Thin-Film-Transistor LCD Module
Model:XTTTA1NP05-01

Acceptance

Approved and Checked by

Approved by	Checked by		Made by

Revise Records

Rev.	Date	Contents	Written	Approved
A	2017/06/07	Preliminary Specification	LUO	JACK

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	

1.General Description and Features

XTTTA1NP05-01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit . The resolution of a 10.1" contains 1280RGBx800 dots and can display up to 16.7M colors. The following table described the features of XTTTA1NP05-01.

LCD Module

Item	Specification	Unit
Screen Size	10.1inches	Diagon
Display Resolution	1024RGB(H)x600(V)	Dot
Active Area	222.72(H) x125.28 (V)	mm
Outline Dimension	235(W) x 143(H) x 5.1(D)	mm
Display Mode	Normally white	--
Pixel Arrangement	RGB-Vertical Stripe	--
Gray scale inversion Direction	12 O'clock	
Viewing Direction	6 O'clock	--

2.Mechanical Information

Item		Min.	Typ.	Max.	Unit	
Module Size	Horizontal (H)	--	235	--	mm	
	Vertical (V)	--	143	--	mm	
	Thickness (T)	--	5.1	--	mm	
Weight		--	N/A	--	g	

Note (1) Not include FPC.
Refer to the Outline Dimension for further information.
(2) Back-light unit are included.

3.Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Operating temperature	T_{OPR}	-10	50	°C	(1)
Storage temperature	T_{STG}	-20	60	°C	(1,2,3)

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
TFT Gate on voltage	VGH	20	21	22	V	
TFT Gate off voltage	VGL	-7	-8	-9	V	
TFT Common electrode voltage	VCOM	3.5	3.7	3.9	V	
Analog power supply voltage	AVDD	10.65	10.85	11.05	V	

3.2.2 Back-Light Unit

Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	ILED	-	120	-	mA	18LEDS
Forward voltage	VF	8.4	9.9	10.2	V	IF=120mA 18LEDS
Reverse current	IR			50	μA	VR=10V,1LED
Power dissipation	Pd	1224			mW	18LEDS
Peak forward current	IFP	100			mA	1LED
Reverse Voltage	VR	10			V	1LED

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

4 Input Terminal Pin Assignment

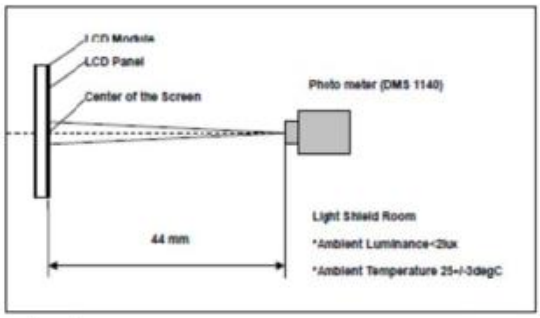
No.	Symbol	Function	Remark
1	LED+	LED Anode	
2	LED+	LED Anode	
3	LED-	LED Cathode	
4	LED-	LED Cathode	
5	GND	Power ground	
6	VCOM	Common voltage	
7	DVDD	Digital Power	
8	MODE	DE/SYNC mode select	Note1
9	DE	Data Input Enable	
10	VS	Vertical sync input	
11	HS	Horizontal sync input	
12	B7	Blue data(MSB)	
13	B6	Blue data	
14	B5	Blue data	
15	B4	Blue data	
16	B3	Blue data	
17	B2	Blue data	
18	B1	Blue data	
19	B0	Blue data(LSB)	
20	G7	Green data(MSB)	
21	G6	Green data	
22	G5	Green data	
23	G4	Green data	
24	G3	Green data	
25	G2	Green data	
26	G1	Green data	
27	G0	Green data(LSB)	
28	R7	Red data(MSB)	
29	R6	Red data	
30	R5	Red data	
31	R4	Red data	
32	R3	Red data	
33	R2	Red data	
34	R1	Red data	
35	R0	Red data(LSB)	
36	GND	Power Ground	
37	DCLK	Clock input	

38	GND	Power Ground	
39	L/R	Left or Right Display Control	Note2
40	U/D	Up / Down Display Control	Note3
41	VGH	Positive Power for TFT	
42	VGL	Negative Power for TFT	
43	AVDD	Analog Power	
44	RESET	Global reset pin	
45	NC	No connection	
46	VCOM	Common Voltage	
47	DITHB	Dithering function	Note4
48	GND	Power Ground	
49	NC	No connection	
50	NC	No connection	

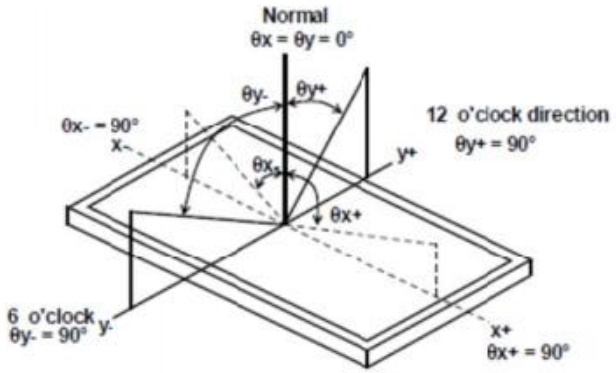
5 Optical Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	400	450	-		Note1 Note3
Luminance		YL	100	120	-	cd/m2	Note1 Note5
Luminance Uniformity		5points	75			%	Note1 Note6
		13 points	70				
Response Time		Rising + Falling	-	8	-	ms	Note1 Note4
Viewing Angle[degrees] K=Contrast Ratio>10	Horizontal	θx+	40	45	-	degree	Note1 Note2
		θx-	40	45	-		
	Vertical	θy+	10	15	-		
		θy-	30	35	-		
Color Chromaticity (CIE1931)	Red	x	0.527	0.577	0.627		Note1
		y	0.290	0.340	0.390		
	Green	x	0.265	0.315	0.365		
		y	0.568	0.618	0.668		
	Blue	x	0.099	0.149	0.199		
		y	0.074	0.124	0.174		
	White	x	0.230	0.280	0.330		
		y	0.270	0.320	0.370		
Color gamut (NTSC ratio)				52		%	Note1

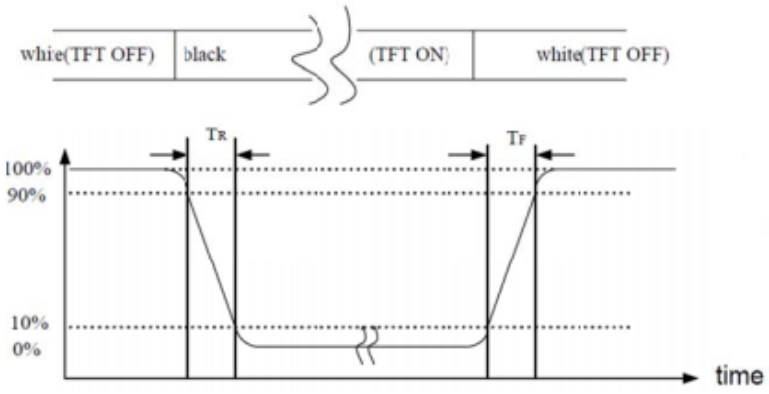
Note1: Measurement Setup
The LCD module should be stabilized at given temperature for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.



Note2:Definition of Viewing Angle



Note3:Definition of Contrast Ratio (CR)
The contrast ratio can be calculated by the following expression
Contrast Ratio (CR) = L63 / L0
L63: Luminance of gray level 63, L0: Luminance of gray level 0
Note4:Definition of Response Time (TR, TF)



Note5:Definition of Luminance White

Measure the luminance of gray level 63 at center point and 5 points.

Center of Luminance = Y1

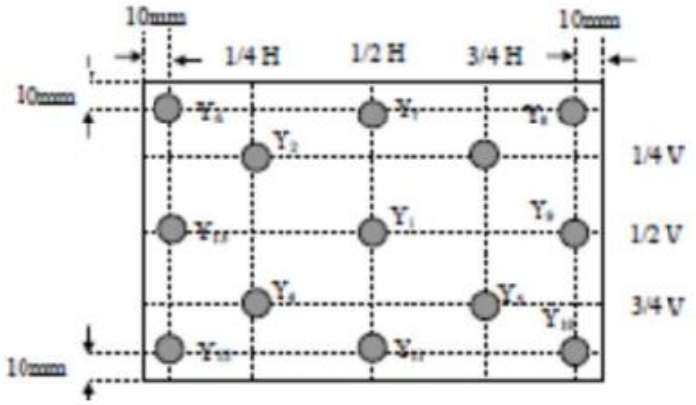
$$\text{Average Luminance of 5 points} = \frac{Y_1 + Y_2 + Y_3 + Y_4 + Y_5}{5}$$

Note6: Definition of Luminance Uniformity(Variation)

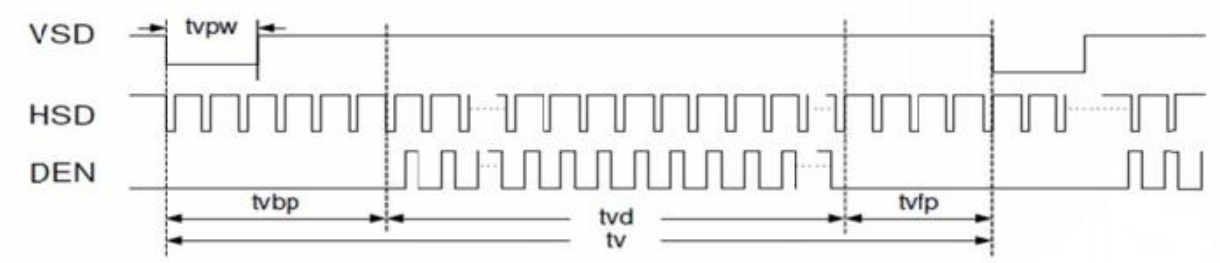
Measure the luminance of gray level 63 at 13 points.

$$\text{Uniformity of 13 points} = \frac{\text{Min Luminance of Y1~Y13}}{\text{Max Luminance of Y1~Y13}} \times 100\%$$

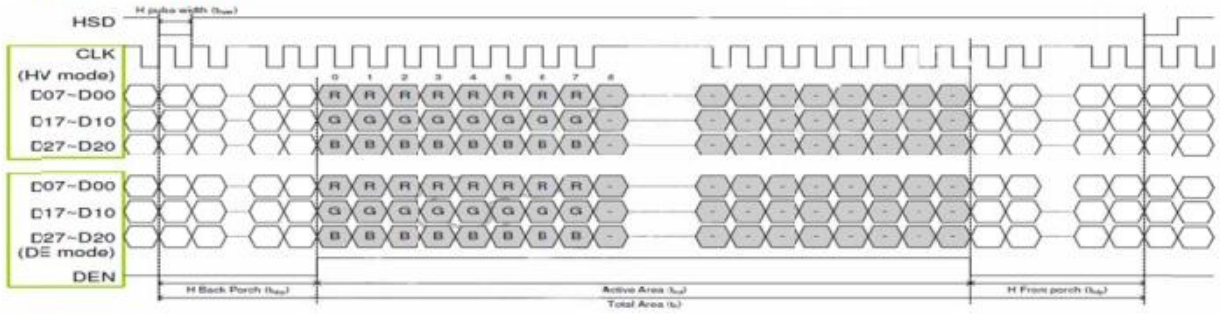
$$\text{Uniformity of 5 points} = \frac{\text{Min Luminance of Y1~Y5}}{\text{Max Luminance of Y1~Y5}} \times 100\%$$



6 Interface Timing



Horizontal Timing



Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd		600		TH
VSD Period	tv	610	635	800	TH
VSD Blanking	tvbp+ tvfp	10	35	200	TH

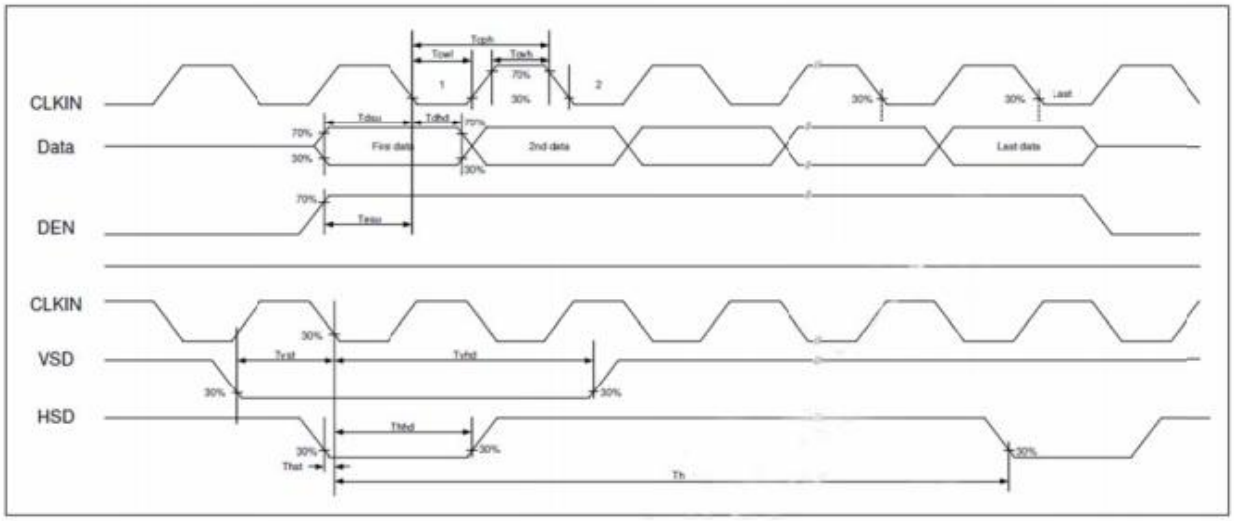
Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp		160		DCLK
HSD Front Porch	thfp	16	160	216	DCLK

Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		600		TH
VSD Period	tv	624	635	750	TH
VSD Pulse Width	tvpw	1	-	20	TH
VSD Back Porch	tvbp		23		TH
VSD Front Porch	tvfp	1	12	127	TH

INPUT CLOCK DAN DATA TIMING DIAGRAM



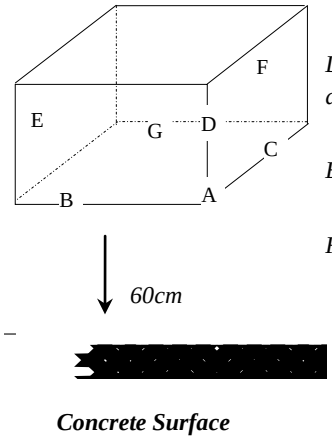
7 Reliability Condition for LCD

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C Humidity: 65±5%RH

Tests will be not conducted under functioning state.

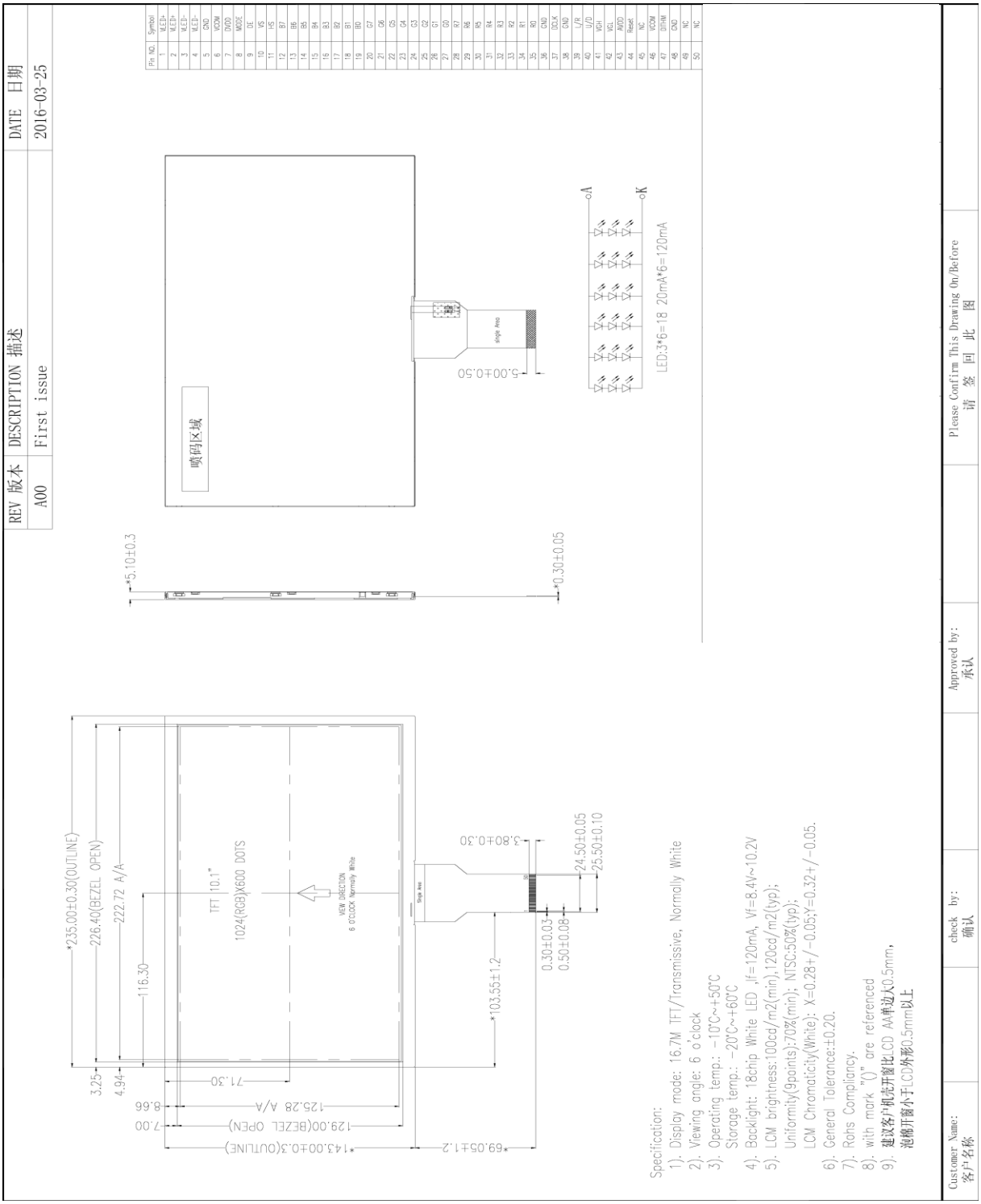
No.	Parameter	Condition	Notes
1	High Temperature Operating	50°C±2°C, 240hrs (Operation state)	--
2	Low Temperature Operating	-10°C±2°C, 240hrs (Operation state)	--
3	High Temperature Storage	60°C±2°C, 240hrs	--
4	Low Temperature Storage	-20°C±2°C, 240hrs	--
5	High Temperature and High Humidity Operation Test	40°C±2°C, 90%, 240hrs	--
6	Vibration Test	Total fixed amplitude: 1.5mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	--
7.	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  *Dropping method corner dropping* *A corner: once* *Edge dropping* *B, C, D edge: once* *Face dropping* *E, F, G face: once*	--

Notes: 1. No dew condensation to be observed.

2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

3. Vibration test will be conducted to the product itself without putting I in a container.

8 Dimensional outlines



9 Incoming Inspection Standards

11.1 VISUAL & FUNCTION INSPECTION STANDARD

11.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

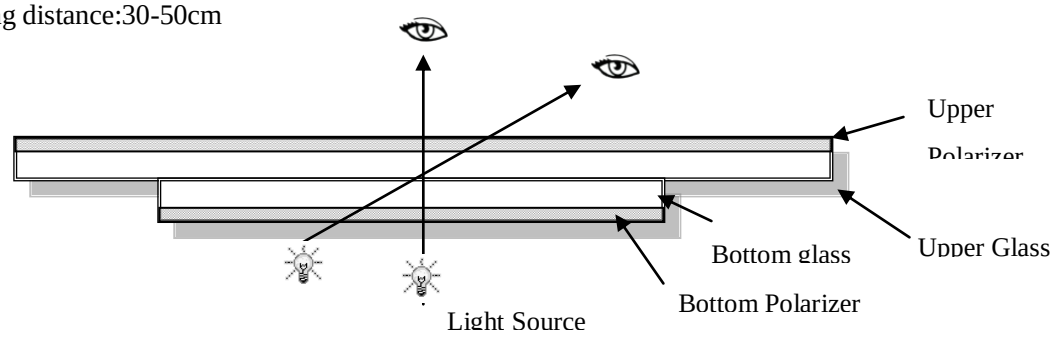
Temperature : 25±5℃

Humidity : 65%±10%RH

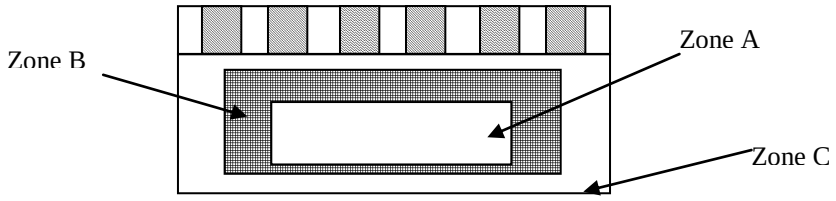
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



10.1.1 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 .)

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.

10.1.2 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

AQL:

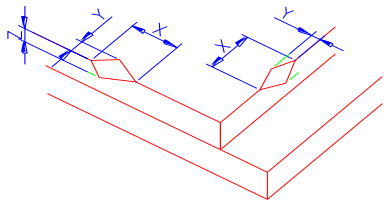
Major defect	Minor defect

0.65	1.5

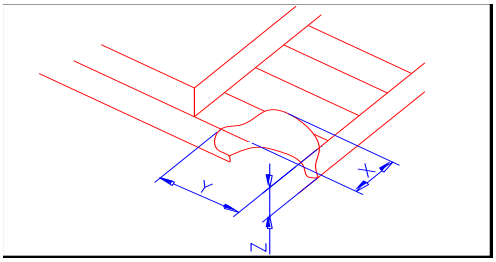
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

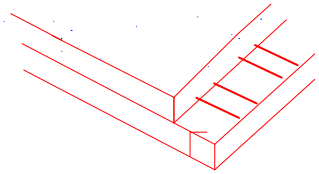
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

10.1.3 Criteria (Visual)

Number	Items	Criteria(mm)
1.0 LCD Crack/Broken NOTE: X: Length Y: Width	(1) The edge of LCD broken	

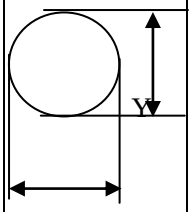
X	Y	Z
≤3.0mm	<Inner border line of the seal	≤T

<table>
<tr><td rowspan="2">Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(2)LCD corner broken</td><td> 

<table>
<tr><td>X</td><td>Y</td><td>Z</td></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>

Number	Items	Criteria (mm)

2.0 Spot defect



X

Φ=(X+Y)/2

① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.10	Ignore		Ignore
0.10<Φ≤0.15	3(distance≧10mm)		
0.15<Φ≤0.2	1		
0.2<Φ	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.1<Φ≤0.2	2(distance≧10mm)		
0.2<Φ≤0.3	1		
Φ＞0.3	0		

③ Polarizer accidented spot

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

<table>
<tr>
<td></td>
<td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</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≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>3.0</td>
<td>Polarizer Bubble</td>
<td>
<table>
<tr><td rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ<0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<Φ<0.4</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">1</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td></tr>
</table>
</td>
</tr>
<tr>
<td>4.0</td>
<td>SMT</td>
<td>According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.</td>
</tr>
</table>