

PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: 1.0

Model No: LS024I46-S-V1

Module Type: COG+FPC+B/L

APPROVED SIGNATURE

- Approved Product Specification only
- Approved Product Specification and Samples

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1. General Description

LS024I46-S-V1 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 2.4 inch and the resolution is 240(RGB)*320, the panel can display up to 262k colors.

2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 240(RGB)×320 Dot-matrix
Input Data	SPI
Viewing Direction (Grayscale Inversion)	Free (IPS)
Drive	ST7789P3

3. Mechanical Specification

Item	Specification	Unit
Module size (H×V×D)	42.72 ×58.5 ×2.20	mm
Number of dots	240(RGB) ×320	pixel
Active area (H×V)	36.72×48.96	mm



5. Absolute Maximum Ratings

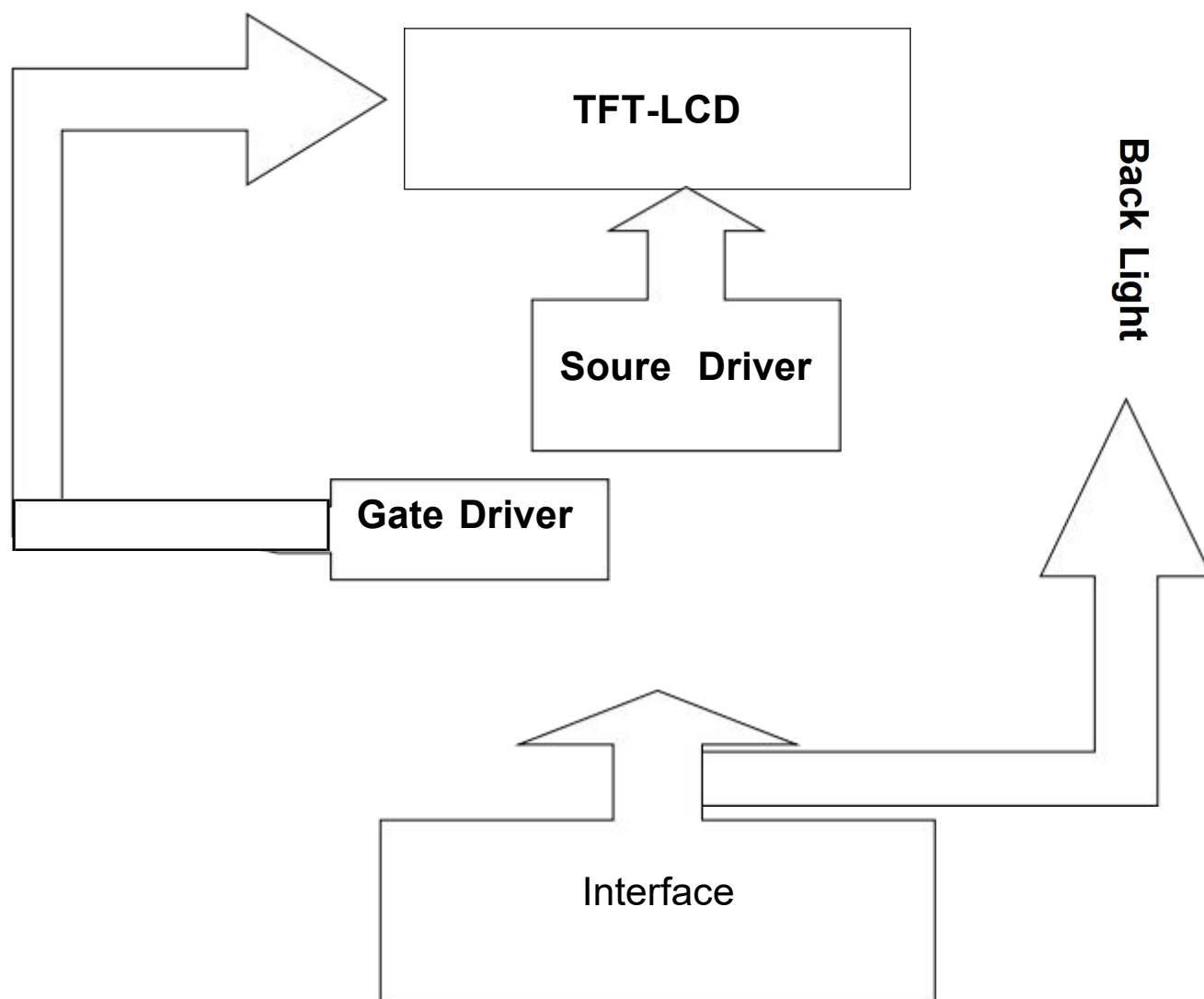
Item	Symbol	Min	Max	Unit	Remark
Supply voltage	VCC	-0.3	4.6	V	Note1 Note2
Supply voltage	IOVCC	-0.3	4.0	V	
Operating temperature	TOPR	-10	70	°C	
Storage temperature	TSTR	-20	80	°C	

6. Electrical Characteristics

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Supply voltage		VCC	2.4	2.8	3.3	V	Note1
Supply voltage		IOVCC	1.65	1.8	3.3	V	
Input Voltage	L level	VIL	0	---	0.3*IOVCC	V	
	H level	VIH	0.7*IOVCC	---	IOVCC	V	

7. Module Function Description

7-1. Block Diagram Of LCM

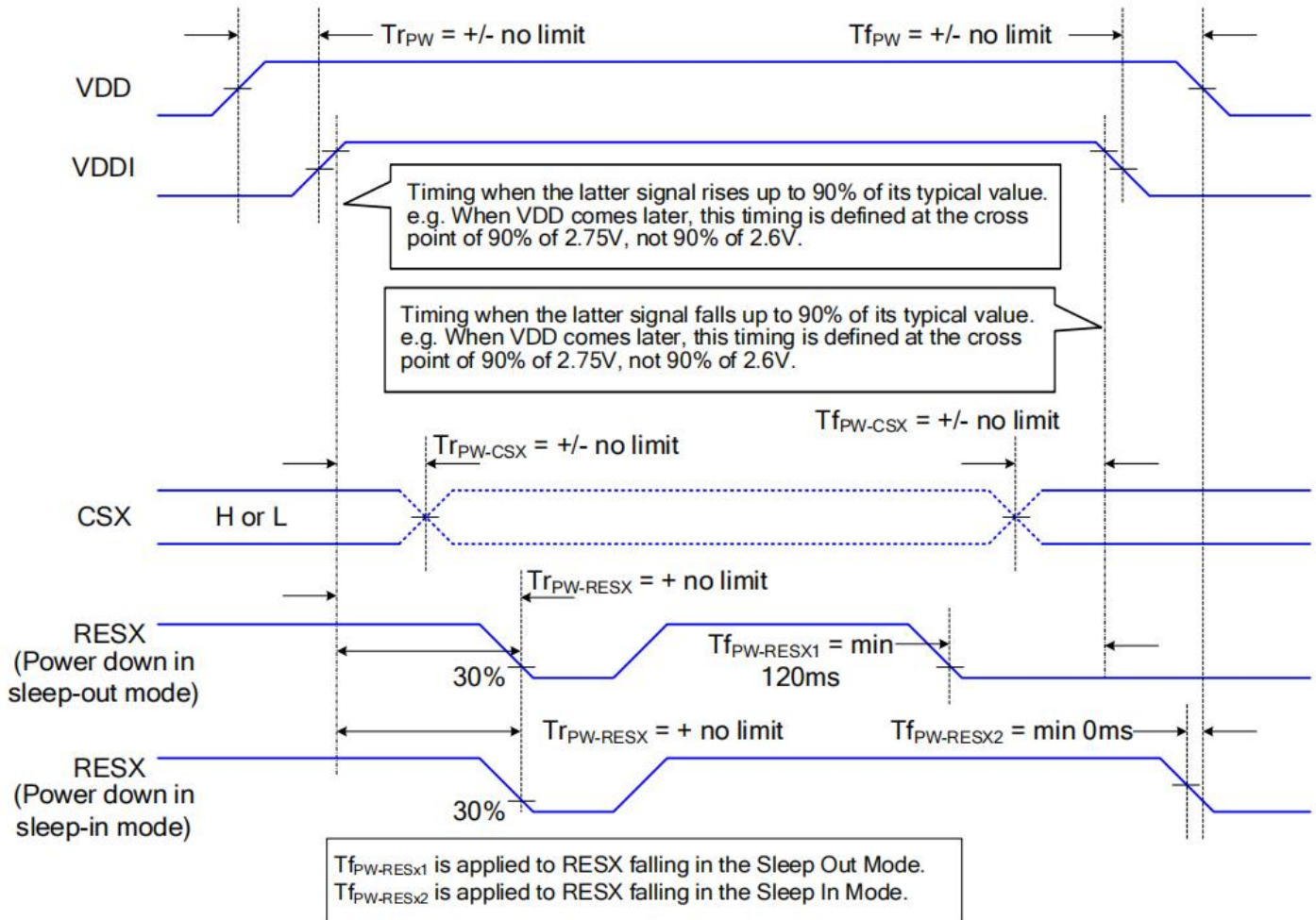


7-2. Pin Description

PIN NO.	Symbol	I/O	Description
1	GND	P	Ground
2	VCI	P	power supply
3	IOVCC	P	power supply
4	TE	O	Tearing effect signal is used to synchronize MCU to frame memory writing.
5	SDA	I	Serial data input/output PIN
6	DC	I	Command and Data select pin
7	SCL	I	Serial clock pin
8	CS	I	Chip select pin
9	RESET	I	Reset pin.
10	GND	P	Ground
11	LEDA	P	Power for LED backlight anode
12	LEDK	P	Power for LED backlight cathode
13	TP_SDA/NC		
14	TP_INT/NC		
15	TP_SCL/NC		
16	TP_VDD/NC		
17	TP_RESET/NC		
18	TP_GND/NC		

7-3 Timing Characteristics

The power on/off sequence is illustrated below



7.4.3 Serial Interface Characteristics (4-line serial):

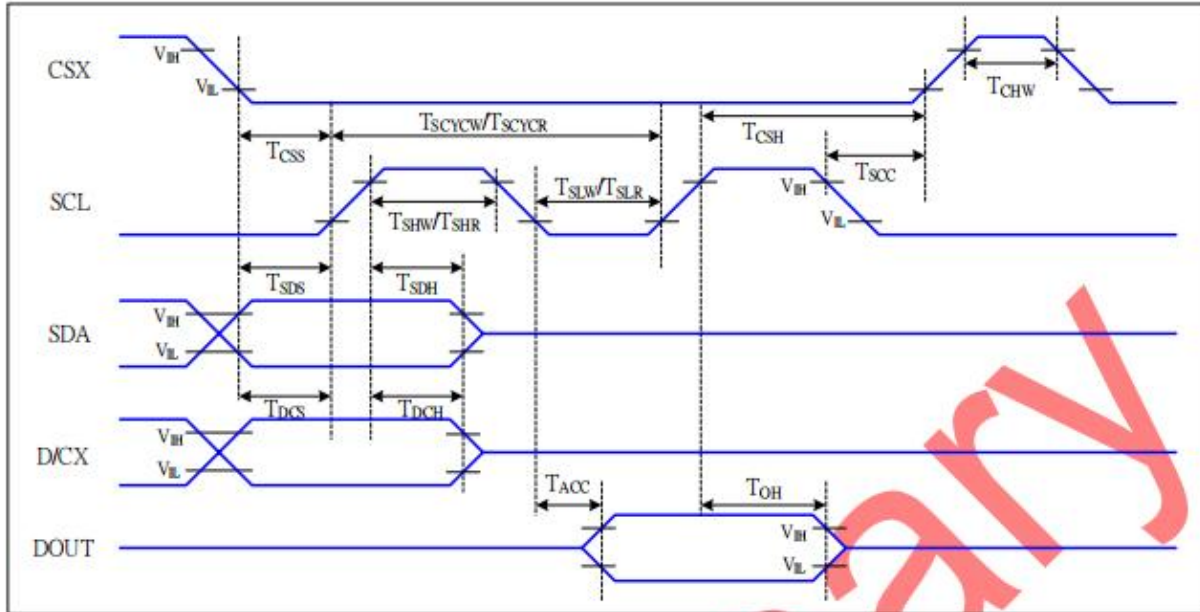


Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T _{CSS}	Chip select setup time (write)	TBD	-	ns	
	T _{CSH}	Chip select hold time (write)	TBD	-	ns	
	T _{CSS}	Chip select setup time (read)	TBD	-	ns	
	T _{SCC}	Chip select hold time (read)	TBD	-	ns	
	T _{CHW}	Chip select "H" pulse width	TBD	-	ns	
SCL	T _{SCYCW}	Serial clock cycle (Write)	TBD	-	ns	-write command & data ram
	T _{SHW}	SCL "H" pulse width (Write)	TBD	-	ns	
	T _{SLW}	SCL "L" pulse width (Write)	TBD	-	ns	
	T _{SCYCR}	Serial clock cycle (Read)	TBD	-	ns	-read command & data ram
	T _{SHR}	SCL "H" pulse width (Read)	TBD	-	ns	
	T _{SLR}	SCL "L" pulse width (Read)	TBD	-	ns	
D/CX	T _{DCS}	D/CX setup time	TBD	-	ns	
	T _{DCH}	D/CX hold time	TBD	-	ns	
SDA (DIN)	T _{SDS}	Data setup time	TBD	-	ns	
	T _{SDH}	Data hold time	TBD	-	ns	
DOUT	T _{ACC}	Access time	TBD	TBD	ns	For maximum CL=30pF
	T _{OH}	Output disable time	TBD	TBD	ns	For minimum CL=8pF

Table 6 4-line serial Interface Characteristics

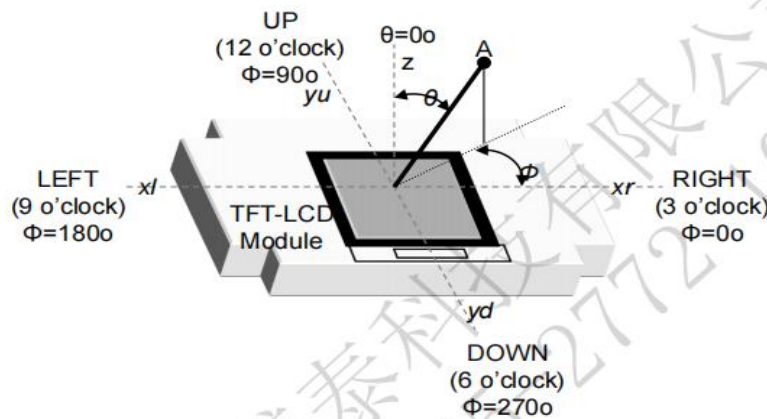
Note1 : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

8. Electro-Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Tr +Tf	$\theta_x = \theta_y = 0$	---	35	40	ms	Note 1
Contrast Ratio	CR		900	1200	---	---	Note 2
Transmittance	T%		4	4.7	---	%	
Color Chromaticity (CIE1931)	White	W x	$\theta_x = \theta_y = 0$	---	0.308	---	
		W y		---	0.339	---	
Viewing angle	θ_T	CR > 10	80	85	---	Deg.	Note 3
	θ_B		80	85	---		
	θ_L		80	85	---		
	θ_R		80	85	---		

Note 4.1: Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 8).

<Figure 8. Viewing Angle Range Is Defined As Follows>



Note 4.2: Contrast measurements shall be made at viewing angle of $\theta=0^\circ$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. Luminance Contrast Ratio (CR) is defined mathematically.

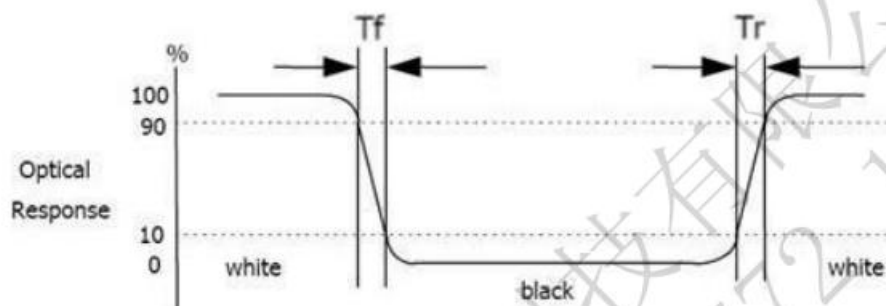
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

Note 4.3: Transmittance is the Value with out **APF** Polarizer.

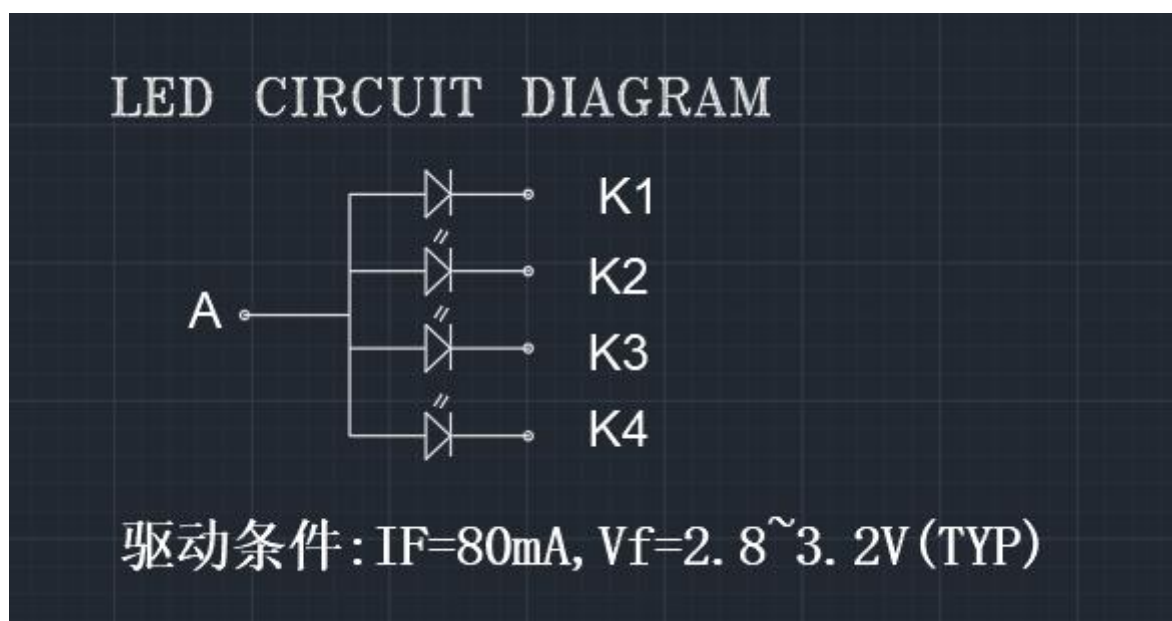
Note 4.4: The color chromaticity coordinates specified in Table 16 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

Note 4.5: The electro-optical response time measurements shall be made as Figure 9 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

<Figure 9. Response Time Testing>



Note(4) Backlight circuit



9. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

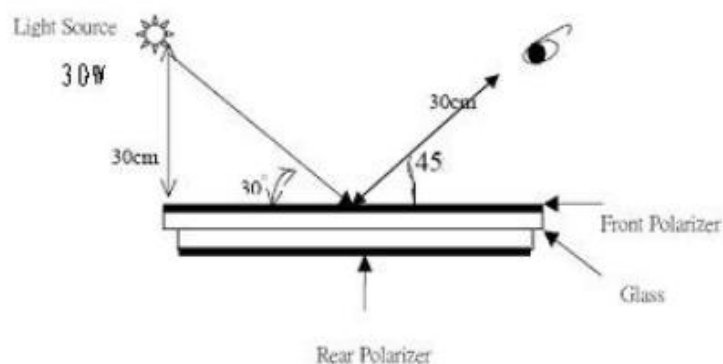
According to GB/T 2828-2003 ; , normal inspection, Class II

MAJOR DEFECT	MINOR DEFECT
0.65	1.5

2. Basic conditions for inspection

The LCM face to us, in normal environment, About an angle of incidence 30, a distance of 30cm with normal eye, with an angle of 45 degree to check the products without uncovering the film!

(As shown below)

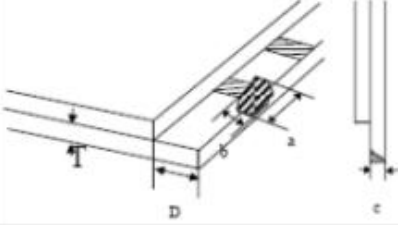
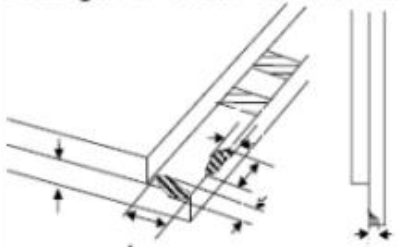


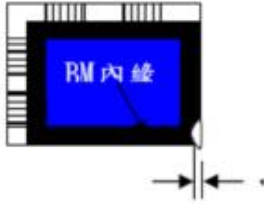
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

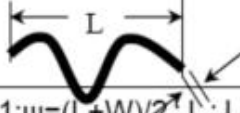
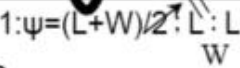
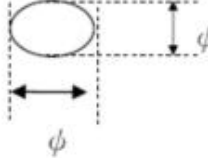
3.1.1 Glass defect

No	Defect item	Criteria	Remark
1	Dimension Unconformity (Major defect)	By Engineering Drawing	

No	Defect item	Criteria	Remark
2	Cracks (Major defect)	1.Linear cracks on panel 【 Reject】 2. Nonlinear crack contrast by limited sample	
3	Glass extrude the conductive area (minor defect)	a: disregards and no influence assemblage 1) $b \leq 1/3$ Pin width(non bonding area) 【 Accept】 2) bonding area $\leq 0.5\text{mm}$ 【 Accept】	a:Length, b:Width
4	Pin-side , conductive area damaged (minor defect)	(a c : disregards) $b \leq 1/3$ of effective length for bonding electrode 【 Accept】	a:Length·b:Width·c:Thickness 
5	Pin-side , non-conductive area damaged (minor defect)	1) Damage area don't touch the ITO (Inclueing contraposition mark,except scribing mark) 【 Accept】 2) $c < T$ $b \leq BM$ 1/3 of width 【 Accept】 3) $c = T$ b not touch the seal glue 【 Accept】 4) a disregards	a:Length·b:Width·c:Thickness 

No	Defect item	Criteria	Remark
6	Non-pin-side damage (minor defect)	$c < T$	c : Thickness b : width of damage 
		1) b exceeds 1/3 BM	
		【Reject】	
		$c = T$ b not touch the seal glue 【Reject】	

3.1.2 LCD appearance defect (View area)

No	Defect item	Criteria		Remark
1	Fiber 、glass cratch 、polarizer scratch/folded (minor defect)	Specification	Allowable	note1: L : Length , W : Width note2: disregard if out of AA 
		$0.05\text{mm} < W \leq 0.1\text{mm};$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 3.0\text{mm}$	0	
2	Polarizer bubble 、 concave and convex (minor defect)	$\psi \leq 0.2\text{mm}$	disregard	note 1: $\psi = (L+W)/2$; L : Length , W : Width note2: disregard if out of AA 
		$0.2\text{mm} < \psi \leq 0.3\text{mm}$	2	
		$0.3\text{mm} < \psi \leq 0.5\text{mm}$	1	
		$0.5\text{mm} < \psi$	0	
3	Black dots 、dirty dots 、 impurities 、eyewinker (Major defect)	$\psi \leq 0.15\text{mm}$	disregard	note2: disregard if out of AA 
		$0.15\text{mm} < \psi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \psi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \psi$	0	
4	Polarizer prick (Major defect)	$\psi \leq 0.1\text{mm}$	disregard	note1: $\psi = (L+W)/2$; L = Length , W = Width note2: the distance between two dots $> 5\text{mm}$
		$0.1\text{mm} < \psi \leq 0.25\text{mm}$	3	
		$\psi > 0.25\text{mm}$	0	

3.1.3 .FPC

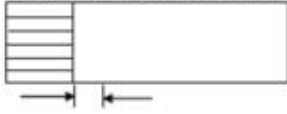
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【 Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【 Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO impurities
		$\psi \leq 0.25\text{mm}$	2	
		$\psi > 0.25$	0	

3.1.4 Black tape & Mara tape

1	FPC or H/S black tape shift (minor defect)	1.shift spec: 1)glue to the polarize 【 Reject】 2) IC bare 【 Reject】 2. left-and-right spec: 1) exceed of FPC edge or H-S edge 【 Reject】 2)IC bare 【 Reject】	
2	No black tape (Major defect)	No black tape 【 Reject】	
3	Tape position mistake (minor defect)	Not by engineering drawing 【 Reject】	
4	Mara tape defect (minor defect)	Peel before pulling the protecting film. 【 Reject】	

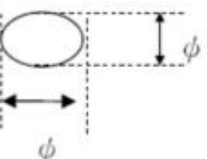
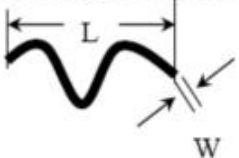
3.1.5 Silicon and Tuffy glue

No	Defect item	Criteria	Remark
1	Quantity of silicon (minor defect)	Uncover the ITO and circuit area. 【 Reject】	note: compared by engineering drawing.

No	Defect item	Criteria	Remark
2	Tuffy glue (minor defect)	1. Uncover the reveal copper area 【Reject】 2. Cover layer 0.3mm(Min) ~ 3.0mm(Max) 【accept】	note:if customer has special requirement , refer to the technical document. 
3	Depth of glue covering (minor defect)	Depth of glue covering overtop front Polarizer 【Reject】	Except of the special requirement .

3.2 Electrical criteria

No	Defect item	Criteria	Remark
1	No display (Major defect)	No display 【Reject】	
2	Missing line (Major defect)	Missing line 【Reject】	
3	Seg-com light and dark (Major defect)	Seg-com light and dark 【Reject】	ND filter 2% test
4	No display in immobility (Major defect)	No display in immobility 【Reject】	
5	Flicker of Pattern (Major defect)	Flicker of Pattern 【Reject】	
6	Mura (Major defect)	ND filter 2% test	
7	Over current (Major defect)	Over current 【Reject】	
8	Voltage out of specification (Major defect)	Voltage out of specification 【Reject】	
9	Pattern blur ,error code (Major defect)	Pattern blur ,error code 【Reject】	
10	Dark light, Flicker (Major defect)	Dark light, Flicker 【Reject】	

No	Defect item	Criteria	Remark	
11	Black/White dots · Dirty dots · eyewinker (Major defect)	Specification	Allowable	Note1: disregard if out of AA 
		$\psi \leq 0.15\text{mm}$	disregard	
		$0.15\text{mm} < \psi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \psi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \psi$	0	
12	Fiber · glass cratch · polarizer scratch/folded (minor defect)	$W \leq 0.03\text{mm}$	disregard	note1: L : Length · W : Width note2: disregard if out of AA 
		$0.03\text{mm} < W \leq 0.05\text{mm} ;$ $L \leq 3.0\text{mm}$	2	
		$0.05\text{mm} < W \leq 0.1\text{mm} ;$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm} ; L > 3.0\text{mm}$	0	

10.Records Of Version

Version	Revise Date	Page	Content
00	2026-7-6	ALL	New released