



Specification For Approval

Preliminary specification

Final specification

Title	5.0 WVGA TFT-LCD (FOGA)
-------	-------------------------

Buyer	
Model	

Supplier	Cheng Du BOE Optoelectronics Technology CO., LTD
Model	BT050WVAB001

TITLE/SIGNATURE	DATE
_____	_____
_____	_____
_____	_____
_____	_____

Please return one copy confirmation with signature and your comments

ITEM	SIGNATURE	DATE
Approved	_____	_____
Reviewed	_____	_____
Reviewed	_____	_____
Prepared	_____	_____

BOE CHENG DU
Optoelectronics Technology CO., LTD



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Record of Revisions

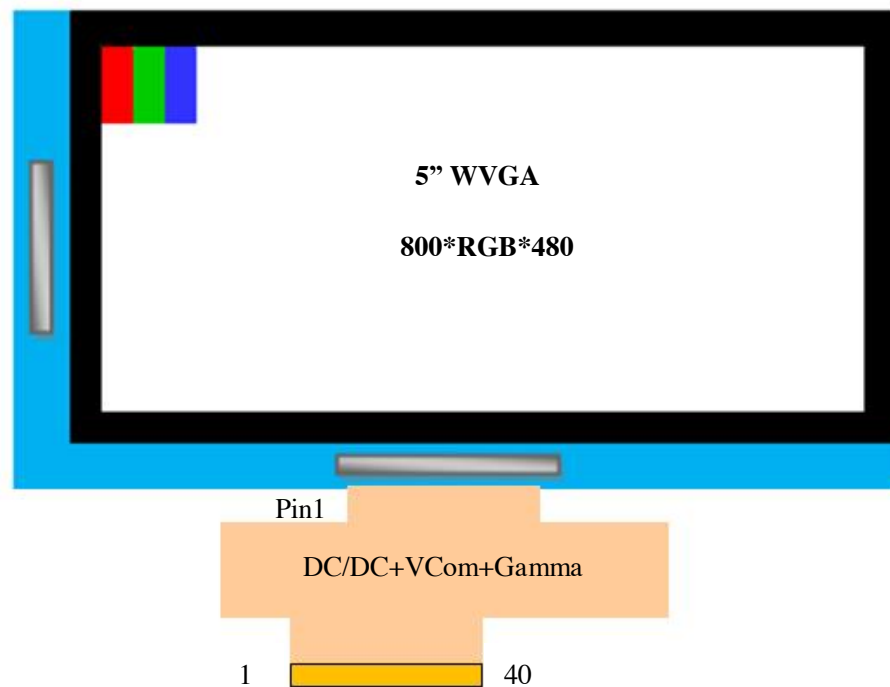
Revision	Date	Page	Description	Released by
Ver0	2010.7.1		Initial Released	Yang Yuqing



1.0 GENERAL DESCRIPTION

1.1 Introduction

BT050WVAB001 is a color active matrix TFT-LCD FOGA using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. It is a transmissive type display operating in the normal white. This TFT-LCD FOGA has a 5.0 inch diagonally measured active area with WVGA resolutions (800 vertical by 480 horizontal pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this panel can display 16M colors.



1.2 Features

0.5t Glass

FOG Design

TTL Interface

8-bit (FRC) color depth, display 16M colors

High luminance and contrast ratio, low reflection and wide viewing angle

DE (Data Enable) & H-Sync & V-sync mode

RoHS Compliant

1.3 Application

Application

**1.4 General Specifications**

Parameter	Specification	Unit	Remark
Active Area	108 (W)×64.8 (H)	mm	
Number of Pixels	800 (W) RGB×480 (H)	pixels	
Pixel Pitch	0.135 ×0.135	mm	
Pixel Arrangement	RGB Vertical stripe		
Display Colors	16M	colors	
Color Gamut	50%(typ.)		
Display Mode	Normally white, Transmissive mode		
Dimensional Outline	114.8 (W)×73.2 (H) ×1.43(D)	mm	
Viewing Direction (Human Eye)	12 O'clock		Note
D-IC		Source	Gate
	HIMAX	HX8264D	HX8664B
	Novatek	NT39416Q	NT52001
	ILITEK	ILI6123C	ILI5960
Weight	TBD (Max)	g	

Note:

Gray Inversion 6:00 o'clock



2.0 ELECTRICAL SPECIFICATION

2.1 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 FPC mounted.

[VSS = GND = 0V]

Parameter	Symbol	Min	Max	Unit	Remark
LC Operating Voltage *1)	V _{op}		3.3	V	Ta = 25°C
Operating Temperature	T _{OP}	-20	+70	°C	
Storage Temperature	T _{ST}	-30	+80	°C	
Operating Ambient Humidity *2)	H _{op}	10	*3)	%RH	*3)
Storage Humidity	H _{st}	10	*3)	%RH	*3)

Note:

*1) Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature.

*2) Temp ≤ 60°C 90% RH MAX

*3) Non-condensation

2.2 Electrical Characteristics

Parameter	Symbol	Value	Unit	Remark
		Reference		
Power Supply Voltage	VDD	2.8~3.6	V	
Power Supply Current	IDD	TBD	mA	
Frame		60	Hz	
Input Signal Voltage	VIH	0.3~0.7 VDD	V	
	VIL	0~0.3VDD	V	

Note:

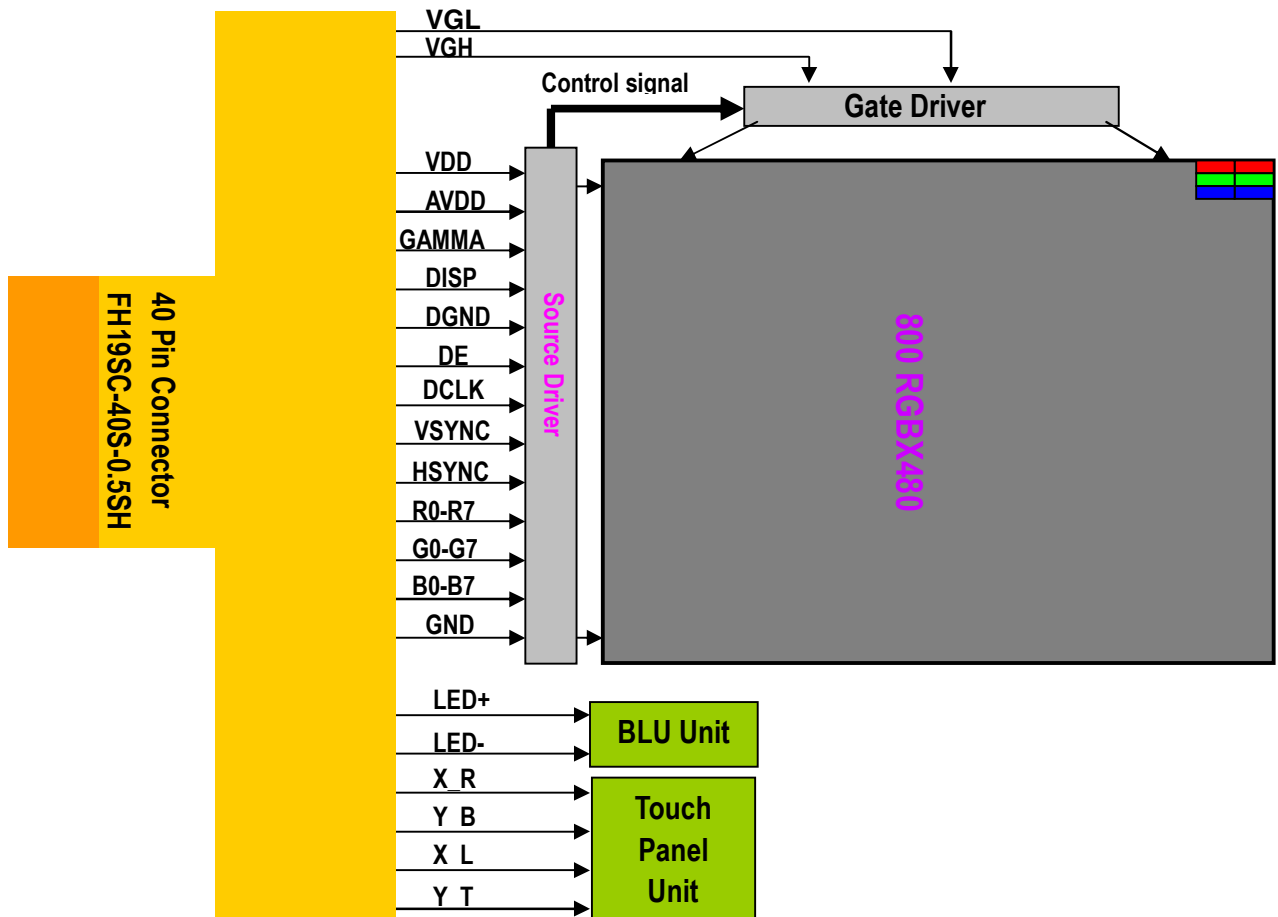
1. V_{GH} is TFT Gate operating voltage.
2. V_{GL} is TFT Gate operating voltage. The low voltage level of VGL signal must be fluctuate with same phase as Vcom, the storage capacitance structure of the product is storage on common.



3. V_{com} must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc.,
We just kindly recommend the setting-voltages the reference value.

In order to get the optimized display quality, the setting-voltage should be changed according to customer's developing condition. (The display quality could be changed by customer's setting -voltage.)

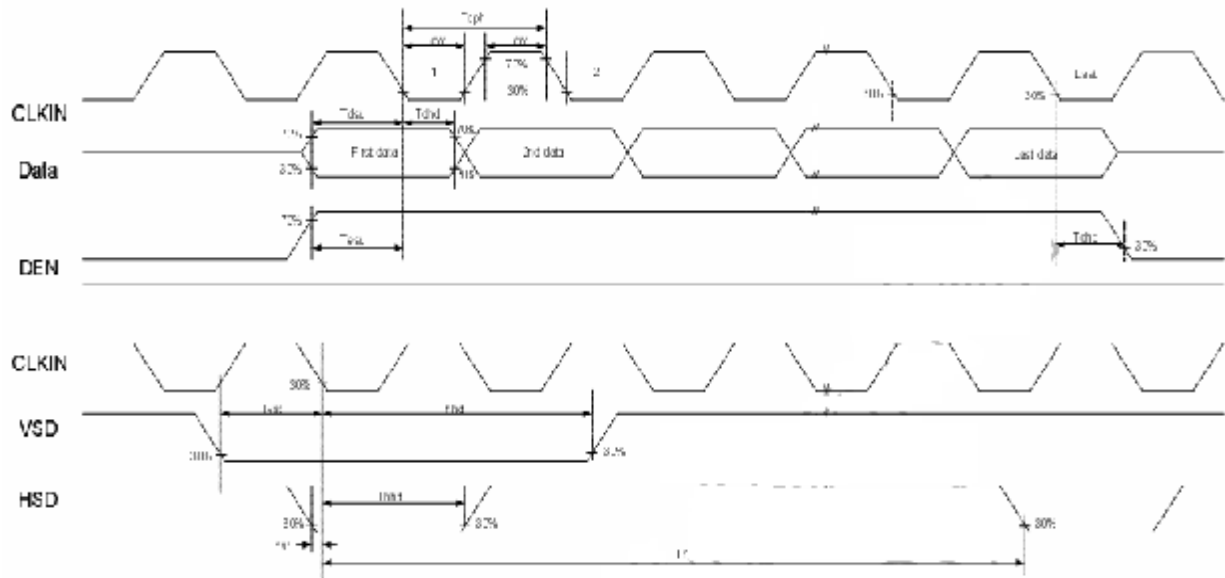
2.3 Block Diagram





2.4 TTL Interface

AC electrical characteristics

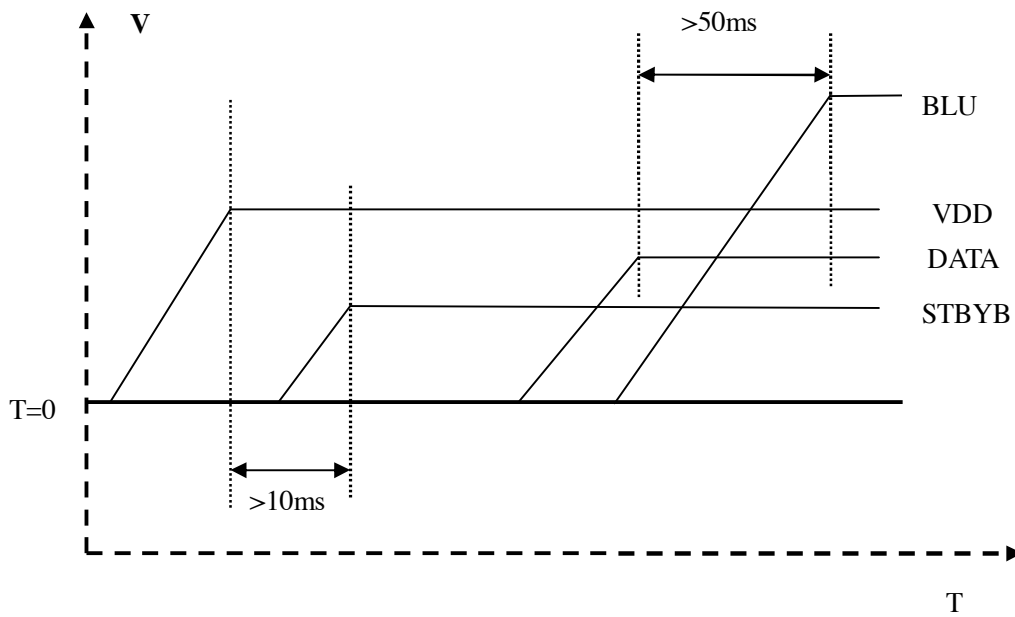


Parameter	Symbol	Spec			Unit:
		Min.	Typ.	Max.	
HS setup time	T _{hst}	8	-	-	ns
HS hold time	T _{hhd}	8	-	-	ns
VS setup time	T _{vst}	8	-	-	ns
VS hold time	T _{vhd}	8	-	-	ns
Data setup time	T _{dsu}	8	-	-	ns
Data hold time	T _{dhd}	8	-	-	ns
DE setup time	T _{esu}	8	-	-	ns
DE hold time	T _{ehd}	8	-	-	ns
VDD Power On Slew time	TPOR	-	-	20	ms
CLKIN cycle time	T _{cph}	20	-	-	ns
CLKIN pulse time	T _{cwh}	40	50	60	%
Output stable time	T _{sst}	-	-	6	us

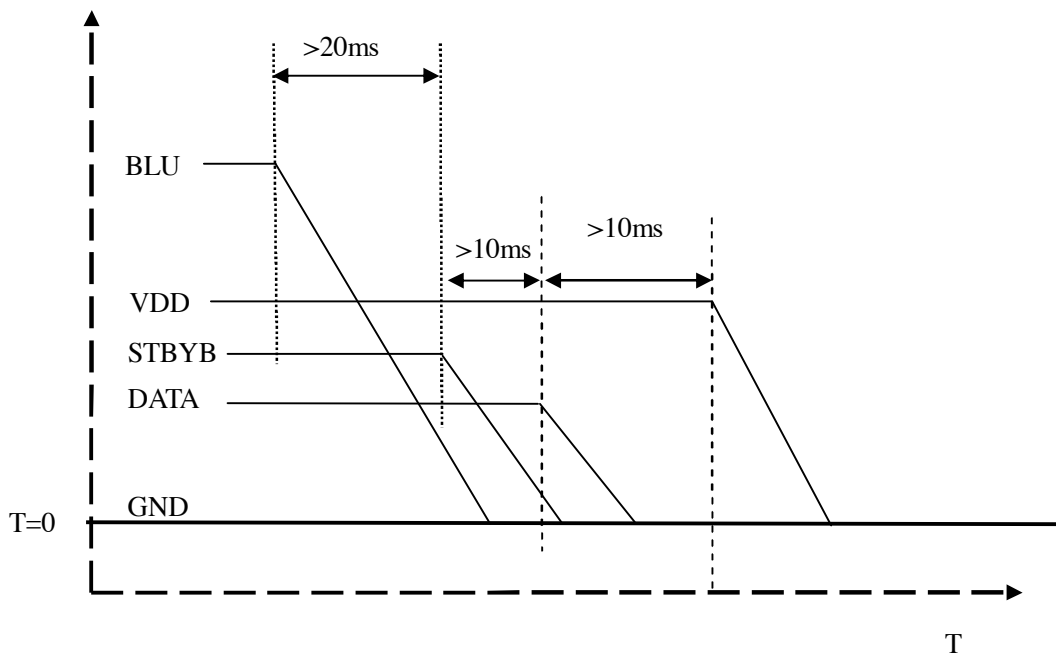


2.5 Power Sequence

2.5.1 Power On (FOGA)



2.5.2 Power Off (FOGA)





3.0 OPTICAL SPECIFICATIONS

3.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) 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. Optimum viewing angle direction is 6 o'clock.

3.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Threshold Voltage		Vsat			TBD		V	Fig.1
		Vth			TBD		V	
Viewing Angle	Horizontal	θ_3	CR>10		60			Note 1
		θ_9			60			
	Vertical	θ_{12}			50			
		θ_6			60			
Contrast Ratio		CR	$\theta = 0^\circ$		500			Note 2
Transmittance		T(%)	$\theta = 0^\circ$		TBD			Note 3
NSTC		%	$\theta = 0^\circ$		50			
Reproduction Of color	Red	Rx	$\theta = 0^\circ$		0.625			Note 4 *Color filter Glass with ITO
		Ry			0.308			
	Green	Gx			0.293			
		Gy			0.517			
	Blue	Bx			0.142			
		By			0.143			
White		Wx	$\theta = 0^\circ$		0.291			
		Wy			0.323			
Response Time		Tr+Tf	$\theta = 0^\circ$		25		ms	Note 5

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 (see FIG.2).
- 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 FIG. 2) 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 color chromaticity coordinates specified in Table1 shall be calculated from The spectral data measured with all pixels first in red, green, blue and white.
Measurements shall be made at the center of the C/F.
Measurement condition is C - light source & Halogen Lamp
5. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF.
The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

Figure 1. The definition of V_{th} & V_{sat}

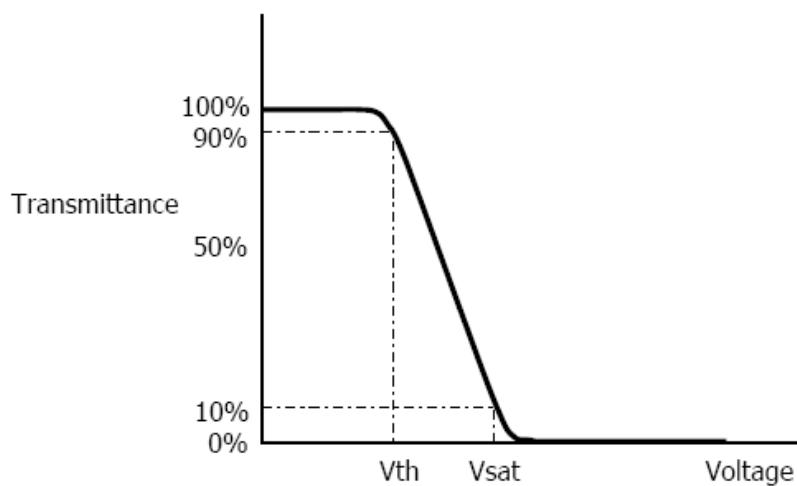




Figure 2. Measurement Set Up

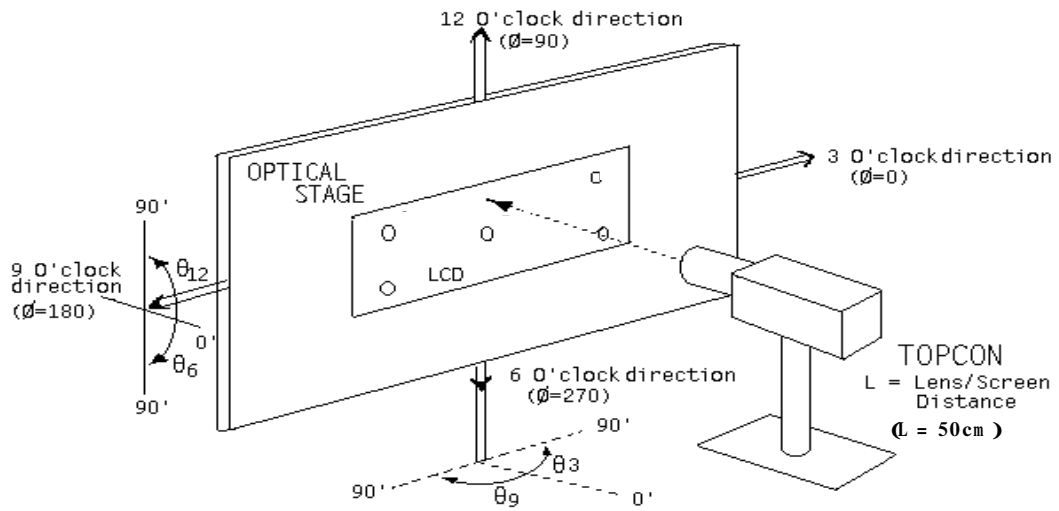
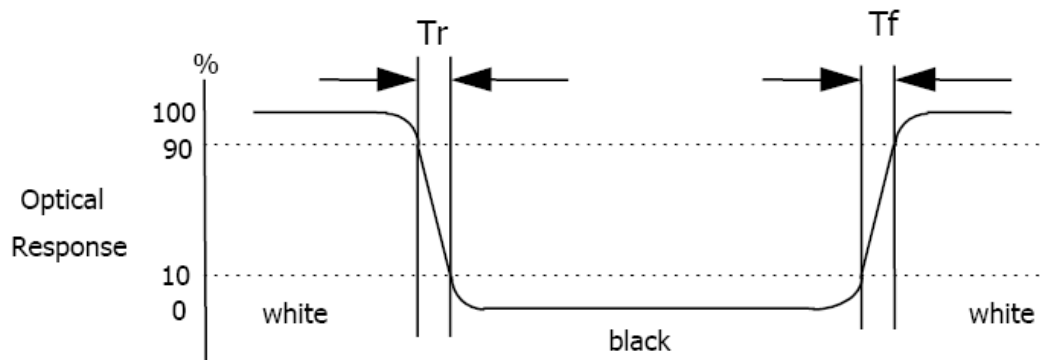


Figure 3. Response Time Testing





4.0 INTERFACE CONNECTION

4.1 Electrical Interface Connection

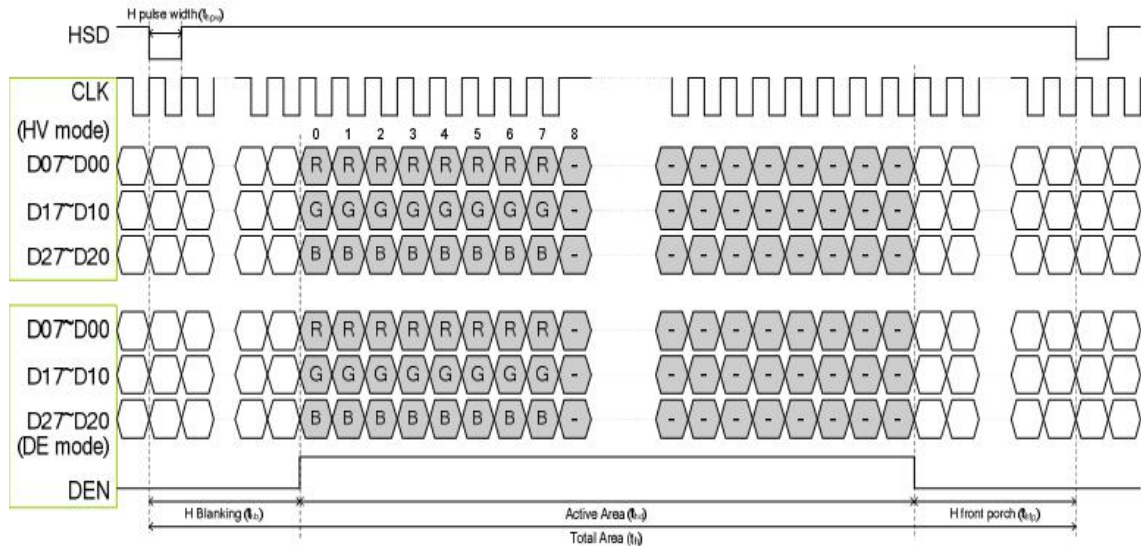
Pin No	Symbol	Function	Pin No	Symbol	Function
1	VLED-	LED Power Cathode	21	B0	Input data Blue
2	VLED+	LED Power Anode	22	B1	Input data Blue
3	GND	Analog Ground	23	B2	Input data Blue
4	VDD	Digital Power	24	B3	Input data Blue
5	R0	Input data Red	25	B4	Input data Blue
6	R1	Input data Red	26	B5	Input data Blue
7	R2	Input data Red	27	B6	Input data Blue
8	R3	Input data Red	28	B7	Input data Blue
9	R4	Input data Red	29	DGND	Digital Ground
10	R5	Input data Red	30	DCLK	Dot clock signal
11	R6	Input data Red	31	DISP	Power saving Control
12	R7	Input data Red	32	HSYNC	Line synchronizing signal
13	G0	Input data Green	33	VSYNC	Frame synchronizing signal
14	G1	Input data Green	34	DE	Data Enable signal
15	G2	Input data Green	35	NC	No connection
16	G3	Input data Green	36	GND	Analog Ground
17	G4	Input data Green	37	X_R	Touch panel Signal (Right)
18	G5	Input data Green	38	Y_B	Touch panel Signal (Bottom)
19	G6	Input data Green	39	X_L	Touch panel Signal (Left)
20	G7	Input data Green	40	Y_T	Touch panel Signal (Top)



5.0 SIGNAL TIMING SPECIFICATION

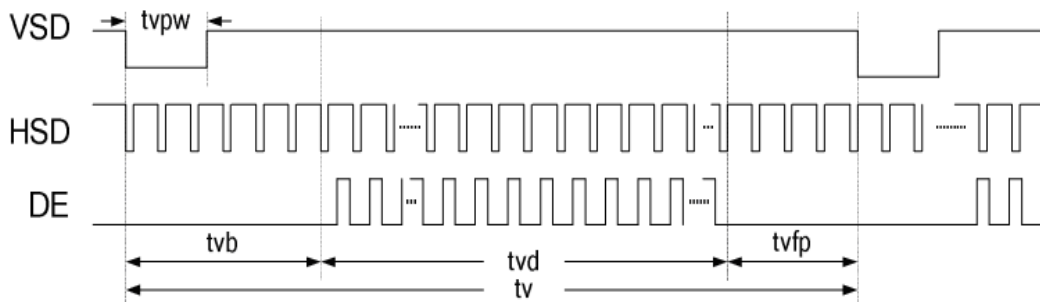
5.1 Timing Parameters (DE & H-Sync & V-Sync mode)

DE & H-Sync mode timing



Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	Thd		800		DCLK
DCLK Frequency	Fclk	-	30	50	MHz
One Horizontal Line	Th	889	928	1143	DCLK
HS Pulse Width	Thpw	1	48	255	DCLK
HS Back Porch(Blanking)	Thb		88		DCLK
HS Front Porch	Thfp	1	40	255	DCLK
DE Mode Blanking	Th-thd	85	128	512	DCLK

V-Sync mode timing





Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
Vertical Display Area	Tvd	480			T _H
VS Period Time	Tv	513	525	767	T _H
VS Pulse Width	Tvpw	3	3	255	T _H
VS Back Porch	Tvb	32			T _H
VS Front Porch	Tvfp	1	13	255	T _H
DE Mode Blanking	Tv-tvd	4	45	255	T _H

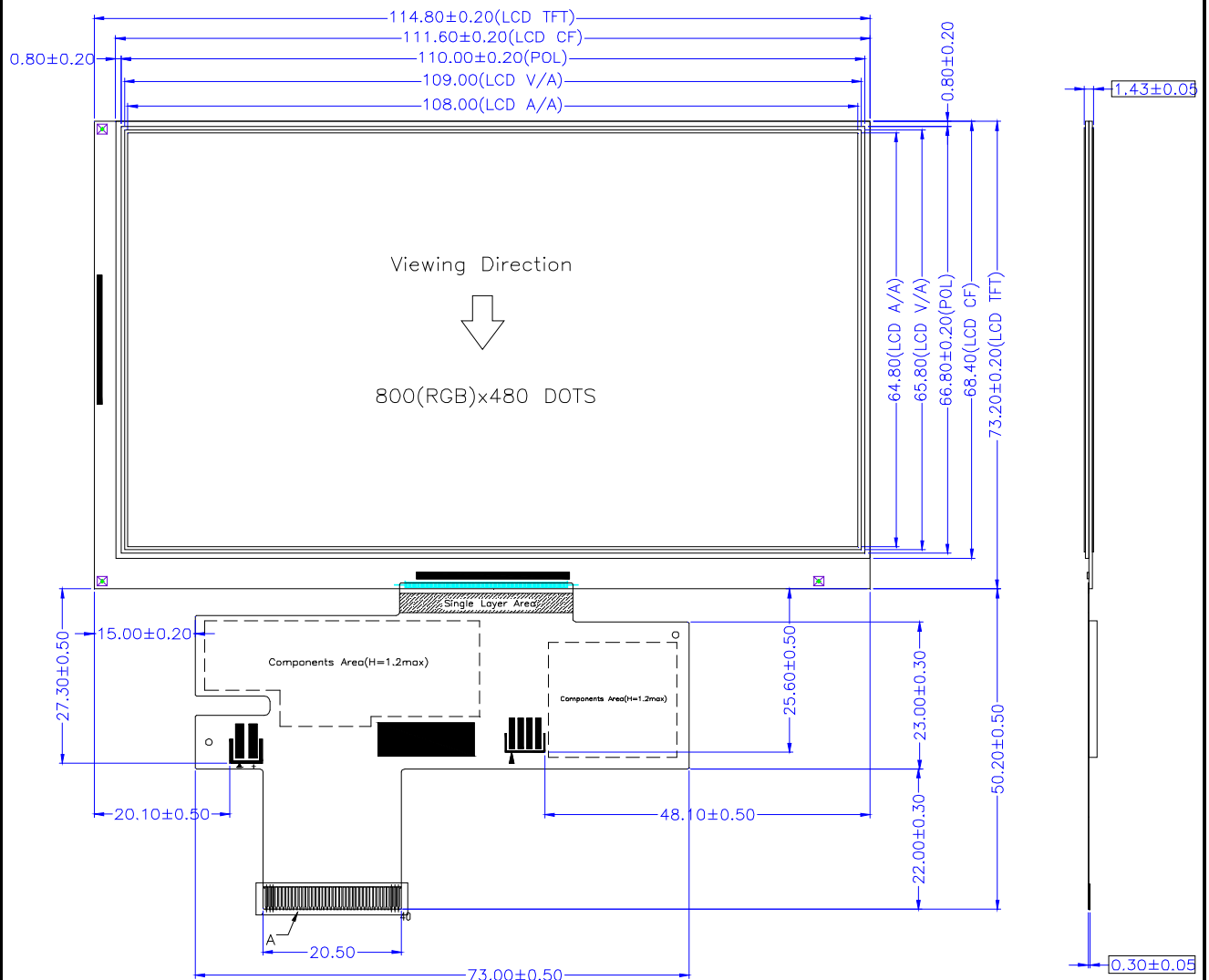


6.0 MECHANICAL CHARACTERISTICS

6.1 Dimension Requirements

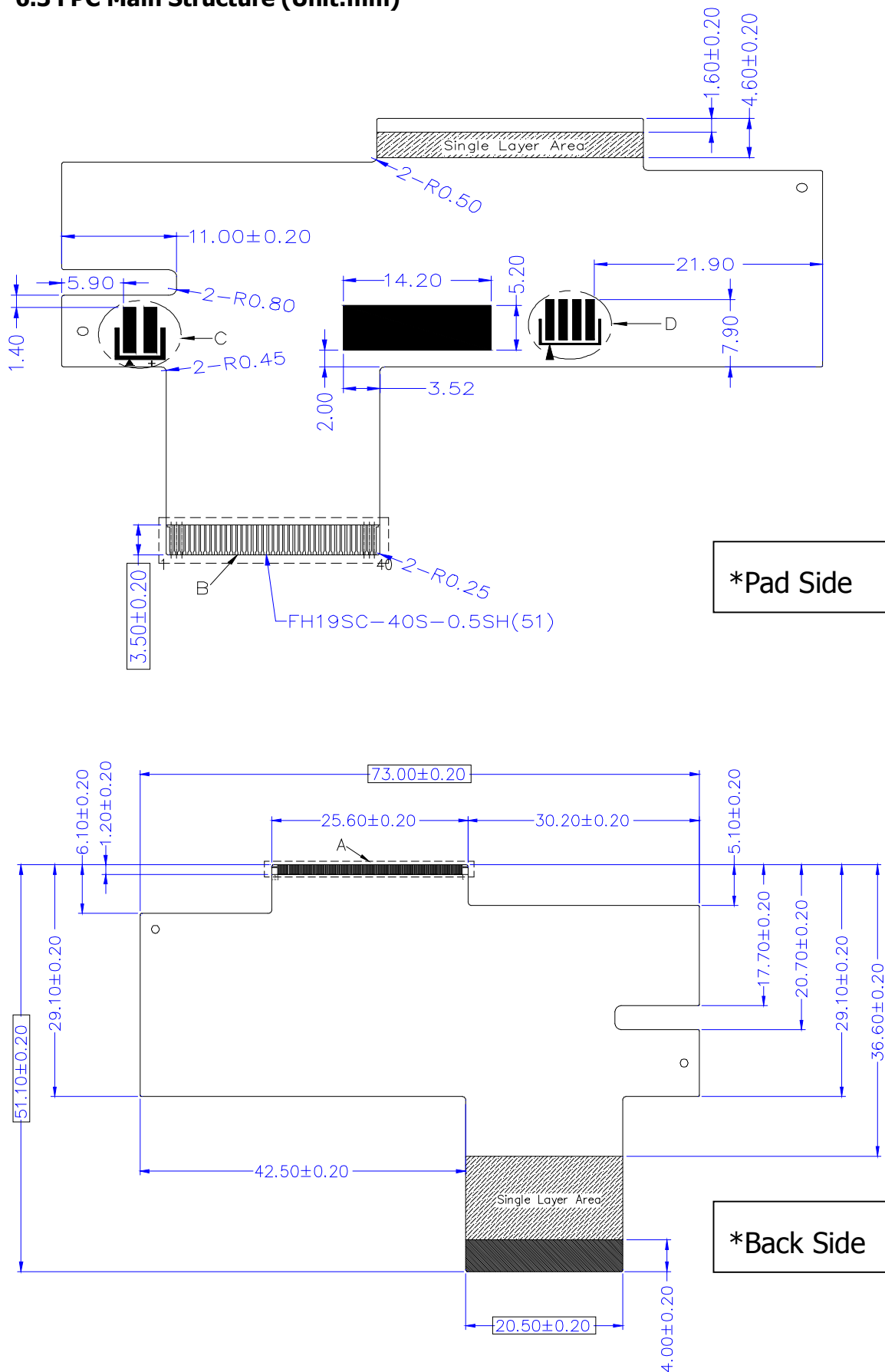
Parameter	Specification	Unit	Remark
Panel Size	114.8(W) x 73.2(H)	mm	
CF Size	111.6(W) X 68.4(H)	mm	
Active Area	108(W) x 64.8(H)	mm	
Panel ID	1.6 X 2	mm	
Gate-COG Pad Area	3.2	mm	
Source-COG Pad Area	4.8	mm	
Seal Area (U/D/L/R)	1.8/1.8/1.8/1.8	mm	
Polarizer Edge to C/F Edge (U/D/L/R)	0.8/0.8/0.8/0.8	mm	
Polarizer Thickness (Top/Down)	0.215/0.215	mm	

6.2 FOG Outline (Unit:mm)



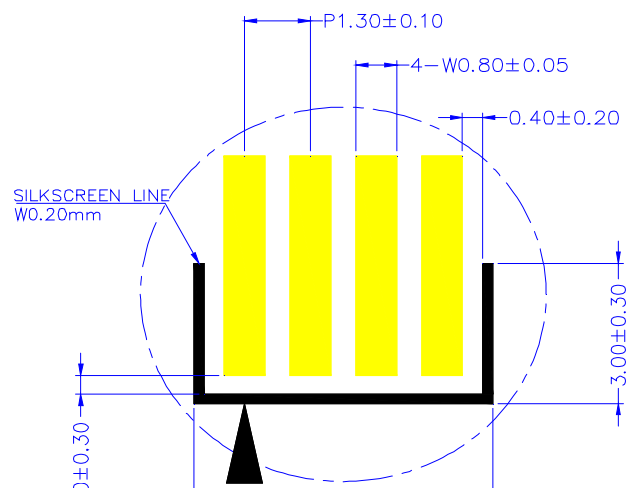
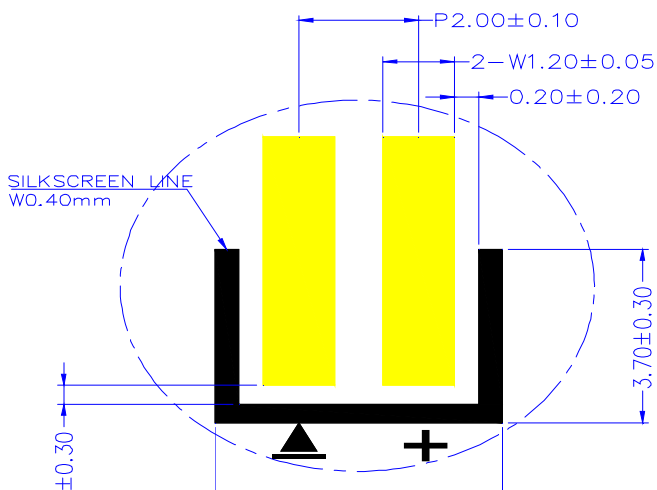
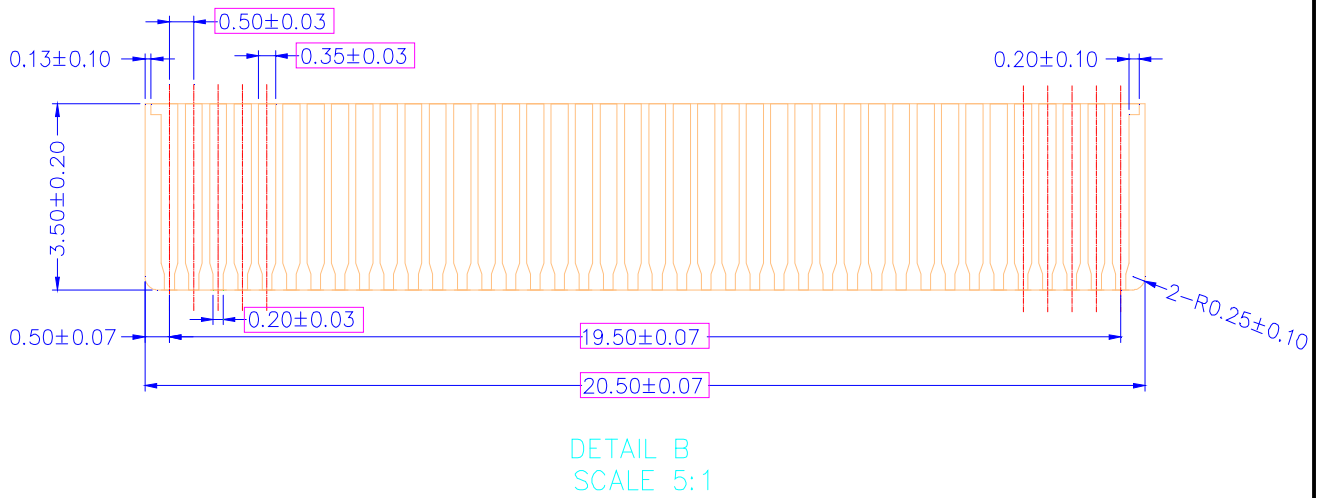


6.3 FPC Main Structure (Unit:mm)



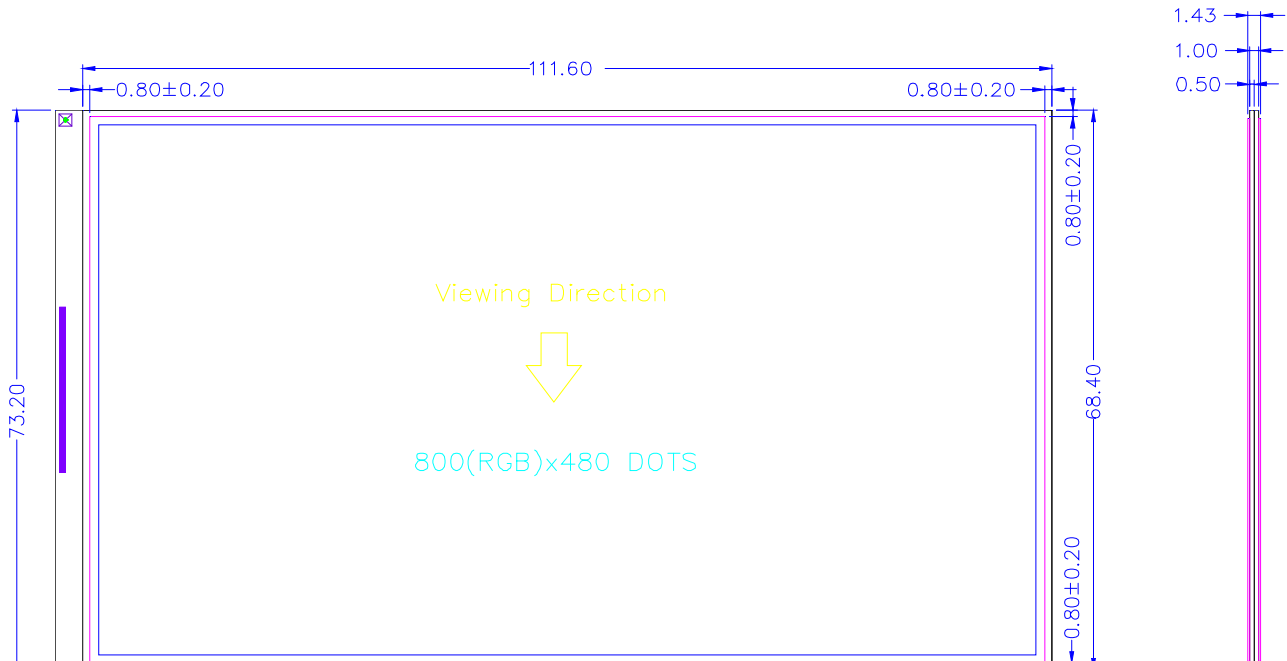


6.4 FPC Detail Structure (Unit:mm)





6.5 Polarizer Design (Unit:mm)



Notes:

- 1) Top Polarizer as size as bottom polarizer



7.0 RELIABILITY TEST

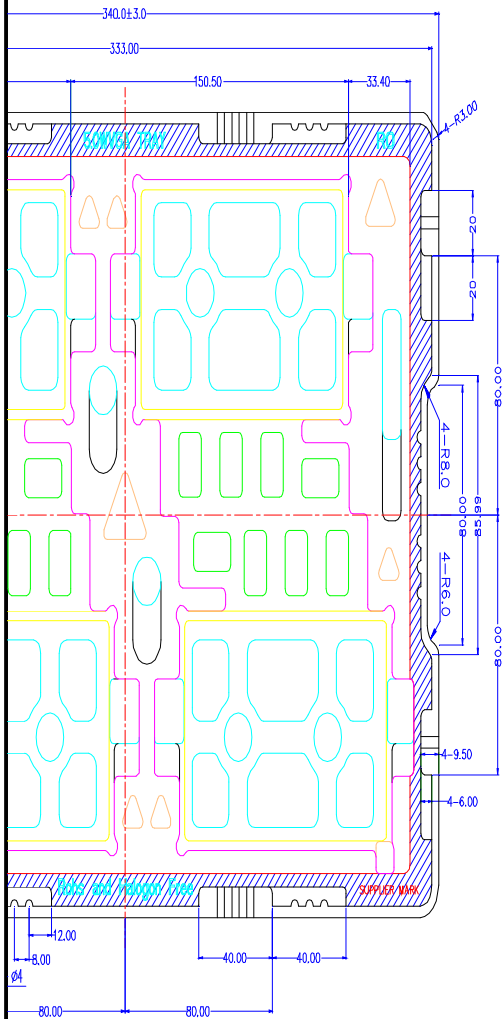
NO.	Test Item	Test Condition	Duration
1	High temperature, high humidity operation test(THO)	60 °C, 90%RH	240hrs
2	Low temperature operation test(LTO)	-20 °C	240hrs
3	High temperature operation test(HTO)	70 °C	240hrs
4	High temperature storage test(HTS)	80 °C	240hrs
5	Low temperature storage test(LTS)	-30 °C	240hrs
6	Thermal shock test (TST)	-30 °C →80 °C (Per 30min)	100hrs
7	Altitude test(ALT)	25 °C, 40000ft	12hrs
8	On/Off	On 30s / Off 30s	3000times
9	PCT	121 °C, 2ATM, 100%RH	12hr
10	ESD	150pF 330Ω ±8KV(Air) / ±6KV(Contact)	20points
11	Vibration	1.5G, 10/500/10, Sine, X/Y/Z Direction	Total:30min



8.0 PACKING

8.1 Packing Tray

<Tray Size> L: 340 mm; W: 248 mm; 4 Pcs/tray

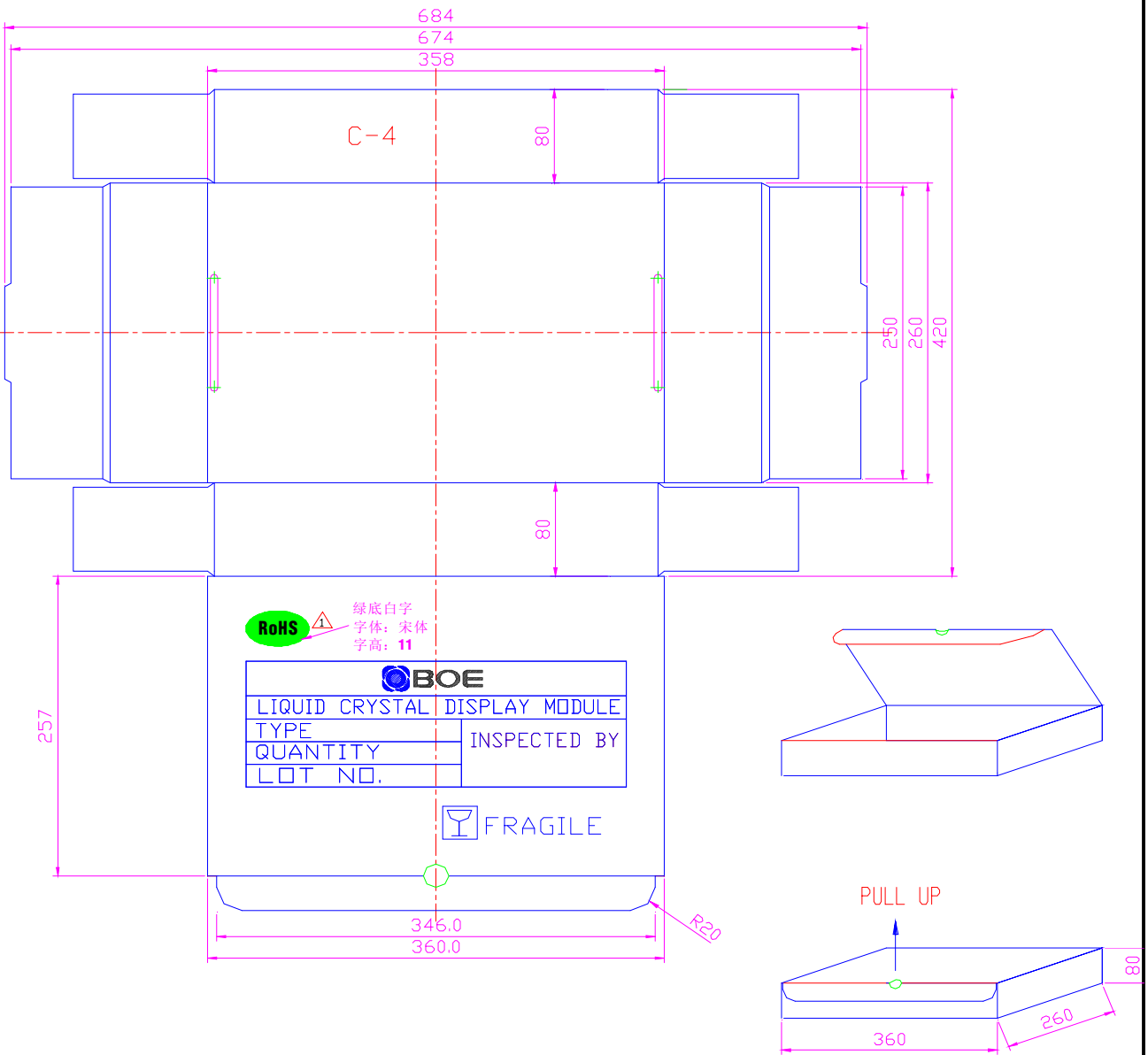




8.2 Inner Box

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

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



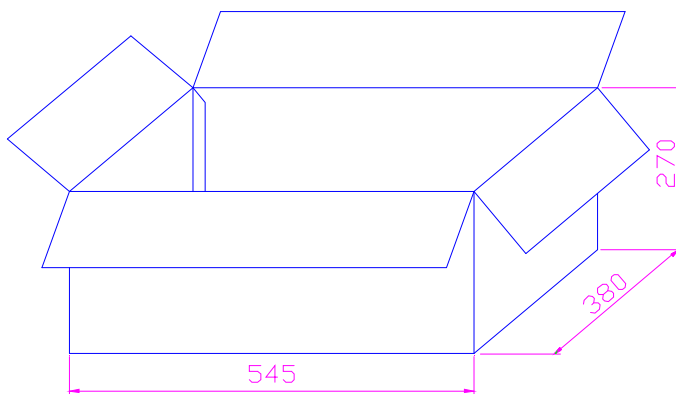
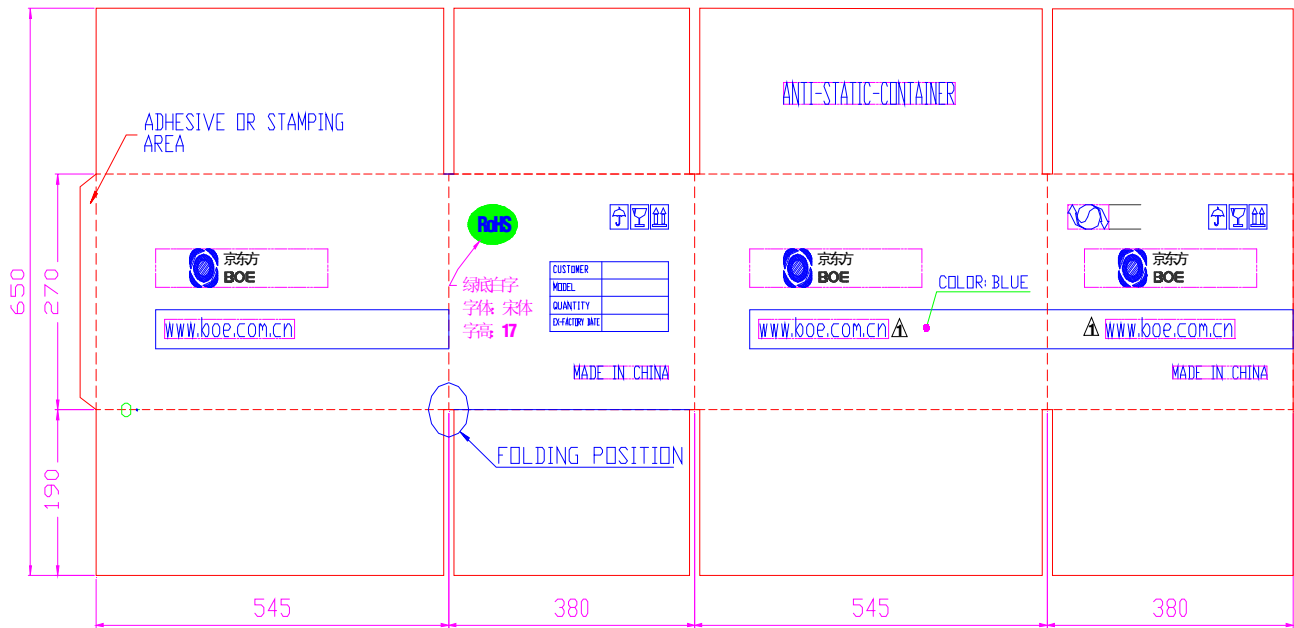


8.3 Outer Box

<Out box size>

L:545mm; W:380mm; H:270mm

6pcs inner box /Out Box



8.4 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.



9.0 PRODUCT ID RULE

Product Name

B T 050 WV A B 001

① ② ③ ④ ⑤ ⑥ ⑦

① <Company>

Code	Description
B	BOE

② <Mode>

Code	Description
T	TN
F	FFS

③ <Size>

Code	Description
022	2.2"
024	2.4"
050	5.0"

④ <Resolution>

Code	Description
QC	QCIF+
QV	QVGA
WV	WVGA

⑤ <Production type>

Code	Description
M	Mobile
A	Application

⑥ <Product state>

Code	Description
A	Array
F	CF
Q	Q-Panel
E	CELL(w/o POL) / CELL Slimming (w/o Pol)
S	Q-panel Slimming
P	CELL(With Pol)
G	COGA
B	FOG
M	Module
T	Touch Panel Module

⑦ <Other Information>

LCD	
Code	Description
	Product Serial NO
001	The first Mode
002	The Second Mode



10.0 HANDLING & CAUTIONS

10.1 Mounting Method

The panel of the LCD consists of two thin glasses with polarizers which easily get damaged.

So extreme care should be taken when handling the LCD.

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

If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD 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 LCD module with the specified mounting parts.

10.2 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 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 LCD's surface with wipe lightly.

-IPA (Isopropyl Alcohol), Ethyl Alcohol, Trichlorotrifluoroethane.

Do not wipe the LCD'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 LCD be handled with soft gloves during assembly, etc.

The polarizer on the LCD's surface are vulnerable to scratch and thus to be damaged by shape 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 from the ITO corrosion, customers are recommended that the ITO area would



be covered by UV or silicon.

Handle FPC with care.

10.3 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 turned on, and ground your 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 of 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.

10.4 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 be avoided. 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 exposed 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. Do not disassemble and/or re-assemble LCD module.

10.5 Packaging



Modules use LCD 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.

10.6 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 LCD'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 LCD near organic solvents or corrosive gasses.

Keep the LCD safe from vibration, shock and pressure.

Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.

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 LCD in the packaging situation LCD when it was delivered.

10.7 Safety

For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

In the case the LCD 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 gets 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.