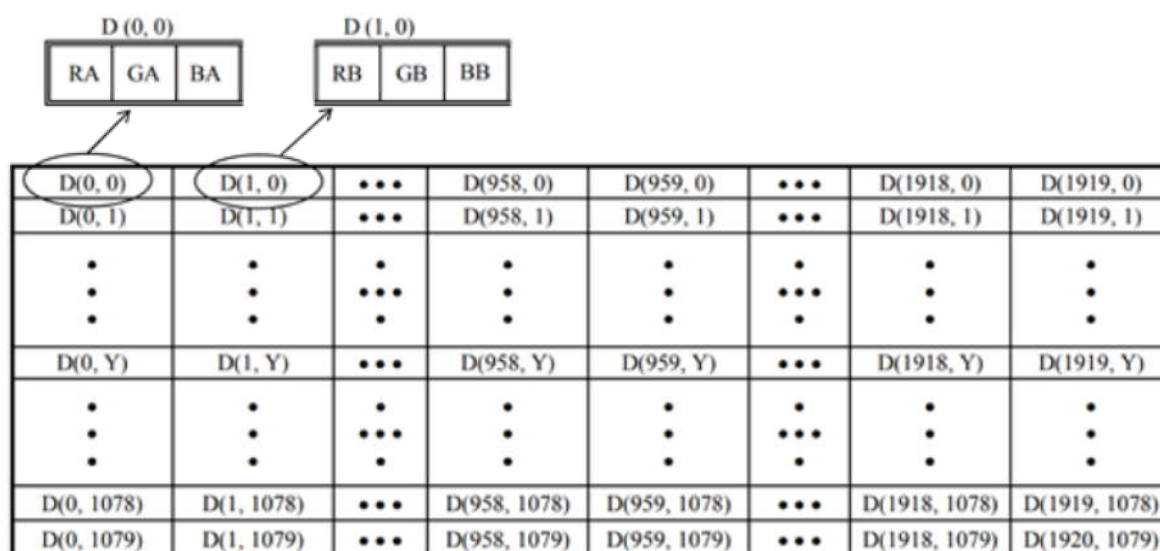


Figure 3.4.1 Pixel arrangement

4. Absolute Maximum Ratings

GND=0V

Parameter	Symbol	Rating	Unit	Remarks
Power supply voltage	VLCD 5V	-0.3 to +15.0	V	Ta= 25°C
Input voltage for signals	Vi	-0.3 to +2.8	V	VDD= 5.0V Ta= 25°C
Storage temperature	Tst	-10 to +60	°C	-

Note1: ORX n+/-, ERXn+/-

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

(Ta= 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Power supply voltage	VLCD_5V	4.5	5.0	5.5	V	-
Power supply current	IDD	-	TBD	TBD	mA	at VDD=5.0V Note1,2
Permissible ripple voltage	VRP	-	TBD	300	mVp-p	for VDD Note3,4,5
Differential input threshold voltage	High	VTH	-	-	+100	mV
Logic-Low Output Voltage	Low	VTL	-100	-	-	mV

Table 5.1 LCD Module Electrical Characteristics

Note1: Write pattern [by IEC 61747-6]

Note2: Pattern for maximum current

Note3: This product works even if the ripple voltage levels are over the permissible values, but there might be noise on the display image.

Note4: The permissible ripple voltage includes spike noise.

Note5: The load variation influence does not include.

5.2 DC Characteristics for Backlight Driving

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Forward Current	IF	-	120		mA	For each LED
Forward Current Voltage	VF	-	62	68	V	
Backlight Power Consumption	WBL	-	7.44	8.16	W	
LED life time	--	-	3000	-	Hrs	

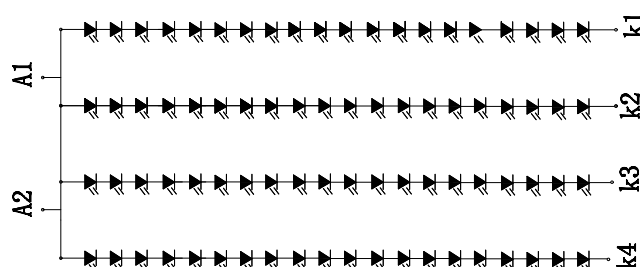
Table 5.2.1 LED Backlight Characteristics

Note1: I F is defined for each channel.

Note2: Optical performance should be evaluated at Ta=25°C 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 70% of initial brightness. Typical operating life time is estimated data.



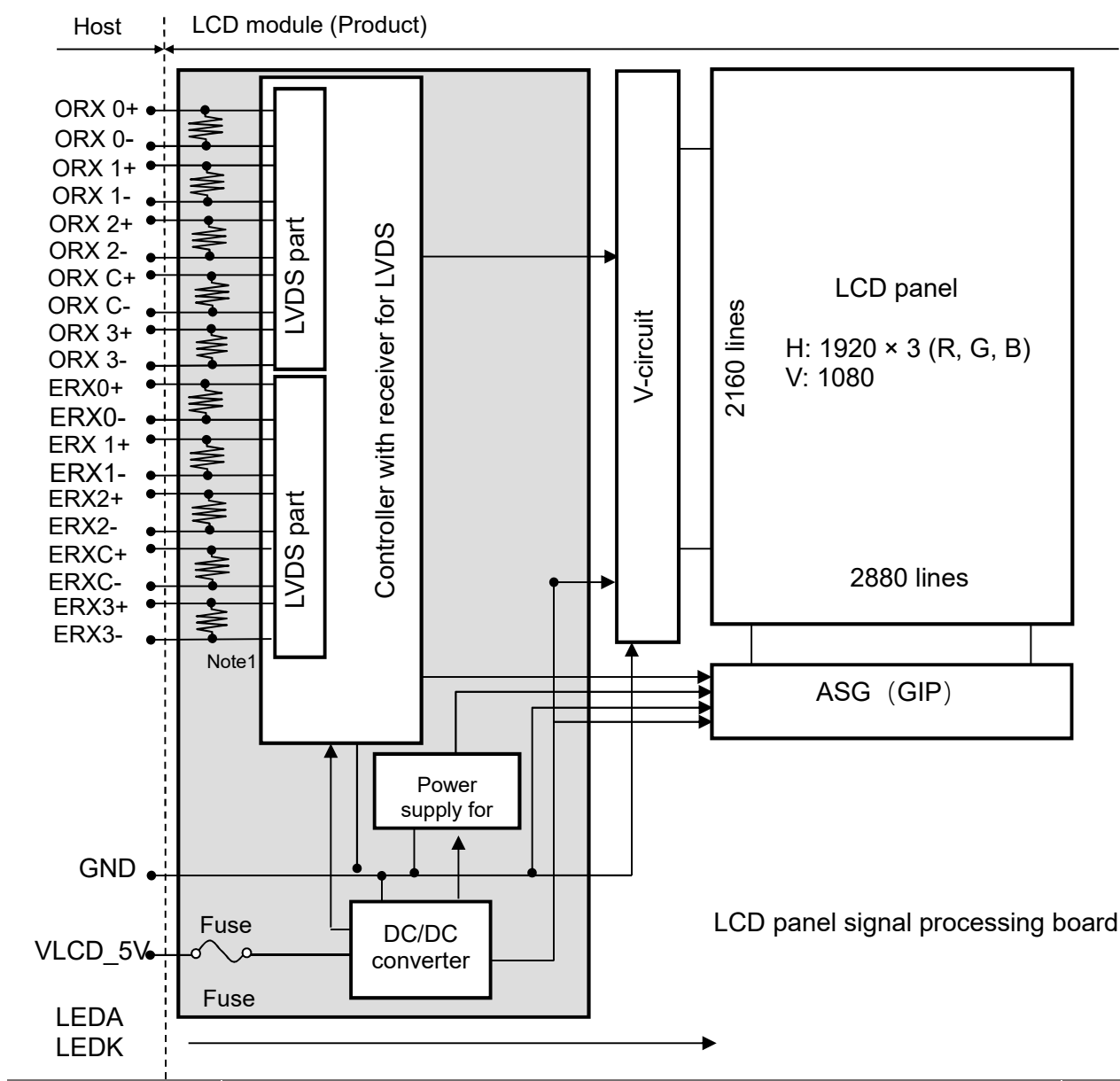
BLU Circuit:20S-4P

背光电路图

Note:

- 1) . The LED lifetime is defined as the module brightness decay 70% of original brightness at Ta=25 degree.
- 2) . Environmental conditions such as sustained high operating temperatures, high humidity, operating conditions and other factors have an adverse effect on LED Lifetime. It is difficult to characterize LED lifetime for all the various operational, environmental and design permutations possible. Numerous environmental conditions such as ambient temperature, humidity and ventilation have impact on LED brightness decay. Brightness decay is also affected by control, thermal management, current levels, and other electrical design considerations.
- 3) . The TM Minima value of LED Life time is estimated to be "30,000hrs" which is based on non-full life testing and our supplier's data. Full life testing for LEDs is impractical due to the long expected lifetime. Even with 24/7 operation, testing an LED for 20,000 hours would take 2.3 years, and such an endeavor is impractical because technology continues to develop and evolve so quickly, products would be obsolete by the time life testing is completed. Results based on actual usage environment may vary. This means that TM shall not be held liable for any problems related to LED life time that do not meet TM typical value from the use of TM's module.

5.3 LCD Module Block Diagram



Note1: The terminating resistor (typ:100Ω) of the LVDS signal lines is inside TCON

Note2: Relations between GND (Signal ground), FG (Frame ground) and GNDB (LED driver ground)

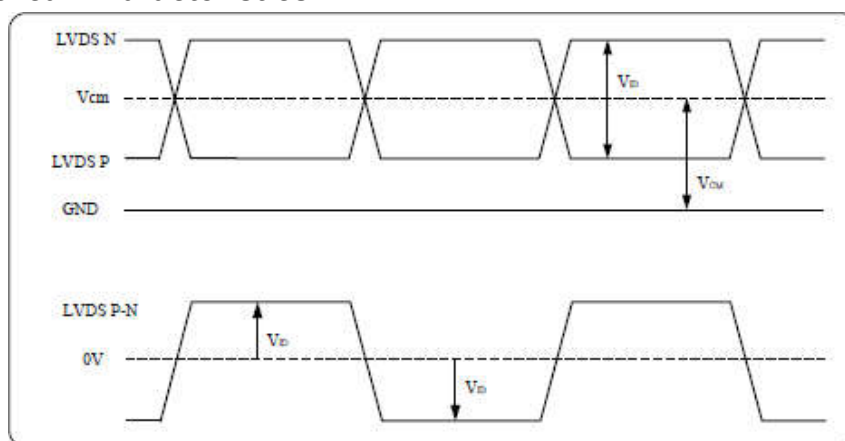
GND - FG	Connected
GND - GNDB	Connected
FG - GNDB	Connected

6. Interface Timing Characteristics

6.1 LVDS DC Electrical Characteristics

Parameter.		Min.	Typ.	Max.	Unit	Remarks
High Level Differential Input Threshold Voltage	V _{IH}	-	-	100	mV	
Low Level Differential Input Threshold Voltage	V _{IL}	-100	-	-	mV	
Differential input voltage	V _{ID}	100	-	600	mV	
Differential input common mode voltage	V _{cm}	1.0	1.2	1.5	V	

6.2 LVDS AC Electrical Characteristics

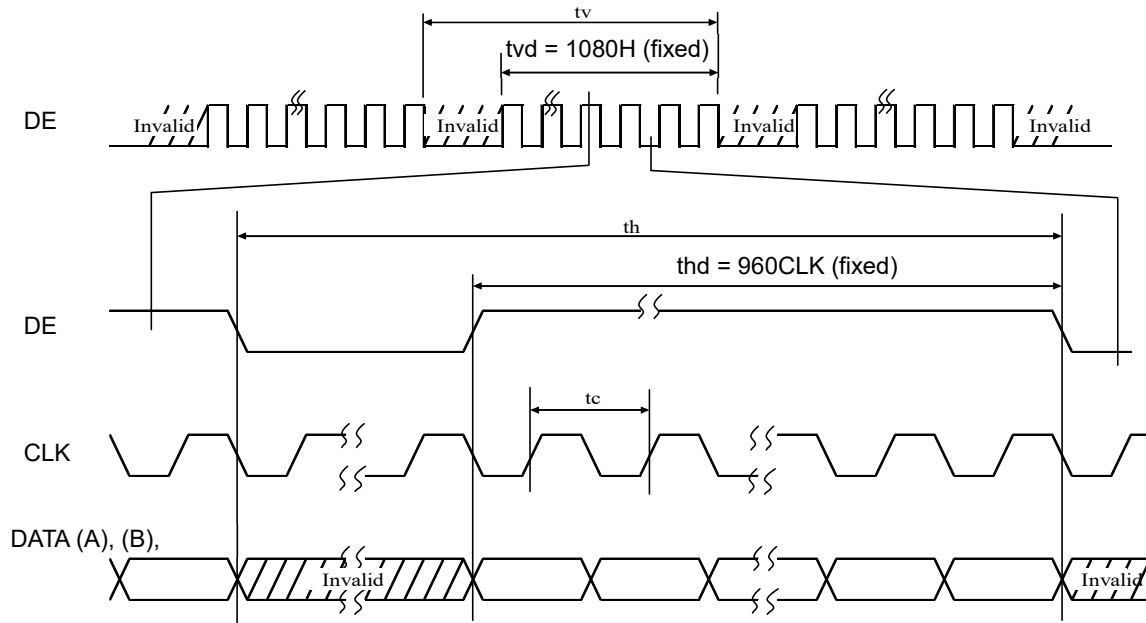


Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	RCIP	10.47	13.47	17.7	nsec	
Input Data 0	RIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	RIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	RIP6	2 × tRCIP/7-0.4	2 × tRCIP/7	2 × tRCIP/7+0.4	nsec	
Input Data 3	RIP5	3 × tRCIP/7-0.4	3 × tRCIP/7	3 × tRCIP/7+0.4	nsec	
Input Data 4	RIP4	4 × tRCIP/7-0.4	4 × tRCIP/7	4 × tRCIP/7+0.4	nsec	
Input Data 5	RIP3	5 × tRCIP/7-0.4	5 × tRCIP/7	5 × tRCIP/7+0.4	nsec	
Input Data 6	RIP2	6 × tRCIP/7-0.4	6 × tRCIP/7	6 × tRCIP/7+0.4	nsec	

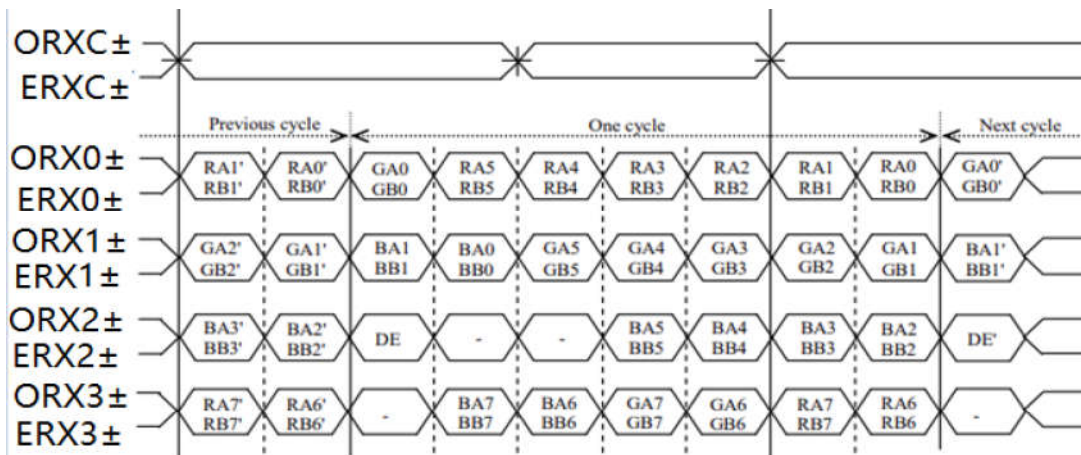
6.3 Timing Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
CLK frequency	tclk	TBD	74.25	TBD	MHz	
Horizontal display area	thd	960			tclk	
Horizontal Blanking time	thbt	TBD	(140)	TBD	tclk	
HSYNC period	th	TBD	(1100)	TBD	tclk	
Vertical display area	tvd	1080			th	
Vertical Blanking time	tvbt	TBD	45	TBD	th	
VSD period	tv	TBD	1125	TBD	th	
Frame rate	FR	60			Hz	

6.4 Input Signal Timing Chart



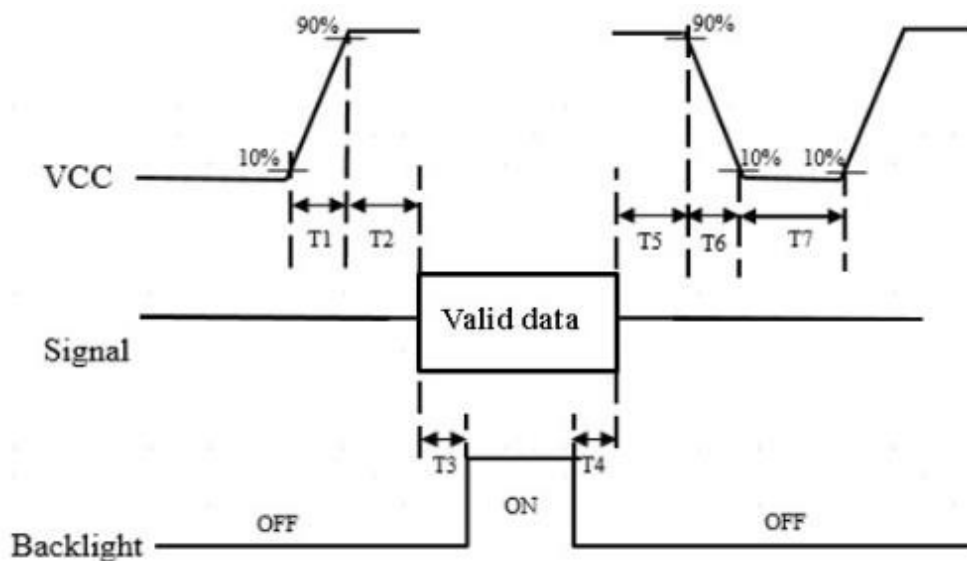
6.5 Input Data Mapping



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.

6.6 POWER on/off



Timing Specifications

Parameter	Value			Unit
	Min	Typ	Max	
t1	0.5	-	10	ms
t2	0	30	50	ms
t3	500	-	-	ms
t4	200	-	-	ms
t5	0.1	20	50	ms
t6	0.1	-	100	ms
t7	1000	-	-	ms

7. Optical Characteristics

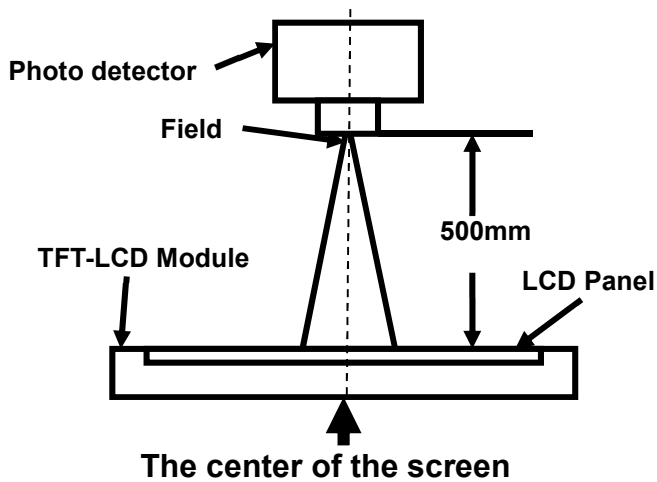
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	80	89	-	Degree	Note2,3
		θB		80	89	-		
		θL		80	89	-		
		θR		80	89	-		
Contrast Ratio		CR	θ=0°	1300	1800	-	-	Note 3
Response Time		T _{ON}	25℃	-	30	40	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	θ=0° Ta=25℃	0.263	0.313	0.363	-	Note 1,5
		y		0.279	0.329	0.379		
	Red	x		0.608	0.658	0.708	-	Note 1,5
		y		0.280	0.330	0.380		
	Green	x		0.280	0.330	0.380	-	Note 1,5
		y		0.561	0.611	0.661		
	Blue	x		0.098	0.148	0.198	-	Note 1,5
		y		0.008	0.058	0.108		
Uniformity		U	-	75	80	-	%	Note 6
NTSC		N			72	-	%	Note 5
Luminance		L	-	-	250		cd/m ²	Note 7

Test Conditions:

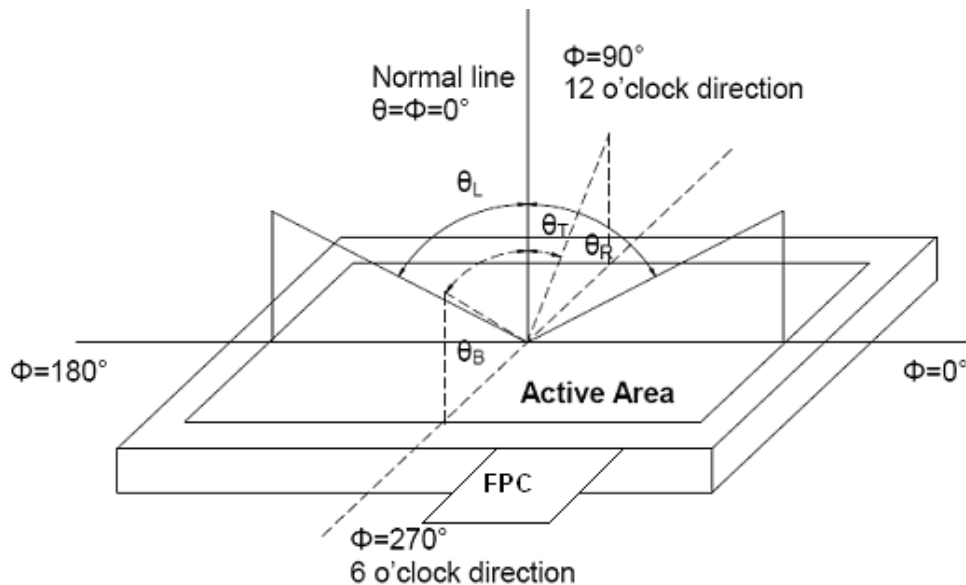
1. $I_F = 20$ mA, and the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.
viewing angle is measured at the center point of the LCD by EZ-Contrast.



Note 3: Definition of contrast ratio

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

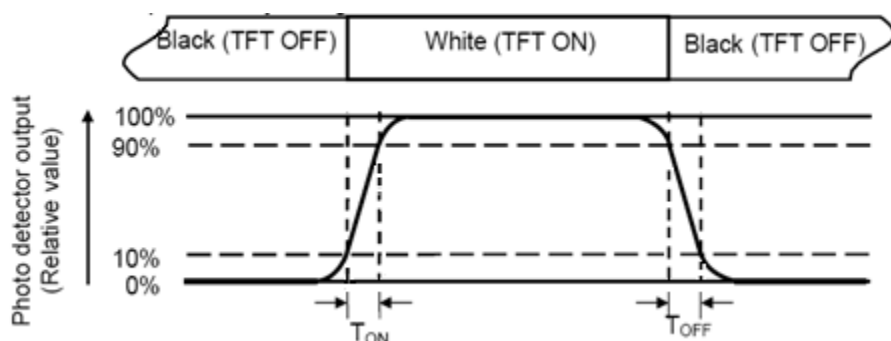
"White state": The state is that the LCD should drive by V_{white} .

"Black state": The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

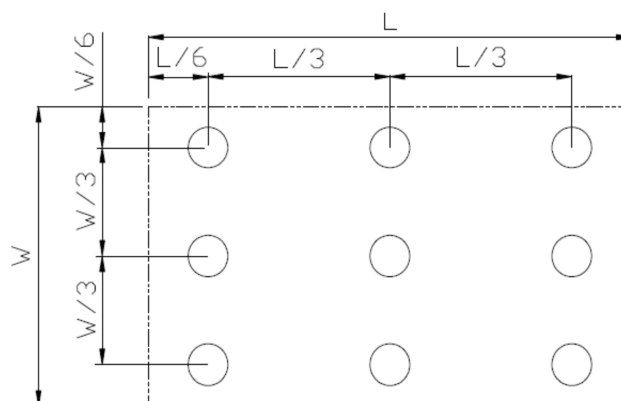
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

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



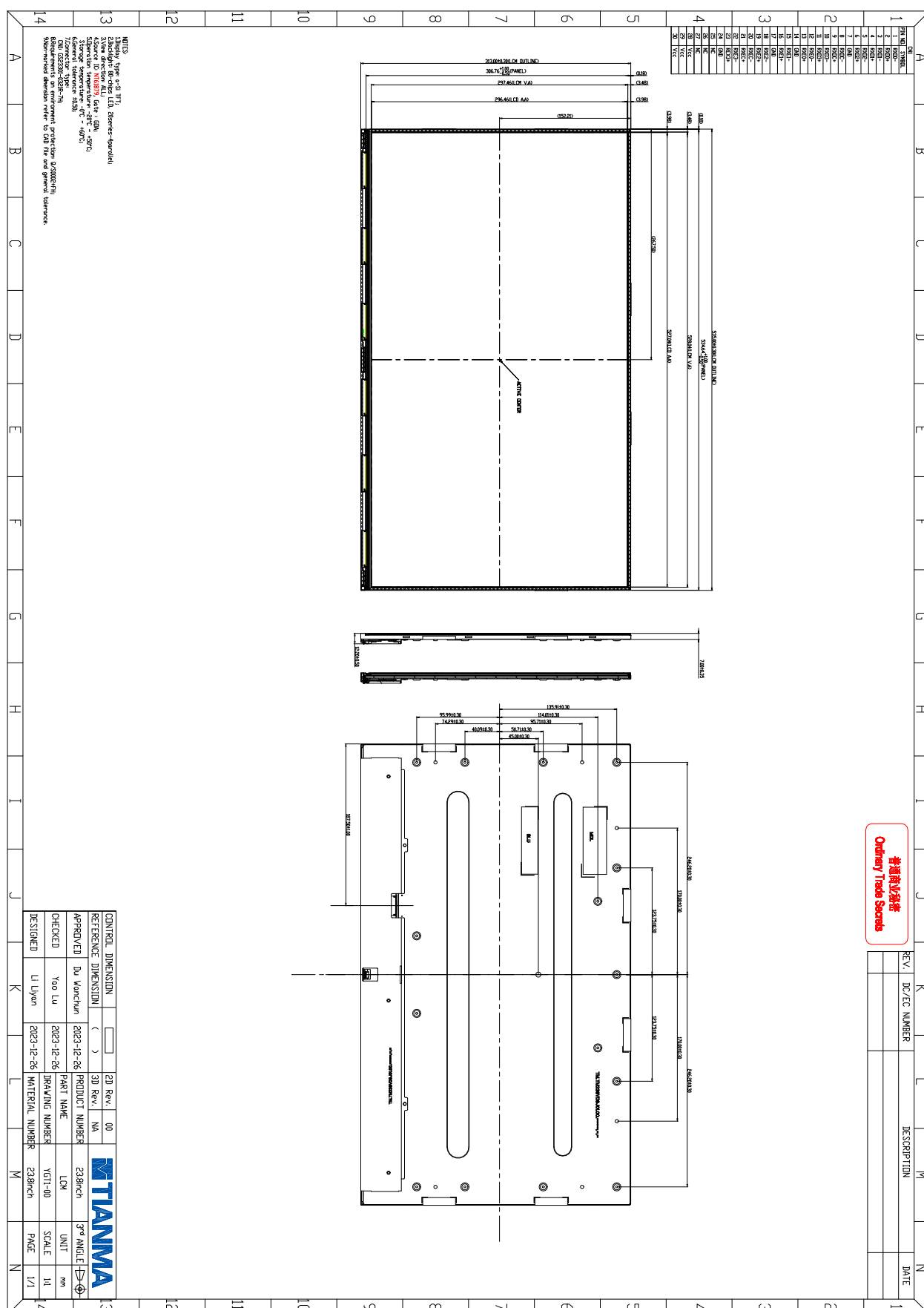
L_{max} : The measured Maximum luminance of all measurement position.

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

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Mechanical drawing



9. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+60℃ , 240H	IEC60068-2-1:2007 GB/T 2423.2-2008
2	Low Temperature Operation	0℃ , 240H	IEC60068-2-1:2007 GB/T 2423.1-2008
3	High Temperature Storage	+70℃ , 240H	IEC60068-2-1:2007 GB/T 2423.2-2008
4	Low Temperature Storage	-20℃ , 240H	IEC60068-2-1:2007 GB/T 2423.1-2008
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 GB/T 2423.22-2012-Na
7	ESD	C=150pF , R=330Ω , 25point/panel Air : ±15kv , 25times ; Contact : ±8kv , 25times ; (Environment : 15℃~35℃ , 30%~60% , 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T 17626.2-2018
8	Package Vibration	频率 (Hz) 5~20-200Hz, PSD:0.01-0.01-0.001 Total:0.781g ² /Hz , 时间 : X/Y/Z 各轴 30min	
9	Shock test (non-operation)	① 50G, 20ms ② ±X, ±Y, ±Z directions ③ One time each directions	IEC60068-2-32:1990 GB/T 4857.5-1992

Table 9.1 Reliability test

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.

10. Packing Instruction

TBD

Table 10.1 Packing instruction

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