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on-site service

In-house Manufacturing

Optical Bonding

Cover glass

System solutions

OEM Solutions

Custom Display

Mechanical design



MODEL NO : ET070WS02-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2023-01-04

☐ Preliminary Specification

☒ Final Product Specification

Customer : _____

Approved by	Notes

Youri Confirmation

Prepared by	Reviewed by	Approved by
John	Johnny	Wang

1. Introduction

1.1 Scope of application

This LCD module should be designed for mobile phone use.

LCD specification: Dots 1024xRGBx600.

As to basic specification of the driver IC, refer to the IC (Orise:TBD) specification and data book.

All material & processing of the LCD module should be Lead Free.

1.2 TFT features:

Structure: TFT PANNEL+IC +FPC+BL;

ALL O'CLOCK Type LCD

1024 dot-segment and 600 dot-common outputs;

16.7M Color can be selected by software;

White LED back light;

LVDS interface

TP interface: I2C

1.3 Applications:

Motorcycle dashboard

Electric Animation Dashboard

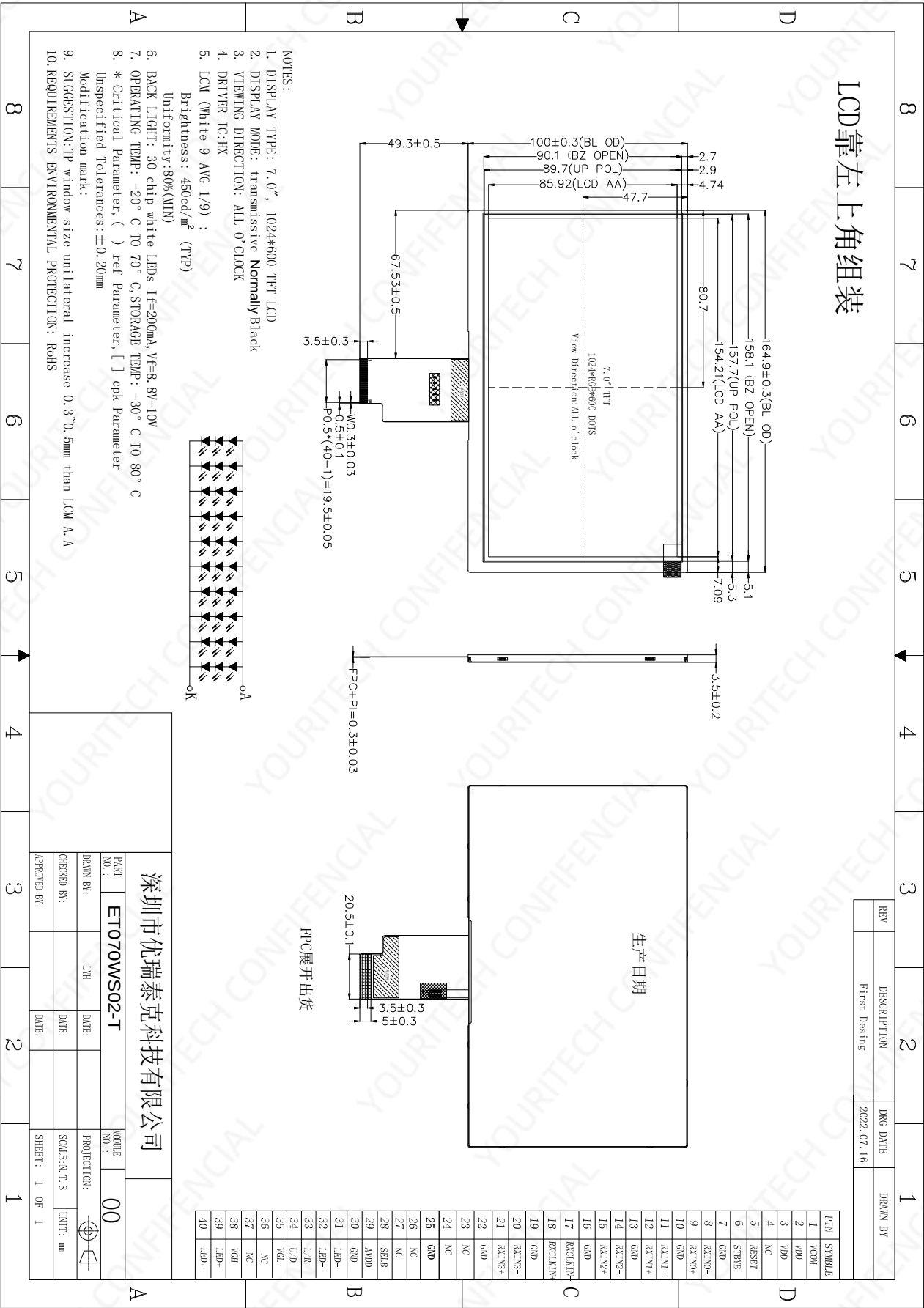
Medical display

Engineering vehicle display

Outdoor highlight equipment

2. LCM General specification

ITEM	Standard value	Unit
LCD Type	Normally Black	--
Drive element	TFT active matrix	--
Number of pixels	1024*3RGB(H)X600(V)	Dots
Pixel arrangement	RGB stripe	--
Pixel Pitch (W*H)	0.1506(W)x 0.1432(H)	mm
Active area	154.21 (H) × 85.92 (V)	mm
Viewing direction	ALL O'CLOCK	
TFT Driver IC	TBD	-
TFT interface	LVDS Interface	-
Approx. Weight	TBD	g
LCM Size(W*H*T)	164.90(W) x100.00(H) x3.50(T)	mm
Touch structure		
Touch Driver IC		-
Touch Interface		



3. Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
LCM Operating Temperature	T _{OPR}	-20	+70	°C
LCM Storage Temperature	T _{STG}	-30	+80	°C
Humidity	RH	10	90	%

4. Electrical Characteristics

4.1 TFT DC Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
TFT OperationFrame rate	Hz	--	60	--	Hz	
Supply Voltage for(DC/DC)	VDD	2.6	3.3	3.6	V	
TFT Gate ON Voltage	VGH	17	18	19	V	Note 2
TFT Gate OFF Voltage	VGL	-6.5	-6	-5.5	V	Note 2
TFT Common Voltage	Vcom	3.0	3.15	3.3	V	Note 1
AVDD	Avdd	8.9	9.0	9.1	V	Note 3

Note: (1) Vcom must be adjusted to optimize display quality: cross-talk, contrast ratio and etc.

(2) VGH is TFT gate operating voltage

(3) VGL is TFT gate operating voltage

(4) Environmental condition: 25±5

4.2 Back-Light Unit Characeristics

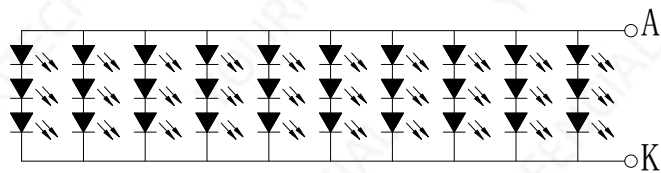
The back-light system is an edge-lighting type with 30 white LEDs. The characteristics of the back-light are shown in the following tables.

Characteristics	Symbol	Min.	Type	Max.	Unit	Notes
Forward Voltage	V _F	8.8	--	10	V	-
Forward current	I _F	--	200	--	mA	-
Luminance(With LCD)	Lv	--	450	--	cd/m ²	-
LED life time	N/A	--	30,000	--	Hr	Note 1

Note:

- (1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=20mA/LED. The LED life time could be decreased if operating I_L is larger than 30mA/LED.

Backlight circuit diagram shown in below:



5. Module Function Description

LCM PIN Description:

Pin No.	Symbol	LCM Description	remarks
1	VCOM	Common Voltage	
2~3	VDD	Power for Digital Circuit 3.3V	
4	NC	No connection	
5	RESET	Global reset pin	
6	STBYB	Standby mode: STBYB = "H", normal operation(default) STBYB = "L", timing controller, source driver will turn off, all output are High-Z.	
7	GND	Ground	
8	NIND0	-LVDS differential data input	
9	PIND0	+LVDS differential data input	
10	GND	Ground	
11	NIND1	-LVDS differential data input	
12	PIND1	+LVDS differential data input	
13	GND	Ground	
14	NIND2	-LVDS differential data input	
15	PIND2	+LVDS differential data input	
16	GND	Ground	
17	NIND	-LVDS CLOCK differential signal input	
18	PIND	+LVDS CLOCK differential signal input	

19	GND	Ground	
20	NIND3	-LVDS differential data input	
21	PIND3	+LVDS differential data input	
22	GND	Ground	
23~24	NC	No connection	
25	GND	Ground	
26~27	NC	No connection	
28	SELB	6bit/8bit mode select	Note1
29	AVDD	Power for Analog Circuit	
30	GND	Ground	
31~32	LEDK	POWER SUPPLY+ FOR BACKLIGHT CATHODE	
33	L/R	Horizontal inversion Left / right selection	
34	U/D	Vertical inversion Up/down selection	
35	VGL	Gate OFF Voltage	
36~37	NC	No connection	
38	VGH	Gate ON Voltage	
39~40	LEDA	POWER SUPPLY- FOR BACKLIGHT ANODE	

Note1:

If LVDS input data is 6 bits, SELB must be set to High;

If LVDS input data is 8 bits, SELB must be set to Low.

Note2: When L/R="0", set right to left scan direction.

When L/R="1", set left to right scan direction.

When U/D="0", set top to bottom scan direction.

When U/D="1", set bottom to top scan direction.

6. Timing Characteristics

● DE mode

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd		600		T _H
VSD Period	tv	610	635	800	T _H
VSD Blanking	tvbp+ tvfp	10	35	200	T _H

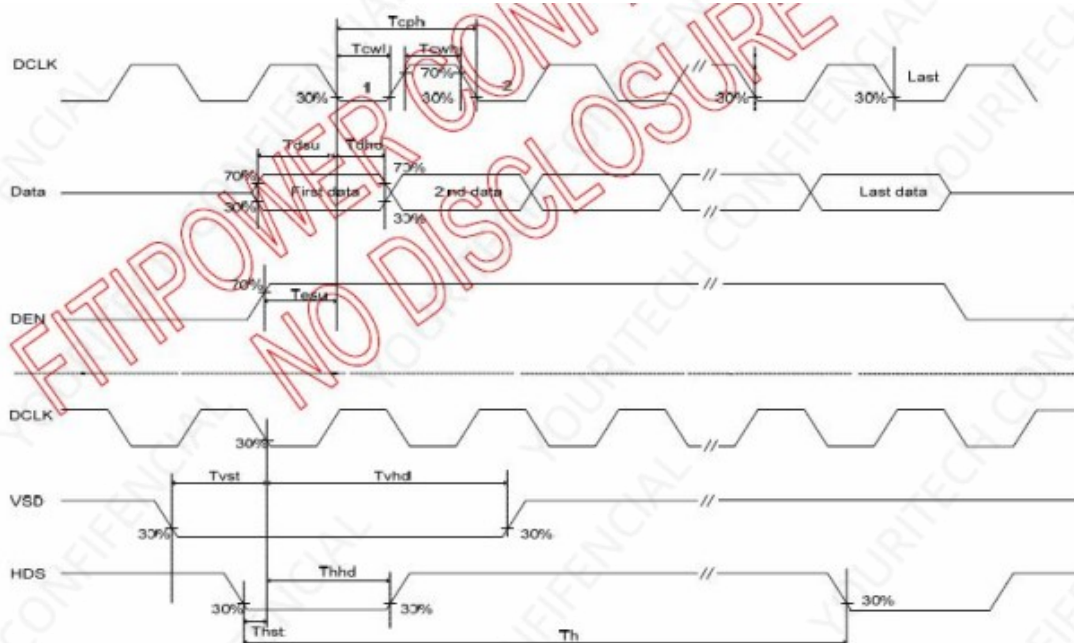
● HV mode

Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp		160		DCLK
HSD Front Porch	thfp	16	160	216	DCLK

Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		600		T _H
VSD Period	tv	624	635	750	T _H
VSD Pulse Width	tvpw	1	-	20	T _H
VSD Back Porch	tvbp		23		T _H
VSD Front Porch	tvfp	1	12	127	T _H



Reset Input Timing:

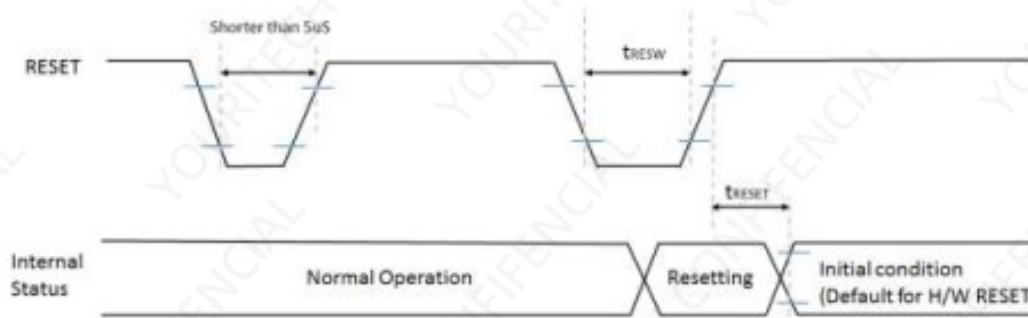


Figure 4-13 Reset Input Timing

Table 4-2 Reset Input Timing

Signal	Symbol	Parameter	Description	Specification			Unit	Notes
				MIN	TYP	MAX		
RESET	tRESW	Reset "L" pulse width		10			uS	1
	tRESET	Reset complete time	When reset applied during Sleep in mode			5	mS	2
			When reset applied during Sleep Out mode			120	mS	5

Note 1: Condition : Ta =25°C

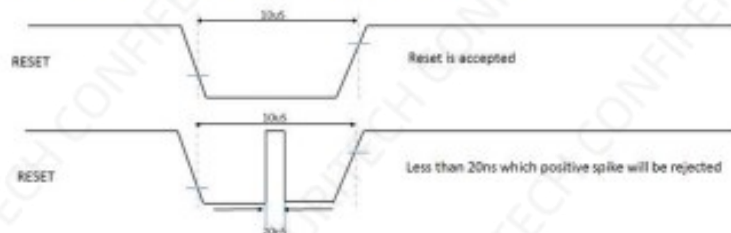
Note 2: Spike due to an electrostatic discharge on RESET line does not cause irregular system reset according to the table below.

RESET Pulse	Action
Less than 5us	Reset Rejected
More than 10uS	Reset
Between 5us and 10uS	Reset Start

Note 2: During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in sleep out mode. The display remains the blank state in sleep in mode) and then return to Default condition for H/W RESET.

Note3: During Reset Complete Time, values in OTP memory will be latched to internal register during this period. This loading is done every time when there is H/W RESET complete time (tRESET) within 5ms after a rising edge of RESET.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: It is necessary to wait 5ms after releasing RESET when sending commands, and Sleep Out command can not be sent within 120ms.

7.Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (With Polarizer)	T (%)	$\Theta=0$ Normal viewing angle	3.7	4.1	—	%	Measuring with Normal Polarizer , For Reference Only
Transmittance (Without Polarizer)	T (%)		14.8	16.5	—	%	
Contrast Ratio	CR		600	800	—	—	(1)(2)
Response Time	Rising		—	13	20	msec	(1)(3)
	Falling		—	15	25		
Color Gamut	S (%)		40	47		%	(C-light)
Color Chromaticity (CIE1931)	White	W _x	0.291	0.321	0.351		(1)(4) CF glass (C-light)
		W _y	0.315	0.345	0.375		
	Red	R _x	0.581	0.611	0.641		
		R _y	0.295	0.325	0.355		
	Green	G _x	0.306	0.336	0.366		
		G _y	0.513	0.543	0.573		
	Blue	B _x	0.118	0.148	0.178		
		B _y	0.127	0.157	0.187		
Viewing Angle (With Normal PZ)	Hor.	Θ_L	80	85	—		
		Θ_R	80	85	—		
	Ver.	Θ_U	80	85	—		
		Θ_D	80	85	—		
Optima View Direction	ALL						(5)

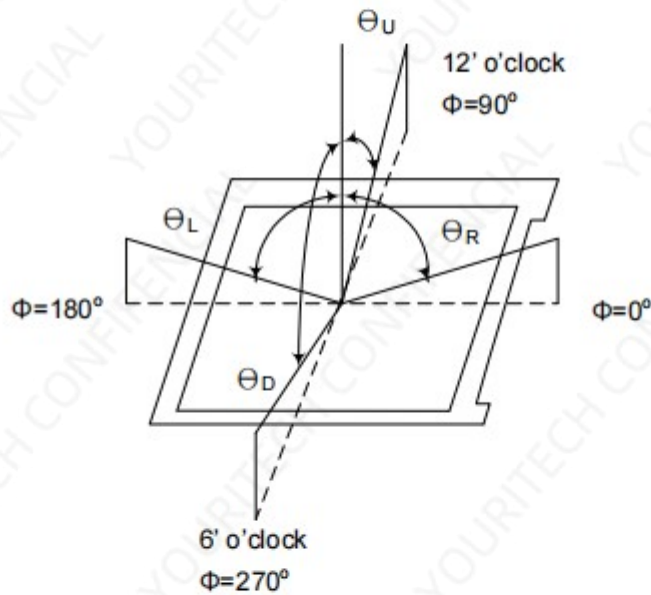
Measuring Condition

- Measuring surrounding: dark room
- Ambient temperature: $25 \pm 2^{\circ}\text{C}$
- 30min. warm-up time.

Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size : 20 ~ 21 mm

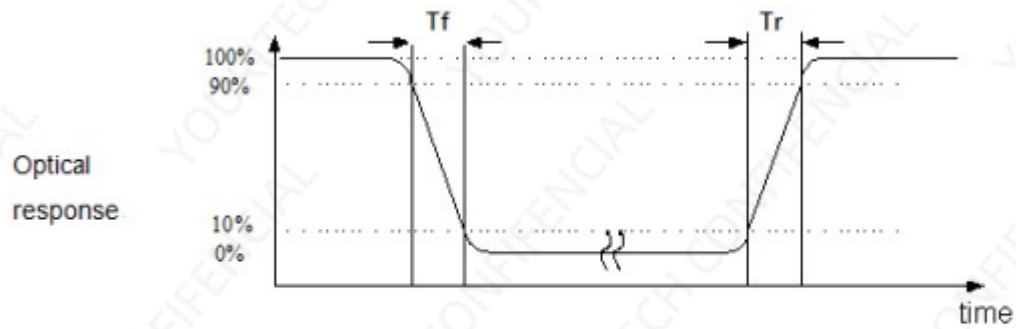
Note (1) Definition of Viewing Angle:



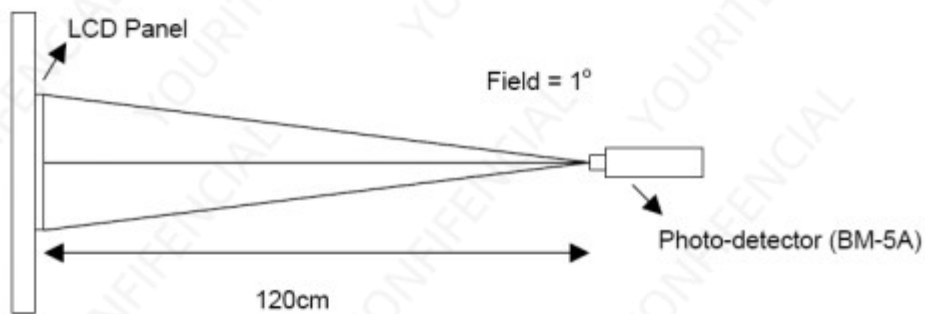
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$\text{CR} = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

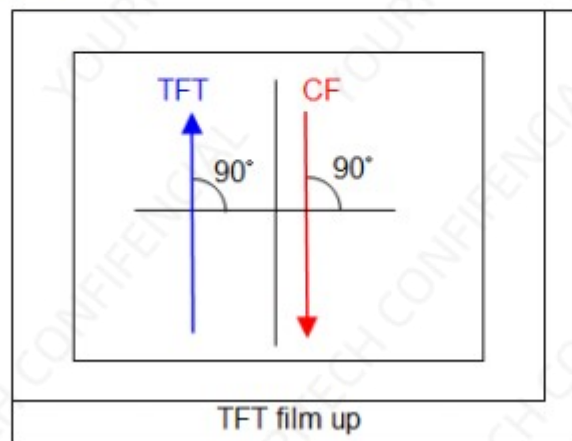
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)



8. Reliability Test Item

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+80°C / 96H	1. Functional test is OK. Missing Segment, short, unclear segment non-display, display abnormally and liquid crystal leakage un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-30°C / 96H	
3	High Temperature Operating	+70°C / 96H	
4	Low Temperature Operating	-20°C / 96H	
5	High Temperature / Humidity storage	60°C x 90%RH / 96H	
6	Thermal and cold shock	Static state, -20°C (30min) ~70°C (30min), 50 cycles	

9. Inspection standards

9.1 AQL (Acceptable Quality Level)

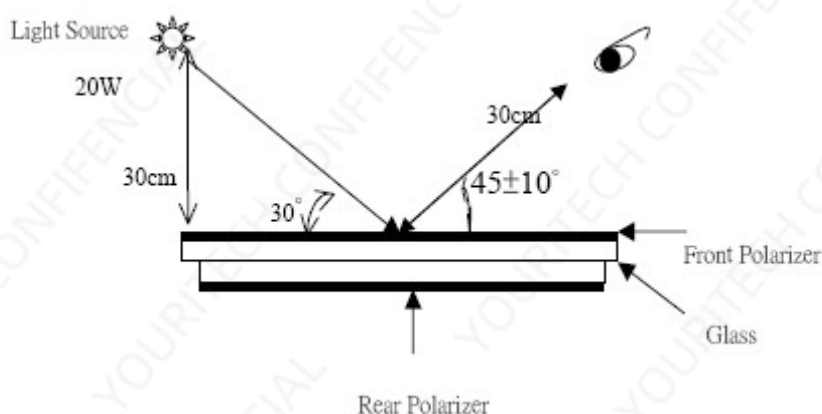
AQL of major and minor defect.

	MAJOR DEFECT	MINOR DEFECT
AQL	1.0	1.5

9.2 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 30 cm with an angle of 45 degree to check the products without uncovering the film!

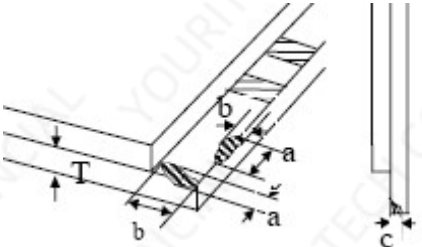
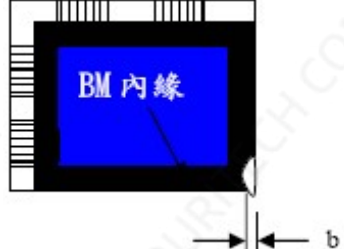
(As shown below)



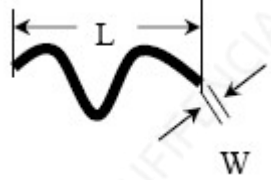
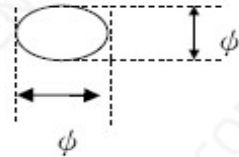
9.3 Inspection item and criteria

9.3.1 Visual inspection criterion in immobility

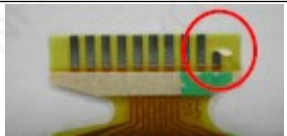
9.3.1.1 Glass defect

N O	Defect item	Criteria	Remark
1	Dimension Unconformity (Major defect)	By Engineering Drawing	
2	Cracks (Major defect)	1. Linear cracks panel 【Reject】 2. Nonlinear crack contrast by limited sample	
3	Glass extrude the conductive area (minor defect)	a: disregards and no influence assemblage. 1) $b \leq 1/3 \text{ Pin width (non bonding area)}$ 【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) $b \leq 1/3 \text{ of effective length for bonding electrode}$ 【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) $C < T$ $b \leq \text{BM} 1/3 \text{ of width}$ 【Accept】 3) $c = T$ b not touch the seal glue 【Accept】 4) a disregards	a: Length, b: Width c: Thickness 
6	Non-pin-side damage (minor defect)	$c < T$ 1) b exceeds $1/3 \text{ BM}$ 【Reject】 $c = T$ b not touch the seal glue 【Reject】	c: Thickness b: width of damage 

9.3.1.2 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 
		$W \leq 0.03\text{mm}$	disregard	
		$0.03\text{mm} < W \leq 0.05\text{mm};$ $L \leq 4.0\text{mm}$	2	
		$0.05\text{mm} < W \leq 0.1\text{mm};$ $L \leq 4.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 4.0\text{mm}$	0	
2	Polarizer bubble、 concave and convex (minor defect)	$\phi \leq 0.2\text{mm}$	disregard	note1: ϕ $= (L+W)/2$, L:Length, W :Width note2:disregard if out of AA
		$0.2\text{mm} < \phi \leq 0.3\text{mm}$	2	
		$0.3\text{mm} < \phi \leq 0.5\text{mm}$	1	
		$0.5\text{mm} < \phi$	0	
3	Black dots、dirty dots、impurities、 eye winker (minor defect)	$\phi \leq 0.15\text{mm}$	disregard	note2:disregard if out of AA 
		$0.15\text{mm} < \phi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \phi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \phi$	0	
4	Polarizer prick (minor defect)	$\phi \leq 0.1\text{mm}$	disregard	note1: ϕ $= (L+W)/2$, L=Length, W=Width note2:the distance between two dots>5mm
		$0.1\text{mm} < \phi \leq 0.25\text{mm}$	3	
		$\phi > 0.25\text{mm}$	0	

9.3.1.3 FPC

NO	Defect item	Criteria		Remark
1	Copper screen peel (minor defect)	Copper screen peel 【Reject】		
2	No release tape or peel	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
		$\phi \leq 0.3\text{mm}$	2	
		$\phi > 0.3$	0	

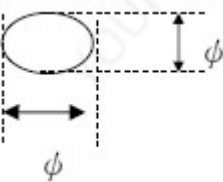
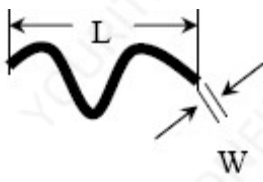
9.3.1.4 Black tape & Mara tape

NO	Defect item	Criteria	Remark
1	FPC or H/S black tape (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	
4	Mara tape defect (minor defect)	Peel before pulling the protecting film 【Reject】	

9.3.1.5 Silicon and Taffy glue

NO	Defect item	Criteria	Remark
1	Quantity of silicon (major defect)	Uncover the ITO and circuit area 【Reject】	note: compared by engineering
2	Taffy glue (major defect)	1. Uncover the reveal copper area 【Reject】 2. Cover layer 0.3mm(Min)~3.0mm(Max) 【Reject】	note: if customer has special requirement, refer to the technical document
3	Depth of glue covering (major defect)	Depth of glue covering overtop front Polarizer 【Reject】	Except of the special requirement

9.3.2Electrical 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】		
11	Black/white dots、 Dirty dots、 eye winker (major defect)	Specification	Allowable	Note1:disregard if out of 
		$\phi \leq 0.15\text{mm}$	disregard	
		$0.15\text{mm} < \phi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \phi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \phi$	0	
12	Fiber、 glass crutch、 Polarizer scratch/folded (major defect)	$W \leq 0.03\text{mm}$	disregard	Note1:L: Length, W: Width Note2: disregard if out of AA 
		$0.03\text{mm} < W \leq 0.05\text{mm}$ $L \leq 4.0\text{mm}$	2	
		$0.05\text{mm} < W \leq 0.1\text{mm}$ $L \leq 4.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 4.0\text{mm}$	0	

10. Packing Method

- END -