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SPECIFICATION

[◉] Preliminary Specification
[ ] Final Specification

Description **18.5” 3840xRGBx2160 TFT-LCD Module**

Part Number **P1850UHF1MA00**

Customer	GARMIN		Industrial Product Dept, PDBU Tianma Microelectronics Co., Ltd.
Signatures	Date	Approved By	Date
		Reviewed By	
		Prepared By	
		Yang Mengjun	2026.3.5
Comments:			

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

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1. Summary

1.1 General Description

This is a 18.5 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, PCB, and two LED boards in the backlight unit.

1.2 Features

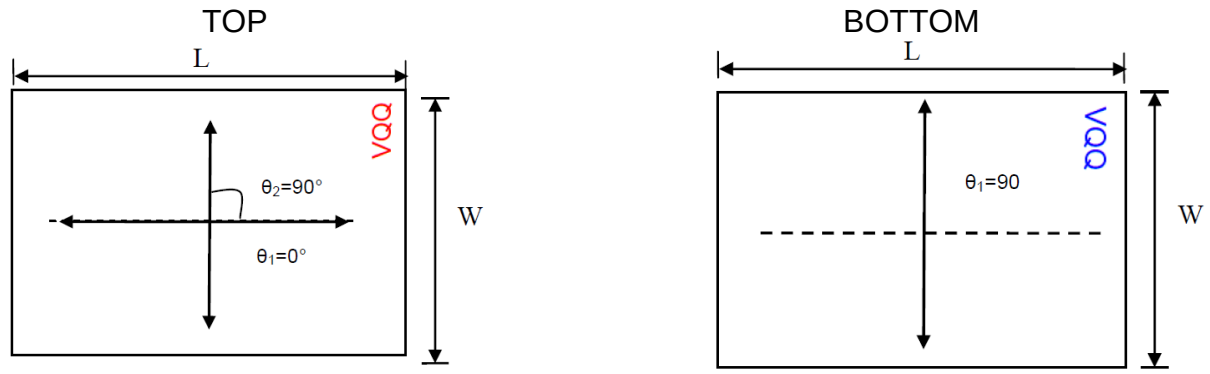
- Ultra-wide viewing angle
- High resolution
- High luminance
- Interface: eDP
- Compliant with the European RoHS Directive

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	18.5 inches	
	Resolution	3840(RGB)x160	
	Pixel Pitch	0.1065*0.1065	mm
	TFT Active Area	408.96*230.04	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	Anti-Glare	
	Viewing Direction	ALL	
	Gray Scale Inversion Direction	NA	
Mechanical Characteristics	LCM (W x H x D)	430.96*252.04*10.00	mm
	Weight	1.6	Kg
Optical Characteristics	Luminance	1300 min	cd/m^2
	Contrast Ratio	1000:1	
	NTSC	70	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	eDP	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:8400 Backlight:49920	mW
	Driver IC	Source IC----RM92M39*12 Gate IC----RM76M89*8 T-con----DP667	

Table 2.1 General TFT Specifications

Polarizer Absorption axis



3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	20849-030E-01
Matching connector	IPEX 20846-030T-01

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	VDD	P	Power supply (12V)	
2	VDD	P	Power supply (12V)	
3	VDD	P	Power supply (12V)	
4	VDD	P	Power supply (12V)	
5	VDD	P	Power supply (12V)	
6	GND	P	Ground	
7	GND	P	Ground	
8	NC	-	No Connection	
9	NC	-	No Connection	
10	GND	P	Ground	
11	HPD	I/O	Hot Plug Detection Signal	
12	GND	P	Ground	
13	DAUXN	I/O	Complement Signal Auxiliary Channel	
14	DAUXP	I/O	True Signal Auxiliary Channel	
15	GND	P	Ground	
16	DRX0P	I	True Signal Link Lane 0	
17	DRX0N	I	Complement Signal Link Lane 0	
18	GND	P	Ground	
19	DRX1P	I	True Signal Link Lane 1	
20	DRX1N	I	Complement Signal Link Lane 1	
21	GND	P	Ground	
22	DRX2P	I	True Signal Link Lane 2	
23	DRX2N	I	Complement Signal Link Lane 2	
24	GND	P	Ground	
25	DRX3P	I	True Signal Link Lane 3	
26	DRX3N	I	Complement Signal Link Lane 3	
27	GND	P	Ground	
28	GND	P	Ground	
29	NC	-	No Connection	
30	BIST	I	BIST enable input, active high, internal pull-down at 80kΩ.	

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: This LCD module supports SYNC & SYNC-DE & DE mode, the pin setting is different from each other. Please refer to the descriptions.

3.2 CN2 Pin assignment (Back Light)

Connector Information	
LCD Module connector	Molex 5015680607
Matching connector	Molex 5013300600
LED part number	NJ2W257KRT P17d22~，Btw70da~ Btw75dd

Table 3.2.1 Connector information

No	Symbol	I/O	Description	Wire Color
1	LEDA	P	LED driving anode (high voltage)	Red
2	NC	-	No Connection	
3	LEDK	P	LED driving cathode (low voltage)	White
4	LEDK	P	LED driving cathode (low voltage)	White
5	LEDK	P	LED driving cathode (low voltage)	White
6	LEDK	P	LED driving cathode (low voltage)	White

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
Power supply (12V)	VDD	-0.3	15	V	
BIST enable input	BIST	-0.3	4.0	V	
eDP signals	HPD, DAUXN, DAUXP, DRX0~3P, DRX0~3N	-0.3	4.0	V	
Power supply voltage for LED	LEDA	-0.3	52.8	V	
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

Table 4.1 Absolute Maximum Ratings

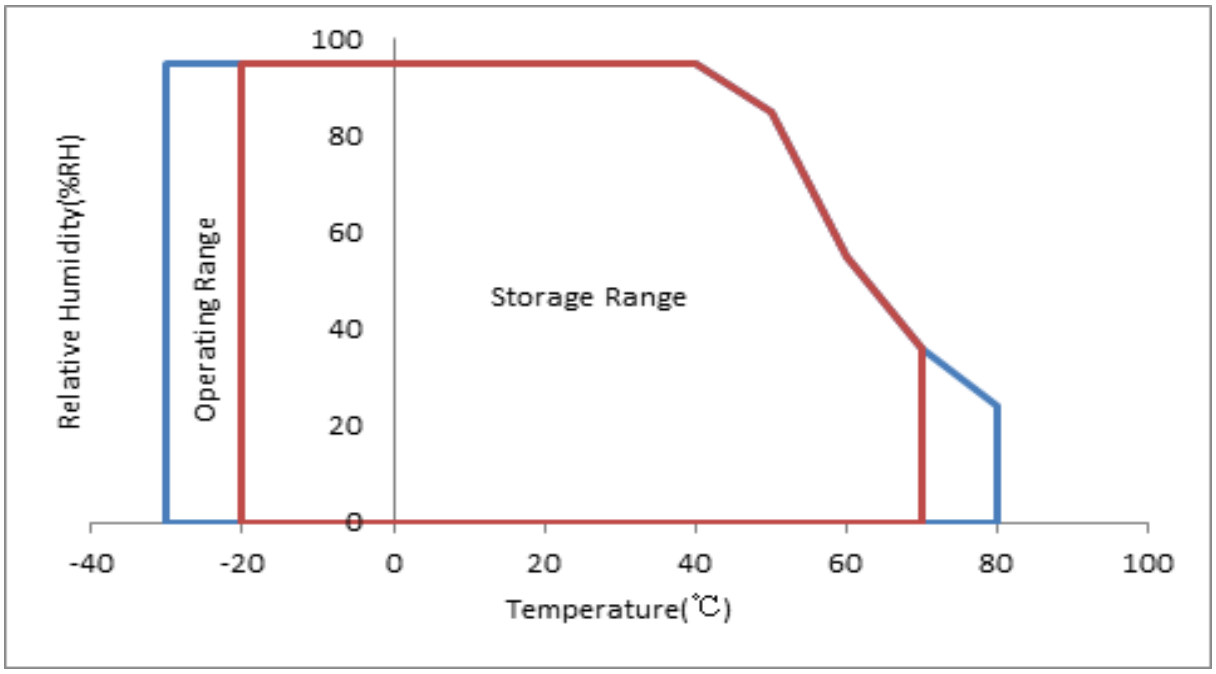


Table 4.2 Absolute Maximum Ratings chart

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

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VDD	11.7	12.0	12.3	V	Reliability tested at VDD=12V
Input voltage for BIST	High-level	V_{IH}	2.7	-	3.6	V_{IH}	The high-level input of BIST must be greater than 2.7V
	Low-level	V_{IL}	0	-	0.4	V_{IL}	The low-level input of BIST must be less than 0.4V
Power supply current		IDD	-	300 Note1	750 Note2	mA	at VDD=12V
Permissible ripple voltage		VRPC	-	-	100	mVp-p	for VDD

Table 5.1.1 Operating Voltages

Note1: Checkered flag pattern [by IEC 61747-6]
Note2: Pattern for maximum current
Note3: Inrush current should be tested under VDD rising time 470us.

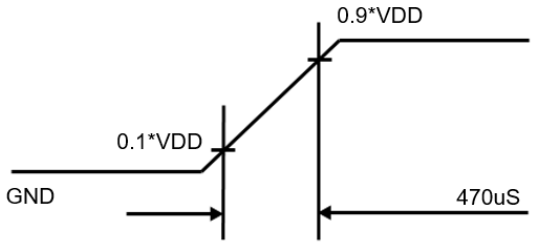


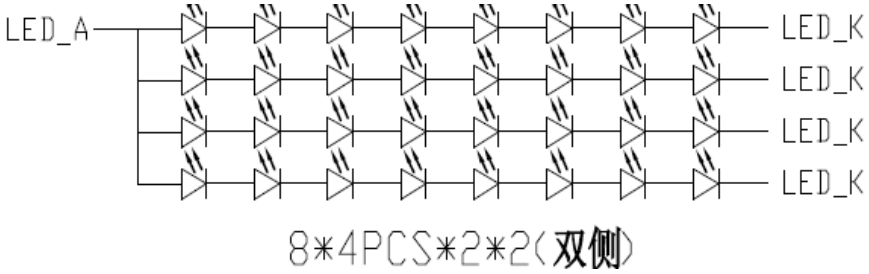
Figure 5.1.1 VDD rising time

5.2 DC Characteristics for Backlight Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	--	65		mA	128 LEDs (8S4P*4)
Forward Current Voltage	VF		6.0		V	
Backlight Power Consumption	WBL	--	49920	—	mW	
LED life time	--	30000	40000	-	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℃ 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.



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 Lifetime 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 Recommended Power ON/OFF Sequence

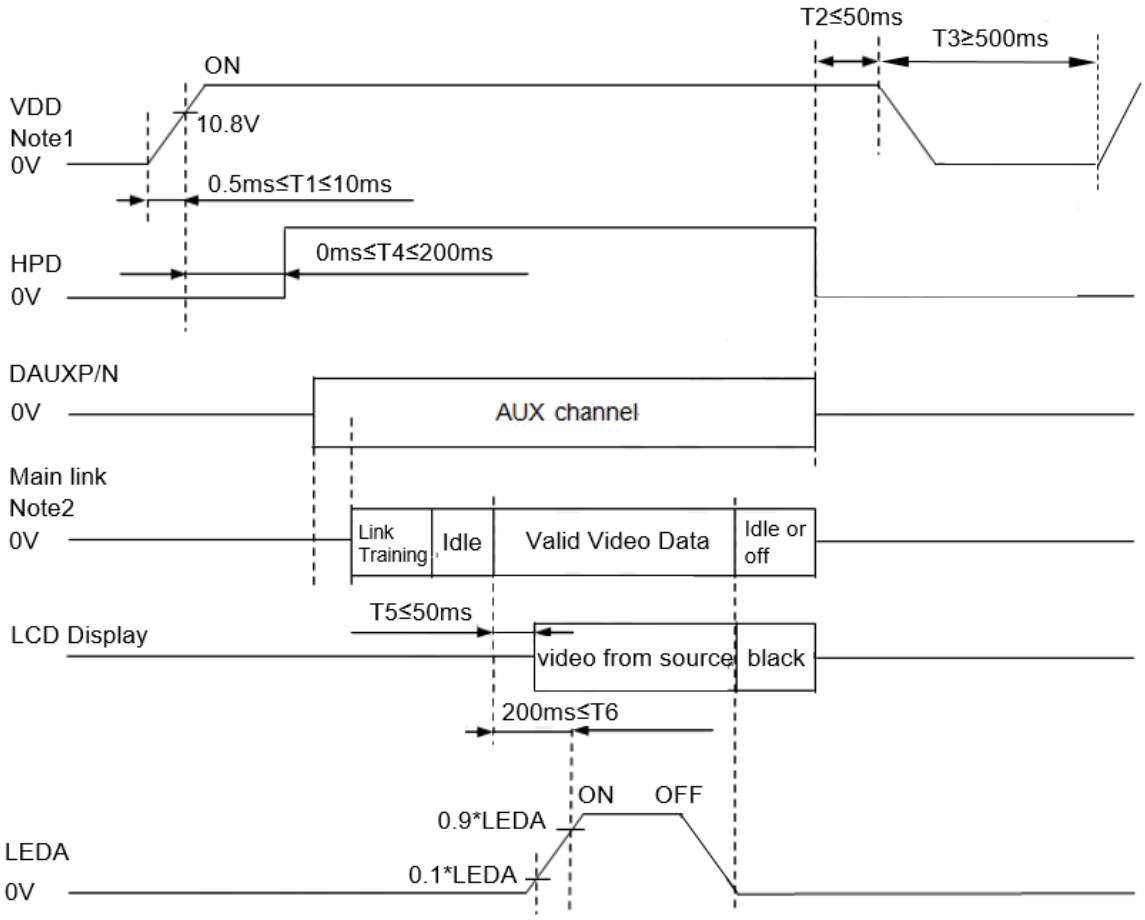


Figure 5.4.2 Power on/off sequence

Note1: T1< T2.
Note2: The low level of these signals and analog powers are GND level.
Note3: 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.
Note4: The power on/off sequence is the first version. It will be updated when the design is fixed.
Note5: BL is the voltage applied to backlight. Keep it turned off until the display has stabilized.

5.4 LCD Module Block Diagram

LCD Module Block Diagram

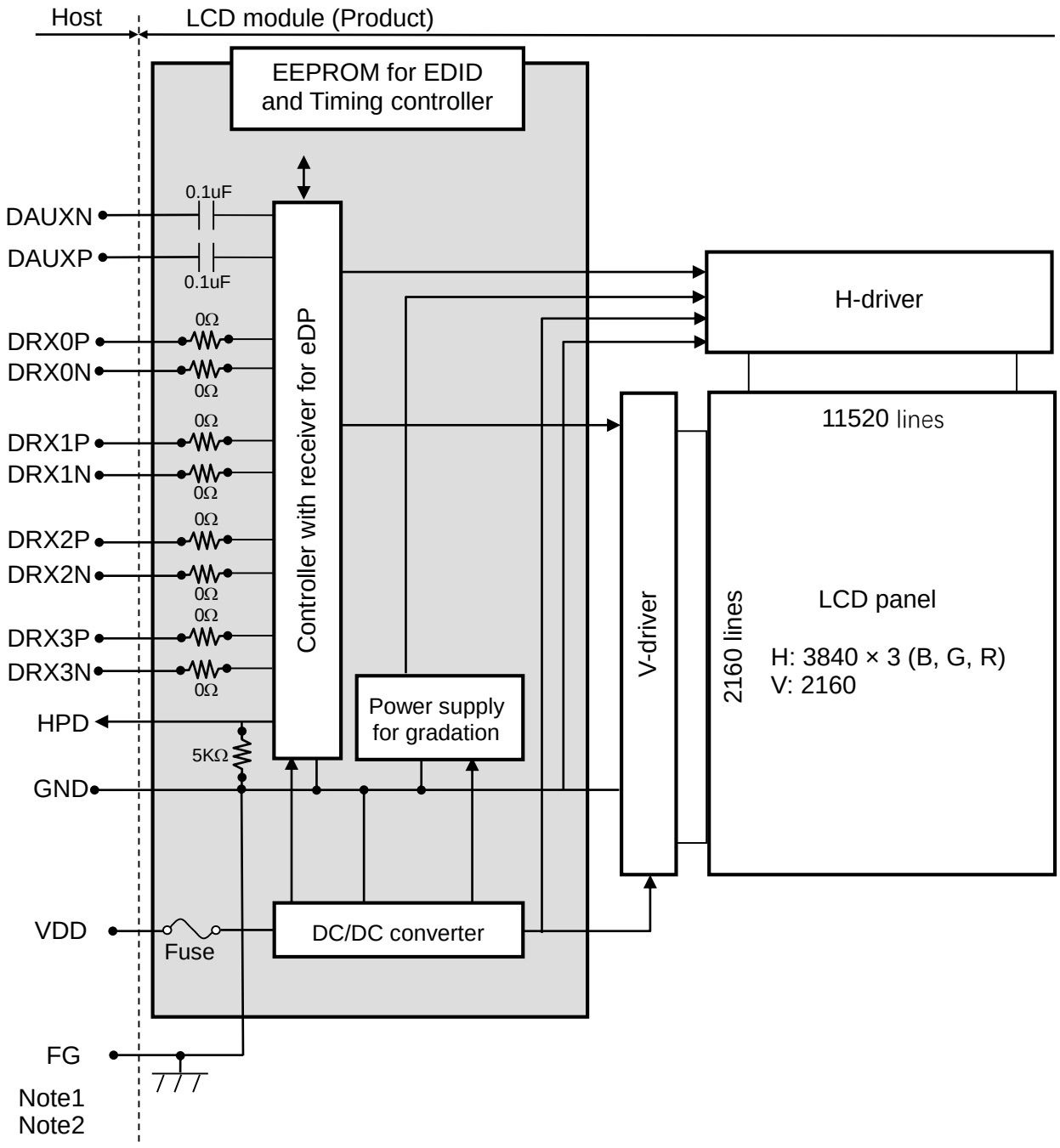


Figure 5.5.1 LCD Module Block Diagram

6. Timing Characteristics

6.1 Display port main link Receiver Characteristics

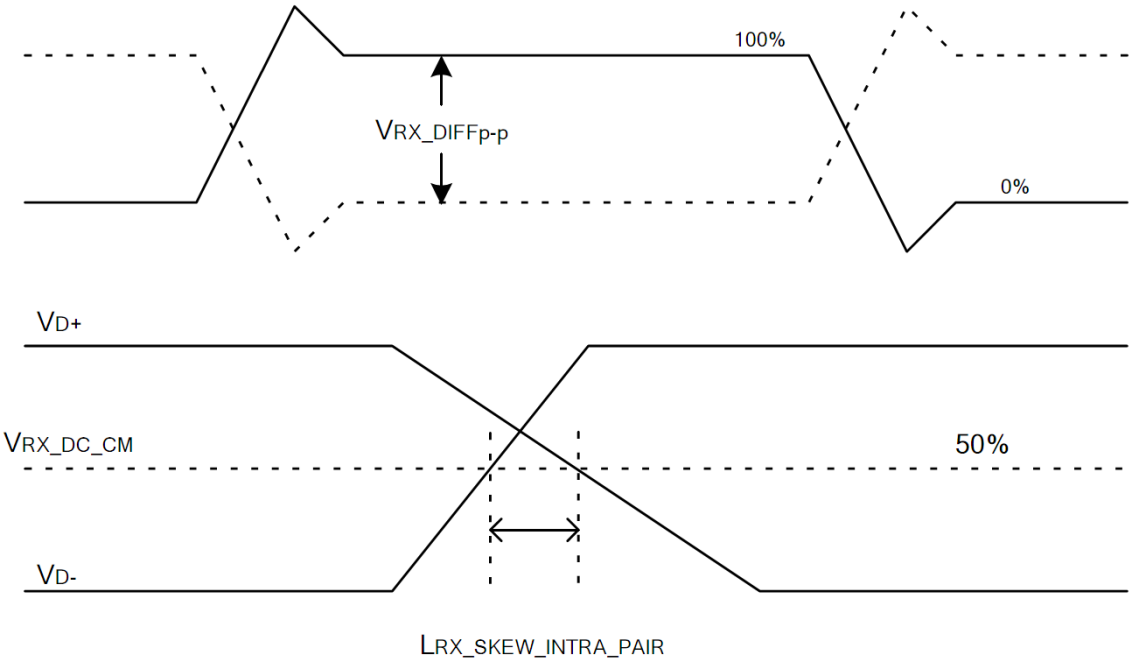


Figure 6.1 DisplayPort™ Main Link Receiver Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock, down-spreading by SOURCE	-		0.5		%	
Differential peak-to-peak input voltage at package pins	$V_{RX-DIFFp-p}$	100		1320	mV	
Maximum adaptive/programmable equalization level at 2.7GHz	-		10		dB	
Rx input DC common mode voltage	$V_{RX\_DC\_CM}$		GND		V	
Differential termination resistance	$R_{RX-DIFF}$	80	100	120	Ω	
Single-ended termination resistance	R_{RX-SE}	40		60	Ω	
Rx short circuit current limit	I_{RX_SHORT}			20	mA	
Intra-pair skew at Rx package pins (HBR2) RX intra-pair skew tolerance at HBR2	$L_{RX\_SKEW\_INTRA\_PAIR}$			60	ps	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	$L_{RX\_SKEW\_INTRA\_PAIR}$			150	ps	
Intra-pair skew at Rx package pins (RBR) RX intra-pair skew tolerance at RBR	$L_{RX\_SKEW\_INTRA\_PAIR}$			300	ps	

Receiver Jitter Tolerance for High Bit Rate 2 (HBR2)	Total jitter tolerance at 2MHz	-		1026		mUI	
	Total jitter tolerance at 10MHz	-		636		mUI	
	Total jitter tolerance at 20MHz	-		624		mUI	
	Total jitter tolerance at 100MHz	-		620		mUI	
Receiver Jitter Tolerance for High Bit Rate (HBR)	Total jitter tolerance at 2MHz	-		1227		mUI	
	Total jitter tolerance at 10MHz	-		548		mUI	
	Total jitter tolerance at 20MHz	-		505		mUI	
	Total jitter tolerance at 100MHz	-		491		mUI	
Receiver Jitter Tolerance for Reduced Bit Rate (RBR)	Total jitter tolerance at 2MHz	-		1648		mUI	
	Total jitter tolerance at 10MHz	-		778		mUI	
	Total jitter tolerance at 20MHz	-		747		mUI	

Table 6.1 DisplayPort™ Main Link Receiver Characteristics

6.2 Display port AUX channel characteristics

7 Parameter	Symbol	Min	Typ	Max	Unit	Remark
Unit Interval for AUX channel	UI	0.4	0.5	0.6	μs	
AUX differential peak-to-peak voltage at TP1 when driving the bus	$V_{AUX-DIFF-p-p}$	500		800	mV	
AUX common mode voltage when receiving	$V_{AUX-DC-CM-RX}$		GND		V	
AUX common mode voltage when transmitting	$V_{AUX-DC-CM-TX}$		0.15		V	
AUX channel short circuit current	$I_{AUX-SHORT}$			20	mA	
Differential termination resistance	$R_{AUX-DIFF}$	80	100	120	Ω	
Single-ended termination resistance	R_{AUX-SE}	40	50	60	Ω	
AUX AC coupling capacitor	C_{AUX}	75		200	nF	

Table 6.2 Displayport™ AUX channel characteristics

6.3 Outline of input signal timings

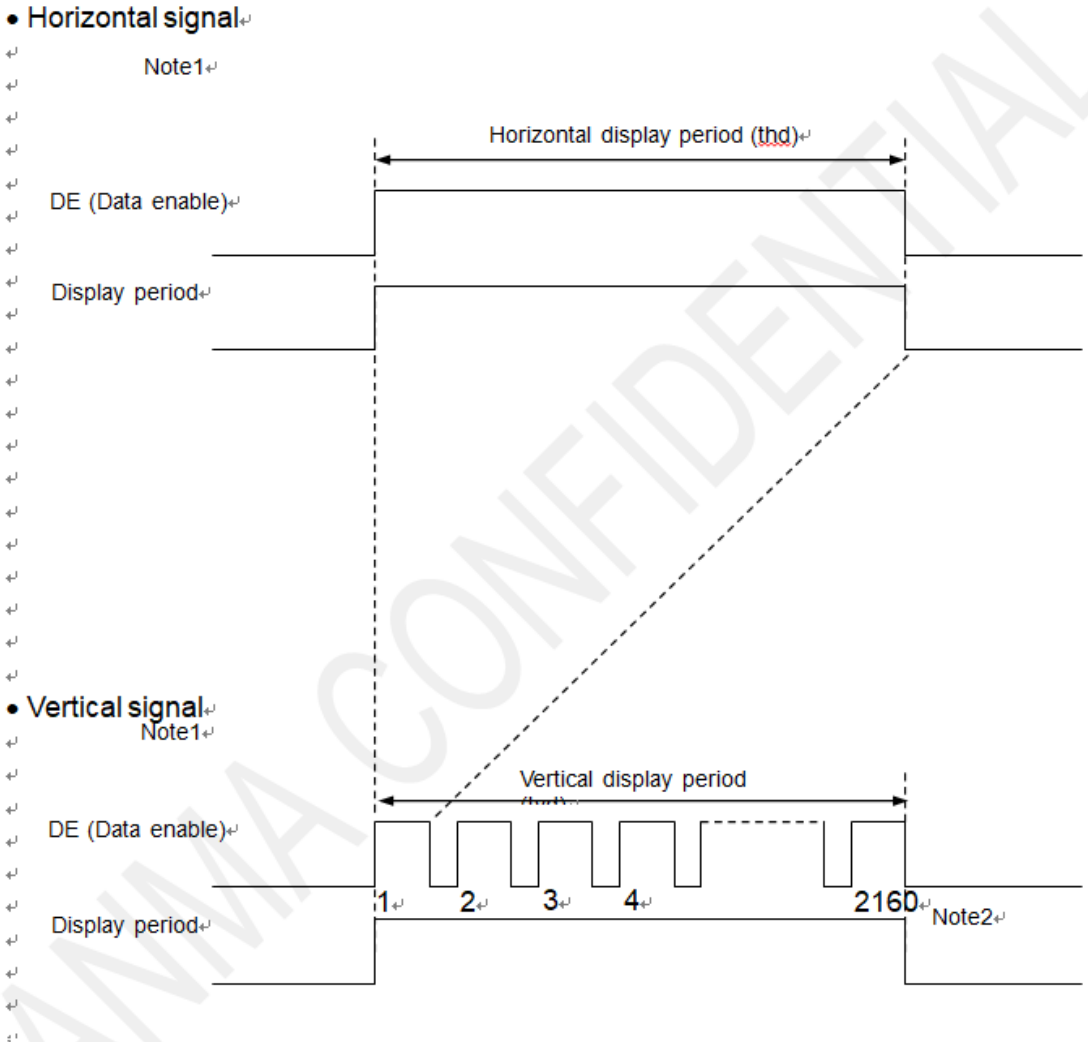


Figure 6.3 Outline of input signal timings

Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "**4.8.3 Input signal timing chart**" for the pulse number.

6.4 Timing characteristics

(Note1)

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	355	533.25	580	MHz	1.875 ns (typ.)
	Duty ratio		-	-			-	-
	Rise time, Fall time		-				ns	
DE	Horizontal	Cycle	th	-	7.50	-	μs	133.31 kHz (typ.)
				3920	4,000	6000	CLK	
		Display period	thd	3,840			CLK	-
	Vertical (One frame)	Cycle	tv	-	16.67	-	ms	60.0 Hz (typ.)
				2200	2,212	3000	H	
		Display period	tvd	2,160			H	-

Table 6.4 Timing characteristics

Note1: Definition of parameters is as follows.
tc= 1CLK, th= 1H

6.5 Input signal timing chart

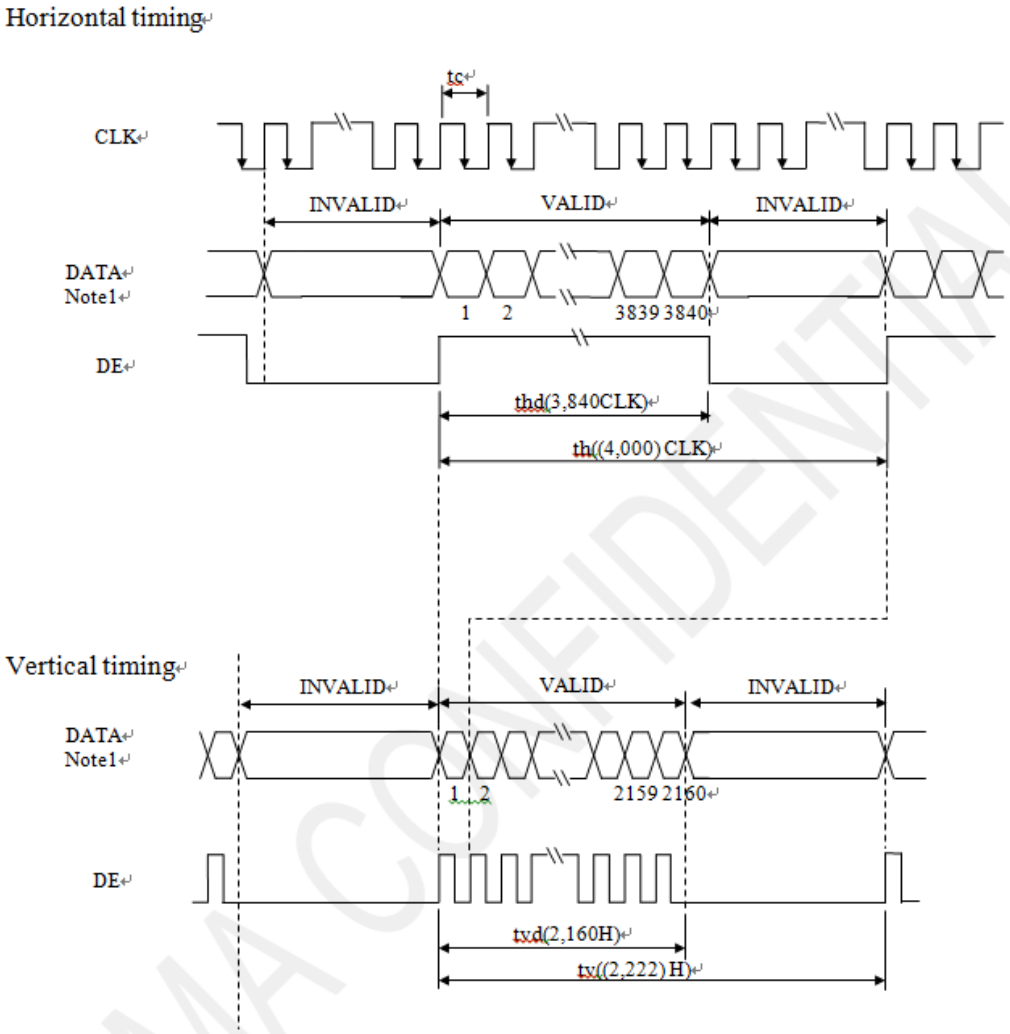


Figure 6.5 Input signal timing chart

Note1: DATA = RA0-RA7, GA0-GA7, BA0-BA7
RB0-RB7, GB0-GB7, BB0-BB7
RC0-RC7, GC0-GC7, BC0-BC7
RD0-RD7, GD0-GD7, BD0-BD7

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°	1000	1200	-		Note 3
			Φ45, θ45	300	400			
			Φ135, θ45	300	400			
			Φ225, θ45	300	400			
			Φ315, θ45	300	400			
Response Time		T_{ON}	25℃	-		35	ms	Note 4
		T_{OFF}						
Chromaticity	**White**	x	Backlight is on	0.252	0.302	0.352		Note 1,5
		y		0.273	0.323	0.373		
	Red	x		0.590	0.640	0.690		Note 1,5
		y		0.277	0.327	0.377		
	Green	x		0.244	0.294	0.344		Note 1,5
		y		0.562	0.612	0.662		
	Blue	x		0.097	0.147	0.197		Note 1,5
		y		0.025	0.075	0.125		
Uniformity		U		70	75	-	%	Note 6
NTSC		-		65	70	-	%	Note 5
Luminance（65mA）		L		1300	1500		cd/m^2	Note 7
Luminance（55mA）		L		1100	1300		cd/m^2	Note 7
Cross Talk						1.2	%	
Flicker						-25	dB	
Gamma				1.9	2.2	2.5		

Table 7.1 Optical Parameters

Test Conditions:

1. I_F= **XX** 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.

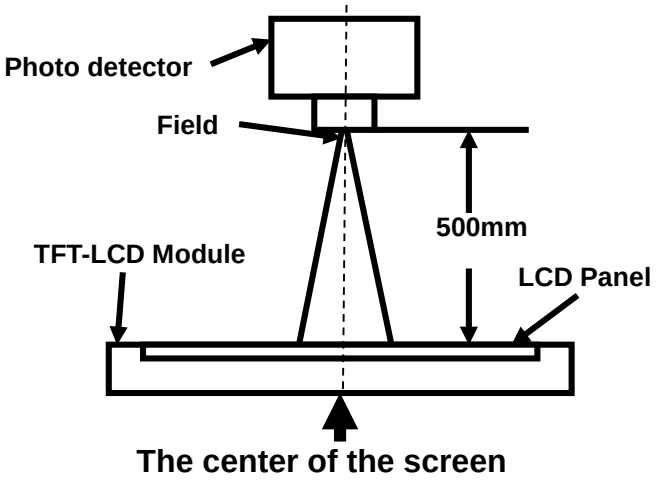


Fig1. Measurement Set Up

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

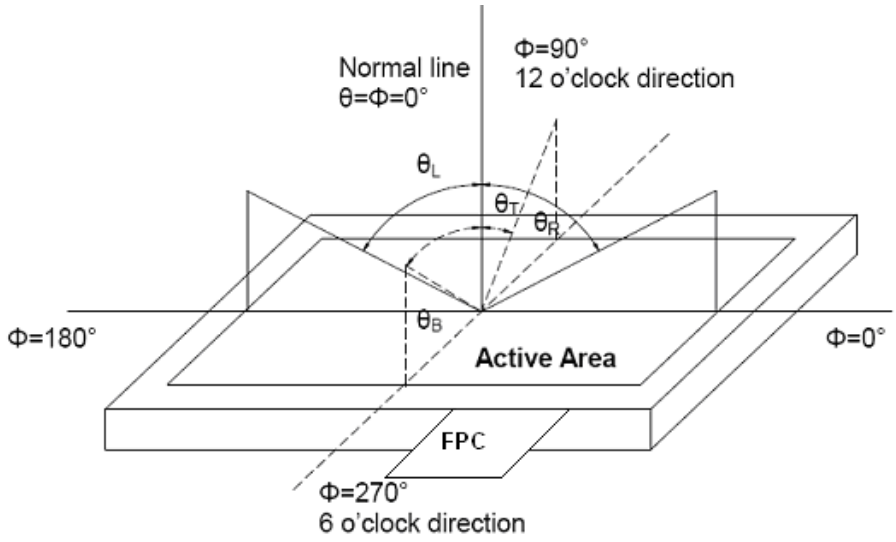


Fig2. Measurement viewing angle

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 TN 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 90% to 10%. And fall time (T_f) is the time between photo detector output intensity changed from 10% to 90%.

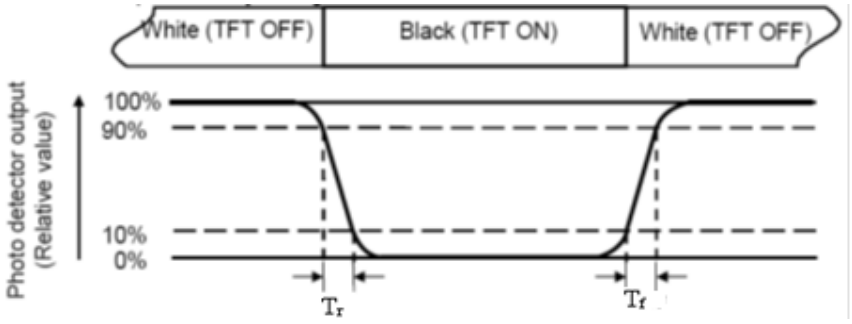


Fig3. Response Time Testing(TN)

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%.

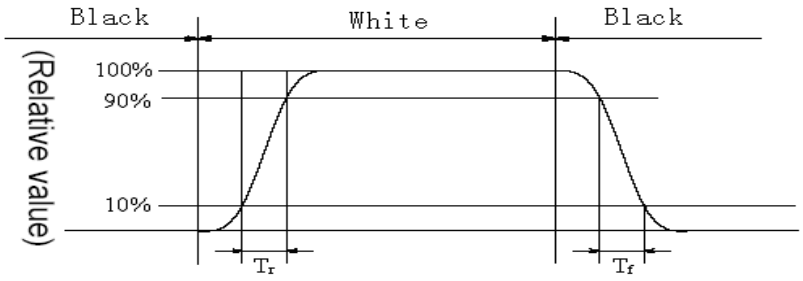


Fig4. Response Time Testing(SFT)

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

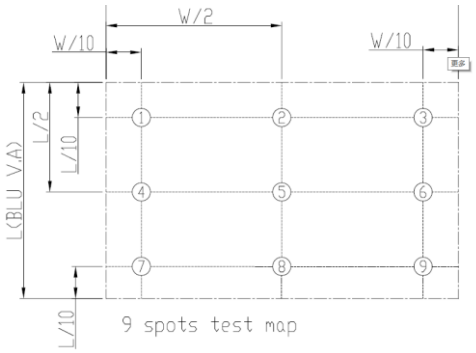
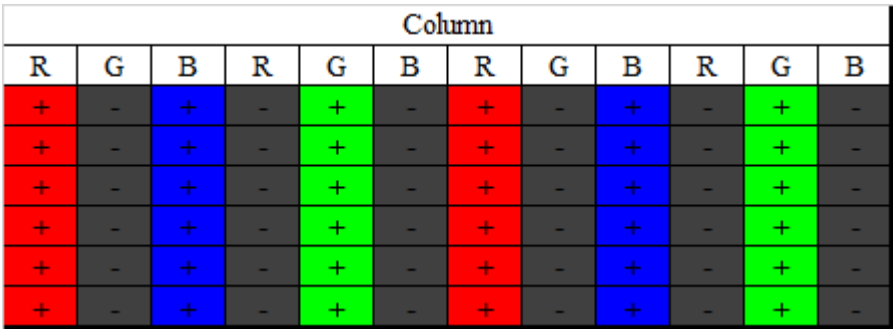


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

Note8: Flicker Pattern（128grey）：



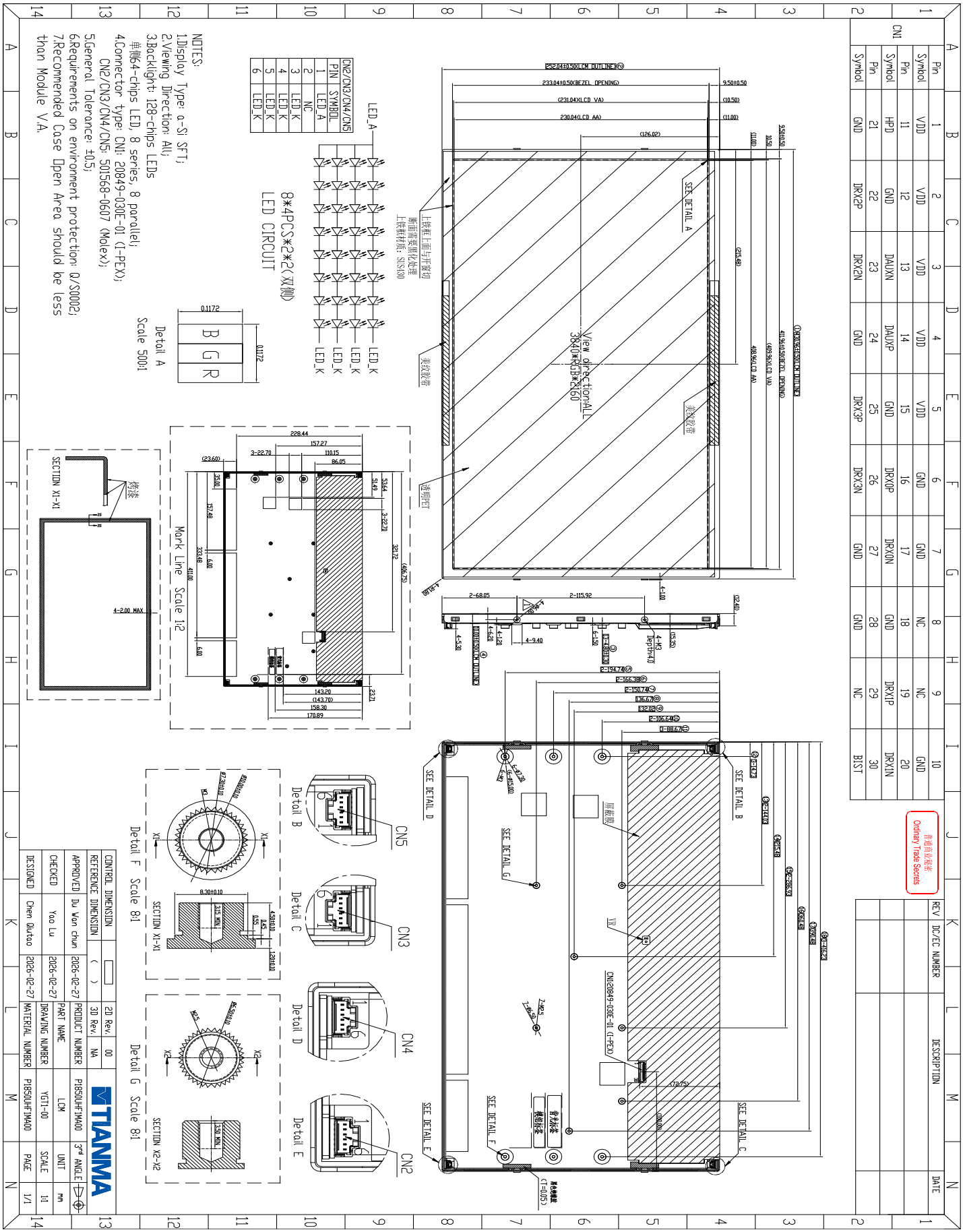
8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+70℃，240H	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃，240H	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+80℃，240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃，240H	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity(non-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，5point/panel Air：±8kv，5times； Contact：±4kv，5times； （Environment：15℃~35℃，30%~60%，86Kpa~106Kpa）	IEC61000-4-2:2001 GB/T17626.2-2006
8	Package Vibration	5-20-200HZ，PSD：0.01-0.01-0.001 Total:0.781g2/HZ,x/y/z 30min）	
9	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
10	Image Sticking	60C*4H, release 30mins	

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.

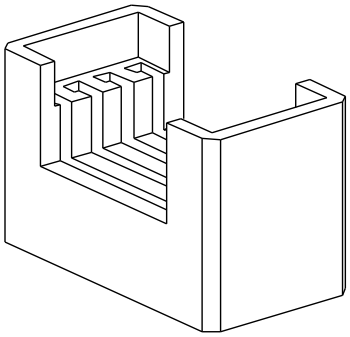
9. Mechanical Drawing



10. Packing Instruction

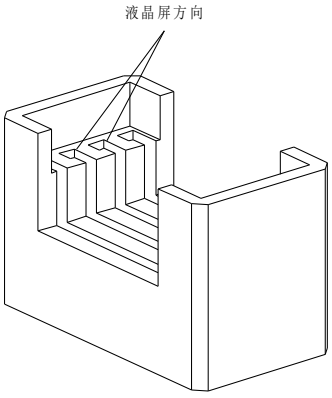
No	Item	Material	Dimension(mm)	Weight(Kg)	Quantity	Remark
1	LCD module	P1850UHF1MA00	430.96x252.04x12.4	3	4	
2	Carton	CORRUGATED PAPER	545×300×365	2.0	1	
3	EPE Buffering(Bottom)	EPE	540×295×338	0.6	1	
4	EPE Buffering(Top)	EPE	540×295×20	0.55	1	
5	Anti-static bag	PE	450×410×3	0.06	2	
6	Masking Tape	Paper	50×10	0.001	4	
7	Label	Paper	100×52	0.001	1	
Total		7.7 Kg				

A. Assemble the carton, seal the bottom with tape, and put the EPE buffering (bottom) into the carton The tall EPE is the bottom EPE, and the short EPE is the top

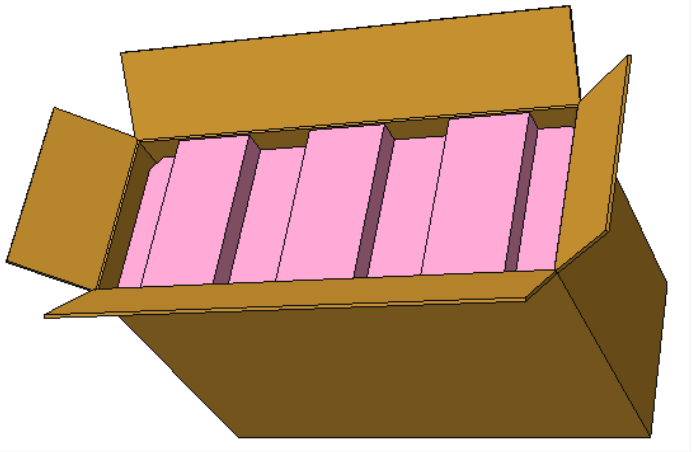


B. when put the module into carton, the product should be held with both hands, and the PCB side of the module (with the shield film side) should be placed downward; ;

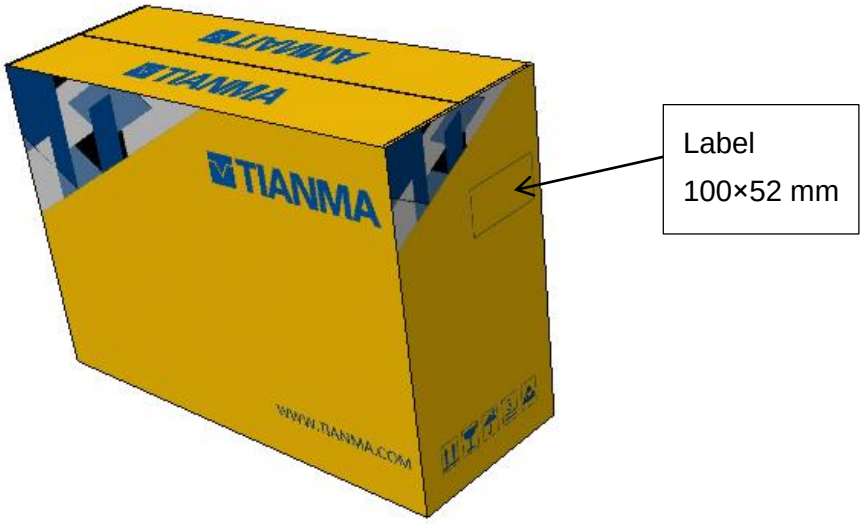
C. Place both module LCD screens facing inward and facing each other, then insert them into the EPE groove



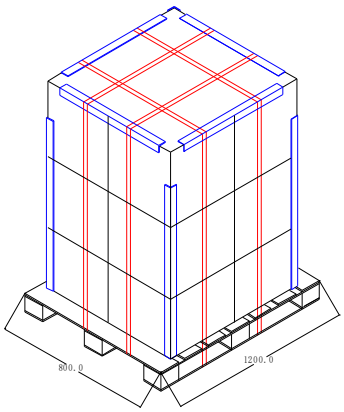
D. After the module is placed, clamp the module with EPE buffering (upper) and press it down



E. Seal the Carton and attach the label：



The number of stacked carton is 2 * 2/layer *, totaling 3 layers



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.

11.6 Bar code Information

Naming Rule

Digit / Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	A	4	P	7	9	A~Z	0	0	1	A	0	0	1
Desc	Shop Fixed	FAB ID 1 - 9	Lot Type P/E/D/T	Year 0 - 9	Month 1 - 9, A,B,C	Panel Size A~Z	Serial No 001~Z99 Except I and O			Glass Slot No Except I	Panel Serial Number		