	<input checked="" type="checkbox"/> Preliminary Specification <input type="checkbox"/> Product Specification	
	Confidential	Part Number: TM123XDKP17-00

### Specification

Customer Part Number: A26  
 Tianma Part Number: TM123XDKP17-00  
 Description: 12.3" WHD with screw

	Department	Name	Signature
Tianma	Integrate Project Manager	Guohua Liu	
	Project Manager	Baodong Lai	
Customer			

### REVISION RECORD

Version	Page	Revision Items	Name	Date
0.1	All	First release	Guohua Liu	2018.6.29
0.2	P17	Drawing updated	Guohua Liu	2018.7.9
0.3	P9	DC Characteristics for Backlight Driving updated	Guohua Liu	2018.8.1
1.0	P8	DC Characteristics updated	Guanqun Tao	2018.9-18
	P10	Description of adding NTC	Yanyu Deng	2018.9.18
	P11-14	Input Signal Timing updated	Guanqun Tao	2018.9-18
	P25	Packing updated	Feng Wu	2018.9.16
1.1	P20	Drawing updated of extended screw pillars	Yanyu Deng	2018-10-22
1.2	P4	Product weight updated	Feng Hu	2018-11-7
	P9	DC Characteristics for Backlight Driving updated	Yanyu Deng	2018-11-7
	P23	Updated Mura inspection standards to 5% ND	Xiaohai Wu	2018-11-7
	P25	Packing updated	Feng Wu	2018-11-7

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## 1. Features

This is 12.3 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. It is composed of 12.3 inch TFT-LCD panels, LCD Driver IC with T-con integrated, FPC and backlight unit.

This TFT-LCD Normally Black technology module, which is designed for Automotive and other high reliability electronic products, required high performance flat panel displays.

Requirements on Environmental Protection of 12.3inch module are following RoHS.

## 2. General Specifications

	Feature	Spec
<b>Display Spec.</b>	Size	12.3 inch
	Resolution	1920(RGB) x 720
	Interface	2 ports -LVDS (VESA)
	Color Depth	16.7M
	Technology Type	a-Si
	Pixel Pitch (mm)	0.15225 x 0.15225
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive with Normally Black
	Surface Treatment	HC
	Surface Hardness	3H
	Gray Scale Inversion Direction	NA
	Viewing Direction	Free
	LCM (W x H x D) (mm)	305.92 x 123.62 x 7 (typ.)
<b>Mechanical Characteristics</b>	Active Area(mm)	292.32×109.62
	With /Without Touch Panel	without
	Weight (g)	333
	LED Configuration	4 parallels 8serials

Note 1: Requirements on Environmental Protection: RoHS

Note 2: The height dimension does not include the FPC and Screw, convex.


Note 3: The weight tolerance is 10%.

### 3. Input/Output Terminals

#### 3.1 Pin assignment for one of TFT Interface

Connector Type : 101049-205050

No	Symbol	I/O	Description	Remark
1	NC	N	No connect	
2	NC	N	No connect	
3	GND	P	Ground	Note1
4	FAIL_T	O	Output for fail detection	Note2,3
5	UPDN	I	Vertical shift direction (gate output) selection	Note4
6	SHLR	I	Horizontal shift direction (source output) selection	Note4
7	STBY	I	Standby mode setting pin, active low.	
8	RESET	I	Global reset pin, active low.	
9	GND	P	Ground	Note1
10	ELV3P	I	Even LVDS data input 3+	
11	ELV3N	I	Even LVDS data input 3-	
12	GND	P	Ground	Note1
13	ELVKP	I	Even LVDS Clock input +	
14	ELVKN	I	Even LVDS Clock input -	
15	GND	P	Ground	Note1
16	ELV2P	I	Even LVDS data input 2+	
17	ELV2N	I	Even LVDS data input 2-	
18	GND	P	Ground	Note1
19	ELV1P	I	Even LVDS data input 1+	
20	ELV1N	I	Even LVDS data input 1-	
21	GND	P	Ground	Note1
22	ELV0P	I	Even LVDS data input 0+	
23	ELV0N	I	Even LVDS data input 0-	
24	GND	P	Ground	Note1
25	OLV3P	I	Odd LVDS data input 3+	
26	OLV3N	I	Odd LVDS data input 3-	
27	GND	P	Ground	Note1
28	OLVKP	I	Odd LVDS Clock input +	
29	OLVKN	I	Odd LVDS Clock input -	

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	Confidential	Part Number: TM123XDKP17-00
		Version: 1.2

30	GND	P	Ground	Note1
31	OLV2P	I	Odd LVDS data input 2+	
32	OLV2N	I	Odd LVDS data input 2-	
33	GND	P	Ground	Note1
34	OLV1P	I	Odd LVDS data input 1+	
35	OLV1N	I	Odd LVDS data input 1-	
36	GND	P	Ground	Note1
37	OLV0P	I	Odd LVDS data input 0+	
38	OLV0N	I	Odd LVDS data input 0-	
39	GND	P	Ground	Note1
40	NC	N	No connect	
41	GND	P	Ground	Note1
42	GND	P	Ground	Note1
43	GND	P	Ground	Note1
44	VDD	P	Power supply,3.3+/-0.3V	
45	VDD	P	Power supply,3.3+/-0.3V	
46	VDD	P	Power supply,3.3+/-0.3V	
47	VDD	P	Power supply,3.3+/-0.3V	
48	GND	P	Ground	Note1
49	GND	P	Ground	Note1
50	GND	P	Ground	Note1

Table 3.1.1 Pin assignment for TFT interface

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

Note2: I/O definition.

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

Note3:Fail\_T: Normally it is pulled low, and it will become high when the chip is in self-protection mode. normally pull L in IC, active "H".

Fail\_T is an output pin, this pin is defined for fail detection .please keep no any pull up or pull down resistor connect this pin on your system when this pin is used for fail detection.

Note4: Scan Direction Control Description

Relationship between source output and SHLR.

SHLR	Source output sequence and data order	Remark
H	Left→Right	Default
L	Right→Left	-

Relationship between vertical shift direction and UPDN.

UPDN	Function	Remark
H	Top→Bottom	Default
L	Bottom→Top	-

Table 3.1.2 Scan direction Description

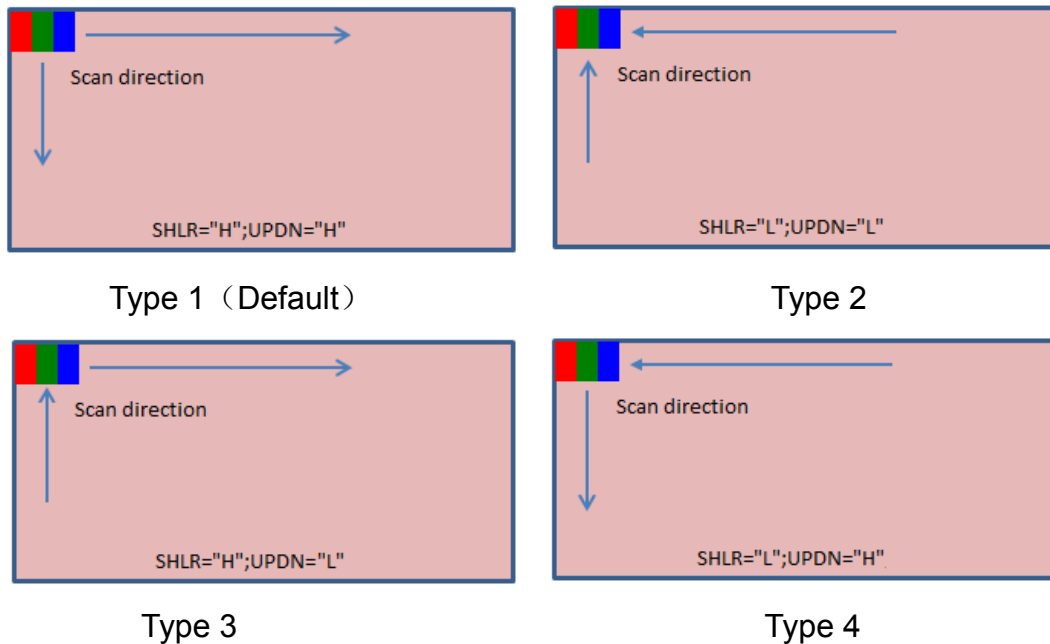


Figure 3.1.2 Scan direction Description

### 3.2 Pin assignment for one of the backlight interface

Connector type: 101049-201250

No	Symbol	I/O	Description	Remark
1	C1	P	LED Cathode1	
2	C2	P	LED Cathode2	
3	C3	P	LED Cathode3	
4	C4	P	LED Cathode4	
5	NC	N	No connection	
6	NTC-	I/O	Thermistor -	
7	NTC+	I/O	Thermistor +	
8	NC	N	No connection	
9	A4	P	LED Anode4	
10	A3	P	LED Anode3	
11	A2	P	LED Anode2	
12	A1	P	LED Anode1	

Table 3.2.1 Pin assignment for backlight interface

## 4. Electrical Characteristics

### 4.1 Absolute Maximum Ratings

GND=0V

Item	Symbol	Min	Max	Unit	Remark
Logic supply voltage	VDD	-0.3	3.96	V	
Operating Temperature	Top	-40	85	°C	Note1
Storage Temperature	Tst	-40	90	°C	Note2

Table 4.1.1 absolute maximum rating

Note 1: During -40~-30°C (ambient), the operating performance is not guaranteed except functional failure occurs.

Note 2: If the voltage exceeds its absolute maximum ratings, the LCM may be damaged. If the LCM is with the absolute maximum ratings for a long time, performance will decrease.

### 4.2 DC Characteristics for Panel Driving

GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
supply voltage	VDD	3.0	3.3	3.6	V	
IVDD	IVDD		400	500	mA	Note 1
IVDD Inrush	Inrush			(1.5)	A	
Permissible Ripple Voltage of VCC	Vr	-	-	100	mV	Note 1
Input High Voltage	V <sub>IH</sub>	0.7*VDD		VDD	V	
Input Low Voltage	V <sub>IL</sub>	GND	-	0.3*VDD	V	
Output High Voltage	V <sub>OH</sub>	VDD-0.4	-	VDD	V	
Output Low Voltage	V <sub>OL</sub>	GND	-	0.4	V	

Table 4.2.1 Operating voltage

Parameter	Symbol	Condition	Spec			Unit
			Min	Typ	Max	
Differential input high threshold voltage	V <sub>th</sub>	VCM=1.2V	-	-	+0.2	V
Differential input low threshold voltage	V <sub>tl</sub>		-0.2	-	-	V
Differential input common mode voltage	VCM	-	1	1.2	1.7- V <sub>id</sub>  /2	V
Differential input voltage	V <sub>id</sub>	-	0.2	-	0.6	V
Differential input leakage current	I <sub>lvleak</sub>	-	-10	-	+10	uA

Table 4.2.2 LVDS mode DC electrical characteristics

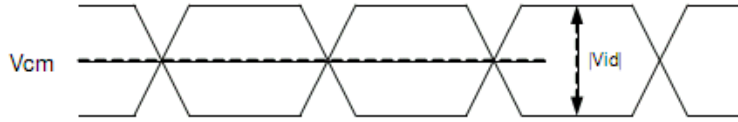


Note 1: test at white pattern,  $T_a=25^{\circ}\text{C}$ ,  $f=60\text{HZ}$ ,  $V_{CC}=3.3\text{V}$

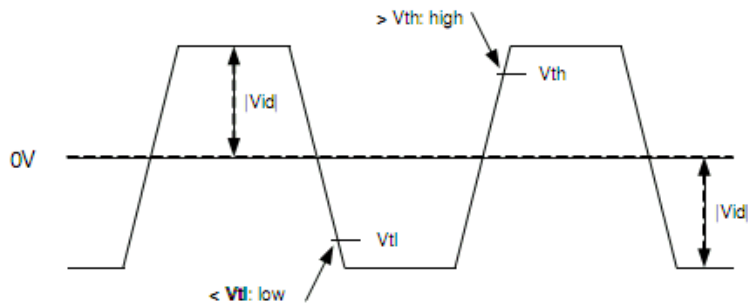
Note 2: Above of all these items spec is the precondition that panel can operate normally.

Note 3: Description of  $|V_{id}|$  is as below

Single-ended:  
LVCLKP(R),  
LVCLKN(R),  
LVD[3:0]P(R),  
LVD[3:0]N(R)



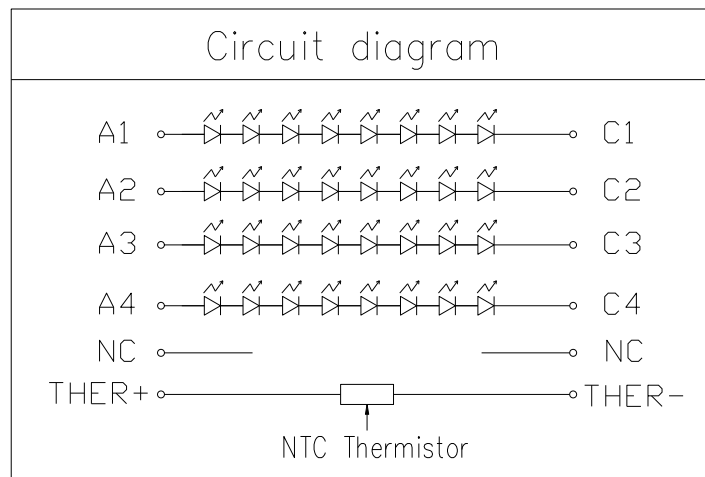
Differential:  
LVCLKP(R)-LVCLKN(R),  
LVD[3:0]P(R)-  
LVD[3:0]N(R)




### 4.3 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	$I_{BL}$		90	110	mA	Note1
Forward Voltage	$V_{BL}$	21.2	24.32	26	V	$I_{BL}=90\text{mA}$
Backlight Power Consumption	WBL	7.632	8.755	9.36	W	
Life Time	-	10000	-	-	Hrs	Note2

Table 5.2.1 LED backlight characteristics



	<input checked="" type="checkbox"/> Preliminary Specification <input type="checkbox"/> Product Specification	
	Confidential	Part Number: TM123XDKP17-00

Note 1: IBL=90mA is defined for one channel LED, There are total 4 LED channels in back light unit Under LCM operating, the stable forward current should be inputted.

Note 2: Optical performance should be evaluated at Ta=25°C 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 80% of original brightness.

Note 3: it is suggested Customer to make sure the LCM module in the system is well heat dissipation.

Note 4: The NTC thermistor Part No.is NCU15XH103F6SRC. NTC thermistor is included in LED circuit. pls refer to appendix for NTC temperature behavior.

Note5: To reduce the influence of NTC self-heating and improve the measurement accuracy, suggest the operating current of NTC is 0.031mA.

Item	Value	Remarks
Part Number	NCU15XH103F6SRC	Murata
Resistance / Tolerance	10kΩ±1%	Ta=25°C
Permissive Operating Max. Current	0.31mA	Ta=25°C Note5

## 4.4 Input Signal Timing

### 4.4.1 2-port LVDS mode

Parameter		Symbol	Min	Typ.	Max	Unit	Remarks
Dclk Frequency		$1/T_{clk}$	44.4	44.7	58	MHz	Note1
Horizontal section	Horizontal total	$T_h$	1020	1024	1150	$T_{clk}$	
	Horizontal blanking	$T_{hb}$	60	64	190	$T_{clk}$	
	Valid Data Width	$T_{hd}$	960			$T_{clk}$	
Vertical section	Frame rate	-	-	60	-	Hz	
	Vertical total	$T_v$	726	728	849	$T_h$	
	Vertical blanking	$T_{vb}$	6	8	129	$T_h$	
	Valid Data Width	$T_{vd}$	720			$T_h$	

Note1: DE signal is necessary.

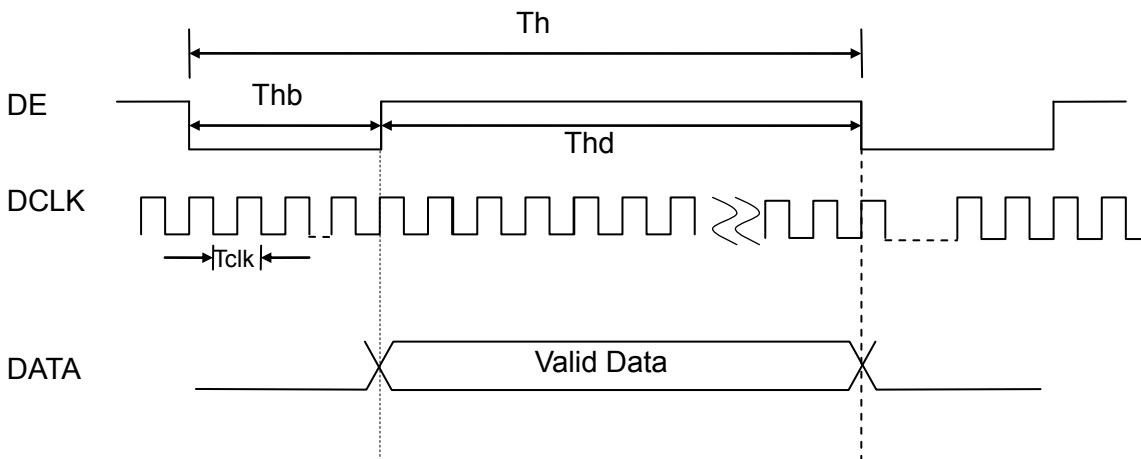
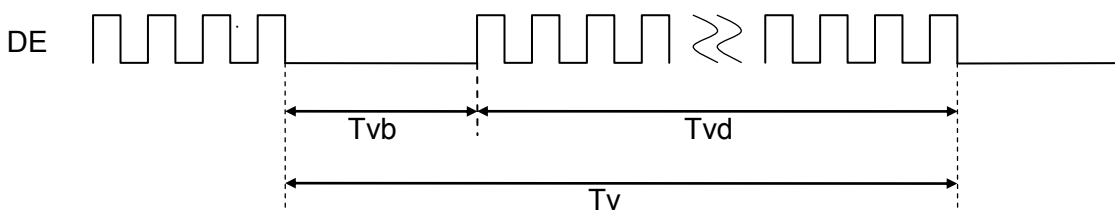
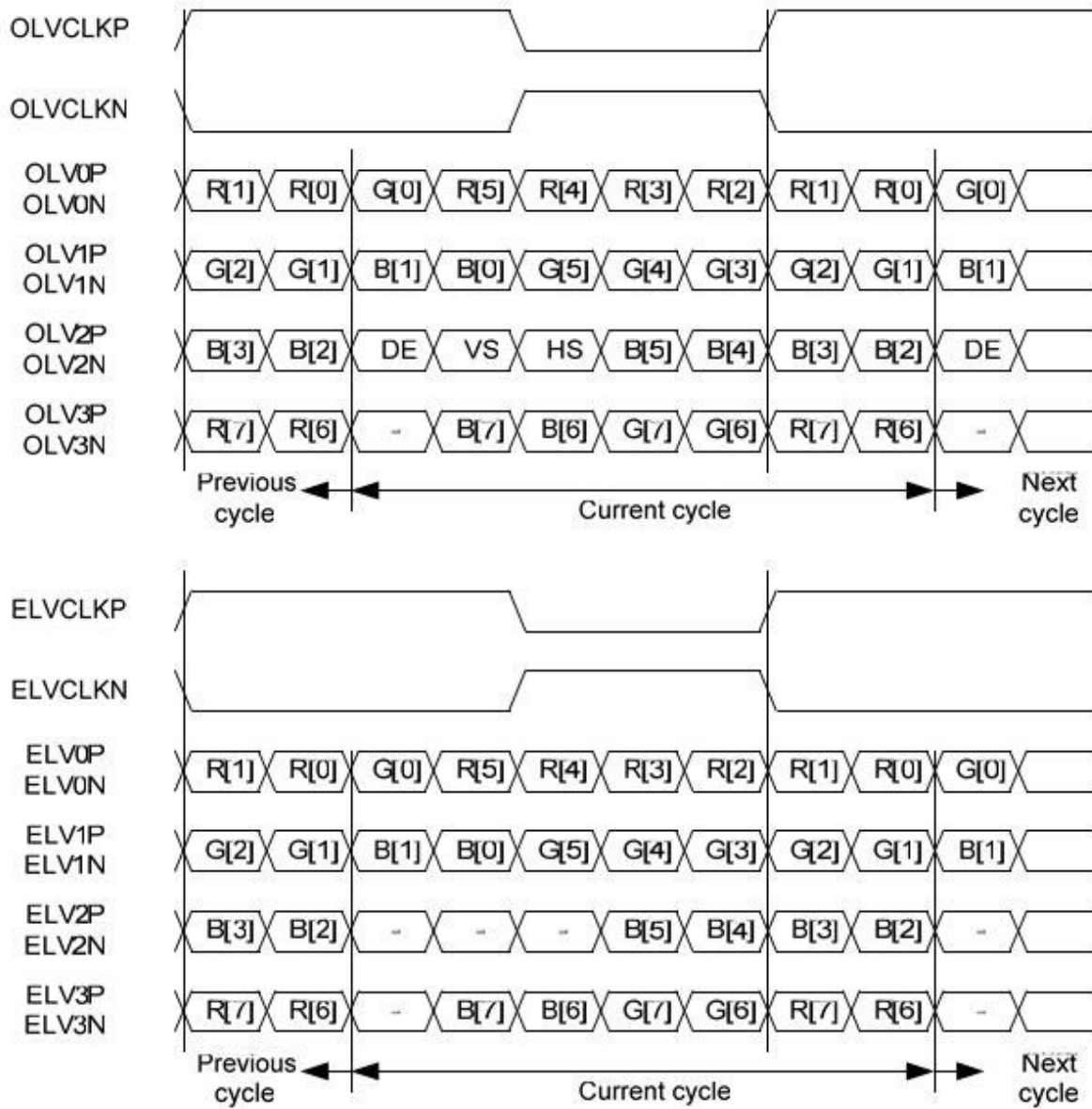


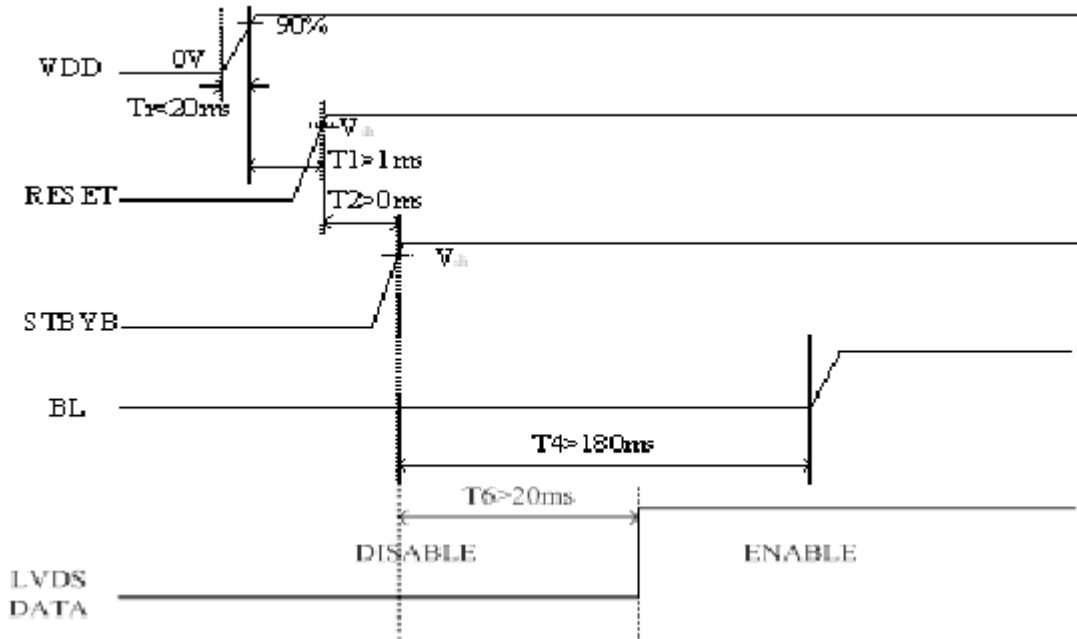
Figure 4.4.1 Recommended input timing of LVDS transmitter

### 4.4.2 Data Mapping

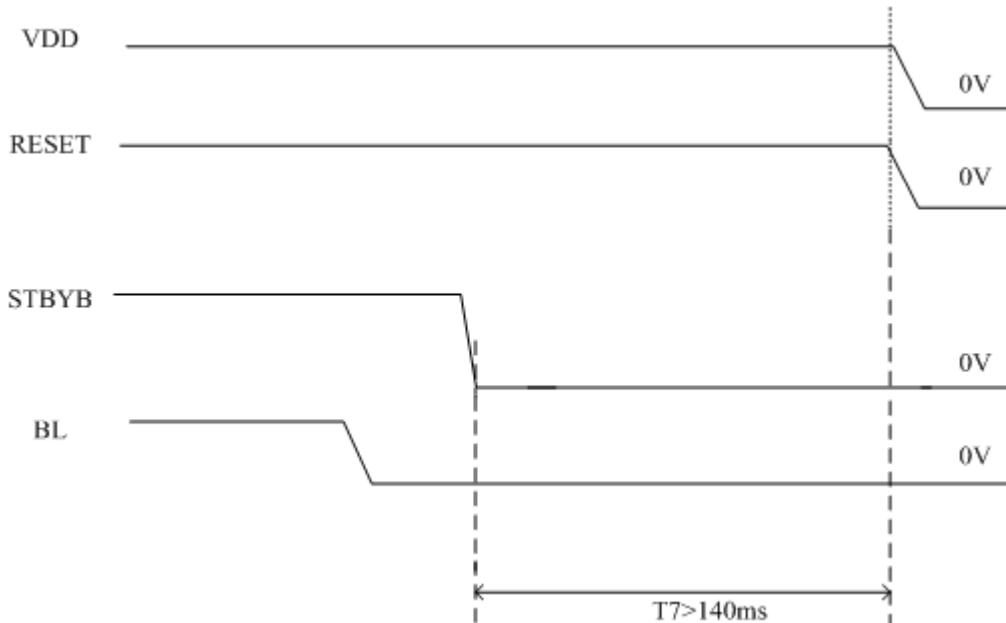


## 4.5 Recommended Power ON/OFF Sequence

### 4.5.1 Power on



### 4.5.2 Power off



#### 4.6 LCD Module Block Diagram

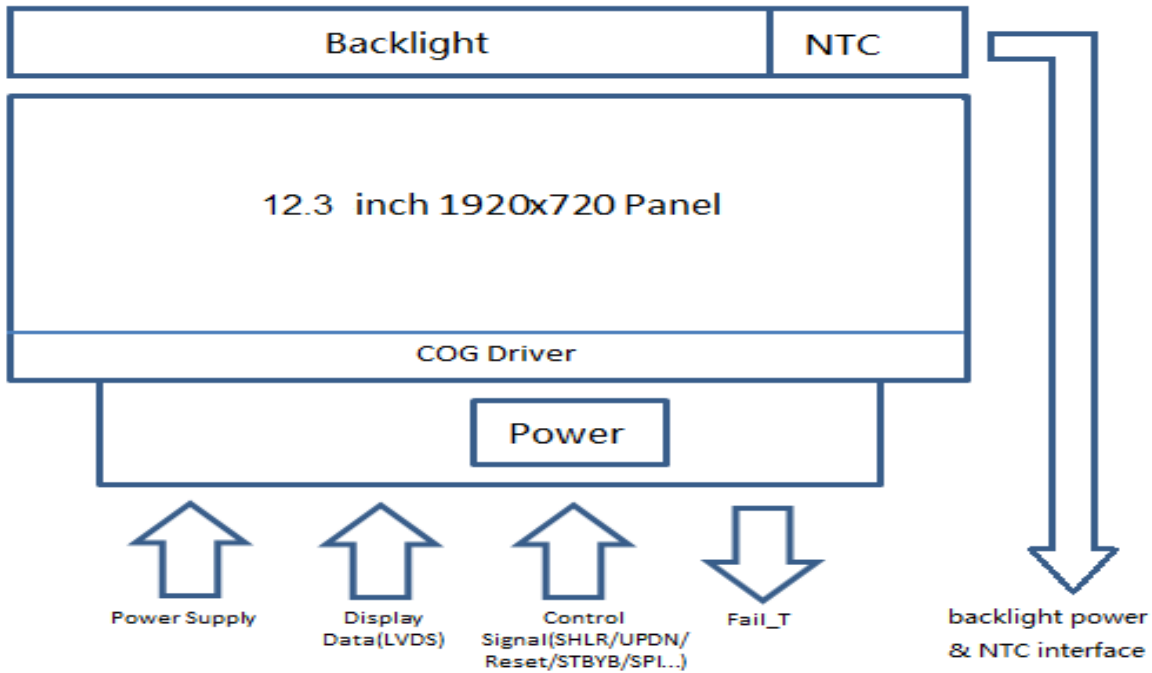


Figure 4.6.1 LCD Module Block Diagram

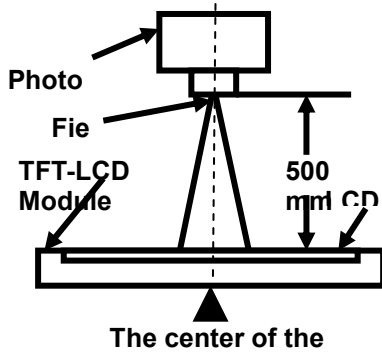
## 5. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	U	CR≥10	80	88	--	Degree	Note 2
	D		80	88	--		
	L		80	88	--		
	R		80	88	--		
Contrast Ratio	CR	$\theta = 0^\circ$	900:1	1300:1	--	--	Note3 Note8
Response Time	Ton+Toff	25°C	--	--	25	ms	Note4
		-20°C	--	--	200		
		-30°C	--	--	350		
Chromaticity	White	X	(0.257)	(0.297)	(0.337)	--	Note5 Only for reference Note2
		Y	(0.286)	(0.326)	(0.366)		
	Red	X	(0.594)	(0.634)	(0.674)		
		Y	(0.293)	(0.333)	(0.373)		
	Green	X	(0.274)	(0.314)	(0.354)		
		Y	(0.595)	(0.635)	(0.675)		
	Blue	X	(0.110)	(0.150)	(0.190)		
		Y	(0.023)	(0.063)	(0.103)		
Uniformity	White	9 points	75	--	--	%	Note6
NTSC	--	CIE1931	70	--	--	%	Note5
Reflection Ratio (SCI)	--	Module			6.5%		Note 9
Gamma	--	--	1.8	2.2	2.6	--	Note 7
Luminance	L	Perpendicular	800		--	cd/m <sup>2</sup>	Note8

### Test Conditions:

1.  $I_F = 90\text{mA}$ (one channel), the room temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.
3. 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.



Item	Photo detector	Field	High
Contrast Ratio	SR-3	1°	H=500mm
Luminance			
Chromaticity			
Lum Uniformity			
Response Time	LCD5200 or DMS	3mm	H=200mm

Note 2: Definition of viewing angle range and measurement system

Note 3: Definition of contrast ratio

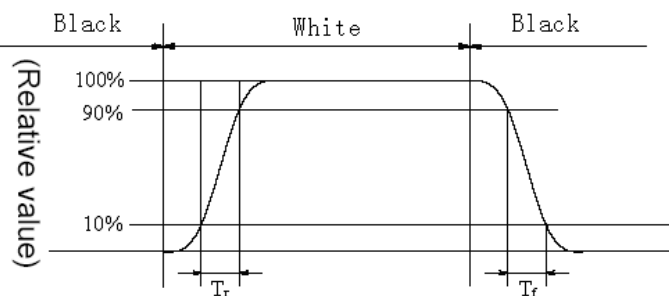
“White state “:The state is that the LCD should be driven at level 255 gray.

“Black state”: The state is that the LCD should be driven at level 0 gray.

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

Note 4:Response time (Ton + Toff)

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 10% to 90%. And fall time (TOFF) is the time between photo detector output intensity changed from 90% to 10%., Refer to below, measured by LCD5200 or DMS.



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 . Every measuring point is placed at the center of each measuring area.

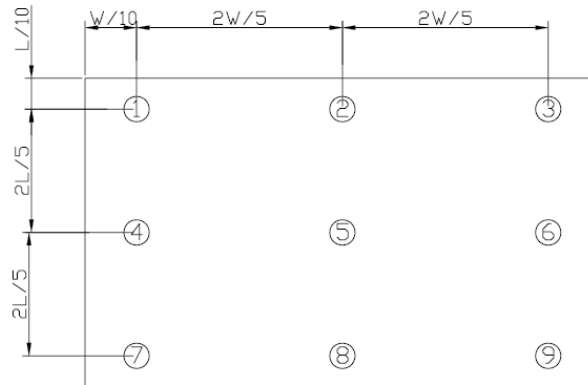
$$\text{Luminance Uniformity (U)} = \text{Lmin} / \text{Lmax}$$

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 Gamma

Measurement and evaluation to be performed according Information Displays Measurement Standard Version 1.03 (2012-Jun-01) section 6.3.

Note 8: Definition of luminance

Luminance is measured at the center point of the LCD by EZ-Contrast .

Note9: SCI reflective ratio measure method.

Measurement system: CM 3600A fully integral sphere

Light source: D65

d/8°(ASTM E 1164-09)

Observer angle: 10°

State: LCD power-off

Standard d/8° Integration Sphere Spectroscopic – Reflectometer

## 6. Reliability Test

No	Test Item	Test condition	Criterion
1	High Temperature Storage	90°C 500H RH<=45% Restore 2H at 25°C Power off	Note1, Note2, Note4
2	Low Temperature Storage	-40°C 500H Restore 2H at 25°C Power off	Note1, Note2, Note4
3	High Temperature Operation	+85 500H RH<=45% Restore 2H at 25°C Power on	Note1, Note2, Note4
4	Low Temperature Operation	-30°C 500H Restore 2H at 25°C Power on 500hrs for reference	Note1, Note2, Note4
5	High Temperature & Humidity Operation	60°C, 90%RH 500H Power on	Note1, Note2, Note4
6	Thermal Shock	-40°C→ change→+85°C 30min 30s 30min 100cycle non-operation	Note1, Note2, Note4
7	Vibration Test	Frequency: 8 - 33.3 Hz, Total amplitude: 1.3mm Frequency: 33.3 - 400 Hz, Acceleration: 29.4 m/s <sup>2</sup> sweep time: 15 minutes 2 hours each for X and Z directions, 4 hours for Y direction (total 8 hours) Non-operation	Note1, Note2
8	Shock Test	100 x 9.8m/s <sup>2</sup> , t=6ms, XYZ directions, Half sin curve, [non-operating],each directions 2 times	Note1, Note2
9	ESD	Air discharge: C=150pF±10%,R=330Ω±10%, 5 point/panel Air: +/-15KV, 5times	Note1, Note2, Note3
		Contact discharge: C=150pF±10%,R=330Ω±10%, 5 point/panel Contact: +/-8KV,5times	Note1, Note2, Note4

Note1: After completion of the test, the sample shall be free from the following defects:

- 1) Air bubble in the LCD

- 2) Seal leak
- 3) Non-display
- 4) Missing segments
- 5) Glass crack
- 6) CR reduction >30%
- 7) Idd increasing >100%
- 8) Brightness reduction >40%
- 9) Color coordinate tolerance >0.05

Note2: Use sample for only one reliability test.

Note3: In case of an abnormal display caused by discharge, if it can recover to normal state after reset, it is considered "PASS". The use of an ionizer (antistatic blower) is recommended during this test. When removing the protection film from LCM panel, do it at a slow speed (preferably more than one second) and blow with ionizer toward the peeling face to minimize ESD which may damage the electrical circuit.

Note4: For duration test in the chamber

- a. Keep a small distance between each sample and don't place the samples close to the wall or the wick. Don't open the chamber unless absolutely necessary.
- b. During the test, avoid moisture condensation on the polarizer.
- c. After taking the samples out of the chamber and returning to room temperature and humidity, wait at least two hours before inspecting and measuring data.
- d. Perform de-rating during high temp. Operation test.
- e. For optical bonding Cover or CTP product, after sample take out of the chamber, should

wait at least 24hrs before mura checking.

Note5: Polarizer color change (Such as yellowish) will judge pass if the optical test data is within specification requirement.



## 8. Cosmetic Specification

### 8.1 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the inspection period) at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller, If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regards as acceptance.

Should the customer fail to notify the seller within the inspection period, the buyers right to reject the modules. Shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

### 8.2 Inspection Sampling Method

- 10.2.1 Lot size: Quantity per shipment lot per model
- 10.2.2 Sampling type: Normal inspection, individual sampling
- 10.2.3 Inspection level: II
- 10.2.4 Sampling table: MIL-STD-105D
- 10.2.5 Acceptable quality level (AQL)
  - Major defect: AQL=0.65
  - Minor defect: AQL=1.00

### 8.3 Inspection Conditions

#### 8.3.1 Ambient conditions

- a. Temperature: Room temperature  $25\pm 5^{\circ}\text{C}$
- b. Humidity:  $(60\pm 10)\% \text{RH}$
- c. Illumination: Visual test: Max 300Lux

Appearance test: Min 700Lux

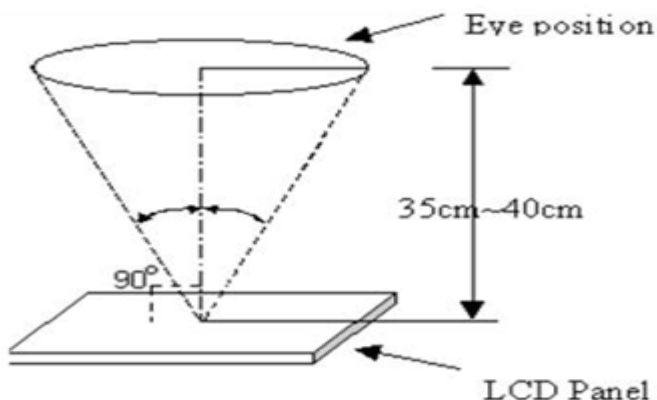
#### 8.3.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be 35~40cm.

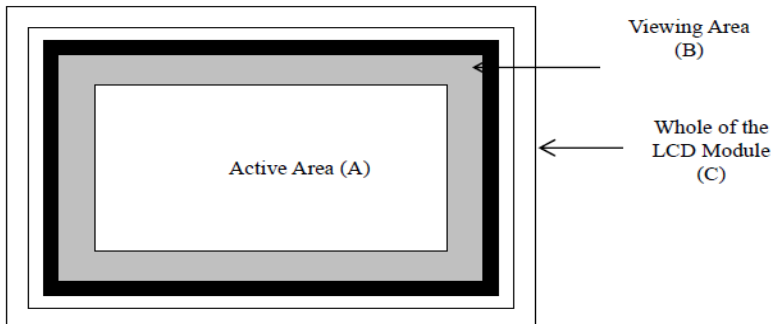
The distance between LCD and ND filter is 3~5cm.

#### 8.3.3 Viewing Angle

U/D:  $30^{\circ}/25^{\circ}$ , L/R:  $40^{\circ}/40^{\circ}$



### 8.3.4 Definition of LCD zone



A-zone: The inside of the Active Area (as defined on the product drawing)

B-zone: The inside of the Viewing Area which is between A-zone and the metal frame. (Including CTP Black painting area)

C-zone: Whole of the LCD Module except the zone A and B. (Including FPC & Metal Frame & backside of the LCD Module)

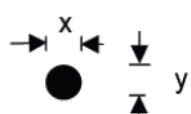

## 8.4 Dot and Line defect Criteria

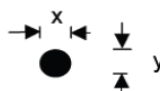


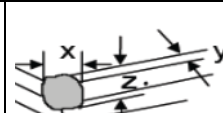
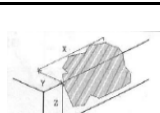

Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

### 8.4.1 Major defect


Item No	Items to be inspected	Inspection Standard
1	All functional defects	1) No display; 2) Display abnormally; 3) Short circuit; 4) Line defect.
2	Missing	Missing function component.
3	Crack	Glass Crack.

### 8.4.2 Minor defect

No.	Inspection Item	Inspection Standards	Acceptable Qty.	Applied Zone	Inspection Mode	Note	Applied To
1	Bright spots	$\varphi \leq 0.2$ $0.2 < \varphi \leq 0.4$ $0.40 < \varphi$	Ignore 3 None	A	Light-on	$\varphi = (x+y) / 2$ 	Module
2	Dark spots	$\varphi \leq 0.2$ $0.2 < \varphi \leq 0.4$	Ignore 3	A/B	Light-on	$\varphi = (x+y) / 2$ 	Module

		$0.40 < \phi$	None					
3	Lints & Scratches	$W \leq 0.05$ and $L \leq 5.0$ $0.05 < W \leq 0.10$ and $L \leq 5.0$ $0.10 < W$ or $L > 5.0$	Ignore  2  None	A/B	Light-on Light-off		Module	
4	Dent/Bubble	$\phi \leq 0.2$  $0.2 < \phi \leq 0.4$  $0.40 < \phi$	Ignore  3  None	A/B	Light-on Light-off	$\phi = (x+y) / 2$ 	Module	
5	Dirty/Dust	Those wiped out easily are acceptable					Module	
6	Electrical Dot Defect	Inspection pattern: Full white, Full black, Red, green and blue screens				 	Module	
		Black dot defect	3	A	Light-on			
		Bright dot defect	0					
		Total Dot	3					
7	Glass defect	1. Corner Fragment:						
		$X \leq 3\text{mm}$  $Y \leq 3\text{mm}$  $Z \leq T$	Ignore T : Glass thickness X: Length Y: Width Z: thickness	A/B	Light-off		Module	
		2. Side Fragment:						
		$X \leq 6.0\text{mm}$  $Y \leq 1\text{mm}$  $Z \leq T$	Ignore T : Glass thickness X: Length Y: Width Z: thickness	A/B	Light-off			
8	Mura	Visible through ND 5% at full black pattern	None	A	Light-on		Module	

Note1: Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.

	<input checked="" type="checkbox"/> Preliminary Specification <input type="checkbox"/> Product Specification	
	Confidential	Part Number: TM123XDKP17-00

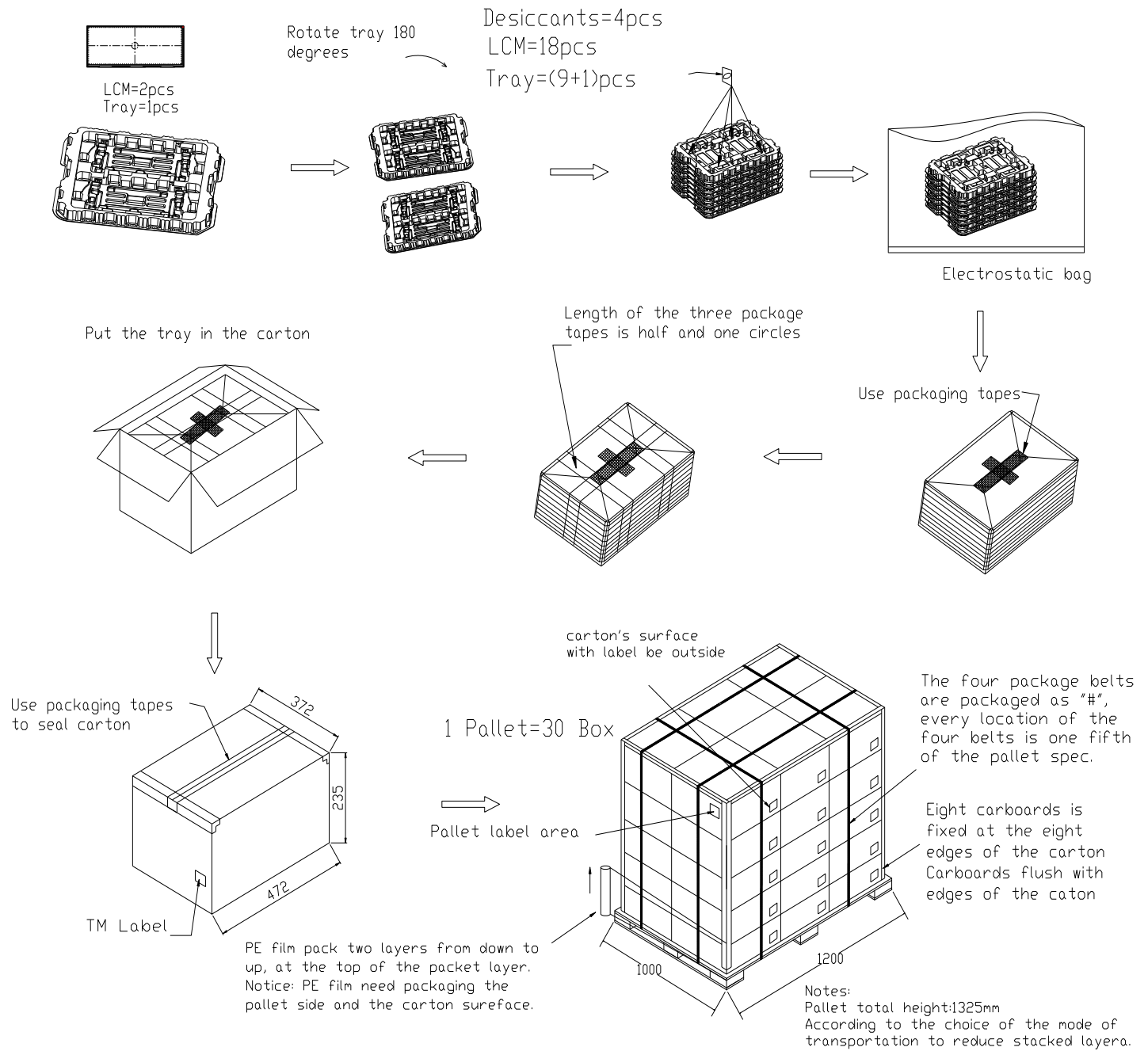
Note2: Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

Note3: If any problems or doubts arise with the LCD, the customer and supplier will cooperate and make efforts to solve it with mutual confidence and respect. Issues which are not defined in these criteria shall be discussed between customer and suppliers for a better solution.

Note4: The distance between black dot defects should be more than 5mm.



## 9. Packing Instruction



No.	Item	Model (Material)	Dimensions(mm)	Quantity
1	Module	TM123XDKP17	305.92 x 123.62 x 7	18
2	Tray	PP	455×355×27.2	10
4	Anti-Static Bag	透明 PE	680×520	1
5	Carton	Corrugated Pape	472×372×235	1



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Module label information



CUS PN:000000  
TM PN:TM123XDKP17-00  
DATE:YY-MM-DD  
SN:XXXXX

## 10. Precautions for Use of LCD Modules

### 10.1 Handling Precautions

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.

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.

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

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

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

1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

1.12 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.

### 10.2 Storage precautions

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

2.2 The LCD modules should be stored under the storage temperature range. the recommend condition is: Temperature : 0℃ ~ 40℃, Relatively humidity: ≤80%, and no more than 1 year.

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

### 10.3 Transportation Precautions

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

## 11. Appendix

The relationship of temperature and resistance for NTC:

TEMP (deg.C)	Resistance (kohm)	TEMP (deg.C)	Resistance (kohm)	TEMP (deg.C)	Resistance (kohm)	TEMP (deg.C)	Resistance (kohm)
-40.000	195.652	2.000	24.988	44.000	5.086	86.000	1.413
-39.000	184.917	3.000	23.951	45.000	4.917	87.000	1.375
-38.000	174.845	4.000	22.963	46.000	4.754	88.000	1.338
-37.000	165.391	5.000	22.021	47.000	4.597	89.000	1.303
-36.000	156.513	6.000	21.123	48.000	4.446	90.000	1.268
-35.000	148.171	7.000	20.267	49.000	4.301	91.000	1.234
-34.000	140.330	8.000	19.450	50.000	4.161	92.000	1.202
-33.000	132.958	9.000	18.670	51.000	4.026	93.000	1.170
-32.000	126.022	10.000	17.926	52.000	3.896	94.000	1.139
-31.000	119.494	11.000	17.214	53.000	3.771	95.000	1.110
-30.000	113.347	12.000	16.534	54.000	3.651	96.000	1.081
-29.000	107.565	13.000	15.886	55.000	3.535	97.000	1.053
-28.000	102.116	14.000	15.266	56.000	3.423	98.000	1.026
-27.000	96.978	15.000	14.674	57.000	3.315	99.000	0.999
-26.000	92.132	16.000	14.108	58.000	3.211	100.000	0.974
-25.000	87.559	17.000	13.566	59.000	3.111	101.000	0.949
-24.000	83.242	18.000	13.049	60.000	3.014	102.000	0.925
-23.000	79.166	19.000	12.554	61.000	2.922	103.000	0.902
-22.000	75.316	20.000	12.081	62.000	2.834	104.000	0.880
-21.000	71.677	21.000	11.628	63.000	2.748	105.000	0.858
-20.000	68.237	22.000	11.195	64.000	2.666	106.000	0.837
-19.000	64.991	23.000	10.780	65.000	2.586	107.000	0.816
-18.000	61.919	24.000	10.382	66.000	2.509	108.000	0.796
-17.000	59.011	25.000	10.000	67.000	2.435	109.000	0.777
-16.000	56.258	26.000	9.634	68.000	2.364	110.000	0.758
-15.000	53.650	27.000	9.284	69.000	2.294	111.000	0.740
-14.000	51.178	28.000	8.947	70.000	2.228	112.000	0.722
-13.000	48.835	29.000	8.624	71.000	2.163	113.000	0.705



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-12.000	46.613	30.000	8.315	72.000	2.100	114.00 0	0.688
-11.000	44.506	31.000	8.018	73.000	2.040	115.00 0	0.672
-10.000	42.506	32.000	7.734	74.000	1.981	116.00 0	0.656
-9.000	40.600	33.000	7.461	75.000	1.925	117.00 0	0.640
-8.000	38.791	34.000	7.199	76.000	1.870	118.00 0	0.625
-7.000	37.073	35.000	6.948	77.000	1.817	119.00 0	0.611
-6.000	35.442	36.000	6.707	78.000	1.766	120.00 0	0.596
-5.000	33.892	37.000	6.475	79.000	1.716	121.00 0	0.583
-4.000	32.420	38.000	6.253	80.000	1.669	122.00 0	0.569
-3.000	31.020	39.000	6.039	81.000	1.622	123.00 0	0.556
-2.000	29.689	40.000	5.834	82.000	1.578	124.00 0	0.544
-1.000	28.423	41.000	5.636	83.000	1.535	125.00 0	0.531
0.000	27.219	42.000	5.445	84.000	1.493		
1.000	26.076	43.000	5.262	85.000	1.452		