TITLE: TPA038-002V03(AA)

Product Specification

ITEM	SIGNATURE	ITEM	SIGNATURE		
Prepared		Checked			
Countersigned		Approved			

Beijing BOE Special Display Technology CO.,LTD

CONTENT LIST

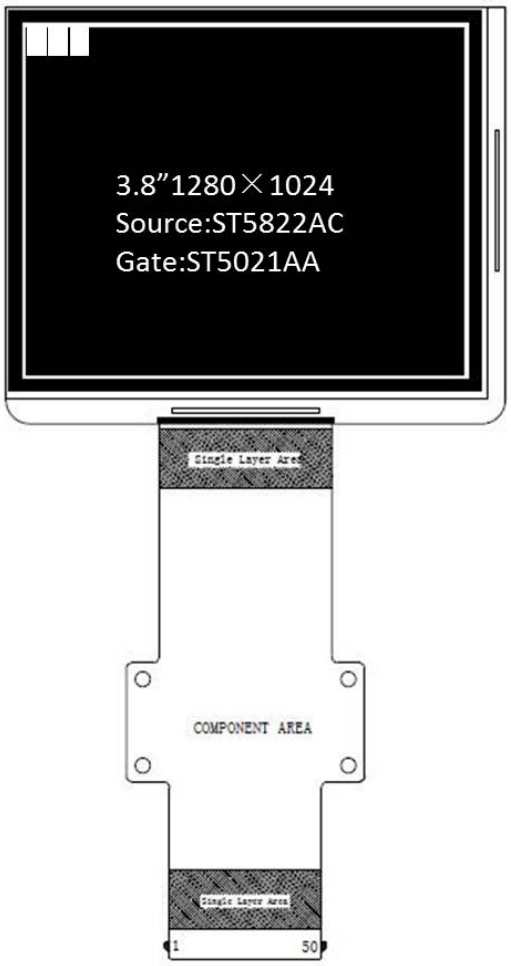
Records Of Revisions

Revision	Date	Page	Description	Released by
Rev.0	2019.1.2		Initial Released	Zhang Xiao

1.0 GENERAL DESCRIPTION

1.1 Introduction

TPA038-002V03(AA) is a monochrome active matrix TFT-LCD Panel using LTPS TFT's (Thin Film Transistors) as an active switching devices. It is a transmissive type display operating in the normal black. This TFT-LCD has a 3.8 inch diagonally measured active area with 1280*1024 resolutions (1280 horizontal by 1024 vertical pixel array).



1.2 Features

- 0.5t Glass(Single)
- Thin and light weight
- High transmittance and contrast ratio , wide viewing angle
- RoHS Compliant

1.3 General Specifications (H: horizontal length, V: vertical length)

Parameter	Specification	Unit	Remark
Active Area	75.37(H) × 60.29 (V)	mm	
Number of Pixels	1280(H)dot × 1024(V)	pixels	
Pixel Pitch	0.05888(H) ×0.05888(V)	mm	
Pixel Arrangement	Vertical Stripe		
Display Colors	Monochrome		
Display Mode	Normally black, Transmissive mode		
Dimensional Outline	83.77(H) × 70.1(V) × 1.0(D)	mm	Unit Cell
Viewing Direction (Human Eye)	U/D/L/R free viewing direction		Note 1
Weight	20(typ.)	g	
Surface Treatment	HC		

Note:

1. At the U/D/L/R direction, the viewing angle is same.

2.0 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. Make sure all the design characteristics are adequate before the panel is initialed. All the measurements should be operated with driver IC and experimental FPC mounted.

[VSS = GND = 0V]

Parameter	Symbol	Min	Max	Unit	Remark
Operating Voltage	V_{op}	3.0	3.6	V	Ta = 25℃
Operating Temperature	T_{OP}	-40	+80	℃	
Storage Temperature	T_{ST}	-55	+85	℃	
Operating Ambient Humidity	Hop	20	80	%RH	Note 1
Storage Humidity	Hst	20	80	%RH	Note 1

Note：

1. Temp≤40℃ 90% RH MAX.

3.0 ELECTRICAL SPECIFICATION

Parameter	Symbol	Value			Unit	Remark
		min	typ	max		
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
Power Supply Current	I_{DD}	-	-	120	mA	
Power Consumption	P_D	-	-	0.4	W	
In-Rush Current	I_{RUSH}	-	-	3	A	

4.0 OPTICAL SPECIFICATIONS

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Topcon SR-UL1R and Westar TRD-100A) 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.

4.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ3	CR>10	80	-	-	°	Note 1
		Θ9		80	-	-	°	
	Vertical	Θ12		80	-	-	°	
		Θ6		80	-	-	°	
Contrast Ratio		CR	Θ= 0°	-	1000	-	-	Note 2
Transmittance		T(%)	Θ= 0°	-	14%	-	-	Note 3
Response Time		Tr+Tf	Θ= 0°	-	25	30	ms	Note 4
Cross talk		-		-	-	2%	-	Fig.3

Note:

1. 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 (see FIG.1). Viewing angle measuring is based on WV Pol attached.

2. Contrast measurements shall be made at viewing angle of Θ= 0° 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 FIG.1) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Transmittance is the value with Polarizer.

4. The electro-optical response time measurements shall be made as FIG.2 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is Tf, and 90% to 10% is Tr.

Figure 1. Measurement Set Up

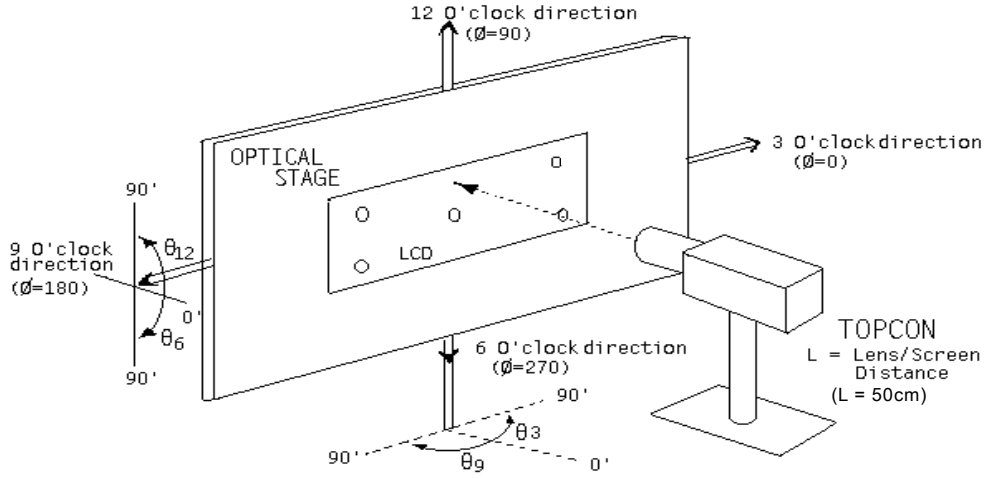


Figure 2. Response Time Testing

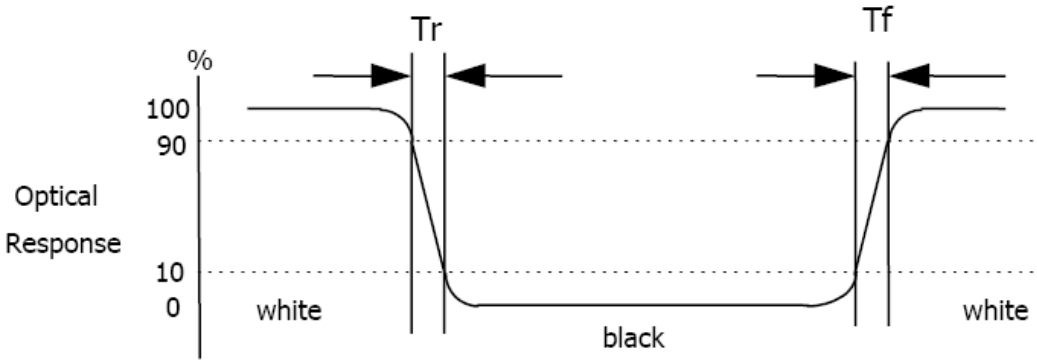
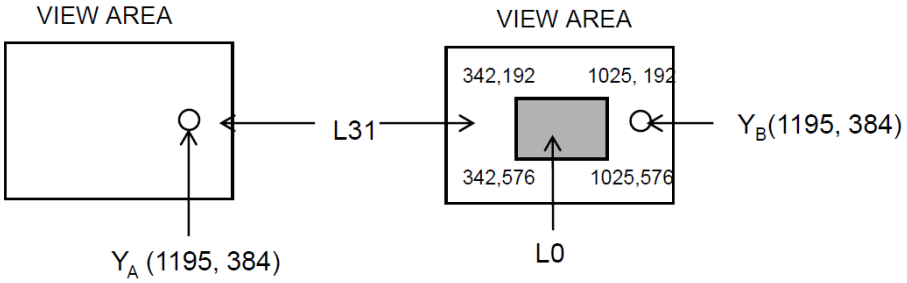


Figure 3. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:

Y_A = Initial luminance of measured area (cd/m^2)

Y_B = Subsequent luminance of measured area (cd/m^2)

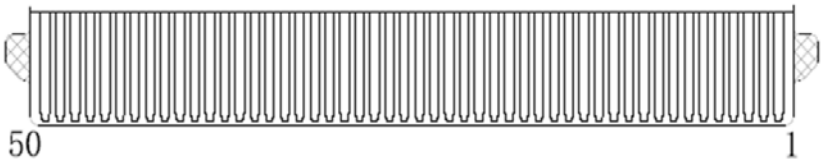
The location measured will be exactly the same in both patterns

5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

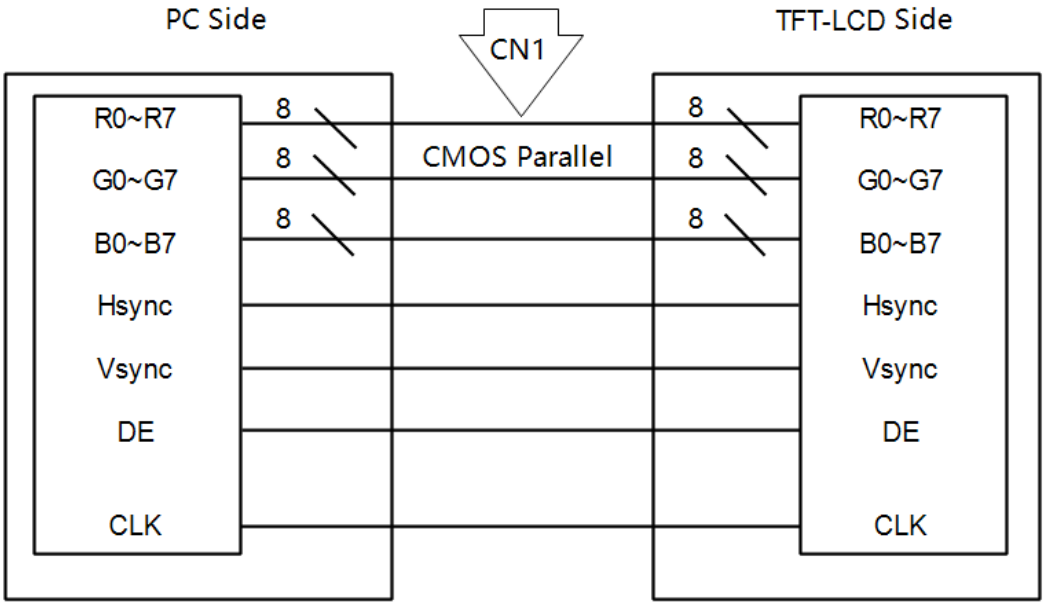
The electronics interface connector is HIROSE FH28-50S-0.5SH or Compatible.

The connector interface pin assignments are listed as follow.



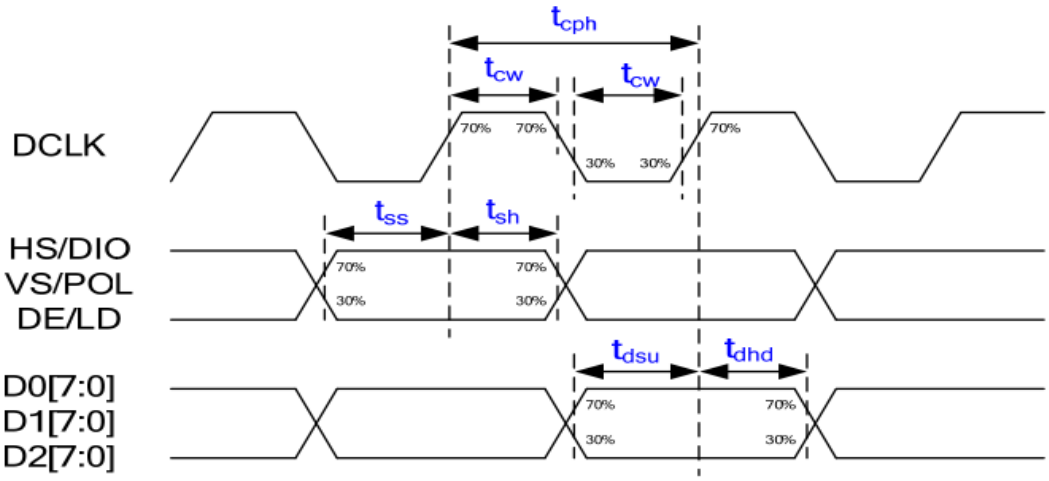
No.	Definition	Functions	No.	Definition	Functions
1	GND	Ground	26	GND	Ground
2	VCC	Power supply 3.3V	27	DATA3_0	B0
3	VCC	Power supply 3.3V	28	DATA3_1	B1
4	GND	Ground	29	DATA3_2	B2
5	STBYB	Standby Mode Enable	30	DATA3_3	B3
6	RSTB	RESET	31	DATA3_4	B4
7	DFB	Driver IC Feedback signal	32	DATA3_5	B5
8	GND	Ground	33	DATA3_6	B6
9	DATA1_0	R0	34	DATA3_7	B7
10	DATA1_1	R1	35	GND	Ground
11	DATA1_2	R2	36	HSYNC	Horizontal Sync
12	DATA1_3	R3	37	DE	Pixel Data Enable
13	DATA1_4	R4	38	VSYNC	Vertical Sync
14	DATA1_5	R5	39	DCLK	Clock for Pixel
15	DATA1_6	R6	40	UD	UP/DOWN Scan
16	DATA1_7	R7	41	LR	Left/Right Scan
17	GND	Ground	42	BGR	Pixel Inversion
18	DATA2_0	G0	43	SCL	SCL of IIC
19	DATA2_1	G1	44	SDA	SDA of IIC
20	DATA2_2	G2	45	CSB	Chip select signal
21	DATA2_3	G3	46	GND	Ground
22	DATA2_4	G4	47	ROM-RLB	Reload Control
23	DATA2_5	G5	48	MTP_VCC	MTP Enable
24	DATA2_6	G6	49	VCC	Power supply 3.3V
25	DATA2_7	G7	50	GND	Ground

5.2 RGB Interface



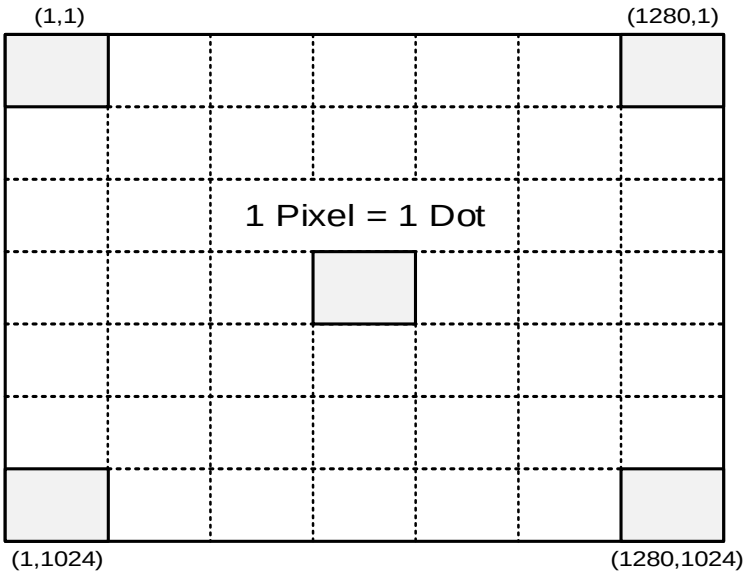
Note. Transmitter : Thine THC63LVDM63A or equivalent.
Transmitter is not contained in Module.

5.3 RGB Input signal



Note. Pin connection in case of using Thine THC63LVDM63A

5.4 Data Input Format



Display Postion of Data (V-H)

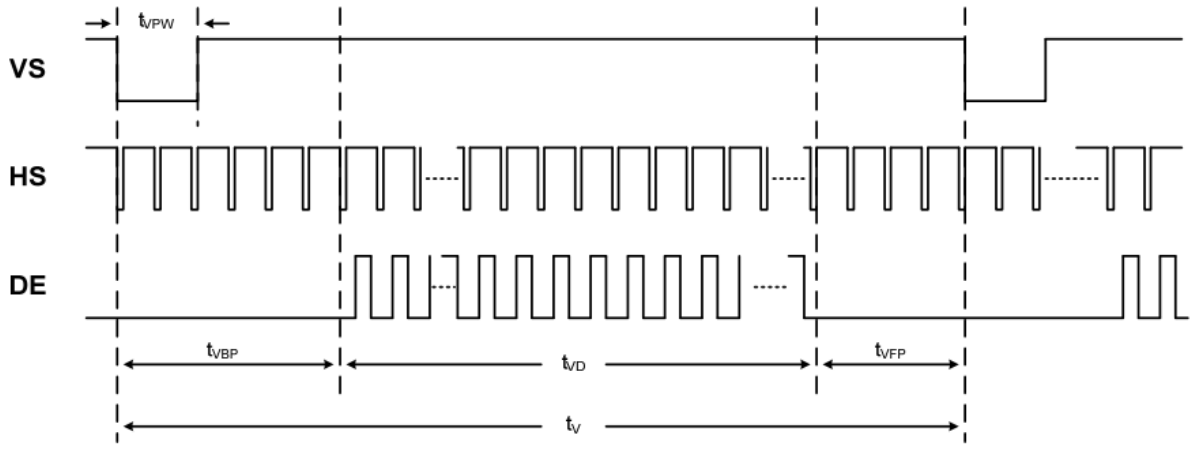
6.0 SIGNAL TIMING SPECIFICATION

6.1 Signal timing table

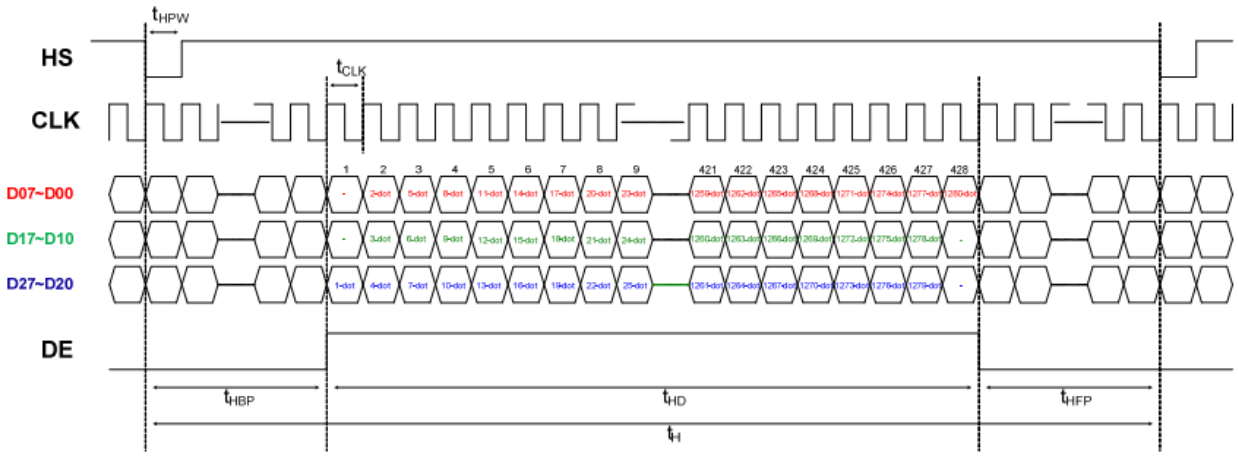
Parameter	Definition	Value			Unit
		Min.	Recommend	User Define	
CLK Frequency	t_{CLK}	27.8	30.2	42.8	MHz
Horizontal back porch	t_{HBP}	5	5	5	t_{CLK}
Horizontal display area	t_{HD}	428	428	428	t_{CLK}
Horizontal front porch	t_{HFP}	15	34	200	t_{CLK}
Horizontal period	t_{H}	448	467	633	t_{CLK}
Horizontal pulse width	t_{HPW}	1	1	1	t_{CLK}
Vertical back porch	t_{VBP}	2	2	2	t_{H}
Vertical display area	t_{VDP}	1024	1024	1024	t_{H}
Vertical front porch	t_{VFP}	7	51	100	t_{H}
Vertical period	t_{VD}	1033	1077	1126	t_{H}
Vertical pulse width	t_{VPW}	1	1	1	t_{H}

6.2 Gate/source control timing

Vertical input timing



Horizontal input timing



7.0 Input Signals Display Colors & Gray Scale of Colors

The brightness of each primary color (Monochrome) is based on the 6-bit gray scale data input for the Color.The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input

Color		Data Signal																							
		Gray								Gray								Gray							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray scale of Monochrome	Gray0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Gray253	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray254	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray scale of Monochrome	Gray0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Gray2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	Gray253	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Gray254	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Gray255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray scale of Monochrome	Gray0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gra1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Gray2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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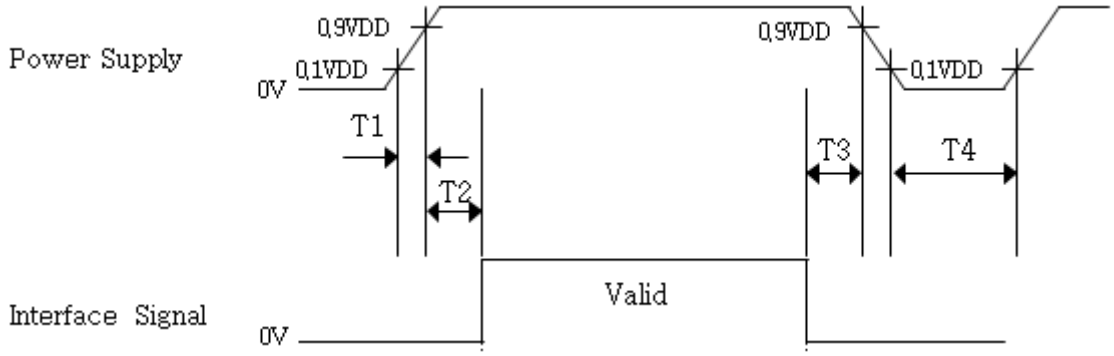
	Gray253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Gray254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Gray255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note(1) 0:Low Level Voltage, 1:High Level Voltage

8.0 Power Sequence

To prevent a latch-up or DC operation of the Open Cell, the power on/off sequence shall be as shown in below.



0.5 ms ≤ T1 ≤ 10 ms
0 ms ≤ T2 ≤ 50 ms
0ms ≤ T3 ≤ 50 ms
1 sec ≤ T4

9.0 Mechanical Characteristics

9.1 Dimensional Requirements

Parameter	Specification	Unit	Remark
Panel size	83.77(H) ×70.1(V)	mm	
CF size	80.92(H) × 65.84 (V)	mm	
Active area	75.37(H) × 60.29 (V)	mm	
Number of pixels	1280(H) dot × 1024 (V)	pixels	
Pixel pitch	0.05888(H) ×0.05888(V)	mm	
Pixel arrangement	Vertical Stripe		
Dimensional outline	83.77 (H)×160.1 (V)×1.23 (D)	mm	FOG
Display mode	Normally Black		

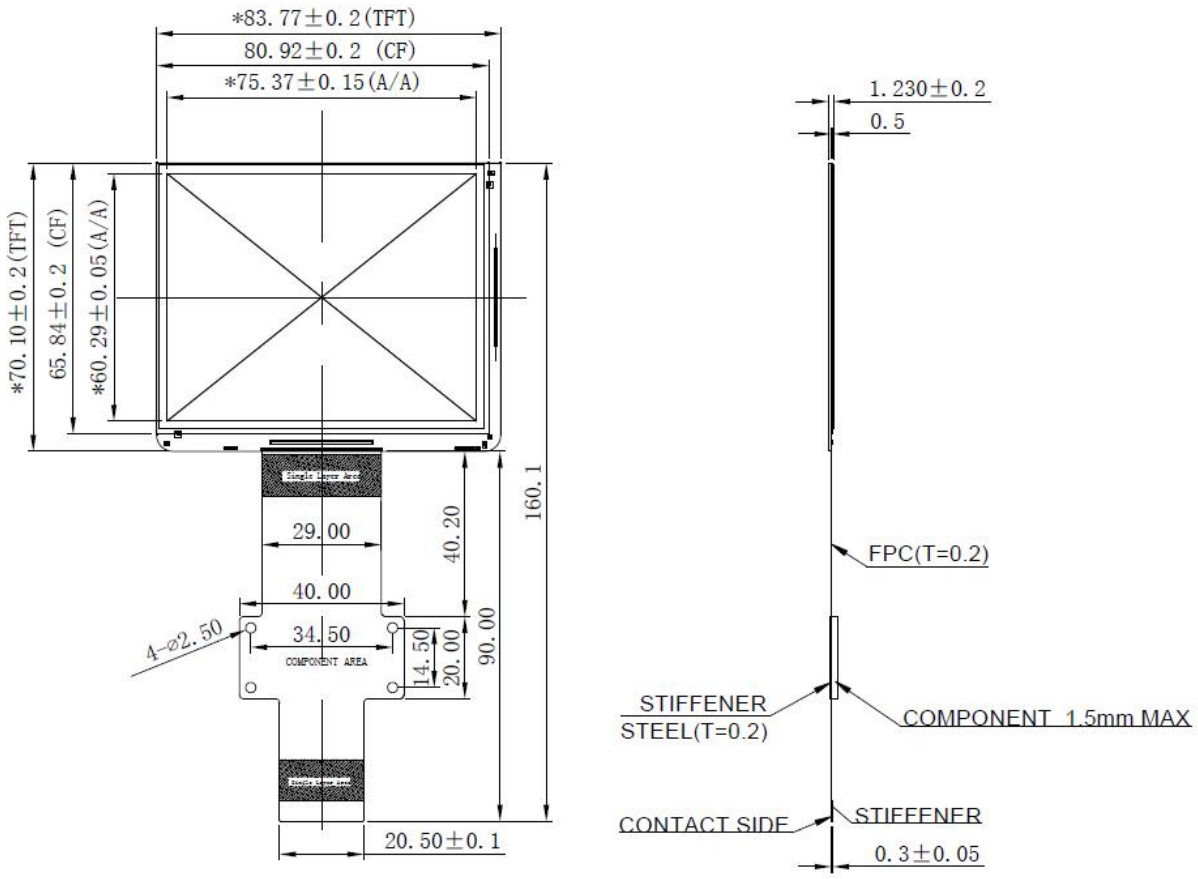
9.2 Mounting

See FIG.5.

9.3 Glare and Polarizer Hardness

The surface of the LCD has a hard coating to reduce scratching.

Figure 5. Open Cell Outline Dimensions (unit: mm if unspecified)



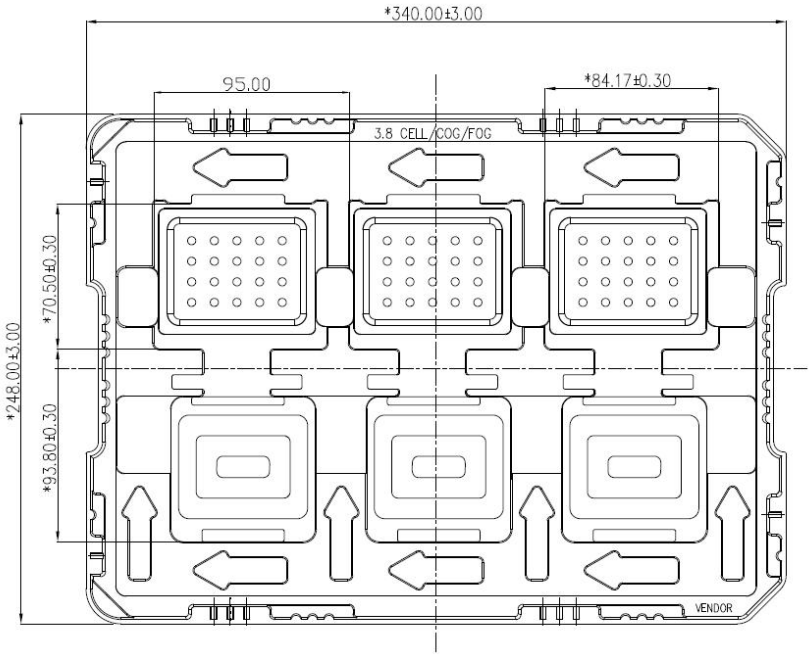
10.0 RELIABILITY TEST

NO	Test Item	Test Condition	Duration
1	Low temperature operation test(LTO)	-40 ℃	2hr
2	High temperature operation test(HTO)	+80 ℃	2hr
3	High temperature storage test(HTS)	+85℃	48hr
4	Low temperature storage test(LTS)	-55℃	24hr
5	Thermal shock test (TST)	+85 ℃：hold for 0.5hr -55 ℃：hold for 0.5hr	20 cycles
6	High temperature, high humidity storage test(THS)	+60℃、95% humidity	240hr

11.0 PACKING

11.1 Packing Tray

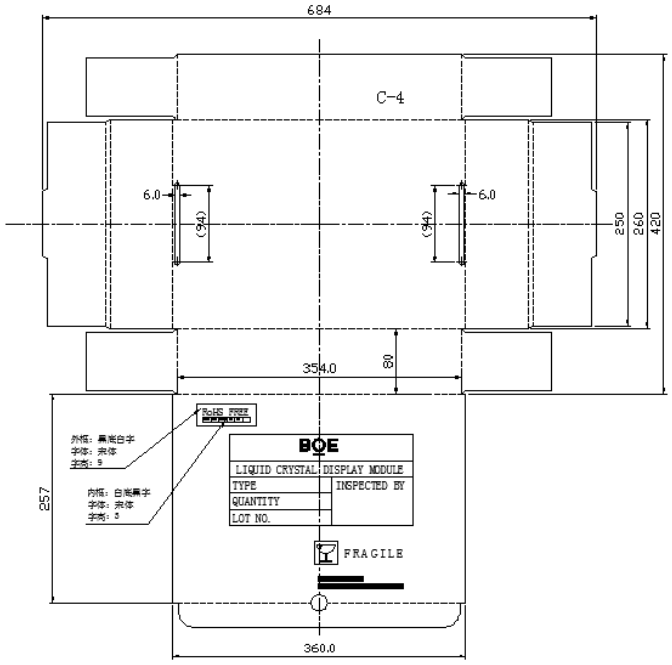
<Tray Size> L: 340 mm; W: 248 mm; 3pcs/tray

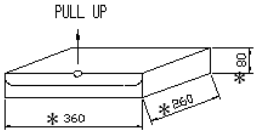


11.2 Inner Box

<Inner Box Size> L: 360mm; W: 260mm; H:80mm

*** 3 tray (with OC) plus 1 Tray (without OC) are packed in a vacuum with PE bag and put in every inner box**

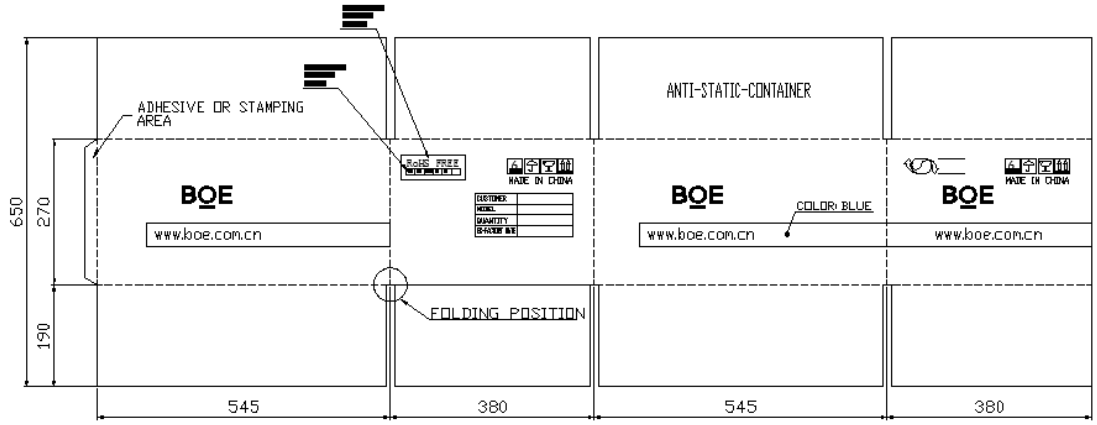


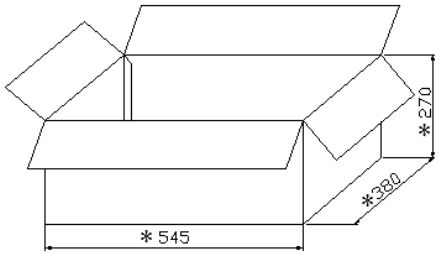


11.3 Outer Box

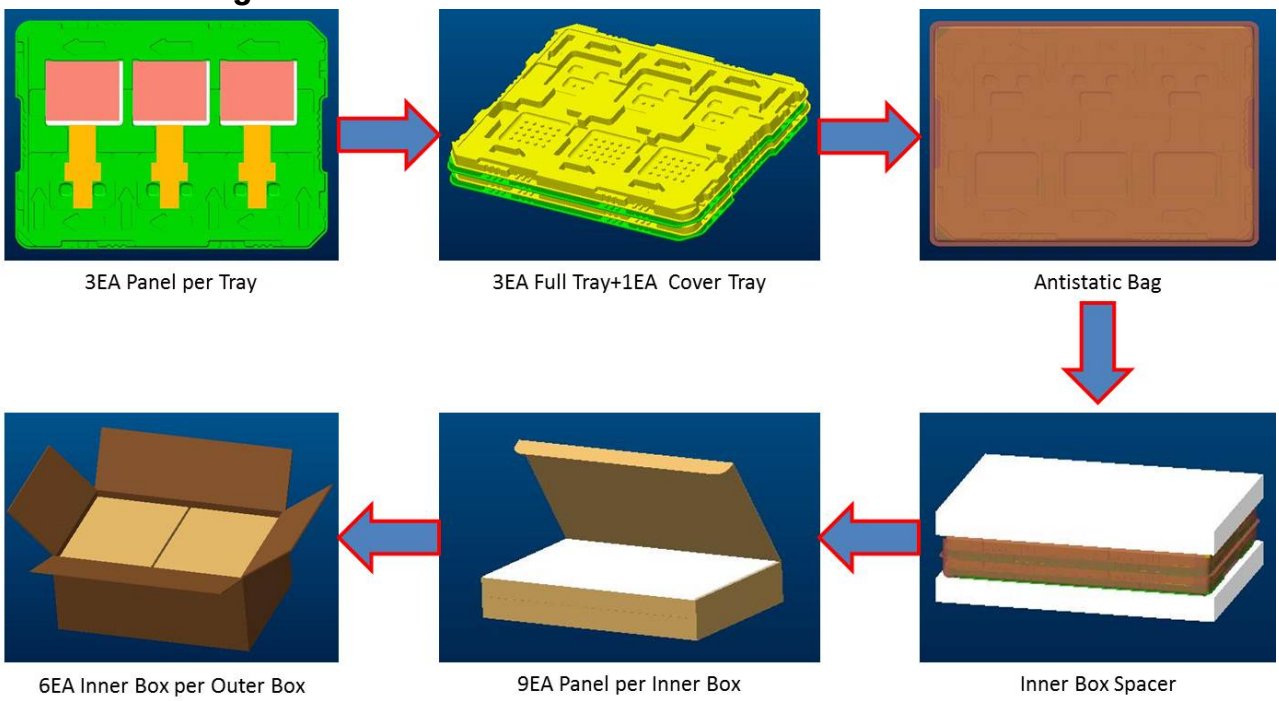
<Outer box size> L:545mm; W:380mm; H:270mm

6pcs inner box /Outer Box





11.4 Packing Process



11.5 Packing Notice

- Panel should be placed upwardly while in the tray.
- Every eight full trays with a blank one while twining twice on both sides by adhesive tape.
- Every tray should be put crossly.
- Panels should be packed in a vacuum with PE (anti-ESD) bag.

12.0 Handling & Cautions

12.1 Mounting Method

● The panel of the LCM consists of two thin glasses with polarizer which easily get damaged. So extreme care should be taken when handling the LCM.

● Excessive stress or pressure on the glass of the LCM should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCM unit when it is mounted.

● If the customer's set presses the main parts of the LCM, the LCM may show the abnormal display. But this phenomenon does not mean the malfunction of the LCM and should be pressed by the way of mutual agreement.

● To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.

● Mount a LCM with the specified mounting parts.

12.2 Caution of LCD Handling and Cleaning

● Since the LCM 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 maybe broken.

● The polarizer on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizer or it leads the polarizer to be deteriorated.

● If the use of a chemical is unavoidable, use soft cloth with solvent recommended below to clean the LCM's surface with wipe lightly.

-IPA (Isopropyl Alcohol), Ethyl Alcohol, Tri-chloro, tri-florothane.

● Do not wipe the LCM's surface with dry or hard materials that will damage the polarizer and others. Do not use the following solvent—Water, acetone, Aromatics.

● It is recommended that the LCM be handled with soft gloves during assembly, etc.

The polarizer on the LCM's surface are vulnerable to scratch and thus to be damaged by shape particles.

● Do not drop water or any chemicals onto the LCM's surface.

● A protective film is supplied on the LCM and should be left in place until the LCM 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 from the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

● Please clean the LCD without ultrasonic to avoid line open.

12.3 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.

12.4 Caution For operation

- It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.
- Do not connect or disconnect the LCM to or from the system when power is on.
- Never use the LCM under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.
- Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM 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 LCM structure. If the screen is displayed with fixed pattern, use a screen saver.
- Do not disassemble and/or re-assemble LCM module

12.5 Packaging

- Modules use LCM element, and must be treated as such.

  -Avoid intense shock and falls from a height.

  -To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

12.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.

- Original protective film should be used on LCM's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizer.
- Do not store the LCM near organic solvents or corrosive gasses.
- Keep the LCM safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCM is stored for long time in the lower temperature or mechanical shocks are applied onto the LCM.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.

-Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
-Store in a dark place where neither exposure to direct sunlight nor light is.
-Keep temperature in the specified storage temperature range.
-Store with no touch on polarizer surface by the anything else. If possible, store the LCM in the packaging situation when it was delivered.

12.7 Safety

- For the crash damaged or unnecessary LCM, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case of LCM is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water and soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.