

# Specification

## **DV185WHM-NM2**

18.5" - 240x320 – LVDS

Spec Revision: A  
Revision Date: 16.01.2024

Note: This specification is subject to change without prior notice



**PROPRIETARY NOTE**

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**TITLE : DV185WHM-NM2**  
**Product Specification**  
**Rev. A**

BEIJING BOE Display TECHNOLOGY CO., LTD

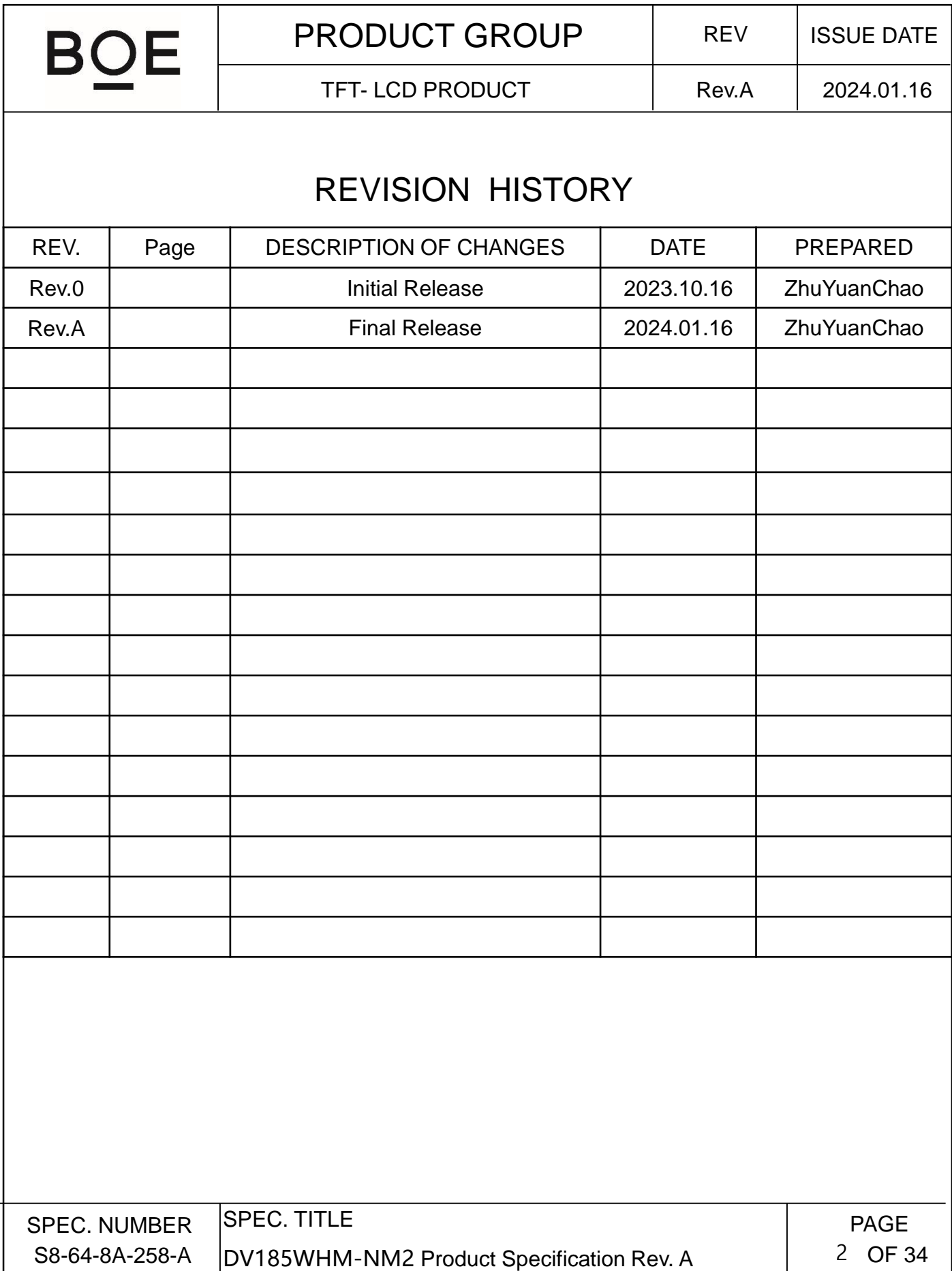
SPEC. NUMBER  
S8-64-8A-258-A

PRODUCT GROUP  
TFT-LCD

Rev.A

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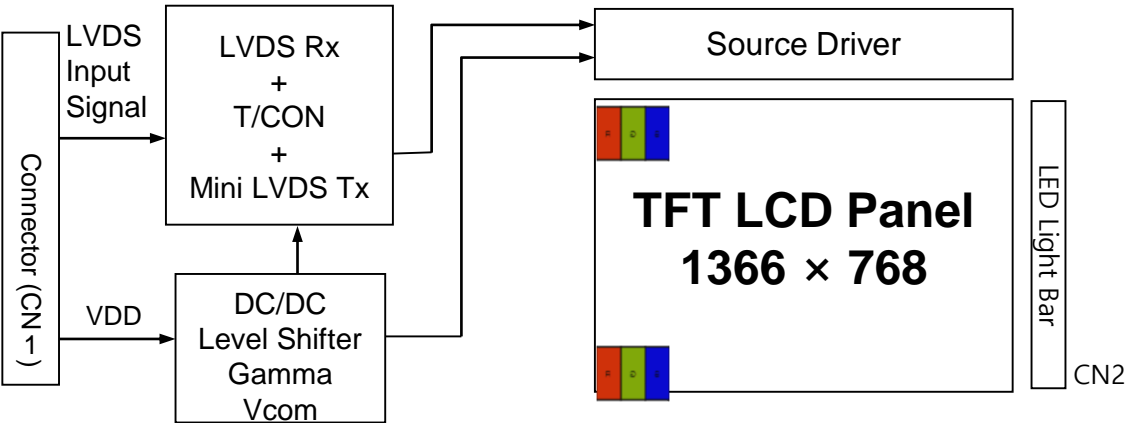
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## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

DV185WHM-NM2 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 18.5 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 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 1 pixel / clock
- High-speed response
- Low power consumption
- 6-bit (Hi-FRC) color depth, display 16. 7M colors
- Incorporated edge type back-light (One Light Bar)
- High luminance and contrast ratio, low reflection and normal viewing angle
- DE (Data Enable) only
- RoHS
- Gamma correction

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### 1.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

### 1.4 General Specification

The followings are general specifications at the model DV185WHM-NM2.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	409.8(H) × 230.4(V)	mm	
Number of pixels	1366(H) × 768(V)	pixels	
Pixel pitch	0.1(H) × 0.3(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Display mode	Normally Black		
Dimensional outline	430.4(H) × 254.6(V) × 10.9(D) typ.	mm	Detail refer to drawing
Weight	1300(typ.)	g	
Bezel width (L/R/U/D)	8.5/8.5/10.3/10.3	mm	
Surface Treatment	Haze 25%, 3H		
Back-light	right edge side, 1- LED Light bar		

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## 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.

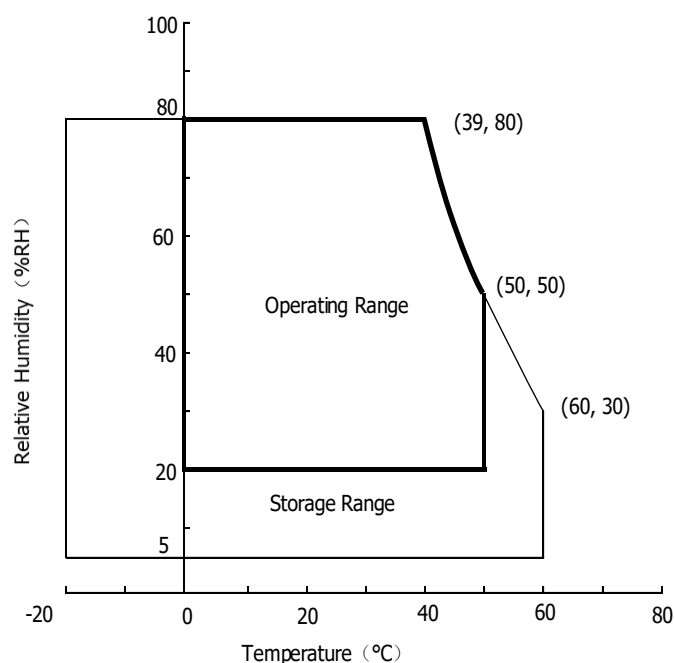
< Table 2. Absolute Maximum Ratings>

[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	$V_{DD}$	-0.3	5.5	V	Ta = 25 °C
Logic Supply Voltage	$V_{IN}$	VSS-0.3	$V_{DD}+0.3$	V	
LED Channel Current	$I_{BL}$	-	120	mA	
Operating Temperature	$T_{OP}$	0	+50	°C	1)
Storage Temperature	$T_{ST}$	-20	+60	°C	1)

Note : 1) Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.



### 3.0 ELECTRICAL SPECIFICATIONS

#### 3.1Electrical Specifications

< Table 3. Electrical specifications >

[Ta =25±2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V <sub>DD</sub>	4.5	5.0	5.5	V	Note1
Power Supply Current	I <sub>DD</sub>	-	500	720	mA	
In-Rush Current	I <sub>RUSH</sub>	-	2	3	A	Note 2
Permissible Input Ripple Voltage	V <sub>RF</sub>	-	-	300	mV	Note1,3
High Level Differential Input Threshold Voltage	V <sub>IH</sub>	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V <sub>IL</sub>	-100	-	-	mV	
Differential input voltage	V <sub>ID</sub>	200	-	600	mV	
Differential input common mode voltage	V <sub>cm</sub>	1.0	1.2	1.5		V <sub>IH</sub> =100mV, V <sub>IL</sub> =-100mV
LED Channel Voltage	V <sub>L</sub>	17.4	18	19.8	V	
LED Channel Current	I <sub>L</sub>	-	120	-	mA	
LED Lifetime		50,000	-	-	Hrs	
Power Consumption	P <sub>D</sub>	-	2.5	3.6	W	@60Hz
	P <sub>BL</sub>	-	8.6	9.2	W	I <sub>L</sub> =120 mA, Note 4
	P <sub>total</sub>	-	11.1	12.8	W	

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=5.0V, Frame rate=60Hz and Clock frequency = 75.4MHz. Test Pattern of power supply current

a) Typ : Color Bar pattern

b) Max: Gray Level 255

2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %

3. Ripple Voltage should be covered by Input voltage Spec.

4. Calculated value for reference (V<sub>L</sub> × I<sub>L</sub>) ×4(channel) excluding driver loss. (LED Light bar: 6S4P)



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### 3.2 Backlight Unit

< Table 4. LED Backlight Unit >

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPIN	17.4	18	19.8	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	-	120	-	mA	Note1,2,
LED Power Consumption	P <sub>BL</sub>	-	8.6	9.2	W	Note 3
LED Life-Time	-	50,000	-		Hrs	Note 4

LED bar consists of 24LED packages,4 strings(parallel)\*6packages(serial)

Note1: There are one light bar ,and the specified current is input LED chip 100% duty current

Note2: The sense current of each input pin is 120mA

Note3:  $P_{BL}=4 \text{ Input pins} \times V_{PIN} \times I_{PIN}$

Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at  $I_{PIN}=120\text{mA}$  on condition of continuous operating at  $25 \pm 2 \text{ }^{\circ}\text{C}$

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## 4.0 OPTICAL SPECIFICATION

### 4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance  $\leq 1$  lux and temperature =  $25\pm 2^{\circ}\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and TOPCONE PR730) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to  $0^{\circ}$ . We refer to  $\theta_{0=0}$  ( $=\theta_3$ ) as the 3 o'clock direction (the "right"),  $\theta_{0=90}$  ( $=\theta_{12}$ ) as the 12 o'clock direction ("upward"),  $\theta_{0=180}$  ( $=\theta_9$ ) as the 9 o'clock direction ("left") and  $\theta_{0=270}$  ( $=\theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning  $\theta$  and/or  $\Phi$ , 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 5.0V +/-10% at  $25^{\circ}\text{C}$ . Optimum viewing angle direction is 6 'clock.

### 4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 75.4MHz,  $I_{BL} = 480\text{mA}$ ,  $T_a = 25\pm 2^{\circ}\text{C}$ ]

< Table 5. Module Optical >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	$\Theta_3$	CR > 10	85	89	-	Deg.	Note 1
		$\Theta_9$		85	89	-	Deg.	
	Vertical	$\Theta_{12}$		85	89	-	Deg.	
		$\Theta_6$		85	89	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	700	1000	-		Note 2
Luminance of White		$Y_w$		450	500	-	cd/m <sup>2</sup>	Note 3
White luminance uniformity		$\Delta Y$		75	80	-	%	Note 4
Reproduction of color	White	$W_x$		0.283	0.313	0.343	-	Note 5
		$W_y$		0.299	0.329	0.359		
	Red	$R_x$		0.617	0.647	0.677		
		$R_y$		0.320	0.350	0.380		
	Green	$G_x$		0.269	0.299	0.329		
		$G_y$		0.603	0.633	0.663		
	Blue	$B_x$		0.117	0.147	0.177		
		$B_y$		0.056	0.086	0.116		
Response Time	GTG	$T_g$		-	14	25	ms	Note 6
Cross Talk		CT		-	-	2.0	%	Note 7

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**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  $\theta = 0^\circ$  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 :  
 $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$   
(See FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 5.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  $T_g$  is the average time required for display transition by switching the input signal as below table and is based on Frame rate  $f_V = 60\text{Hz}$  to optimize. Each time in below table is defined as appendix Figure 3 and shall be measured by switching the input signal for "any level of gray(bright)"and "any level of gray(dark)"
7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance ( $Y_A$ ) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance ( $Y_B$ ) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

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**5.0 INTERFACE CONNECTION.**

**5.1 Electrical Interface Connection**

**5.1.1 LED Light Bar**

-LED connector : 3708K-Q06N-00R manufactured by Entry

< Table 6. LED Light Bar>

Pin No	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	IRLED3	LED current sense for string3
6	IRLED4	LED current sense for string4

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## 5.0 INTERFACE CONNECTION.

### 5.1 Electrical Interface Connection

- CN1      Module Side Connector : UJU IS100-30O-C23 or Equivalent  
User Side Connector : JAE FI-X30H or Equivalent

Pin No	Symbol	Function	Remark
1	NC	No connection	
2	NC	No connection	
3	NC	No connection	
4	GND	GND Ground	
5	RX0-	Negative LVDS differential data input. Channel 0	
6	RX0+	Positive LVDS differential data input. Channel 0	
7	GND	Ground	Optical: Bist function
8	RX1-	Negative LVDS differential data input. Channel 1	
9	RX1+	Positive LVDS differential data input. Channel 1	
10	GND	Ground	
11	RX2-	Negative LVDS differential data input. Channel 2	
12	RX2+	Positive LVDS differential data input. Channel 2	
13	GND	Ground	
14	RXCLK-	Negative LVDS differential clock input.	
15	RXCLK+	Positive LVDS differential clock input.	
16	GND	Ground	
17	RX3-	Negative LVDS differential data input. Channel 3	
18	RX3+	Positive LVDS differential data input. Channel 3	
19	GND	Ground	
20	NC	Not connection, this pin should be open.	
21	NC	Not connection, this pin should be open.	
22	NC	Not connection, this pin should be open.	
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VCC	5V Power supply	
27	VCC		
28	VCC		
29	VCC		
30	VCC		

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5.2 LVDS Interface ( Tx; THC63LVDF83A or Equivalent )							
5.2.1 LVDS Interface							
L V D S	Input Signal	Transmitter		Interface		MT185WHM-N20 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	5 6	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4	46 45	OUT1- OUT1+	RXO1- RXO1+	8 9	
	OG1	6					
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15	42 41	OUT2- OUT2+	RXO2- RXO2+	11 12	
	OB1	19					
	OB2	20					
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27	38 37	OUT3- OUT3+	RXO3- RXO3+	17 18	
	Vsync	28					
	DE	30					
	MCLK	31					
	OR6	50					
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

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## 6.0 SIGNAL TIMING SPECIFICATION

6.1 The DV185WHM-NM2 is operated by the DE only.

Item	Symbols		Min	Typ	Max	Unit
DCLK	Period	tCLK	10.6	13.26	15.91	ns
	Frequency	-	62.9	75.4	94.3	MHz
Horizontal Display Term	Period	tHP	1446	1560	1936	tCLK
	Horizontal Valid	tHV	1366	1366	1366	tCLK
	Horizontal Blank	tHB	80	194	570	tCLK
	Frequency	fH	40.3	48.36	60.45	KHz
Vertical Display Term	Period	tVP	778	806	888	tHP
	Vertical Valid	tVV	768	768	768	tHP
	Vertical Blank	tVB	10	<b>38</b>	120	tHP
	Frequency	fV	50	60	75	Hz
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%

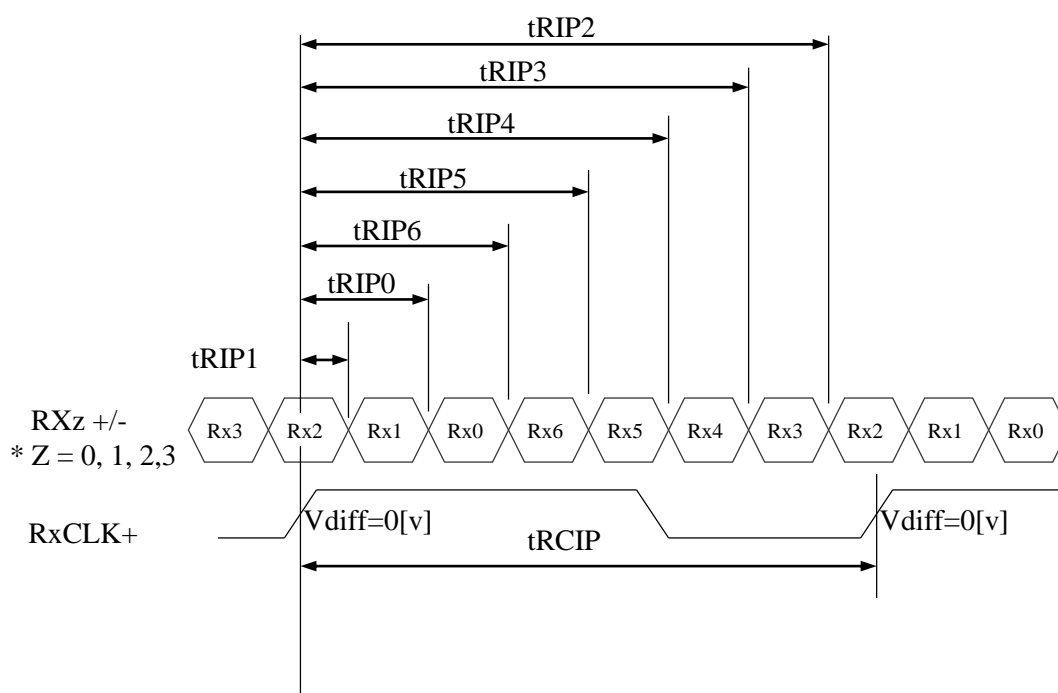
Note: The DCLK range at last line of V-blanking should be set in 0~987

## 6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 7.

<Table 7. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.60	13.26	15.91	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 × tRCIP/7-0.4	2 × tRCIP/7	2 × tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 × tRCIP/7-0.4	3 × tRCIP/7	3 × tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 × tRCIP/7-0.4	4 × tRCIP/7	4 × tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 × tRCIP/7-0.4	5 × tRCIP/7	5 × tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 × tRCIP/7-0.4	6 × tRCIP/7	6 × tRCIP/7+0.4	nsec	



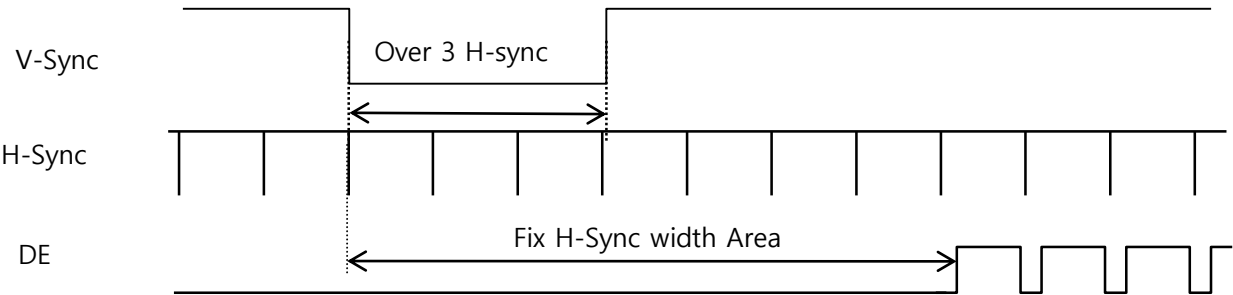
\* Vdiff = (RXz+)-(RXz-),..., (RXCLK+)-(RXCLK-)



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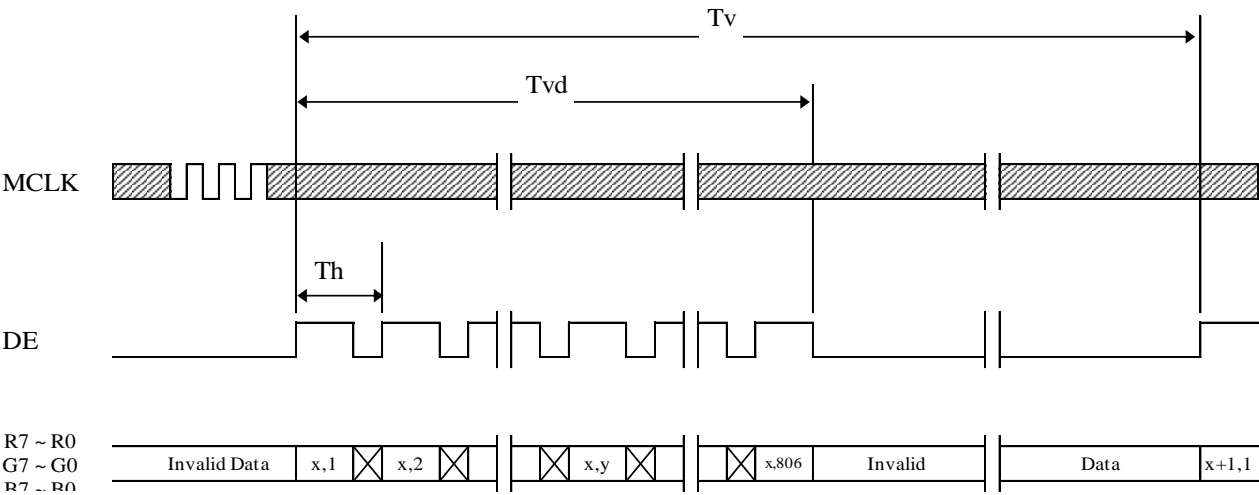
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 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

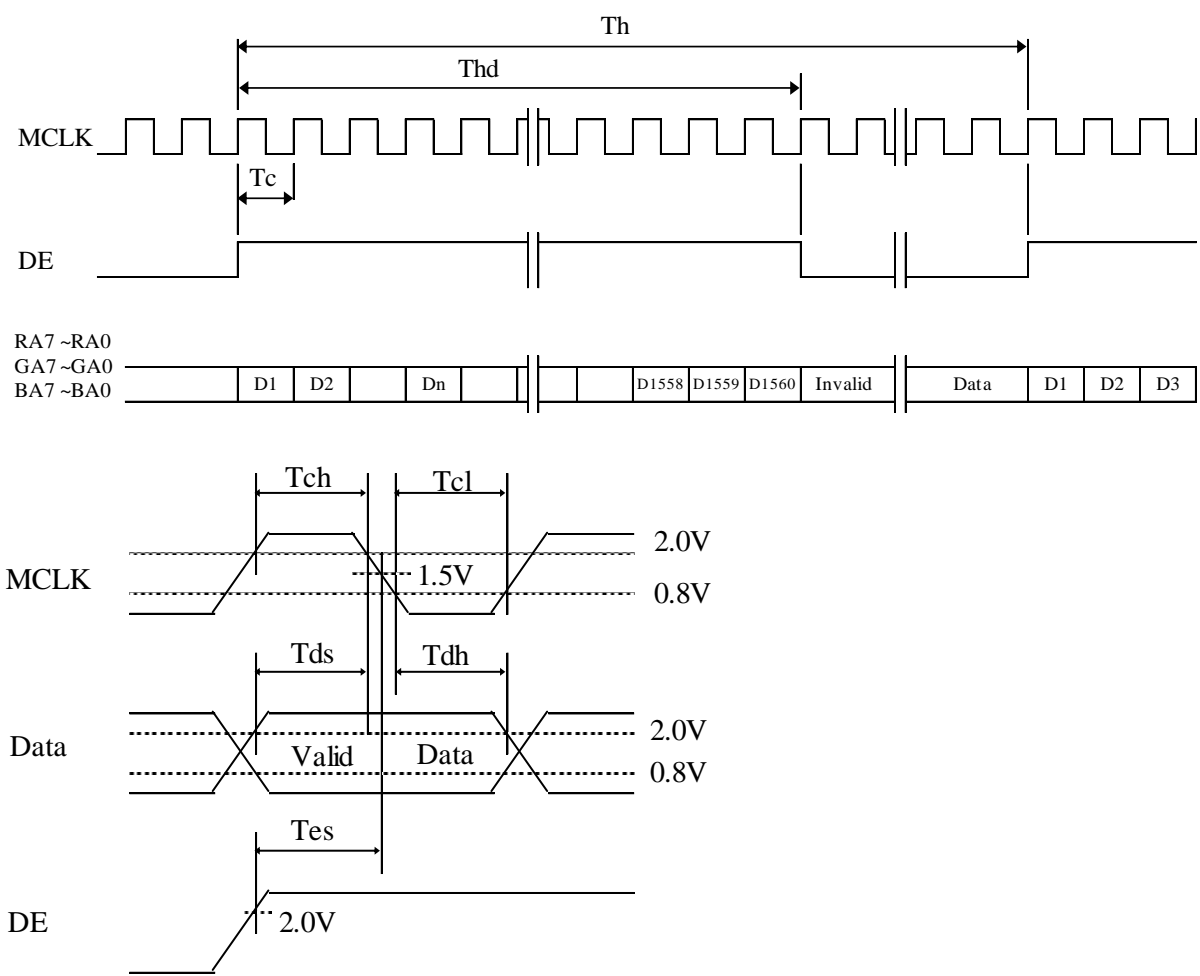
7.2 Vertical Timing Waveforms



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7.3 Horizontal Timing Waveforms



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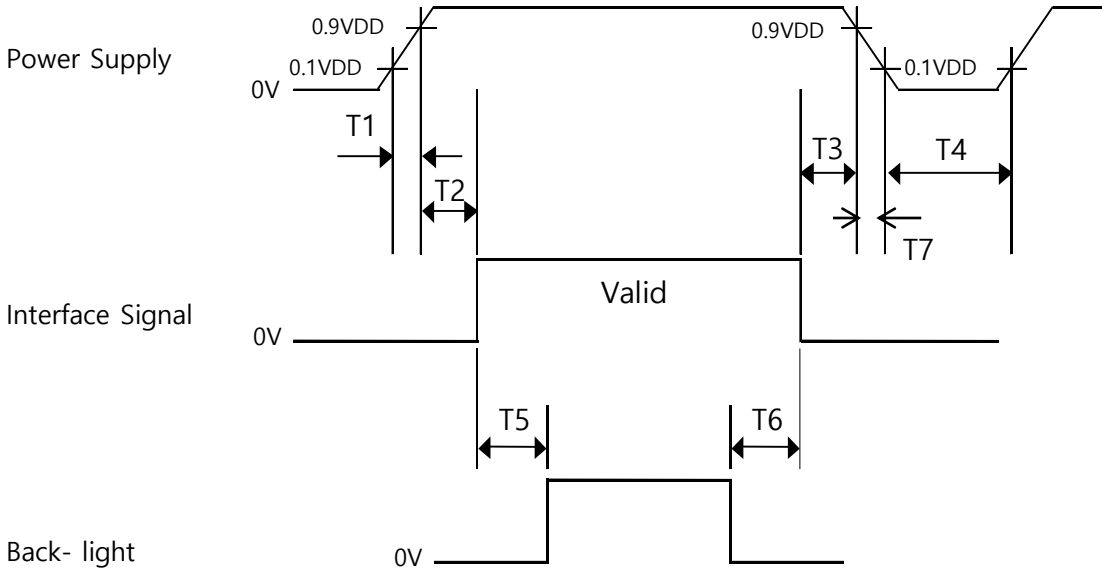
**8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS**

Color & Gray Scale		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	0	1	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

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### 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



- $0.5\text{ ms} \leq T1 \leq 10\text{ms}$
- $0 \leq T2 \leq 50\text{ ms}$
- $0 \leq T3 \leq 50\text{ ms}$
- $1\text{ sec} \leq T4$
- $200\text{ ms} \leq T5$
- $200\text{ ms} \leq T6$

#### Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.

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## 10.0 MECHANICAL CHARACTERISTICS

### 10.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model DV185WHM-NM2. Other parameters are shown in Table 8.

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	430.4 ×254.6×10.9	mm
Weight	1300(typ.)	gram
Active area	409.8(H) × 230.4(V)	mm
Pixel pitch	0.1(H) ×0.3(V)	mm
Number of pixels	1366(H)×768(V) (1 pixel = R + G + B dots)	pixels
Back-light	Right edge side 1-LED Light bar Type	

### 10.2 Mounting

See FIGURE 5. (shown in Appendix)

### 10.3 Anti-Glare and Polarizer Hardness.

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

### 10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

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## 11.0 RELIABILITY TEST

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

<Table 9. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature storage test	Ta = 60 °C, 240 hrs
2	Low temperature storage test	Ta = -20 °C, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs
4	High temperature operation test	Ta = 50 °C, 240hrs
5	Low temperature operation test	Ta = 0 °C, 240hrs
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle
7	Vibration test (non-operating)	Frequency            5 ~ 200 Hz, Sweep rate 60 min Gravity / AMP        1.05 G Period                X, Y, Z 60 min
8	Electro-static discharge test (non-operating)	Air        : 150 pF, 330Ω, 15 KV Contact   : 150 pF, 330Ω, 8 KV

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## 12.0 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.

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13.0 PRODUCT SERIAL NUMBER

DV185WHM-NM2	B4	BOE
		
XXXX	XXXXXXXXXXXXXXXXXXXXXX	
		
XXXXXXXXXXXXXXXXXXXXXX		
		  MADE IN CHINA

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

1. Control Number

2. Rank / Grade

3. Line Classification

4. Year (2001 : 01, 2002 : 02, ...)
5. Month (1,2,3, ... , 9, X, Y, Z)

6. Internal Use

7. Serial Number

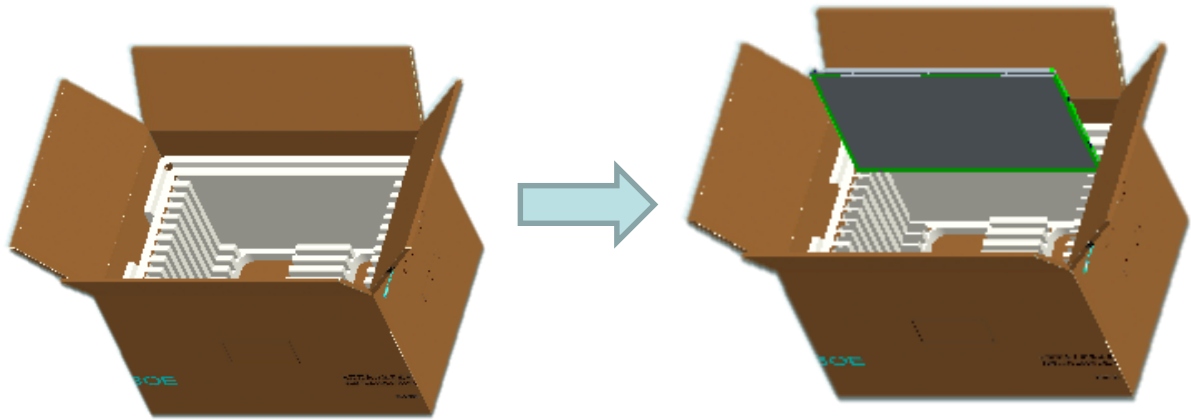
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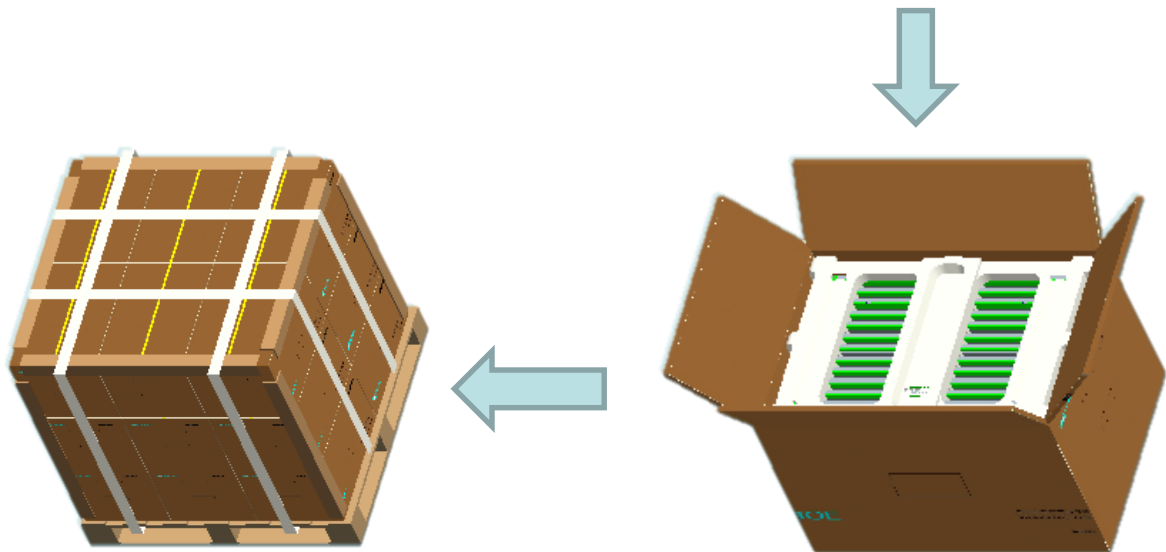
## 14.0 Packing

### 14.1 Packing Order



-Put 1 EPO bottom into the inner box.

-Put each module into a PE bag.  
-Insert 13 Pcs MDL into each box.



-Put the boxes on the Pallet  
18boxes/Pallet:6Boxes per layer, total 3 layers  
-Place paper corners and wrap film around the boxes  
-Pack with 4 packing belts

-Put 1 EPO cover in and seal the box.

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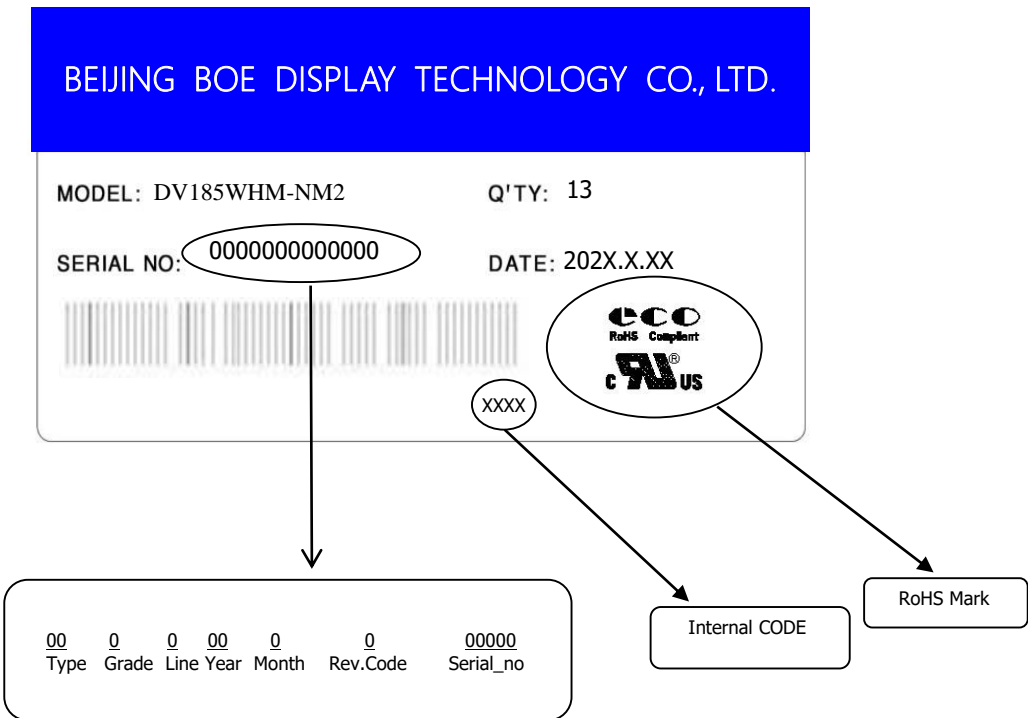
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**14.2 Packing Note**

- Box Dimension : 508mm(L) × 358mm(W) × 325mm(H)
- Package Quantity in one Box : 13 pcs

**14.3 Box label**

- Label Size : 108 mm (L) × 56 mm (W)
- Contents
  - Model : DV185WHM-NM2
  - Q`ty : Module Q`ty in one box
  - Serial No. : Box Serial No. See next page for detail description.
  - Date : Packing Date



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## 15.0 PRECAUTIONS

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

### 15.1 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 module 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 module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module 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 module , 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 module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module 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.

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<ul style="list-style-type: none"> <li>• This module has its circuitry PCB's on the rear side and Driver IC, should be handled carefully in order not to be stressed.</li> <li>• Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package &amp; wire</li> <li>• Do not disassemble the module.</li> </ul> <h3>15.2 Operating Precautions</h3> <ul style="list-style-type: none"> <li>• Do not connector or disconnect the cable to/from the Module at the "Power On" Condition.</li> <li>• When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the module would be damaged.</li> <li>• Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.</li> <li>• Do not allow to adjust the adjustable resistance or switch</li> <li>• The electrochemical reaction caused by DC voltage will lead to LCD module degradation, so DC drive should be avoided.</li> <li>• 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 equipment to protect against static electricity.</li> <li>• 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 Module may be damaged.</li> <li>• Module 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.</li> <li>• 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</li> <li>• The cables should be as short as possible between System Board and PCB interface.</li> <li>• Connectors are precision devices to transmit electrical signals, and operators should plug in parallel</li> <li>• 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.</li> </ul>			
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### 15.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a module 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.

### 15.4 Precautions for Strong Light Exposure

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

### 15.5 Precautions for Storage

#### A. Atmosphere Requirement

ITEM	UNIT	MIN	TYP	MAX
Storage Temperature	(°C)	5	25	39
Storage Humidity	(%rH)	40	50	80
Storage Life	6 months			
Storage Condition	<ul style="list-style-type: none"> <li>• The storage room should be equipped with a dark and good ventilation facility.</li> <li>• Prevent products from being exposed to the direct sunlight, moisture and water.</li> <li>• The product need to keep away from organic solvent and corrosive gas.</li> <li>• Be careful for condensation at sudden temperature change.</li> <li>• Storage condition is guaranteed under packing conditions.</li> </ul>			

#### 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.

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## 15.6 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.

## 15.7 Appropriate Condition for Commercial Display

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

### 1. Normal operating condition

- Temperature:  $20 \pm 15^{\circ}\text{C}$
- Operating Ambient Humidity :  $55 \pm 20\%$
- Display pattern: dynamic pattern (Real display)
- Well-ventilated place is recommended to set up Commercial Display system

### 2. Special operating condition

#### a. Ambient condition

- Well-ventilated place is recommended to set up Commercial 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 module 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 module will return to normal display.

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

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 Module may be damaged.

f. Products exposed to low temperature environment for a long time, need to carry out necessary protection , low temperature environment is usually refrigerators , vending machine Etc...

g. Long time and large angle forward use or unconventional use , It is strongly recommended to contact BOE for filed application engineering advice

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<p>h. 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.</p> <p>3. Operating usages to protect against image sticking due to long-term static display.</p> <p>a. Suitable operating time: under 20 hours a day.</p> <p>b. Static information display recommended to use with moving image.</p> <p>- Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.</p> <p>c. Background and character (image) color change</p> <p>- Use different colors for background and character, respectively.</p> <p>- Change colors themselves periodically.</p> <p>d. Avoid combination of background and character with large different luminance.</p> <p>1) Abnormal condition just means conditions except normal condition.</p> <p>2) Black image or moving image is strongly recommended as a screen save</p> <p>4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.</p> <p><b>15.8 Other Precautions</b></p> <p>A. LC Leak</p> <ul style="list-style-type: none"> <li>• If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.</li> <li>• 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.</li> <li>• If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.</li> <li>• If LC touch eyes, eyes need to be washed with running water at least 15 minutes.</li> </ul> <p>B. Rework</p> <ul style="list-style-type: none"> <li>• When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.</li> </ul> <p>C. In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line through the I2C Interface. ( Q/Single/OC出货时填写)</p>			
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16.0 APPENDIX

Figure 1. Measurement Set Up

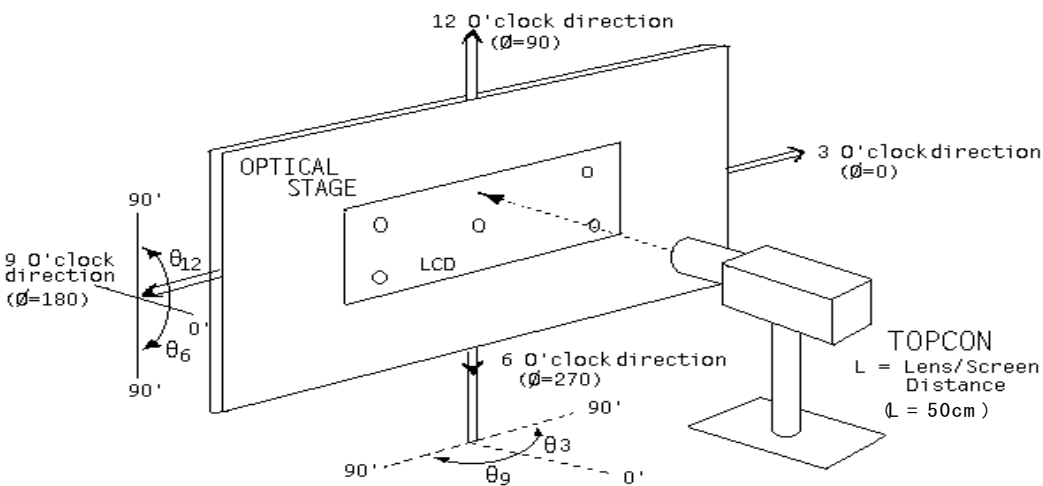
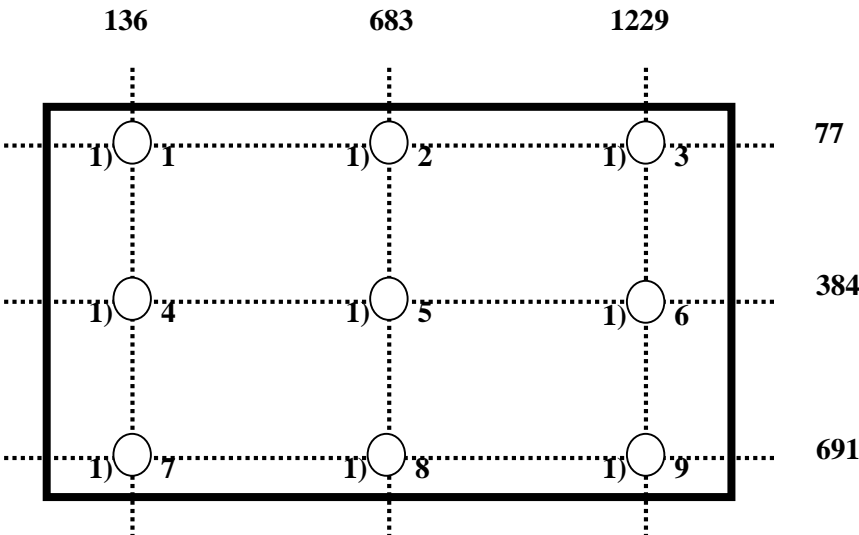


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



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Figure 3. Response Time Testing

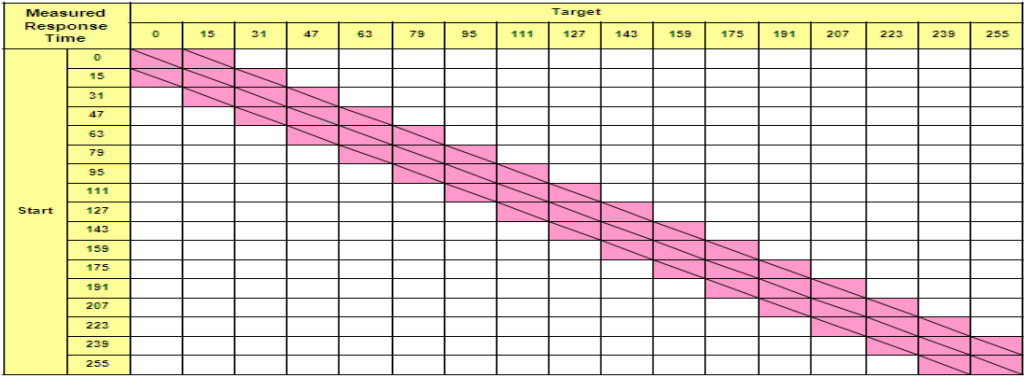
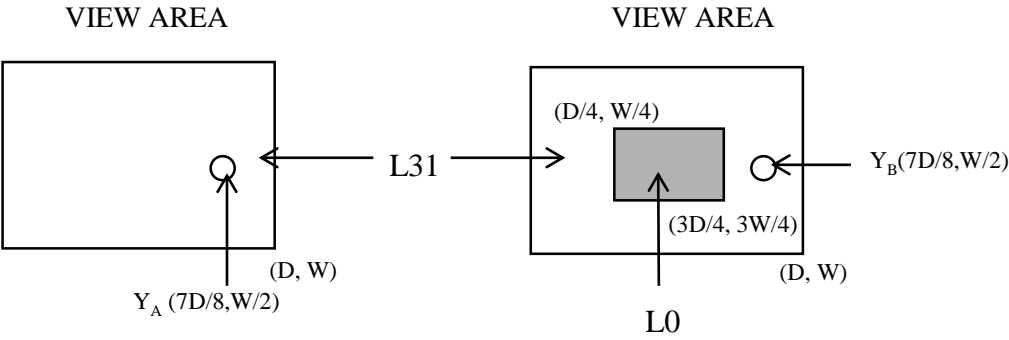


Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

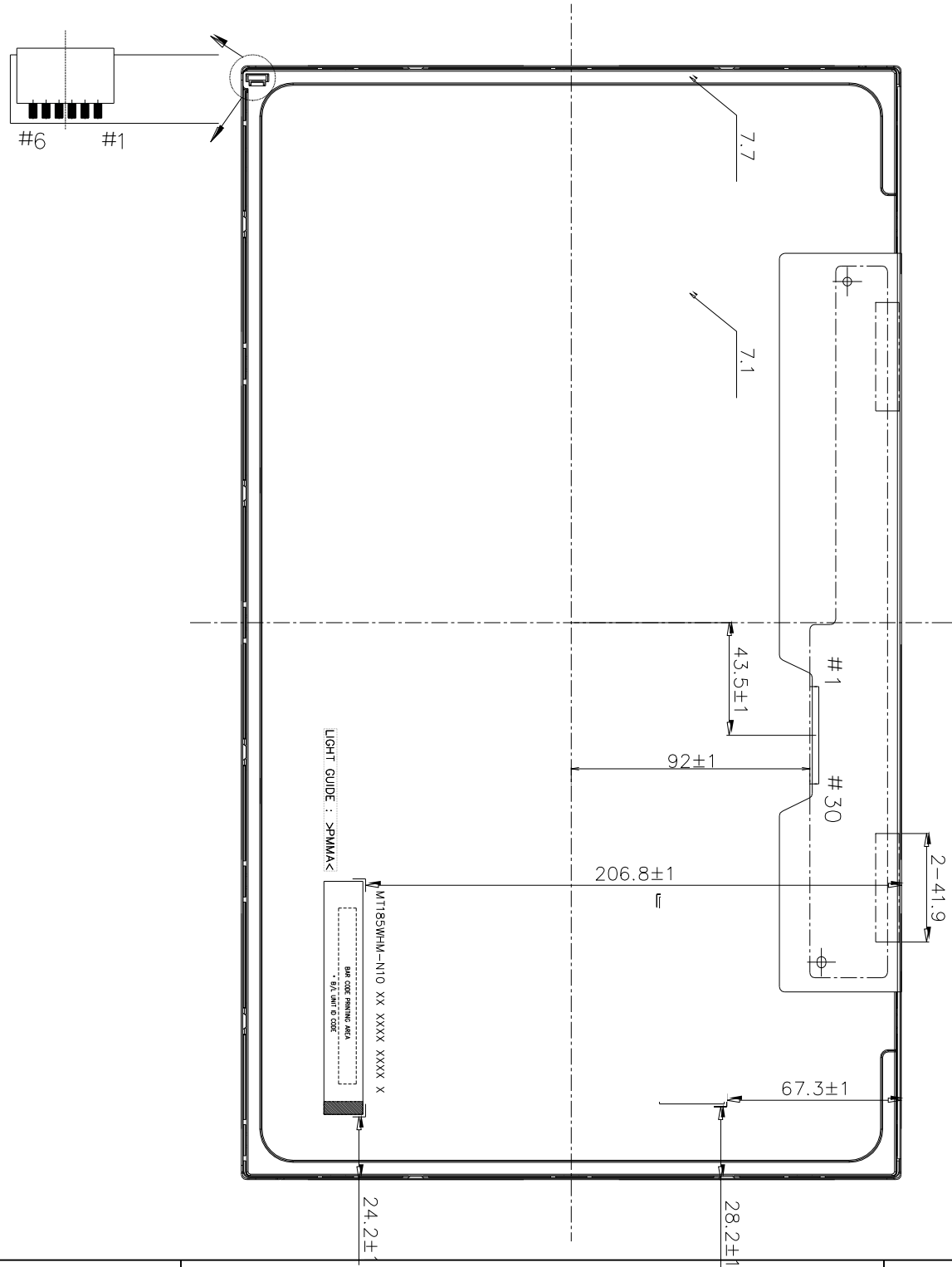
Where:  $Y_A$  = Initial luminance of measured area (cd/m<sup>2</sup>)  
 $Y_B$  = Subsequent luminance of measured area (cd/m<sup>2</sup>)  
The location measured will be exactly the same in both patterns

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



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