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Product Specification

( ) Product Information
( ) Preliminary Specification
(√) Approval Specification

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CUSTOMER	R/A Customer
DATE OF ISSUE	2016/06/19

MODEL NO.	BI1K-DV190E0M-N11 (1000 nits)
EXTENSION CODE	-V(0)

Customer Approval & Feedback

Approved by	2016/06/19
Prepared by	2016/06/19

The power of interpretation belongs to Sinotectronics.

DV190E0M-N11

Product Specification

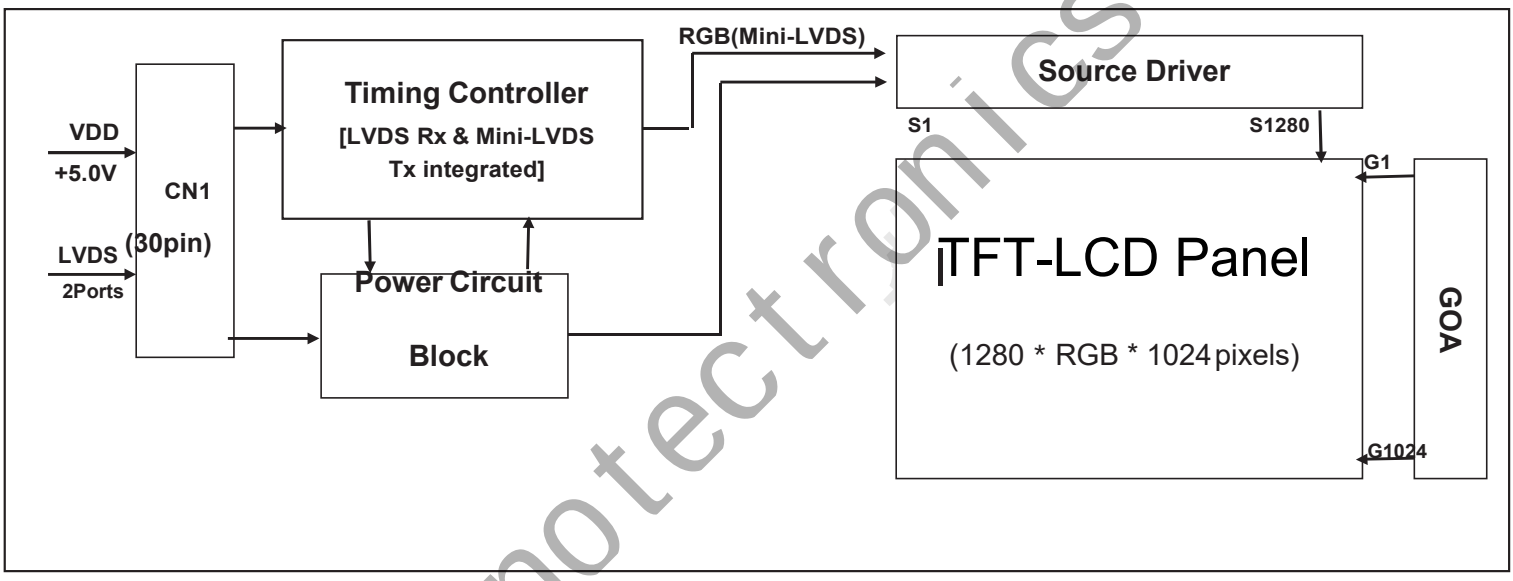
Rev. O

FUZHOU BOE OPTOELECTRONICS TECHNOLOGY Co.,LTD

1.0 GENERAL DESCRIPTION

1.1 Introduction

DV190E0M-N11 is a color active matrix TFT LCD MDL using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This MDL has a 19inch diagonally measured active area with FHD resolutions (1280 horizontal by 1024 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. The TFT-LCD MDL panel 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
- 6-bit (Hi-FRC) color depth, display 16.7M colors
- Wide viewing angle
- DE (Data Enable) only mode
- HADS technology is applied for high display quality
- RoHS compliant

1.3 Application

- Commercial Digital Display
- Display Terminals for Control System
- Landscape and Portrait Display

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	374.784(H) 299.8272(V)	mm	
Number of pixels	1280(H) 1024(V)	pixels	
Pixel pitch	97.6(H) 292.8(V)	um	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	16.7M	colors	6bits+FRC
Display mode	Normally Black		
Dimensional outline	396.0(H) 324.0(V) 9.9(D)	mm	Detail refer to drawing
Weight	1520	g	19.82kg/box
Power Consumption	10.64 Typ. 14.216 Max.	Watt	
Bezel width (L/R/U/D)	8.6/8.6/10.5/10.5	mm	
Surface Treatment	Haze 25%, 3H		
Back-light	Backlight increased to 1000 nits		
Possible display type	Landscape and Portrait Enabled		

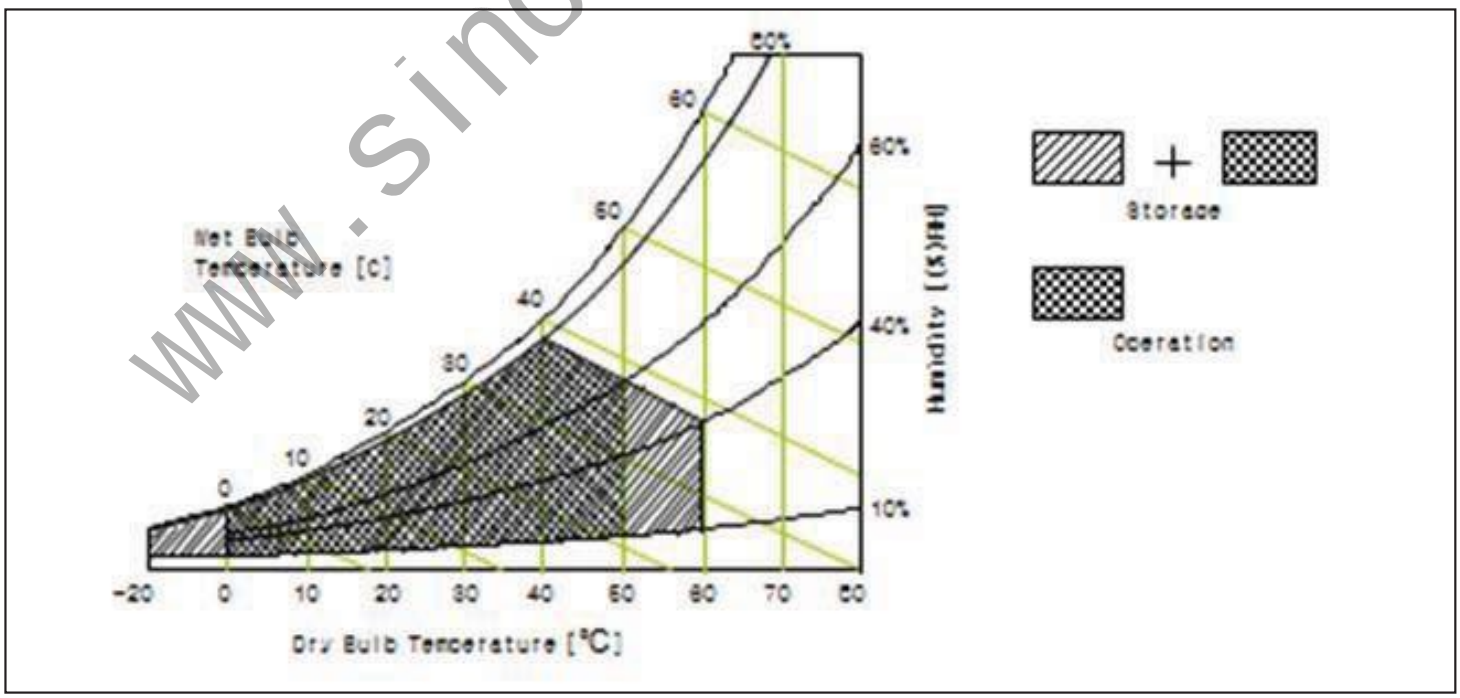
2.0 ABSOLUTE MAXIMUM RATINGS

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	-0.3	6.0	V	Ta = 25℃
Logic Supply Voltage	VIN	VSS-0.3	VDD+0.3	V	
Operating Temperature	T_{OP}	0	+50		Note 1
Storage Temperature	T_{SUR}	-20	+60	℃	
	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

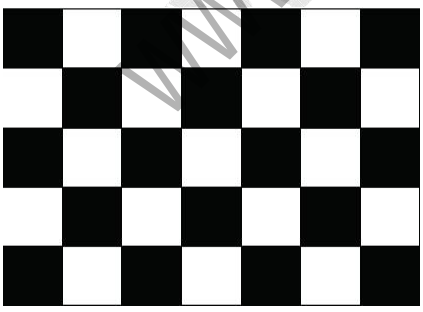
< Table 3. Open Cell Electrical Specifications >

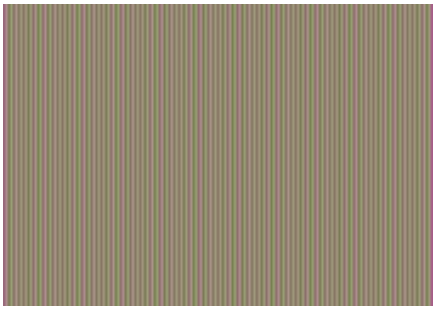
[Ta =25 2]

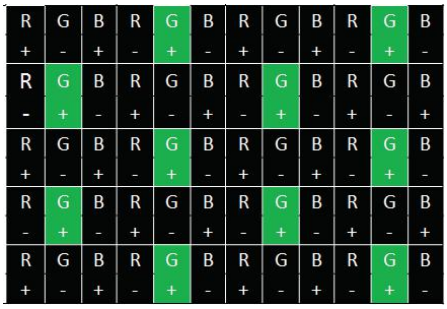
Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	4.5	5.0	5.5	Vdc	
Power Supply Ripple Voltage		VRP	-	-	200	mV	
Power Supply Current		IDD	-	400	1000	mA	Note 1
Power Consumption		PDD	-	2	5	Watt	
Rush current		IRUSH	-		3.0	A	Note 2
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	+100	-	+300	mV	
	Differential Input Low Threshold Voltage	VLVTL	-300	-	-100	mV	
	Input Differential Voltage	VID	200	-	600	mV	
	Differential input common mode voltage	VCM	1.0	1.2	1.5	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=5.0V,
Frame rate f_V=60Hz and Clock frequency = 54MHz.
Test Pattern of power supply current

a) Typ : Mosaic 7X5 (L0/L255) b) Max : Vline Subline (L255)) c) Flicker Pattern







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

3.0 ELECTRICAL SPECIFICATIONS

3.2 Backlight Unit

< Table 3. Backlight Unit Electrical Specifications > [Ta =25 2 ℃]

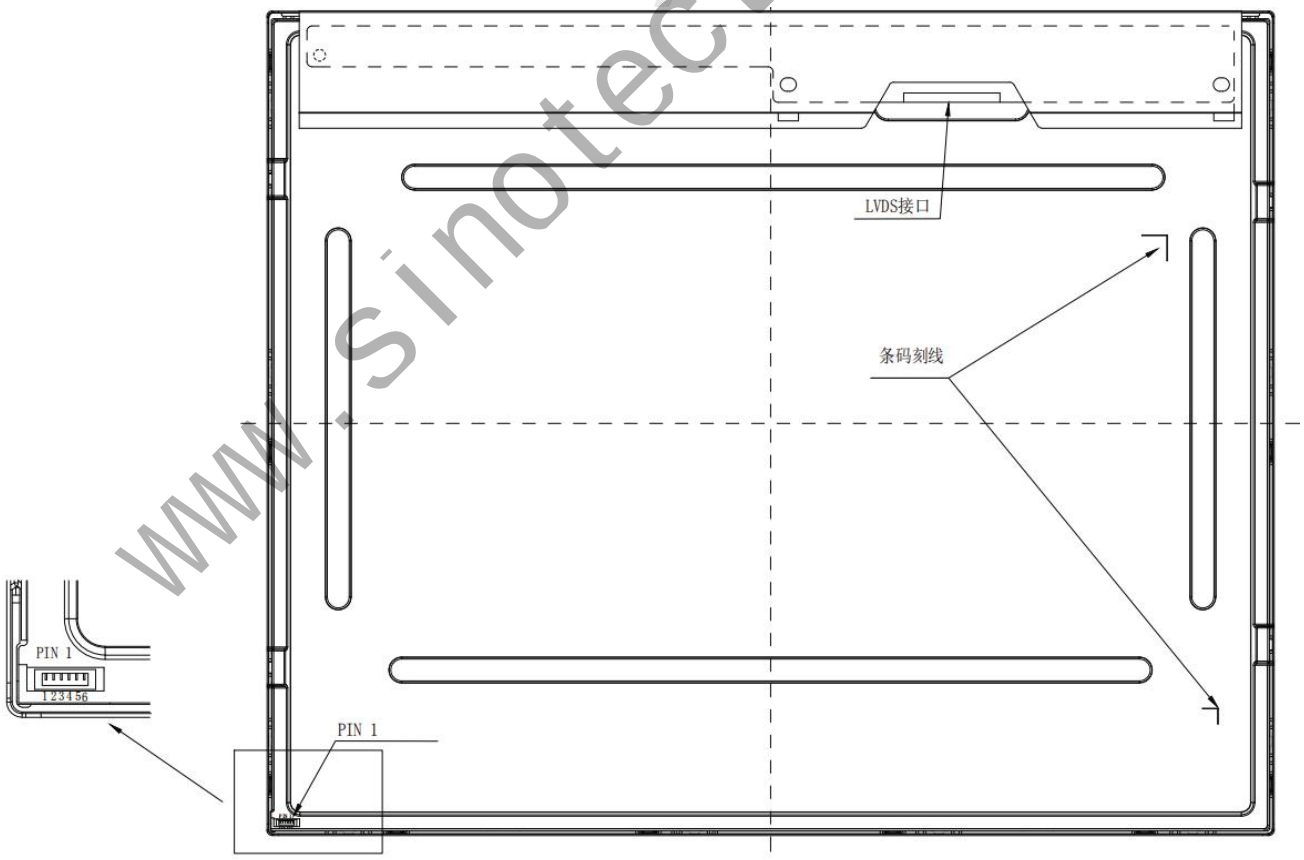
parameter			Symbol	VALUES			Unit	Notes
				MIN	TYP	MAX		
Power supply input voltage			VBL		12		VDC	1
Power supply input current			IBL_A	-	2.0	-	A	VBR=3.3V
Power consumption			PBL		24.0		W	VBR=3.3V
Input signal for inverter control	On/off	on	V on	2.5	-	5	V	
		off	V off	0	-	0.5	V	
	Brightness adjust		EXTV$_{BR-B}$	35		100	%	Automatic sensitization control

3.3 Backlight Input Pin Assignments

&RQQHFWRU W\SH : SM06B-SHJH(HF) RU HTXLYDOHQW

3LQ 1R.	6\PERO	)HDWXUH
1	&+1-	-
2	1&	1R &RQQHFWLRQ
3	&+1+	-
4	&+2+	-
5	1&	1R &RQQHFWLRQ
6	&+2-	-

Remark: The mating type connector: SHJP-06V-S(HF) or SHJP-06-A-K(HF) and equivalent



4.0 INTERFACE CONNECTION

4.1 Open Cell Input Signal & Power

- LVDS Connector : IS100-L30O-C23(UJU), MSBKT2407P30HC(STM) or Equivalent.

< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	16	RXE1+	Positive Transmission data of
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	17	GNG	Power Ground
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	18	RXE2-	Negative Transmission data
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	19	RXE2+	Positive Transmission data of
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	20	RXEC-	
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	No. Connection
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	26	NC	No. Connection
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	27	NC	No. 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	

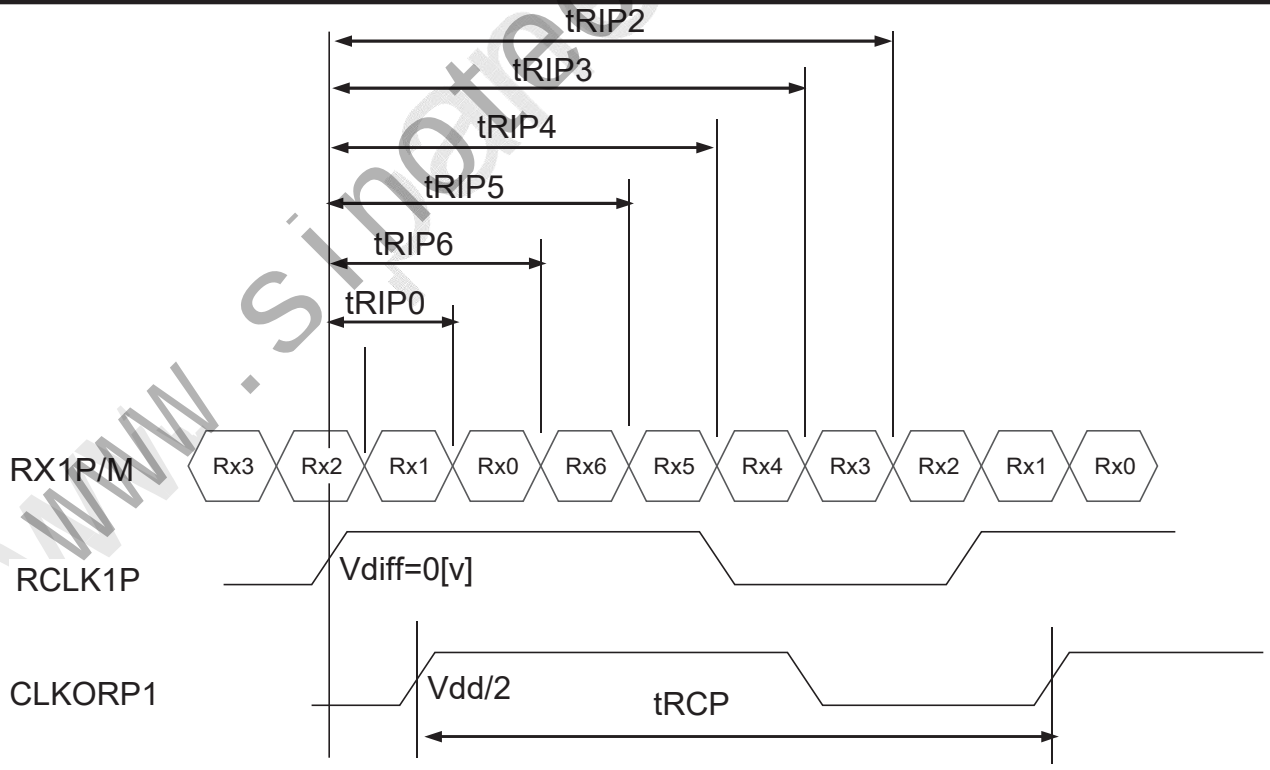
Note : Pin 24 should be connected with GND.

4.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 6.

<Table 6. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	
CLKIN Period	tRCP	14.8	18.5	22.2	nsec	
Receiver Data Input Margin	tRMG	-0.35	-	0.35	nsec	fCLKIN=110MHz
		-0.40	-	0.40	nsec	fCLKIN=95MHz
		-0.45	-	0.45	nsec	fCLKIN=85MHz
		-0.60	-	0.60	nsec	fCLKIN=65MHz
Input Data 0	tRIP1	-∟tRMG∟	0.0	∟tRMG∟	Clock	
Input Data 1	tRIP0	T/7-∟tRMG∟	T/7	T/7+∟tRMG∟	Clock	
Input Data 2	tRIP6	2 T/7-∟tRMG∟	2T/7	2T/7+∟tRMG∟	Clock	
Input Data 3	tRIP5	3T/7-∟tRMG∟	3T/7	3T/7+∟tRMG∟	Clock	
Input Data 4	tRIP4	4T/7-∟tRMG∟	4T/7	4T/7+∟tRMG∟	Clock	
Input Data 5	tRIP3	5T/7-∟tRMG∟	5T/7	5T/7+∟tRMG∟	Clock	
Input Data 6	tRIP2	6T/7-∟tRMG∟	6T/7	6T/7+∟tRMG∟	Clock	



* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

5.0 SIGNAL TIMING SPECIFICATION

5.1 Timing Parameters (DE only mode)

< Table 7. Timing Table >

Item		Symbols		Min	Typ	Max	Unit
Clock	Frequency	1/Tc		45	54	67.5	MHz
	High Time	Tch		-	4/7Tc	-	
	Low Time	Tcl		-	3/7Tc	-	
Frame Period		Tv		1036	1066	1150	lines
				50	60	75	Hz
Horizontal Active Display Term		Valid	t_{HV}	-	640	-	t_{CLK}
		Total	t_{HP}	704	844	960	t_{CLK}
Vertical Active Display Term		Valid	t_{VV}	-	1024	-	t_{HP}
		Total	t_{VP}	1036	1066	1150	t_{HP}

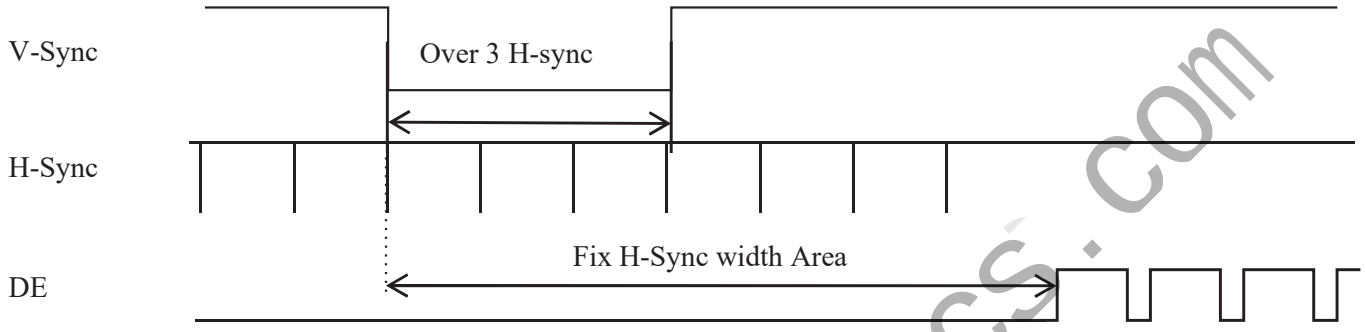
Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

< Table 8. LVDS Input SSCG>

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F	LVDS Input frequency	-	45	54	67.5	MHz
T_{RSKM}	Input data skew margin	F=100MHz V_{IC}=1.2V V_{ID}= 400mV	-300	-	+300	ps
F	Input modulation frequency		-	-	300	KHz
SS_R	Input spread spectrum ratio		-3	-	+3	%

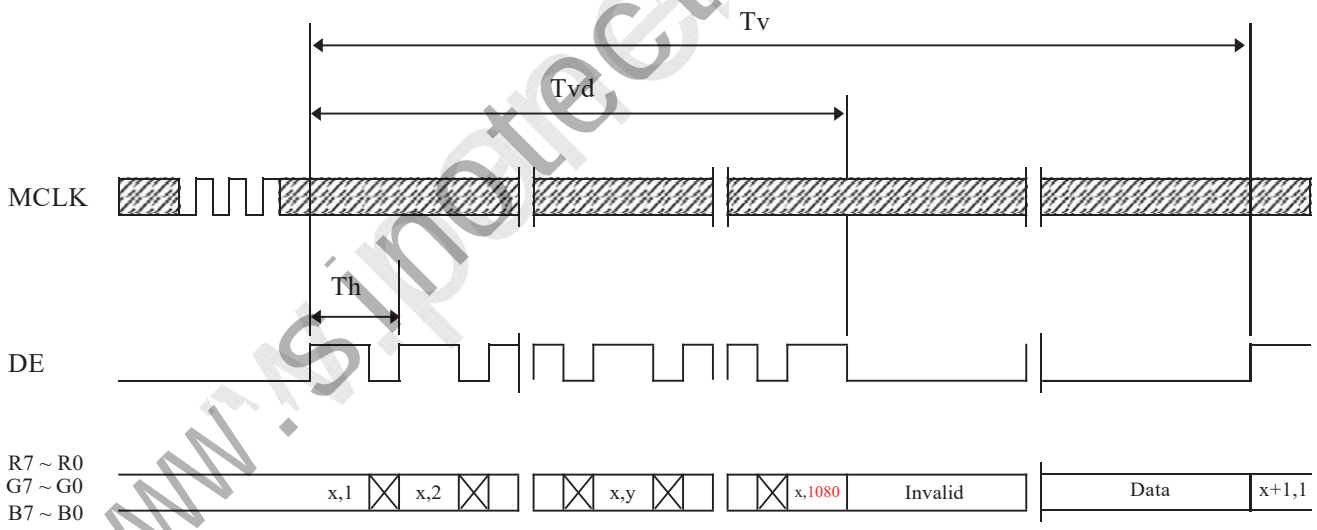
5.2 Signal Timing Waveform

5.2.1 Sync Timing Waveforms

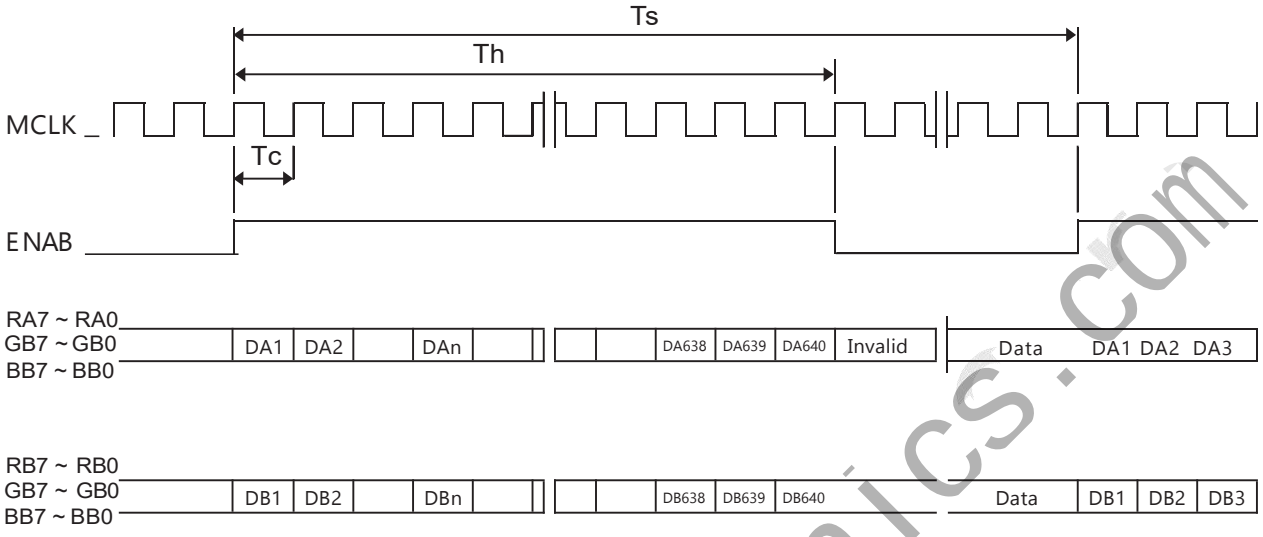


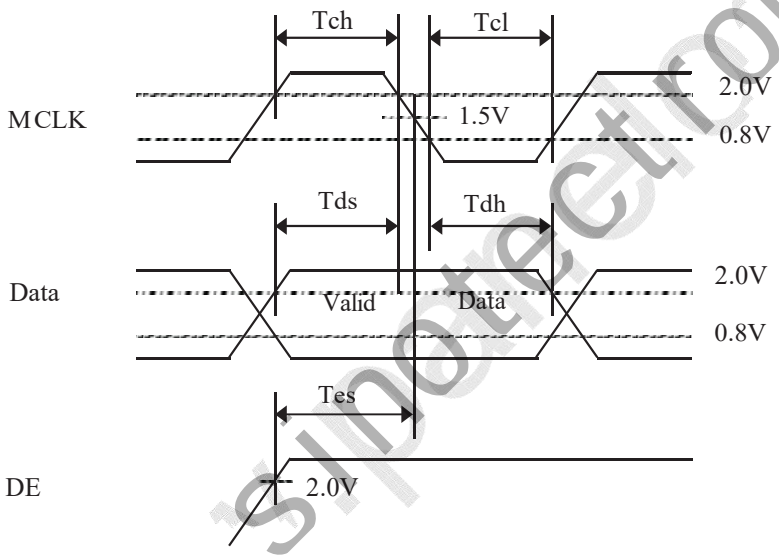
1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

5.2.2 Vertical Timing Waveforms



5.2.3 Horizontal Timing Waveforms





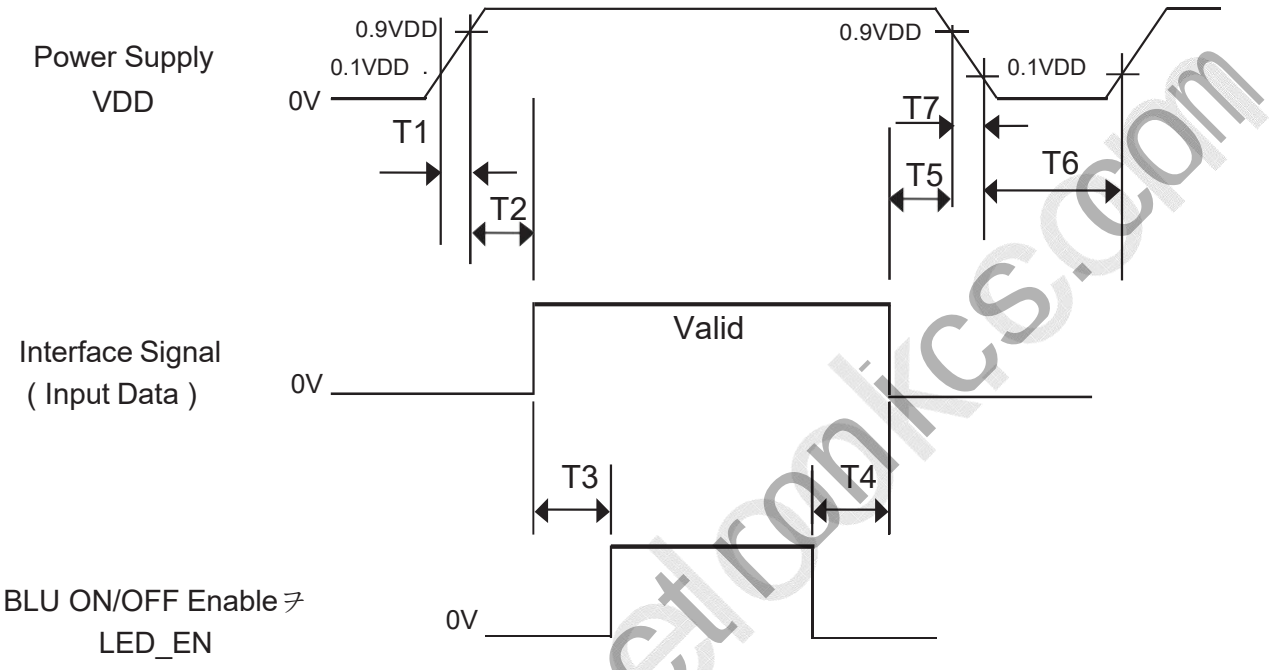
5.3 Input Signals, Basic Display Colors and Gray Scale ofColors

< Table 9. 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 10. Sequence Table >

Parameter	Min	Typ	Max	Units
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.
3. When VDD<0.9VDD(Typ.),Power off.
4. T7 decreases smoothly, if there were rebounding voltage, it must smaller than 5 volts.

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 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to $\theta_{Ø=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= θ_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 at 25°C. Optimum viewing angle direction is 6 'clock.

< Table 11. 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	80	89	-	Deg.	Note 1
		Θ_9		80	89	-	Deg.	
	Vertical	Θ_{12}		80	89	-	Deg.	
		Θ_6		80	89	-	Deg.	
Brightness		Lv	Θ = 0° (Center) Normal Viewing Angle	900	1000	-	nit	
Contrast ratio		CR		700:1	1000:1	-		Note 2
White luminance uniformity		ΔY		75	80	-	%	Note 3
Reproduction of color	White	W_x		:?6. - 0.03	0.313	TYP. + 0.03		Note 4
		W_y			0.329			
	Red	R_x			0.6520			
		R_y			0.3341			
	Green	G_x			0.3167			
		G_y			0.6262			
	Blue	B_x			0.1531			
		B_y			0.0586			
Color Gamut				68	72	-	%	
Cell Transmittance				4.9	5.5			
Response Time	G to G	T_g		-	14	20	ms	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 $\theta = 0°$ 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 White luminance uniformity on LCD surface is then expressed as:
   ΔY = (Minimum Luminance of 9 points / Maximum Luminance of 9 points) * 100
   (See Figure 5 shown in Appendix).
4. 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. The BLU is used by BOE.
5. 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 shall be measured by switching the signal for "any level of gray(brig ht)"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																	

6. 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 DV190E0M-N11 . Other parameters are shown in Table 12.

< Table 12. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	396.0(H) 324.0(V) 9.9(D)	mm
Weight	1520 g /(19.82kg/box)	
Active area	374.784(H)*299.8272(V)	mm
Pixel pitch	97.6(H) Ő292.8(V)	um
Number of pixels	1280(H) Ő10240(V)(1 pixel = R + G + B dots)	pixels
Back-light	Down edge side 1-LED Light bar Type	

7.2 Mounting

6HH),*85(5. (VKRZQ LQ $SSHQGL[)

7.3 Anti-Glare and Polarizer Hardness.

7KH VXUIDFH RI WKH /&' KDV DQ DQWL-JODUH FRDWLQJ WR PLQLPL]H UHIOHFWLRQ DQG D FRDWLQJ WR UHGXFH VFUDWFKLQJ

8.0 RELIABILITY TEST

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

< Table 13. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature storage test	Ta = 60 ℃, 240 hrs
2	Low temperature storage test	Ta = -20 ℃, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 240hrs
4	High temperature operation test	Ta = 50 ℃, 240hrs
5	Low temperature operation test	Ta = 0 ℃, 240hrs
6	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle

This test condition is based on BOE module.

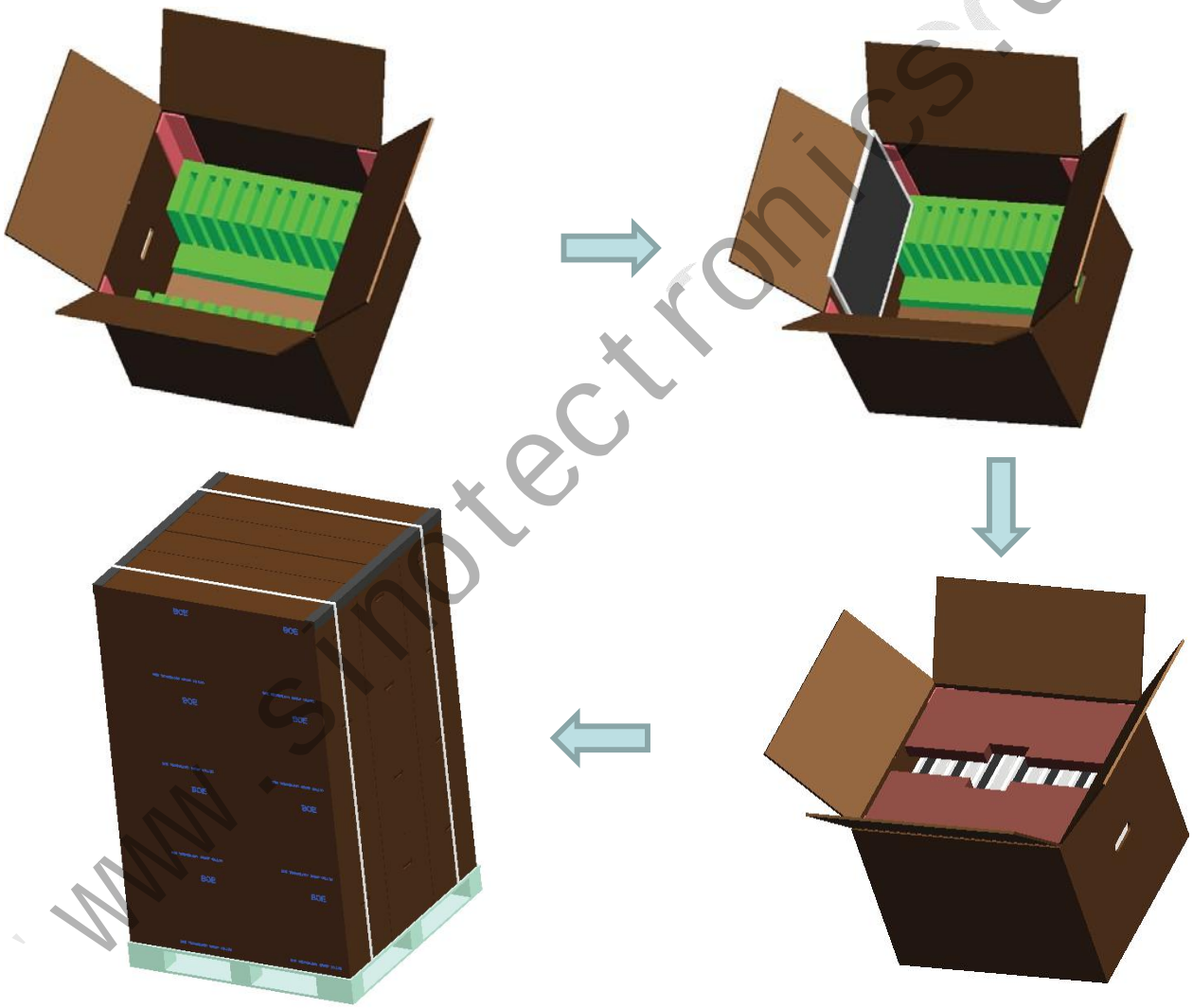
10.0 PACKING INFORMATION

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

Put 1 EPE bottom into the inner box.

Put each module into a PE bag.
Insert 12 Pcs MDL into each box

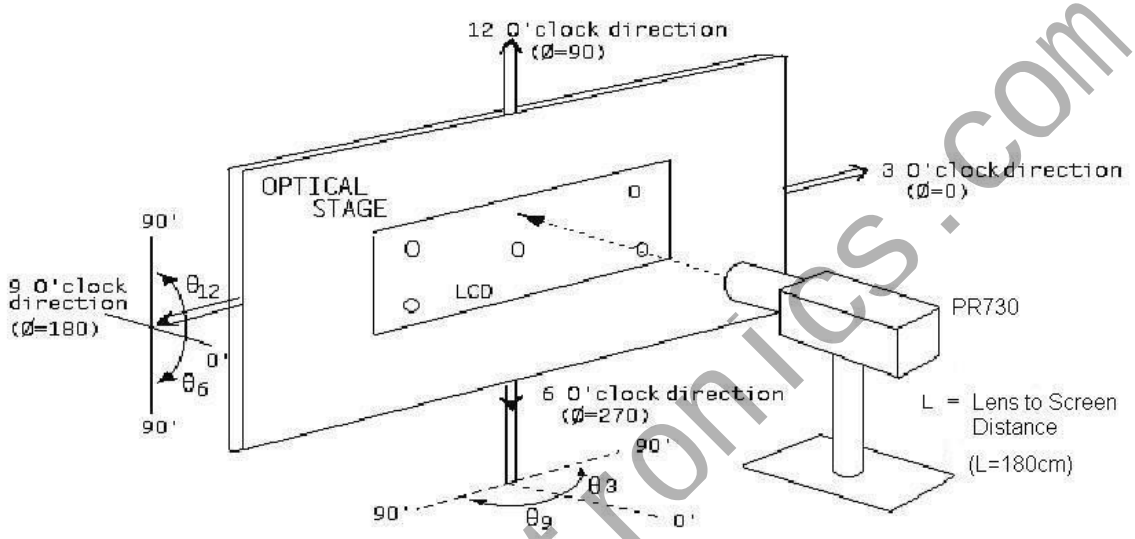


-6[Z ZNK HU^KY UT ZNK 6GRRKZ
16HU^KY/6GRRKZ 16HU^KY VKX RG_KX, ZUZGR 1 RG_KXY
-6RGIK VGVKX IUXTKXY GTJ]XGV LORS GXU[TJ ZNK
HU^KY
-6GIQ]OZN 4 VGIQOTM HKRZY

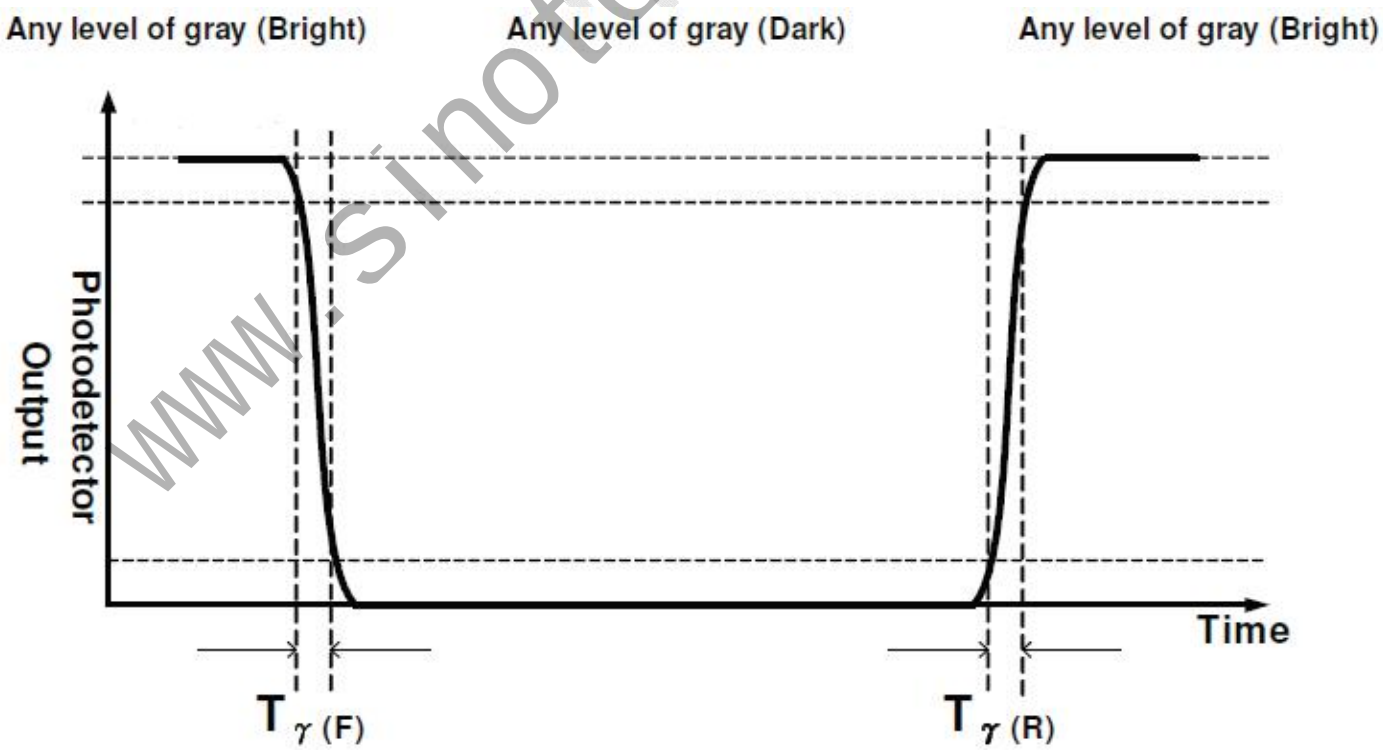
Put 1 EPE cover in and seal the box.

12.0 APPENDIX

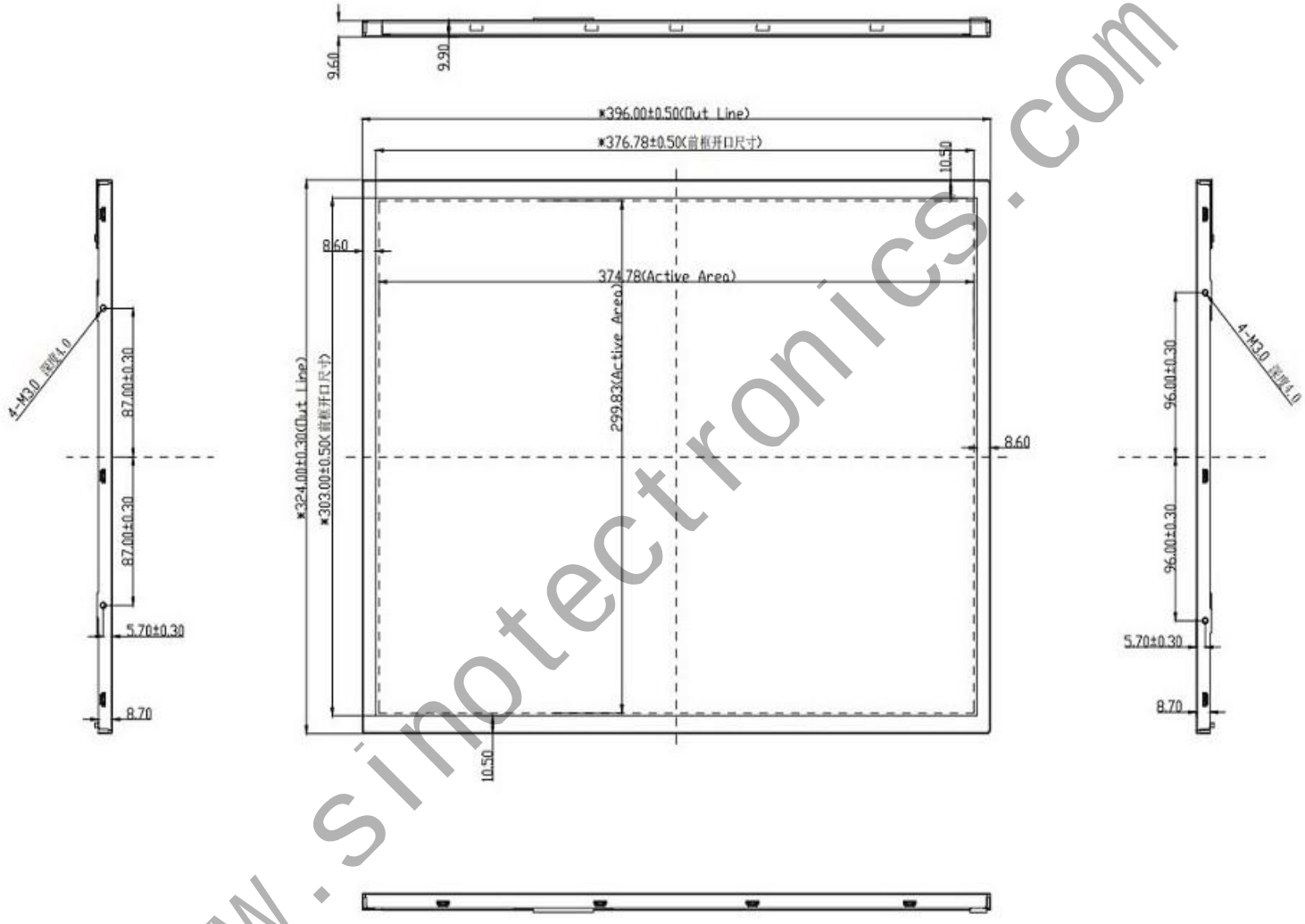
< Figure 1. Measurement Set Up >

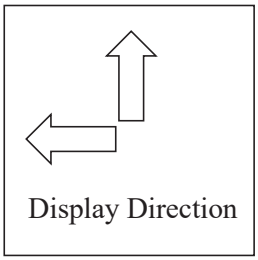


< Figure 2. Response Time Testing >

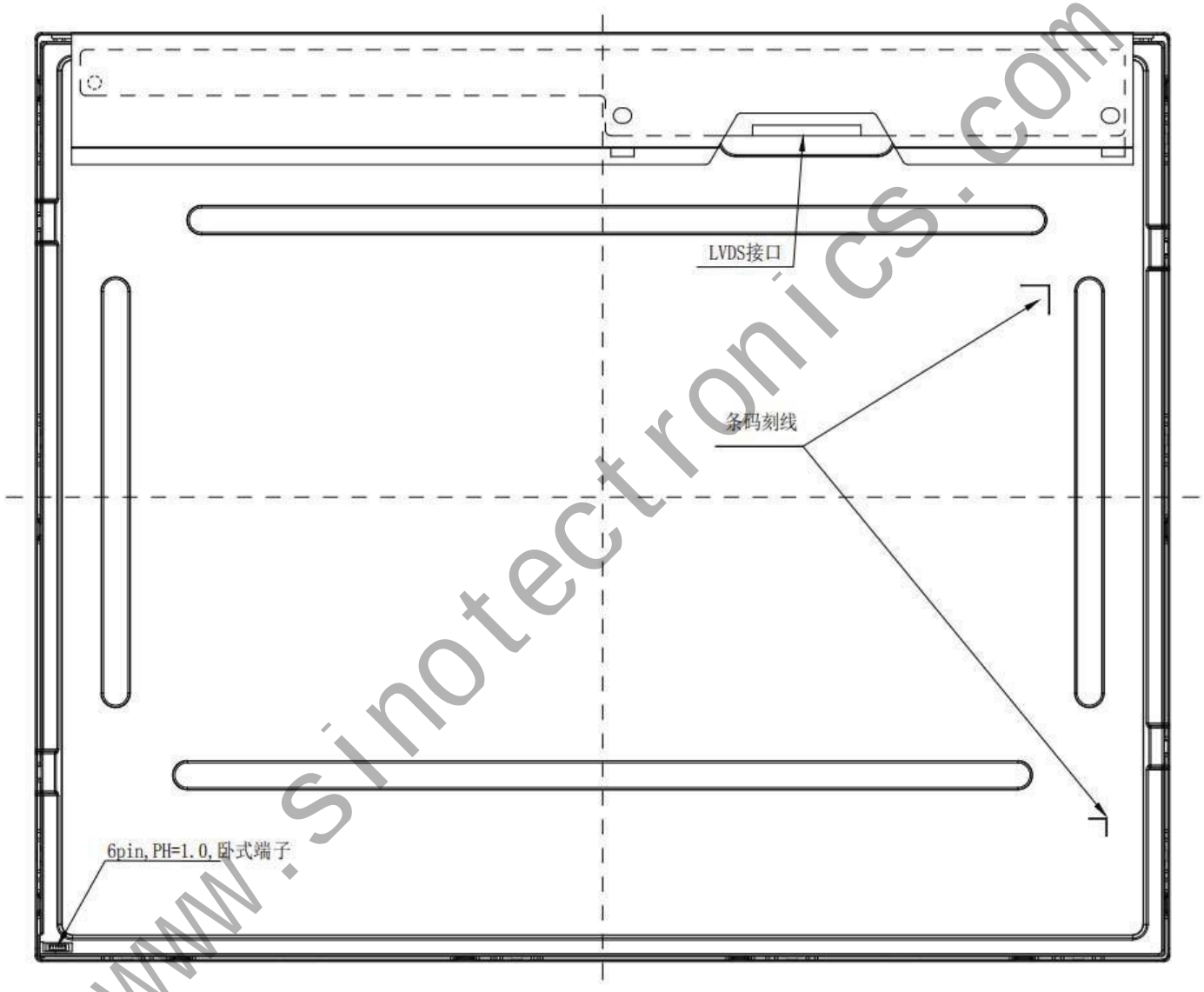


< Figure 3.TFT-LCD Module Outline Dimensions (Front View) >





< Figure 4.TFT-LCD Module Outline Dimensions (Rear View) >



'' ,OM[XK 5. =NOZK 2[SOTGTIK GTJ ;TOLUXSOZ_ 3KGY[XKSKTZ 2UIGZOUT