

SPECIFICATION

☐ Preliminary Specification
☒ Final Specification

Description **12.1" 1024(RGB) X 768 TFT-LCD Module**
Part Number **P1210XGN1MB00**

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

REVISION HISTORY

Rev	Date	Page	Revision Items	Editor
1.0	2023/07/13	-	Preliminary spec	Zhao Zhang
1.1	2023/08/18		Update luminance from 450typ 300min to 500typ 400min	Zhao Zhang
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1. Summary

1.1 General Description

This is a 12.1 inch a-Si TFT-LCD module with Normal- white technology. It is composed of a TFT-LCD panel, FPC, Bezel and a LED backlight unit.

1.2 Features

- Interface: LVDS 1port
- Compliant with UL 60950-1/CAN/CSA C22.2 No.60950-1-07 (E250878)
- Acquisition product for 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	12.1 inches	
	Resolution	1024(RGB) x 768	
	Pixel Pitch	0.240 (H) x 0.240 (V) mm	mm
	TFT Active Area	245.76 (H) x 184.32 (V) mm	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	TN, Normally White	
	Surface Treatment	AG	
Mechanical Characteristics	LCM (W x H x D)	279.0 (W) x 209.0 (H) x 8.6 (D) mm (typ.)	mm
	Weight	476	g
Optical Characteristics	Luminance	500 typ	cd/m ²
	Contrast Ratio	700:1 typ	
	NTSC	55 typ	%
	Viewing Angle	80/80/80/80 typ	degree
Electrical Characteristics	Interface	LVDS 1port	
	Color Depth	16.2M/262K	colors
	Power Consumption	6.4 typ	W

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
Connector type	MSB240420HE (STM)
Matching connector	P240420 (STM) or DF14-20S-1.25C (Hirose Electric Co., Ltd. (HRS))

Pin No.	Symbol	Signal	Input data signal: 8-bit	Input data signal: 6-bit	Remarks
1	VCC	Power supply	Power supply		Note1
2	VCC				
3	GND	Ground	Ground		Note1
4	FRC	Selection of the number of colors	High	Low or Open	
5	D0-	Pixel data	R0-R5, G0		Note2
6	D0+				
7	GND	Ground	Ground		Note1
8	D1-	Pixel data	G1-G5, B0-B1		Note2
9	D1+				
10	GND	Ground	Ground		Note1
11	D2-	Pixel data	B2-B5, DE		Note2
12	D2+				
13	GND	Ground	Ground		Note1
14	CLK-	Pixel clock	Pixel clock		Note2
15	CLK+				
16	GND	Ground	Ground		Note1
17	D3- / GND	Pixel data / Ground	R6-R7 G6-G7 B6-B7	Ground	Note2
18	D3+ / GND				
19	DPS	Selection of scan direction	High: Reverse scan Low or Open: Normal scan		
20	N.C.	Non connection	-		Keep this pin Open.

Note1: All GND and VCC terminals should be used without any non-connected lines.

Note2: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

3.2 CN2 Pin assignment (Back Light)

Connector Information	
Connector type	MSB24038P5 (STM)
Matching connector	P24038P5 (STM) or 51146-0500 (Molex)

Pin No.	Symbol	Signal	Remarks
1	N. C.	Non connection	Keep this pin Open.
2	PWM	Luminance control	PWM Dimming
3	BRTC	Backlight ON/OFF control	High: ON / Low: OFF
4	GND	Ground	-
5	VDD	Power supply	-

4. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Power Supply Voltage	VCC	-0.3	3.96	V	
Operating Temperature	T _{OP}	-20	70	°C	
Storage Temperature	T _{ST}	-30	80	°C	
Relative Humidity (Note1)	RH	--	≤95	%	Ta ≤ 40°C
		--	≤85	%	40°C < Ta ≤ 50°C
		--	≤55	%	50°C < Ta ≤ 60°C
		--	≤36	%	60°C < Ta ≤ 70°C
Absolute Humidity	AH	--	≤70	g/m ³	Ta > 70°C

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 Driving TFT LCD Panel

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VCC	3.0	3.3	3.6	V	-
Power supply current		ICC	-	340 Note1	740 Note2	mA	at VCC= 3.3V
Permissible ripple voltage		VRP	-	-	300	mVp-p	for VCC
Differential input threshold voltage	High	VTH	-	-	+100	mV	at VCM= 1.25V Note3
	Low	VTL	-100	-	-	mV	
Terminating resistance		RT	-	100	-	Ω	-
Input voltage for DPS signal	High	VFH1	0.7VCC	-	VCC	V	-
	Low	VFL1	0	-	0.3VCC	V	
Input voltage for FRC signal	High	VFH2	0.7VCC	-	VCC	V	-
	Low	VFL2	0	-	0.3VCC	V	
Input current for DPS signal	High	IFH1	-	-	500	μA	-
	Low	IFL1	-500	-	-	μA	
Input current for FRC signal	High	IFH2	-	-	300	μA	-
	Low	IFL2	-300	-	-	μA	

Note1: Checkered flag pattern [by EIAJ ED-2522]

Note2: Pattern for maximum current

Note3: Common mode voltage for LVDS receiver

5.2 Backlight Unit

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage	VDD	10.8	12.0	13.2	V	Note1
Power supply current	IDD	-	410	480 Note2	mA	At the maximum luminance control
Permissible ripple voltage	VRPD	-	-	200	mVp-p	for VDD Note3
Input voltage for PWM signal	High	VDFH1	2.0	-	VDD	-
	Low	VDFL1	0	-	0.8	
Input voltage for BRTC signal	High	VDFH2	2.0	-	VDD	-
	Low	VDFL2	0	-	0.8	
PWM frequency	fPWM	200	-	20k	Hz	Note4, Note5
PWM duty ratio	DRPWM	1	-	100	%	Note6, Note7
PWM pulse width	tPWH	5	-	-	μs	
LED life time	--	30000	50000	-	Hrs	

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. Put a capacitor between the power supply lines (VDD and GND) to reduce the noise if necessary.

Note4: A recommended f_{PWM} value is as follows.

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

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

Note5: Depending on the frequency used, some noise may appear on the screen, please conduct a

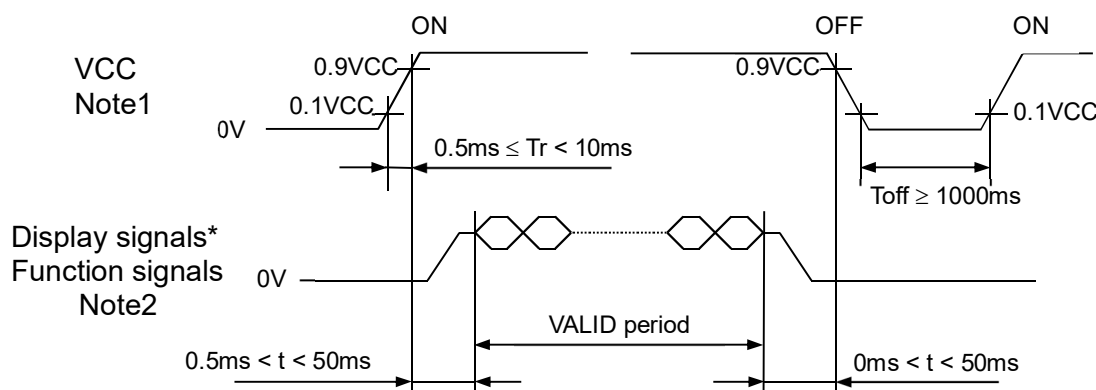
thorough evaluation.

Note6: While the BRTC signal is high, do not set the tPWH (PWM pulse width) is less than $5\mu\text{s}$. It may cause abnormal working of the backlight. In this case, turn the backlight off and then on again by BRTC signal.

Note7: Regardless of the PWM frequency, both PWM duty ratio and PWM pulse width must be always more than the minimum values.

5.3 Recommended Power ON/OFF Sequence

5.3.1 LCD panel signal processing board



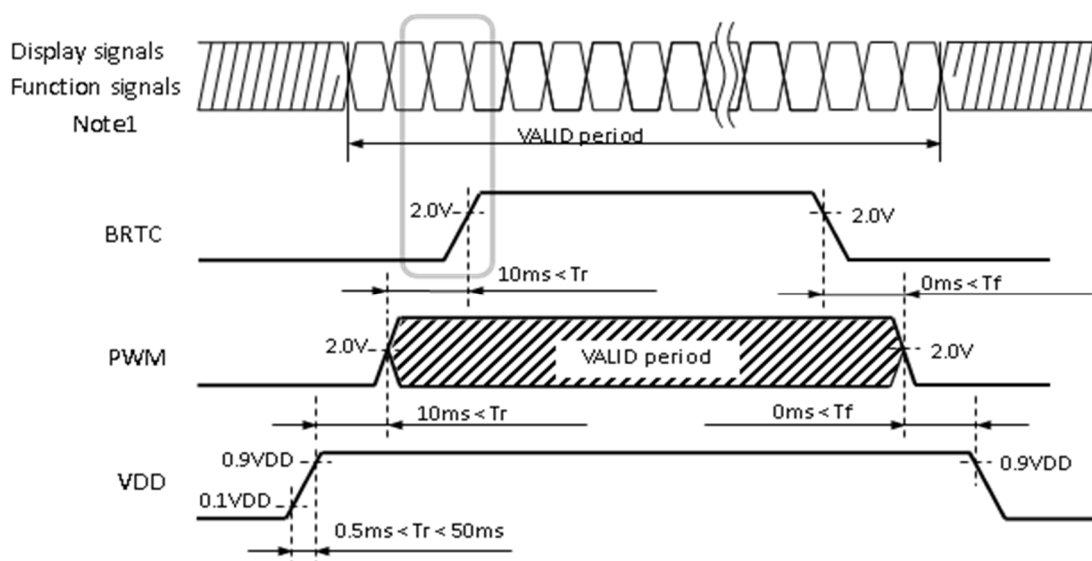
* These signals should be measured at the terminal of 100Ω resistance.

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 (DPS and FRC) 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.

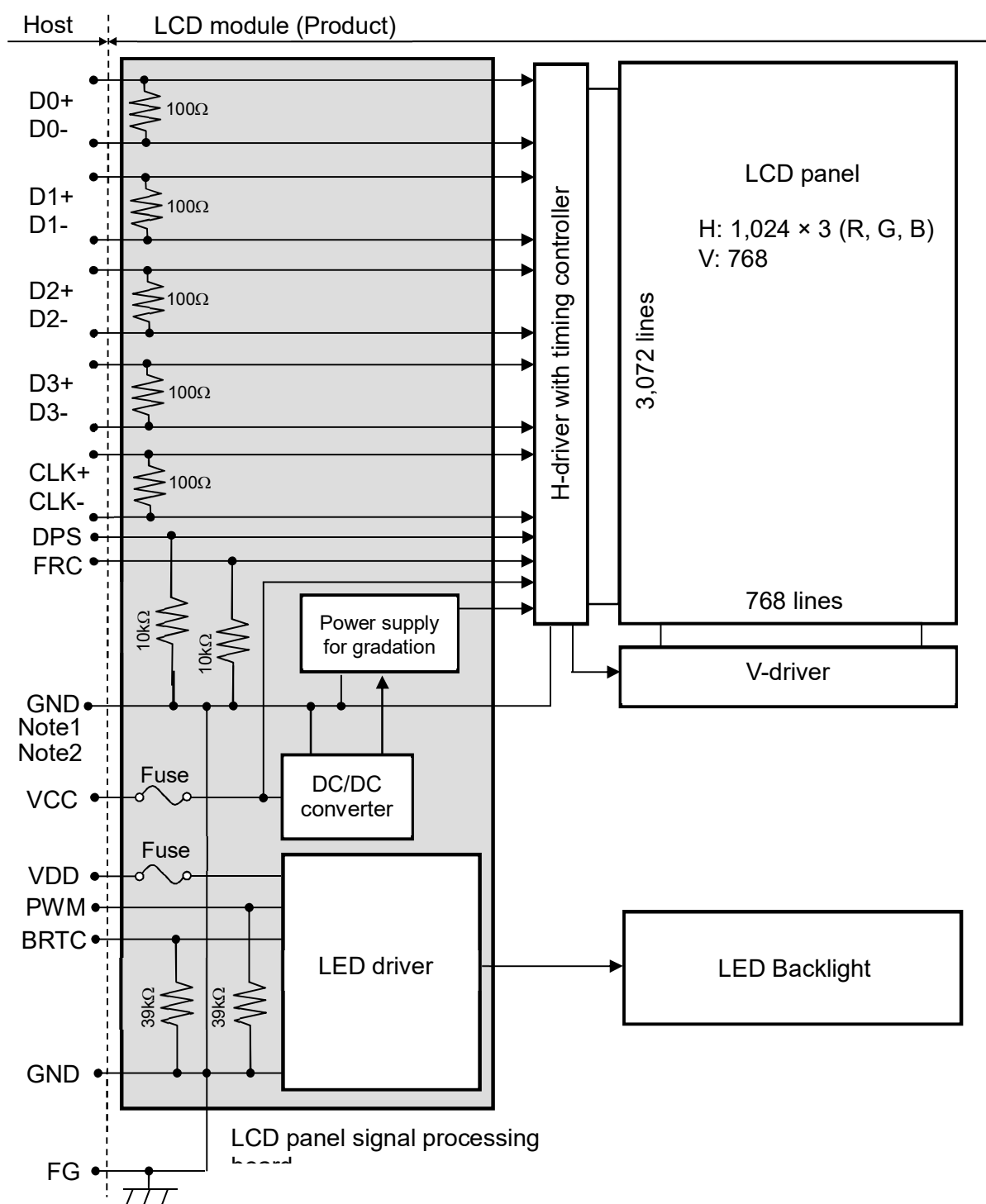
5.3.2 LED driver



Note1: These are the display and function signals for LCD panel signal processing board.

Note2: The backlight should be turned on within the valid period of display and function signals, in order to avoid unstable data display.

5.4 Block Diagram



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

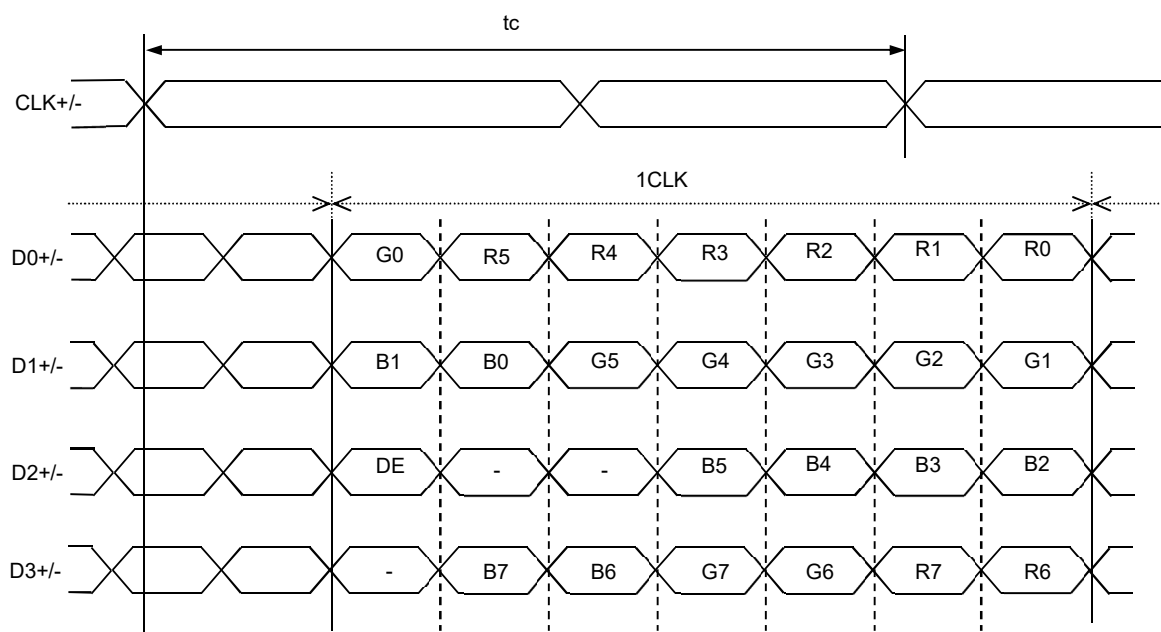
GND- FG	Connected
---------	-----------

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

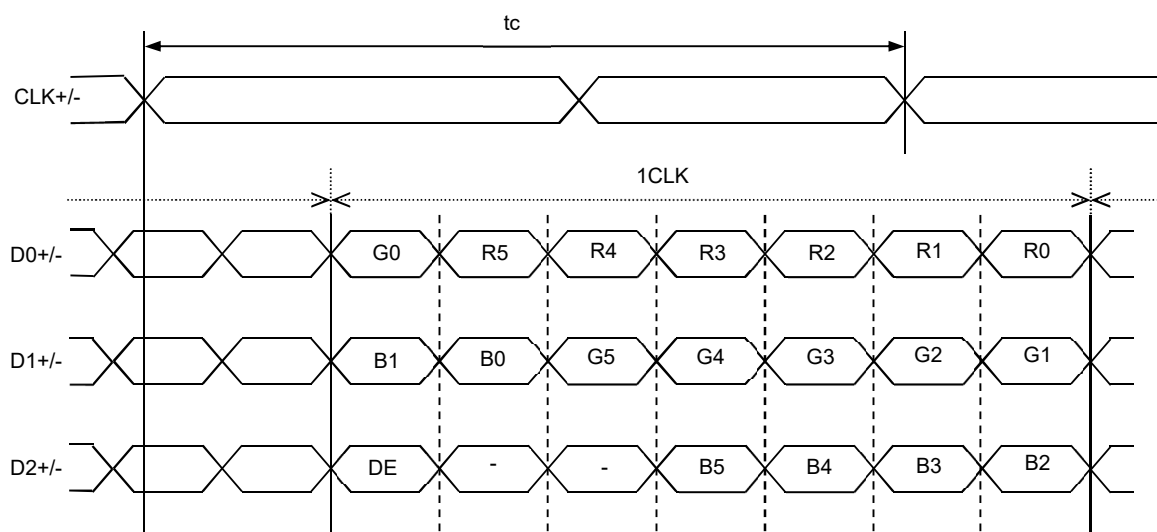
6. Timing Characteristics

6.1 Input data mapping

(1) LVDS Input data signal: 8-bit



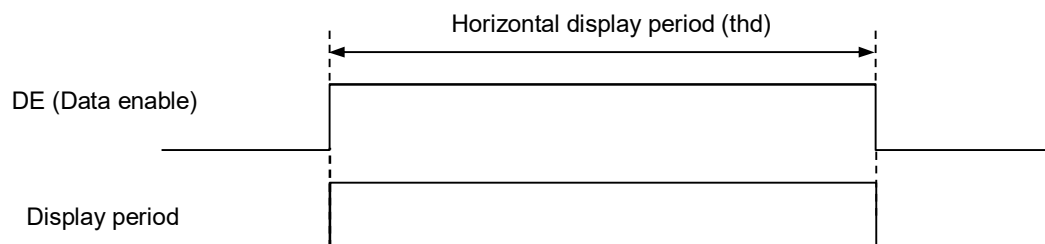
(2) LVDS Input data signal: 6-bit



6.2 Outline of input signal timings

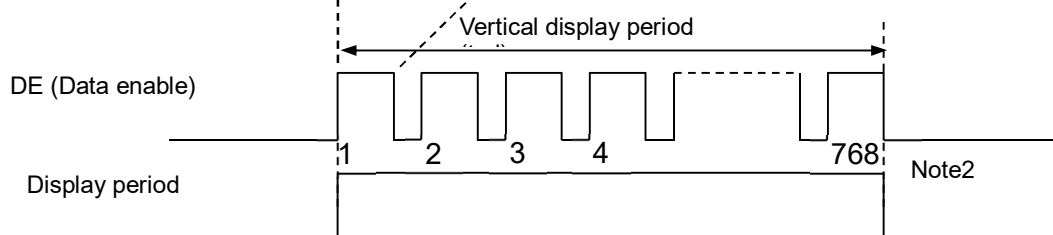
- Horizontal signal

Note1



- Vertical signal

Note1



Note1: This diagram indicates virtual signal for set up to timing.

Note2: See "6.4 Input signal timing chart" for the pulse number.

6.3 Timing characteristics

Parameter			Sym bol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	52.0	65.0	71.0	MHz	15.385ns (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	48.363kHz (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	60.0Hz (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.

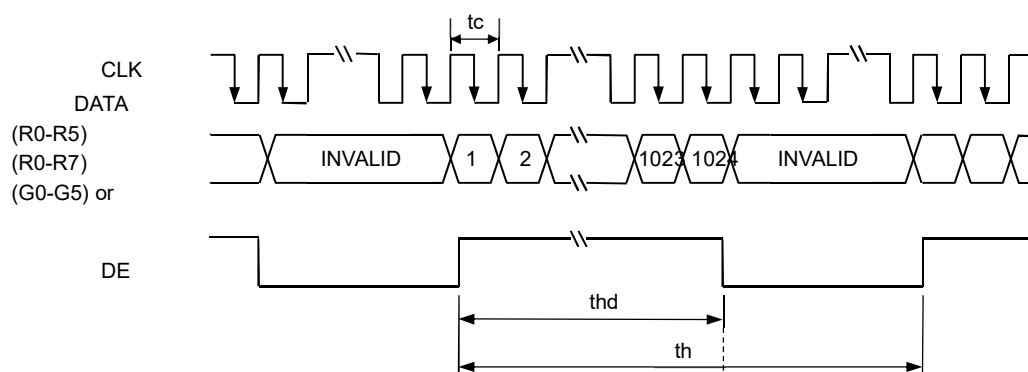
$t_c = 1\text{CLK}$, $t_h = 1\text{H}$

Note2: See the data sheet of LVDS transmitter.

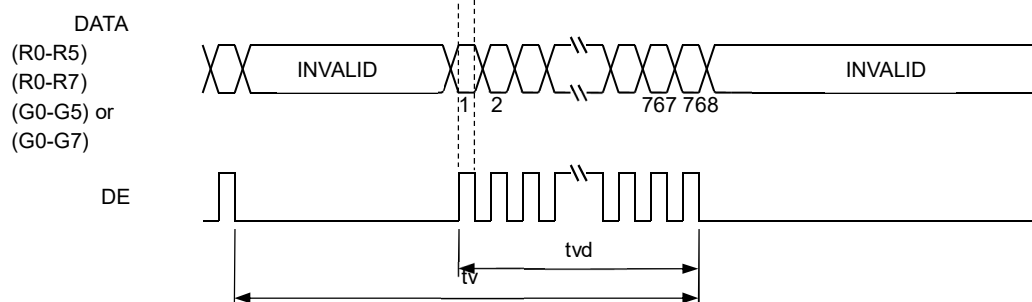
Note3: Vertical cycle (t_v) should be specified in integral multiple of Horizontal cycle (t_h).

6.4 Input signal timing chart

Horizontal timing



Vertical timing



7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	70	80	-	Degree	Note2,3
		θB		70	80	-		
		θL		70	80	-		
		θR		70	80	-		
Contrast Ratio		CR	θ=0°	500	700	-	-	Note 3
Response Time		T _{ON}	25℃		3	5	ms	Note 4
		T _{OFF}			5	8		
Chromaticity	White	x	Backlight is on	0.243	0.293	0.343	-	Note 1,5
		y		0.258	0.308	0.358		
	Red	x		0.521	0.571	0.621	-	Note 1,5
		y		0.286	0.336	0.386		
	Green	x		0.267	0.317	0.367	-	Note 1,5
		y		0.555	0.605	0.655		
	Blue	x		0.105	0.155	0.205	-	Note 1,5
		y		0.038	0.088	0.138		
Uniformity		U	-	75	80	-	%	Note 6
NTSC		-	-	48	55	-	%	Note 5
Luminance		L	-	400	500	-	cd/m ²	Note 7

1.1

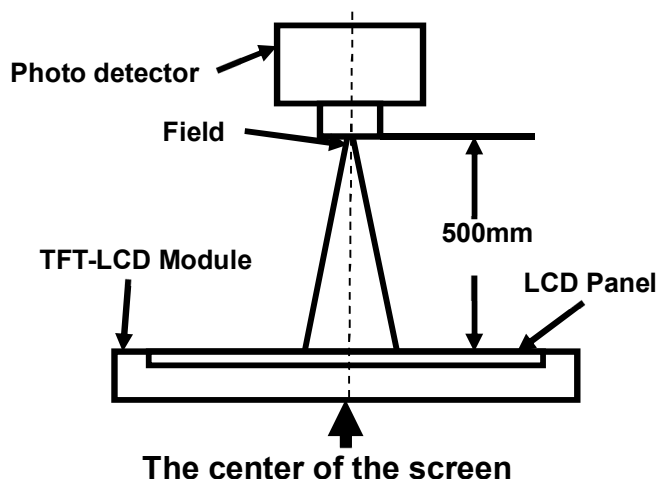
Table 7.1 Optical Parameters

Test Conditions:

1. The ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

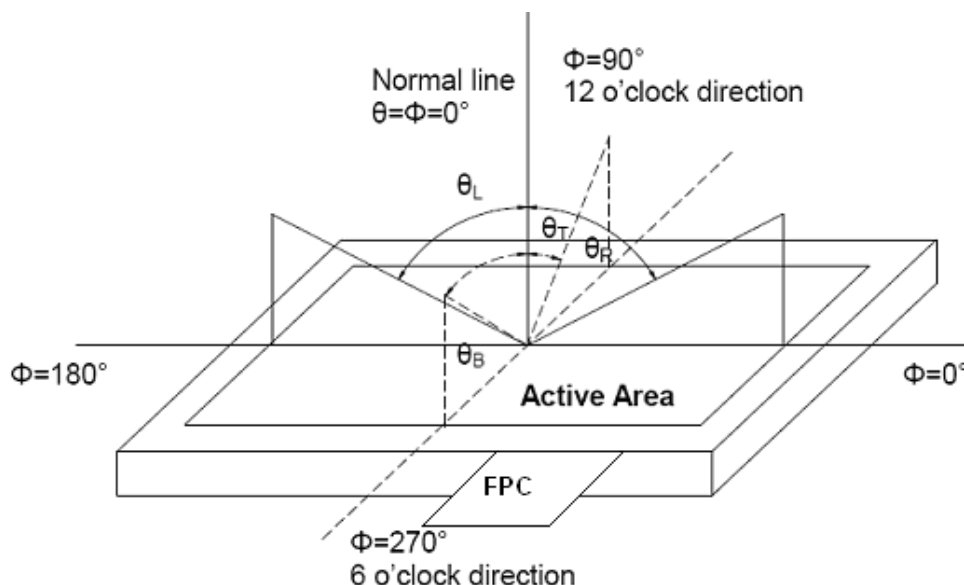
Note 1: Definition of optical measurement system.

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.

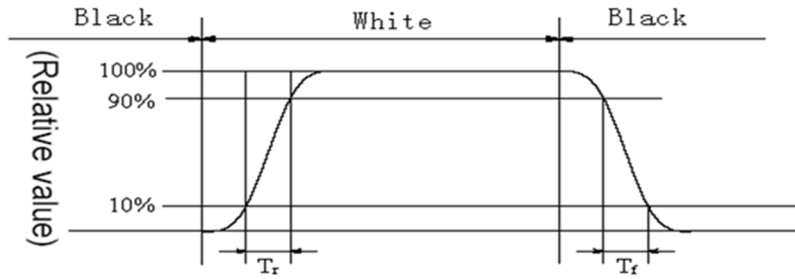


Note 3: Definition of contrast ratio

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

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 10% to 90%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 90% to 10%.



Note 5: Definition of color chromaticity (CIE1931)

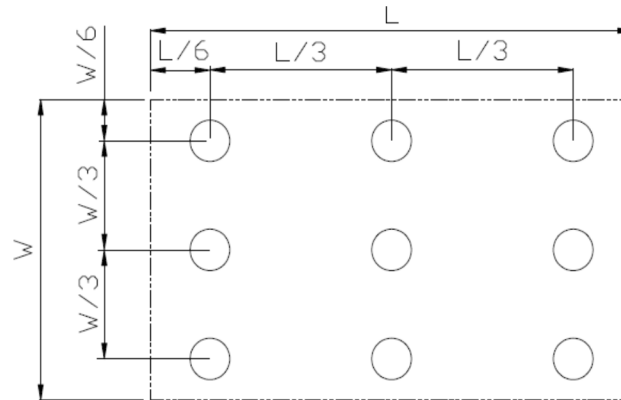
Color coordinates measured at center point of LCD.

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.

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

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. Reliability Test

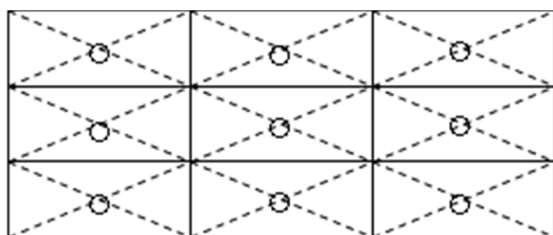
No	Test Item	Condition	Remarks
1	High Temperature Operation	+70°C, 240 hours (Note1)	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20°C, 240 hours (Note1)	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+80°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	+50°C, 80% RH max, 240hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-20°C 30 min ~ +60°C 30 min, Change time:5min, 20 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, GB2423.22-2002
7	ESD(Operation)	C=150pF, R=330Ω, Air: ±15Kv, 9points,25times/point; Contact: ±8Kv, 9points,25times/point (Note4) (Environment: 15°C~35°C, 30%~60%. 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Package Drop Test	Height: 60cm, 1corner, 3edges, 6surfaces	IEC60068-2-32:1990 GB/T2423.8—1995
9	Vibration (Non-operation)	Frequency range:5~100Hz,11.76m/s ² 1minute/cycle X,Y,Z directions 50times each directions	IEC600682-6:1982 GB2423.10-1995
10	Shock (Non-operation)	30G,11ms,±X,Y,Z directions,3times For each direction	IEC60068-2-27:1987 GB/T2423.5—1995

Note1: Temperature is the ambient temperature of sample

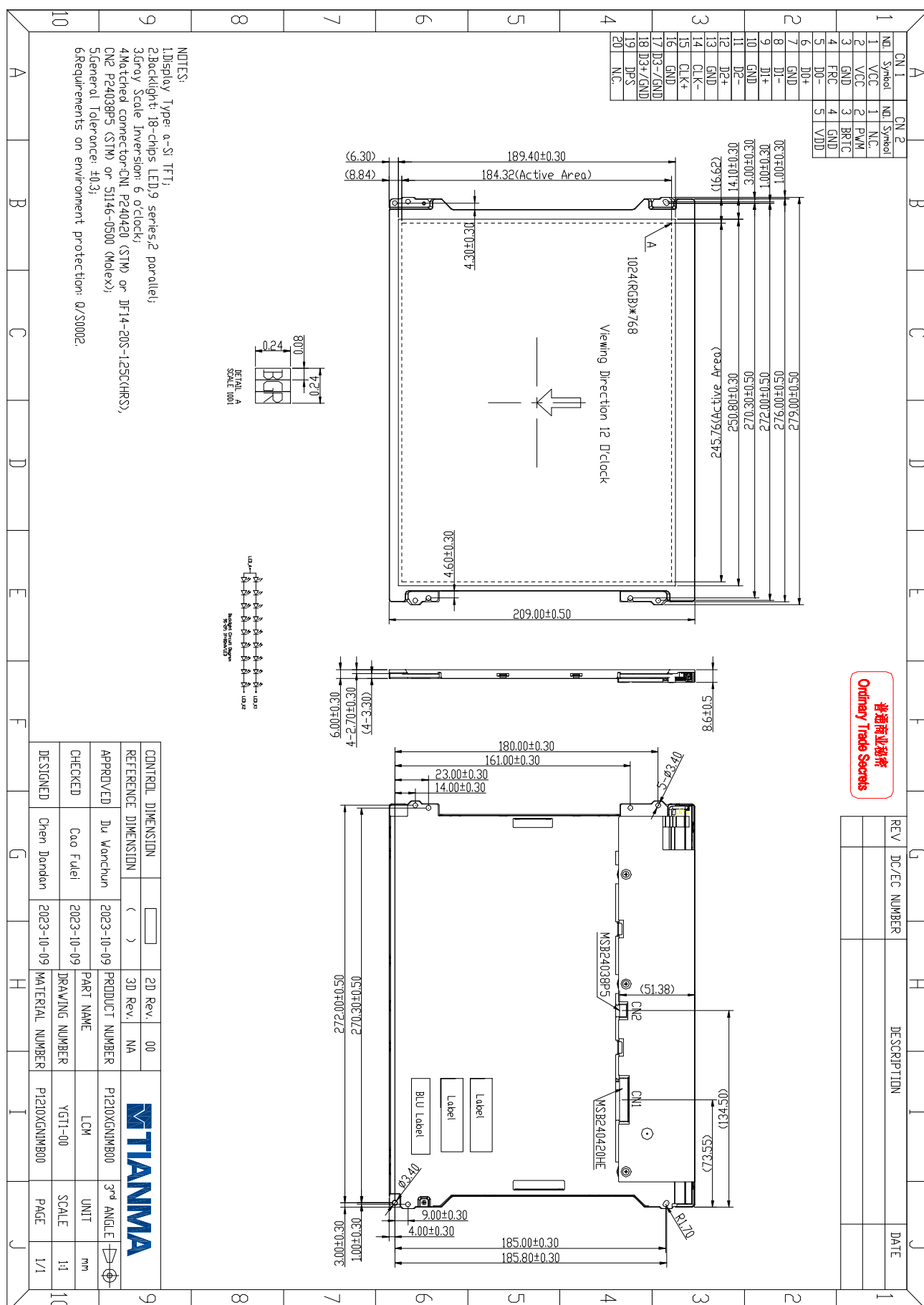
Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

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.

Note4: See the following figure for discharge points.



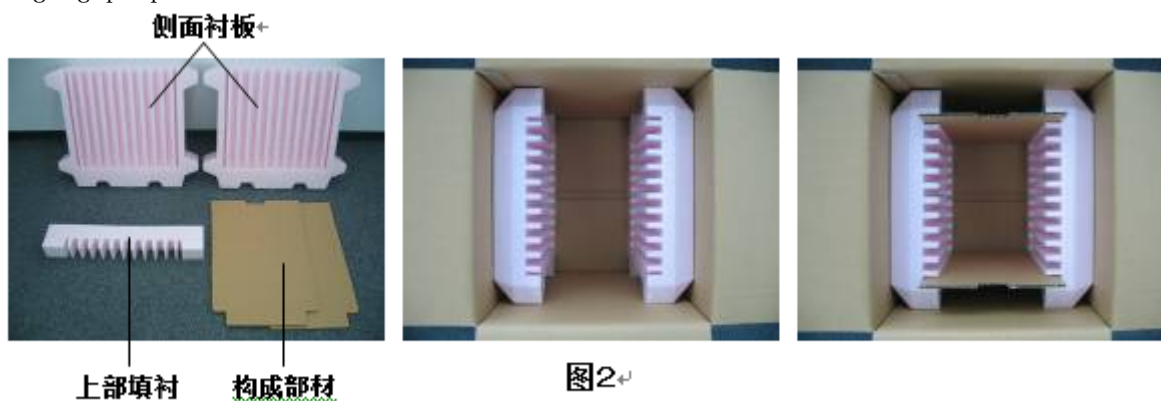
9. Mechanical Drawing



10. Packing Instruction

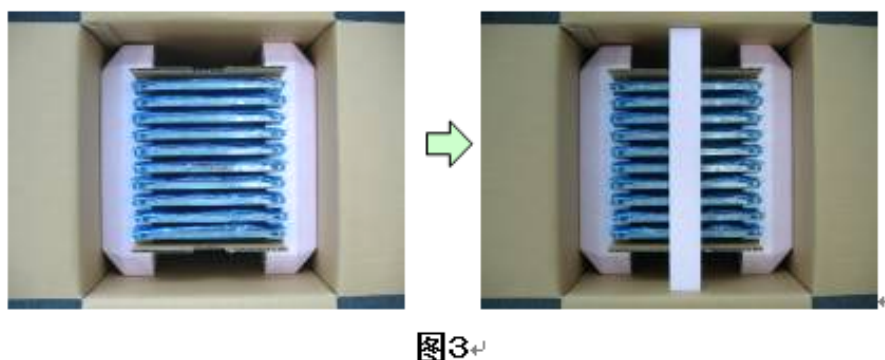
No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	P1210XGN1MB00	279.0×209.0 × 8.6	0.476	10	
2	Partition board	Corrugated paper	321×212	0.035	2	
3	Anti-static Bag	LD-PE	360×255	0.007	10	
4	EPP (Left&Right)	EPP	386×325×85	0.092	2	
5	EPP (Up)	EPP	376×60×50	0.027	1	
6	Carton-inside	Corrugated pape	395x311x377	0.487	1	
7	Model Label	Paper	52x12.5	0.001	20	
8	Barcode Label	Paper	76x104	0.001	1	
9	Total weight	5.62±10%				

1) Packaging preparation

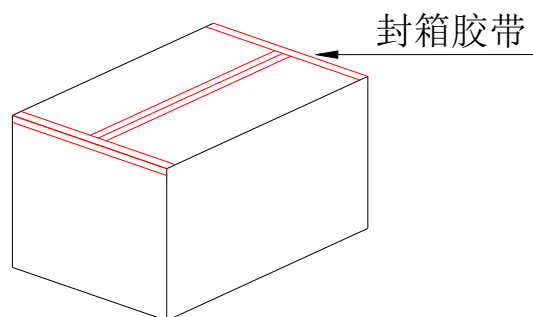


2) Package

10 Pcs. In one box.



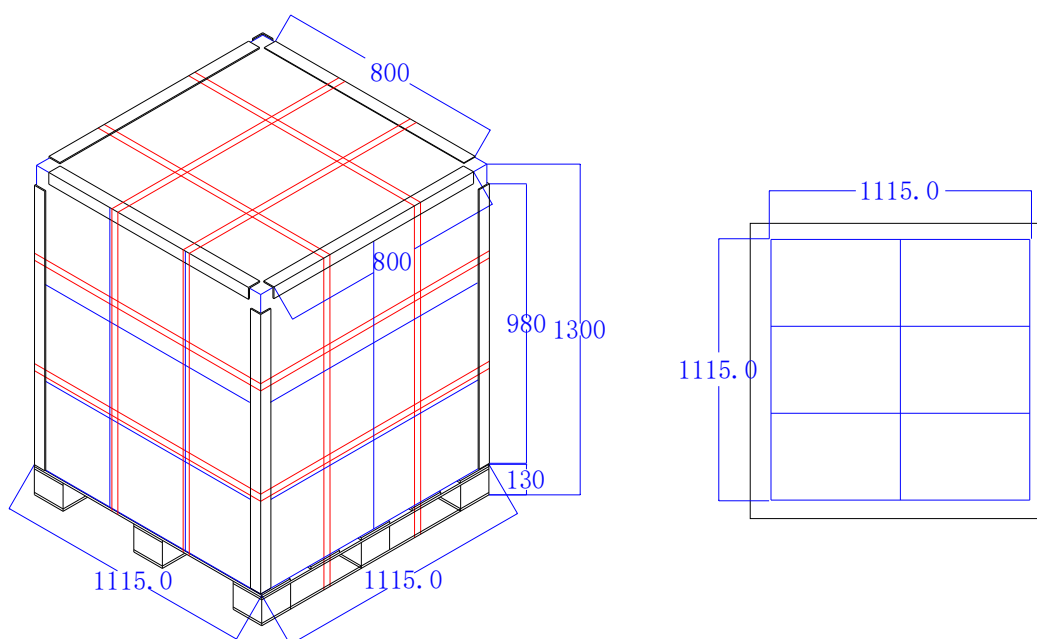
3) Sealing of packaging boxes



4) Prepare the pallet and lay the cardboard on it

The whole pallet is stacked in 3 layers, with 6 boxes per layer, as shown in the following figure

Note: Depending on the quantity produced, the number of layers can also be changed (the L corner should be cut according to the number of 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 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.