

SPECIFICATION

Customer Part Number: ...
Tianma Part Number: TM101DDHG06-71
Product Description: 10.1" 1024xRGBx600 TFT-LCD Module

- Target Specification
- Preliminary Specification
- Final Specification

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1. Summary

1.1 Summary

This is a 10.1 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module with Normally White technology. This product is designed for industrial applications.

1.2 Features

- 30Khrs LED life time
- Without LED driver
- RGB888 TTL interface
- FPC pin out
- Anti- glare surface treatment
- Compliant with the ROHS

2. General Specification

Feature		Spec
Display Spec.	Size	10.1 inch
	Resolution	1024(RGB)x600
	Pixel Pitch (mm)	0.2175x0.2088
	Technology Type	a-Si
	Pixel Configuration	R.G.B Vertical Stripe
	Display Mode	TN, Normally White
	Surface Treatment	Anti-Glare
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	235.00 x 143.00 x 5.0
	Active Area(mm)	222.72 x 125.28
	Weight (g)	272
	Matching Connection Type CN1	STARCONN: 089H50-000100-G2-R
	Matching Connection Type CN2	SM02B-BHSS-1-TB
Optics	Luminance(nits)	350
	Contrast ratio	500
	NTSC	47%
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
	Viewing angle(U/D/L/R)	75/80/80/80(TN)
Electrical Characteristics	Interface	TTL(RGB888)
	Color Depth	262K/16.2M
	Power consumption	LCD:450mW(Black pattern) Backlight:2150mW
	Power supply voltage	LCD panel: -- LED :224mA/9.6V

Table 2.1 General TFT Specifications

Note 1: For TN LCM: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: LCM weight tolerance: $\pm 5\%$

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Matching connector type: STARCONN 089H50-000100-G2-R

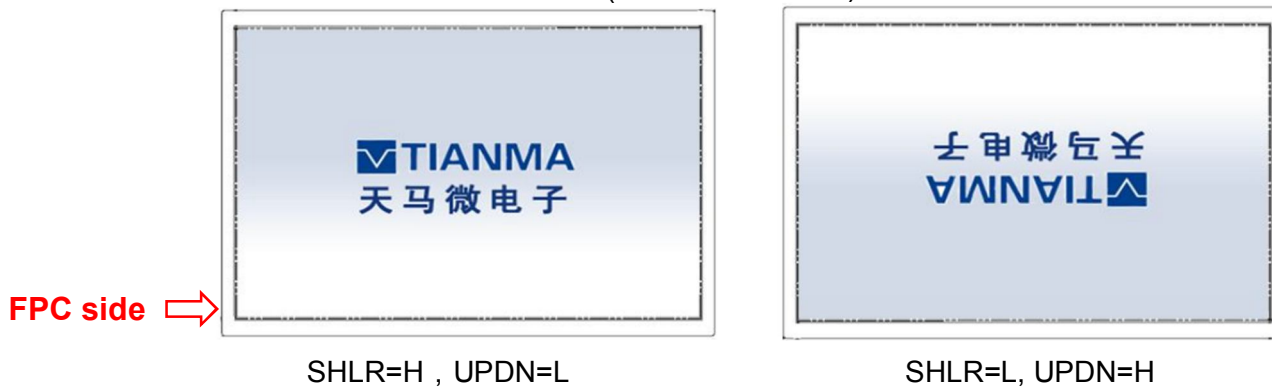
Pin	Symbol	I/O	Description	Remark
1	NC	-	No connection	
2	NC	-	No connection	
3	NC	-	No connection	
4	NC	-	No connection	
5	GND	P	Power GND	
6	NC	-	No connection	
7	VDD	P	Digital Power	
8	MODE	I	DE/SYNC mode select MODE=H: DE mode MODE=L : SYNC mode	
9	DE	I	Data input enable	
10	VS	I	Vertical sync input	
11	HS	I	Horizontal sync input	
12	B7	I	Blue data(MSB)	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	
19	B0	I	Blue data(LSB)	
20	G7	I	Green data(MSB)	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data(LSB)	
28	R7	I	Red data(MSB)	
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	
35	R0	I	Red data(LSB)	
36	GND	P	Power GND	
37	DCLK	I	Latch data at falling edge	
38	GND	P	Power GND	
39	SHLR	I	Left or right display control	Note1
40	UPDN	I	UP/down display control	

41	VGH	P	Positive power for TFT
42	VGL	P	Negative power for TFT
43	AVDD	P	Analog power
44	RESET	I	Global reset pin
45	NC	-	No connection
46	NC	-	No connection
47	DITHB	I	Dithering function DITHB=H: Enable internal dithering function. DITHB=L: Disable internal dithering function.
48	GND	P	Power GND
49	NC	-	No connection
50	NC	-	No connection

Table 3.1 Pin Assignment for LCD Interface

I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

Note1: Scan direction is shown as below (FPC at down side):



3.2 CN2 Pin assignment (BL Interface)

Matching connector type: SM02B-BHSS-1-TB

No	Symbol	I/O	Description	Wire Color
1	LEDA	P	LED driving anode (high voltage)	Red
2	LEDK	P	LED driving cathode (low voltage)	White

Table 3.2 Pin Assignment for BL Interface

I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

4. Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.50	5.00	V	Maximum value due due to MOS characteristics, user should set on advised value.
	AVDD	-0.50	15.00	V	
	VGH	-0.30	42.00	V	
	VGL	-20.00	0.30	V	
	VGH-VGL	-0.30	40.00	V	
Signal Input	Vin	-0.50	5.00	V	Note1
Operating Temperature	T _{op}	-20.0	70.0	°C	
Storage Temperature	T _{st}	-30.0	80.0	°C	
Operating and Storage Humidity	HSTG	-	90	% (RH)	Exceed 90%RH may cause abnormal display
Relative Humidity (Note2)	RH	--	≤90	%	T _a ≤ 40°C
		--	≤85	%	40°C < T _a ≤ 50°C
		--	≤55	%	50°C < T _a ≤ 60°C
		--	≤36	%	60°C < T _a ≤ 70°C
		--	≤24	%	70°C < T _a ≤ 80°C
Absolute Humidity	AH	--	≤70	g/m ³	T _a > 70°C

Table 4.1 Absolute Maximum Ratings

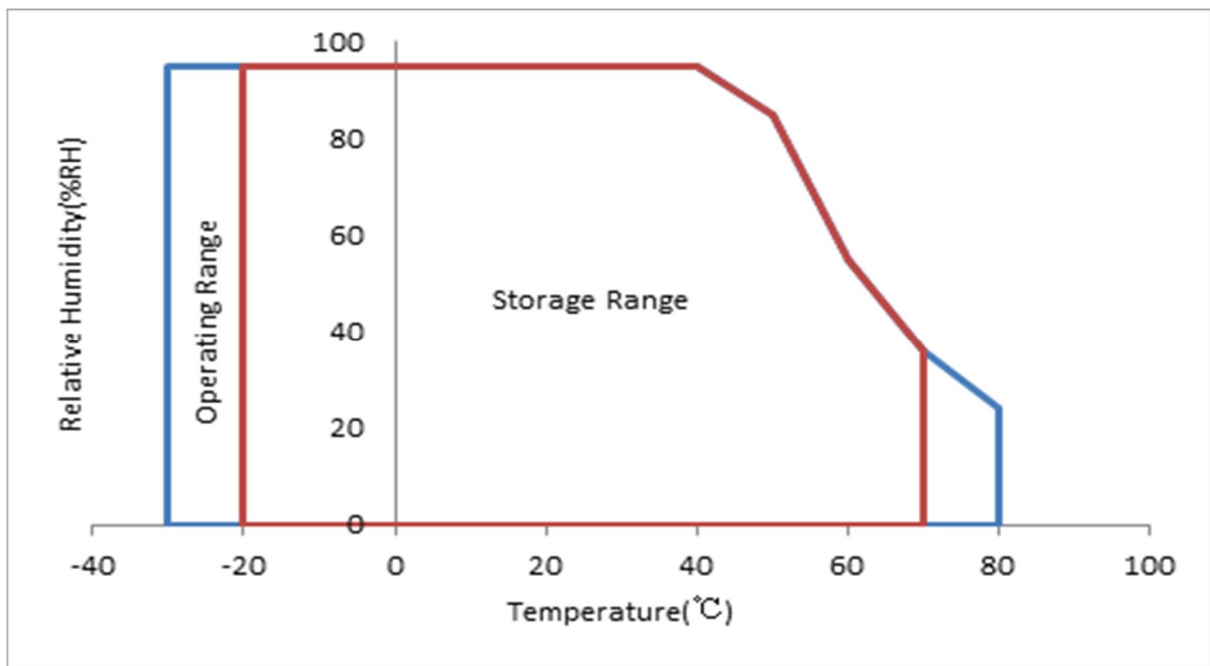


Table 4.2 Absolute Maximum Ratings chart

Note1: Input voltage include all in put data.

Note2: T_a 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.
When exceeded the maximum ratings, 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

GND=0V, Ta = 25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark	
Digital supply Voltage	VDD	3.00	3.30	3.60	V		
Analog supply Voltage	AVDD	10.8	11	11.2	V	Very important voltage, exceed this value may cause abnormal display	
Gate on voltage	VGH	21	22	23	V		
Gate off voltage	VGL	-7.5	-7.0	-6.5	V		
Input Signal Voltage	Low Level	V _{IL}	0	-	0.3xVDD	V	R0~R7,G0~G7,0~B7,DE, DCLK,HSYNC,VSYNC,MODE, RESET, DITH
	High Level	V _{IH}	0.7xVDD	-	VDD	V	
Current of digital supply voltage	I _{VDD}	-	5	-	mA	VCC=3.3V,all white pattern	
Current of analog supply voltage	I _{AVDD}	-	40	-	mA	AVDD=11V	
Current of Gate on voltage	I _{VGH}	-	0.50	-	mA	VGH=25V	
Current of Gate off voltage	I _{VGL}	-	0.50	-	mA	VGL=-7.0V	
Power consumption	P	-	450	-	mW	This value may vary with different patterns.	

Table 5.1 DC Characteristics

Note1:To test the current dissipation, use “all Black Pattern”.

5.2 DC Characteristics for Backlight Driving

GND=0V, Ta = 25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I _F	-	224	240	mA	Note 1
Forward Current Voltage	V _F	8.7	9.6	10.5	V	Note 1
Backlight Power Consumption	WBL	-	2150	2520	mW	Note 1
Operating Life Time	--	-	30000	-	hrs	Note 2

Table 5.2 LED Backlight Characteristics

Note1: I_F is defined for total LED(3S8P).

2: Optical performance should be evaluated at Ta=25°C only.

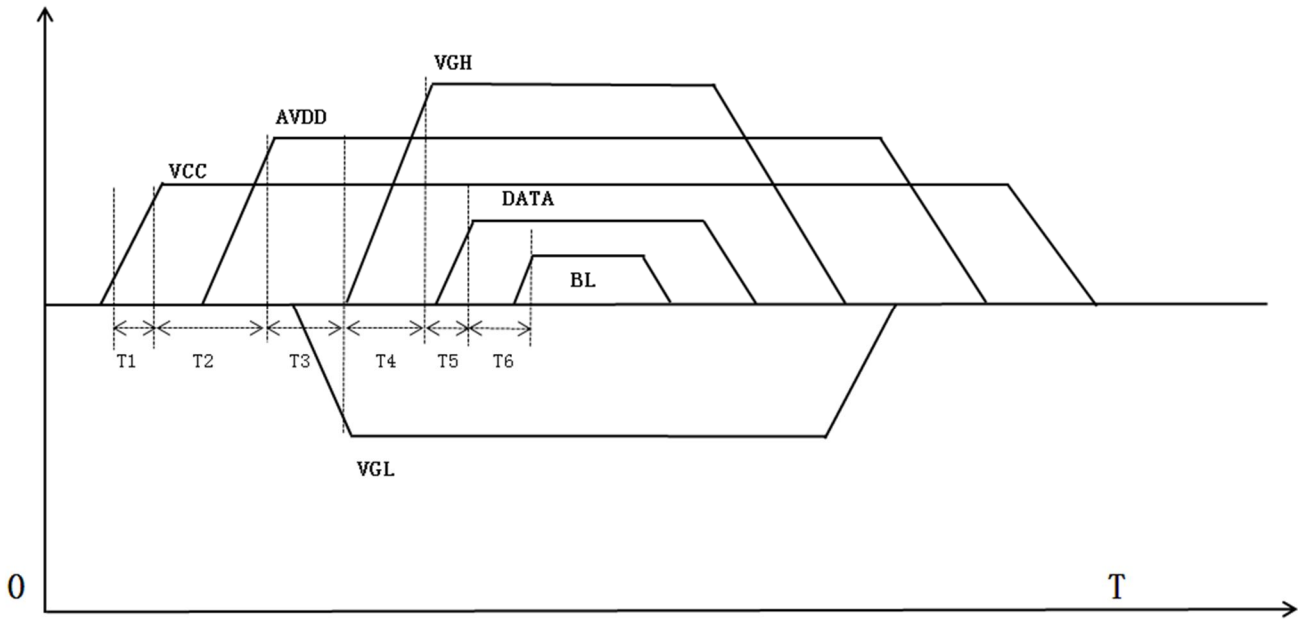
3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.

4:Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is an estimated data.

5.3 Recommended Power ON/OFF Sequence

Item	Symbol	Min	Typ	Max	Unit	Remark
VCC 3.3V rising time	T1	0	-	20	ms	
VCC to AVDD on time	T2	16.7	-	-	ms	
AVDD to VGL on time	T3	>0	-	-	ms	
VGL to VGH on time	T4	>0	-	-	ms	
VGH to DATA on time	T5	>0	-	-	ms	
DATA to BL on time	T6	>0	-	-	ms	

Table 5.3 Power ON/OFF Sequence



- Note:
1. Power on sequence: VCC→AVDD→VGL→VGH→DATA ON→BACKLIGHT ON
 2. Power off sequence: BACKLIGHT OFF→DATA OFF→VGH→VGL→AVDD→VCC
 3. When VCC turned on, the rising time T1 should less than 20ms.
 4. AVDD stable to VCC stable time T2 should better longer than 1 frame time.
 5. The power off sequence can be set according to power on settings.
 6. It is advised that LCD power turned on much later than system when RGB pin is multiple used for system initial.

5.4 LCD Module Block Diagram

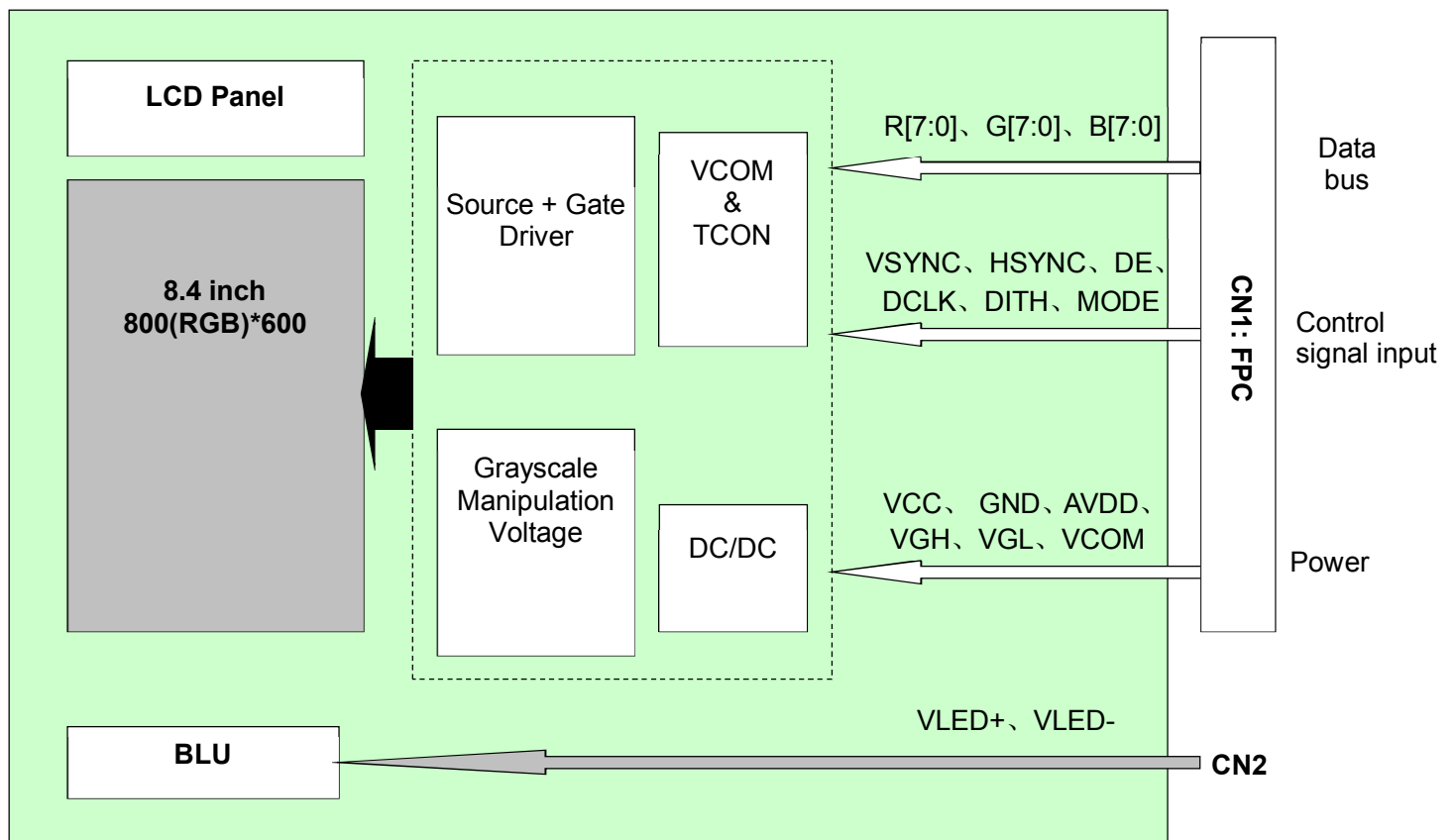


Figure 5.4 LCD Module Block Diagram

6. Interface Timing Characteristics

6.1 AC characteristics

VCC=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
HSYNC Setup Time	T_{hst}	8	-	-	ns	
HSYNC Hold Time	T_{hhd}	8	-	-	ns	
VSYNC Setup Time	T_{vst}	8	-	-	ns	
VSYNC Hold Time	T_{vhd}	8	-	-	ns	
Data Setup Time	T_{dsu}	8	-	-	ns	
Data Hold Time	T_{dhd}	8	-	-	ns	
DE Setup Time	T_{esu}	8	-	-	ns	
DE Hold Time	T_{ehd}	8	-	-	ns	
CLKIN Cycle Time	T_{cph}	14	-	-	ns	
CLKIN Pulse Width	T_{cwh}	40	50	60	%	
Output stable time	T_{sst}	-	-	6	us	
VCC Power ON Slew rate	T_{por}	-	-	20	ms	From 0V to 90% VCC
RSTB pulse width	T_{Rst}	50	-	-	us	

Table 6.1 AC characteristics

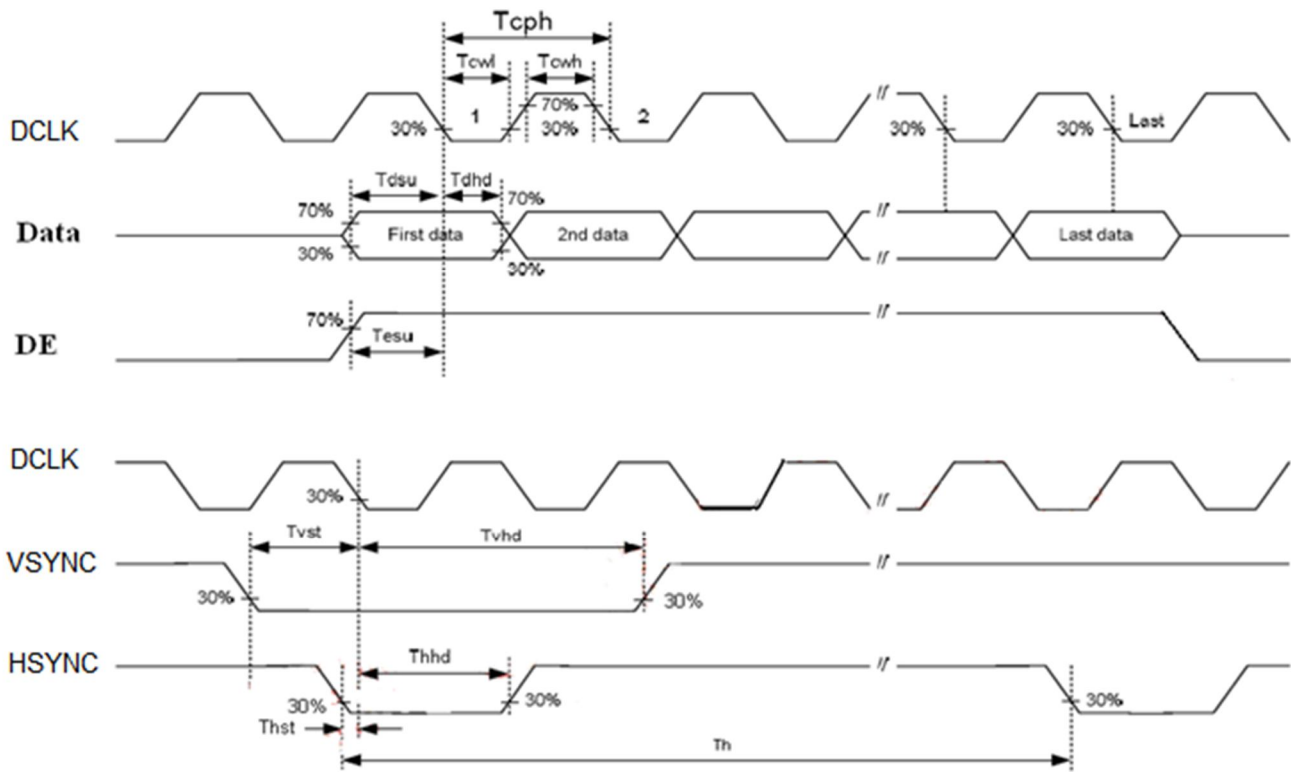


Figure 6.1 AC characteristics

6.2 Data input timing table

i. Input timing at DE mode

VCC=3.3V, GND=0V, Ta=25°C

	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
	Dclk frequency(Frame rate=60HZ)	Fclk	40.8	51.2	67.2	MHz	Tclk=1/Fclk
Horizontal section	Horizontal total	TH	1114	1344	1400	Tclk	
	Horizontal blanking	THC	90	320	376	Tclk	
	Valid Data Width	THD	1024			Tclk	
Vertical section	Vertical total	TV	610	635	800	TH	
	Vertical blanking	TVC	10	35	200	TH	
	Valid Data Width	TVD	600			TH	

Table 6.2.1 input timing (DE mode)

ii. Input timing at HV mode

VCC=3.3V, GND=0V, Ta=25°C

	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
	Dclk frequency(Frame rate=60HZ)	Fclk	44.9	51.2	63	MHz	Tclk=1/Fclk
Horizontal section	Horizontal pulse width	THPW	1	-	140	Tclk	
	Horizontal total	TH	1200	1344	1400	Tclk	
	Horizontal back porch	THB	160			Tclk	
	Horizontal front porch	THFP	16	160	216	Tclk	
	Valid Data Width	THD	1024			Tclk	
Vertical section	Vertical pulse width	TVPW	1	-	20	TH	
	Vertical total	TV	624	635	750	TH	
	Vertical back porch	TVB	23			TH	
	Vertical front porch	TVFP	1	12	127	TH	
	Valid Data Width	TVD	-	600	-	TH	

Table 6.2.2 input timing (HV mode)

Note1: In HV mode, it is necessary to keep it on typical value.

6.3 Data input timing diagram

i. Vertical Input Timing Diagram

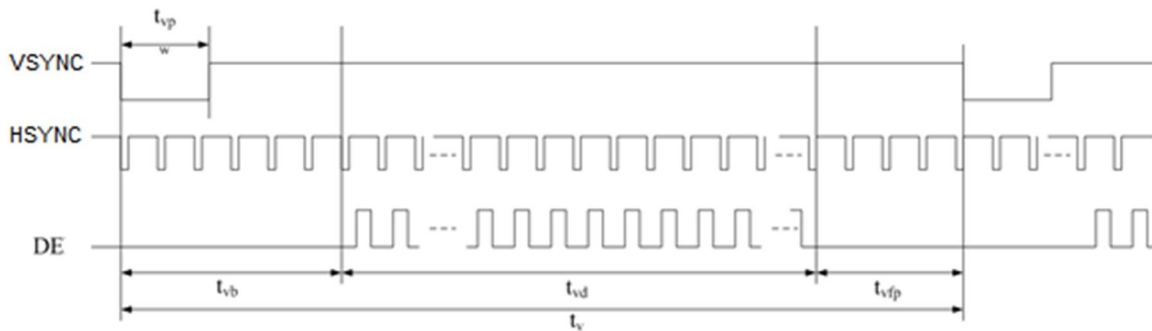


Figure 6.3.1 Vertical Input Timing Diagram

ii. Horizontal Input Timing Diagram

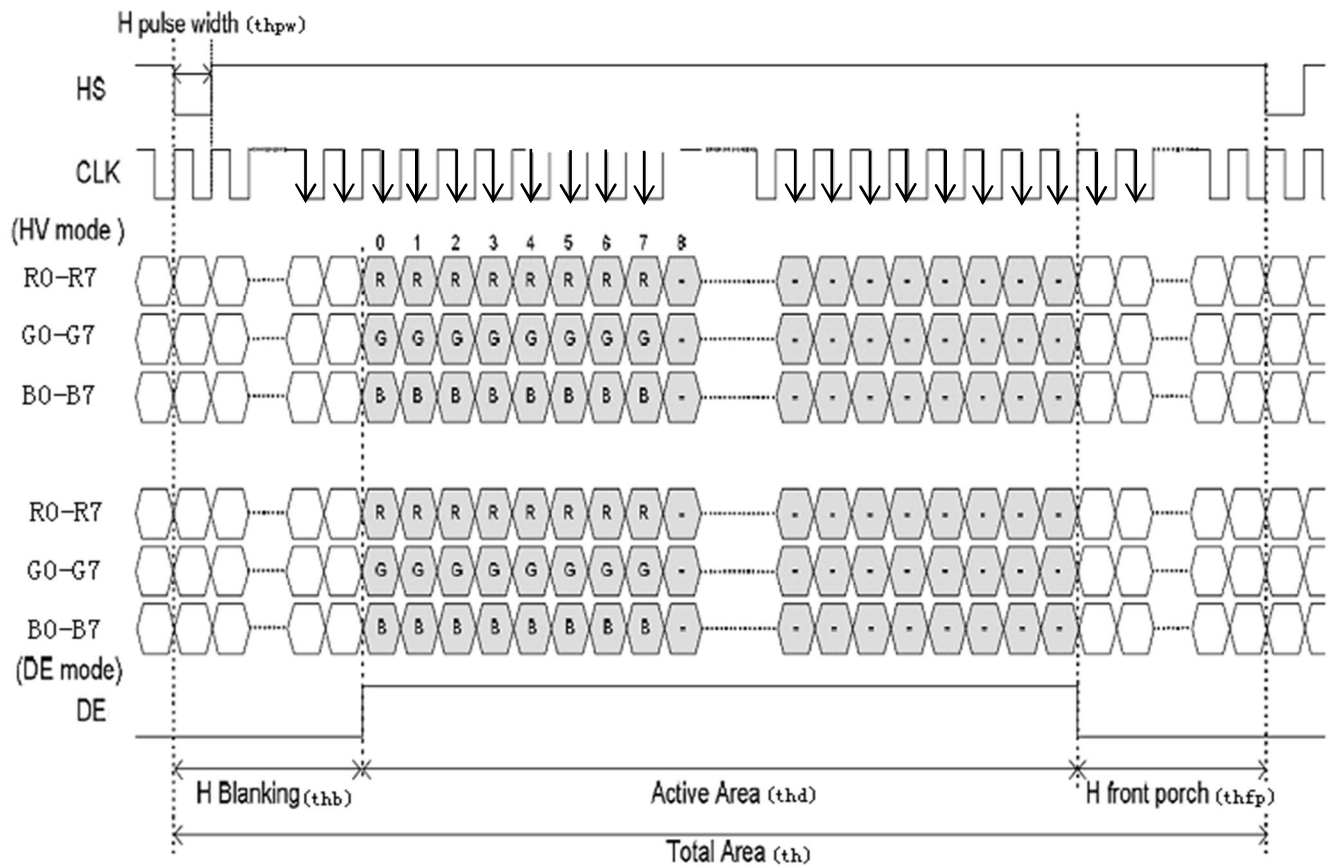


Figure 6.3.2 Vertical Input Timing Diagram

7. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	$CR \geq 10$	60	75	-	Degree	Note2,3
	θB		70	80	-		
	θL		70	80	-		
	θR		70	80	-		
Contrast Ratio	CR	$\theta=0^\circ$	400	500			Note 3
Response Time	T_{ON}	25°C	-	16	28	ms	Note 4
	T_{OFF}						
Chromaticity	White	Backlight is on	x	0.263	0.313	0.363	Note 1,5
			y	0.279	0.329	0.379	
	Red		x	0.524	0.574	0.624	Note 1,5
			y	0.285	0.335	0.385	
	Green		x	0.280	0.330	0.380	Note 1,5
			y	0.525	0.575	0.625	
	Blue		x	0.108	0.158	0.208	Note 1,5
			y	0.090	0.140	0.190	
Uniformity	U		70	80	-	%	Note 6
NTSC			42	47	-	%	Note 5
Luminance	L		280	350	-	cd/m ²	Note 7

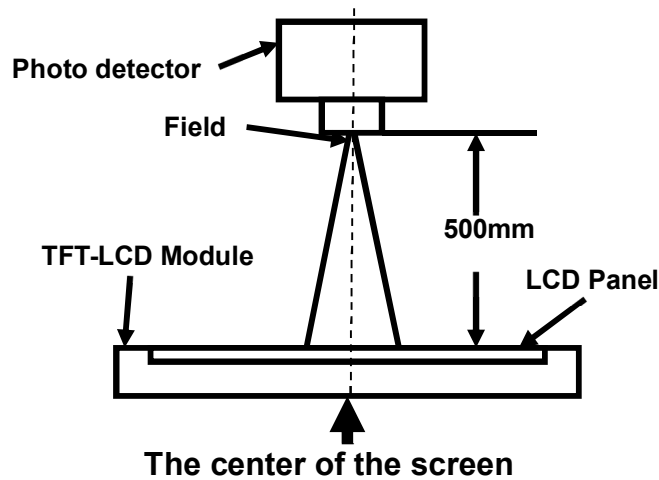
Table 7.1 Optical characteristics

Test Conditions:

1. $I_F=224\text{ mA}$, and the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

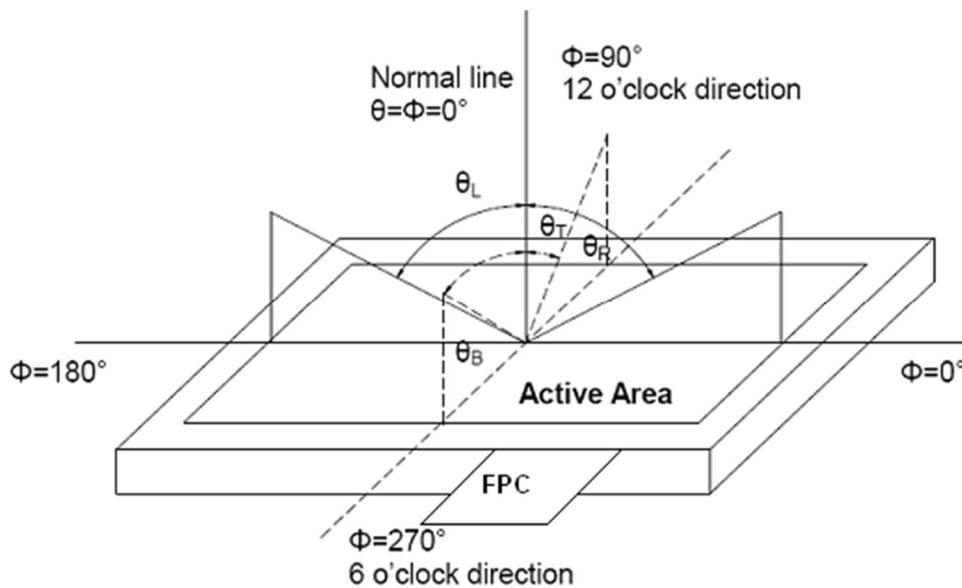
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, 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

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

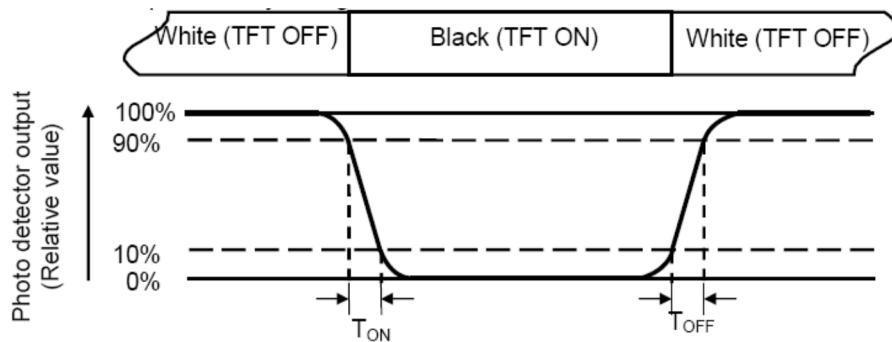
“White state “: The state is that the LCD should drive by V_{white}.

“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)

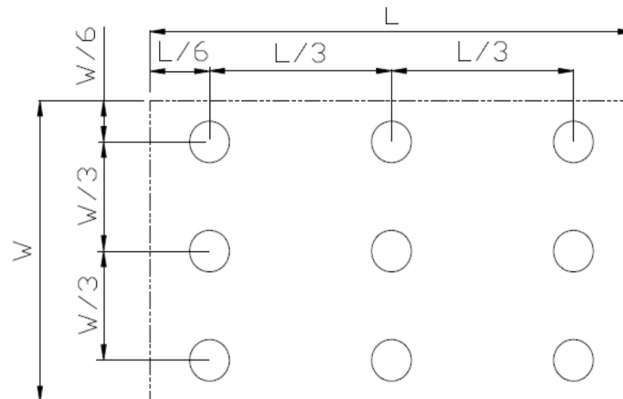
Color coordinates measured at center point of LCD.

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.

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

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



Lmax: The measured Maximum luminance of all measurement position.

Lmin: 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

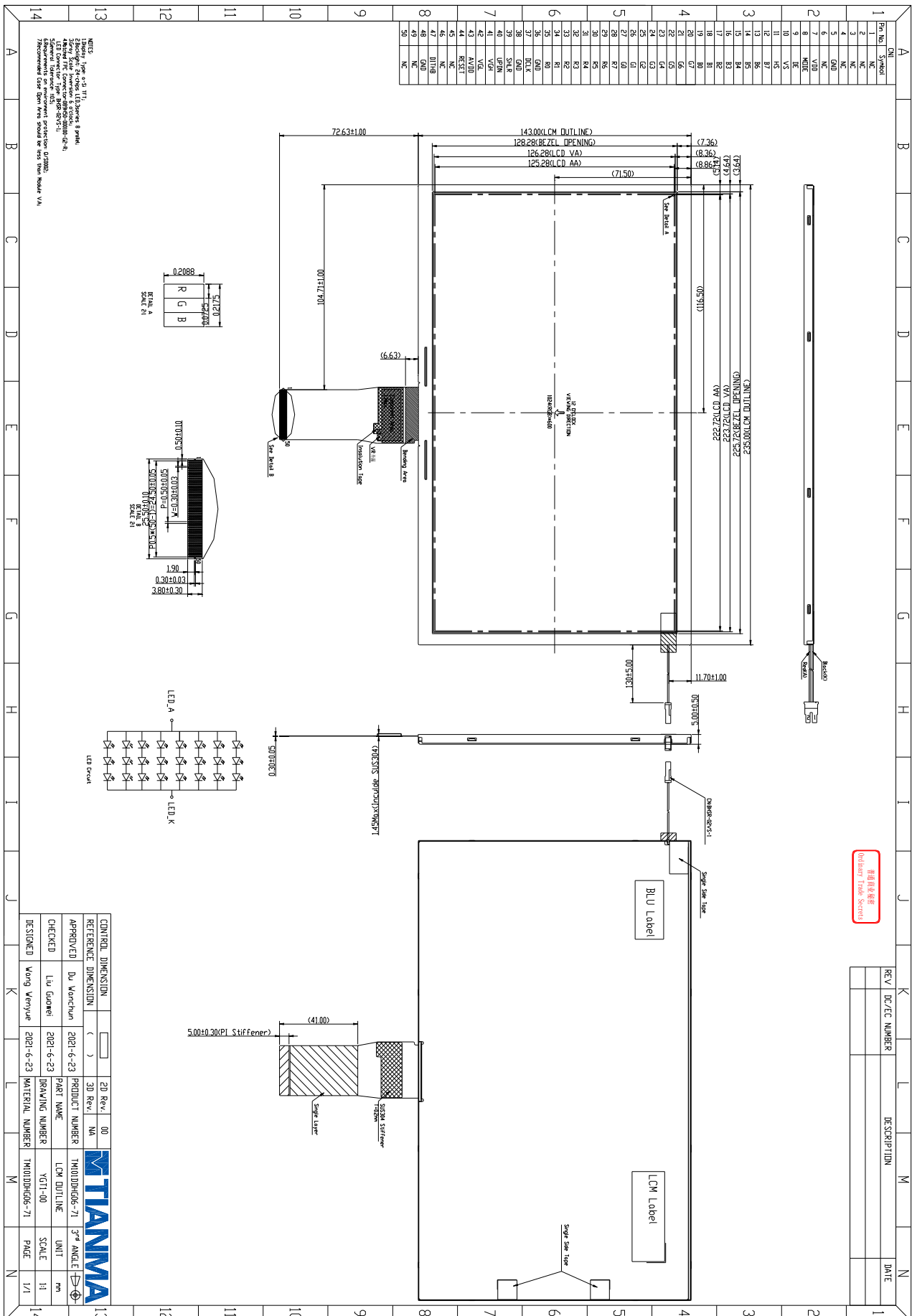
No	Test Item	Condition	Remark
1	High Temperature Operation	+70℃, 240hrs	Note1 IEC60068-2-1:2007,GB2423.2-2008
2	Low Temperature Operation	-20℃, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage (non-operation)	+80℃, 240hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage (non-operation)	-30℃, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & High Humidity Operation	+60℃, 90% RH max, 240 hours	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 100 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	Electro Static Discharge (operation)	C=150pF,R=330Ω, Air:±8Kv, Contact:±4Kv, 10times/terminal	IEC61000-4-2:2001 GB/T17626.2-2006

Table 8.1 Reliability test condition

Note1: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 2: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

9. Mechanical Drawing



10. Packing Instruction

No.	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM101DDHG06	235.0×143.0×5.0	0.272	20	
2	Partition_1	Corrugated Paper	409×253×37	1.382	1	
3	Dust-Proof Bag	PE	700×545	0.046	1	
4	Partition_2	Corrugated Paper	505×332	0.1	1	
5	Crepe Paper Tape	PE	30×10	0.002	80	
6	Carton	Corrugated Paper	513×333×217	0.76	1	
7	Anti-Static Bubble Bag	PE	315×250×4	0.011	20	
8	Label	Label	100×52	0.002	1	
9	Total weight	(8.116 ± 5%) kg				

Table10.1 Packing instruction

The detail of packaging method is shown as below:

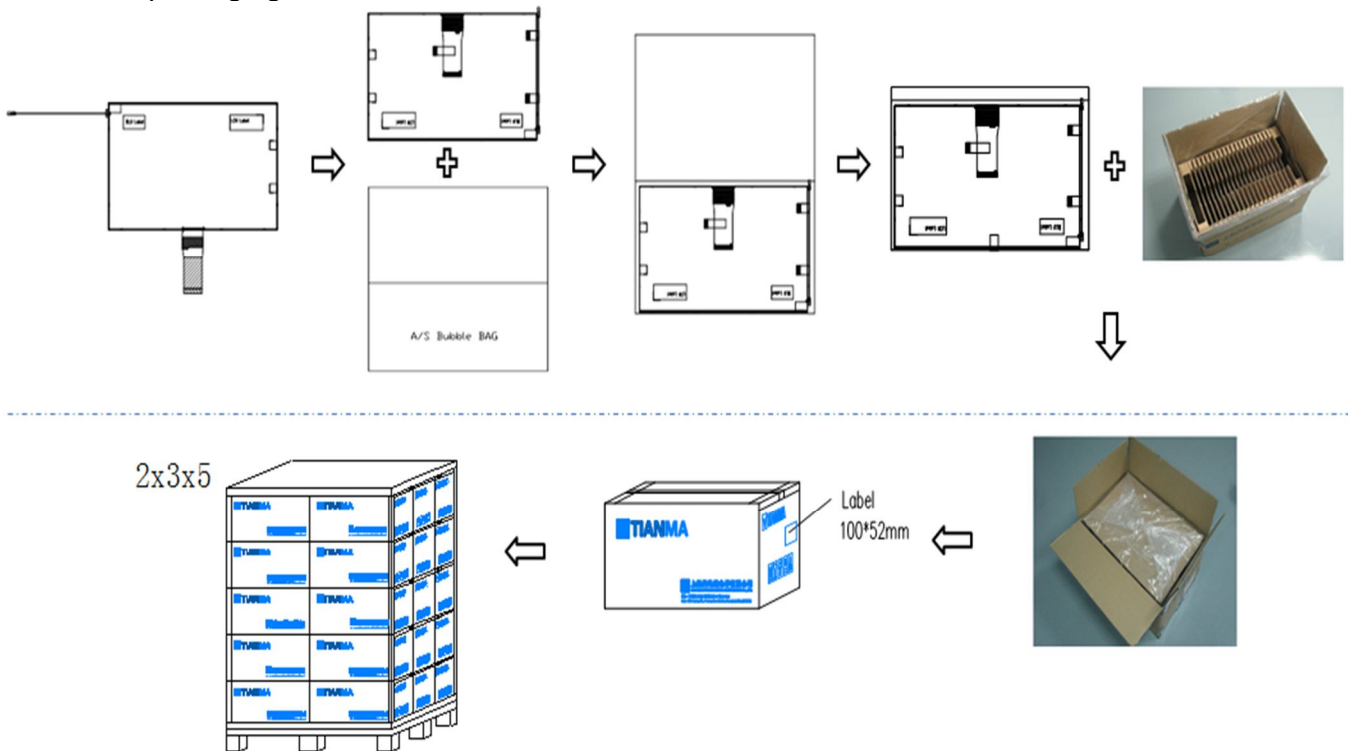


Figure10.1 Packing instruction

11 Precautions for Use of LCD Modules

11.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

11.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuit power is off, do not apply the input signals.

11.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

11.2 Storage precautions

11.2.6 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.7 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

11.2.8 The LCD modules should be stored in the room without acid, alkali and harmful gas.

11.3 Transportation Precautions

11.3.6 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

11.4 Do not display the fixed pattern for a long time because it may cause image sticking. Use a screen saver, if the fixed pattern is displayed on the screen

11.5 SAFETY PRECAUTIONS

a. 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.

b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

c. Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.

d. LED driver should be designed carefully to limit or stop its function when over current is detected on the LED.

11.6 screen saver

Not display the fixed pattern for a long time because it may cause image sticking. Use a screen saver, if the fixed pattern is displayed on the screen