TITLE:

HV320WX2-267 Product Specification

BEIJING BOE DISPLAY TECHNOLOGY

REVISION HISTORY

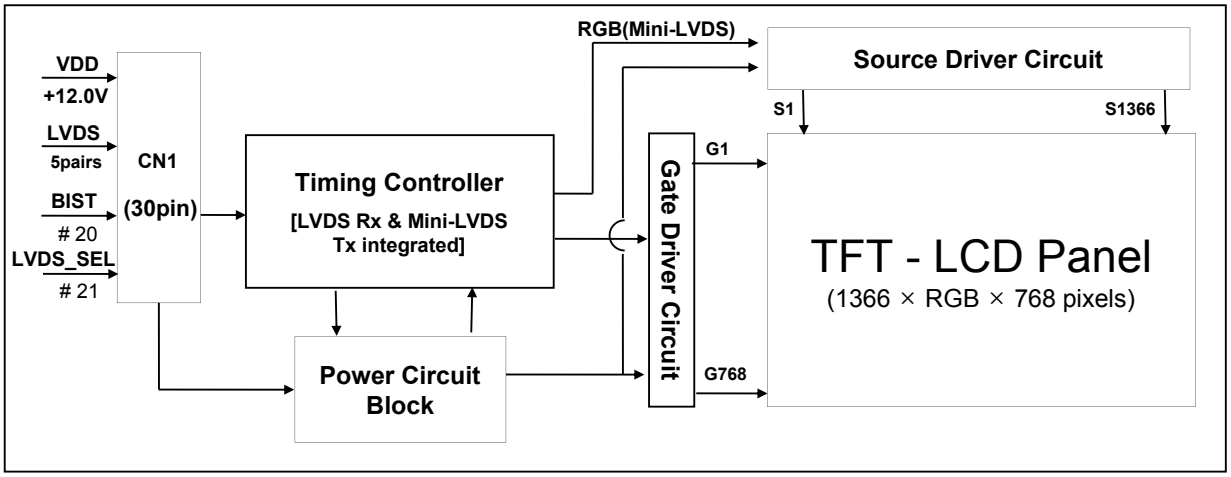
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
O	-	Glass Thickness Change from 0.7t to 0.5t Gate COF Chamfer Design	2013.04.04	Dong Ting

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HV320WX2-267 is a color active matrix TFT LCD open cell using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This open cell has a 31.51 inch diagonally measured active area with WXGA resolutions (1366 horizontal by 768 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this open cell can display 16.7M colors. The TFT-LCD panel used for this open cell is adapted for a low reflection and higher color type.



1.2 Features

- LVDS interface with 1 pixel / clock
- High-speed response
- Low color shift image quality
- 8-bit color depth, display 16.7M colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only mode
- ADS technology is applied for high display quality
- RoHS compliant

1.3 Application

- Home Alone Multimedia TFT-LCD TV
- Display Terminals for Control System
- High Definition TV(HD TV)
- AV application Products

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remark
Active area	697.685(H) × 392.256(V)	mm	
Number of pixels	1366(H) ×768(V)	pixels	
Pixel pitch	170.25(H) ×RGB×510.75(V)	㎛	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M(8bits-true)	colors	
Display mode	Transmission mode, Normally Black		
Open Cell Transmittance	6.6 (typ.)	%	At center point with BOE BLU
Weight	895(typ.)	gram	
Power Consumption	4.0 (typ.)	Watt	
Surface Treatment	Haze 10%, 3H, Semi-glare or Anti-glare treatment (Front Polarizer) Clear (Bottom Polarizer)		

2.0 ABSOLUTE MAXIMUM RATINGS

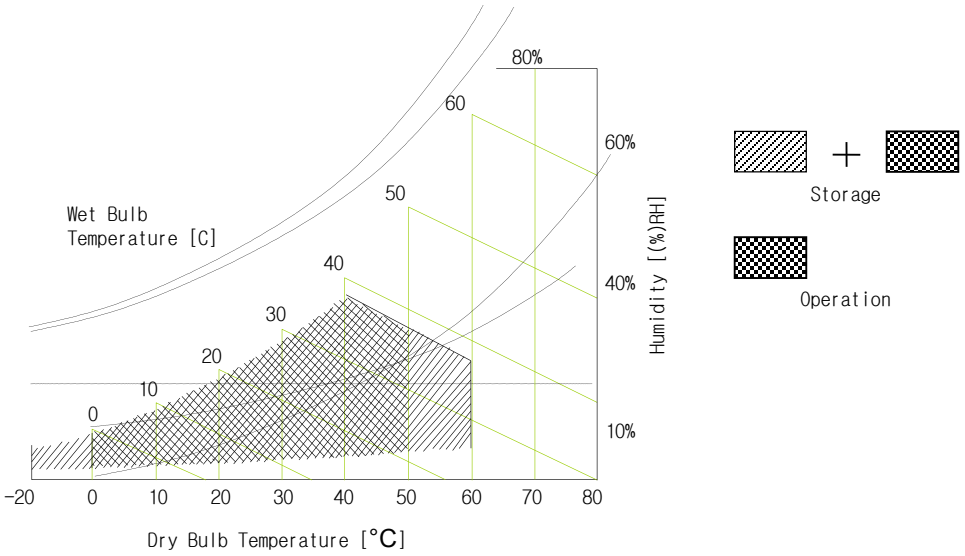
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Open Cell Electrical Specifications >

[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.2	V	Ta = 25 ℃
Operating Temperature	T_{OP}	0	+50	℃	Note 1
	T_{SUR}	0	+60	℃	
Storage Temperature	T_{ST}	-20	+60	℃	
Operating Ambient Humidity	Hop	10	80	%RH	
Storage Humidity	Hst	10	80	%RH	

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

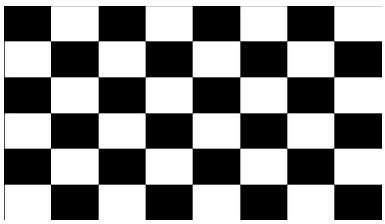
3.1 TFT LCD Open Cell

< Table 3. Open Cell Electrical Specifications >

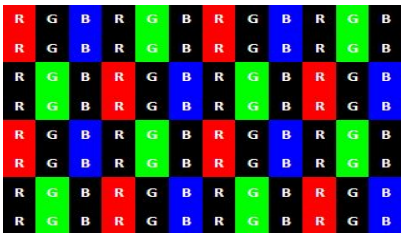
[Ta =25±2 ℃]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP			300	mV	
Power Supply Current		IDD	-	333	592	mA	Note 1
Power Consumption		PDD		4.0	7.1	Watt	
Rush current		IRUSH	-	-	3.0	A	Note 2
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	+100		+300	mV	
	Differential Input Low Threshold Voltage	VLVTL	-300		-100	mV	
	Common Input Voltage	VLVC	1.0	1.2	1.4	V	
CMOS Interface	Input High Threshold Voltage	VIH	2.7	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.6	V	

Note 1 : The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDD=12.0V,
Frame rate f_V=60Hz and Clock frequency = 75.4MHz.
Test Pattern of power supply current
a) Typ : Mosaic 8 x 6 Pattern(L0/L255)
Pattern(L0/L255)



b) Max : Skip 1H2V Sub Dot



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

4.0 INTERFACE CONNECTION

4.1 Module Input Signal & Power

4.1.1 LVDS Connector

- Connector : Fw10039-30(Manufactured by Foosung) or Equivalent.

< Table 4. Open Cell LVDS Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	NC	No Connection	16	GND	Ground
2	SCL	SCL	17	RXIN3-	LVDS Receiver Signal(-)
3	SDA	SDA	18	RXIN3+	LVDS Receiver Signal(+)
4	GND	Ground	19	GND	Power Ground
5	RXIN0-	LVDS Receiver Signal(-)	20	NC	No Connection
6	RXIN0+	LVDS Receiver Signal(+)	21	NC	No Connection
7	GND	Ground	22	WP	Write Protection
8	RXIN1-	LVDS Receiver Signal(-)	23	GND	Power Ground
9	RXIN1+	LVDS Receiver Signal(+)	24	GND	Power Ground
10	GND	Ground	25	GND	Power Ground
11	RXIN2-	LVDS Receiver Signal(-)	26	VCC	Power Supply : +12V
12	RXIN2+	LVDS Receiver Signal(+)	27	VCC	
13	GND	Ground	28	VCC	
14	RXCLKIN-	LVDS Receiver Clock Signal(-)	29	VCC	
15	RXCLKIN+	LVDS Receiver Clock Signal(+)	30	VCC	

Notes : 1. NC(Not Connected) : These pins are only used for BOE internal operations.
2. Input Level of LVDS signal is based on the IEA 664 Standard.
3. LVDS data format: According to SEC VD request, JEIDA format is adopted.

4.0 INTERFACE CONNECTION

4.1 Module Input Signal & Power

4.1.2 Aging Connector

- Connector : 12507WR-H10G(Manufactured by YEONHO)or Equivalent.

< Table 5. Open Cell Aging Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VCC	Power Supply : +12V	6	SDA	SDA
2	VCC		7	SCL	SCL
3	GND	GND	8	GND	GND
4	Aging_EN	Aging Mode Enable	9	NC	NC
5	WP	Write Protection	10	NC	NC

Notes : 1. NC(Not Connected) : This pins are only used for BOE internal operations.

2. Aging _ EN : This pin is used for selecting display pattern mode when input DE or input CLOCK quits toggling.

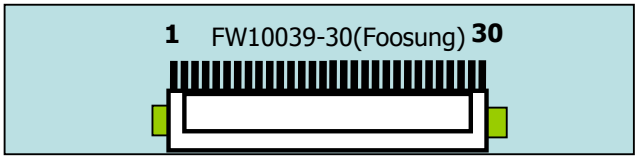
If this Pin : Low (GND) → Aging mode(BIST Mode)

Otherwise : High(3.3V) or Open (NC) → Free run mode(Black Data)

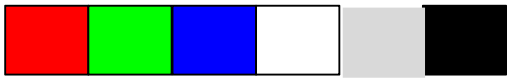
Sequence : On = VDD ≥LVDS Option , BIST Option ≥Interface signal

Off = Interface signal ≥ LVDS Option , BIST Option ≥ VDD

Rear view of LCM



BIST(Aging) Patte rn



4.2 LVDS Interface

- LVDS Receiver : Timing Controller (LVDS Rx merged) / LVDS Data : Pixel Data

< Table 6. Open Cell Input Connector Pin Configuration >

	LVDS Pin	Vesa Data format	JEIDA Data format	Remark
TxOUT/RxIN0	TxIN/RxOUT0	Red0 [LSB]	R2	
	TxIN/RxOUT1	Red1	R3	
	TxIN/RxOUT2	Red2	R4	
	TxIN/RxOUT3	Red3	R5	
	TxIN/RxOUT4	Red4	R6	
	TxIN/RxOUT6	Red5	R7 [MSB]	
	TxIN/RxOUT7	Green0 [LSB]	G2	
TxOUT/RxIN1	TxIN/RxOUT8	Green1	G3	
	TxIN/RxOUT9	Green2	G4	
	TxIN/RxOUT12	Green3	G5	
	TxIN/RxOUT13	Green4	G6	
	TxIN/RxOUT14	Green5	G7 [MSB]	
	TxIN/RxOUT15	Blue0 [LSB]	B2	
	TxIN/RxOUT18	Blue1	B3	
TxOUT/RxIN2	TxIN/RxOUT19	Blue2	B4	
	TxIN/RxOUT20	Blue3	B5	
	TxIN/RxOUT21	Blue4	B6	
	TxIN/RxOUT22	Blue5	B7 [MSB]	
	TxIN/RxOUT24	HSYNC	HSYNC	
	TxIN/RxOUT25	VSYNC	VSYNC	
	TxIN/RxOUT26	DEN	DEN	
TxOUT/RxIN3	TxIN/RxOUT27	Red6	R0 [LSB]	
	TxIN/RxOUT5	Red7 [MSB]	R1	
	TxIN/RxOUT10	Green6	G0 [LSB]	
	TxIN/RxOUT11	Green7 [MSB]	G1	
	TxIN/RxOUT16	Blue6	B0 [LSB]	
	TxIN/RxOUT17	Blue7 [MSB]	B1	
	TxIN/RxOUT23	Reserved	Reserved	

5.0 SIGNAL TIMING SPECIFICATION

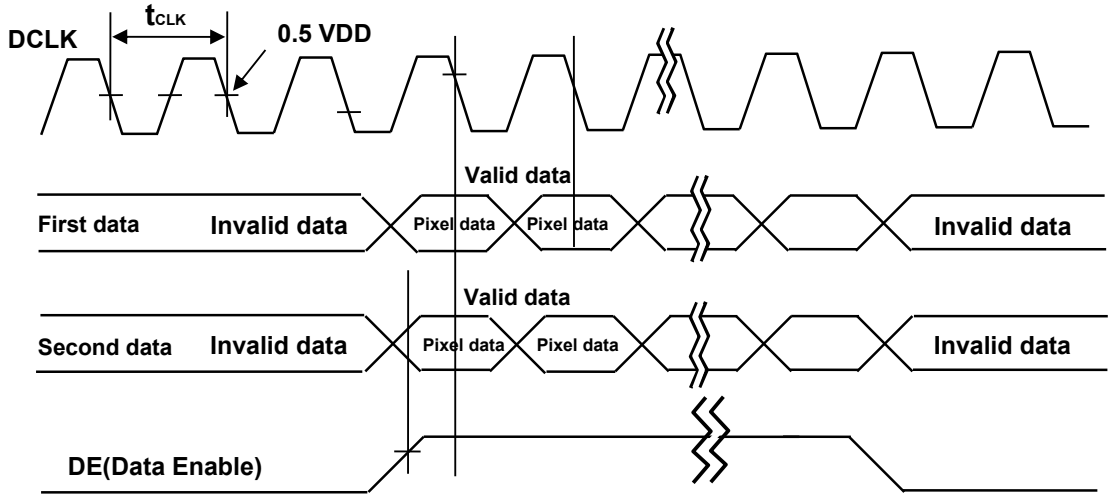
5.1 Timing Parameters (DE only mode)

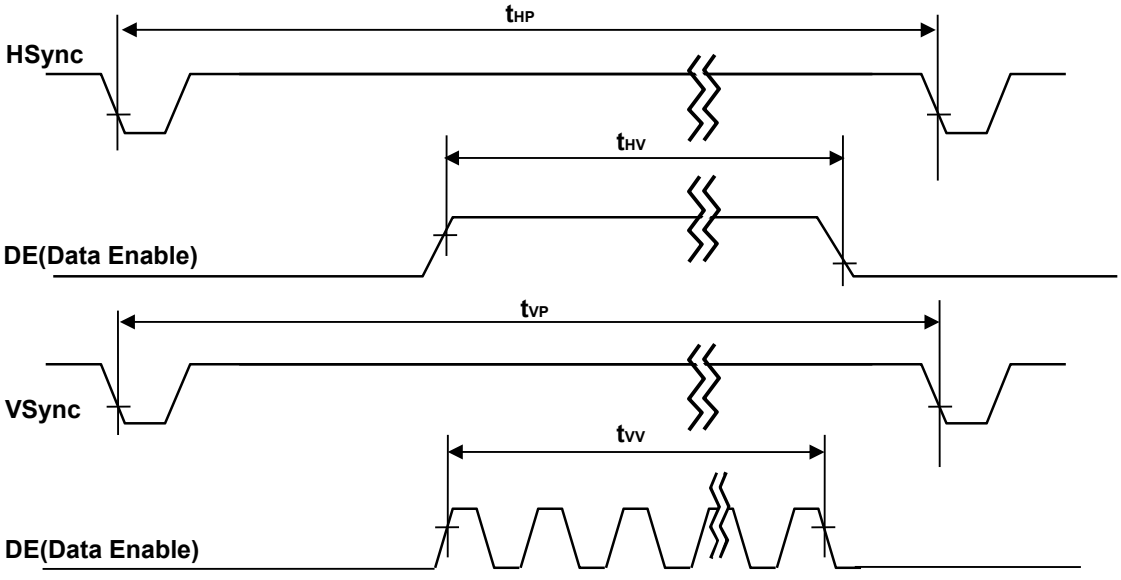
< Table 7. Timing Table >

ITEM	Symbol		Min	Typ	Max	Unit	Note
CLK	Period	t_{CLK}	11.8	13.3	17.9	ns	
	Frequency	-	56	75.4	85.0	MHz	
Hsync	Period	t_{HP}	1450	1560	2000	t_{CLK}	
	Frequency	f_H	39.4	48.4	55	KHz	
Vsync	Period	t_{VP}	778	806	1200	t_{HP}	
	Frequency	f_V	47	60	65	Hz	
Horizontal Active Display Term	Valid	t_{HV}	-	1366	-	t_{CLK}	
	Total	t_{HP}	1450	1560	2000	t_{CLK}	
Vertical Active Display Term	Valid	t_{VV}	-	768	-	t_{HP}	
	Total	t_{VP}	778	806	1200	t_{HP}	

Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

5.2 Signal Timing Waveform





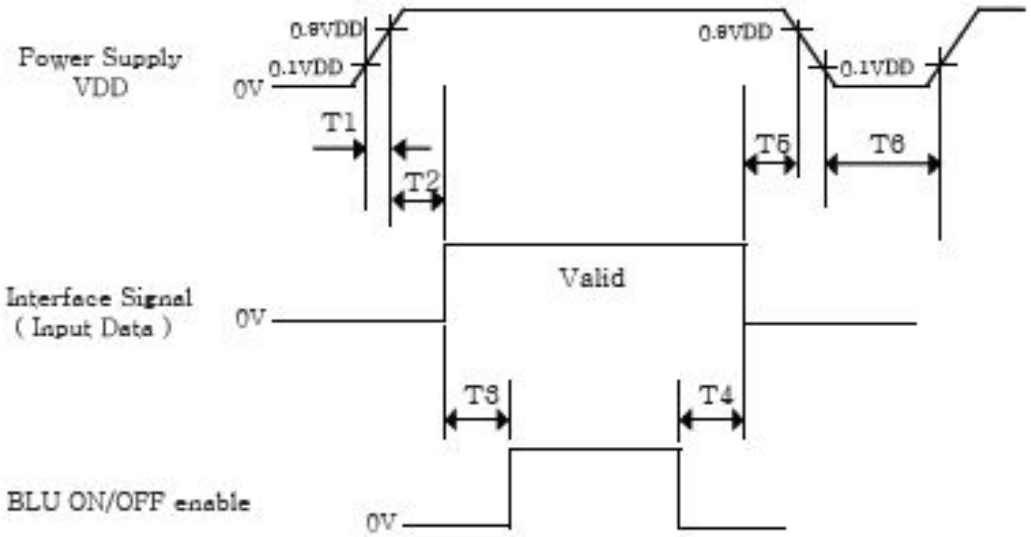
5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 8. Input Signal and Display Color Table >

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

5.4 Power Sequence

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



< Table 9. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0	-	50	ms
T6	1	-	-	s

Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
2. Back Light must be turn on after power for logic and interface signal are valid.

6.0 OPTICAL SPECIFICATIONS

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 (Goniometer system and PR730) 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 $\theta_{\phi=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{\phi=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{\phi=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{\phi=270}$(= θ_6) as the 6 o'clock direction ("bottom"). While scanning θ and/or ∅, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

< Table 10. Optical Table >

[VDD = 12.0V, Frame rate = 60Hz, Ta =25±2 ℃]

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	Horizontal	Θ_3	CR > 10		89		Deg.	Note 1
		Θ_9			89		Deg.	
	Vertical	Θ_{12}			89		Deg.	
		Θ_6			89		Deg.	
Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle With BOE Module	900:1	1200:1	-		Note 2
Reproduction of color	White	W_x		TYP. - 0.03	0.280	TYP. + 0.03		Note 3
		W_y			0.290			
	Red	R_x			0.630			
		R_y			0.340			
	Green	G_x			0.300			
		G_y			0.630			
	Blue	B_x			0.148			
		B_y			0.068			
Response Time	G to G	T_g		-	8	10	ms	Note 4
Gamma Scale				2.0	2.2	2.4		
Luminance of Black		Y_b		-	-	0.5	cd/m²	Note 6
Cell Transmittance			ACC OFF		6.6		%	Note 5
JND Mura			Horizontal	-	-	24		
			Vertical	-	-	18		
ACC(50, 255Gray)		Wx	With SEC Module	TYP -0.03	TYP	TYP +0.03		
		Wy			TYP			

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.
2. Contrast measurements shall be made at viewing angle of ❑= 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 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. The color chromaticity coordinates specified in Table 9.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 panel.
4. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize.
   Each time in below table is defined as Figure 2and shall be measured by switching the input signal for "any level of gray(bright)"and "any level of gray(dark)".

Measured Response Time		Target																
		0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
Start	0																	
	15																	
	31																	
	47																	
	63																	
	79																	
	95																	
	111																	
	127																	
	143																	
	159																	
	175																	
	191																	
	207																	
	223																	
	239																	
	255																	

5. Definition of Transmittance (T%) :
   Module is with white(L255) signal input

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of BLU}} \times 100\ \%$$

6. There will be less than 3 times of black luminance difference between center and each 4 corners. The position of 4 corners are described in Appendix Figure.4

7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3 (located in Appendix) shows mechanical outlines for the model HV320WX2-262. Other parameters are shown in Table 10.

< Table 11. Dimensional Parameters >

Parameter	Specification	Unit
Active area	697.685 (H) ×392.256(V)	mm
Pixel pitch	0.51(H) ×0.51(V)	mm
Number of pixels	1366(H) ×768(V) (1 pixel = R + G + B dots)	pixels
Weight	895 (typ.)	gram

7.2 Semi-Glare and Polarizer Hardness

The surface of the LCD has an semi-glare coating to minimize reflection and a coating to r educe scratching.

8.0 Reliability Test Condition

< Table 12. Reliability Test Condition >

Item	Test Condition
High Temperature Storage Test	Ta = 60 ℃, 240 hrs
Low Temperature Storage Test	Ta = -20 ℃, 240 hrs
High Temperature & High Humidity Operation Test	Ta = 50 ℃, 80%RH, 240hrs
High Temperature Operation Test	Ta = 50 ℃, 240hrs
Low Temperature Operation Test	Ta = 0 ℃, 240hrs
Thermal Shock Test	Ta = -20 ℃ (0.5 hr) ↔ 60 ℃ (0.5 hr), 100 cycles
Product ESD Test	+/- 7KV (Contact), Test Point: LVDS connector (Note.1)

Note.1:ESD test results for 5 samples:

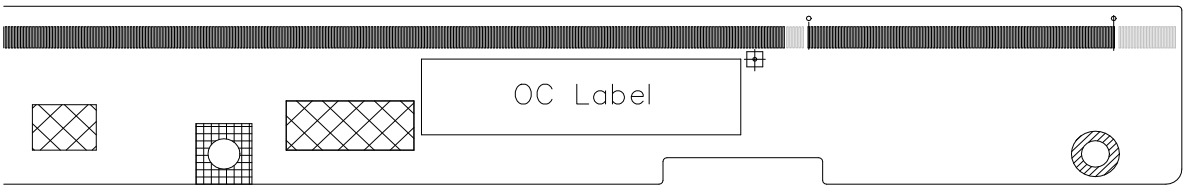
Item	Panel ID					Result
	A2C5	B8C4	B3A1	B5C4	AXA3	
+/- 7KV	OK	OK	OK	OK	OK	OK
+/- 8KV	OK	OK	OK	OK	OK	OK
+/- 9KV	OK	OK	OK	OK	OK	OK
+/- 10KV	OK	OK	OK	OK	OK	OK
+/- 11KV	OK	OK	OK	OK	OK	OK
+/- 12KV	OK	OK	OK	OK	OK	OK
+/- 13KV	OK	OK	OK	OK	OK	OK
+/- 14KV	OK	OK	OK	OK	OK	OK
+/- 15KV	NG	NG	NG	NG	NG	NG

9.0 PRODUCT SERIAL NUMBER

1		2	3	4		5	6				7						
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

1. Control Number
2. Rank / Grade
3. Line Classification
4. Year (2011 : 11, 2012 : 12, …)
5. Month (1,2,3, … , 9, X, Y, Z)
6. Internal Use
7. Serial Number

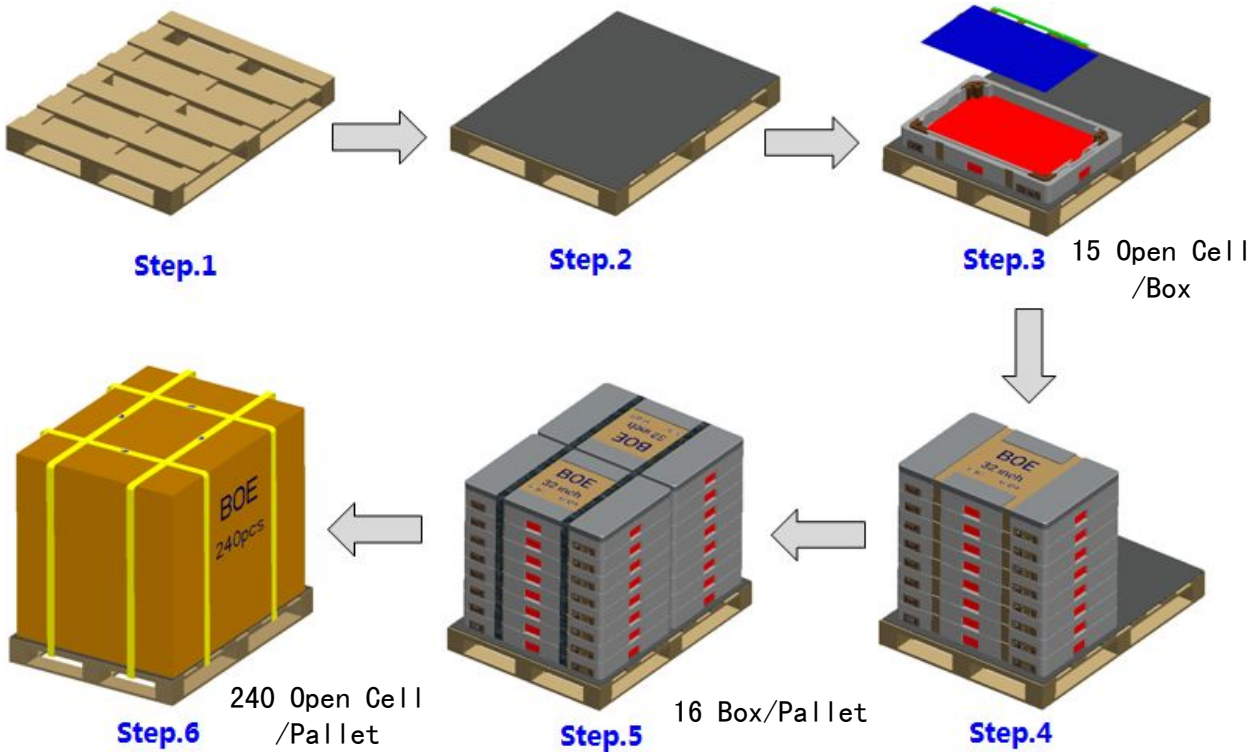
Product label will be attached on top side of source PCBA. The position is showed as below:



10.0 PACKING INFORMATION

BOE provides the standard shipping container for customers, unless customer specifies th eir packing information. The standard packing method and Barcode information are shown in below. The packing material ESD Spec is shown in Appendix Figure 7.

10.1 Packing Order



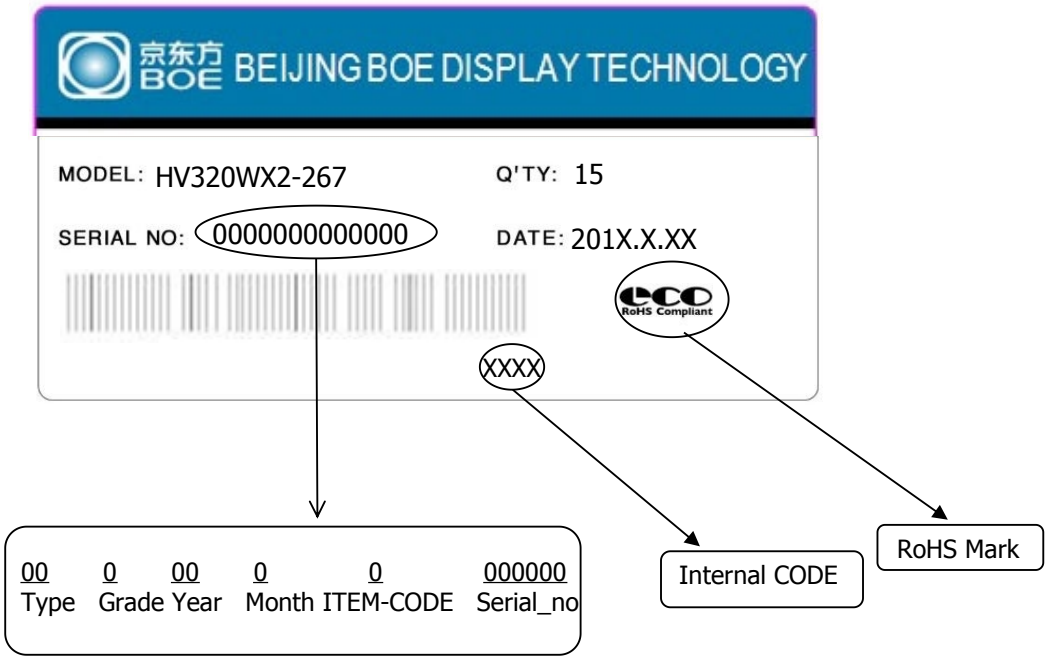
10.2 Packing Note

Item	Size(mm)	Weight(Kg)	Remark
Box	880*605*105	-	-
Packing	1260*940*1018	-	-

10.3 Box Label

- Label Size : 110 mm (L) ◈ 55 mm (W)
- Contents

  Model : HV320WX2-267
  Q`ty : 15 Open Cell in one box.
  Serial No. : Box Serial No. See next page for detail description.
  Date : Packing Date
  FG Code : FG Code of Product



10.4 Packing Material ESD Specification

Item	SPEC
Surface Resistance [10^n Ω]	Control by 10^6~10^9 - Box, Spacer, POL Protection film

11.0 HANDLING & CAUTIONS

CAUTIONS

(1)Cautions when taking out the Panel

Pick the pouch only, when taking out panel from a shipping package.

(2) Cautions for handling the panel

As the electrostatic discharges may break the LCD Panel, handle the LCD panel with ca re. Peel a protection sheet off from the LCD panel surface as slowly as possible.

As the LCD panel and back -light element are made from fragile glass material, impulse and pressure to the LCD panel should be avoided.

As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth with out chemicals for cleaning.

Do not pull the interface connector in or out while the LCD panel is operating.

Put the panel display side down on a flat horizontal plane.

Handle connectors and cables with care.

(3) Cautions for the operation

When the panel is operating, do not lose CLK, ENAB signals. If any one of these signal s Is lost, the LCD panel would be damaged.

Obey the supply voltage sequence. If wrong sequence is applied, the panel would be da maged.

(4) Cautions for the atmosphere

Dew drop atmosphere should be avoided.

Do not store and/or operate the LCD panel in a high temperature and/or humidity atmos phere. Storage in an electro-conductive polymer packing pouch and under relatively low te mperature atmosphere is recommended.

(5) Cautions for the panel characteristics

Do not apply fixed pattern data signal to the LCD panel at product aging.

Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions

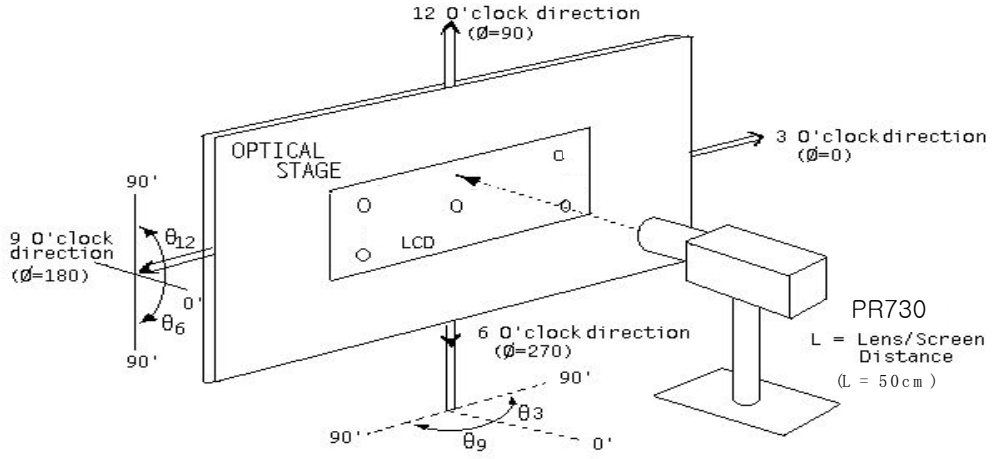
Do not disassemble and/or re-assemble LCD panel.

Do not re-adjust variable resistor or switch etc.

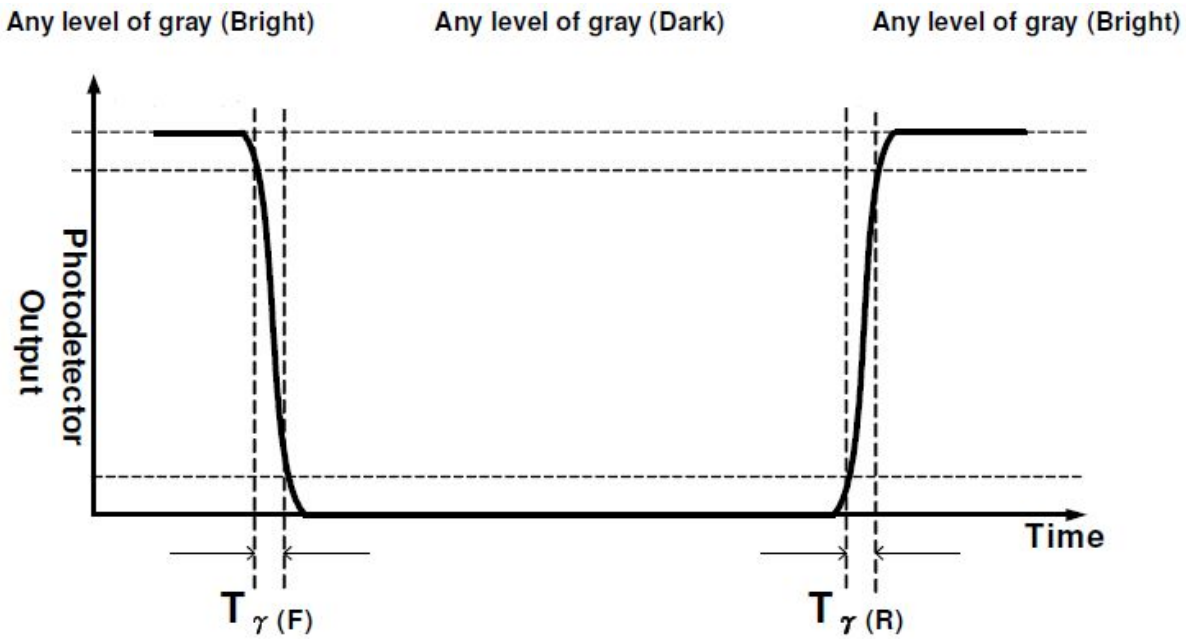
When returning the panel for repair or etc., Please pack the panel not to be broken. We r ecommend to use the original shipping packages.

12.0 APPENDIX

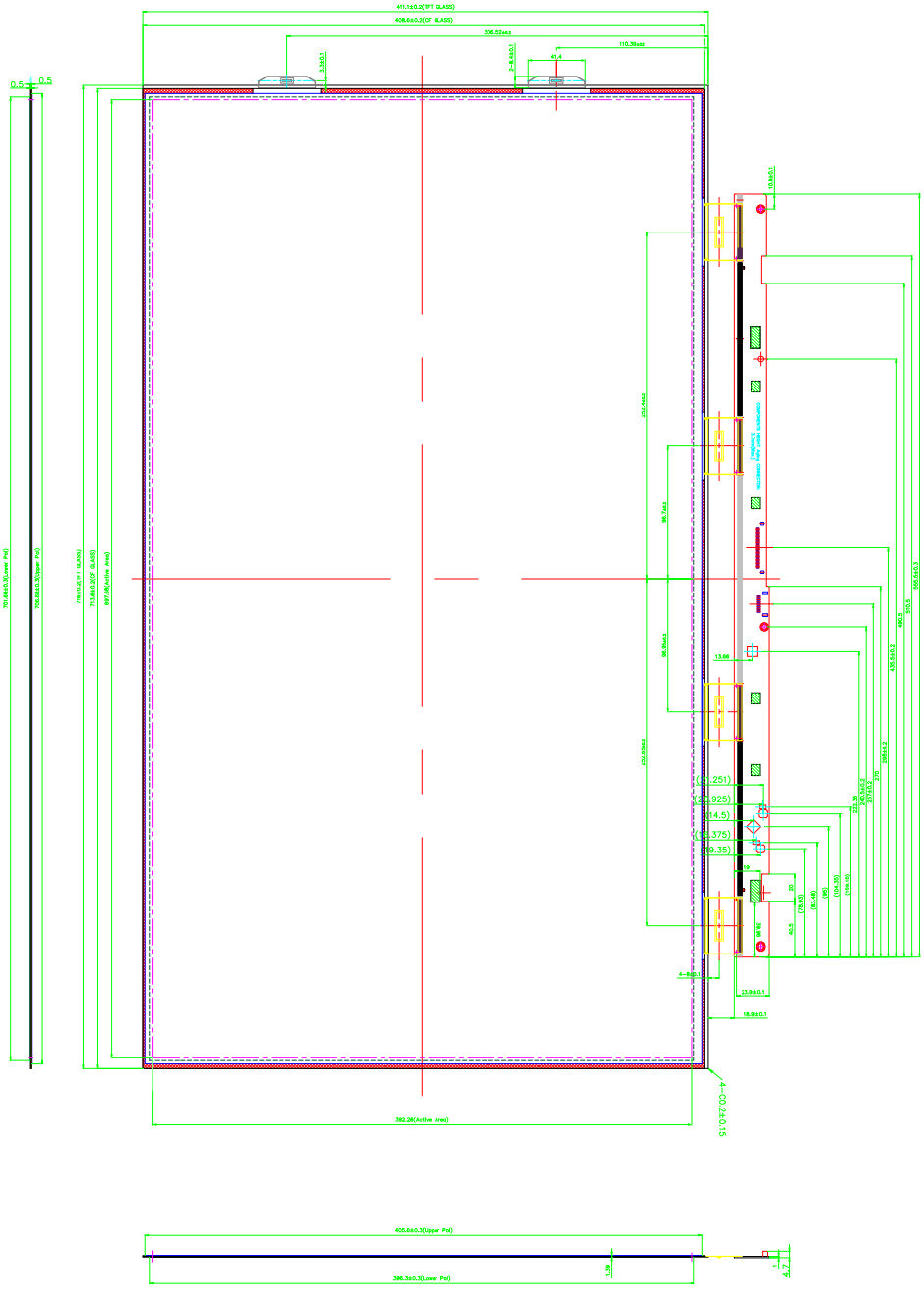
< Figure 1. Measurement Set Up >



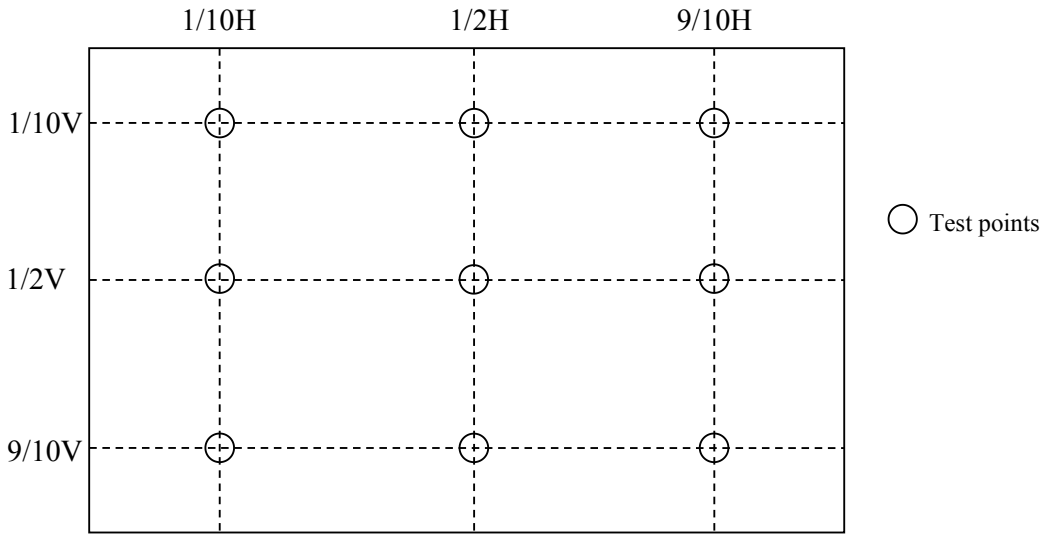
< Figure 2. Response Time Testing >



< Figure 3. Open Cell Outline Dimensions (Front View) >

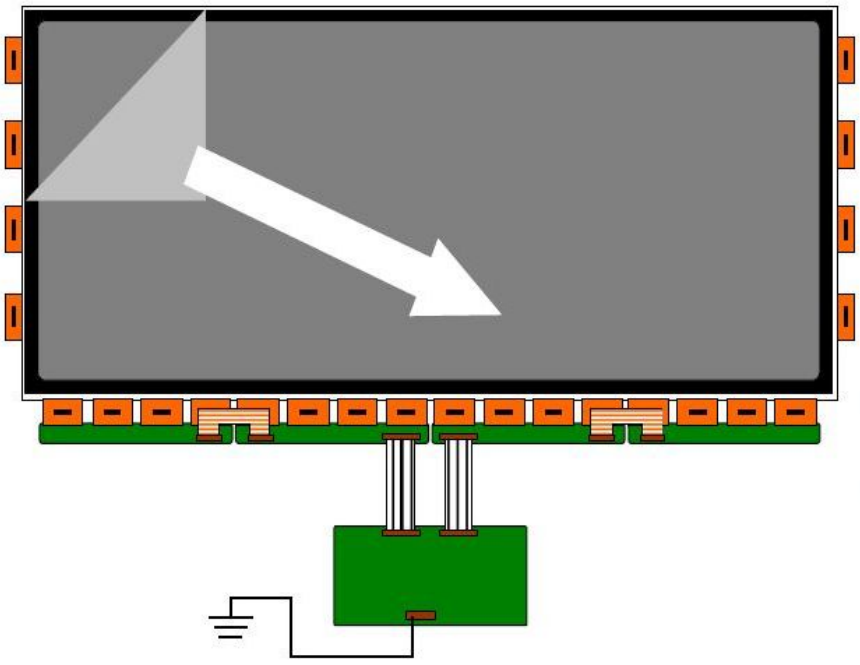


< Figure 4. Optical Measurement Locations >



Active Area: 697.7 ×392.3mm

< Figure 5. TFT POL Protect Film Peeling Method >



1. Be sure to peel off slowly(recommended more than 7sec) and constant speed.
2. Peeling direction shows in Figure 5.
3. Be sure to ground person with adequate methods such as the anti-static wrist band.
4. Be sure to ground S-PWB while peeling off the protection film.
5. Ionized air should be blown over during peeling action.
6. The protection film must not touch drivers and S-PWBs.
7. If adhesive may remain on the polarizer after the protection film peeling off, please rem ove with isopropyl-alcohol.

- Pol protect film peel off strength: 75g/m^2

< Table 13. Customer Request Specification >

Item	SPEC
Dark room criteria	Max. 10Lux
Unknown Black Mura guarantee time	25,000 hours