



PRODUCT GROUP

REV

ISSUE DATE

7 inch WV TFT LCD PRODUCT

P1

2020.10.28

7 inch WV MDL Product Final Specification

Rev. P1

CHENGDU BOE OPTOELECTRONICS TECHNOLOGY Co., Ltd

SPEC. NUMBER

SPEC TITLE
7 inch WV MDL Product Final Specification

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1.0 GENERAL DESCRIPTION

1.1 Introduction

7.0 inch module is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. It is a transmissive type display operating in the normal black. The TFT-LCD has a 7.0 inch diagonally measured active area with resolutions (800 horizontal by 480 vertical pixel arrays). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this panel can display 16.7M colors.

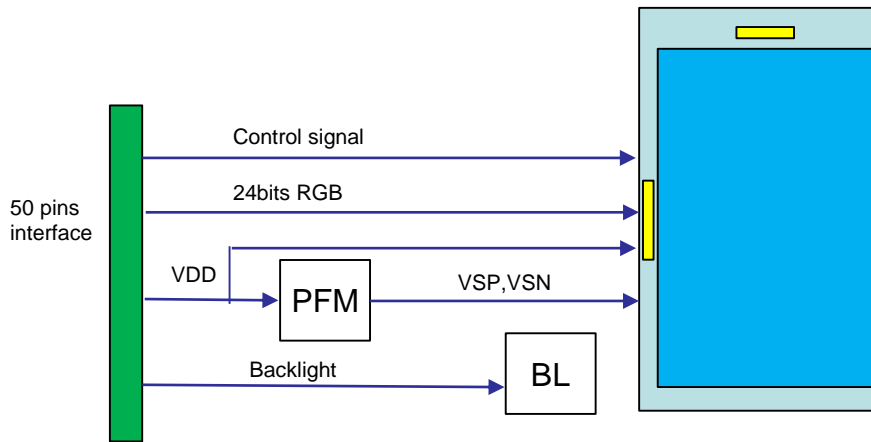


Figure 1-1 Block Diagram

1.2 Features

- Wide viewing angle (U/D/L/R) : Typ 85/85/85/85, CR>10:1 @25°C
- Color Gamut : 75% Typ.
- Cell thickness : 1.0t
- 24bits RGB Interface
- Surface treatment : AG

1.3 Application

- **Vehicle-mounted Production**

1.4 General Specification

<Table 1-1 General Specifications>

Parameter	Specification	Unit	Remarks
Active area	152.4(H) X 91.44(V)	mm	15 : 9
Number of pixels	800(H) X 480(V)	pixels	-
Pixel pitch	0.1905(H) ×RGB×0.1905 (V)	mm	-
Pixel arrangement	RGB Vertical stripe		-
Display colors	16.7M	colors	-
Color gamut	Min 70% Typ75%	%	-
Display mode	Normally black		-
Module outline	164.3(H) x 106.54(V)	mm	
Viewing Direction (Human Eye)	U/D/L/R Min 80/80/80/80 Typ 85/85/85/85	°	CR>10:1 @25°C
Driver IC	Source*1 + Gate*1	-	-

Note:

- 1.At the U/D/L/R direction, the viewing angle is same;
- 2.The TFT and CF Align Direction;

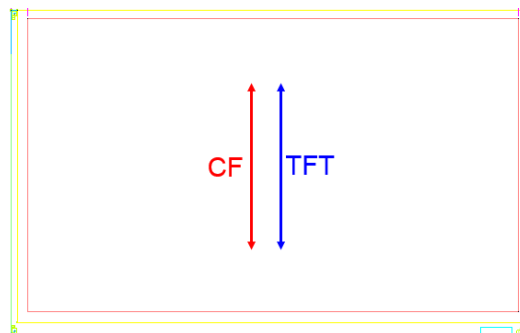


Figure 1-2 The TFT and CF Align Direction

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2-1

< Table 2-1 Environment Absolute Maximum Ratings >

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	VCC	-0.3	4.0	V	
Operating Temperature (Humidity)	T _{OP}	-40	+85	°C	Note 1
	RH	-	90	%	At 60°C
Storage Temperature (Humidity)	T _{ST}	-40	+90	°C	
	RH	-	90	%	At 60°C

Note 1. Operating @ -40~-30°C , no display function issues.

3.0 ELECTRICAL SPECIFICATIONS

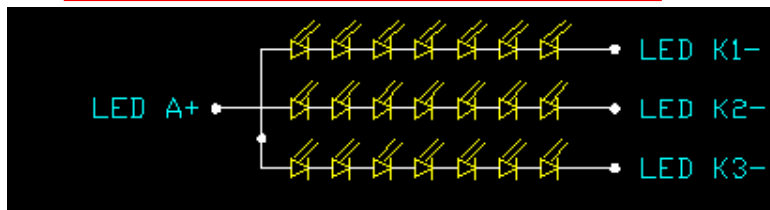
3.1 Electrical Specifications

Ta=25+/-2°C

Parameter	Symbol	Values			Unit	Notes
		Min	Typ.	Max		
Voltage of VCC		3.15	3.3	3.45	V	
Current of VCC(White pattern)			100	150	mA	TBD
Supply current of LED backlight	Per string		75		mA	7 LED
Total Supply current of LED Backlight	I _{LED} Total		225		mA	3 strings
Supply voltage of LED backlight	Per string	18.9	21	23.1	V	3 strings
LED Life Time	LIFF	30,000			Hrs	Note4

Notes :

- 1 : VCOM should be adjusted to make the flicker level be minimum and optimize display quality.
- 2: Frame rate=60HZ
- 3: BLU LED : Backlight current =**225mA**, Number of LED dies =21pcs
- 4: The “LED Life Time” is defined as the time period when the brightness decrease to 50% of the initial value under continuous lighting at 25°C



Backlight circuit diagram

Figure 3-1 LED&NTC Diagram

4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance \leq 1lux and temperature = $25\pm 2^\circ\text{C}$) with the equipment of Luminance meter system and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

<Table 4-1 Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing Angle	Horizontal	Θ_3	CR > 10:1 @25°C	80	85	-	Deg.	Note 1	
		Θ_9		80	85	-	Deg.		
	Vertical	Θ_{12}		80	85	-	Deg.		
		Θ_6		80	85	-	Deg.		
Contrast ratio @25°C		CR	Perpendicular	800	1000	-	-	Note 2	
Luminance		cd/m2	Perpendicular	800	1000	-	nit		
CR over temperature		ΔCR	-40°C	-	-	50%	-	Center	
			-10°C	-	-	20%	-	Center	
			45°C	-	-	20%	-	Center	
			85°C	-	-	50%	-	Center	
White luminance uniformity		ΔY	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	70	80		%	Note 3	
NTSC		%		70	75	-	-	-	
White Chromaticity		x_w		Typ-0.03	0.304	Typ+0.03	-	-	Simulation data only for reference , Actual result based on 1st sample Note 4
		y_w	0.324						
Reproduction of color	Red	x_R	0.649						
		y_R	0.336						
	Green	x_G	0.305						
		y_G	0.629						
	Blue	x_B	0.149						
		y_B	0.055						

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units	Remark
Response Time (Rising / Falling)	T _{RT}	25°C	-	-	30	ms	Note 5
		-20°C	-	-	200		
		-30°C	-	-	500		
Response Time (G2G,42step)	T _{RT}	25°C	-	-	30	ms	Note 6
		-20°C	-	-	200		
		-30°C	-	-	500		
Liquid Crystal Clearing point	T _{ni}	-	-	101	-	°C	
Surface Reflection Rate	SCI	-	-	-	6.5	%	
Backlight LED Forward Current VS. Ambient Temperature	PWM	85°C	-	45%	-	%	
Flicker	-	-	-	-	-20dB		Interval Gray Pattern between L0 and L127, after 30s light up stably

Note :

These items are measured using the following equipment:

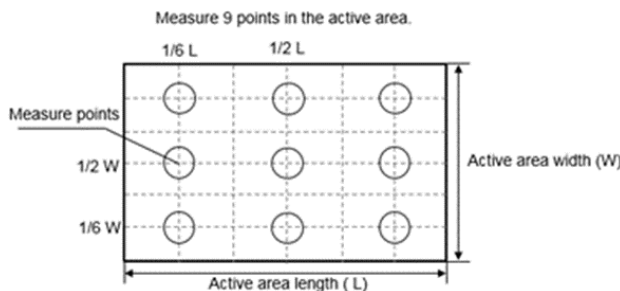
- Color/View angle range: SR-UL1R
- Contrast ratio/9 points luminance uniformity: CA-210/SR-UL1R
- Luminance @ room temperature : CA-210
- Response time @ room temperature: TRD-100A
- Low temperature response time/High temperature contrast ratio/Low temperature contrast ratio: DMS 903
- Reflectance: X-RITE Ci7800

Note :

- Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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.
- 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. (See FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

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

- The White luminance uniformity on LCD surface is then expressed as :
 $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$



- The color coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white according to CIE1931. Measurements shall be made at the center of the module with JF YAG backlight. .
- Response time (black to white): $Tr + Tf$ White(90%) to Black(10%). As shown in figure 5-3, the time needed for the transmittance to change from 10% to 90% is Tr , and 90% to 10% is Tf .
- Response time (G2G) Tij describes the time required to switch from grey level i to grey level j . It is defined by $Tij = Tij90\% - Tij10\%$. $Tij,10\%$: time to achieve 10% level of luminance change $\Delta L = Lj - Li$ switching from grey level i to grey level j ; $Tij,90\%$: time to achieve 90% level of luminance change $\Delta L = Lj - Li$ switching from grey level i to grey level j . To check grey to grey response time, 42 transitions between 7 equidistant grey levels have to be measured.

level		Current data						
		0	43	85	128	170	212	255
previous data	0	*	*	*	*	*	*	*
	43	*	*	*	*	*	*	*
	85	*	*	*	*	*	*	*
	128	*	*	*	*	*	*	*
	170	*	*	*	*	*	*	*
	212	*	*	*	*	*	*	*
	255	*	*	*	*	*	*	*

5.0 OPTICAL TEST APPENDIX

Figure 5-1 The Definition of Vth & Vsat

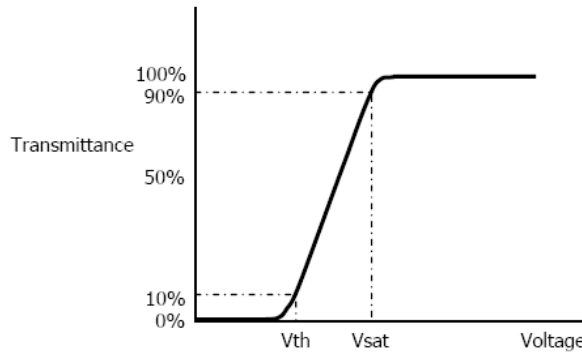


Figure 5-2 Measurement Set Up

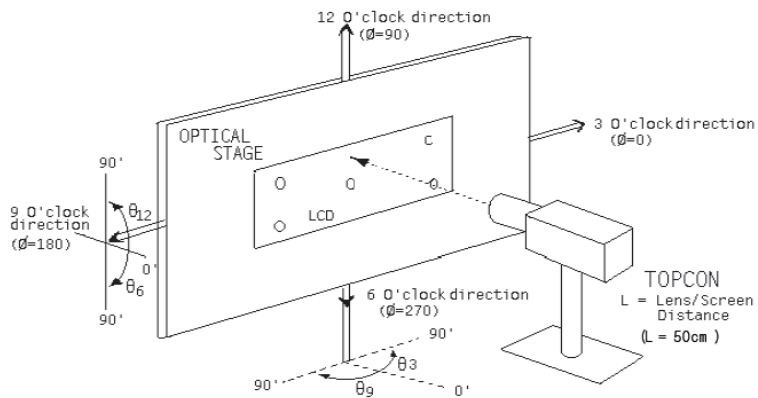
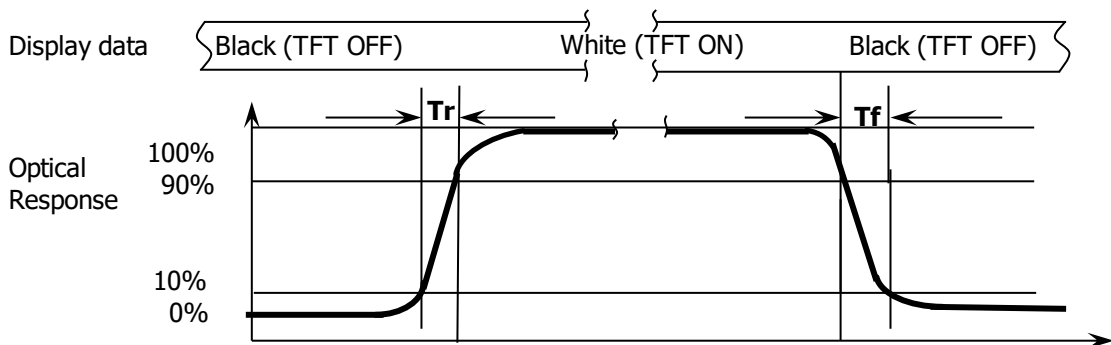


Figure 5-3 Response Time Testing



6.0 MECHANICAL CHARACTERISTICS

6.1 Dimensional Requirements

Figure in next page shows mechanical outlines for the panel

<Table 6-1 Dimensional Parameters>

Parameter	Specification	Unit
Active Area	152.4(H) X 91.44(V)	mm
Number of pixels	800(H) X 480(V)	Pixels
Pixel pitch	0.1905(H) X RGB X 0.1905 (V)	mm
Pixel arrangement	RGB Vertical stripe	-
Display colors	16.7M	colors
Display mode	Normally black	-
Module thickness	6.6(body)	mm
Module outline	164.3(H) x 106.54(V)	mm
AA-MDL outline L/R/U/D	6.9/5/5/10.1	mm

8.0 RELIABILITY TEST**8.1 Reliability Test Conditions**

No	Test Items	Conditions	Reference
1	High temperature storage test	Ta = 90 °C, 500 hrs	The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours. These defects can't be accepted: 1.Air bubble 2.Seal leak 3.Non-display 4.Missing segments 5.Glass crack
2	Low temperature storage test	Ta = -40 °C, 500 hrs	
3	High temperature operation test(Note 1)	Ta = 85°C, 500 hrs	
4	Low temperature operation test	Ta = -40 °C, 500 hrs	
5	High temperature & high humidity operation test	Ta = 60 °C, 90%RH, 500 hrs	
6	Thermal shock	Ta = -30 °C ↔ 85 °C , 30min/10s/30min, 200 cycle, Non-operation	
7	Image Sticking	Burn in: 5x5 Checkerboard, 2h@+25°C , perpendicular view. Inspection Pattern:50% grey, the mura must disappear completely after 5 min, Burn in: 5x5 Checkerboard, 2h@+65°C , perpendicular view. Inspection Pattern:50% grey, the mura must disappear completely after 5 min,	The low and high temp. tested with different sample.
9	Mechanical Shock (Note2)	3 directions: X,Y,Z axes Repeats: 6 Peak acc.: 100G Pulse duration: 6 ms(half sine wave) Non-Operating	IEC60068-2-27Ea
10	Mechanical Vibration (Note2)	3 directions: X,Y,Z axes(40 minutes in each direction) Sweep time : 10(1Oct/min) Frequency: 10->150->10Hz 10-58Hz: constant amplitude 0.75 mm peak 58-150Hz: constant acceleration 5 g peak Sinusoidal, Non-Operating	IEC60068-2-6Fc

Note 1、 Panel surface temperature should not exceed 85°C.

Note 2、 For Module internal structure robustness test purpose only. Customer application cluster design should take care of overall mounting robustness with display module.

Note 3、 Operating @-40~-30°C , no display function issues.

8.2 Electrostatic Discharge (ESD)

Test	Conditions	Method	Remark
ESD	R=330Ω, C=330pF, • Air discharge:±8 KV(class B), ±15Kv(class C)display surface • Contact discharge:±8 KV (class B), to metal frame	IEC61000-4-2	Operating

Note 1、 The TFT-LCD Panel and IC on module are sensitive to electrostatic discharge. Please make sure equipments and operators are properly ground before during handing.

Note 2、 As different customer application have different interfacing designs and assembly processes, the touch panel module has no ESD protection circuitry. Customer is required to take special care on ESD level control in the assembly and test processes.

9.0 INTERFACE CONNECTION

9.1 The LCD Module Electrical Interface Connection

The Recommended connector is Hirose “FH28D-50S-0.5SH”

The connector interface pin assignments are listed in Table 9-1

Table 9-1 Pin Assignments for the LCD Connector

PIN	SYMBOL	Description	Remark
1	VDD_OTP	Power for OTP	NC for Customer, No need connect
2	VCC	Power supply (3.3V)	
3	VCC	Power supply (3.3V)	
4	GND	Ground	
5	Fail_DET	Fail detection signal output	H:Abnormal L:Normal
6	BIST	L:Normal H:Bist Mode	NC For Customer, Suggest connect to GND
7	DE	Data enable signal	
8	GND	Ground	
9	CLK	Data clock	
10	GND	Ground	
11	B7	Blue data(MSB)	
12	B6	Blue data	
13	B5	Blue data	
14	B4	Blue data	
15	B3	Blue data	
16	B2	Blue data	
17	B1	Blue data	
18	B0	Blue data(LSB)	
19	GND	Ground	
20	G7	Green data(MSB)	
21	G6	Green data	
22	G5	Green data	
23	G4	Green data	

PIN	SYMBOL	Description	Remark
24	G3	Green data	
25	G2	Green data	
26	G1	Green data	
27	G0	Green data(LSB)	
28	GND	Ground	
29	R7	Red data(MSB)	
30	R6	Red data	
31	R5	Red data	
32	R4	Red data	
33	R3	Red data	
34	R2	Red data	
35	R1	Red data	
36	R0	Red data(LSB)	
37	GND	Ground	
38	RESET	reset pin, active low	
39	STBYB	Standby mode setting pin, active low	
40	SDA	Serial interface address and data	NC For Customer,Suggest connect to GND
41	SCL	Serial interface clock input	NC For Customer, Suggest connect to GND
42	CSB	Serial Interface chip enable signal	NC For Customer, Suggest connect to VCC
43	TS1	Thermistor Sensor	
44	TS2	Thermistor Sensor	
45	K1	LED Cathode1	
46	K2	LED Cathode2	
47	K3	LED Cathode3	
48	NC	NO connection	
49	LEDA	LED Anode	
50	LEDA	LED Anode	

10.0 SIGNAL SPECIFICATION

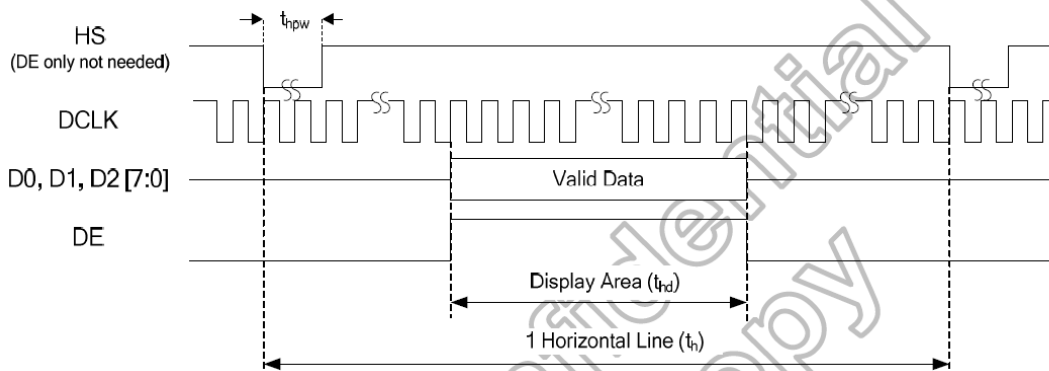
10.1 TTL Signal Timing

Table 10-1 TTL Signal Timing

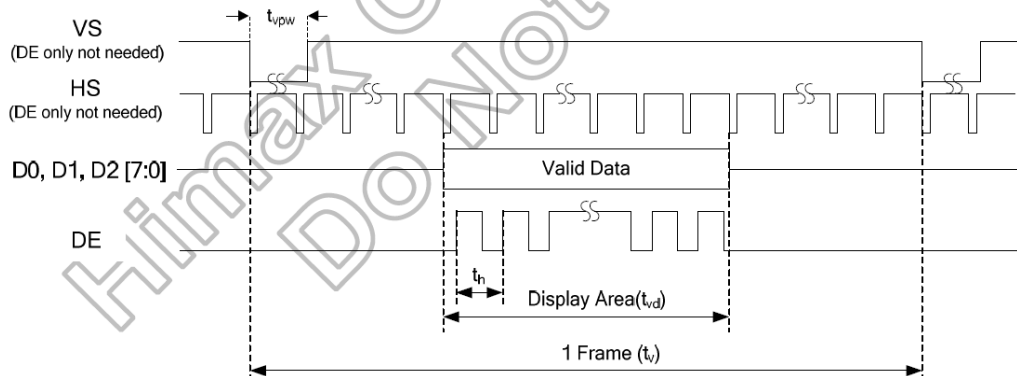
Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	CLK	24.25	26.03	36.3	MHz
Horizontal Display Area	Thd	800			DCLK
1 Horizontal line	Th	830	880	968	DCLK
Vertical Display Area	Tvd	480			H
1 Vertical Field	Tv	487	493	625	H
Frame Frequency	Fframe		60		Hz

10.2 Signal Format

- Horizontal

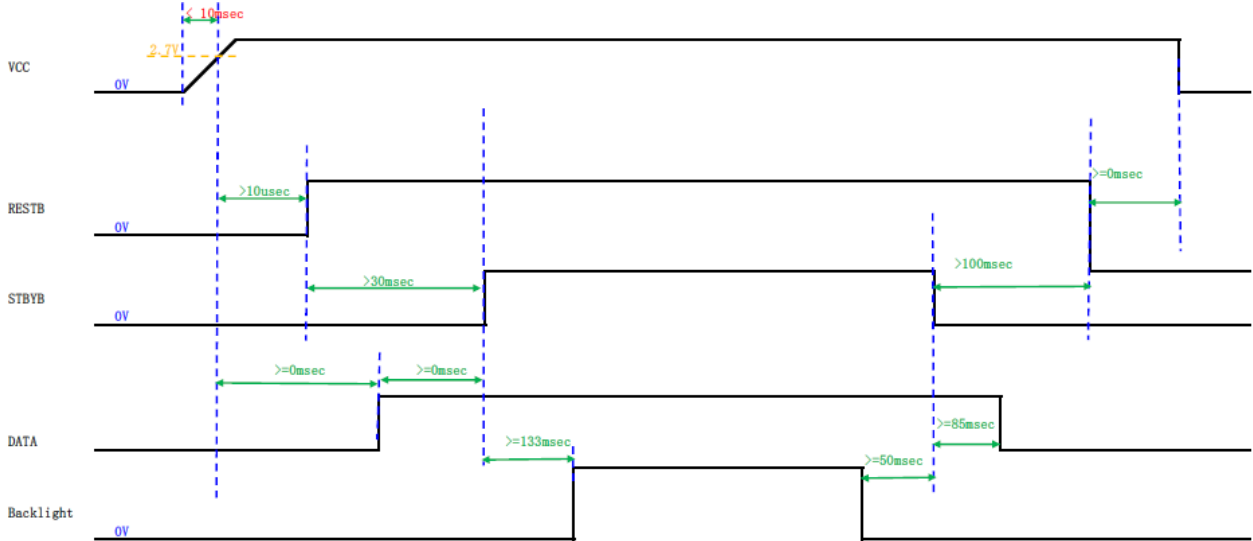


- Vertical

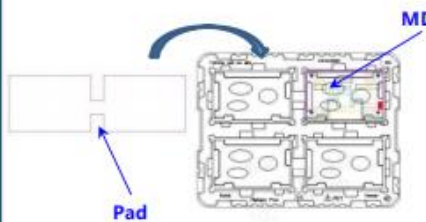
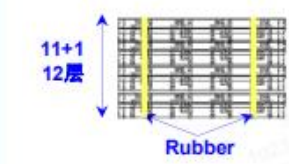
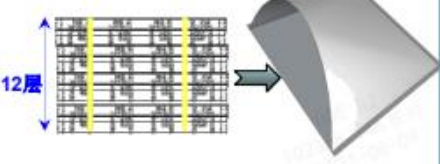





11.0 POWER ON/OFF SEQUENCE

11.1 POWER ON SEQUENCE



12. Package

<p>Put 4 MDL upon Tray , Put 1 Pad upon 2 MDL.</p> <p>4 MDL/ Tray ; 2 Pad/Tray</p>	<p>Put 11 full Tray with MDL & Pad , Put 1 dummy Tray on the top , then rubber band.</p> <p>44 MDL/22 Pad/12 Tray</p>	<p>Put 12 Tray into 1 Shielding Bag. Vacuum pressure : -8KPa~-6KPa</p> <p>44 MDL/ Box ; 1 Bag/ Box</p>
 <p style="text-align: right;">Step 1</p>	 <p style="text-align: right;">Step 2</p>	 <p style="text-align: right;">Step 3</p>
<p>Put 2 Cushion & 12 Tray into 1 Box , sealing box with type "H" .</p> <p>2 Cushion/Box ; 44 MDL/Box</p>	<p>Put 1 Dual Cover on pallet , Put 18 Outer Box on Dual Cover ,2x3x3.</p> <p>1 Dual Cover/Pallet ; 18 Outer Box/Pallet</p>	<p>Put 8 Paper Corner , 3 layers stretch film wind 5 surface , belt pack with total 4 line , paste Label.</p> <p>792 MDL/Pallet</p>
 <p style="text-align: right;">Step 4</p>	 <p style="text-align: right;">Step 5</p>	 <p style="text-align: right;">Step 6</p>

Remark:

This PS is used in the sample stage. If there is any change point in the follow-up FS, the business and schedule need to be reconfirmed.

BOE**BOE**

BOE Technology Group Co., Ltd.

page number: - 1/ 9 -

version : Rev.1

File Name

Incoming Inspection Spec For Customer

Effective date : 2021.08.03

Incoming Inspection Spec Approval Sheet

Product Description: __TFT-LCD-LCM__

BOECD Product Name: __7WV__

Customer : _ITELMA_

Customer Signature	Date	BOE Signature	Date

Content

A: Incoming Inspection Specification

1. Introduction
 - 1.1. Scope
 - 1.2. Incoming Inspection Right
 - 1.3. Operation Instruction
2. Generals
 - 2.1. Sampling Method
 - 2.2. Inspection Environment
 - 2.3. Definitions
3. Inspection Criteria
 - 3.1. Visual Inspection Criteria
 - 3.2. Appearance Inspection Criteria

B: Customer Quality Service Process

A: Incoming Inspection Specification

1.0 Introduction

1.1. Scope

This incoming Inspection Standard is limited to the TFT-LCD LCD which supplied by BOE Technology Group Co.,Ltd. (hereinafter called the "Supplier") to its Customer.

1.2. Incoming inspection Right

The buyer (customer) shall inspect the LCD within twenty days from receiving as inspection period at its own cost. The results of the inspection, acceptance or rejection shall be notified to Supplier .

The buyer may, under commercially reasonable reject procedures, reject an entire lot within inspection period, define unacceptable LCD number in accordance with incoming inspection standard. Should the buyer fail to notify the result of the inspection to supplier within the inspection period, the buyer's right to reject the LCD shall lapse and whole lot shall be deemed to have been accepted by the buyer.

1.3. Operation Instruction

1.3.1 Mounting Method

- As the panel of LCD which consists of two thin glasses with polarizers was easily get Damaged, please handling LCD cautiously.
- Excessive stress or pressure on the glass of the LCD should be avoided. Please insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- Abnormal display may occur under press setting problem from customer, which does not mean the malfunction of the LCD and should be verified by both party.
- Optimum mounting angle was determined based on specified viewing angle range.
- Please assemble LCD module in accordance with the specification.
- Please mark condition of humiture.

1.3.2 Caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals that not to touch the polarizers or it may leads the polarizers to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent (recommended below) to clean the LCD's surface with wipe lightly.
-IPA(Isopropyl Alcohol),Ethyl Alcohol, Trichlorotrifloroethane
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers

and others. Do not use the following solvent.

-Water, Ketone, Aromatics

- It is recommended that the LCD be handled with soft material during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint. To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.
LCD should be stored in static-protective & vacuum polythene bag, please assemble it
When it expose to the air within 3 days to avoid ITO corrosion
- Please clean the LCD without ultrasonic to avoid line open.
- Temperature of clean and bake should be less than 80°C.

1.3.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

1.3.4 Caution For operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature(hot to cold or cold to hot) ,the LCD may be affected; specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at

temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.
- Static electricity (ESD) will damage the panel,. Please make sure that operators wear static-protective glove effectively and working tables & device are effectively grounded during operation and other ESD protective method
- Please place LCD on the tray provided by BOE while moving it, in order to avoid mechanical damage.
- LCD should be stored in required humidity. Low humidity may add static, while high humidity may corrode the ITO circuit of LCD product.
- Before use the LCD. Please check the Engineering specification.
- Please keep the LCD in the specified, original packing boxes when storage.
- LCD contain a small amount of Liquid Crystal and Mercury. Please follow local ordinances or regulations for disposal.
- DO NOT press the area covered with PET or such materials. These are weak point of LCD since of TCPs (Driver ICs) and PWBs.
- Please DO NOT touch the surface of glass (Polarizer).

2.0 Generals

2.1. Sampling Method

Unless otherwise agreed upon in writing ,the sampling inspection shall be applied to the customer's Incoming inspection.

2.1.1. Lot Size: 1 pallet per same model;

2.1.2. Sampling type: Random sampling;

2.1.3. Inspection level: II

2.1.4. Sampling table: MIL-STD-105E

Major Defect: AQL=0.65

Minor Defect: AQL=1.5

2.2. Inspection Environment

2.2.1. Inspection environment conditions:

a. Room temperature: 25±3 °C ;

b. Humidity: 60 ± 20% RH;

c. Inspection Ambient Illumination : 300~700 Lux (<100 Lux for function test);

2.2.2. Viewing Distance

The distance between the panel and the inspector's eyes shall be at 30CM~50CM;

2.2.3. Viewing Angle

performing in front of the panel All directions for inspecting the sample should be:

ADS Production: within 45° to perpendicular line.;

TN Production: within 10° to perpendicular line.;

2.2.4. Inspection Area :

Display Area (Active Area)

2.3. Main Defect Definitions

2.3.1 Black / White Spots

Points on display which appear Black/ white at L0/L127/L255 .

2.3.2. Dark / Bright Lines

Lines on display which appear dark/bright at R/G/B. such as vertical, horizontal, or cross lines.

2.3.3. Bright Dot Defects

Dots(sub-pixels) on display which appear bright in the display area at R/G/B.

2.3.4. Dark Dot Defects

Dots(sub-pixels) on display which appear dark in the display area at R,G,B Color Pattern.

2.3.5. Mura

Mura on display which appears darker / brighter against background brightness on parts of display area at L0/L127/L255

2.3.6. Visual Inspection

Inspect PNL in operation

2.3.7. Appearance Inspection

External inspection for Panel in Non Operation

3.0 Inspection Criteria

3.1. Visual Inspection Criteria

Dimensional unit: mm

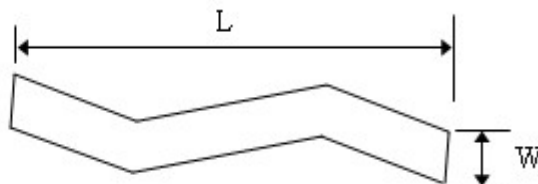
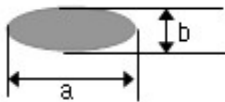
Items		Details	Inspection Criteria		Type	
			A Area	B/C Area		
	Pixel Defects	Bright Dot	N≤0	Ignore	Major	
		Dark Dot	N≤4			
		Bright + Dark Dot	N≤4			
		2S	N≤1			
	Line Defects	Bright Line, Dark Line	Not Allowed			Minor
	No Display		Not Allowed			
	Abnormal Display		Not Allowed			
Mura		5%ND not visible, or reference limit samples				

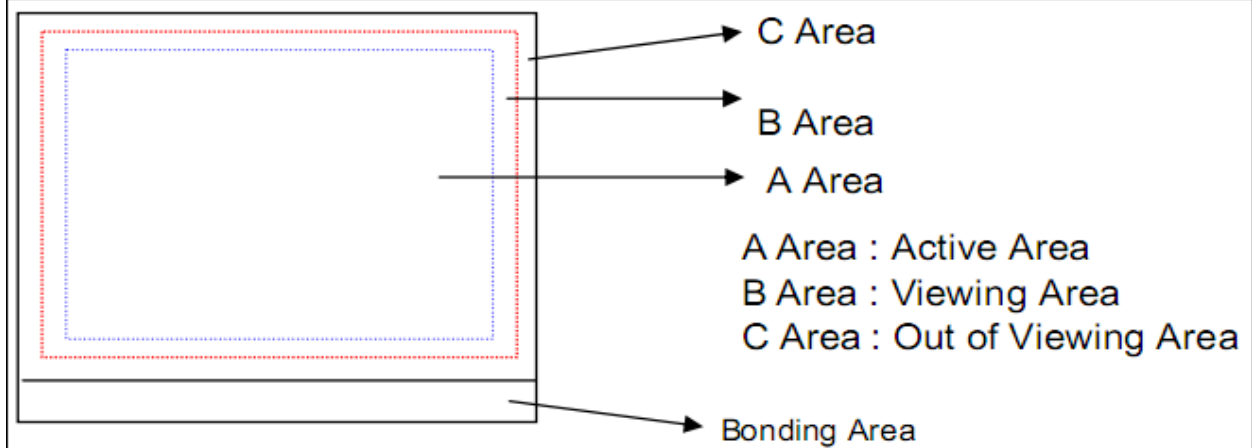
Remark: The determination of all defects is based on the panel with Polarizer.

※ Note 1) D = Diameter, L = Length, W = Width, N = Number

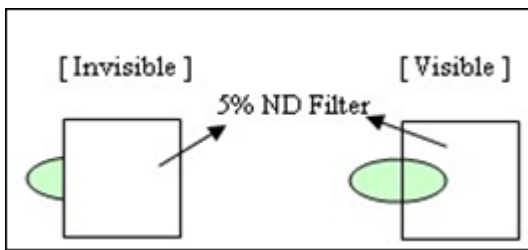
※ Note 2) Definition of the Area A Area: Display area B/C Area: No display area

$$D = (a + b) / 2$$



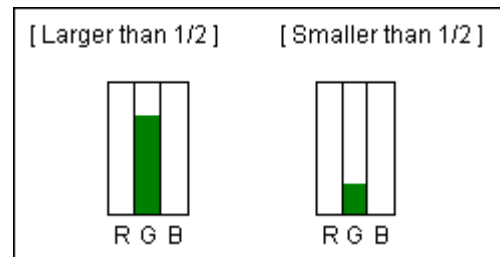


※Note 3) For pixel defect, dot means a sub-pixel. Dot defects should be larger than half size of a sub-pixel.
Dot which is invisible through 5% ND filter or smaller than 1/2 of sub-pixel size will not counted as "1 dot" defect.



"No dot defect"
(=ignored)

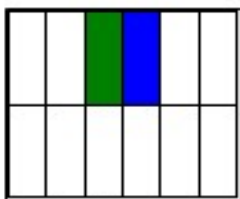
"1 dot defect"
(=counted)



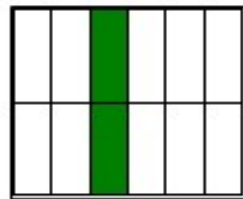
"1 dot defect"
(=counted)

"No dot defect"
(=ignored)

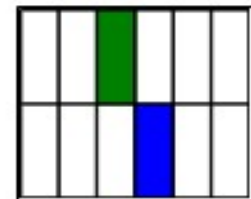
[2 adjacent dots defect]



Type 1



Type 2



Type 3

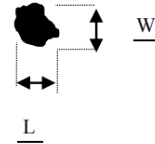
※Note 4) Circular/Linear Type defect, color will be ignored. And only control the size.

3.2.Inspection Conditions

3.2.1Circular defects

Circular defects requirement – LCD

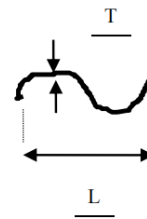
Size (mm)	Acceptance number	
	Active area	Black border
$D \leq 0.15$	No count	No count
$0.15 < D \leq 0.4$	4(with distance $\geq 10\text{mm}$)	
$D > 0.4$	0	



Remark: $D = (\text{Length} + \text{Width}) / 2$, for L and W.

Long defects

Size (mm)		Acceptance number	
		Active area	Black border
$T \leq 0.05$		No count	No count
$0.05 < T \leq 0.1$	$0.5 \leq L \leq 3.0$	3(with distance $\geq 10\text{mm}$)	
$T > 0.1$	$L > 3$	0	

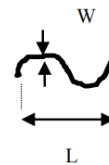


Remark: T = defect thickness, L = defect contour length.

3.2.1Scratch

Table 21: Scratch

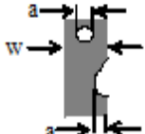
Size (mm)		Acceptance number	
		Active area	Black border
$W \leq 0.05$		No count	No count
$0.05 < W \leq 0.1$	$0.5 \leq L \leq 3.0$	3 (with distance $\geq 10\text{mm}$)	
$W > 0.1$	-	0	



Remark: W= defect thickness, L = defect contour length.

3.2.1FPC defects Fpc

FPC defects

Items	Size (mm)	Acceptance criteria
FPC defect Fpc 	Dent, Pinhole $a \leq w/3$	No count
	Open circuit	0
	Oxidation, contamination and distortion	0

3.2.1Bubble in polarizer

Item	Acceptance number		
	Size 尺寸 (mm)	Active Area	Black boarder
Bubble in polarizer	$D \leq 0.15$	No count	No count
	$0.15 < D \leq 0.3$	3(with distance $\geq 10\text{mm}$)	
	$D > 0.3$	0	

Remark: $D = (\text{Length} + \text{Width}) / 2$, for L and W.

3.2.2Other cosmetic defects

Table 26: Other cosmetic defects

Item	Criteria of acceptance	Inspection pattern
Mura (Non-uniformity)	Invisible through a 5% ND filter	Pure black and pure white

Other defects refer to QUA-012B

B : BOE Customer Quality Service Process

In order to provide better service to Customer, BOE shall apply the after-sales product quality service process as below:

- 1.0.** According to the P/O from Customer, BOE should deliver required product to the place appointed by Customer.
- 2.0.** Customer will do IQC for the incoming product.
- 3.0.** Inspection standard should be provided by BOE, and it will be valid after confirmed by Customer. Inspection and Defects determination should be carried out according to the standard agreed by both Parties.
- 4.0.** In order to guarantee in-time communication of product quality information and effective service, QA staff on Customer side should send Weekly Quality Report to the appointed CS staff in BOE.
- 5.0.** BOE should cooperate with Customer for special quality requirement.
- 6.0.** After confirmed by both side, BOE should be responsible for the defect products which caused by its quality problem.
- 7.0.** Customer should use the LCD product according to the instruction. BOE will not be responsible for the defect product caused by violation of Users' Instruction.
- 8.0.** Both parties should deal with the quality problem with friendly cooperative policy. And both parties should negotiate to deal with the defect products of which the responsibility is not very clear.
- 9.0.** The warranty of the product is 12 months after the delivery date.

The warranty will be avoided in cases of below:

- a. When the warranty period is expired.
- b. When the LCMs were repaired by 3rd party without Supplier's approval.
- c. When the LCMs were treated like disassemble and rework by the Customer and/or customer's representatives without Supplier's approval.