

PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: V0

Model No: BDT-T5040-12A-SERIES

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

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

BDT-T5040-12A 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 5.0 inch and the resolution is 800RGB)*480. The LCM can be easily accessed by RGB interface.

2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 800RGB)*480 Dot-matrix
Input Data	The Data input by RGB interface
Viewing Direction	6 O'clock
Drive	ILI6122 and ILI5960

3. Mechanical Specification

Item	Contents	Unit
Module size (W×H×T)	120.70 × 75.80× 4.58	mm
Number of dots	800RGB)*480	---
Active area (W×H)	108.00×64.80	mm

4. Outline Dimension



5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VCC	2.3	3.6	V	Note1、 Note2
Operating temperature	TOPR	-20	+70	°C	
Storage temperature	TSTR	-30	+80	°C	
Humidity	---	---	90	%RH	---

Remark:

Note 1) The OTA7001A_C and OTA9960A may be permanently damaged if it is used under the condition exceeding the above absolute maximum values. It is also recommended to use the OTA7001A_C and OTA9960A within the limit of its electric characteristics during normal operation. Exceeding the conditions may lead to malfunction of OTA7001A_C and OTA9960A and affect its credibility.

Note 2) The voltage from VSS.

6. Electrical Characteristics

6-1. TFT-LCM Electrical Characteristics

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Power Voltage	Logic	VCC	2.3	3.3	3.6	V	Note1
Input Voltage	L level	VIL	-0.3	----	0.3*VCC	V	VCC=2.3 ~ 3.6V
	H level	VIH	0.7* VCC	---	VCC	V	
LCD Drive Power current		ILCD	---	---	---	mA	---

Remark:

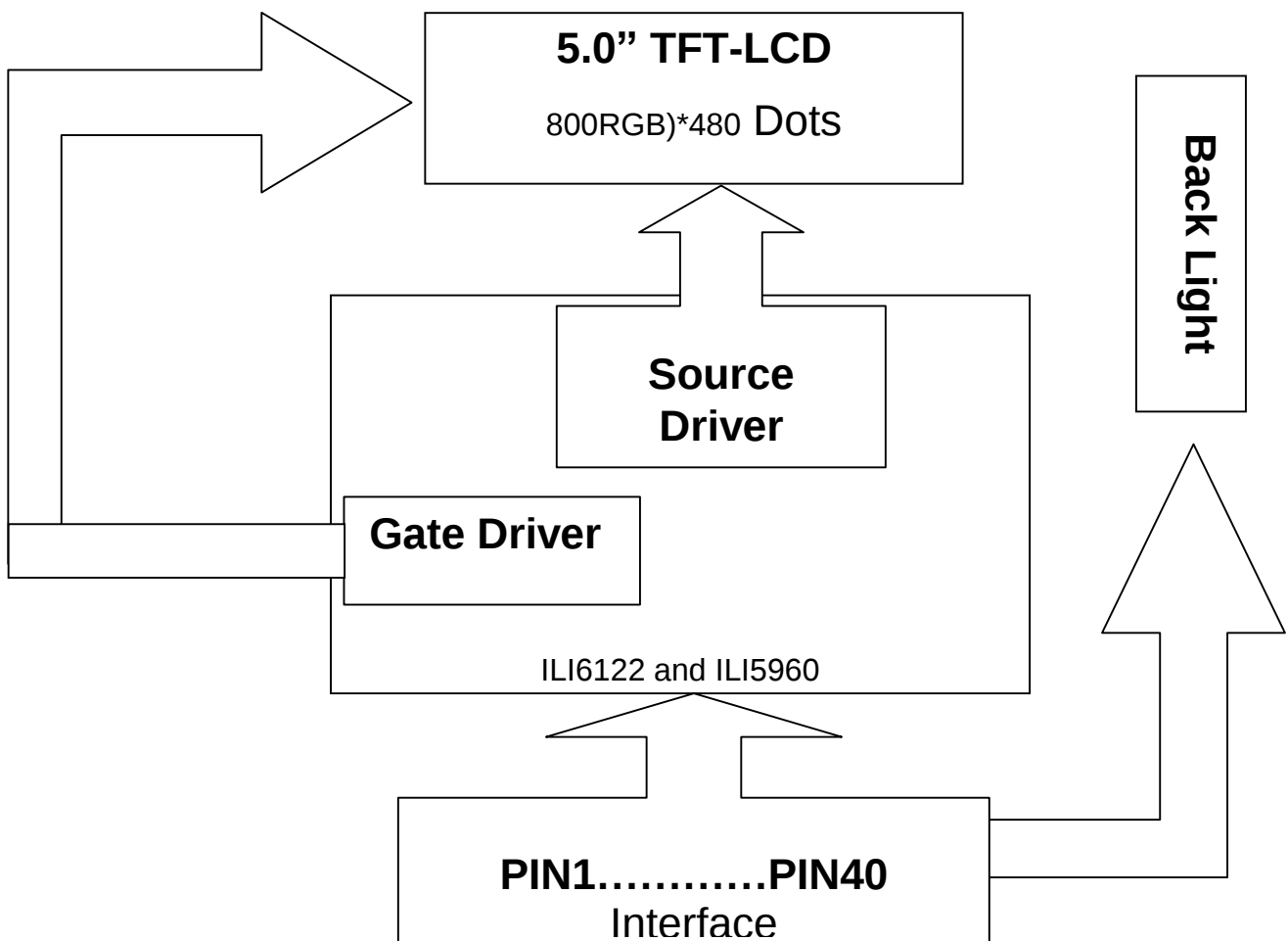
Note1:Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.

6-2. CTP characteristics

Item	Specification	Unit	Remark
Panel Type	Glass Cover + Glass Sensor	-	-
Resolution	800 × 480	pixel	-
Surface Hardness	6H	-	-
Transparency	≥82%	-	-
Driver IC	-	-	-
Interface Type	I2C	-	-
Support Points	5	-	-
Sampling Rate	20~100	Hz	-
Supply voltage	3.3	V	-

7. Module Function Description

7-1. Block Diagram Of LCM



7-2. Pin Description

A、LCD Interface Description

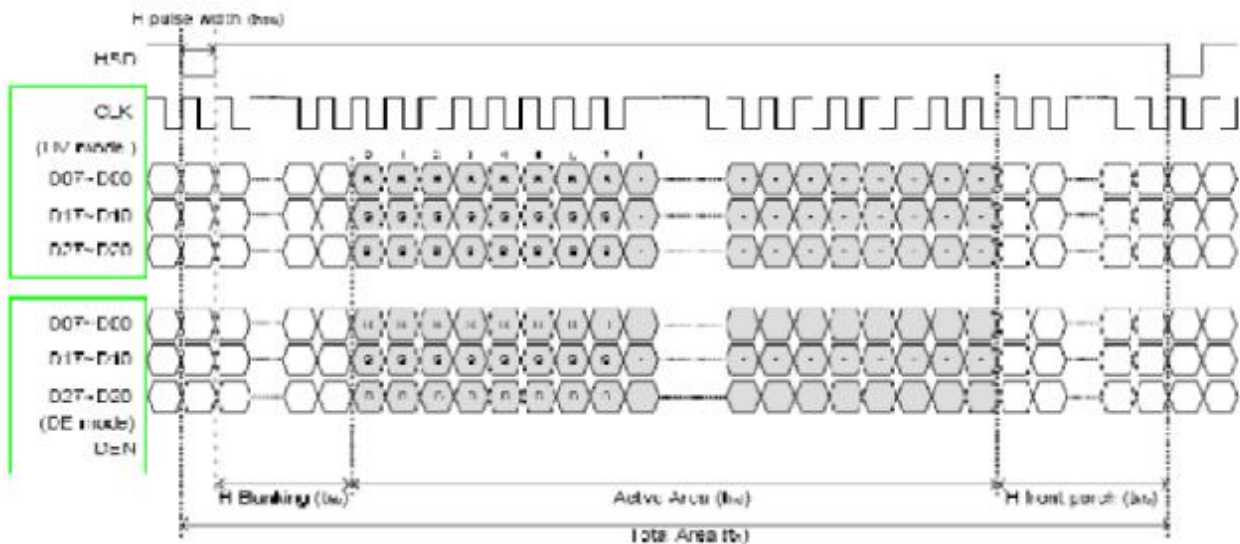
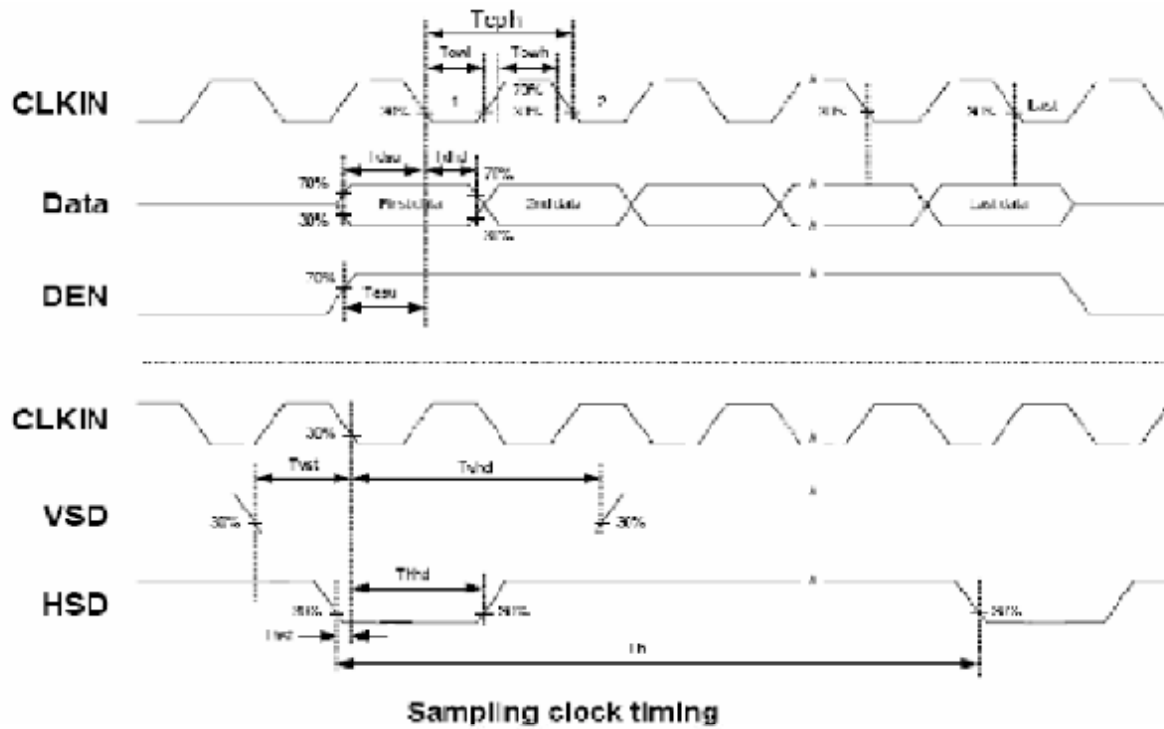
NO.	Symbol	I/O	DESCRIPTION
1	LED-K	Power supply	Backlight Cathode
2	LED-A	Power supply	Backlight Anode
3	GND	Power supply	Power ground
4	VDD	Power supply	Digital Power supply(3.3V Typ.)
5~12	R0~R7	I	8bit digital Red data input(R0:LSB; R7:MSB)
13~20	G0~G7	I	8bit digital Green data input(G0:LSB; G7:MSB)
21~28	B0~B7	I	8bit digital Blue data input(B0:LSB; B7:MSB)
29	GND	Power supply	Power ground
30	DCLK	I	Clock signal. Latching data at the rising edge.
31	DISP	I	Standby setting pin, it should be connected to VDD in normal operation mode. If connected to GND, the driver IC is in standby mode.
32	HSYNC	I	Horizontal Sync input. Negative polarity.
33	VSNC	I	Vertical Sync input. Negative polarity.
34	DEN	I	Data input Enable. Active high to enable the data input Bus.
35	NC	-	No Connection
36	GND	Power supply	Power ground
37	XR	-	RTP pin
38	YD	-	RTP pin
39	XL	-	RTP pin
40	YU	-	RTP pin

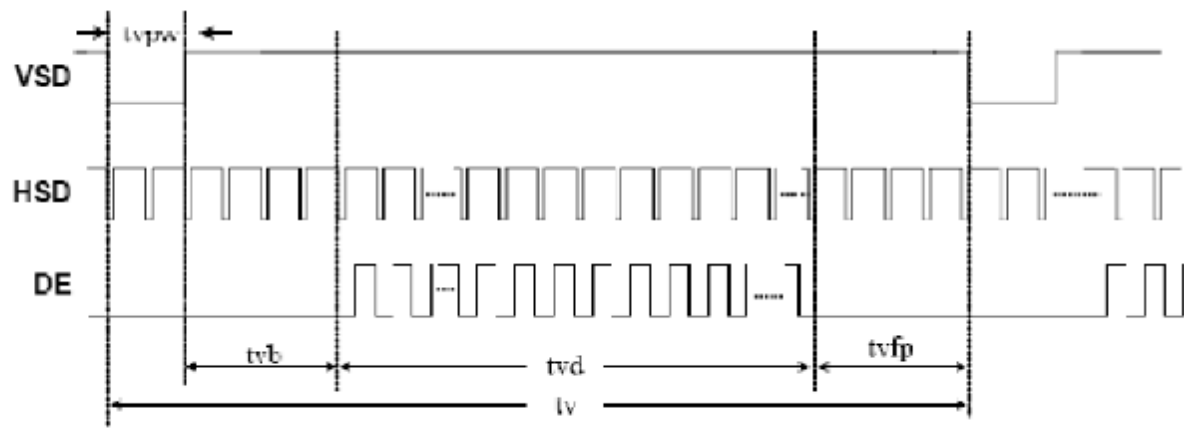
B、CTP Interface Description

NO.	Symbol	I/O	DESCRIPTION
1	RESET	I	CTP external reset signal, Low is active
2	VDD	Power supply	CTP Power input
3	GND	Power supply	Power ground
4	INT	O	CTP External interrupt to the host
5	SDA	I/O	CTP I2C data input and output
6	SCL	I	CTP I2C clock input

7-3. Timing Characteristics

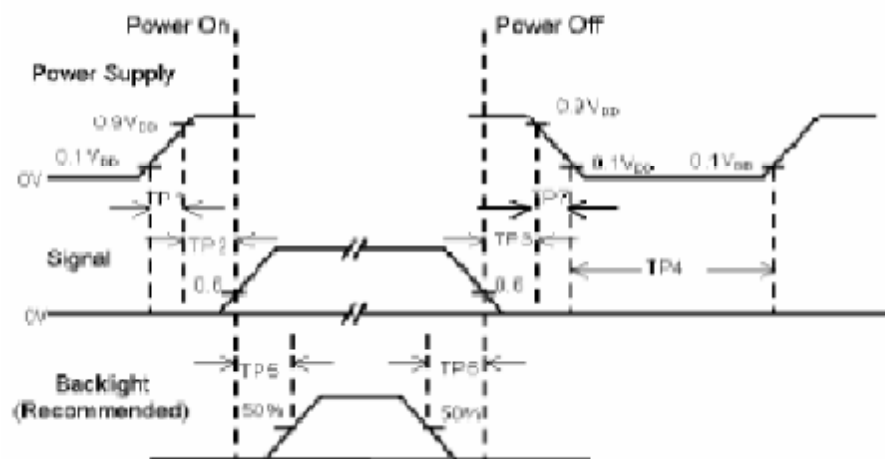
7.3.1 Interface Timing Characteristics





Vertical timing

6.5 Power Sequence



Note : (1) The supply voltage of the external system for the module input should be the same as the definition of VDD.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

(4) TP4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

8. Backlight Characteristics

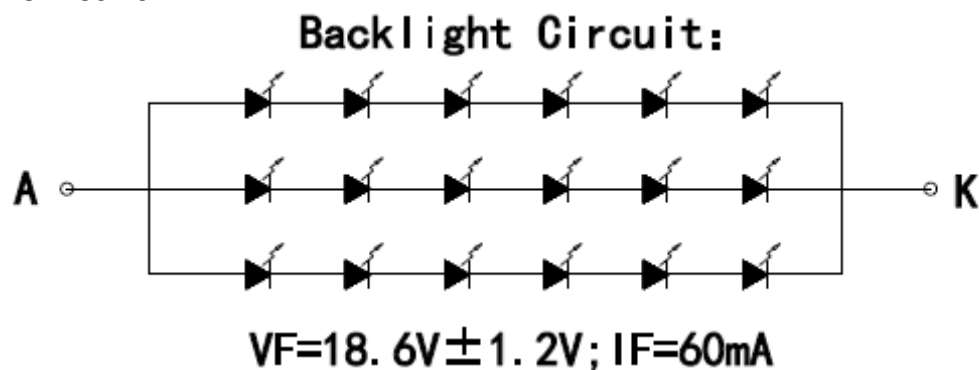
Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	V _f	17.4	18.6	19.8	V	Note1
Forward Current	I _f	-	60	-	mA	-
Number of LED	-	-	6*3=18	-	Piece	-
LED Connection mode	P/S	-	Serial/Parallel	-	-	-
Lifetime of LED	-	-	20000	-	hour	Note2

Note:

Ø Note1: The LED Supply Voltage is defined by the number of LED at Ta=25°C and I_f=60mA.

Ø Note2: The LED lifetime define as the estimated time to 50% degradation of initial luminous. The LED lifetime could be decreased if operating I_f is larger than 60mA.

Ø Backlight circuit:

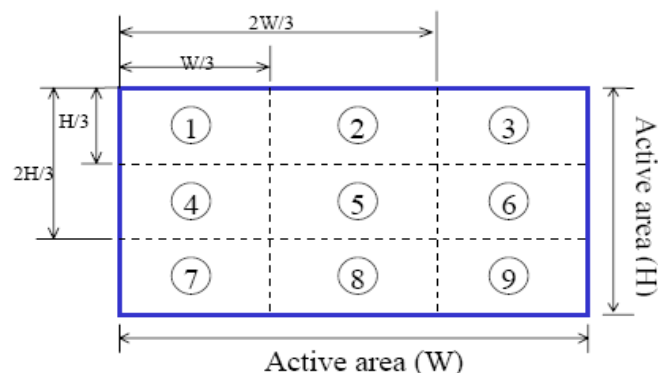


★1 Test condition is :

- (a) Center point on active area
- (b) Best Contrast

★2 Uniform measure condition :

- (1) Measure 9 point. Measure location is show below :
- (2) Uniform = (Min. brightness / Max. brightness)×100%
- (3) Best Contrast.

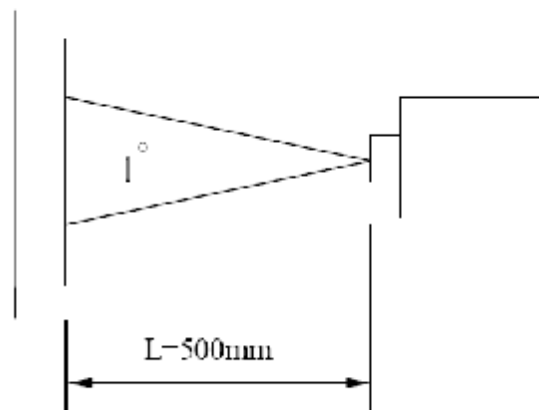


9. Electro-Optical Characteristics

Item of electro-optical characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time		Tr+Tf	$\theta =0$ $=0$ Ta=25℃	-	25	50	ms	FIG 1.	4
Contrast Ratio		CR		-	500	-	-	FIG 2.	1
Luminance uniformity		WHITE		-	80	-	%	FIG 2.	3
Surface Luminance		Lv		-	450	-	cd/m2	FIG 2.	2
CIE (x, y) chromaticity	White	White x	$\theta =0$ $=0$ Ta=25℃	0.26	0.31	0.36	-	FIG 2.	5
		White y		0.28	0.33	0.38			
Viewing angle range	$=90(12$ o' clock)		CR ≥ 10	-	50	-	deg	FIG 3.	6
	$=270(6$ o' clock)			-	70	-	deg		
	$=0(3$ o' clock)			-	70	-	deg		
	$=180(9$ o' clock)			-	70	-	deg		
NTSC ratio		-	-	-	50	-	%	-	-

Note 1. Ambient condition : $25^\circ\text{C} \pm 2^\circ\text{C}$, $60 \pm 10\% \text{RH}$, under 10 Lux in the darkroom .

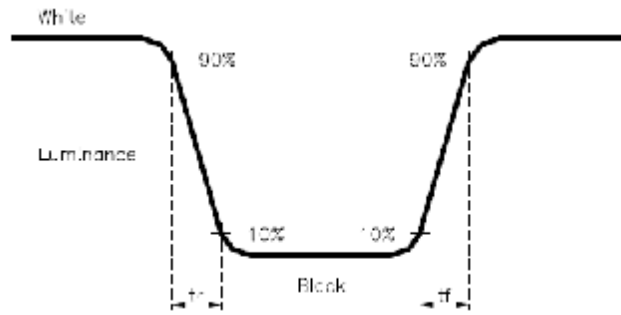
Note 2. Measure device : BM-5A (TOPCON) , viewing cone- 1° , I_L -20mA .



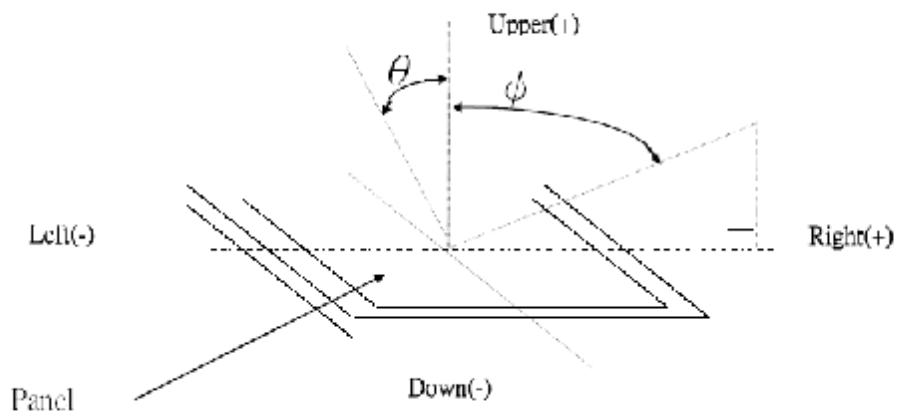
Note 3. Definition of Contrast Ratio :

$$CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$$

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ , ψ) :



Note 6. Light source: C light.

10. Reliability

10. 1. MTBF

The LCD module shall be designed to meet a minimum MTBF value of 20000 hours with normal. (25°C in the room without sunlight)

10. 2. Test condition

ITEM	CONDITIONS	CRITERION
OPERATING TEMPERATURE	HIGH TEMPERTURE +70°C 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERTURE -20°C 48HRS	
STORAGE TEMPERATURE	HIGH TEMPERTURE +80°C 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERTURE -30°C 48HRS	
HUMIDITY	40°C 90%RH 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION

Note: The need to restore at room temperature for 2 hours after the test.

11. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

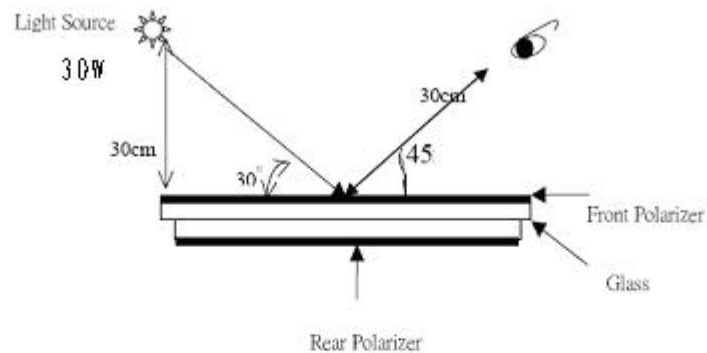
According to GB/T 2828-2003 ; , normal inspection, Class II

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)

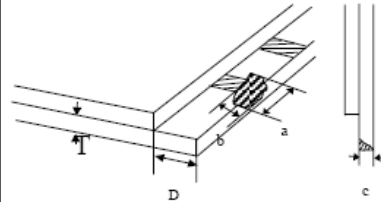
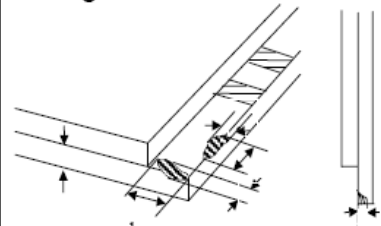


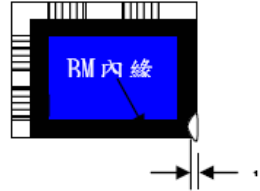
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

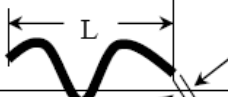
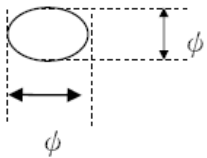
3.1.1 Glass defect

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 (Inclueling 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

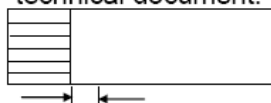
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【 Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【 Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO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

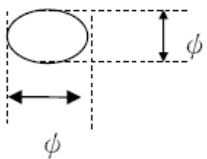
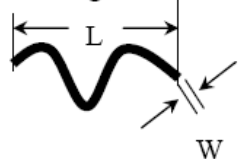
3.1.5 Silicon and Tuffy glue

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	

12. Precautions For Using LCD Modules

Please pay attentions to the followings as using the LCD module.

12.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the ITO film very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Wipe off water droplets or oil immediately.
- (f) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (g) Do not touch the output pins directly with bare hands.
- (h) Do not disassemble the LCD module.

12.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

12.3 Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.

- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.

12.4 Others

- (a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- (b) It is recommended to peel off the protection film on the ITO film slowly so that the electrostatic charge can be minimized.
- (c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.

13. Records Of Version

Version	Revise Date	Page	Content
V0	2020-05-25	All	First Release