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TITLE:

DV320FHM-NN0 Product Specification

BEIJING BOE DISPLAY TECHNOLOGY

REVISION HISTORY

REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2016.4.7	Li Mengjie

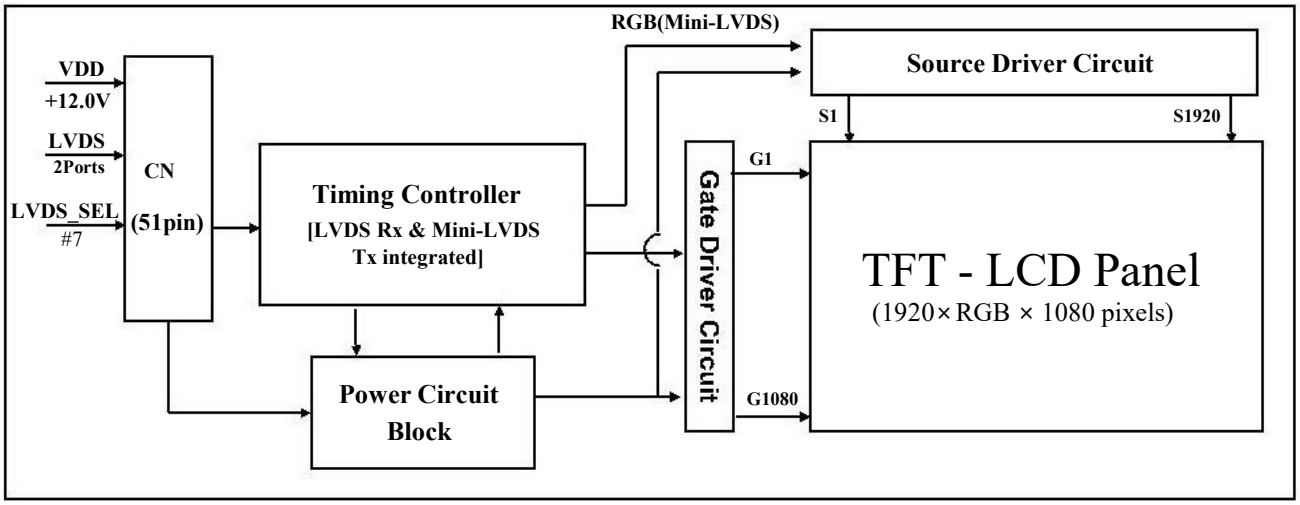
Contents

No	ITEM	Page
	REVISIONS HISTORY	2
	CONTENTS	3
1	GENERAL DESCRIPTION	4
	1.1 Introduction	
	1.2 Features	
	1.3 Applications	
	1.4 General Specification	
2	ABSOLUTE MAXIMUM RATINGS	6
3	ELECTRICAL SPECIFICATIONS	7
	3.1 TFT LCD Module	
	3.2 LED Converter	
4	INTERFACE CONNECTION	9
	4.1 Open Cell Input Signal & Power	
5	SIGNAL TIMING SPECIFICATIONS	13
	5.1 Timing Parameters	
	5.2 Signal Timing Waveform	
	5.3 Input Signals, Basic Display Colors & Cray Scale Of Colors	
	5.4 Power Sequence	
6	OPTICAL SPECIFICATIONS	17
7	MECHANICAL CHARACTERISTICS	19
8	RELIABILITY TEST CONDITION	20
9	PRODUCT SERIAL NUMBER	21
10	PACKING INFORMATION	22
	10.1 Packing Order	
	10.2 Box Label	
11	HANDING & CAUTIONS	24
12	APPENDIX	25

1.0 GENERAL DESCRIPTION

1.1 Introduction

DV320FHM-NN0 is a color active matrix TFT LCD MDL 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 FHD resolutions (1920 horizontal by 1080 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 2 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
- ADSDS 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(FHD TV)
- AV application Products

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remark
Active area	698.4(H) × 392.85 (V)	mm	
Number of pixels	1920(H)×1080(V)	pixels	
Pixel pitch	121.25(H)×RGB×363.75(V)	μm	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M(8bits-true)	colors	
Display mode	Transmission mode, Normally Black		
Open Cell Transmittance	5.0 (Typ.)	%	At center point with BOE BLU
Weight	4.2(Typ)	Kg	
Power Consumption	4.0	Watt	
Surface Treatment	Haze 1%		

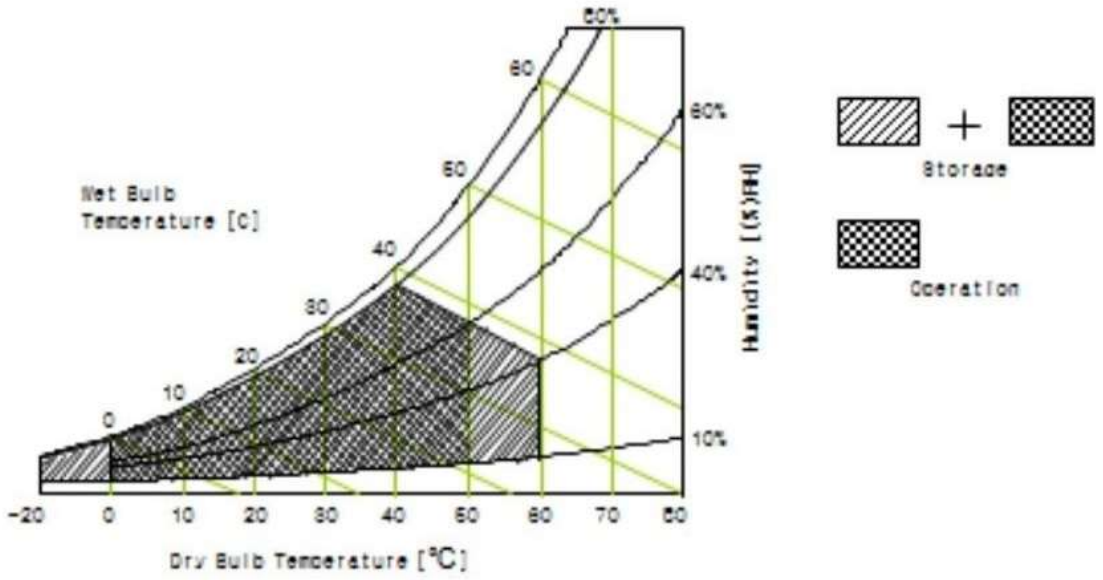
2.0 ABSOLUTE MAXIMUM RATINGS

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	TOP	0	+50	℃	Note 1
	TSUR	0	+60	℃	
Storage Temperature	TST	-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

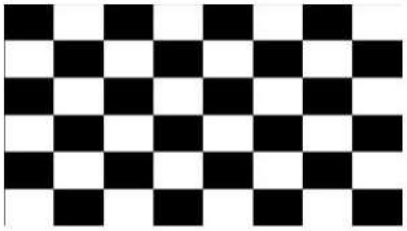
< Table 3. Open Cell Electrical Specifications >

[Ta =25±2℃]

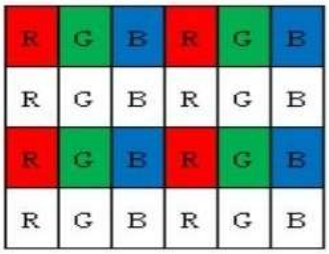
Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP			300	mV	
Power Supply Current		IDD	-	333	630	mA	Note 1
Power Consumption		PDD		4.0	7.6	Watt	
Rush current		IRUSH	-	-	3.0	A	Note 2
LVDS Interface	Differential Input 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 fv=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 : H- Stripe



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

3.2 LED Converter

3.2.1 Input Electrical Characteristics ：

INPUT VOLTAGE：

Minimum	Nominal	Maximum	Unit
24V/2.0A	24V/2.5A	-	V/A

3.2.2 Output Electrical Characteristics：

DC OUTPUT：

LED DRIVER (DC/DC) ELECTRICAL REQUIREMENTS:

Notes: The LED protection test for a single set of test.

a.LIGHT BAR TYPE:

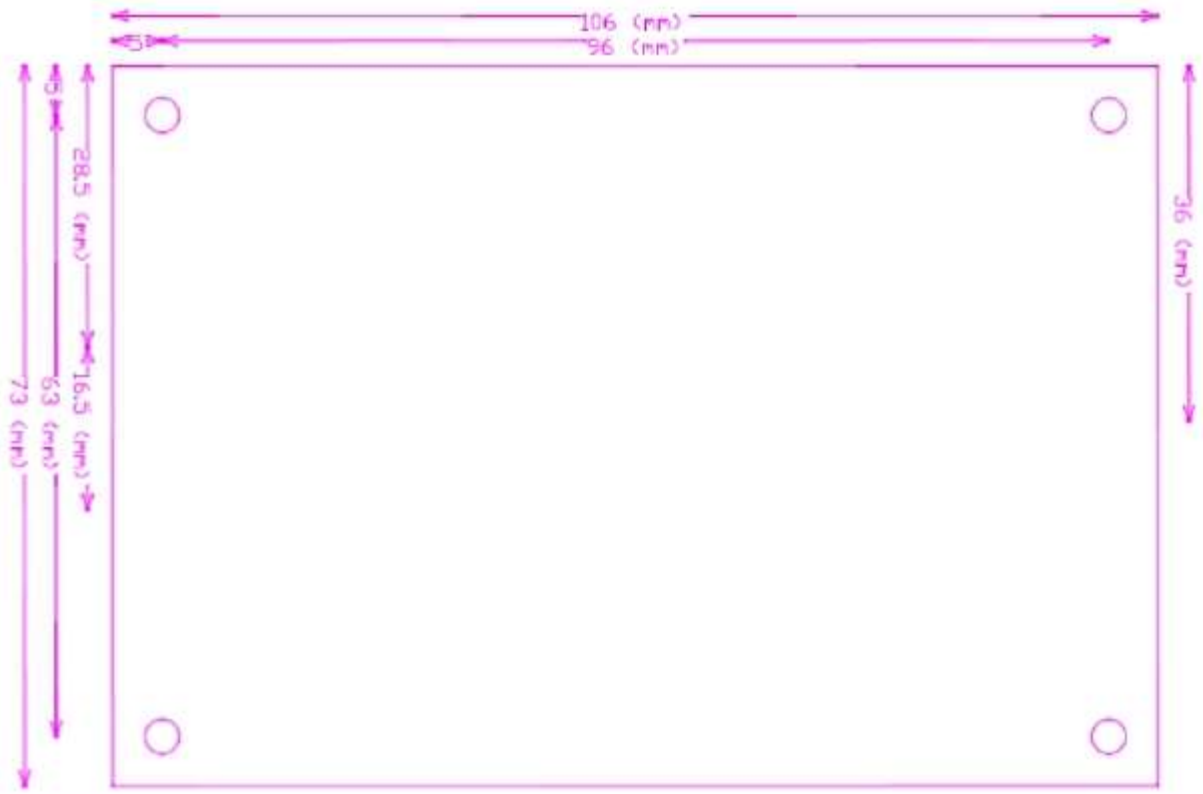
LTEM	DESCRIPTION	CONDITION	MIN.	TYP	MAX	UNIT
1	LED VOLTAGE		84	90	96	Vdc
2	LED CURRENT		-	480	-	mA
3		DEVIATION		5		%
4	POWER CONSUMPTION		-	-	46	W
5	BACKLINHT ON/OFF CONTROL	ON	2.5		5	Vdc
		OFF	0		0.7	HZ
6	DC/PWM DIMMING	Frequency	100		200	HZ
		Duty cycle	20		100	%

Notes: When the discrepancy of lights voltage is more than 3.0V,Please do not use the LED driver.		
a. Protection characteristics:		
ITEM	CONDITION	SPECIFICATION
1.LED OPEN PROTECTION:	OPEN OUTPUT	SHUTDOWN AND NO DAMAGE
2.LED STRING SHORT PROTECTION:	SHORT OUTPUT	SHUTDOWN AND NO DAMAGE

Mechanical Characteristics：

3.3 Dimension:

106.0(L)*73.0(W)*13(H) mm (L *W * H)



3.4 CN1-14PIN-2.0

Pin No	Symbol	Description	
1	VBL	Power Supply +24V	
2	VBL	Power Supply +24V	
3	VBL	Power Supply +24V	
4	VBL	Power Supply +24V	
5	VBL	Power Supply +24V	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	NC	No Connection	
12	VBLON/OFF	BLU On-Off control	Max：3.3V / Min：0V
13	PWM 调光	0V:Min，3.3V:Max	On：2.8V~5.0V/Off :0~0.8V
14	NC	NC	

While system is turned ON or OFF, the power sequences must follow as below descriptions:

Turn ON sequence: VBL-ON → PWM signal → BLON
Turn OFF sequence: BLOFF → PWM signal → VBL-ON

4.0 INTERFACE CONNECTION

4.1 Module Input Signal & Power

- Connector : IS050-C51B-C39-S (UJU) / FI-RE51S-HF-R1500 (JAE) or Equivalent.

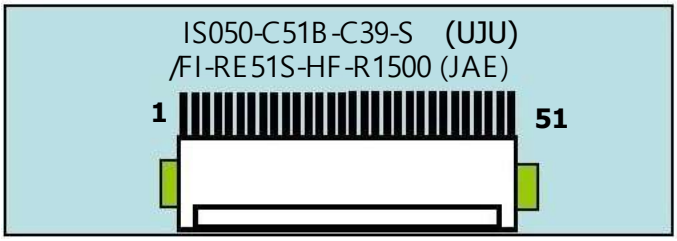
< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	NC	No Connection	21	GND	Ground
2	SDA	I2C Data	22	CH1[3]-	First pixel negative LVDS differential data input. Pair3
3	SCL	I 2C Clock	23	CH1[3]+	First pixel positive LVDS differential data input. Pair3
4	NC	Not Connected	24	NC	Not Connected
5	NC	Not Connected	25	NC	Not Connected
6	NC	Not Connected	26	NC	Not Connected
7	SELLVDS	High: JEIDA Low or Open: VESA	27	NC	Not Connected
8	NC	Not Connected	28	CH2[0]-	Second pixel negative LVDS differential data input. Pair0
9	NC	Not Connected	29	CH2[0]+	Second pixel positive LVDS differential data input. Pair0
10	NC	Not Connected	30	CH2[1]-	Second pixel negative LVDS differential data input. Pair1
11	GND	Ground	31	CH2[1]+	Second pixel positive LVDS differential data input. Pair1
12	CH1[0]-	First pixel negative LVDS differential data input. Pair0	32	CH2[2]-	Second pixel negative LVDS differential data input. Pair2
13	CH1[0]+	First pixel positive LVDS differential data input. Pair0	33	CH2[2]+	Second pixel positive LVDS differential data input. Pair2
14	CH1[1]-	First pixel negative LVDS differential data input. Pair1	34	GND	Ground
15	CH1[1]+	First pixel positive LVDS differential data input. Pair1	35	CH2CLK-	Second pixel negative LVDS clock
16	CH1[2]-	First pixel negative LVDS differential data input. Pair2	36	CH2CLK+	Second pixel positive LVDS clock
17	CH1[2]+	First pixel positive LVDS differential data input. Pair2	37	GND	Ground
18	GND	Ground	38	CH2[3]-	Second pixel negative LVDS differential data input. Pair3
19	CH1CLK-	First pixel negative LVDS clock	39	CH2[3]+	Second pixel positive LVDS differential data input. Pair3
20	CH1CLK+	First pixel positive LVDS clock			

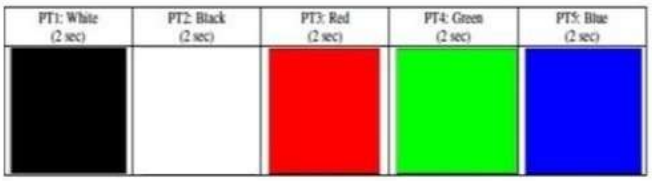
Pin No	Symbol	Description	Pin No	Symbol	Description
40	NC	Not Connected	46	GND	Ground
41	NC	Not Connected	47	NC	Not Connected
42	NC	Not Connected	48	VCC	Input Voltage +12V
43	NC	Not Connected	49	VCC	Input Voltage +12V
44	GND	Ground	50	VCC	Input Voltage +12V
45	GND	Ground	51	VCC	Input Voltage +12V

Notes : 1. NC(Not Connected) : This pins are only used for BOE internal operations.
2. Input Level of LVDS signal is based on the IEA 664 Standard.
3. LVDS_SEL : This pin is used for selecting LVDS signal data format.
If this Pin : High (3.3V) →JEIDA LVDS format
Otherwise : Low (GND) or Open (NC) → Normal NS LVDS format

Rear view of LCM



BIST Pattern



5.0 SIGNAL TIMING SPECIFICATION

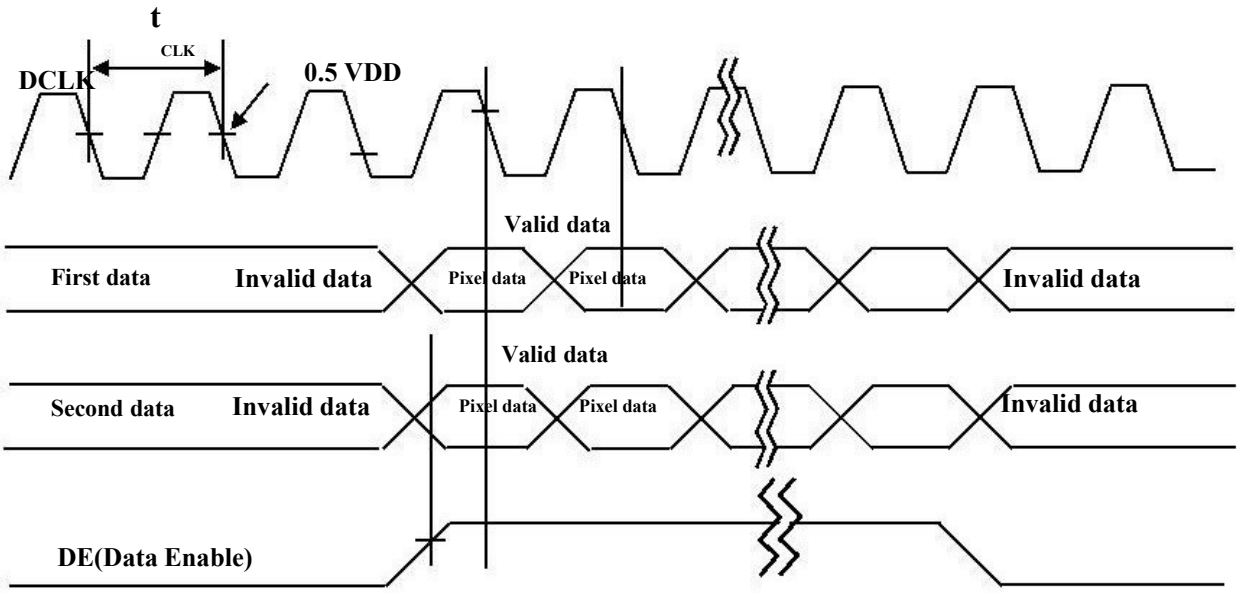
5.1 Timing Parameters (DE only mode)

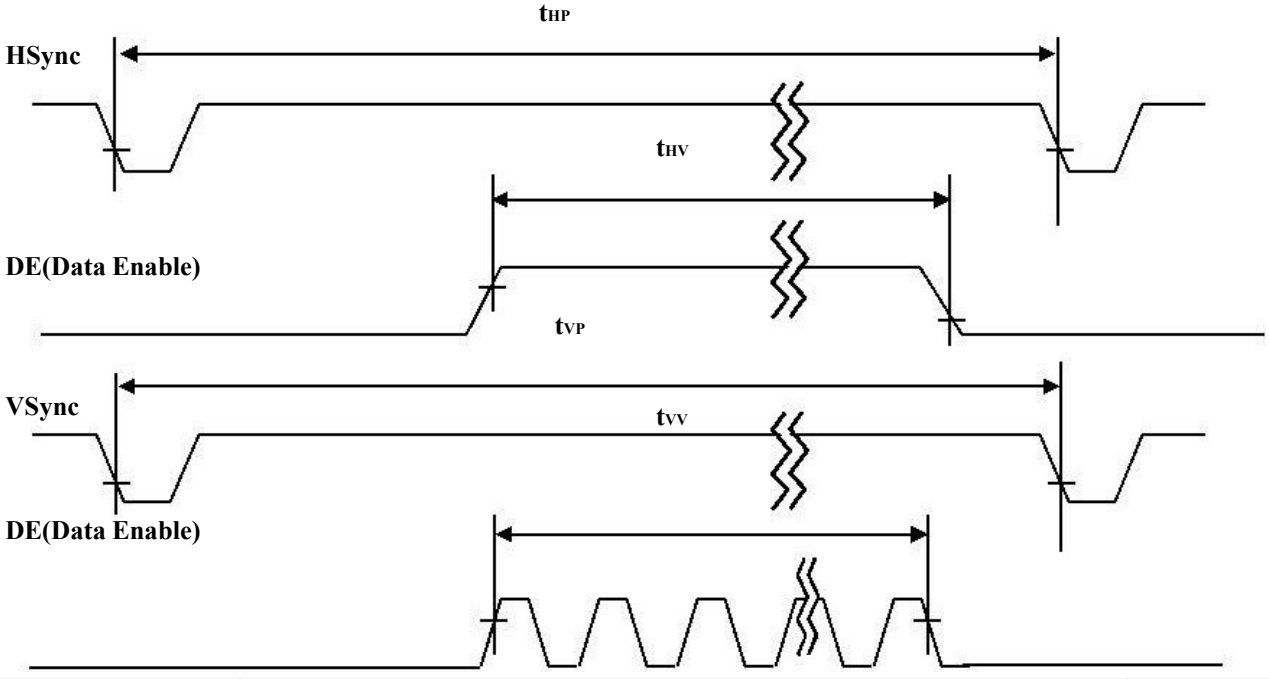
< Table 5. Timing Table >

Item		Symbols		Min	Typ	Max	Unit
Clock	Frequency	1/Tc		63	74.25	78	MHz
	High Time	Tch		-	4/7Tc	-	
	Low Time	Tcl		-	4/7Tc	-	
Frame Period		Tv		1100 (1308)	1125 (1350)	1149 (1380)	lines
				57 (47)	60 (50)	63 (53)	Hz
Horizontal Active Display Term		Valid	t_{HV}	-	960	-	t_{CLK}
		Total	t_{HP}	1060	1100	1200	t_{CLK}
Vertical Active Display Term		Valid	t_{VV}	-	1080	-	t_{HP}
		Total	t_{VP}	1100	1125	1149	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





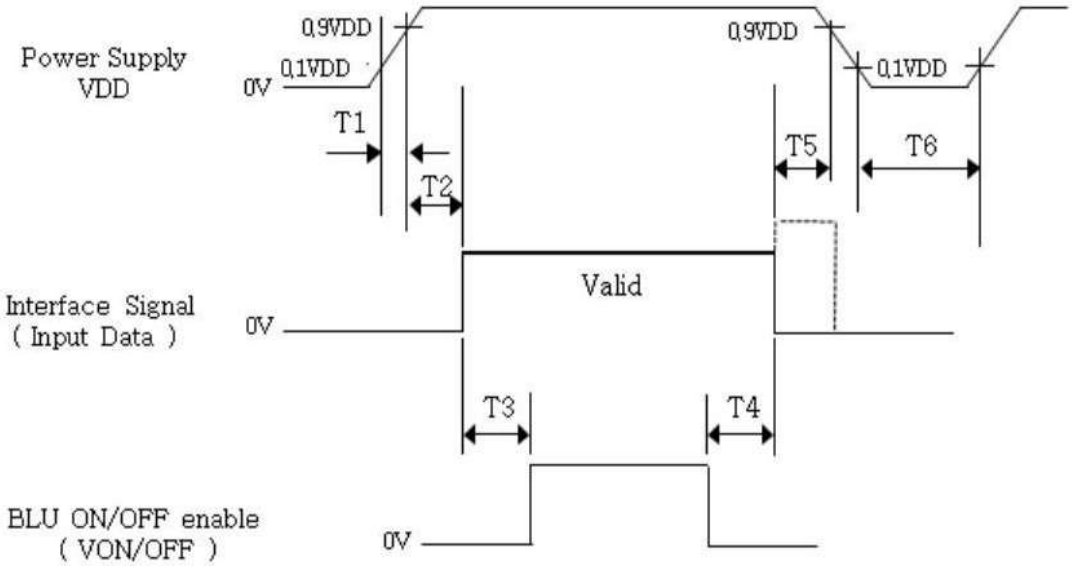
5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 6. 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 be as shown in below



< Table 7. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	20	ms
T2	10	-	100	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0	-	-	ms
T6	1	-	-	s

Notes: 1. Back Light must be turn on after power for logic and interface signal are valid.
2. Even though T1 is out of SPEC, it is still ok if the inrush current of VDD is below the limit.

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 $\theta_{Ø=0}(=\theta_3)$ as the 3 o'clock direction (the "right"), $\theta_{Ø=90}(=\theta_{12})$ as the 12 o'clock direction ("upward"), $\theta_{Ø=180}(=\theta_9)$ as the 9 o'clock direction ("left") and $\theta_{Ø=270}(=\theta_6)$ 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 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 8. Optical Table >

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

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Luminance	Central Luminance	Lwc	Center	300	350		nit	
	Uniformity	△ Lw	Min/Max	75			%	
Viewing angle	Horizontal	Θ3	CR > 10		89		Deg.	Note 1
		Θ9			89	-	Deg.	
	Vertical	Θ12			89		Deg	
		Θ6			89		Deg	
Contrast ratio		CR	(Center) Normal Viewing Angel	900:1	1200:1	-	-	Note 2
Response time	Gray to Gray	TGtG_AVE			8	10	ms	Note 4
Chromaticity of white		x		TYP.-0.03	0.269	TYP. +0.03	-	Note 3(with BOE BLU)
		y			0.271		-	
Chromaticity of red		x			0.620		-	
		y			0.346		-	
Chromaticity of green		x			0.318		-	
		y			0.634		-	
Chromaticity of blue		x			0.154		-	
		y			0.037		-	
Center Transmittance		T%		-	5.0	-	%	Note 5

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 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 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 8.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. The BLU is used by BOE.
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 2 and shall be measured by switching the

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

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

7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 3(located in Appendix) shows mechanical outlines for the model DV320FHM-NN0.
Other parameters are shown in Table 9.

< Table 9. Dimensional Parameters >

Parameter	Specification	Unit
Active area	698.4(H) × 392.85 (V)	mm
Pixel pitch	121.25(H)×RGB×363.75(V)	μm
Number of pixels	1920(H) ×1080(V) (1 pixel = R + G + B dots)	pixels
Weight	850	gram

7.2 Semi-Glare and Polarizer Hardness

The surface of the LCD has an Anti-glare coating to minimize reflection and a coating to Reduce scratching.

8.0 Reliability Test Condition

< Table 10. Reliability Test Condition >

Type	Test Item			BOE	
				Test Condition	时间
Optical Test	Chromaticity/Brightness/Uniformity				
Electrical Test	Power Consumption				
	Electric Static Discharge	ESD	Module	150pF 330Ω ±15KV(Air)/ ±8kV(Contact)	100point
Reliability Test	Operation Test	THO	Temperature & Humidity Operation	50 ℃,80%	500 hr
		HTO	High Temperature Operation Test	60℃	240 hr
		LTO	Low Temperature Operation Test	-5℃	240 hr
		On/Off	On/Off Operation Test	1min(on) / 1min(off)	30000cycle
	Storage Test	HTS	High Temperature Storage Test	60℃	240hr
		LTS	Low Temperature Storage Test	-20℃	240hr
		TST	Thermal Shock Test-1	-20℃~60℃ (Per 30min)	100cycle
	Mechanical	P-VIB& Drop	Packing VIB&Drop	VIB:1.05G；5~200Hz,+Z,1hr	6hr
				Drop：JIS0200Z	
	Altitude		Altitude Test (低气压测试)	40000 ft, -10℃ / 24 hr,25℃ /	72hr
				24 Hr,-10℃ / 24 hr	
	Acoustic Noise		Acoustic Noise (噪音测试)	Front/Left @ Center≤18dB,	2cycle
				Rear/Inverter≤25dB	(90min/cycle)

9.0 PRODCUT 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

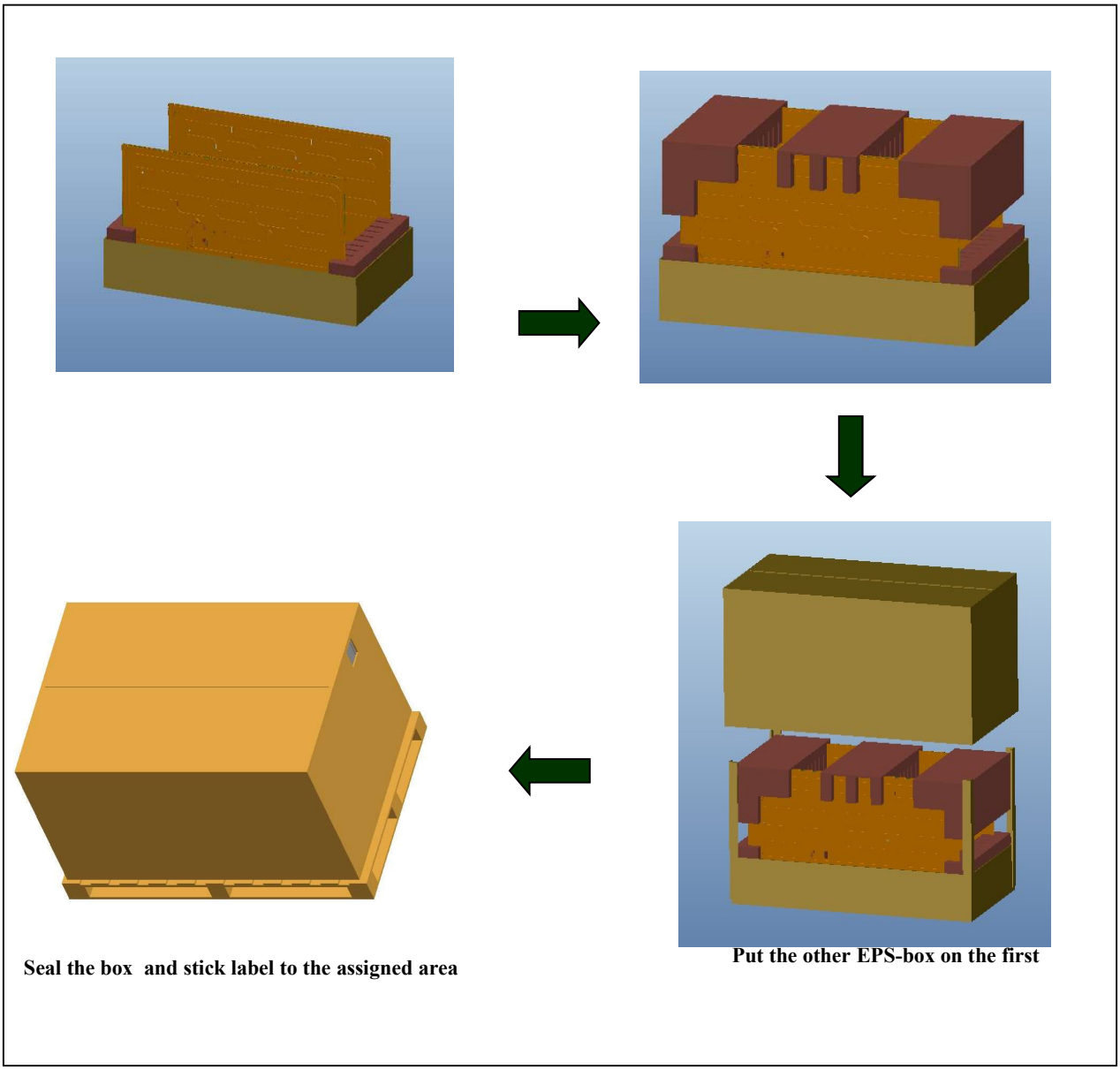
1. Control Number
2. Rank / Grade
3. Line Classification
4. Year (2011 : 11, 2012 : 12, …)
5. Month (1,2,3, … , 9, X, Y, Z)
6. Internal Use
7. Serial Number

10.0 PACKING INFORMATION

待定，设计中

BOE provides the standard shipping container for customers, unless customer specifies their packing information. The standard packing method and Barcode information are shown in below.

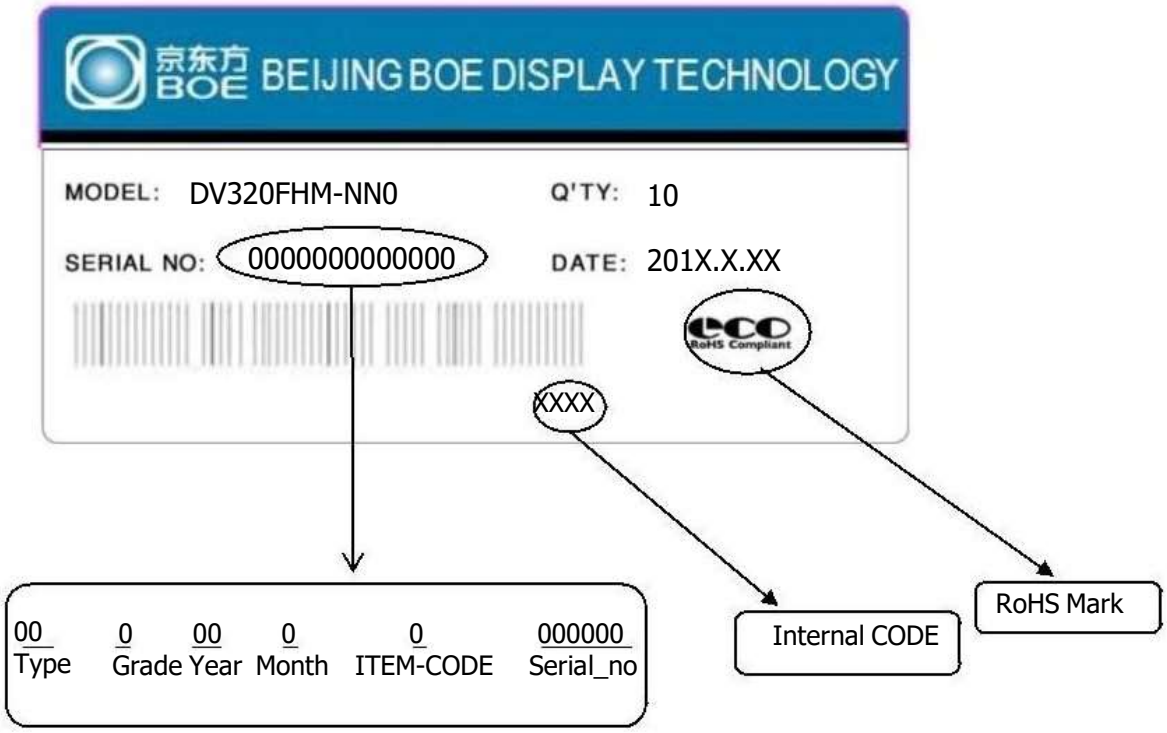
10.1 Packing Order



10.2 Box Label

待定，设计中

- Label Size : 110 mm (L) × 55 mm (W)
- Contents
  Model : DV320FHM-NN0
  Q`ty : 10 Open Cell in one box.
  Serial No. : Box Serial No. See next page for detail description.
  Date : Packing Date



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 care. 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 without 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 signals Is lost, the LCD panel would be damaged.

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

(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 atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature 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

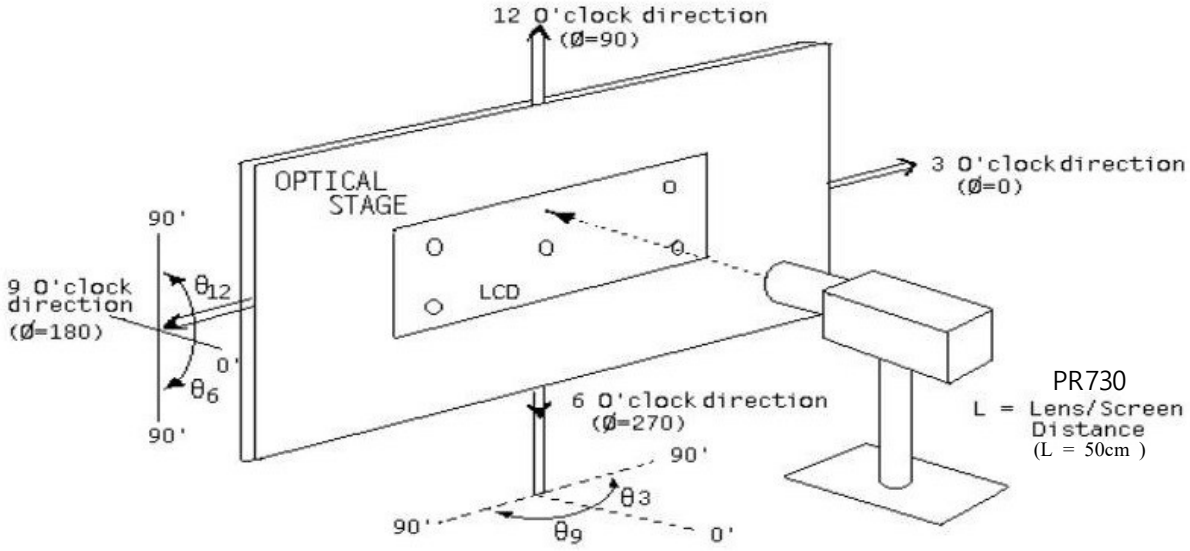
Do not disassemble and/or re-assemble LCD panel.

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 recommend to use the original shipping packages.

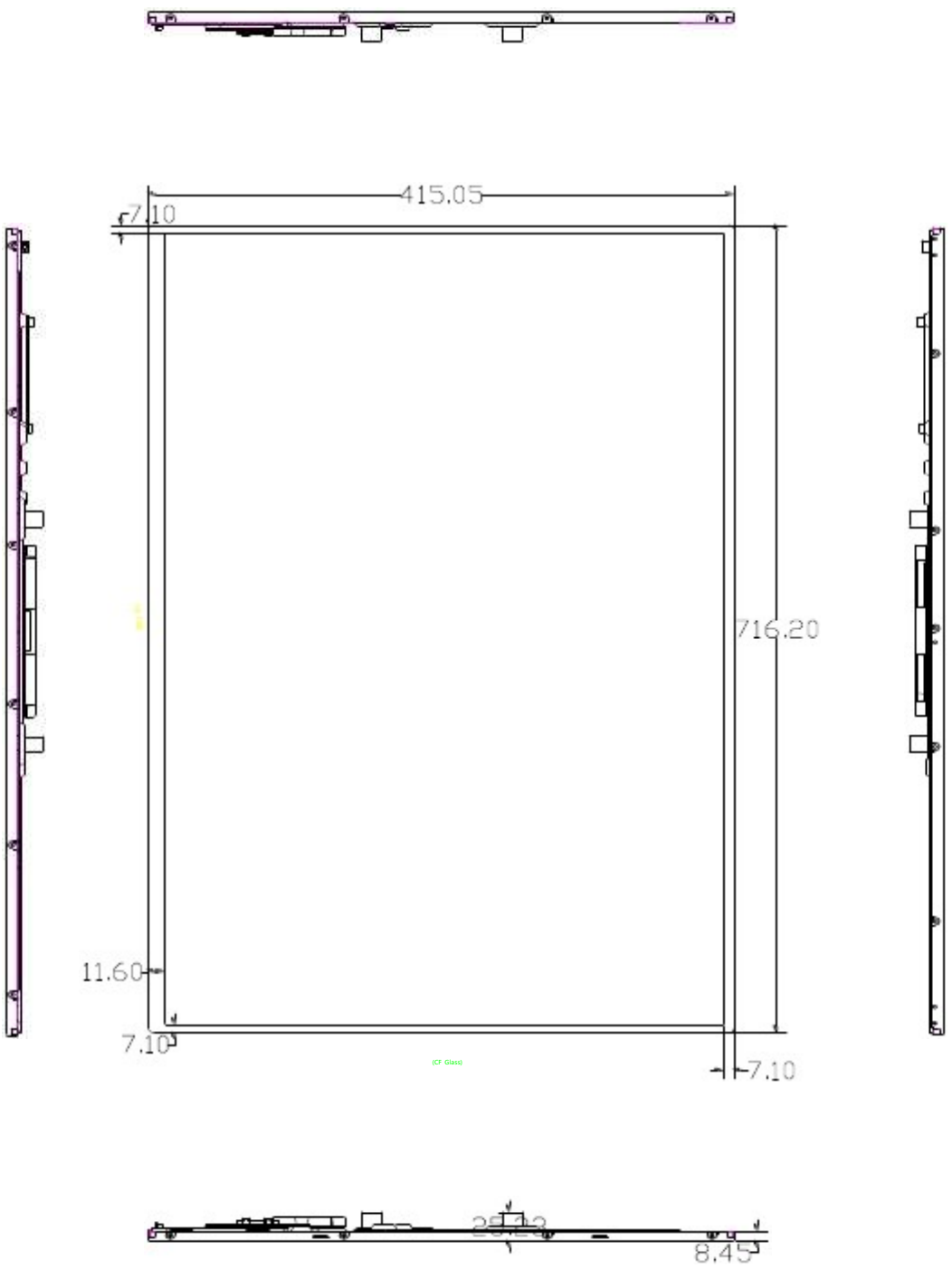
12.0 APPENDIX

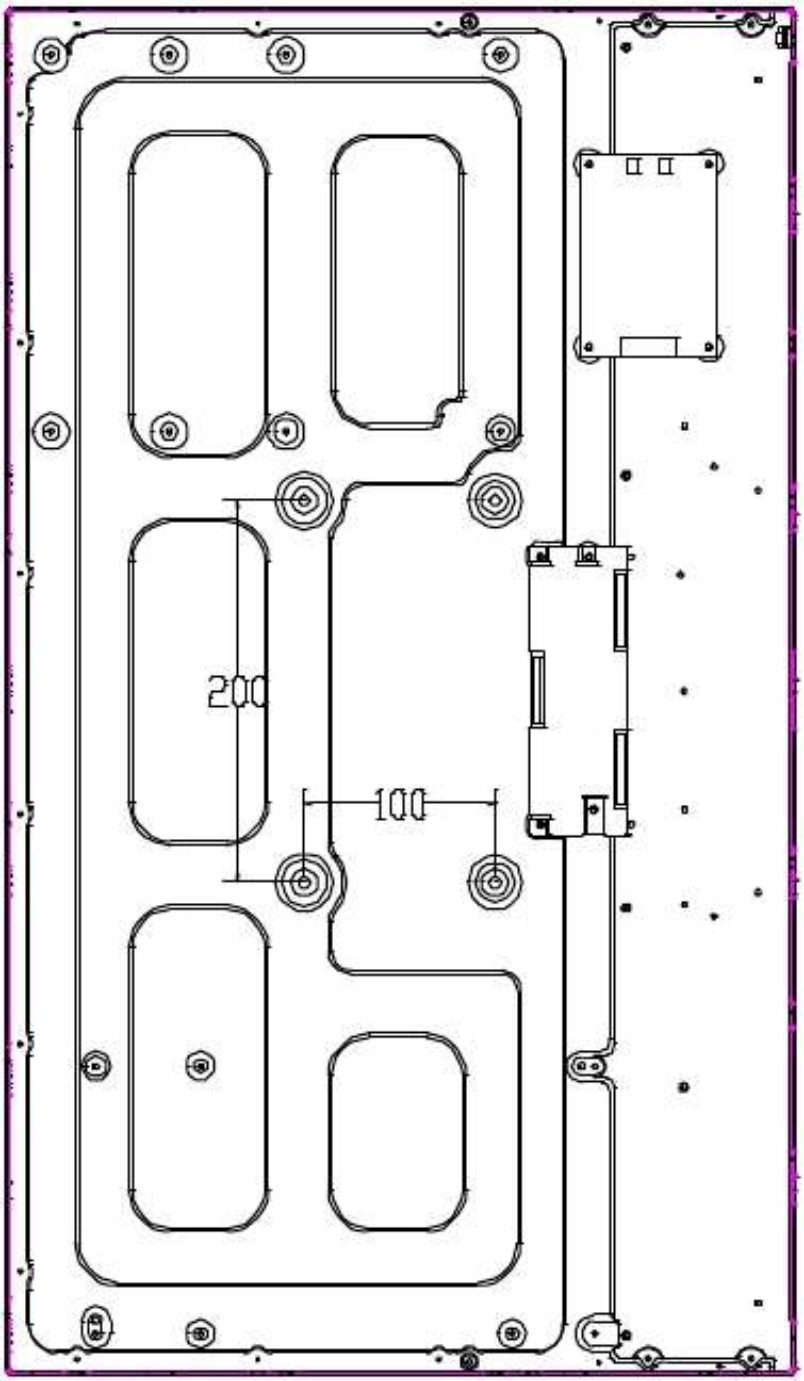
< Figure 1. Measurement Set Up >



< Figure 2. Response Time Testing >

TFT-LCD Module Outline Dimensions(Front View)




200
100