ZETTLER DISPLAYS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

CUSTOMER APPROVAL			
※ **PART NO. :** ATM0240B32 (ZETTLER DISPLAYS) VER V1.1			
APPROVAL		**COMPANY CHOP**	
CUSTOMER COMMENTS			

ZETTLER DISPLAYS ENGINEERING APPROVAL		
DESIGNED BY	**CHECKED BY**	**APPROVED BY**
ZZK		

REVISION RECORD

REVISION	REVISION DATE	PAGE	CONTENTS
PRELIMINARY	**2019-09-03**	**--**	**FIRST ISSUED**
PRELIMINARY V1.1	**2019-12-25**	**4**	**MODIFY FPC**
PRELIMINARY V1.2	**2020-01-03**	**4**	**MODIFY FPC**
PRELIMINARY V1.3	**2020-01-03**	**4**	**MODIFY FPC**
VER1.0	**2020-04-08**	**4**	**ADD 704 SILICONE RUBBER**
VER1.1	**2020-06-10**	**4**	**CHANGE TO BLACK PLASTIC FRAME，REMOVE SILICONE RUBBER**

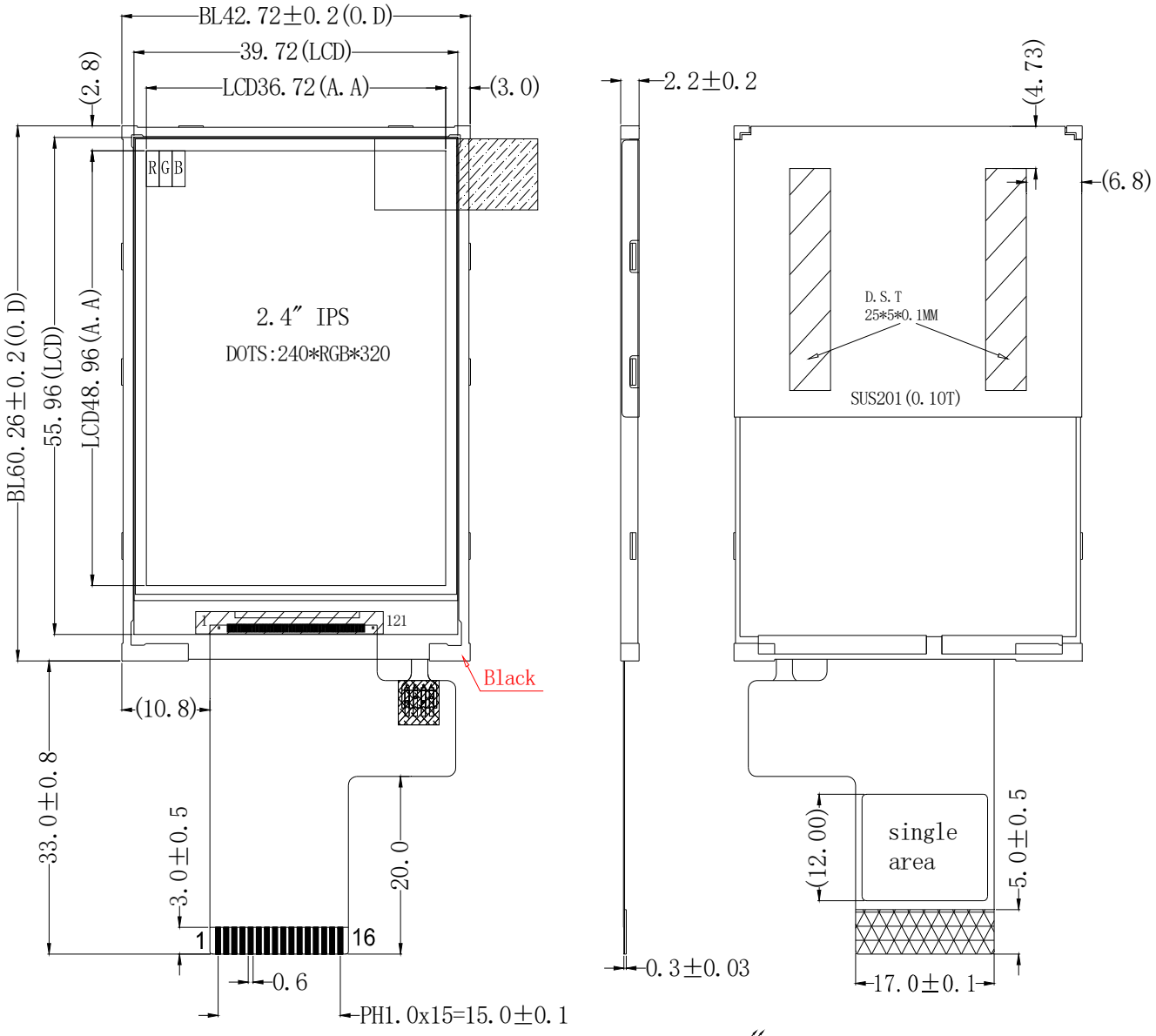
CONTENTS

1. General specification

Item	Specification	Remark
1. LCD size	2.4 inch(Diagonal)	
2. Driver element	a-Si TFT active matrix	
3. Resolution	240x(RGB)x320	
4. Display mode	Normally Black, IPS, Transmissive	
5. Dot Pitch (W*H)	0.045mm(W) x 0.135mm(H)	
6. Pixel pitch(W*H)	0.135mm(W) x 0.135mm(H)	
7. Active Area(W*H)	36.72mm(W) x 48.96mm(H)	
8. Module size (W*H)	42.72mm(W) x 60.26H) x2.2mm(D)	Note 1
9. Surface treatment	Anti-glare	
10. Color arrangement	RGB-stripe	
11. Color	65K	
12. Viewing angle (L/R/T/B)	80/80/80/80	
13. Interface	SPI	
14. LCD controller	ST7789V2	
15. LCM brightness	350 cd/m2 Typ.	
16. Backlight driving condition	80mA @3.2V	
17. Touch panel	N.A.	
18. Touch controller	N.A.	
19. Operation temperature	-20~60 ºC	
20. Weight	8.4g	
21. RoHS	RoHS compliant	

Note 1: Please refer to mechanical drawing.

2. Mechanical drawing



1. GENERAL TOLERANCE: ±0.3.
2. (...) IS REFERENCE DIMENSION.

3. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Power Supply LCD voltage 1	VCC-VSS	-0.3	+4.6	V
Power Supply LCD voltage 3	VGH-VGL	-0.3	+30.0	V
Supply current (One LED)	I_{LED}	--	25	mA
Operating temperature	T_{OP}	-20	+60	°C
Storage temperature	T_{ST}	-30	+70	°C

4. Electrical characteristics

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
	VCC	+2.4	+2.8	+3.3	V	
	VGH	+12.2	/	+14.97	V	
	VGL	-12.5	/	-7.16	V	
Logic Low level Input voltage	V_{IL}	VSS	--	0.3IOVCC	V	
Logic High level Input voltage	V_{IH}	0.7IOVCC	--	IOVCC	V	
Logic Low level output voltage	V_{oL}	VSS	--	0.2IOVCC	V	
Logic High level output voltage	V_{oH}	0.8IOVCC	--	IOVCC	V	
Input leakage current	I_{LKG}	5		50	μA	

4.1. LCD Power waste (Normal display) Top : Ta=25°C , Frame 60Hz

Parameter	Symbol	Conditions	Min.	Typ.	Max	worst	Unit	Remark
Current forIOVCC	I_{IOVCC}	--	--	27	33	--	mA	--
Current for VCI	I_{VCC}	--	--	/	/	--	mA	--
Current for AVDD	I_{AVDD}	--	--	9	11	--	mA	--
Current for AVEE	I_{AVEE}	--	--	9	11	--	mA	--
Power Consumption	P_{LCD}	--	--	153	187	--	mW	Without backlight

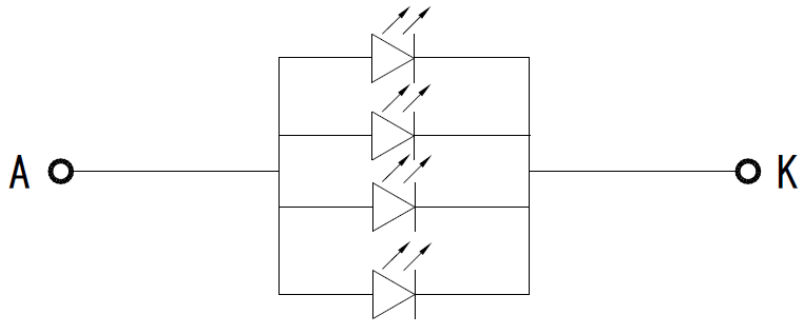
4.2. LCD Power waste (Sleep mode) Top : Ta=25°C , Frame 60Hz

Parameter	Symbol	Conditions	Min.	Typ.	Max	worst	Unit	Remark
Current for IOVCC	I_{IOVCC}	--	--	38	46	--	uA	--
Current for VCI	I_{VCI}	--	--	/	/	--	uA	--
Current for AVDD	I_{AVDD}	--	--	25	30	--	uA	--
Current for AVEE	I_{AVEE}	--	--	26	32	--	uA	--
Power Consumption	P_{LCD}	--	--	0.364	0.442	--	mW	Without blacklight

4.3. LED backlight Power waste Top : Ta=25°C

Number of LED: 4pcs, LED current: 20mA@1pcs

Circuit of LED:

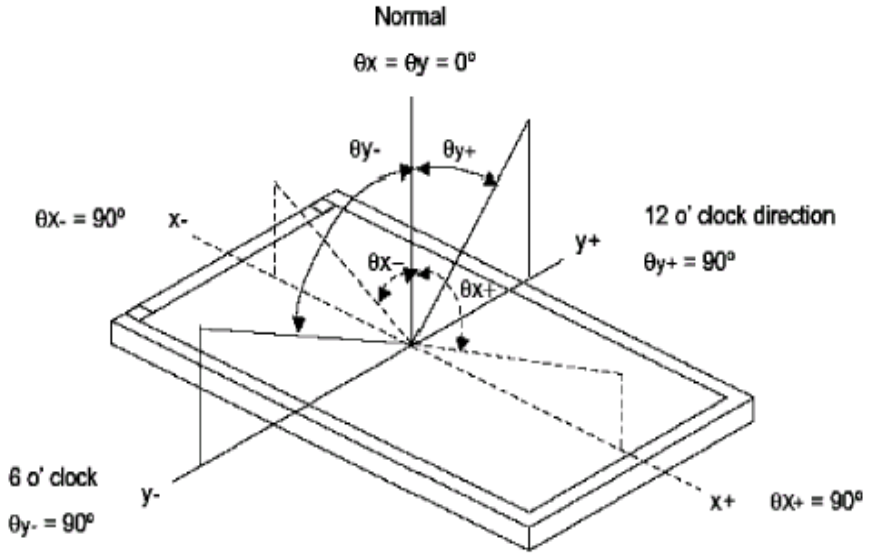


Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit	Remark
LED forward Current	ILED	--	--	80	--	mA	@4lane
LED forward Voltage		ILED=20mA	--	3.2	--	V	@1lane
Power Consumption		ILED=80mA	--	256	--	mW	@4lane

5. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B	Viewing normal angle	300	350	--	Cd/m^2	All left side data are based on LONGYU's product reference only
Contrast Ratio		CR		640	800	--	--	
Response Time		Tr+Tf		--	20	--	ms	
CIE Color coordinate	Red	X_R		--	0.647	--		
		Y_R		--	0.317	--		
	Green	X_G		--	0.275	--		
		Y_G		--	0.582	--		
	Blue	X_B		--	0.140	--		
		Y_B		--	0.088	--		
	White	X_W		--	0.29	--		
		Y_W		--	0.31	--		
Viewing Angle	Hor.	θ_{X+}	Center CR>=10	--	80	--	Deg.	
		θ_{X-}		--	80	--		
	Ver.	θ_{Y+}		--	80	--		
		θ_{Y-}		--	80	--	--	
NTSC				--	50%			CIE1931
Uniformity	Un			80	--	--	%	

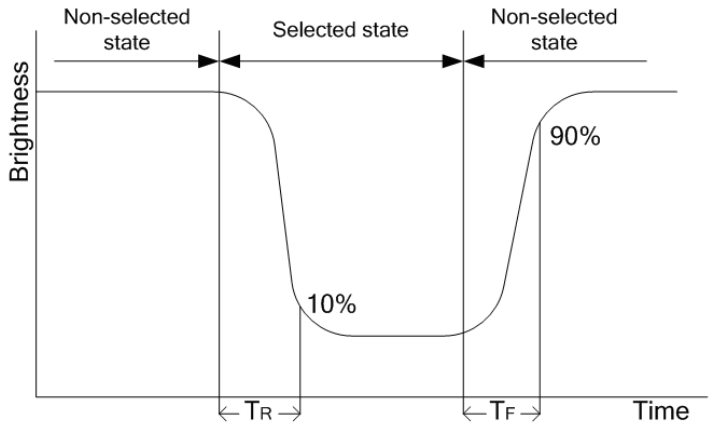
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

$$CR = \frac{\text{Brightness of non-selected dots (white)}}{\text{Brightness of selected dots (black)}}$$

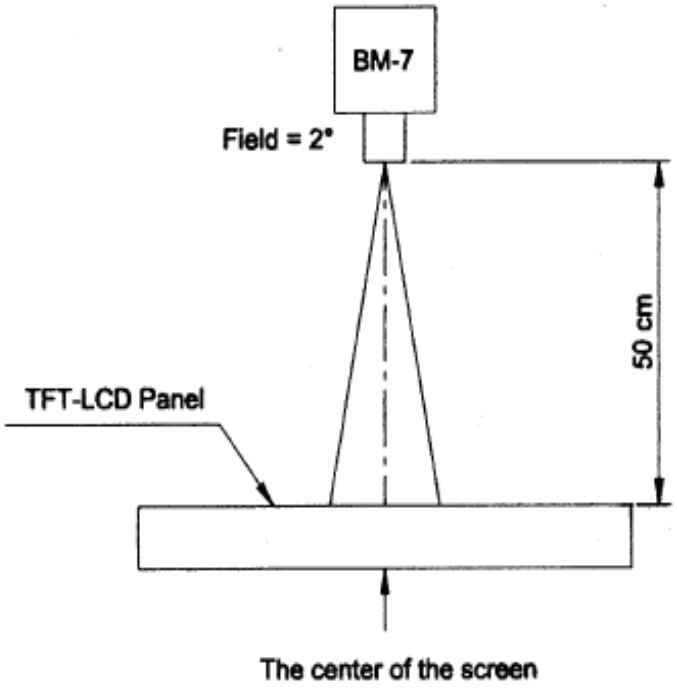
Note 3: Definition of response time (T_R, T_F)



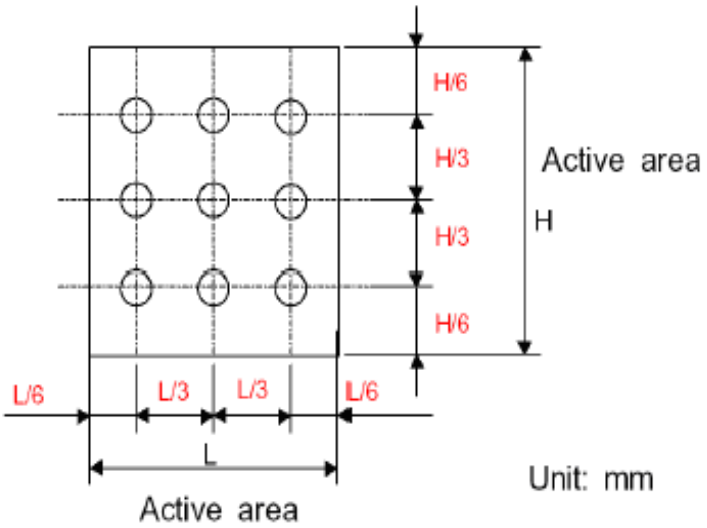
: The brightness test equipment setup

20mA
(One LED)

Field=2° (As measuring "black" image, field=2° is the best testing condition)



Note 4 :



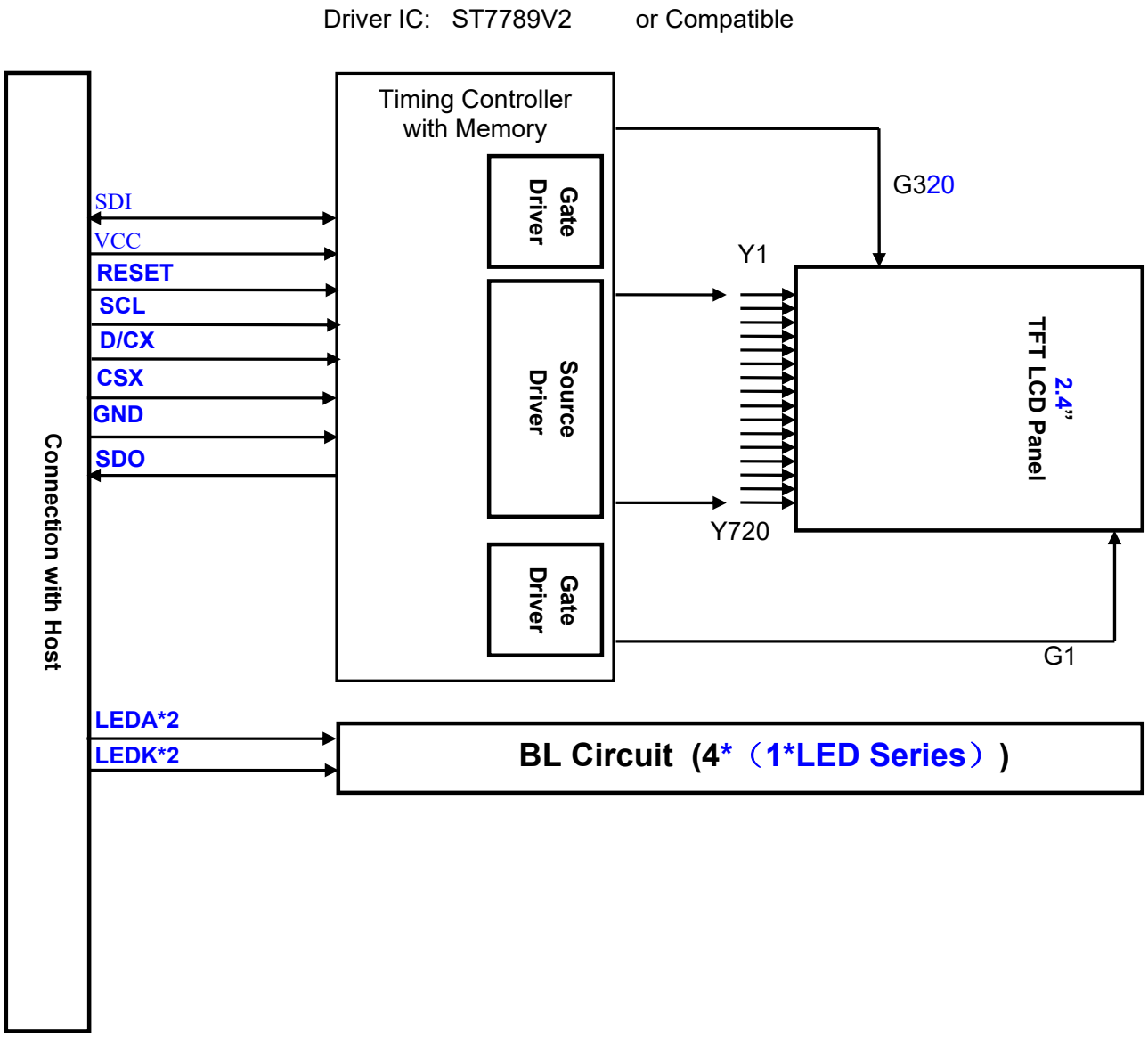
6. Pin Assignment

TFT LCD Panel Driving Section

FPC Connector is used for the module electronics interface. The recommended model is "FH12-16S-1SH" manufactured by Hirose.

NO.	SYMBOL	I/O	Description
1	GND	I	Power ground
2	RESET	I	Reset Pin.
3	SCL	I	SPI clock signal
4	D/CX	I	Data/command select
5	CSX	I	Chip select
6	SDI	I	SPI data in
7	SDO	O	SPI data out
8	GND	P	Power ground
9	VCC	I	Power input
10	LEDA	P	Backlight anode
11	LEDK	P	Backlight cathode
12	NC	-	NO connection
13	NC	-	NO connection
14	NC	-	NO connection
15	NC	-	NO connection
16	NC	-	NO connection

7. BLOCK DIAGRAM

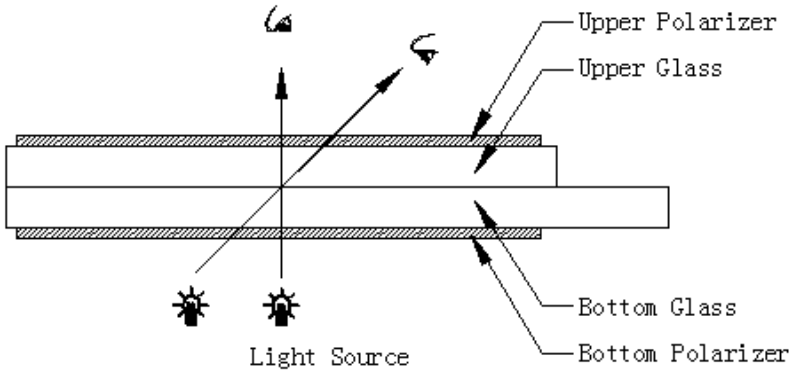


8. LCM Quality Criteria

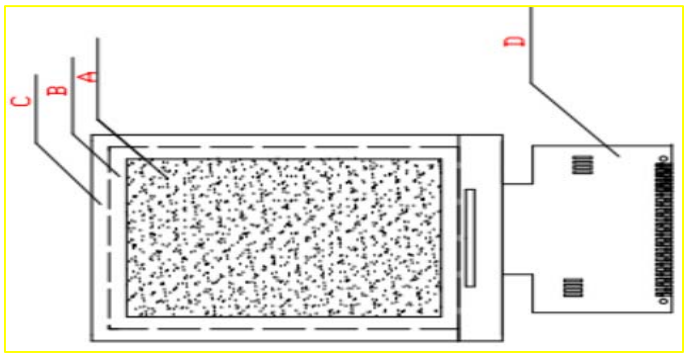
8.1. VISUAL & FUNCTION INSPECTION STANDARD

8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.
Temperature : 25±5℃
Humidity : 65%±10%RH
Viewing Angle : Normal viewing Angle(90° ±45°).;
llumination: Single fluorescent lamp (800～1200 LUX) ;
Viewing distance: 25-35cm ,time: 5-10s;



8.1.2 Definition



Zone A : LCD AA
Zone B : Viewing Area
Zone C : Outside of the Viewing 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.

8.1.3 Sampling Plan

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

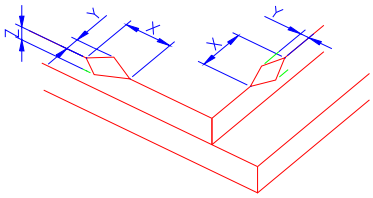
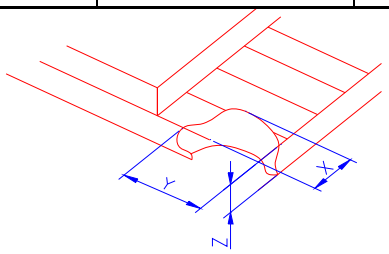
Major defect	Minor defect
0.65	1.5

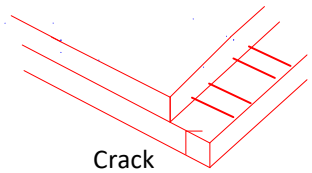
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

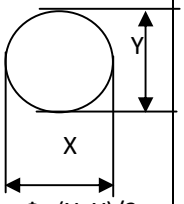
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display 2) Display abnormally 3) Missing vertical， horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting 6)Cross-Talk 7)Noise 8)Color contrast	Major
2	Missing	Missing component	
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	Black/White spot/line, scratch, crack, etc.	
7	mura	ND5%, 128 gray	Major
8	Cross-talk	≤ 5%	Minor

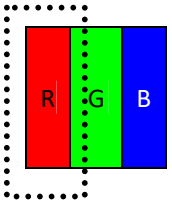
8.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="2">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>≤1.5mm</td><td><Inner border line of the sel</td><td>≤T/2</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>≤3mm</td><td>≤2mm</td><td>≤T</td></tr>
</table></td></tr>
</table>

	(3) LCD crack	

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defect
  </td><td>① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.15</td><td colspan="2">2</td></tr>
<tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr>
<tr><td>0.2<Φ</td><td colspan="2">0</td></tr>
</table>
② Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable ty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">2(D>10mm)</td></tr>
<tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table></td></tr>
<tr><td></td><td>Line defect (LCD /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><th>Width(mm)</th><th>Length(mm)</th><th>Acceptable Qty</th></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤1.5</td><td>1</td></tr>
<tr><td>0.05<W</td><td colspan="2">W > 0.05 for Spot defect</td></tr>
</table></td></tr>
</table>

<table>
<tr><td rowspan="2">3.0</td><td>Polarizer scratch</td><td>
<table>
<tr><th>Width(mm)</th><th>Length(mm)</th><th>Acceptable Qty</th></tr>
<tr><td>W≤0.03</td><td>Ignore</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤5</td><td>1</td></tr>
<tr><td>0.05< W</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Polarizer Bubble</td><td>
<table>
<tr><th>Zone
Size (mm)</th><th>Acceptable Qty</th></tr>
<tr><td>Φ≤0.1</td><td>Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td>2（D≥15mm）</td></tr>
<tr><td>0.2<Φ</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>SMT</td><td colspan="2">According to the <Acceptability of electronic assemblies>
IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.</td></tr>
<tr><td>5.0</td><td>TFT</td><td>
<table>
<tr><th>distinguish</th><th>type</th><th>Acceptable Qty</th></tr>
<tr><td rowspan="2">Bright dot</td><td>Any color window</td><td>0</td></tr>
<tr><td>Adjacent Bright dot</td><td>0</td></tr>
<tr><td rowspan="2">Dark dot</td><td>Dark dot</td><td>2</td></tr>
<tr><td>Adjacent Dark dot</td><td>0</td></tr>
</table>
Note: the red (R), green, blue (G), (B) 3 points constitute a pixel
</td><td> 

Dot</td></tr>
</table>

8.2. RELIABILITY TEST

ITEM	Condition	Sample size	Criterion
High Temp. Storage	70℃, 48hrs	5pcs	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.Missing segments; 5. The surface shall be free from damage. 6. Contrast must be no more than 10% by the linearity tester. 7. Power must be no more than 10% by the linearity tester.
Low Temp. Storage	-30℃, 48 hrs	5pcs	
High Temp. Operation	60℃,48 hrs	5pcs	
Low Temp. Operation	-20℃, 48 hrs	5pcs	
Humidity operation	40℃,90%RH ,48 hrs	5pcs	
Humidity storage	60℃,90%RH ,48 hrs	5pcs	
Thermal shock	-30℃/30min → 70℃/30mins Total:16cycles	5pcs	
Simulated transport	Reciprocating，190+/-10 Ring，2 hours，amplitude 25.4MM	1Carton-box	After testing, there are no any defective appearances or electrical properties.
Packaging drop	Six faces，Three edge（Diagonal landing），The weight and height correspond to the following 0 to 45.4KG：80CM；45.4-90.8KG：60CM；90.8-454KG：45CM；OVER454KG：40CM	1Carton-box	
ESD	1.Contact discharge method±4KV, 150pF/330Ω 10times（Can not face the role of IC）	5pcs	1. After testing, there are no any defective appearances or electrical properties. 2. It can be acceptable when all defective ESD disappears in the RESET.
	2.Air discharge method±4KV,150pF/330Ω 10times（Can not face the role of IC）	5pcs	