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No	PART NO.	DESCRIPTION	SPECIFICATION
	EV220WPB-N10	22 Inch OC	B3 EV220WPB-N10 Product Specification Rev.0 VISUAL INSPECTION CRITERIA FOR ALL CUSTOMERS

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HEFEI BOE OPTOELECTRONICS TECHNOLOGY CO.,LTD

BOE

SPEC. NUMBER	PRODUCT GROUP	REV.	ISSUE DATE	PAGE
S8-*	TFT- LCD	0		1 OF 30

EV220WPB-N10
Product Specification Rev. 0

HEFEI BOE Optoelectronics Technology CO., LTD

DAS-RD-2019033-O

REVISION HISTORY

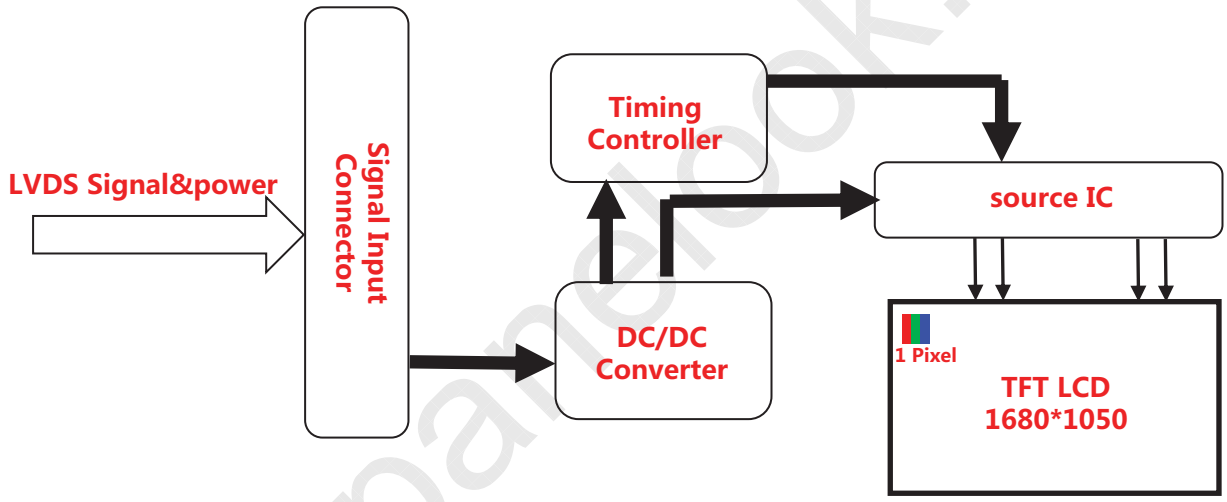
REV.	Page	DESCRIPTION OF CHANGES	DATE	PREPARED
0	-	Initial Release	2021.03.20	Zhang xiao lei

Contents

1.0 GENERAL DESCRIPTION

1.0.1 Introduction

EV220WPB-N10 is a color active matrix TFT LCD FOB using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This FOB has a 22 inch diagonally measured active area with WSXGA resolutions (1680 horizontal by 1050 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.



1.0.2 Features

- 0.5T Glass (Single)
- Normal Type
- 8bits LVDS data input
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS compliant

1.0.3 Application

- Monitoring

1.0.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	473.76 (H) × 296.1(V)	mm	
Number of pixels	1680(H) × 1050(V)	Pixels	
Pixel pitch	0.282(H) × 0.282 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	Colors	8bit
Display mode	Normally Black		
Dimensional outline	483.86 (H) × 380.1(V)	mm	
Weight	520	g	typ
Surface treatment	Haze 25%		

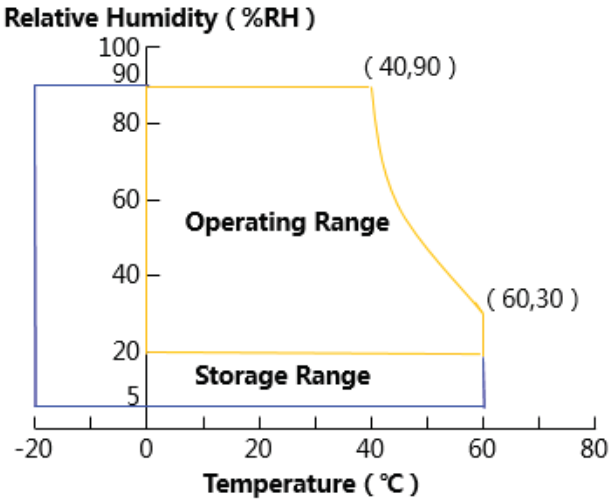
2.0 ABSOLUTE MAXIMUM RATINGS

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.

< Table 2. LCD FOB Electrical Specifications > [Ta =25±2 ℃]

Parameter		Symbol	Min.	Max.	Unit	Remarks
Power Supply	LCD Module	VDD	0	5.5	V	Ta = 25 ℃
	BLU	V_{LED}	-	21	V	
Operating Temperature		T_{OP}	0	+60	℃	Note 1
Storage Temperature		T_{ST}	-20	+60	℃	

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.



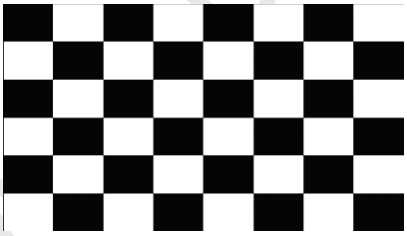
3.0 ELECTRICAL SPECIFICATIONS

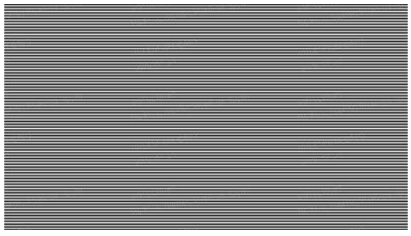
3.0.1 TFT LCD FOB

< Table 3. LCD FOB Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	VDD	4.5	5	5.5	V	Note 1
Power Supply Current	IDD	-	704	1700	mA	
Rush current	IRUSH	-	-	2.5	A	Note 2
Power Consumption	P_D	-	4	8	W	Note 1

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDD=5V, Frame rate f_V=60Hz and Clock frequency = 156.8MHz. Test Pattern of power supply current
a) Typ : Mosaic 7 x 5 Pattern(L0/L255) b) Max : H 1 line





2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

3.0 ELECTRICAL SPECIFICATIONS

3.2 Back-Light Unit

Parameter			Min.	Typ.	Max.	Unit	Remarks
LED Forward Current		I_F	-	81	-	mA	-
LED Power Input Voltage		V_{LED}	8	12	21	V	
LED Power Supply for LED driver Inrush		I_{RUSH}	-	-	2.5	A	
EN Control Level	Backlight on		2	-	3.3	V	
	Backlight off		0	-	0.8	V	
PWM Control Level	PWM High Level		2	-	3.3	V	
	PWM Low Level		0	-	0.8	V	
PWM Control Frequency		F_{PWM}	200Hz		22KHz	Hz	
Duty Ratio		-	10	-	100	%	
LED Channel Quantity			-	4	-	Ch	

Notes: 1. Power supply voltage 12V for LED driver.

2. Calculator value for reference V_F*I_F* 52/driver efficiency=PLED

4.0 OPTICAL SPECIFICATION

4.0.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON CS2000/CA310) 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°. We refer to θØ=0 (=θ3) as the 3 o'clock direction (the "right"), θ Ø=90 (= θ12) as the 12 o'clock direction ("upward"), θ Ø=180 (= θ9) as the 9 o'clock direction ("left") and θ Ø=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by CS2000/CA310. VDD shall be 3.3 ± 0.3V at 25°C. Optimum viewing angle direction is 6 'clock

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	-	89	-	Deg.	Note 1
		Θ_9		-	89	-	Deg.	
	Vertical	Θ_{12}		-	89	-	Deg.	
		Θ_6		-	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	800	1000	-		Note 2
Response Time		T_{RT}	Ta= 25° C Θ = 0°	-	25	30	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles 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 FIGURE 1).

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 FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

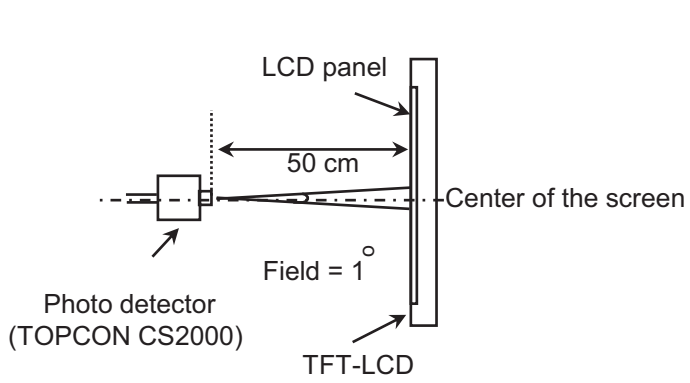
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

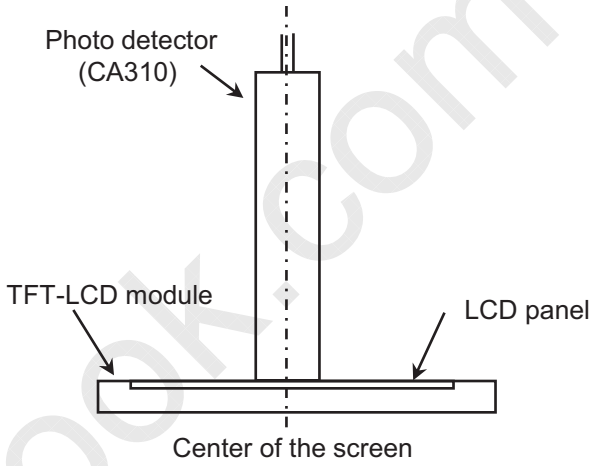
4. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark. (See FIGURE 4).

4.0.2 Optical measurements

Figure 1. Measurement Set Up

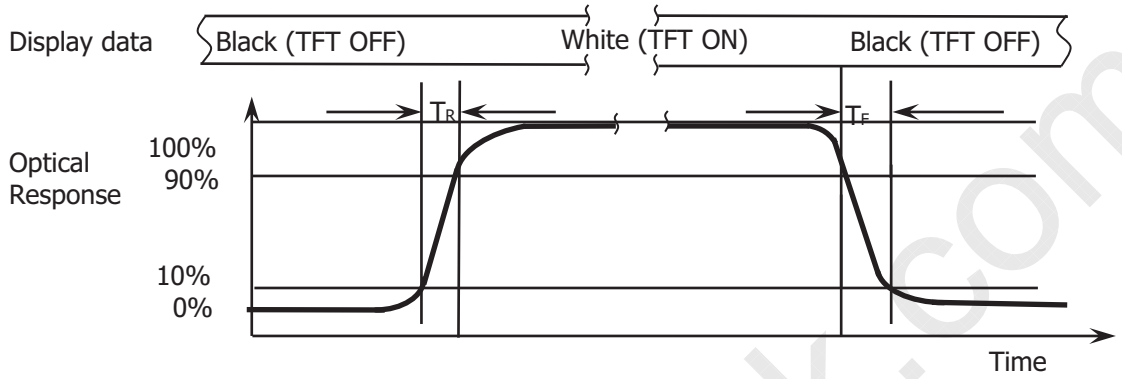


View angel range, etc. measurement setup



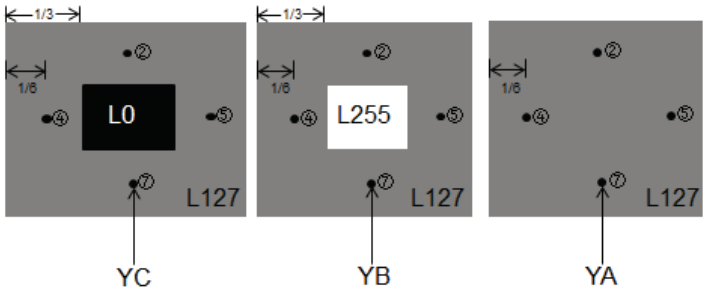
Flicker, measurement setup

Figure 2. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.

Figure 3. Cross Modulation Test Description



$$\text{White Bar Cross-Talk(\%)} = \left| \frac{YB - YA}{YA} \right| \times 100$$

$$\text{Black Bar Cross-Talk(\%)} = \left| \frac{YC - YA}{YA} \right| \times 100$$

Where:

YA = Initial luminance of measured area (cd/m2)

YB = Subsequent luminance of measured area (cd/m2) @White Bar

YC = Subsequent luminance of measured area (cd/m2) @Black Bar

The location measured will be exactly the same in both patterns

5.0 INTERFACE CONNECTION.

5.0.1 Electrical Interface Connection

This LCD employs two interface connections, a 30 pin connector(IS100-L30O-C23(UJU)or equivalent) is used for the LCD module electronics interface.

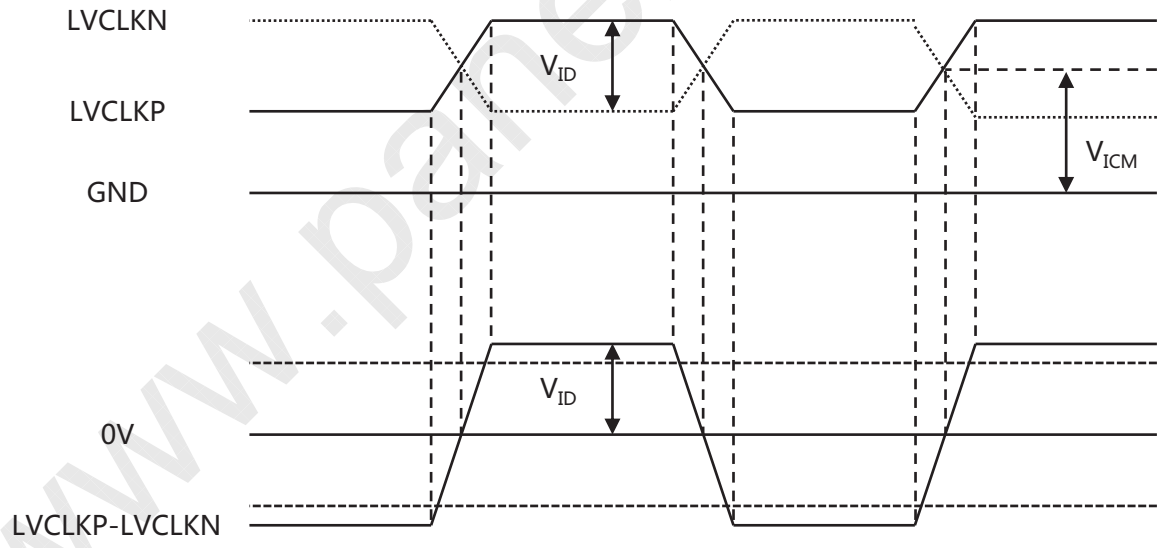
<Table 6. Pin Assignments for the Interface Connector>

Pin No	Symbol	Description	Pin No	Symbol	Description
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	17	GND	Power Ground
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	20	RXEC-	Negative Transmission Clock (EVEN)
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	21	RXEC+	Positive Transmission Clock (EVEN)
7	GND	Power Ground	22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)
8	RXOC-	Negative Transmission Clock (ODD)	23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)
9	RXOC+	Positive Transmission Clock (ODD)	24	GND	Power Ground
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	25	NC	SCL_PG(BOE USE only)
11	RXO3+	PositiveTransmission data of Pixel 3 (ODD)	26	NC	SDA_PG(BOE USE only)
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	27	NC	Not connection
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	28	VDD	Power Supply : +5V
14	GND	Power Ground	29	VDD	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	30	VDD	

5.0.2 LVDS DC Electrical Specification

< Table7. LVDS DC Specification >

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VTH	Differential input High Threshold	VICM=1200	-	-	+100	mV
V_{TL}	Differential input Low Threshold	VICM=1200	-100	-	-	mV
|VID|	Input Differential Voltage		±100	±350	±600	mV
RTERM	Termination resister @ 100ohm Resistor		-	100	-	ohm
IIHL	Input current in power down mode		-40	-	+40	uA
VICM	Differential input Common Mode Voltage	LRHVDD=3.3V		1.2		V



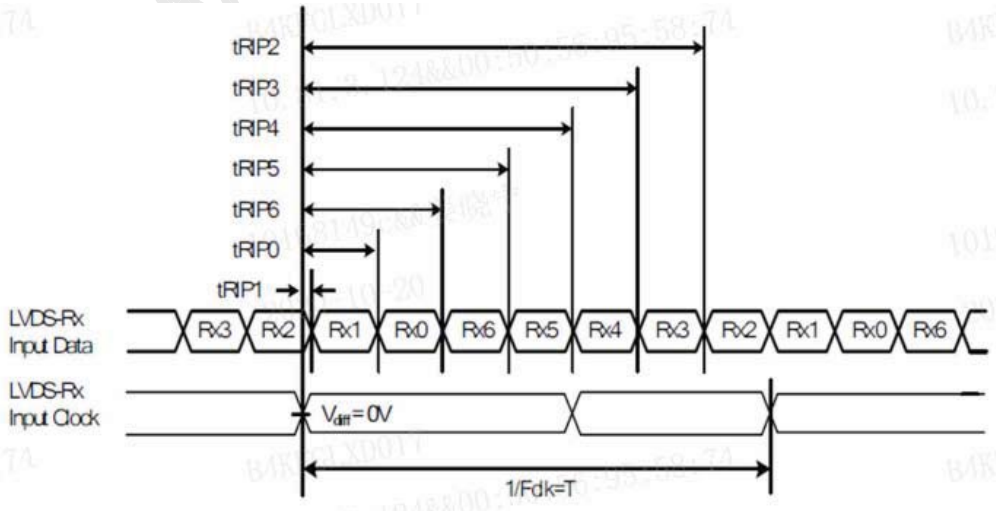
< LVDS V_{ID} and V_{ICM} definition>

5.0.3 LVDS AC Electrical Specification

< Table8. LVDS AC Specification >

Symbol	Parameter	Min	Typ	Max	Unit
fCLKIN	Input clock frequency	40		100	MHz
tRCP	CLKORP1 Period	10		25	ns
tRCH	CLKORP1 High time	0.45T	0.5T	0.55T	TCK
tRCL	CLKORP1 Low time	0.45T	0.5T	0.55T	TCK
tRMG	Receiver Data Input Margin FCLKIN = 100MHz FCLKIN = 85MHZ FCLKIN = 65MHZ	 -0.30 -0.45 -0.60		 0.30 0.45 0.60	ns
tRIP 1	Input data Position1	-|tRMG|	0.0	+|tRMG|	Clock
tRIP 0	Input data Position0	T/7-|tRMG|	T/7	T/7+|tRMG|	Clock
tRIP 2	Input data Position2	6T/7-|tRMG|	6T/7	6T/7+|tRMG|	Clock
tRIP 3	Input data Position3	5T/7-|tRMG|	5T/7	5T/7+|tRMG|	Clock
tRIP 4	Input data Position4	4T/7-|tRMG|	4T/7	4T/7+|tRMG|	Clock
tRIP 5	Input data Position5	3T/7-|tRMG|	3T/7	3T/7+|tRMG|	Clock
tRIP 6	Input data Position6	2T/7-|tRMG|	2T/7	2T/7+|tRMG|	Clock
tRPLL	Phase Locked Loop set time			300	us

LVDS Receiver AC Electrical Characteristics

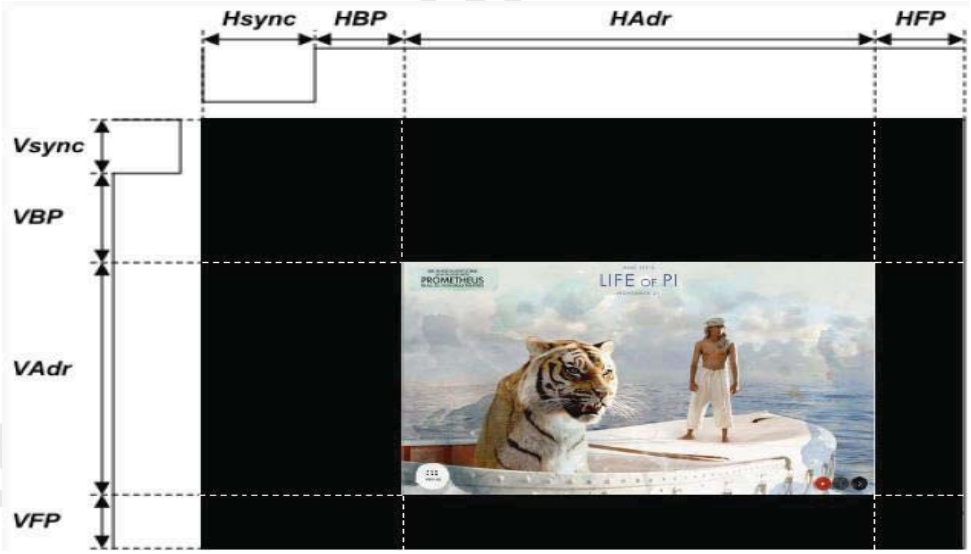


LVDS RX data Margin

6.0 SIGNAL TIMING SPECIFICATION

6.0.1 The EV220WPB-N10 is operated by the DE only.

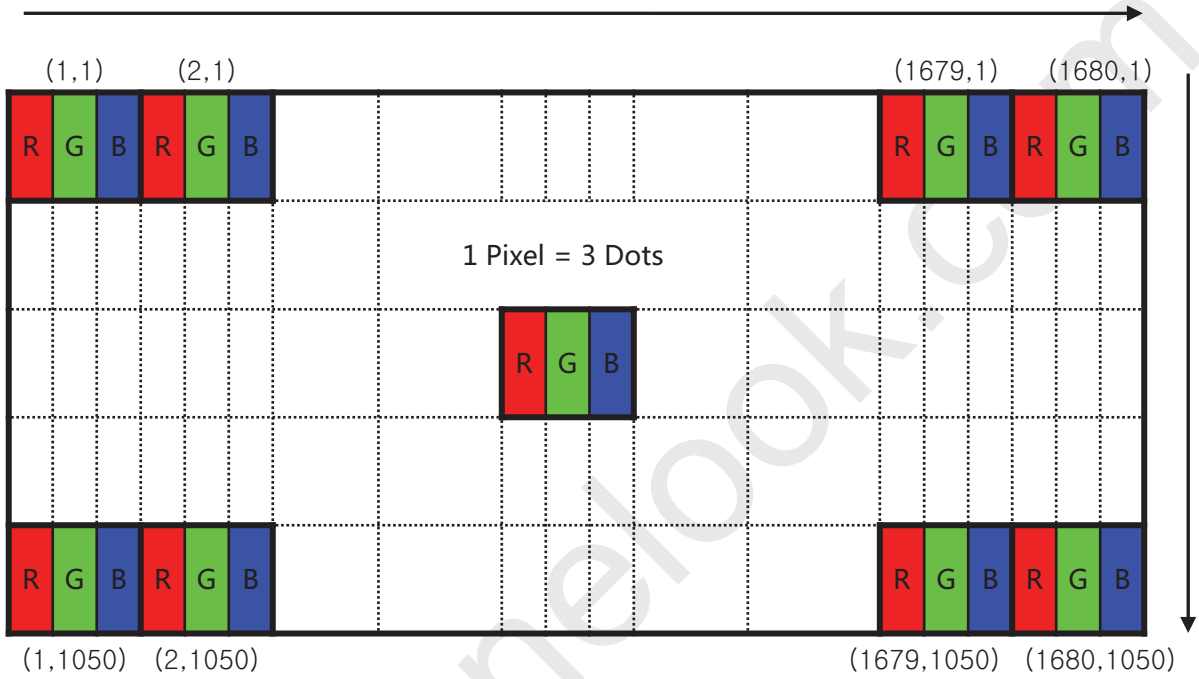
Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	50	60	75	Hz
	Pixels Rate		-	46.6	72.1	82.5	MHz
Timing	Horizontal	Horizontal total time	tHP	880	1128	1848	t_{CLK}
		Horizontal Active time	tHadr		840		t_{CLK}
	Vertical	Vertical total time	tvp	1060	1066	2040	t_H
		Vertical Active time	tVadr		1050		t_H
port				-	2	-	port



7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	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 Red	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
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	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 Green	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	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 Blue	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	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
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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

8.0 Input Color Data Mapping

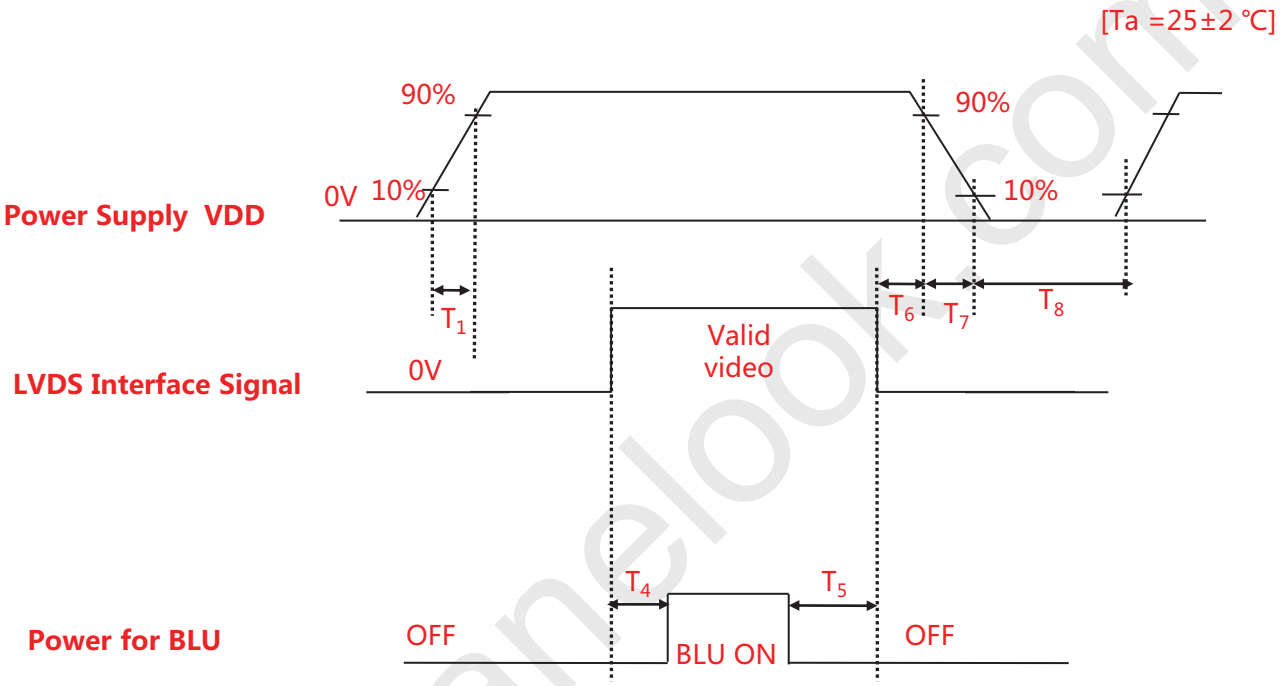


Display Position of Input Data (V-H)

9.0 POWER SEQUENCE

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

[Ta =25±2 ℃]



< Table11. Sequence Table >

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.1	-	5	(ms)
T4	200	-	-	(ms)
T5	200	-	-	(ms)
T6	0	-	50	(ms)
T7	0	-	10	(ms)
T8	500	-	-	(ms)

9.0 MECHANICAL CHARACTERISTICS

9.0.1 Dimensional Requirements

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	473.76 (H) × 296.1(V)	mm
Number of pixels	1680(H) X1050 (V) (1 pixel = R + G + B dots)	
Pixel pitch	0.282(H) × 0.282 (V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M (8bit)	colors
Display mode	Normally Black	
Dimensional outline	483.86 (H) × 380.1(V)	Typ.
Weight	520	gram

10.0 RELIABILITY TEST

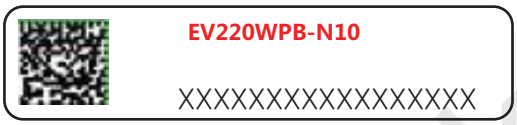
The Reliability test items and its conditions are shown in below.

<Table 9. Reliability test>

No	Test Items	Conditions
1	High temperature & high humidity (storage test)	60℃，90%RH，240hr
2	High temperature storage test	60℃，240hr
3	Low temperature storage test	-20℃，240hr
4	High temperature & high humidity (operation test)	50℃，80%RH，240hr
5	Low temperature operation test	0℃，240hr
6	High temperature operation test	60℃，240hr
7	Thermal Shock Test	-20℃~60℃，1hr/cycle，100cycle
8	ESD	150pF，330Ω，±8kV(Contact) Class B：允许可以自动恢复的偶发性息屏或功能异常
9	Packing VIB	1.47G，1-200hz，Random，±Z，30min/Axis

11.0 LABEL

(1) Product label



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Type designation

No 1~2 GBN

No 3 等级

No 4 B3

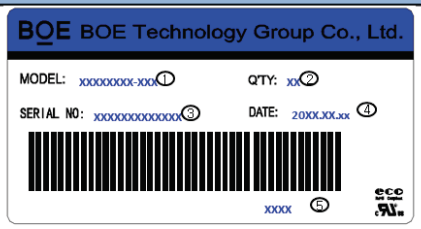
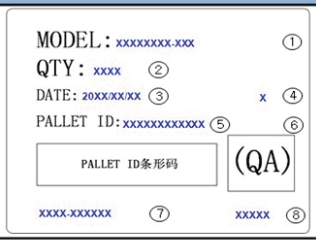
No 5~6 年份

No 7 月份

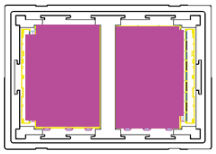
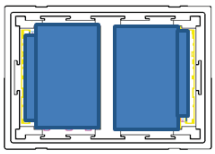
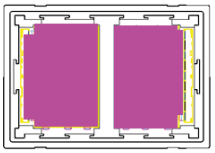
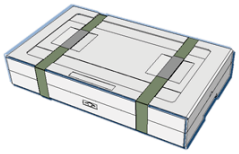
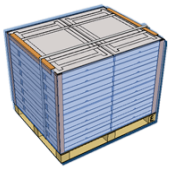
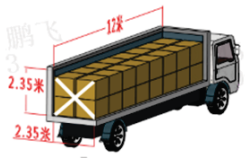
No 8~11 FG-CODE后四位

No 12~17 序列号

(3) Box&Pallet label

Item	Box Label	Pallet Label
Picture		
代号说明	序列号标注部分需打印, 说明如下: 1. FG-CODE(前12位) : EV220WPB-N10 2. 产品数量 : 16 3. Box ID 4. 包装日期 5. FG-Code后四位:39K0 6. Total Size:110×55mm	序列号标注部分需打印, 说明如下: 1. FG-CODE(前12位) 2. Pallet 产品数量 3. Pallet Packing 日期 4. E:Export (出口) D:Domain (内销) 5. Pallet ID , 编码规则如下 6. QA检查标志 7. 产品物料号(客户端 无则不填) 8. FG Code后四位
编码规则		

12.0 PACKING INFORMATION

BOX两侧底部分别放置1pcs EPE Spacer	两侧分别1pcs FOB 放于垫片上	再放置1pcs EPE垫片在FOB上，如此重复，共放置8pcs FOB，最后将1pcs EPE垫片放于最上层 FOB上 在滑块槽内放置4包干燥剂 容量：16pcs FOB/Box；18pcs EPE垫片/Box
 Step 1	 Step 2	 Step 3
将EPS Box扣合，并用2条捆绑带捆绑 容量：16pcs FOB /Box	横向打Pallet，共7层 ，每层2ea Box，Pallet外进行扎带捆扎、缠膜包装 容量：224pcs FOB/14ea Box/Pallet	厢车装载方式：两竖双层码放 厢车装载量_12m：7168pcs（32托）
 Step 4	 Step 5	 Step 6

Packing Note:

- Box Dimension : 980mm (L) × 680mm (W) × 117mm (H)
- Package Quantity : 16pcs FOB/Box，14pcs Box /Pallet，224pcs FOB/Pallet，

13.0 PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Panel.

13.1 Mounting Precautions

•Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

•You must mount a Panel using specified mounting holes (Details refer to the drawings)

•You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the Panel. And the case on which a Panel is mounted should have sufficient strength so that external force is not transmitted directly to the Panel.

•Do not apply mechanical stress or static pressure on Panel; Abnormal display cause by pressing some parts of Panel during assembly process , do not belong to product failure, the press should be agreed by two sides.

•Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.

•Do not apply mechanical stress or static pressure on Panel , and avoid impact, vibration and falling.

•Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.

•Protection film for polarizer on the Panel should be slowly peeled off before display.

•Be careful to prevent water & chemicals contact the Panel surface.

•You should adopt radiation structure to satisfy the temperature specification.

•Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.

Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)

•When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.

•Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading..

- This Panel has its circuitry PCB's on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire
- Do not disassemble the Panel.

13.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Panel at the "Power On" Condition.
- When the Panel is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the Panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the Panel would be damaged.
- Do not allow to adjust the adjustable resistance or switch
- The electrochemical reaction caused by DC voltage will lead to LCD Panel degradation, so DC drive should be avoided.
- The LCD Panels 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 equipment to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Panel may be damaged.
- Panel has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- Design the length of cable to connect between the connector for back-light and the converter as shorter as possible and the shorter cable shall be connected directly , The long cable between back-light and Converter may cause the Luminance of LED to lower and need a higher startup voltage
- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

13.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a Panel is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

13.4 Precautions for Strong Light Exposure

- Do not leave the Panel operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

13.5 Precautions for Storage

A. Atmosphere Requirement

ITEM	UNIT	MIN	MAX
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	40	75
Storage Life	6 months		
Storage Condition	• The storage room should be equipped with a dark and good ventilation facility. • Prevent products from being exposed to the direct sunlight, moisture and water. • The product need to keep away from organic solvent and corrosive gas. • Be careful for condensation at sudden temperature change. • Storage condition is guaranteed under packing conditions.		

B. Package Requirement

•The product should be placed in a sealed polythene bag.

•Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.

•The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

•As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

13.6 Precautions for protection film

- 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.
- People who peeled off the protection film should wear anti-static strap and grounded well.

13.7 Appropriate Condition for Display

-Generally large-sized LCD Panels are designed for consumer applications . Accordingly, long-term display application can cause uneven display including image sticking. To optimize Panel's lifetime and function, several operating usages are required.

1. Normal operating condition

- Temperature: 20±15℃
- Operating Ambient Humidity : 55±20%
- Display pattern: dynamic pattern (Real display)
- Well-ventilated place is recommended to set up display system

2. Special operating condition

a. Ambient condition

- Well-ventilated place is recommended to set up display system.

b. Power and screen save

- Periodical power-off or screen save is needed after long-term display.

c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD Panel may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD Panel will return to normal display.

d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD Panel may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD Panel 's surface which may affect the operation of the polarizer and LCD Panel

e. Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Panel may be damaged.

f. Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, special display images, running time, long time operation, outdoor operation, etc. It is strongly recommended to contact BOE for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

3. Operating usages to protect against image sticking due to long-term static display.

a. Suitable operating time: under 20 hours a day.

b. Static information display recommended to use with moving image.

- Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.

c. Background and character (image) color change

- Use different colors for background and character, respectively.
- Change colors themselves periodically.

d. Avoid combination of background and character with large different luminance.

1) Abnormal condition just means conditions except normal condition.

2) Black image or moving image is strongly recommended as a screen save

13.8 Other Precautions

A. LC Leak

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

- When returning the Panel for repair or etc., Please pack the Panel not to be broken. We recommend to use the original shipping packages.

14.0 MECHANICAL OUTLINE DIMENSION

Figure 5. TFT-LCD FOB Outline Dimension (Front View)

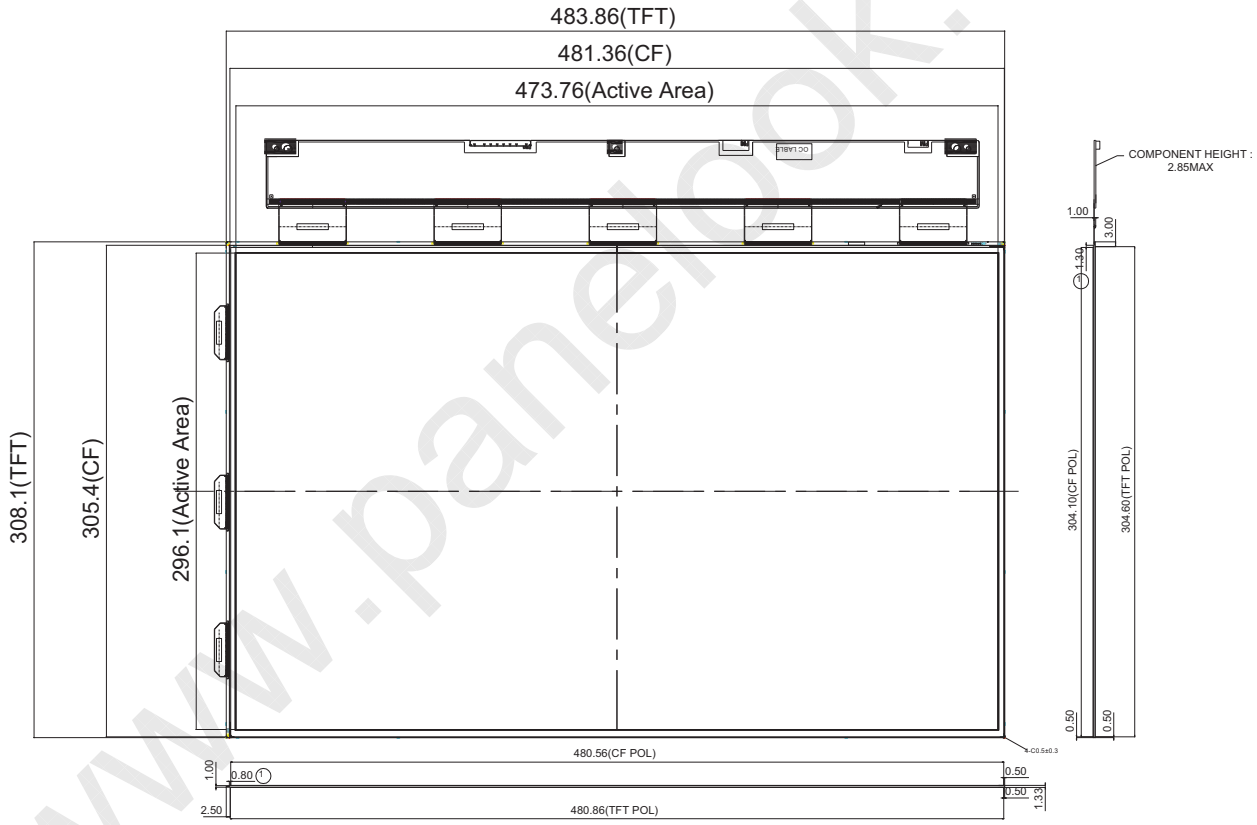
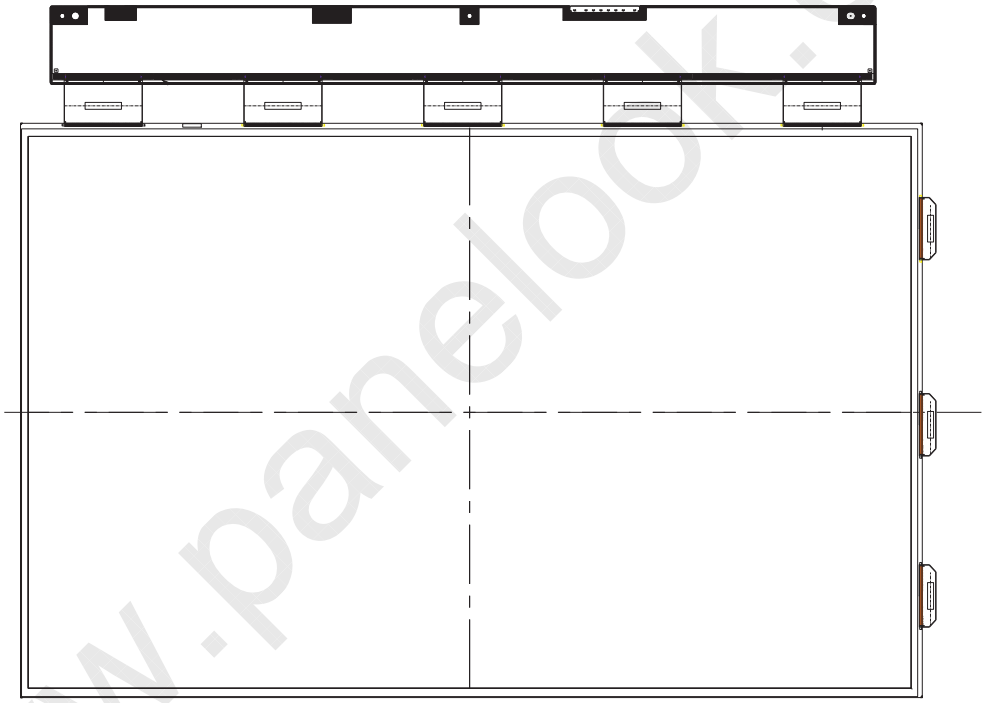


Figure 6. TFT-LCD FOB Outline Dimensions (Rear view)



Incoming Inspection Spec Approval Sheet

Product Description： TFT-LCD OC			
B3 Product Name: 22”			
Customer :			
Customer Signature	**Date**	**BOE Signature**	**Date**

Record of Revision

Version	Issue Date	Content	Page
0	2020.11.16	Rev.2	ALL

Content

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, Trichlorotriflorothane
- 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℃.

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: 23±2 ℃;

b. Humidity: 60 ± 5% RH;

c. Inspection Ambient Illumination : 300~700 Lux (150~250 Lux for function test);

2.2.2. Viewing Distance

The distance between the panel and the inspector's eyes shall be at 70CM~100CM;

2.2.3. Viewing Angle

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

ADS Production： within 45º to perpendicular line.;

TN Production： within 10º 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

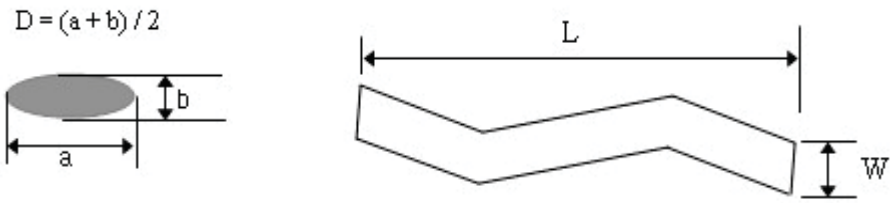
Dimensional unit: mm

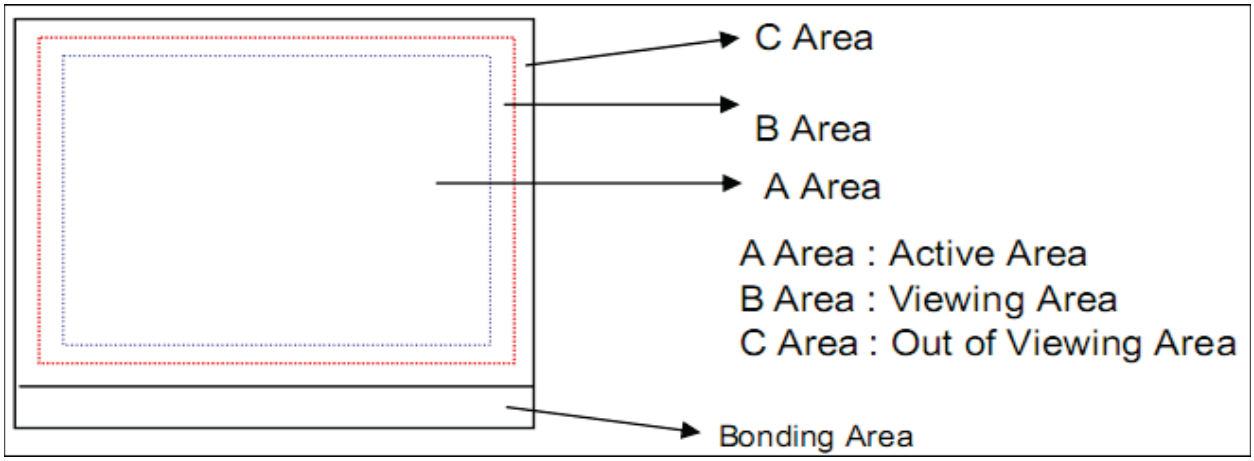
Items		Details	Inspection Criteria		Type
			A Area	B/C Area	
Visual (Function) Inspection	Foreign Material /Dent/ Bubble/ Spots//Extraneous Substances/Dot	Circular Type	0.2<D≤0.5,N≤5	Ignore	Minor
		Linear Type	0.05<W ≤0.1, L≤3 N≤3		
	Pixel Defects	Bright Dot	N≤2	Ignore	Major
		Dark Dot	N≤5		
		Bright + Dark Dot	N≤7		
		2S	N≤2		
	Line Defects	Bright Line, Dark Line	Not Allowed		
	No Display		Not Allowed		
	Abnormal Display		Not Allowed		
	Zara		10*10mm≤15		
	L0 Light leakage & Mura		5%ND not visible, or reference limit samples		Minor

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

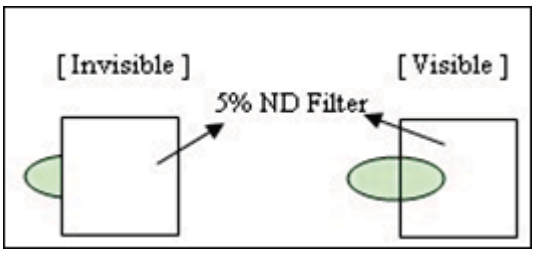
※ Note 1) D = Diameter, L = Length, W = Width, N = Number

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



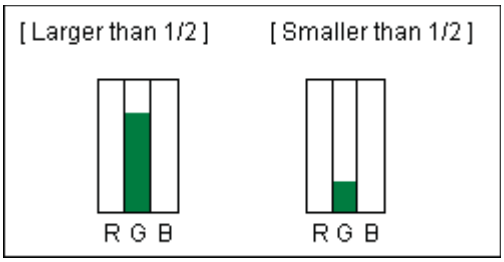


※Note 3) For pixel defect, dot means a sub-pixel. Dot defects should be larger than half size of a sub-pixel. Dot which is invisible through 5% ND filter or smaller than 1/2 of sub-pixel size will not counted as "1 dot" defect.



"No dot defect" (=ignored)

"1 dot defect" (=counted)

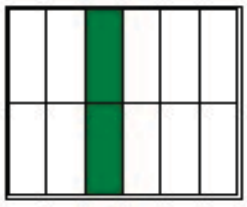


"1 dot defect" (=counted)

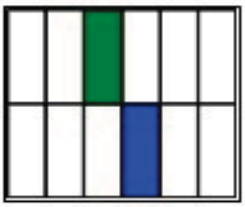
"No dot defect" (=ignored)

[2 adjacent dots defect]

Type 1

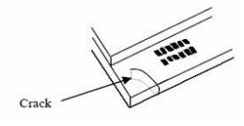
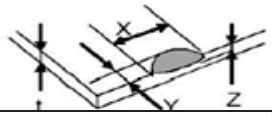
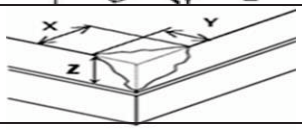
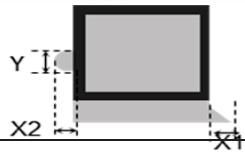
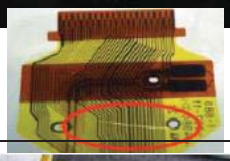


Type 2



Type 3

3.2. Appearance Inspection Criteria

location	Items	Criterion for Defects		Type	scope
All	Stain		Removable stain is OK	-	All
Be related to PNL	Crack		Not Allowed	Major	Shipment status：Single Cell/FOG /MDL Production
	Side Chipping		Function and assembly are not affected	Minor	
	Corner Chipping		Function and assembly are not affected	Minor	
	Burr		Function and assembly are not affected	Minor	
	Scratch		PNL with POL，based on point/line foreign (scratch) standard to determine,	Minor	
Be related to FPC/PCB	short circuit / open circuit		Not Allowed	Major	Shipment status：FOG/MDL Production
	components and parts		Component missing is not allowed	Minor	

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.