

PRODUCT SPECIFICATION
FOR LCD MODULE



Revision: 00

Model No: BDT-T7040-01

Module Type: COG+FPC+B/L

APPROVED SIGNATURE

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

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

Contents

1. General Description	3
2. Physical Features	3
3. Mechanical Specification	3
4. Outline Dimension	4
5. Absolute Maximum Ratings	5
6. Electrical Characteristics	5
7. Module Function Description	7
8. Backlight Characteristics.....	12
9. Electro-Optical Characteristics.....	13
10. Reliability	16
11. Inspection Standards	17
12. Precautions For Using LCD Modules.....	23
13. Records Of Version.....	25

1. General Description

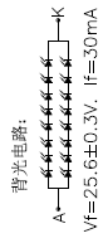
BDT-T7040-01 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 7.0 inch and the resolution is 800(RGB)*480, the panel can display up to 16M colors. 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 800×RGB×480 Dot-matrix
Input Data	24 bit RGB interface
Viewing Direction	12 O'clock

3. Mechanical Specification

Item	Contents	Unit
Module size (W×H×T)	164.90 × 100.00× 3.52	mm
Number of dots	800(RGB) × 480	---
Active area (W×H)	154.08×85.92	mm



PIN	Symbol
1	LED _A
2	LED _B
3	GND
4	VDD
5	R1
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	G8
22	H1
23	R2
24	R3
25	R4
26	R5
27	R6
28	R7
29	GND
30	GND
31	DSP
32	H2
33	VSYS
34	DE
35	NC
36	NC
37	XR
38	Y0
39	Y1

BLAZE Blaze Display Technology Co., Ltd.

DISPLAY TYPE:	7.0" TFT	DISPLAY DRIVER:	ST5623-03-1&ST5091-03-1	PIXEL PITCH:	0.1926 X 0.179 mm
POLARIZER MODE:	TRANSMISSIVE	OPERATING TEMP:	-20°C TO +70°C	BACK LIGHT:	LED WHITE(X16),8串*2并
VIEWING DIRECTION:	12 O'CLOCK	STORAGE TEMP:	-30°C TO +80°C		
Dot matrix:	800(RGB)X480 DOTS	STRUCTURE:	LCD+HC+FFC+BL	MATERIAL NOTE	ROHS REQUEST

DESIGNED BY: BDT-23	BDT-T7040-01-SERIES		VERSION: 1.0
CHECKED BY: BDT-09			PAGE 1 OF 1
APPROVED BY: BDT-05			UNIT: mm
Website: http://www.blazedisplays.com			
DATE: 2015-08-15			

5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Digital Supply Voltage	DVDD	-0.3	5	V	Note1
Analog Supply Voltage	AVDD	6.5	13.5	V	
Gate On Voltage	VGH	-0.3	40	V	
Gate Off Voltage	VGL	-20	0.3	V	
Gate On-Gate Off Voltage	VGH-VGL	12	40	V	
Operating temperature	TOPR	-20	70	°C	
Storage temperature	TSTR	-30	80	°C	
Humidity	---	---	90	%RH	---

Remark:

Note1 : If users use the product out off the environmemtal operation range (temperature and humidity,it will have visual quality concerns) .

6. Electrical Characteristics

6.1 Typical Operation Conditions

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Digital Power Supply Voltage	Logic	VDD	3.0	3.3	3.6	V	Note1
Analog Power Supply Voltage	Analog	AVDD	10.2	10.4	10.6		
Gate On Power Supply Voltage		VGH	15.3	16	16.7		
Gate Off Power Supply Voltage		VGL	-7.7	-7	-6.3		
Common Power Supply Voltage		VCOM	2.6	3.6	4.6		
Input Voltage	L level	VIL	GND	---	0.3*DVDD	V	VCC=3.0 ~ 3.6V
	H level	VIH	0.7* DVDD	---	DVDD	V	
LCD Drive Power current		ILCD	---	---	50	mA	VCC=3.3V

Remark:

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

6.2 TFT-LCD Current Consumption

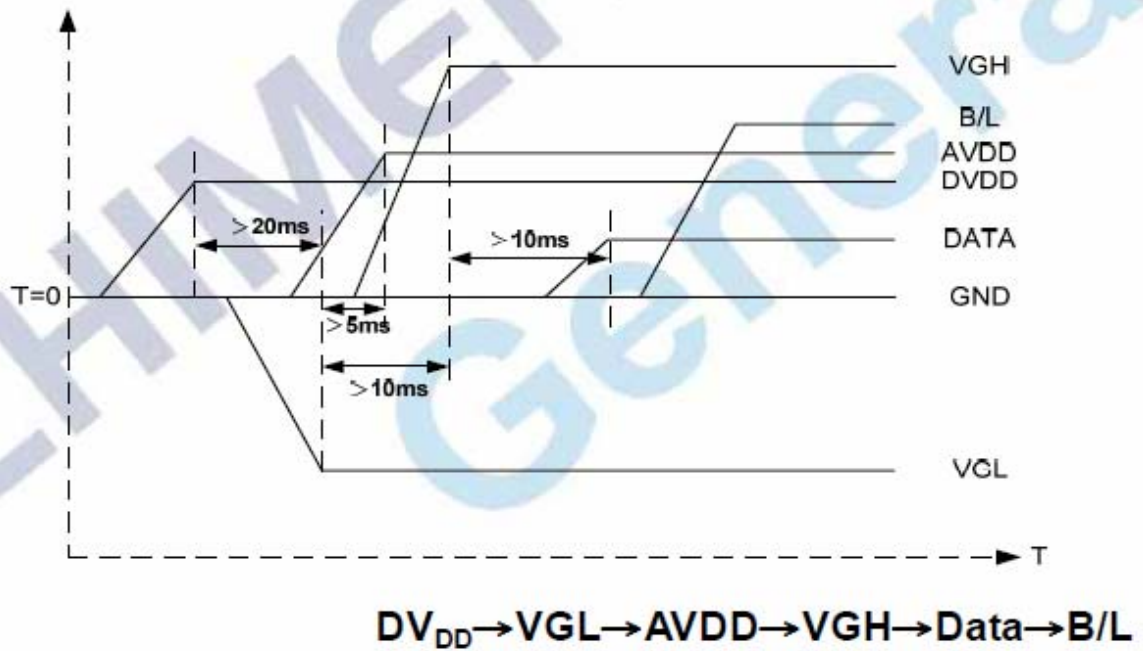
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{GH}	-	0.2	1.0	mA	$V_{GH} = 16.0V$
	I_{GL}	-	0.2	1.0	mA	$V_{GL} = -7.0V$
	IDV_{DD}	-	4.0	10	mA	$DV_{DD} = 3.3V$
	IAV_{DD}	-	20	50	mA	$AV_{DD} = 10.4V$

*NOTE

$V_{DDG} = V_{GH}, V_{EEG} = V_{GL}$

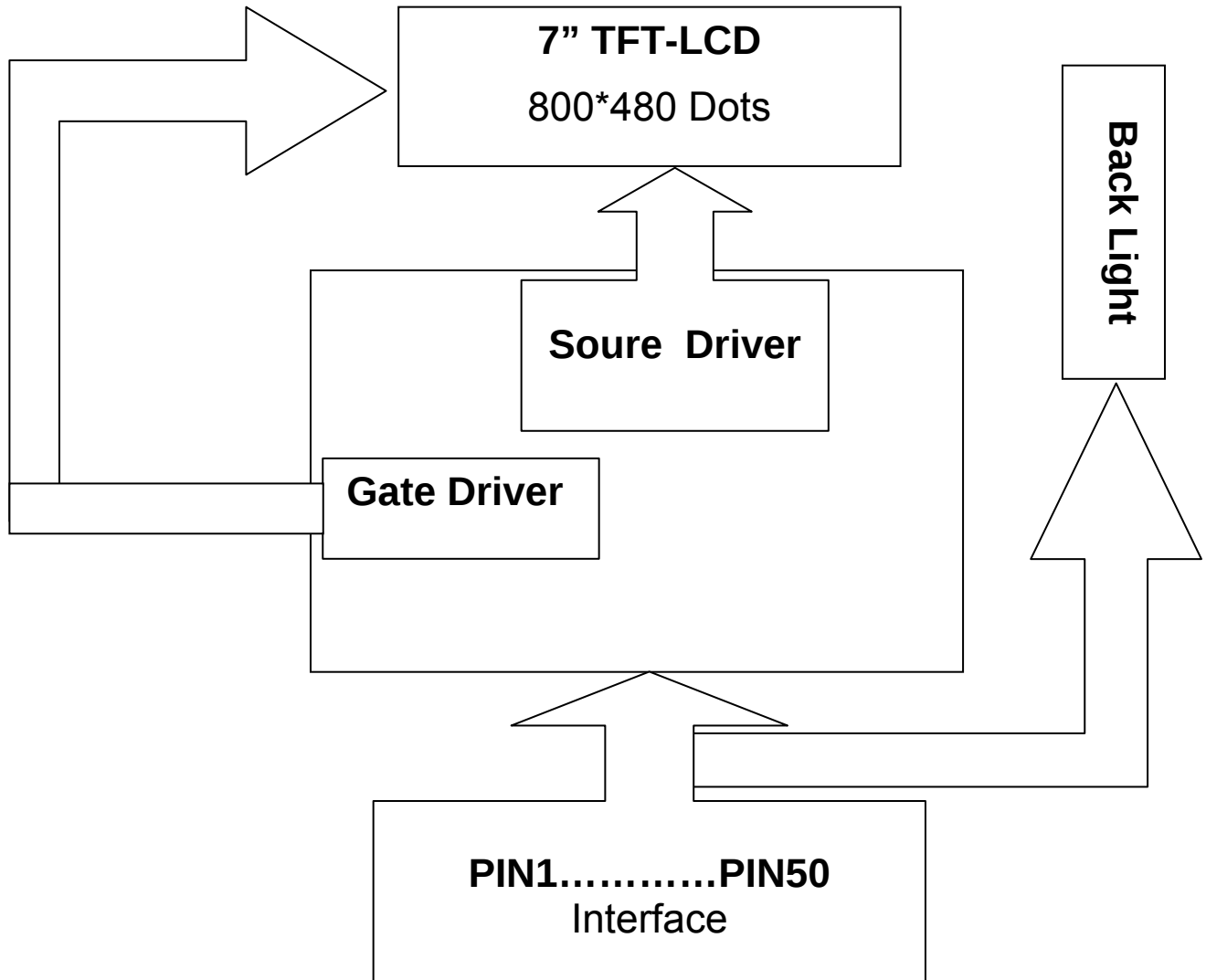
6.3 Power、Signal Sequence

a. Power on:



7. Module Function Description

7-1. Block Diagram Of LCM

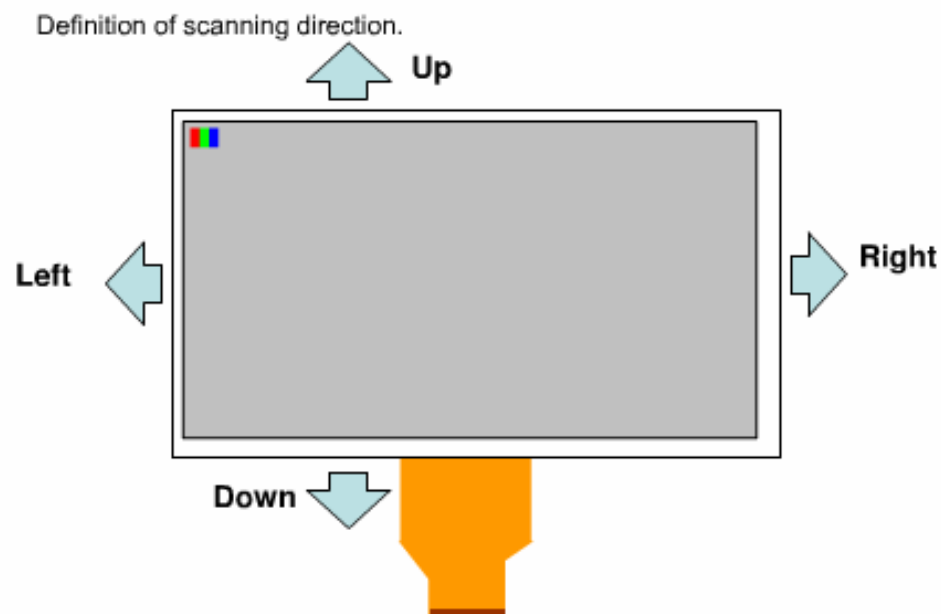


7-2. Pin Description

PIN NO.	Symbol	I/O	Description
1	LED-K	P	Power for LED backlight cathode
2	LED-A	P	Power for LED backlight anode(25.6V,30mA)
3	GND	P	Power ground
4	VDD	P	Power supply for digital block.(+3.3V)
5-12	R0-R7	I	Red data
13-20	G0-G7	I	Green data
21-28	B0-B7	I	Blue data
29	GND	P	Power ground
30	DCLK	I	Clock for input data
31	DISP	I	Display on/off
32	HSYNC	I	Horizontal sync signal
33	VSYSN	I	Vertical sync signal
34	DE	P	Input data enable control.
35	NC	-	NO connecter
36	GND	P	Power ground
37	YR	I	NC
38	YD	I	NC
39	XL	I	NC
40	YU	I	NC

【Note1】 SHLR : left or right setting
UPDN : up or down setting

SHLR	UPDN	Data shifting
DVDD	GND	Left→Right , Up→Down(default)
GND	GND	Right→Left , Up→Down
DVDD	DVDD	Left→Right , Down→Up
GND	DVDD	Right→Left , Down→Up



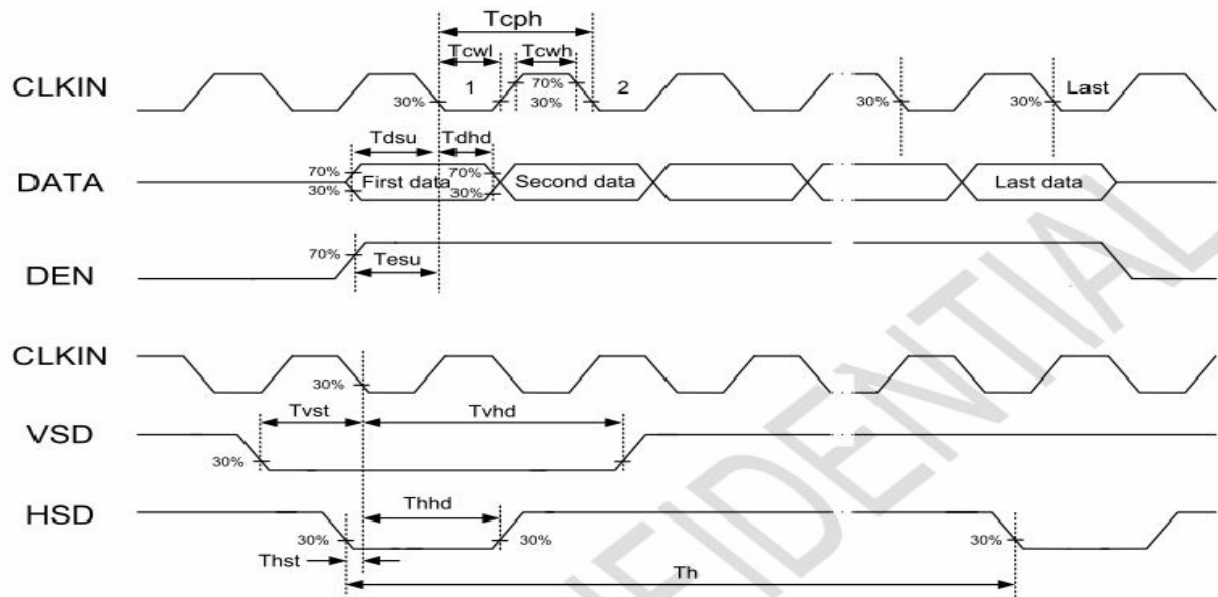
7-3. Timing Characteristics

7.3.1 Input Timing Table

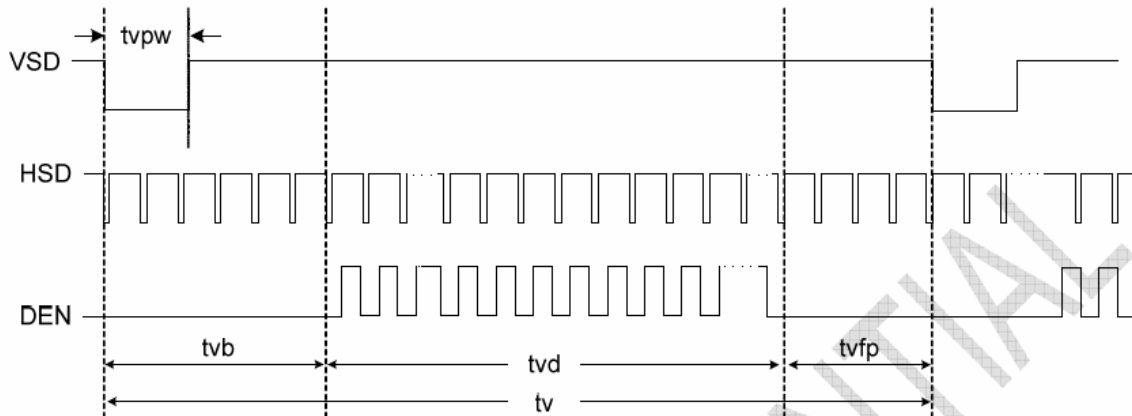
	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Note
DCLK	Dot Clock	$1/t_{CLK}$	29	33	38	MHz	
	DCLK pulse duty	Tcwh	40	50	60	%	
DE	Setup Time	Tesu	8	-	-	ns	
	Hold time	Tehd	8	-	-	ns	
	Horizontal Period	t_H	1026	1056	1086	t_{CLK}	
	Horizontal Valid	t_{HA}	800			t_{CLK}	
	Horizontal Blank	t_{HB}	226	256	286	t_{CLK}	
	Vertical Period	t_V	515	525	535	t_H	
	Vertical Valid	t_{VA}	480			t_H	
	Vertical Blank	t_{VB}	35	45	55	t_H	
SYNC	HSYNC Setup Time	Thst	8	-	-	ns	
	HSYNC Hold Time	Thhd	8	-	-	ns	
	VSYSN Setup Time	Tvst	8	-	-	ns	
	VSYSN Hold Time	Tvhd	8	-	-	ns	
	Horizontal Period	th	1026	1056	1086	t_{CLK}	
	Horizontal Pulse Width	thpw	-	30	-	t_{CLK}	thb + thpw=46DCLK is fixed
	Horizontal Back Porch	thb	-	16	-	t_{CLK}	
	Horizontal Front Porch	thfp	180	210	240	t_{CLK}	
	Horizontal Valid	thd	800			t_{CLK}	
	Vertical Period	tv	515	525	535	th	
	Vertical Pulse Width	tpw	-	13	-	th	tpw + tvb = 23th is fixed
	Vertical Back Porch	tvb	-	10	-	th	
	Vertical Front Porch	tvfp	12	22	32	th	
	Vertical Valid	tvd	480			th	
DATA	Setup Time	Tdsu	8	-	-	ns	
	Hold Time	Tdhd	8	-	-	ns	

7.3.2 Input Clock and Data Timing Diagram

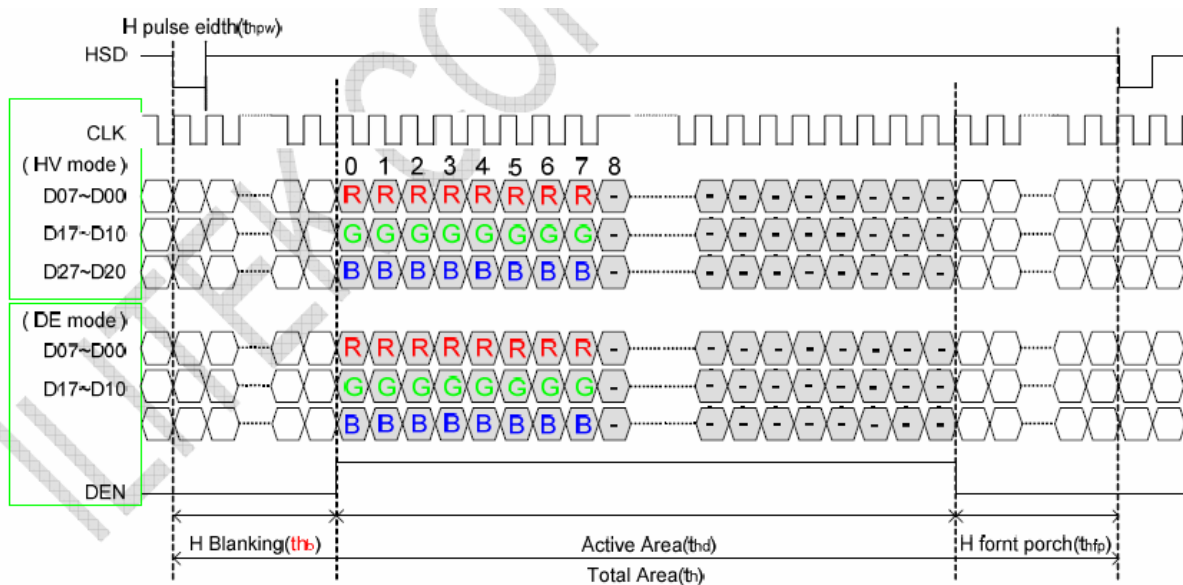
Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
DVDD Power On Slew Rate	TPOR	-	-	20	ms	From 0V to 90% DVDD
RSTB Pulse Width	TRst	50	-	-	us	DCLK=65MHz
DCLK Cycle Time	Tcph	14	-	-	ns	
DCLK Pulse Duty	Tcwh	40	50	60	%	
VSD Setup Time	Tvst	5	-	-	ns	
VSD Hold Time	Tvhd	5	-	-	ns	
HSD Setup Time	Thst	5	-	-	ns	
HSD Hold Time	Thhd	5	-	-	ns	
Data Setup Time	Tdsu	5	-	-	ns	D0[7:0],D1[7:0],D2[7:0] to DCLK
Data Hold Time	Tdhd	5	-	-	ns	D0[7:0],D1[7:0],D2[7:0] to DCLK
DEN Setup Time	Tesu	5	-	-	ns	
DEN Hold Time	Tehd	5	-	-	ns	



Vertical input timing



Horizontal input timing



8. Backlight Characteristics

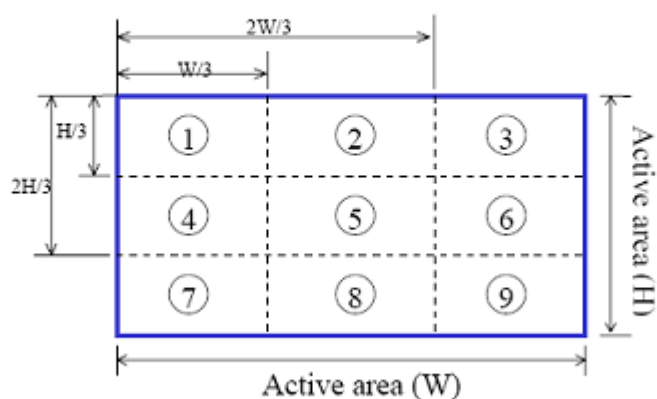
Item	Symbol	Min	Typ	Max	Unit	Remark
Forward voltage	V_{BL}	-	9.6	-	V	-
Current	I_{BL}		120		mA	-
LCM Luminance (display white)			380			$I=40mA$
Uniformity	-	80	-	-	%	★1

★1 Uniform measure condition:

(1) Measure 9 point. Measure location is show below :

(2) $Uniform = (Min. \text{ brightness} / Max. \text{ brightness}) \times 100\%$

(3) Best Contrast.



9. Electro-Optical Characteristics

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR $\geq$ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	60	70	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	60	70	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	40	50	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	60	70	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	15	30	msec	Note 3
Contrast ratio	CR		400	500	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2 Note 5
	W_Y		0.28	0.33	0.38	-	Note 6
Transmittance	Tr	-	-	5.11	-	%	

Test Conditions:

1. $DV_{DD}=3.3V$, the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

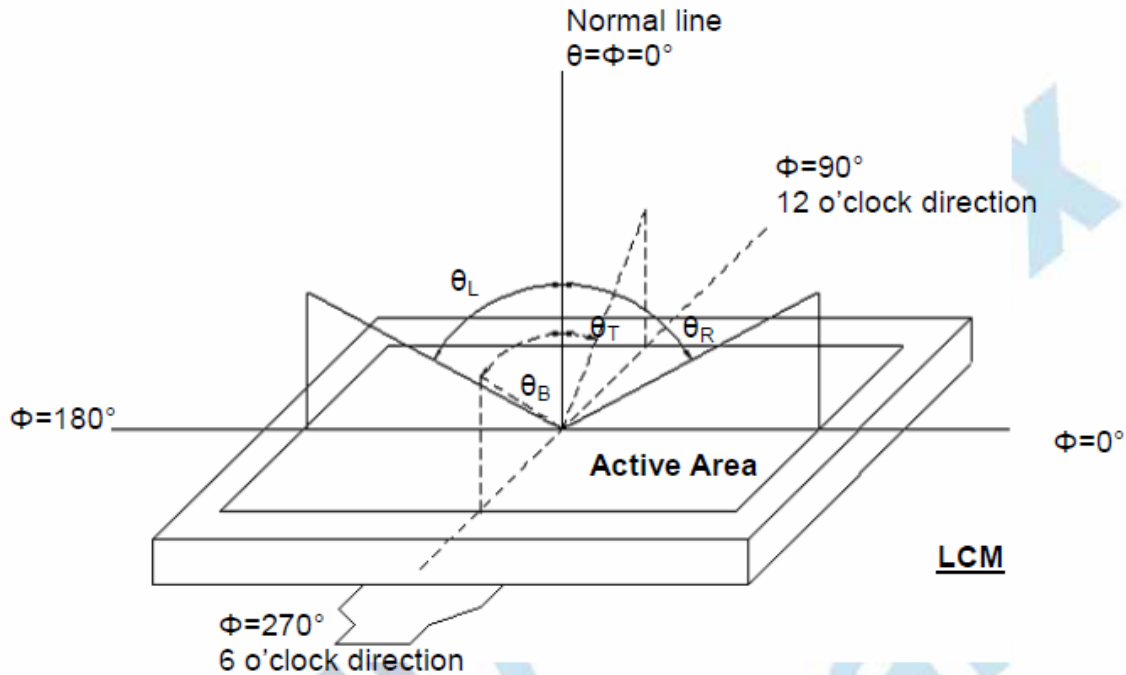


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

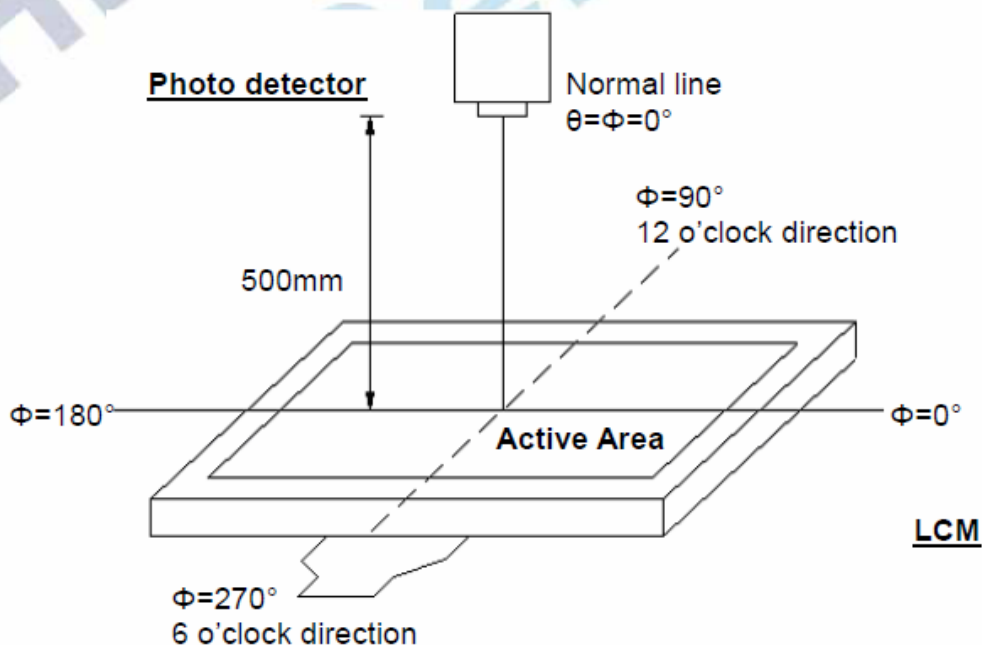


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

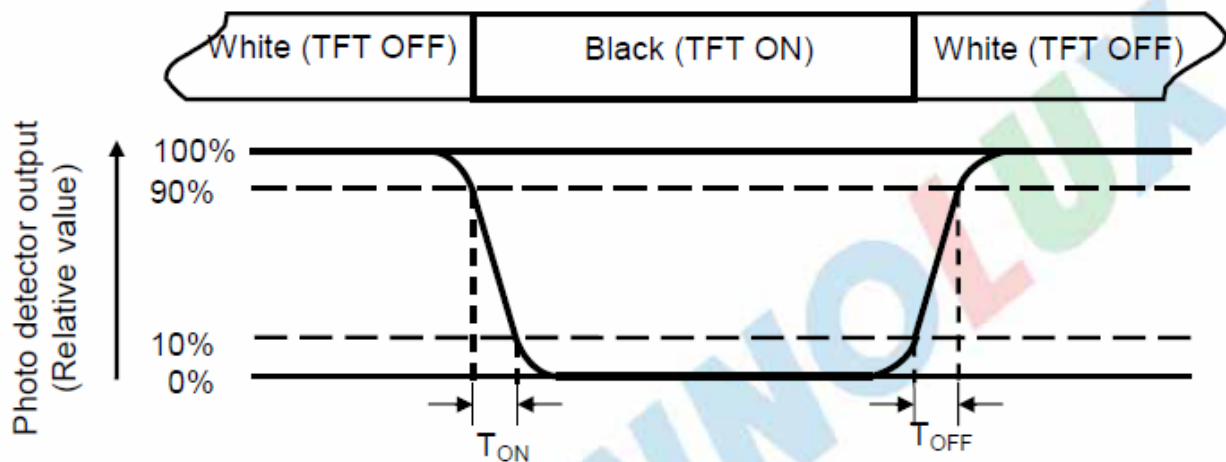


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel.

10. Reliability

10. 1. MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 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	60°C 90%RH 48HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION

11. Inspection Standards

1. AQL(Acceptable Quality Level)

AQL of major and minor defect

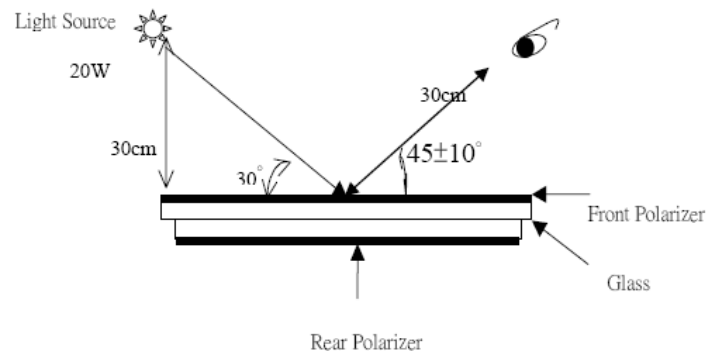
	MAJOR DEFECT	MINOR DEFECT	MAJOR+MINOR
APPEARANCE	0.40%	1.0%	1.0%
ELECTRIC-OPTICAL	0.15%	0.15%	0.15%

2. Basic conditions for inspection

The LCM face to us, in normal environment, the lux is 1000 ± 200 . (Darkroom's lux: 100 ± 50),

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)

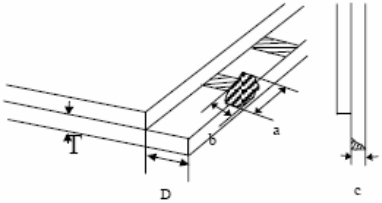
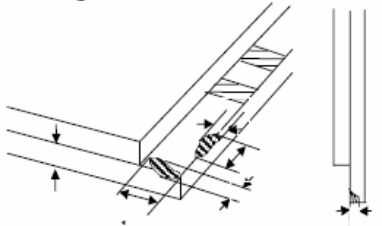


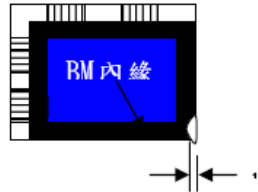
3. Inspection item and criteria

3.1 Visual inspection criterion in immobility

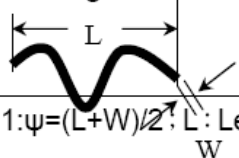
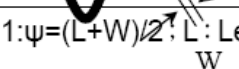
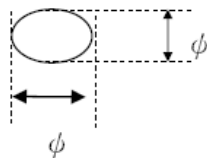
3.1.1 Glass defect

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 (Including 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

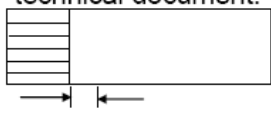
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【 Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【 Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO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

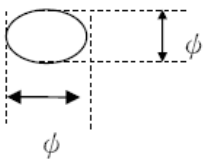
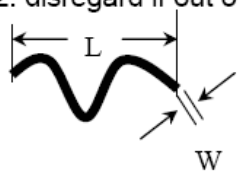
3.1.5 Silicon and Tuffy glue

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
00	2015-06-05	All	New released