

PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: 1.0

Model No: LSR024T13-S-V1

Module Type: COG+FPC+B/L+RTP

APPROVED SIGNATURE

- ☒ Approved Product Specification only
- ☐ Approved Product Specification and Samples

<u>Prepared By</u>	<u>Checked By</u>	<u>Approved By</u>

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1. General Description

LSR024T13-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

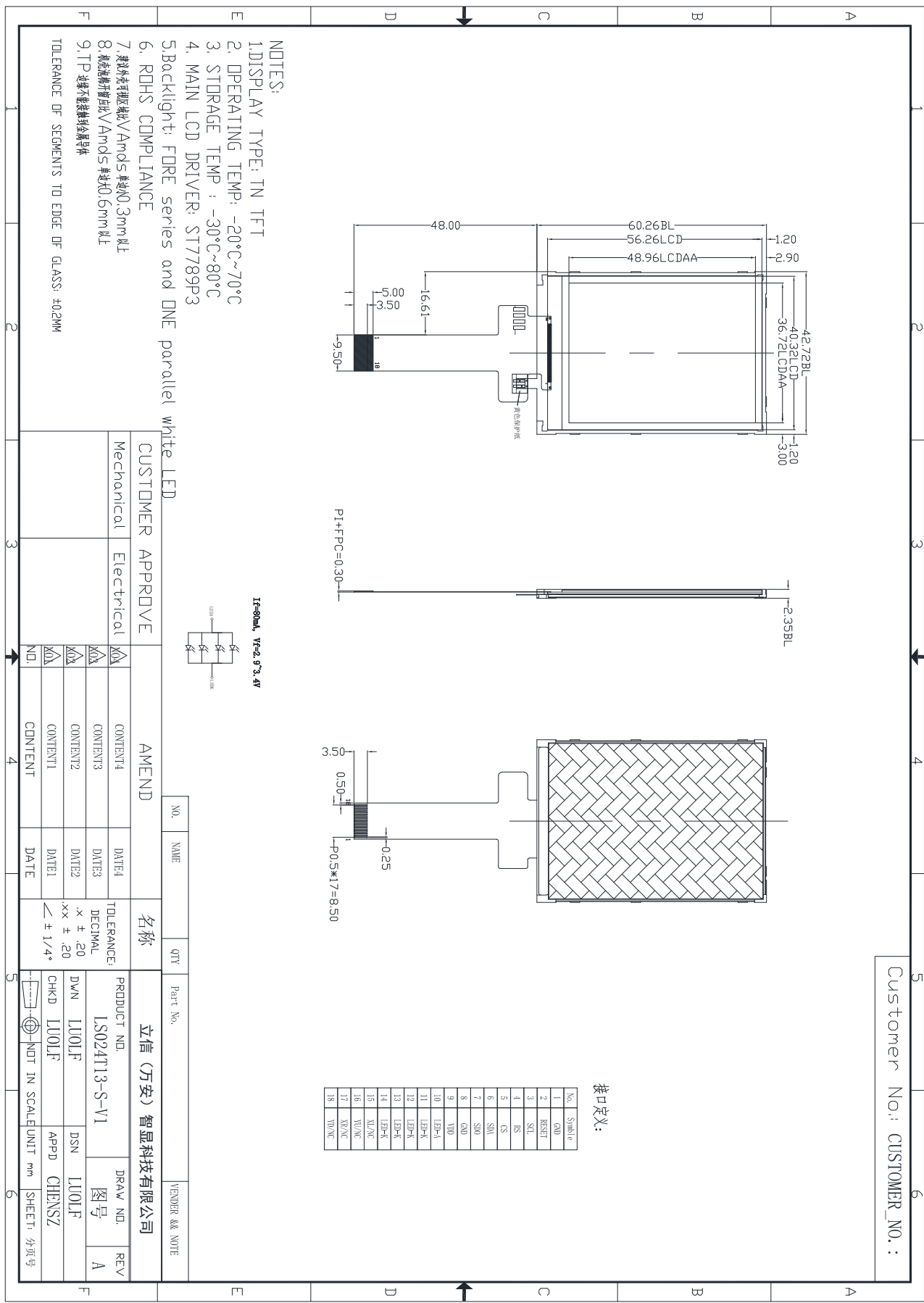
Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 240(RGB)×320 Dot-matrix
Input Data	SPI
Viewing Direction (Grayscale Inversion)	TN
Drive	ST7789P3

3. Mechanical Specification

Item	Specification	Unit
Module size (H×V×D)	42.72 ×60.26 ×3.55	mm
Number of dots	240(RGB) ×320	pixel
Active area (H×V)	36.72×48.96	mm

4. Outline Dimension

LCM





5. Absolute Maximum Ratings

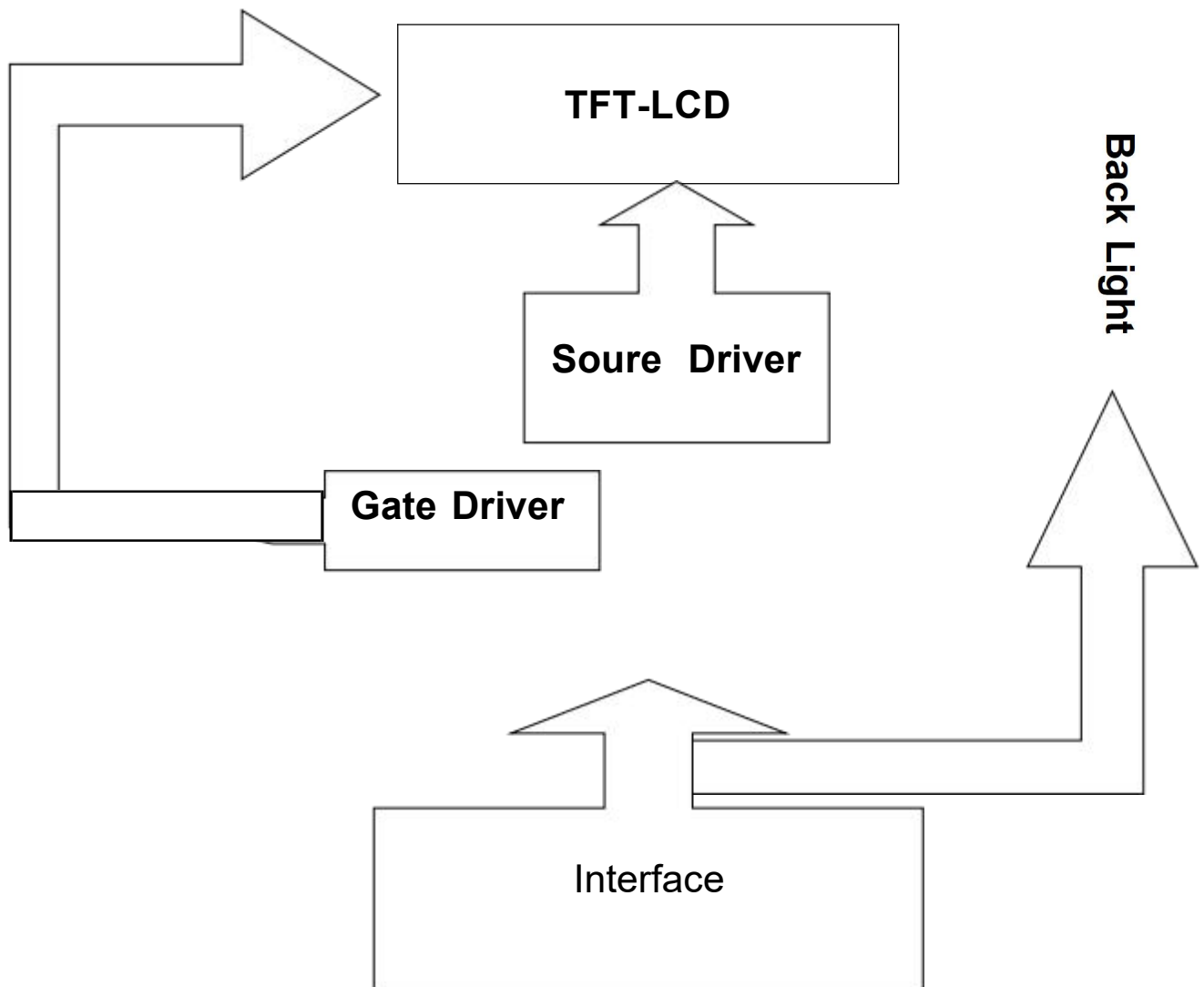
Item	Symbol	Min	Max	Unit	Remark
Supply voltage	VDD	-0.3	4.6	V	Note1 Note2
Operating temperature	TOPR	-20	70	°C	
Storage temperature	TSTR	-30	80	°C	

6. Electrical Characteristics

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Supply voltage		VDD	2.4	2.8	3.3	V	Note1
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	RESET	I	Reset signal
3	SCL	I	serial interface clock
4	RS	I	Display data/command selection pin
5	CS	I	Chip select pin
6	SDA	I/O	Serial data input
7	SDO	O	Serial data output
8	GND	P	Ground
9	VDD	P	Power supply 2.8~3.3V
10	LED A	P	Back light anode +
11	LED K	P	Back light cathode -
12	LED K	P	Back light cathode -
13	LED K	P	Back light cathode -
14	LED K	P	Back light cathode -
15	XL	I	TP X-
16	YU	I	TP YU-
17	XR	I	TP X+
18	YD	I	TP YU+

7-3 Timing Characteristics

7.4.3 Serial Interface Characteristics (4-line serial):

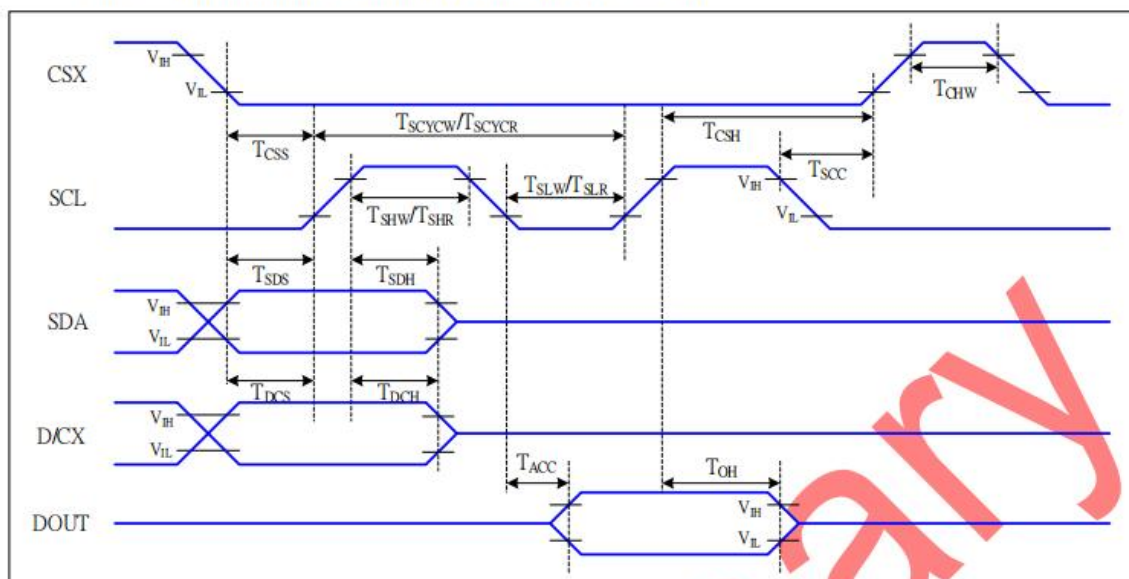


Figure 5 4-line serial Interface Timing Characteristics

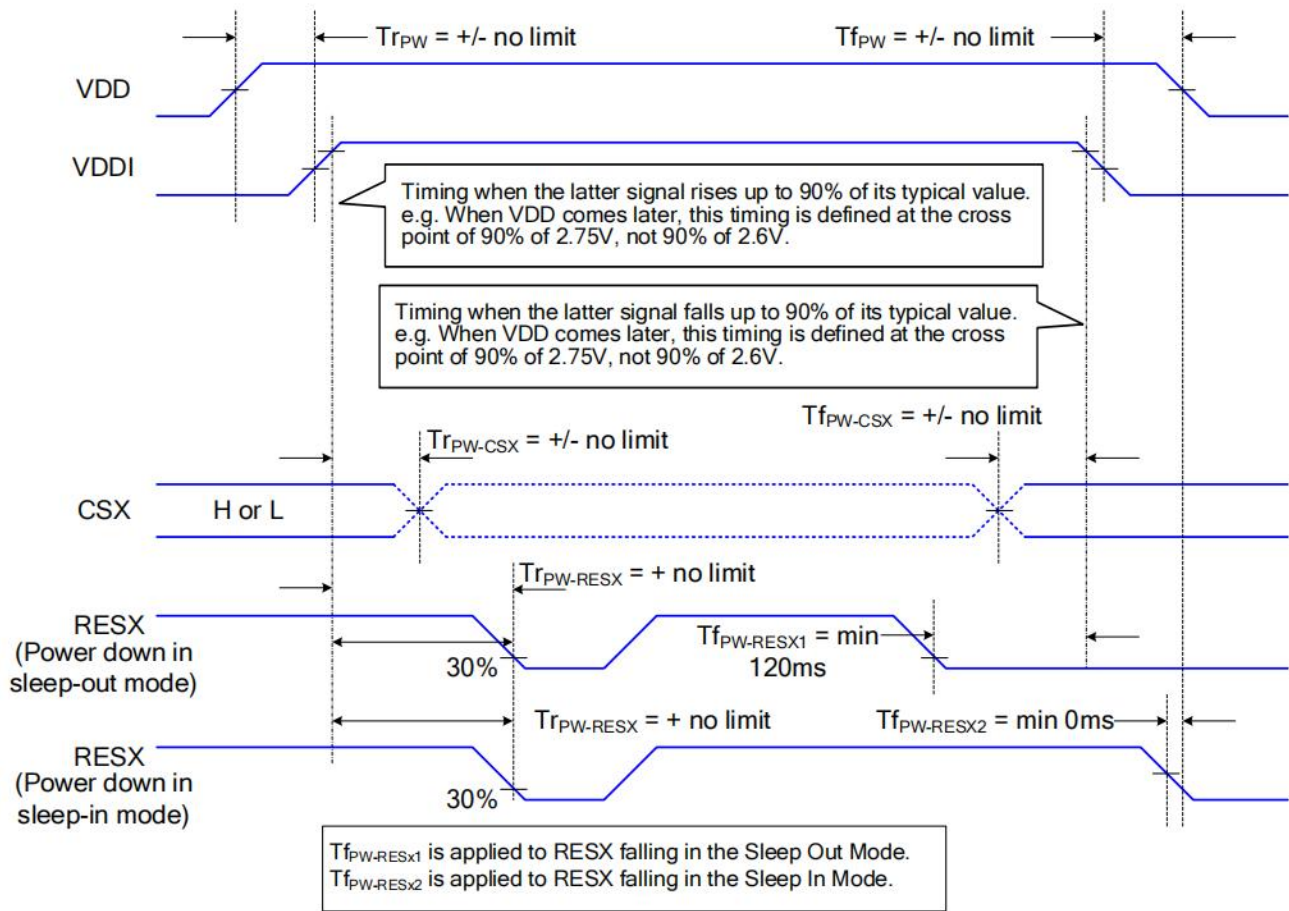
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25 °C

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

Note 1 : 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.

The power on/off sequence is illustrated below



8. Electro-Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time		Tr +Tf	$\theta_x = \theta_y = 0$	---	30	---	ms	Note 1
Contrast Ratio		CR		---	250	---	---	Note 2
Transmittance		T%		4	4.7	---	%	
Color Chromaticity (CIE1931)	White	W x	$\theta_x = \theta_y = 0$	---	0.308	---	---	
		W y		---	0.325	---	---	
Viewing angle	θ_T		CR > 10	---	45	---	Deg.	Note 3
	θ_B			---	20	---		
	θ_L			---	45	---		
	θ_R			---	45	---		
Luminance ($I_F = 80mA$)		L		---	TBD	---	cd/m2	Note4

Note 1: Ambient temperature = 25°C.

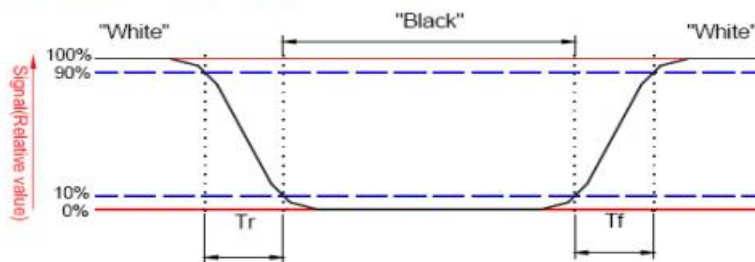
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

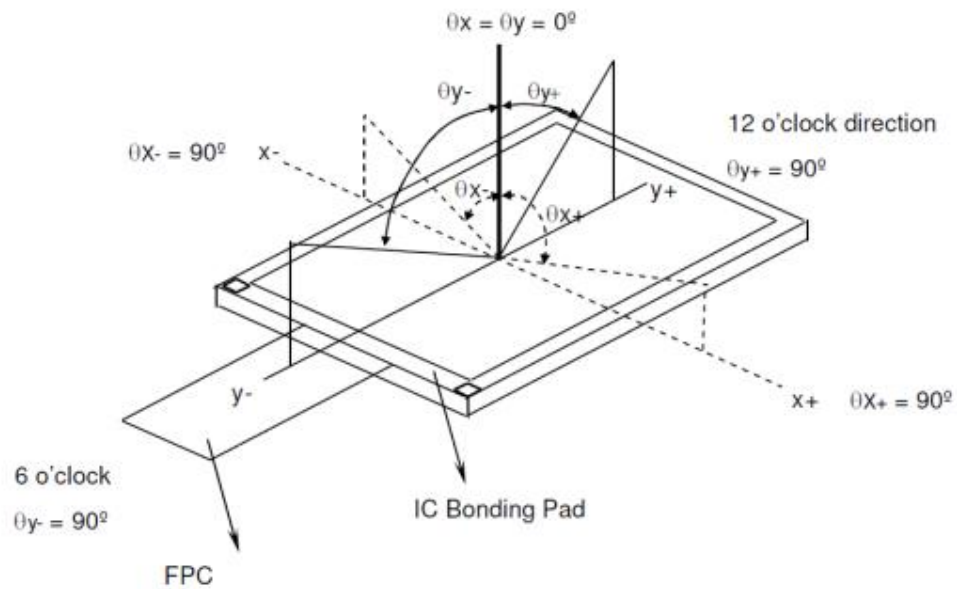


Note 6: Definition of contrast ratio:

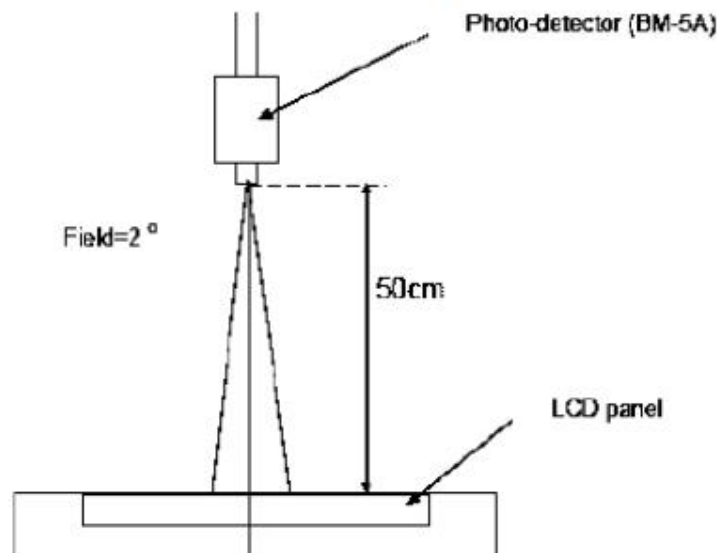
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

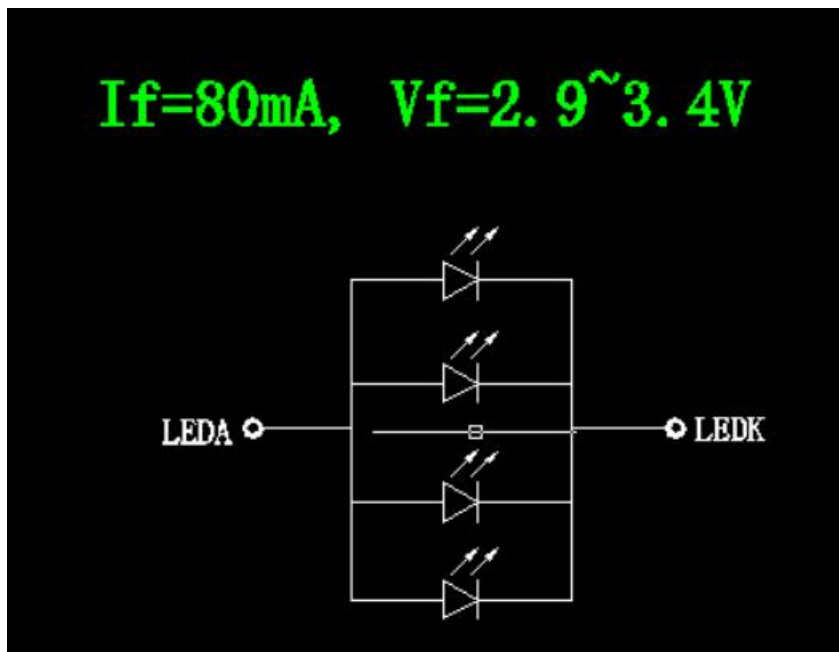
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note(4) Backlight circuit



9. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

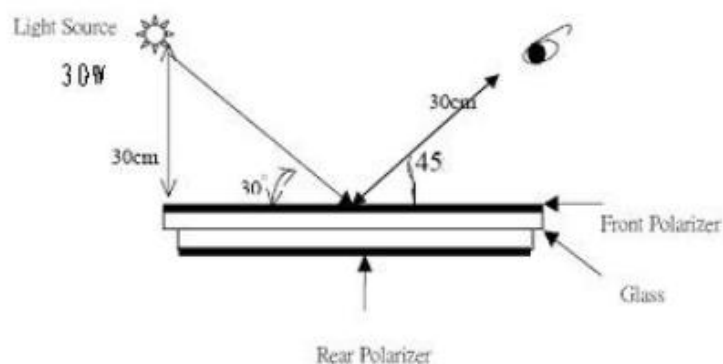
According to GB/T 2828-2003 ; , normal inspection, Class II

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° to check the products without uncovering the film!

(As shown below)

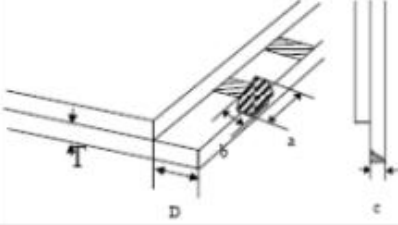
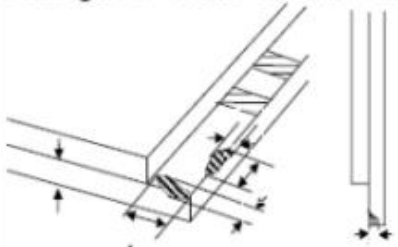


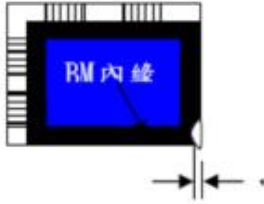
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

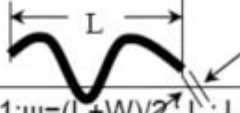
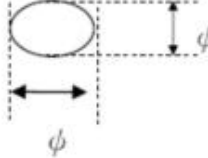
3.1.1 Glass defect

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)	$c < T$ 1) b exceeds 1/3 BM 【Reject】	c : Thickness b: width of damage 
		$c = T$ 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 > 5mm
		$0.1\text{mm} < \psi \leq 0.25\text{mm}$	3	
		$\psi > 0.25\text{mm}$	0	

3.1.3 .FPC

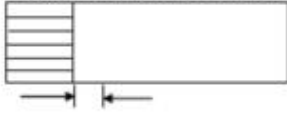
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【 Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【 Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO 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】	

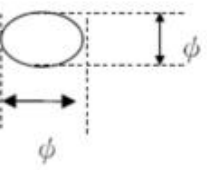
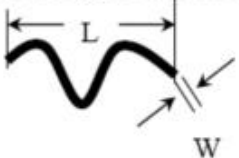
3.1.5 Silicon and Tuffy glue

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	2024-3-30	ALL	New released