京东方 BOE

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TITLE:

HV460WUC-200 Preliminary Product Specification

BEIJING BOE DISPLAY TECHNOLOGY

SPEC. NUMBER	PRODUCT GROUP	REV.	ISSUE DATE	PAGE
S8XX-XXXX	TFT LCD	P0	2011.12. 07	1 of 28

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	TFT LCD	P0	2011.12.07

REVISION HISTORY

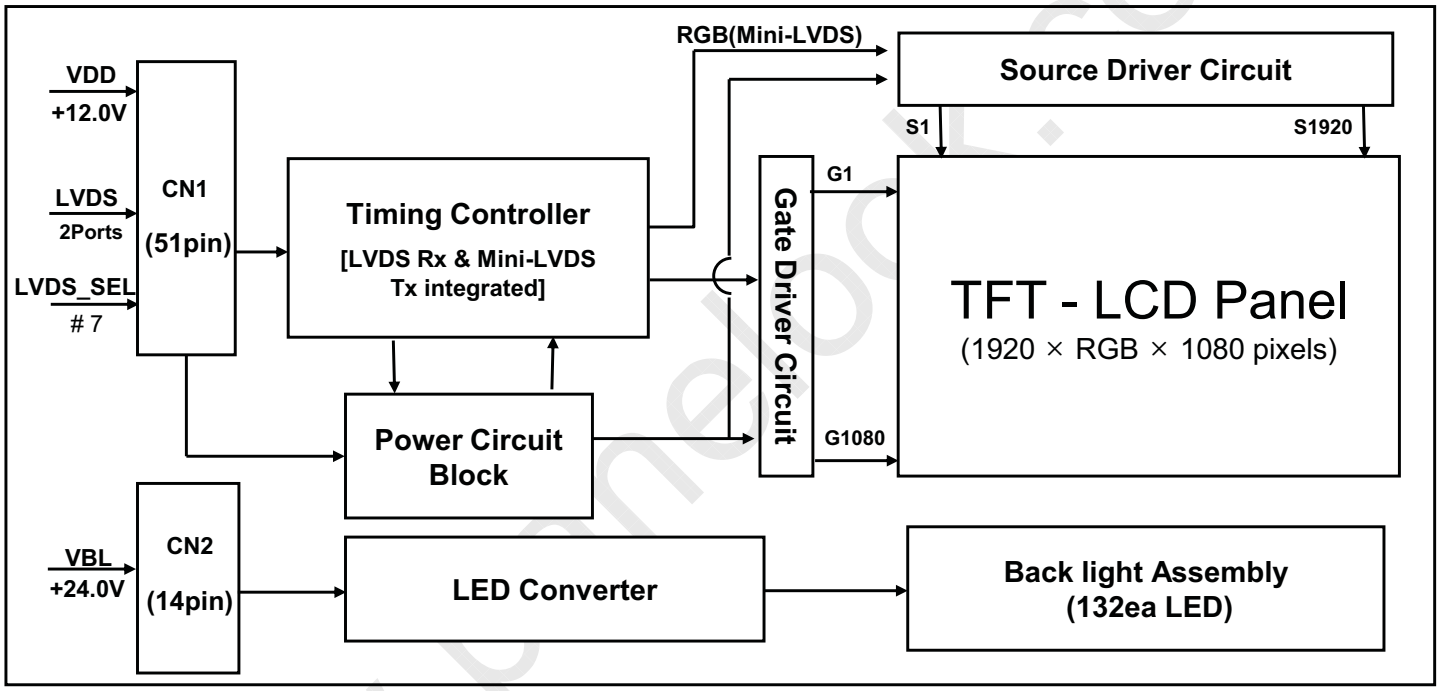
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2011.12.07	Hongming Zhan

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HV460WUC-200 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 46.00 inch diagonally measured active area with WUXGA 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 module can display 16.7M colors. The TFT-LCD panel used for this module 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
- ADS technology is applied for high display quality
- RoHS compliant

1.3 Application

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

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remark
Active area	1018.08(H) × 572.67(V)	mm	Array
Number of pixels	1920(H) ×1080(V)	pixels	
Pixel pitch	176.75(H) ×RGB×530.25(V)	㎛	Array
Pixel arrangement	Pixels RGB Vertical stripe		Array
Display colors	16.7M(8bits-true)	colors	
Display mode	Transmission mode, Normally Black		
Outline Dimension	1045.9(H) × 602.1(V) × 10.8(D) typ.	mm	Mech
Weight	11800 (Typ.)	gram	Mech
Power Consumption	Total=93.0Watt (Typ.) (Logic=9.0W, BL=84W)	Watt	
Surface Treatment	Haze 13%, 3H, Anti-glare treatment (Front Polarizer)		

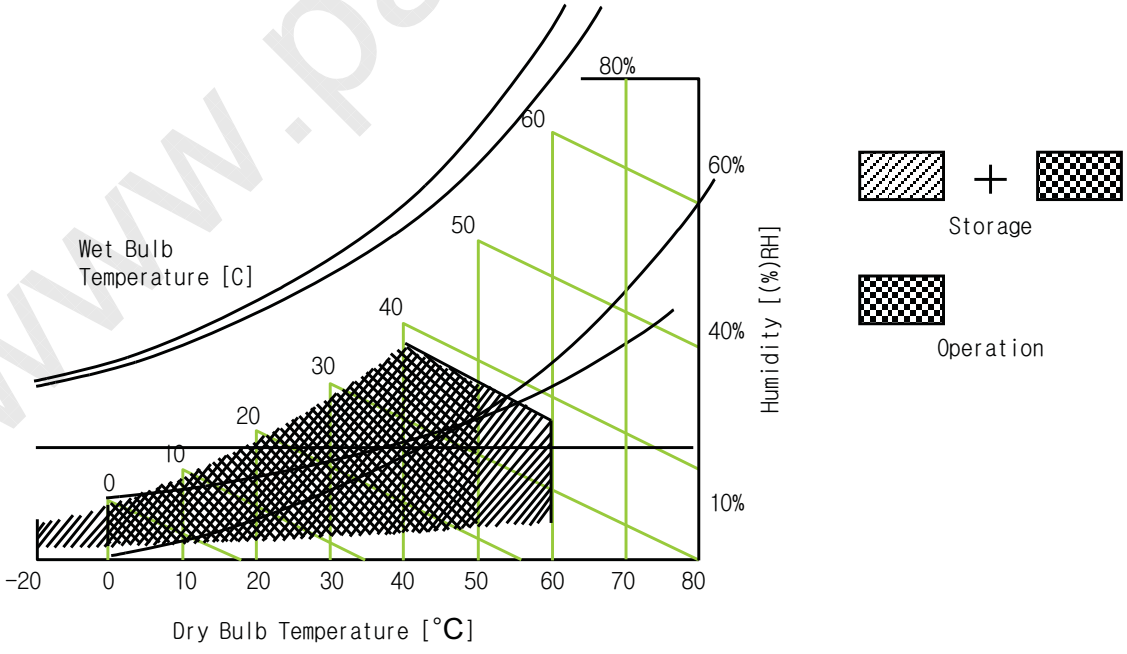
2.0 ABSOLUTE MAXIMUM RATINGS

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. LCD Module Electrical Specifications > [VSS=GND=0V]

Parameter		Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	LCD Module	VDD	VSS-0.3	13.5	V	Ta = 25 ℃
	Converter	VBL	VSS-0.3	26.4	V	
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 Module

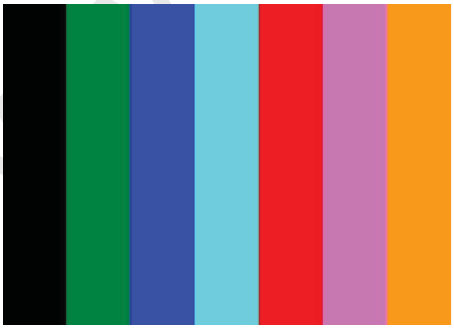
< Table 3. LCD Module Electrical Specifications >

[Ta =25±2 ℃]

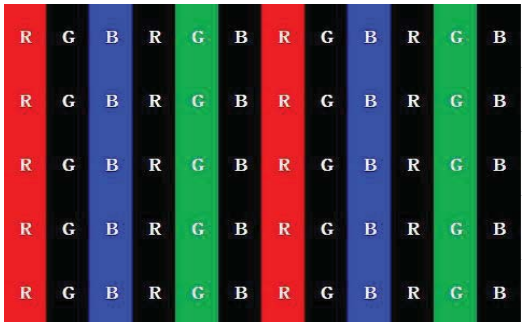
Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP			300	mV	
Power Supply Current		IDD	-	750	850	mA	Note 1
Power Consumption		PDD		9.0	10.2	Watt	
Rush current		IRUSH	-	-	3.0	A	Note 2
LVDS Interface	Differential Input 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 : Color Test (L0/L255)



b) Max : Vertical Subline (L0/L255)



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

3.2 LED Converter

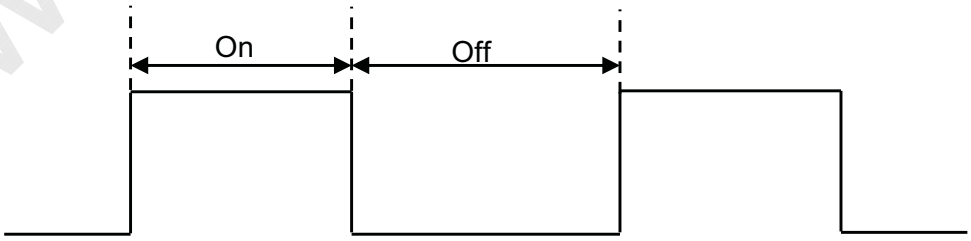
< Table 4. LED Converter Electrical Specifications >

[Ta =25±2 ℃]

Parameter	Symbol	Condition	Values			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	VBL		22.8	24.0	25.2	V	
Input Current	IBL	V_{DIM}=3.3V	-	3.5		A	Note 1
Rush current	IRUSH	VBL= 24V	-	-	3	A	
Power Consumption	PBL	Typical Luminance	-	84		Watt	
B/L on/off control	$V_{ON/OFF}$	BL ON = High	2.8	3.3	5	V	
		BL OFF =Low	0	-	0.8	V	
Analog Dimming	V_{DIM}	Voltage	0		3.3	V	
	L_{DIM}	Luminance	20		100	%	
PWM Frequency	F_{PWM}		140	190	240	Hz	
PWM Level	High Level		2.8	3.3	5	V	
	Low Level		0	-	0.5	V	
PWM Duty	D_{PWM}		10	-	100	%	Note 2
Life Time			30k	-	-	Hrs	Note 3

Note 1:The specified current and power consumption are under the typical supply Input voltage, 24V. It is total power consumption.

Note 2 : High-duty = On/(On+Off) * 100



Note 3 : The life time of LED, 30,000Hrs, is determined as the time at which luminance of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25 ± 2°C.

4.0 INTERFACE CONNECTION

4.1 Module Input Signal & Power

- Connector : IS100-L30B-C23(Manufactured by UJU) or Equivalent.

< Table 5. LCM Module Input Connector Pin Configuration >

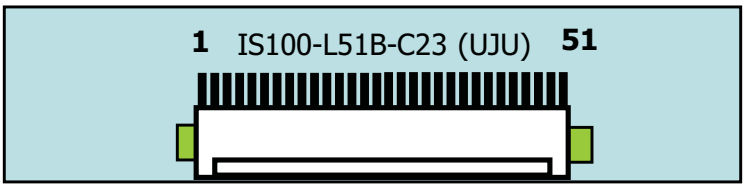
Pin No	Symbol	Description	Pin No	Symbol	Description
1	NC	No Connection	26	2D/3D	2D/3D Signal Select
2	SDA	I²C Data	27	L/R	Left Right Eye Frame Sync.
3	SCL	I²C Clock	28	CH2[0]-	Second pixel negative LVDS differential data input. Pair0
4	NC		29	CH2[0]+	Second pixel positive LVDS differential data input. Pair0
5	NC		30	CH2[1]-	"
6	NC		31	CH2[1]+	"
7	SELLVDS	High or Openh: NS Low: JEIDA	32	CH2[2]-	"
8	NC		33	CH2[2]+	"
9	NC		34	GND	
10	NC		35	CH2CLK-	First pixel negative LVDS clock
11	GND		36	CH2CLK+	First pixel positive LVDS clock
12	CH1[0]-	First pixel negative LVDS differential data input. Pair0	37	GND	
13	CH1[0]+	First pixel positive LVDS differential data input. Pair0	38	CH2[3]-	"
14	CH1[1]-	"	39	CH2[3]+	"
15	CH1[1]+	"	40	CH2[4]-/NC	Second pixel negative LVDS differential data input. Pair0
16	CH1[2]-	"	41	CH2[4]+/NC	Second pixel positive LVDS differential data input. Pair0
17	CH1[2]+	"	42	NC	
18	GND		43	NC	
19	CH1CLK-	First pixel negative LVDS clock	44	GND	Ground
20	CH1CLK+	First pixel positive LVDS clock	45	GND	"
21	GND		46	GND	"
22	CH1[3]-		47	NC	"
23	CH1[3]+		48	VCC	Input Voltage
24	CH1[4]-/NC	First pixel negative LVDS differential data input. Pair0	49	VCC	"
25	CH1[4]+/NC	First pixel positive LVDS differential data input. Pair0	50	VCC	"
			51	VCC	"

4.0 INTERFACE CONNECTION

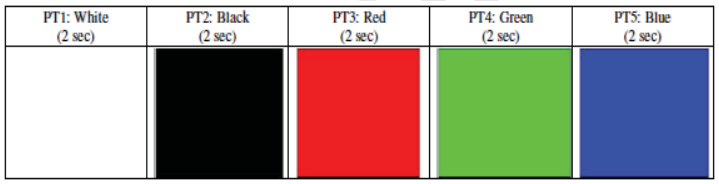
4.1 Module Input Signal & Power

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) or Open (NC) → Normal NS LVDS format
Otherwise : Low (GND) → JEIDA LVDS format

Rear view of LCM



BIST Pattern



4.2 LVDS Interface

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

< Table 6. LCM Module Input Connector Pin Configuration >

Channel No.	Data No.	8-bit LVDS Type	
		NS	JEIDA
0	Bit-0	R0	R2
	Bit-1	R1	R3
	Bit-2	R2	R4
	Bit-3	R3	R5
	Bit-4	R4	R6
	Bit-5	R5	R7
	Bit-6	G0	G2
1	Bit-0	G1	G3
	Bit-1	G2	G4
	Bit-2	G3	G5
	Bit-3	G4	G6
	Bit-4	G5	G7
	Bit-5	B0	B2
	Bit-6	B1	B3
2	Bit-0	B2	B4
	Bit-1	B3	B5
	Bit-2	B4	B6
	Bit-3	B5	B7
	Bit-4	HS	HS
	Bit-5	VS	VS
	Bit-6	DE	DE
3	Bit-0	R6	R0
	Bit-1	R7	R1
	Bit-2	G6	G0
	Bit-3	G7	G1
	Bit-4	B6	B0
	Bit-5	B7	B1
	Bit-6	-	

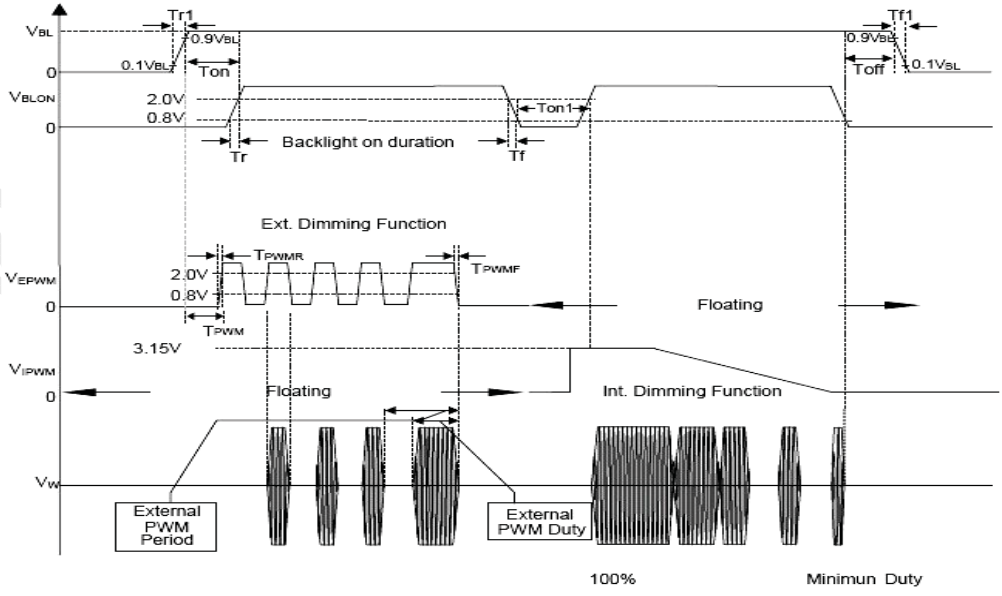
4.3 LED Converter Input Signal & Power

- Connector : CI0114M1HRL-NH (Cvilux) or equivalent

< Table 7. LED Converter Input Connector Pin Configuration >

Pin No	Symbol	Description	Remarks
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	DET	Normal (Low) / Abnormal (Open Collector)	Low : 0~0.8V
12	VBLON/OFF	Backlight ON/OFF control	On : 2.8V~5.0V/Off :0~0.8V
13	VDIM	Internal PWM control signal	Max : 3.3V / Min : 0V
14	PDIM	External PWM control signal	

Notice: 1. PIN 13:Internal PWM Control (Use Pin 13): Pin 14 must open.
PIN 14:External PWM Control (Use Pin 14): Pin 13 must open.
Pin 13(VDIM) and Pin 14(PDIM) can't open in same period.
2. While system is turned ON or OFF, the power sequences must follow as below descriptions:
Turn ON sequence: VBL → PWM signal → BLON
Turn OFF sequence: BLOFF → PWM signal → VBL



5.0 SIGNAL TIMING SPECIFICATION

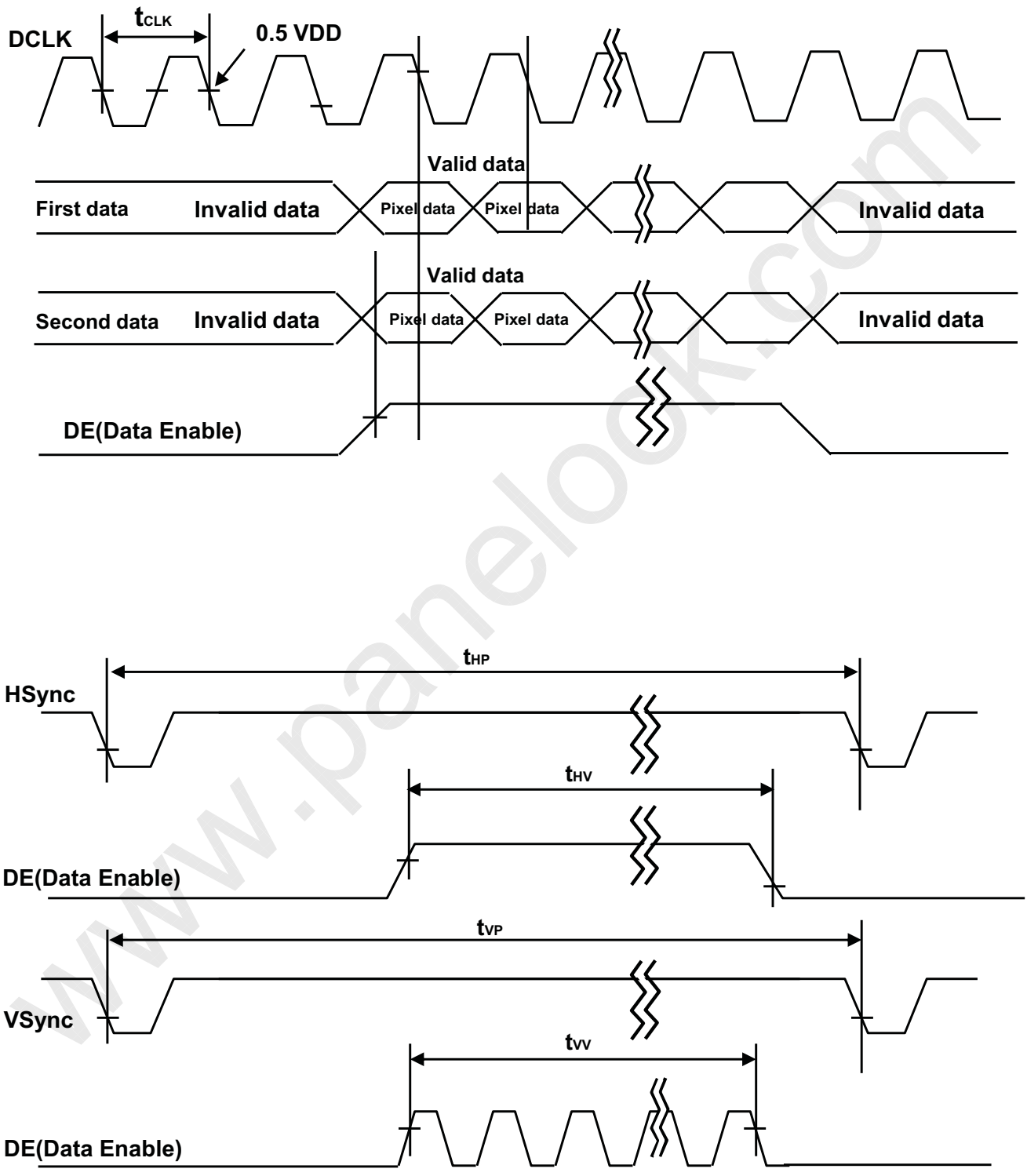
5.1 Timing Parameters (DE only mode)

< Table 8. Timing Table >

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	66.00	74.25	82	MHz
	High Time	Tch	-	4/7Tc	-	
	Low Time	Tcl	-	4/7Tc	-	
Frame Period		Tv	1116	1126	1150	lines
			56.32	60	62.77	Hz
Vertical Display Period		Tvd	-	1080	-	lines
One line Scanning Period		Th	1050	1100	1150	clocks
Horizontal Display Period		Thd	960	960	960	clocks

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

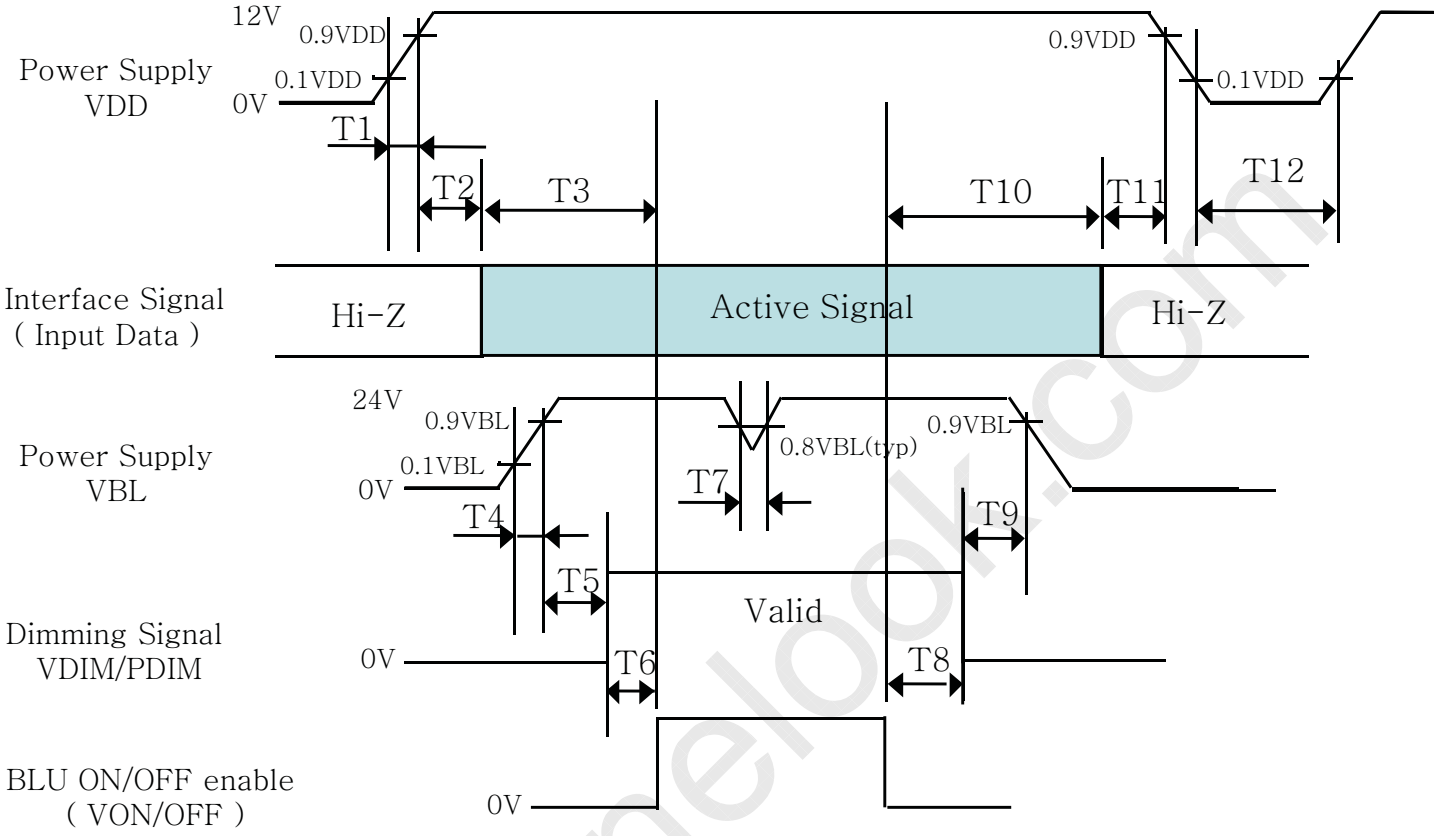


5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 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



< Table 10. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	20	-	-	ms
T5	500	-	-	ms
T6	0	-	-	ms
T7	-	-	10	ms
T8	0	-	-	ms
T9	500	-	-	ms
T10	200	-	-	ms
T11	0	-	50	ms
T12	1	-	-	s

Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
2 .Even though T4 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
3. 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 $\theta_{Ø=0}$ (=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 +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

< Table 11. Optical Table >

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

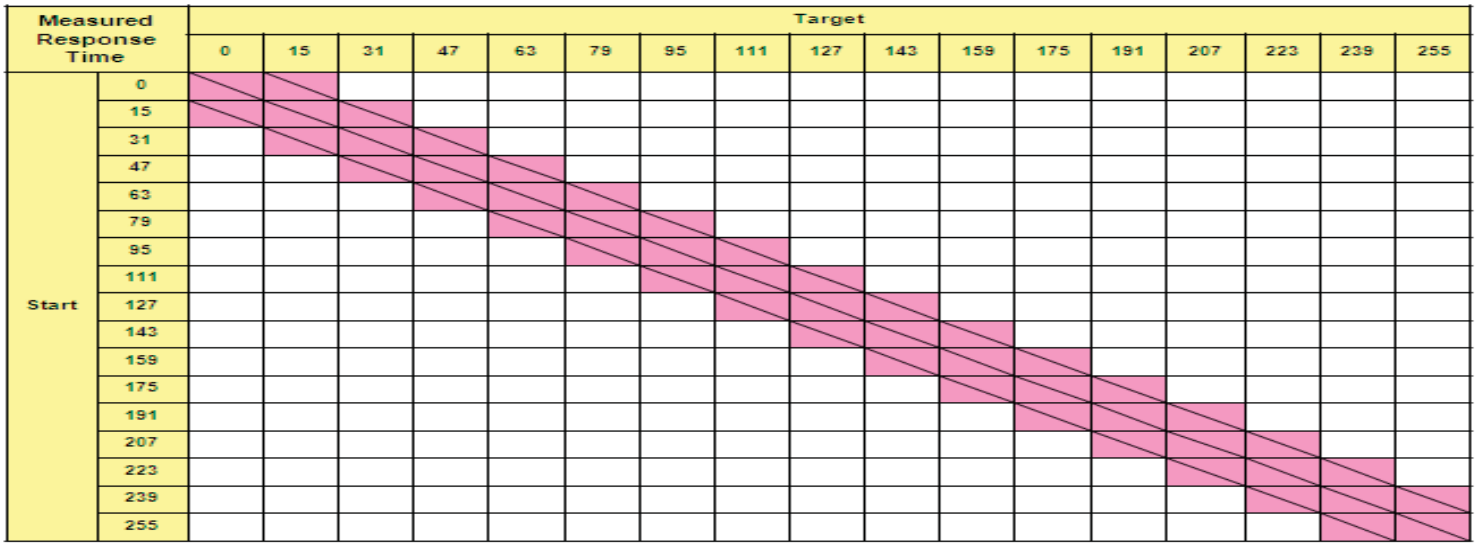
Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	Horizontal	Θ_3	CR > 10		89		Deg.	Note 1
		Θ_9			89		Deg.	
	Vertical	Θ_{12}			89		Deg.	
		Θ_6			89		Deg.	
Color Temperature				-	10,000		K	
Color Gamut				-	72		%	
Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	900:1	1200:1	-		Note 2
Luminance of White		Y_w		300	360	-	cd/m^2	Note 3
White luminance uniformity		ΔY		75	-		%	Note 4
Reproduction of color	White	W_x		TYP. - 0.03	0.280	TYP. + 0.03		Note 5
		W_y			0.290			
	Red	R_x			TBD			
		R_y			TBD			
	Green	G_x			TBD			
		G_y			TBD			
	Blue	B_x			TBD			
		B_y			TBD			
Response Time	G to G	T_g		-	8	10	ms	Note 6
Gamma Scale				2.0	2.2	2.4		

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. Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in Figure 2 for a total of the measurements per display.
4. The White luminance uniformity on LCD surface is then expressed as :
   ΔY = (Minimum Luminance of 5points / Maximum Luminance of 5points) * 100
   (See Figure 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 11. 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.
6. 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 3 and shall be measured by switching the



7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 4 (located in Appendix) shows mechanical outlines for the model HV460WUC-200. Other parameters are shown in Table 12.

< Table 12. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	1045.9(H) ×602.1 (V) ×10.8 (D)	mm
Weight	11800 (Typ.)	gram
Active area	1018.08 (H) ×572.67(V)	mm
Pixel pitch	0.53025(H) ×0.53025(V)	mm
Number of pixels	1920(H) ×1080(V) (1 pixel = R + G + B dots)	pixels
Back-light	Dual Edge Type LED Backlight (66*2ea)	

7.2 Mounting

See Figure 5. (Shown in Appendix)

7.3 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

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
7	Vibration test (non-operating)	Frequency : 10 ~ 300 Hz, Random Gravity / AMP : 1.0 Grms Period : X, Y, Z 30 min/axis
8	Shock test (non-operating)	Gravity : 50G Pulse width : 11msec, Sine wave ±X, ±Y, ±Z Once for each direction
9	Electro-static discharge test	Air : ±15kV ,150pF/330Ω ,100Point ,1time/Point Contact : ±8kV ,150pF/330Ω ,100Point ,1time/Point Non operation Contact: ±4KV~±6KV,150pF/330Ω,100Point, Input connector Pin, 3 times/pin with no function loss

9.0 PRODCUT SERIAL NUMBER

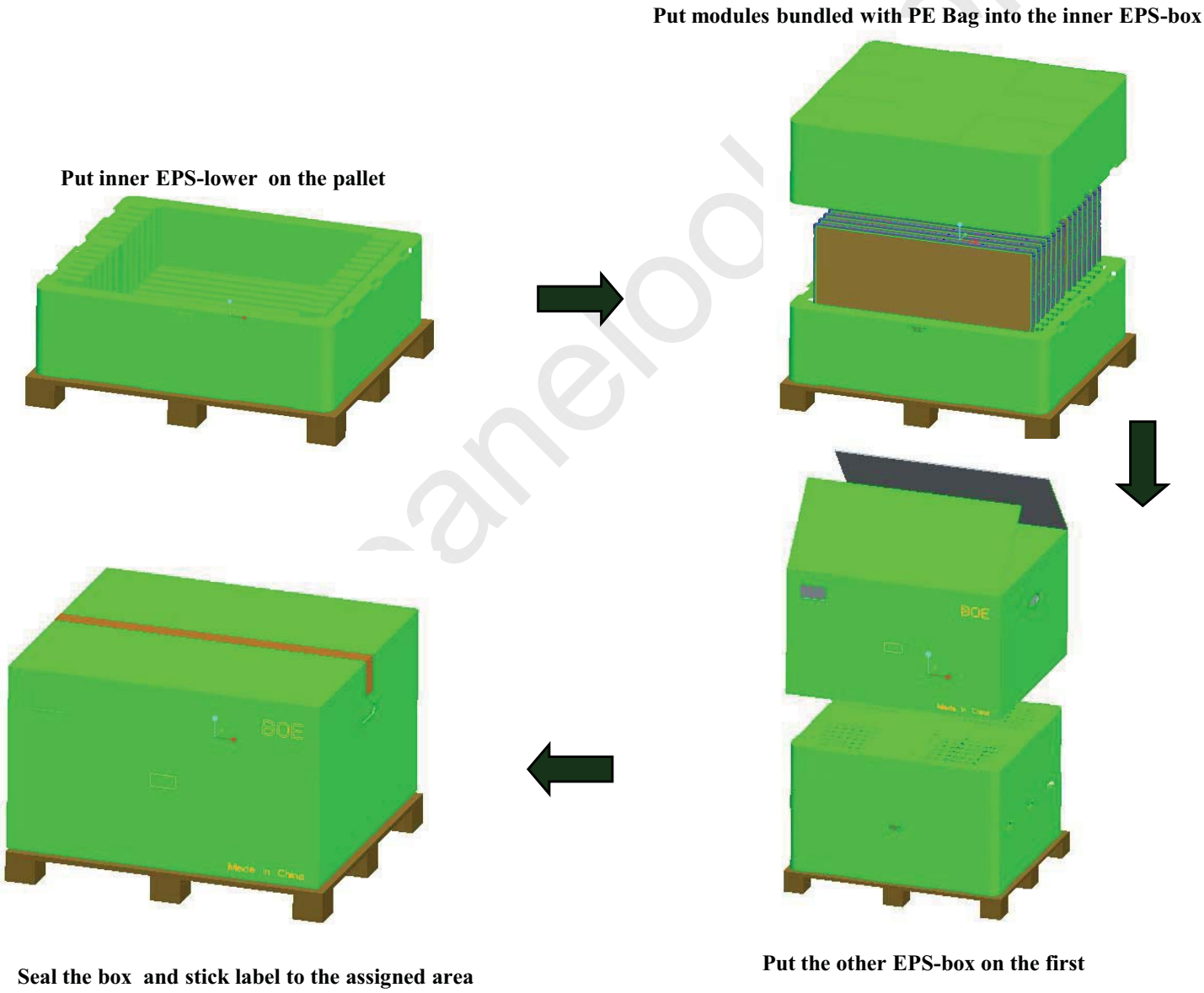
1	2	3	4	5	6	7
X X	X	X	X X	X	X X X X	X X X X X X

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

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



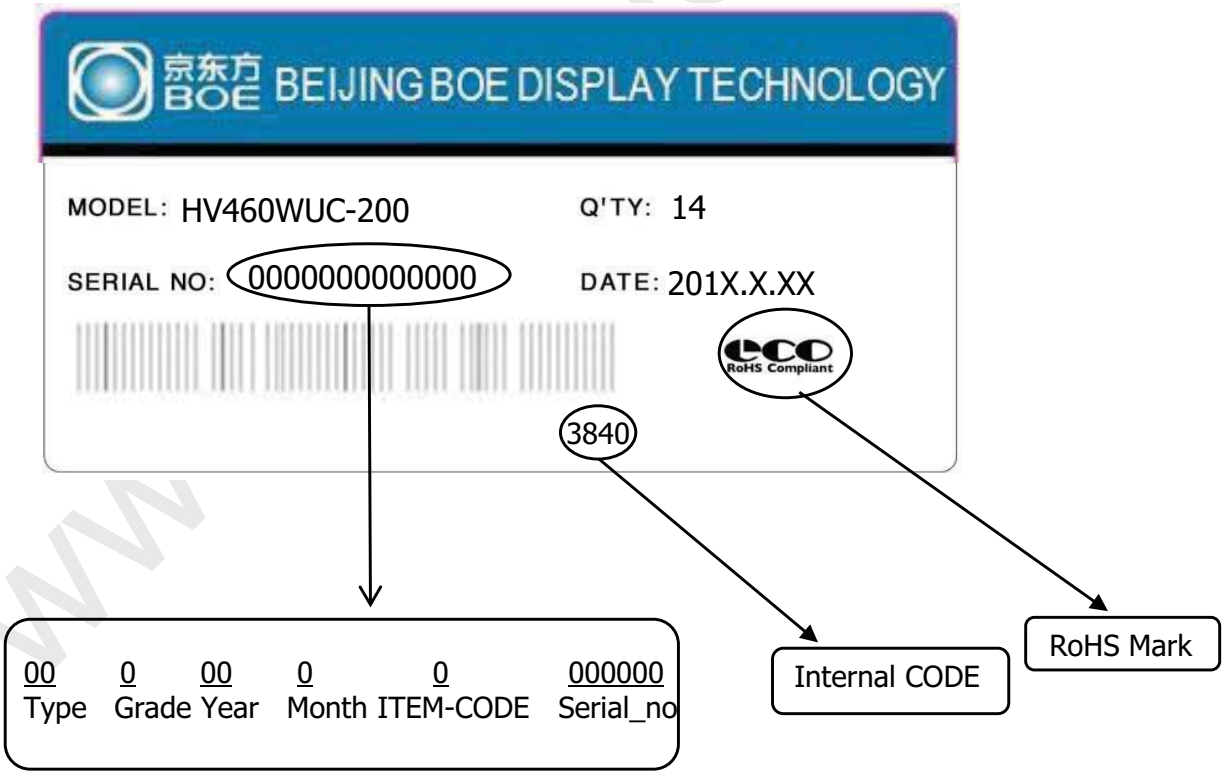
10.2 Packing Note

- Box Dimension : 1256 mm (L) × 1131mm (W) ×740mm (H)
- Package Quantity in one Box : 14pcs

10.3 Box Label

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

  Model : HV460WUC-200
  Q`ty : 14 Module in one box.
  Serial No. : Box Serial No. See next page for detail description.
  Date : Packing Date
  FG Code : FG Code of Product



11.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module
- As the electrostatic discharges may break the LCD module, handle the LCD module 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 module 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 module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation
- When the module 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 module would be damaged.

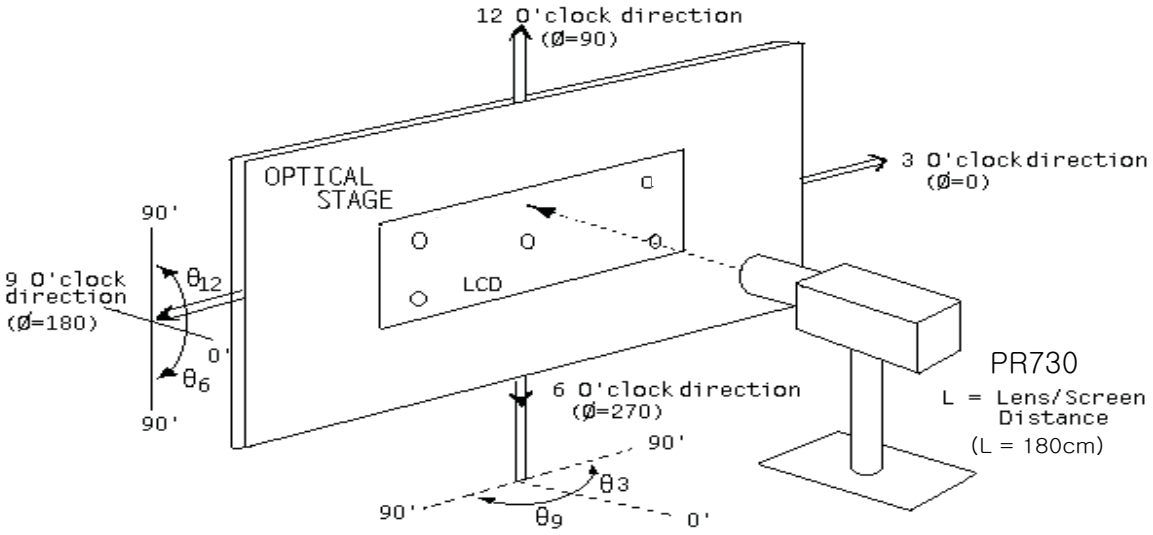
(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

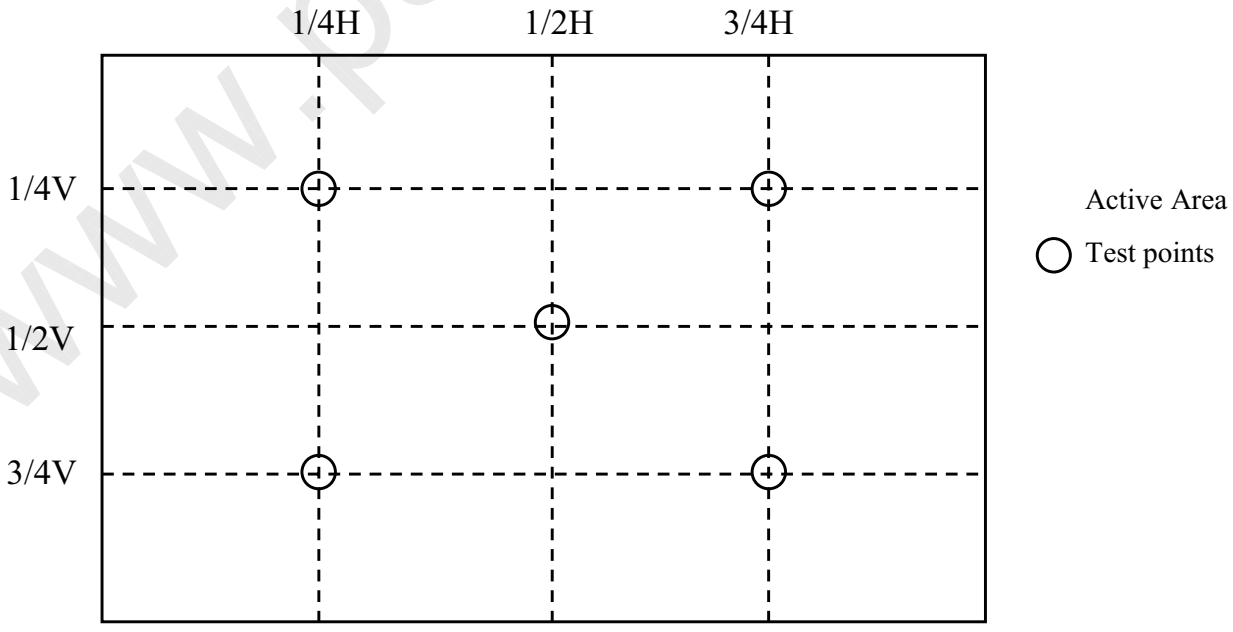
(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

12.0 APPENDIX

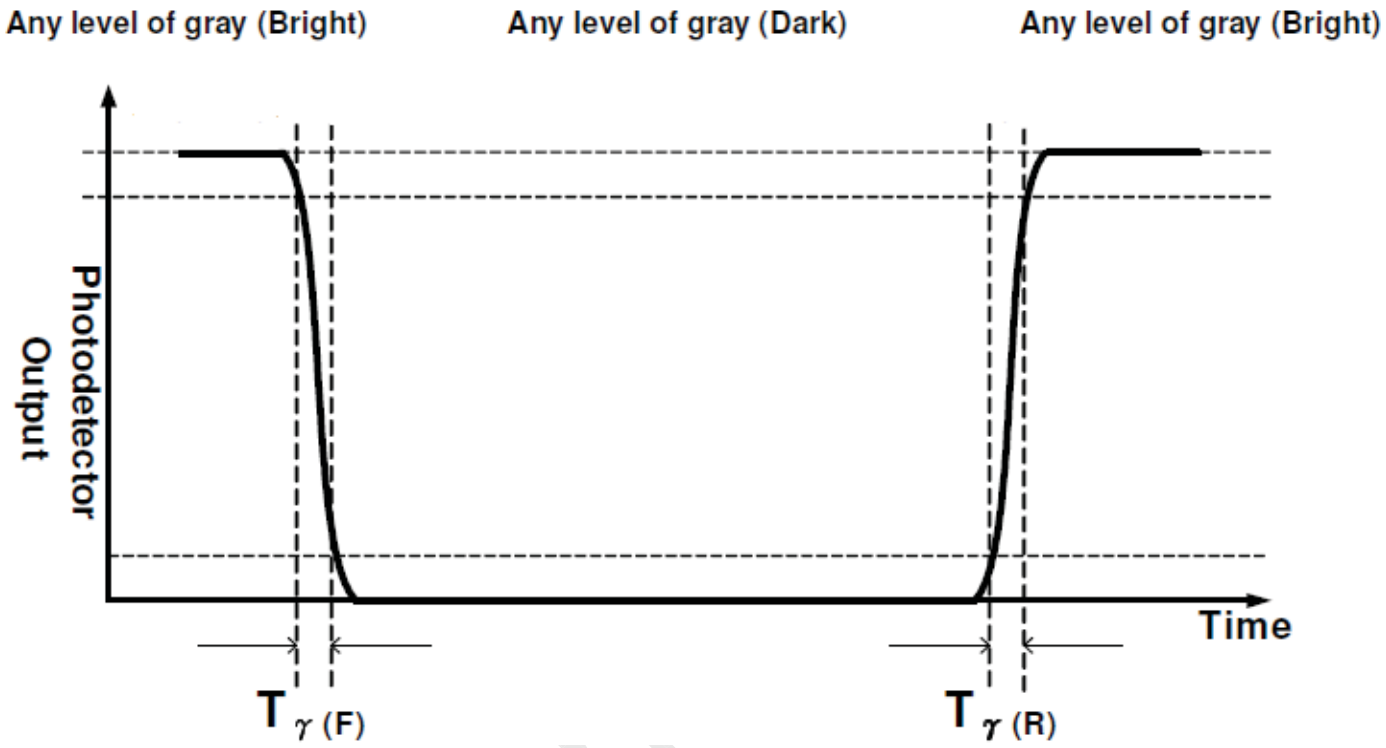
< Figure 1. Measurement Set Up >



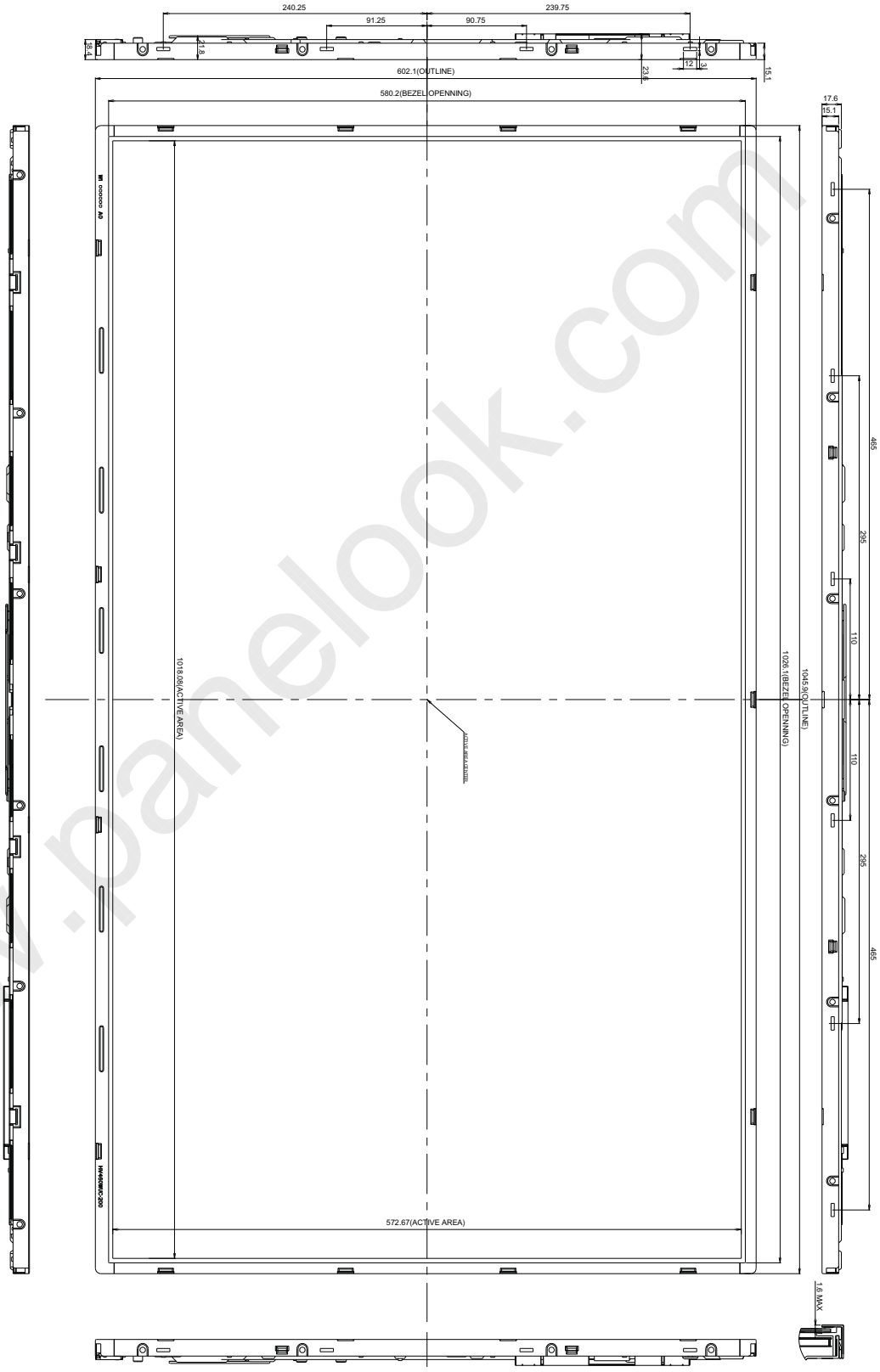
< Figure 2. White Luminance and Uniformity Measurement Locations >



< Figure 3. Response Time Testing >



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



NOTE

1.I/F CONNECTOR CN1: UJU IS050-C51B-C39-S OR EQUIVALENT
2.LED DIVRER BOARD CONNECTOR: CVILUX CI0114M1H OR EQUIVALENT
3.UNSPECIFIED TOLERANCE: ±1
4.TORQUE OF M2.5 SCREW HOLE: 5Kgf-cm
5.TORQUE OF M3 SCREW HOLE: 6Kgf-cm
6.TORQUE OF M4 SCREW HOLE: 13Kgf-cm
7.TORQUE OF M4 SCREW HOLE: 13Kgf-cm
8.BEZEL TO GLASS MAX: 1.6mm

< Figure 5. TFT-LCD Module Outline Dimensions (Rear View) >