SPECIFICATION
FOR
LCM Module

MODULE No:	KD123WUFLD009
CUSTOMER:	

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Date	Rev. No.	Page	Summary
2024.08.24	V1.0	ALL	FIRST ISSUE

Contents

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorpho us silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Pan el, driver circuit,Mini LED Back-light unit. The resolution of a 12.3 " TFT-LCD contains 1920x720 pixels, and can display up to 16.7M colors.

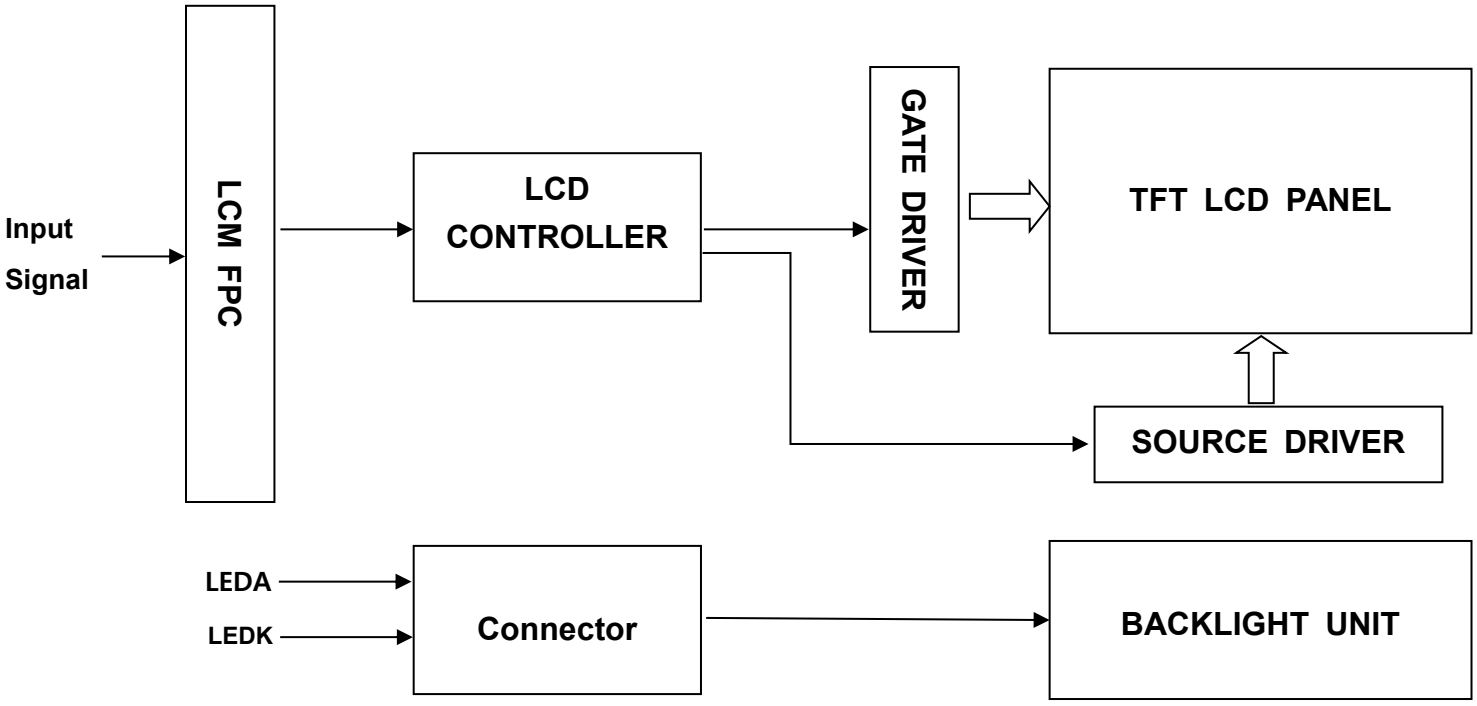
* Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	292.032(H)*109.512(V) (12.3 inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M（8bit）	colors	
Number of pixels	1920(RGB)*720	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.1521(H)*0.1521(V)	mm	
Viewing angle	ALL	o'clock	
LCM Interface	2 port LVDS	-	
Backlight	Mini LED		
Display mode	Normally Black	-	
Operating temperature	-30～+85	℃	
Storage temperature	-40～+90	℃	

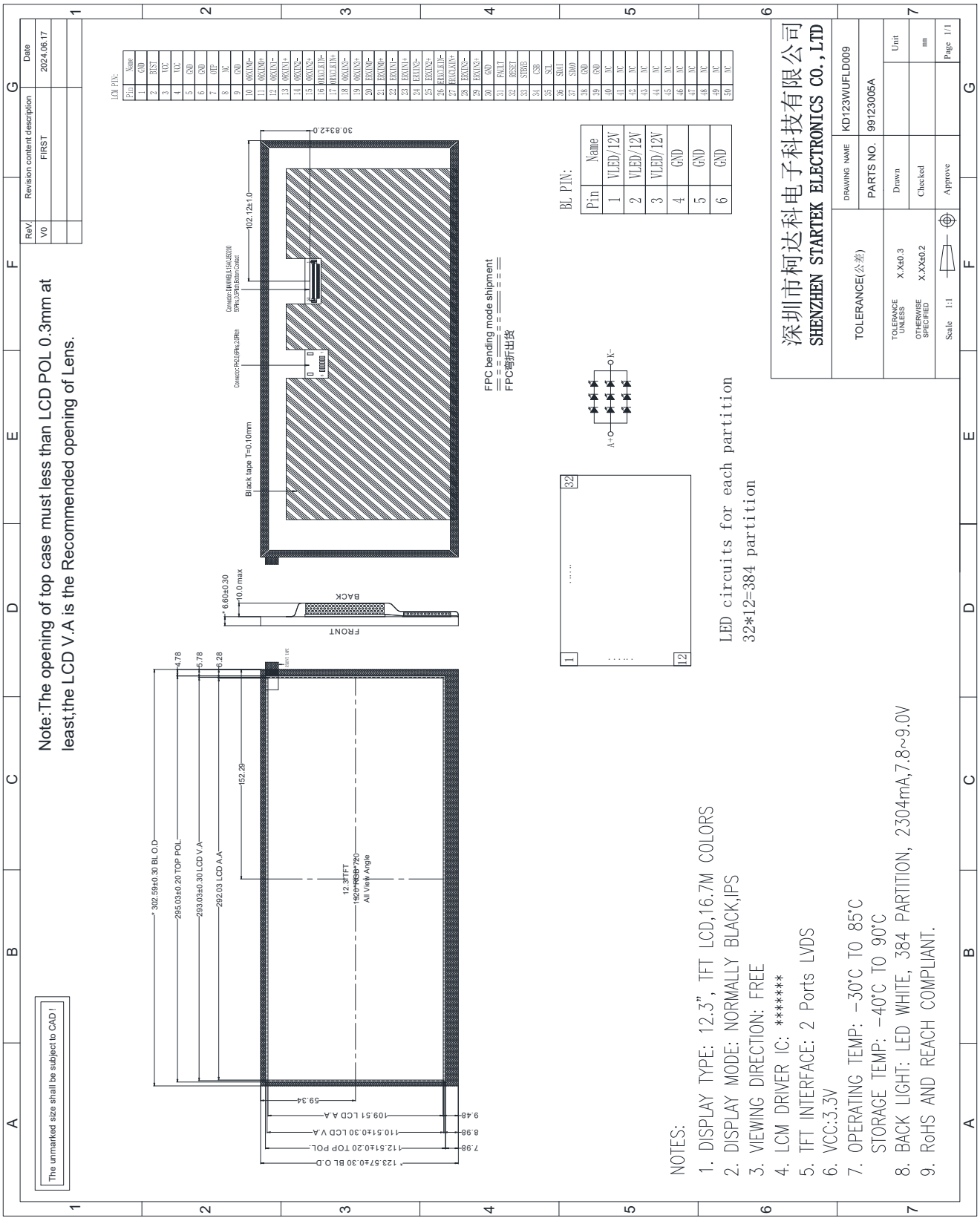
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	302.59	-	mm	
	Vertical(V)	-	123.57	-	mm	
	Depth(D)	-	10.00	-	mm	
Weight		-	378	-	g	

1. Block Diagram



2. Outline dimension



Part. No	KD123WUFLD009	REV	V1.2	Page 6 of 29

常 备 库 存 Stock For Sale | 长 期 供 货 Long Time supply | 支持小量 NO MOQ | 品 种 齐 全 In Full Range

3. Input terminal Pin Assignment

3.1 TFT (Connector:AORORA F31L -1A 7H 1-21050 or BLD-101049-205050,50PIN)

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	BIST	LCD Panel Self Test Enable,When it is not used,connecting to GND is recommended,don't floating	I
3	VCC	Supply voltage (3.3V).	P
4	VCC	Supply voltage (3.3V).	P
5	GND	Ground.	P
6	GND	Ground.	P
7	OTP	Serial interface OTP power	I
8	NC	No connector	--
9	GND	Ground.	I
10	ORXIN0-	Negative LVDS differential data input(Odd data)	I
11	ORXIN0+	Positive LVDS differential data input(Odd data)	I
12	ORXIN1-	Negative LVDS differential data input(Odd data)	I
13	ORXIN1+	Positive LVDS differential data input(Odd data)	I
14	ORXIN2-	Negative LVDS differential data input(Odd data)	I
15	ORXIN2+	Positive LVDS differential data input(Odd data)	I
16	ORXCLKIN-	Negative LVDS differential clock input(Odd clock)	I
17	ORXCLKIN+	Positive LVDS differential clock input(Odd clock)	I
18	ORXIN3-	Negative LVDS differential data input(Odd data)	I
19	ORXIN3+	Positive LVDS differential data input(Odd data)	I
20	ERXIN0-	Negative LVDS differential data input(Even data)	I
21	ERXIN0+	Positive LVDS differential data input(Even data)	I
22	ERXIN1-	Negative LVDS differential data input(Even data)	I
23	ERXIN1+	Positive LVDS differential data input(Even data)	I
24	ERXIN2-	Negative LVDS differential data input(Even data)	I

25	ERXIN2+	Positive LVDS differential data input(Even data)	I
26	ERXCLKIN-	Negative LVDS differential clock input(Even clock)	I
27	ERXCLKIN+	Positive LVDS differential clock input(Even clock)	I
28	ERXIN3-	Negative LVDS differential data input(Even data)	I
29	ERXIN3+	Positive LVDS differential data input(Even data)	I
30	GND	Ground.	P
31	FAULT	FAULT signal output(normal=H,abnormal-L)	I
32	RESETB	Global reset pin,active low	I
33	STBYB	Standby mode setting pin,active low	I
34	CSB	Serial interface chip enable	I
35	SCL	Serial interface clock input	I
36	SDAI	Serial interface data input	I
37	SDAO	Serial interface data output	I
38	GND	Ground.	P
39	GND	Ground.	P
40	NC	No connector	--
41	NC	No connector	--
42	NC	No connector	--
43	NC	No connector	--
44	NC	No connector	--
45	NC	No connector	--
46	NC	No connector	--
47	NC	No connector	--
48	NC	No connector	--
49	NC	No connector	--
50	NC	No connector	--

3.2 Back Light (Connector:PH2.0,6Pins,2.0Pitch)

NO.	SYMBOL	DISCRIPTION	I/O
1	VLED	Mini LED Power/12V	P
2	VLED	Mini LED Power/12V	P
3	VLED	Mini LED Power/12V	P
4	GND	Power ground	P
5	GND	Power ground	P
6	GND	Power ground	P

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	1200	1500	--		(1)(2)
Response time	Rising	T_R		--	25	30	msec	
	Falling	T_F		--				(1)(3)
LCM Luminance		LV		--	700	--	cd/m2	
Color Gamut		S(%)		75	80	--	%	
Color Filter Chromacicity	White	W_X		-0.04	0.295	+0.04		(1)(4) CF glass
		W_Y			0.330			
	Red	R_X			0.683			
		R_Y			0.303			
	Green	G_X			0.227			
		G_Y			0.732			
	Blue	B_X			0.182			
		B_Y			0.066			
Viewing angle	Hor.	ΘL	CR>10	80	85	--		
		ΘR		80	85	--		
	Ver.	ΘU		80	85	--		
		ΘD		80	85	--		
Option View Direction		ALL						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

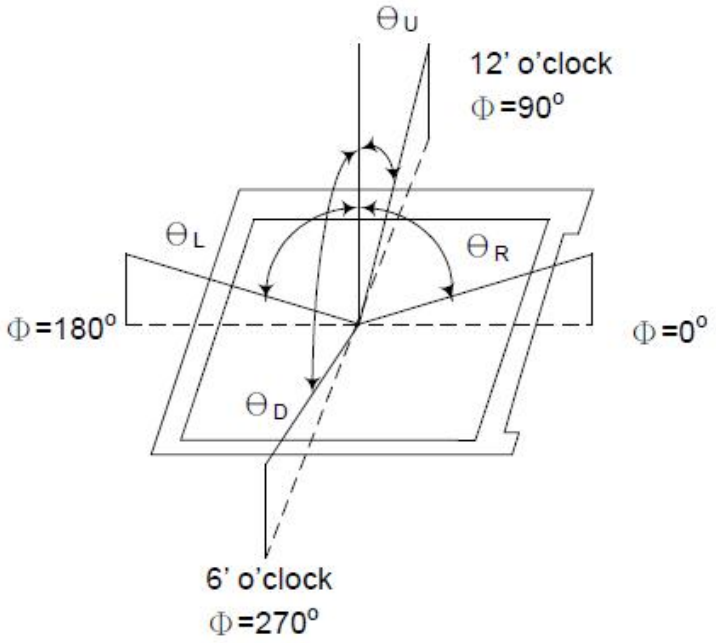
Ambient temperature : 25±2°C

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

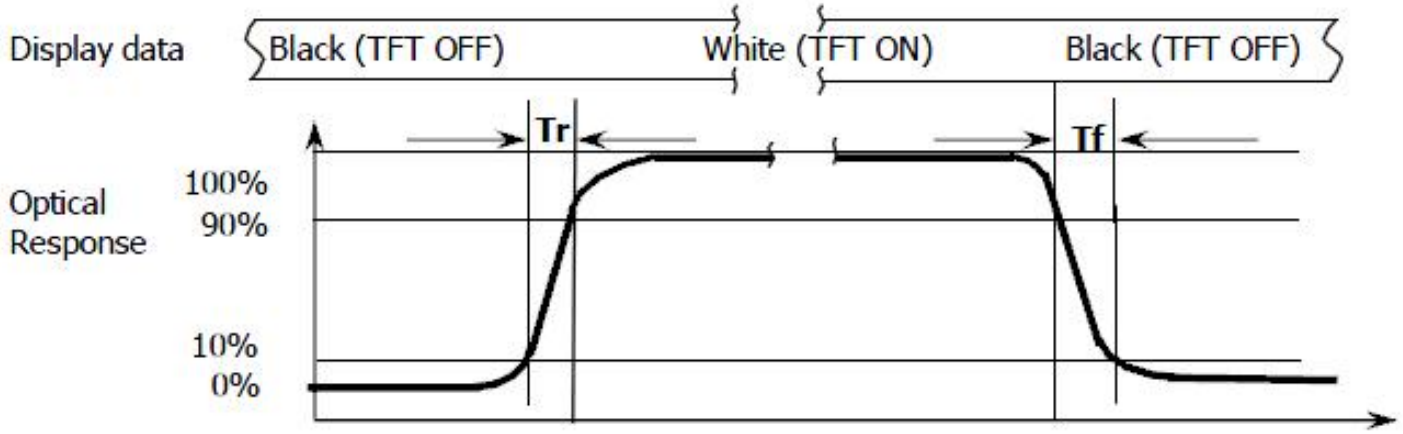
Note (1): Definition of Viewing Angle :



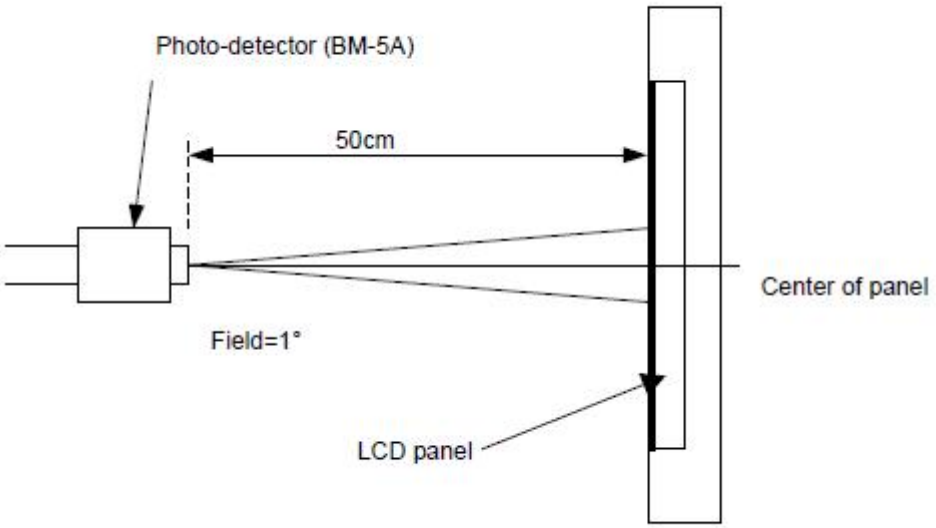
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	VCC	-0.3	4.0	V	Note1
Operating temperature	T_{OP}	-30	+85	℃	
Storage temperature	T_{ST}	-40	+90	℃	

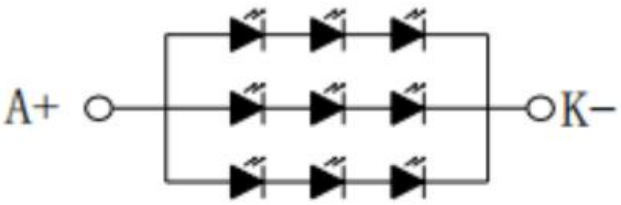
NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VCC	3.0	3.3	3.6	V	
Normal mode Current	IDD	--	370	740	mA	
Level input voltage	V_{IH}	0.7Vcc 3V3		Vcc 3V3	V	
	V_{IL}	GND		0.3 Vcc 3V3	V	
Level output voltage	V_{OH}	Vcc3V3-0.4		--	V	
	V_{OL}	GND		GND+0.4	V	

5.3 BL MODULE

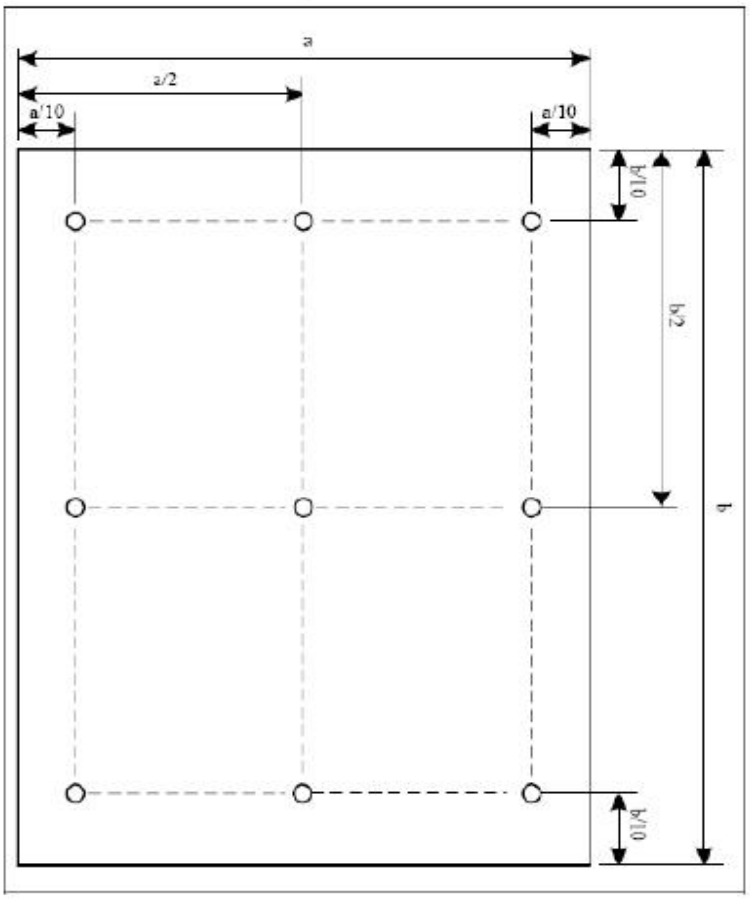
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Total Segment	-	32（H）x12（V）=384			-	
Number of LEDs		3(S)x3(P)=9			-	Single segment
LED Power Input	VLED	-	12V	-		
LED Power Current	ILED	3	-	-	A	
Forward Voltage	VF	-	9.0	-	V	Single segment
Mini LED Current	Ir	-	2	-	mA	Single segment



Single segment

Total segment

Note (3) Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. SIGNAL TIMIING SPECIFICATION

6.1 Signal Timing Specification

<Table 8. Signal Timing Specification>

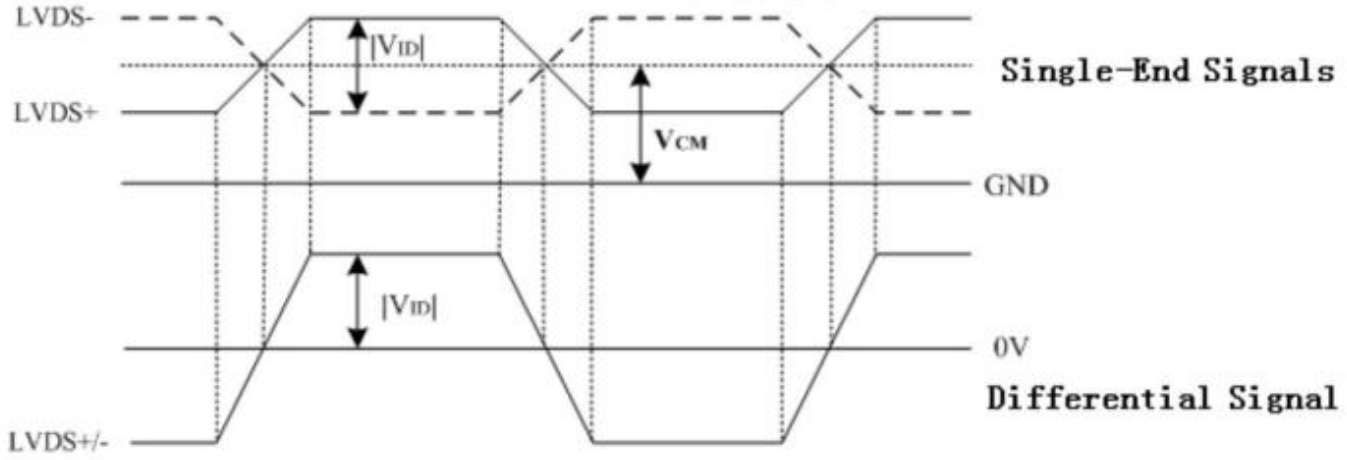
Parameter	Symbols	Panel Resoiution			Unit
		1920RGB*720 (2 port)			
		Min	Typ.	Max	
DCLK frequency	Fdclk	-	45.3	-	MHz
Horizontal valid data	Thd	-	960	-	DCLK
1 horiaontal line	Th	1015	1026	1248	DCLK
Vertical valid data	Tvd	-	720	-	H
1 vertical field	Tv	730	736	756	H
Frame rate	FR	-	60	-	Hz

6.2 Signal Electrical Characteristics for LVDS Receiver

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644) standard.

<Table 9. LVDS Receiver Electrical Characteristics>

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Differential input high Threshold voltage	Vth	Vcm=1.2V	+0.10	-	-	V
Differential input low threshold voltage	Vtl	Vcm=1.2V	-	-	-0.10	V
Differential input common Mode voltage	V_{CM}	-	1	1.2	1.7-|V_{id}|/2	V
LVDS input voltage	V_{INLV}		0.7		1.7	V
Differential input voltage	|Vid|	-	0.1	-	0.6	V
Differential input leakage Current	Ilvleak	-	-10	-	+10	μA



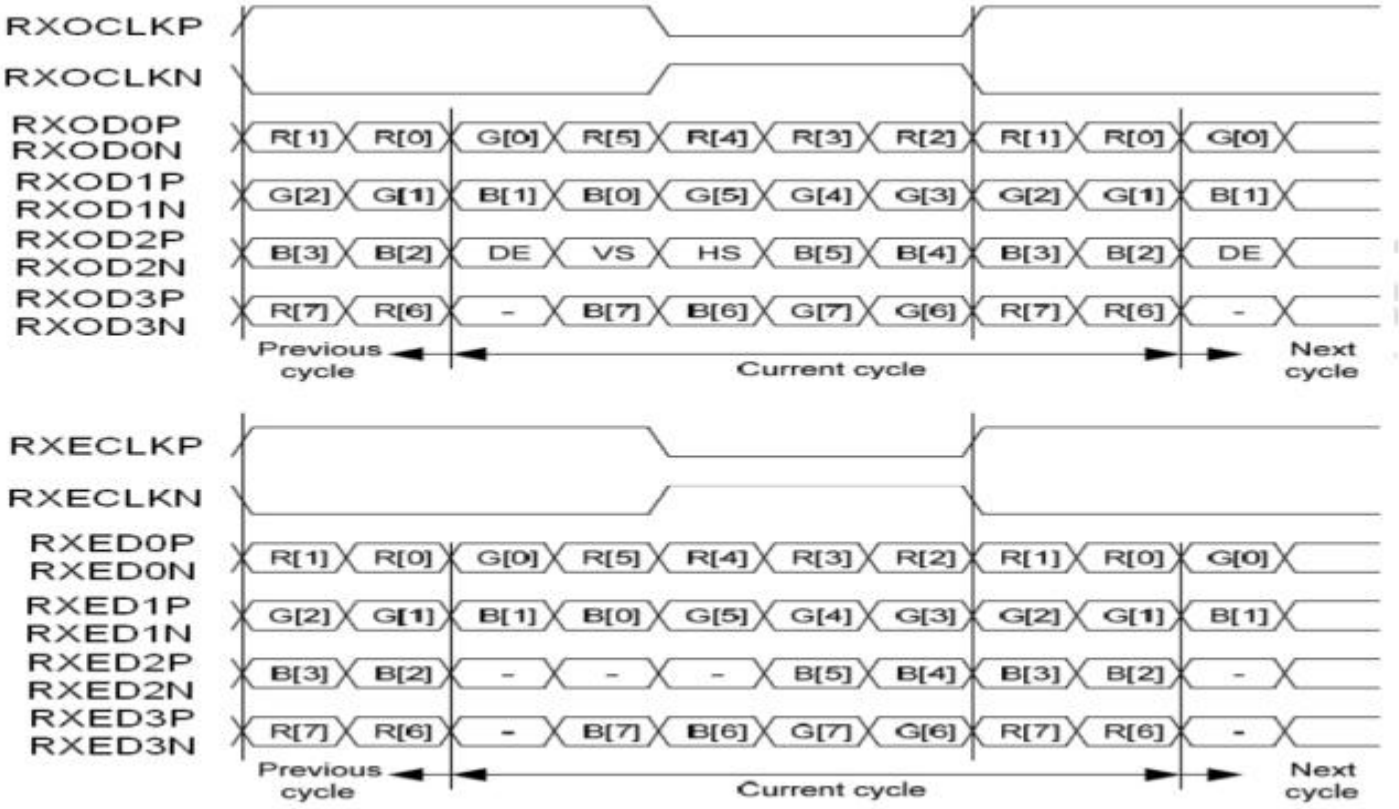


Figure 11. Data Mapping

6.3 LVDS Receiver Internal Circuit

Figure 12 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link

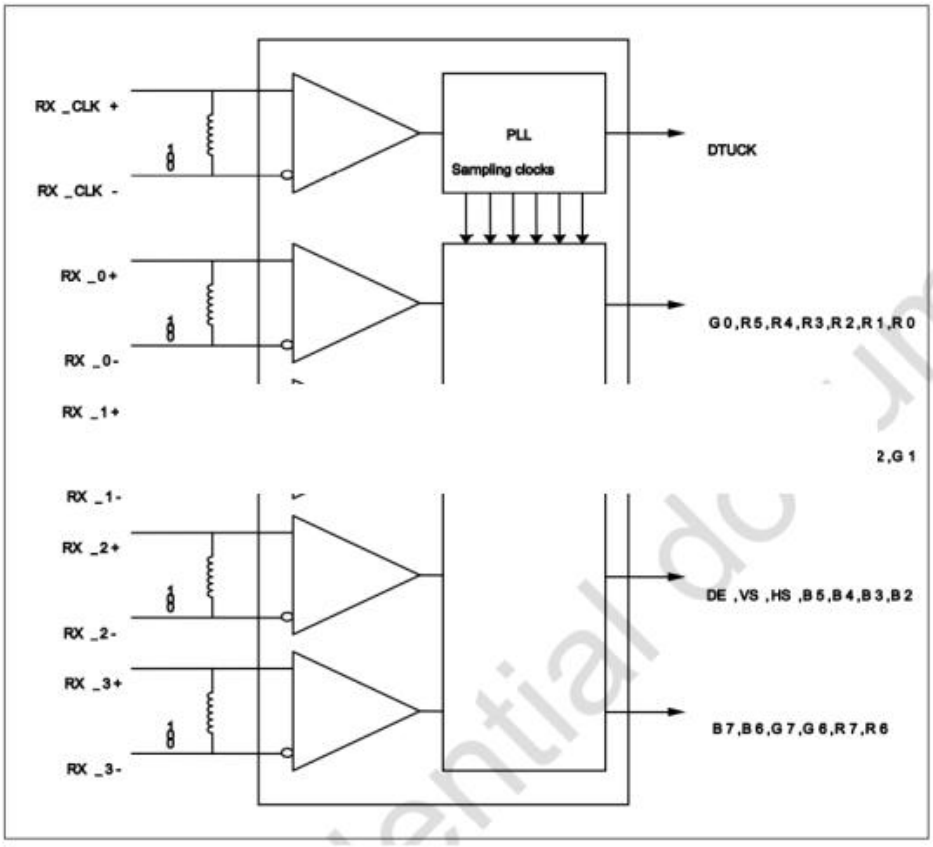


Figure 12. LVDS Receiver Internal Circuit

6.4 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below.

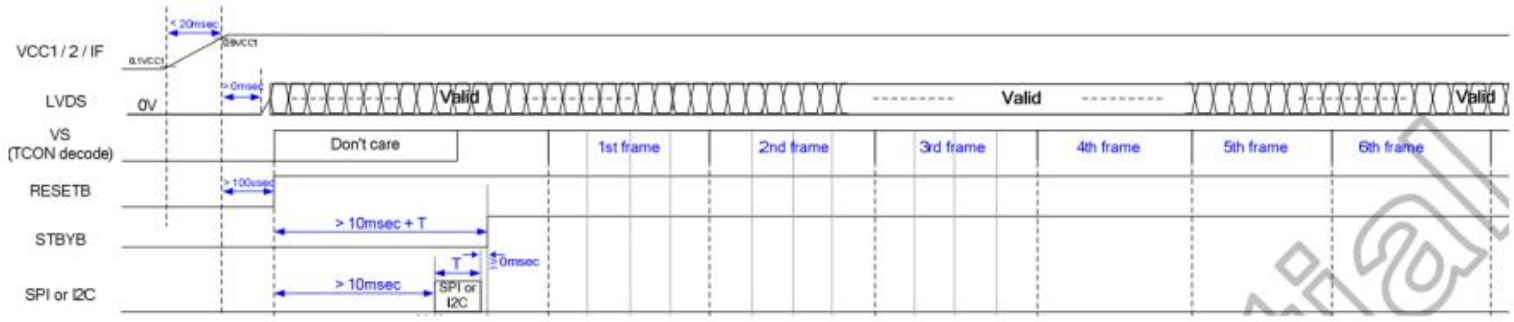


Figure 13. Power-on Sequence

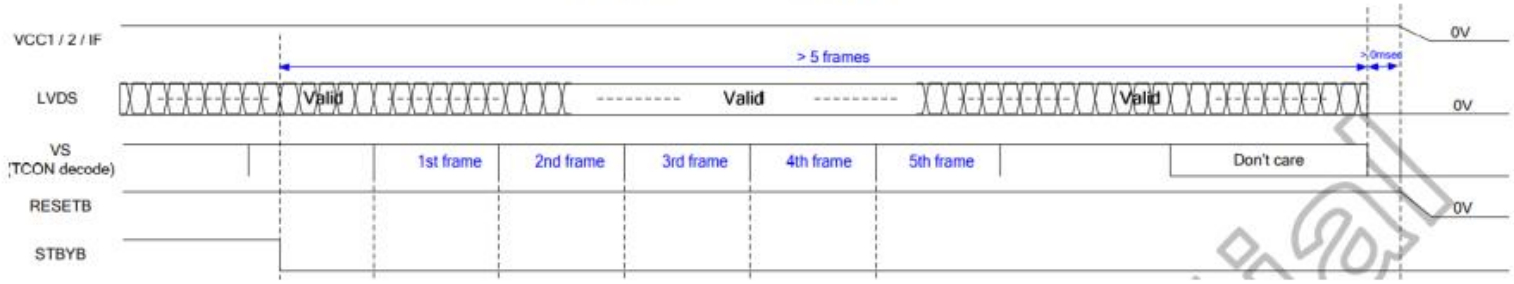


Figure 14. Power-off Sequence

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

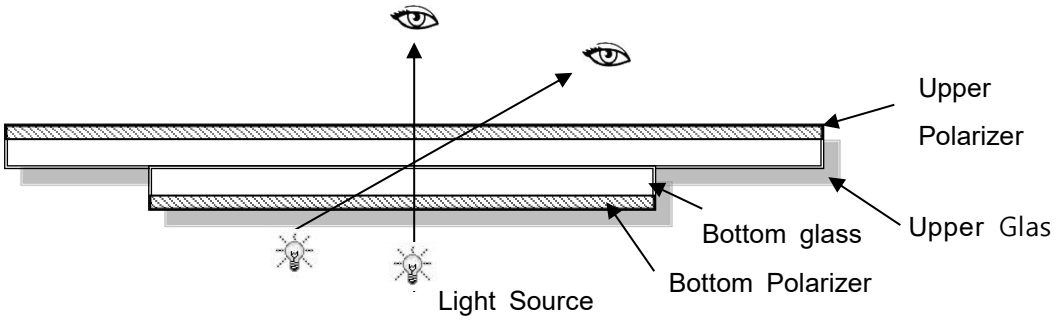
Temperature : 25±5℃

Humidity : 65%±10%RH

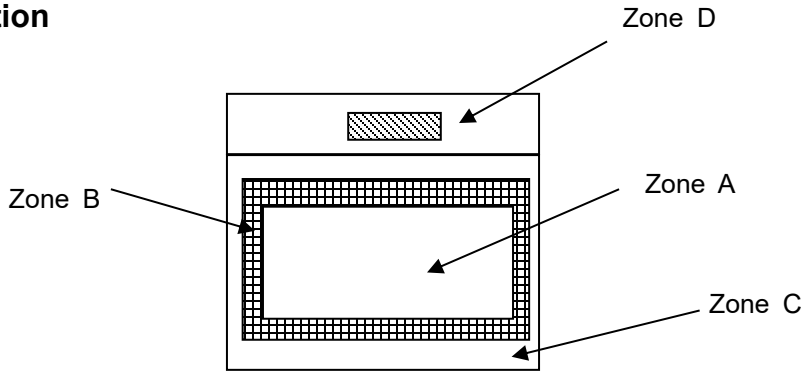
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2012 ; , normal inspection, Class Ⅱ

AQL:

Major defect	Minor defect
0.65	1.5

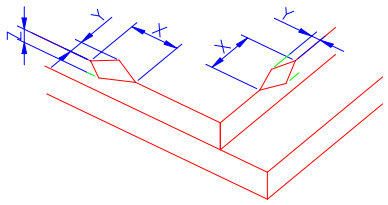
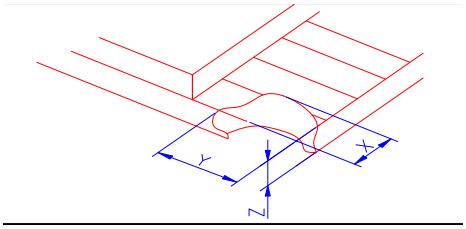
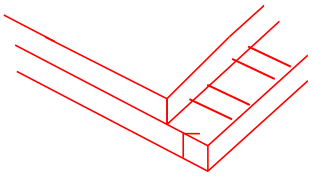
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc…	Major
2	Missing	Missing components and etc…	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed,deformation and etc…	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot,Dim spot,(Note1) Polarizer Air Bubble, Polarizer accidented spot and etc…	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc…	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	

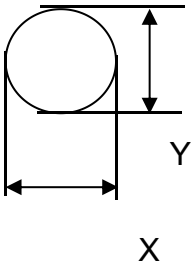
Note1: a) Light dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

2.0 Spot defect



Φ=(X+Y)/2

① light dot (black/white spot , pinhole, stain, etc.)

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

② Dim spot (light leakage、dent、dark spot, etc)

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

③ Polarizer accidented spot

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

④Polarizer Bubble

Size (mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	2(distance≧10mm)		
0.4<Φ≤0.5	1		
Φ>0.5	0		

3.0 LCD Pixel defect

Pixel bad points

Item	Zone A	Acceptable Qt
Bright dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Dark dot	Random	N≤3
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm
Total bright and dark dot		N≤4

Note:

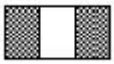
A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

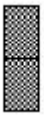
C) 2 dot adjacent = 1 pair = 2 dots

Picture:

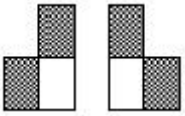
2 dot adjacent



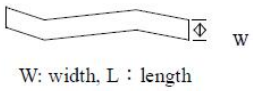
2 dot adjacent



2 dot adjacent (vertical)



2 dot adjacent (slant)

<table>
<tr>
<td>4.0</td>
<td>Line defect (LCD /Polarizer backlight black/white line, scratch, stain)
 

N : Count</td>
<td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤5.0</td><td colspan="2">N≤3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L≤4.0</td><td colspan="2">N≤2</td></tr>
<tr><td>W>0.08</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>5.0</td>
<td>Electronic Components SMT.</td>
<td>Not allow missing parts，solderless connection，cold solder joint，mismatch，The positive and negative polarity opposite</td>
</tr>
<tr>
<td>6.0</td>
<td>Display color& Brightness.</td>
<td>1. Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples.
2. Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td>
</tr>
<tr>
<td>7.0</td>
<td>LCD Mura/Waving/ Hot spot</td>
<td>Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.</td>
</tr>
</table>

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed

8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	85℃,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-30℃, 96HR	
High Temperature Storage	90℃, 96HR	
Low Temperature Storage	-40℃, 96HR	
High Temperature & High Humidity Operating	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-30℃,30 min ↔ +85℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX)	

Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

6. The color fading mura of polarizing filter should not care.

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

10. Packing

----TBD----------