# TITLE : MV185WHM-N10

## Preliminary Product Specification

## Rev. P0

BEIJING BOE Display TECHNOLOGY

# REVISION HISTORY

| REV. | Page | DESCRIPTION OF CHANGES | DATE | PREPARED |
|---|---|---|---|---|
| Rev.P0 | | Initial Release | May.29,15‘ | Yan Yan |
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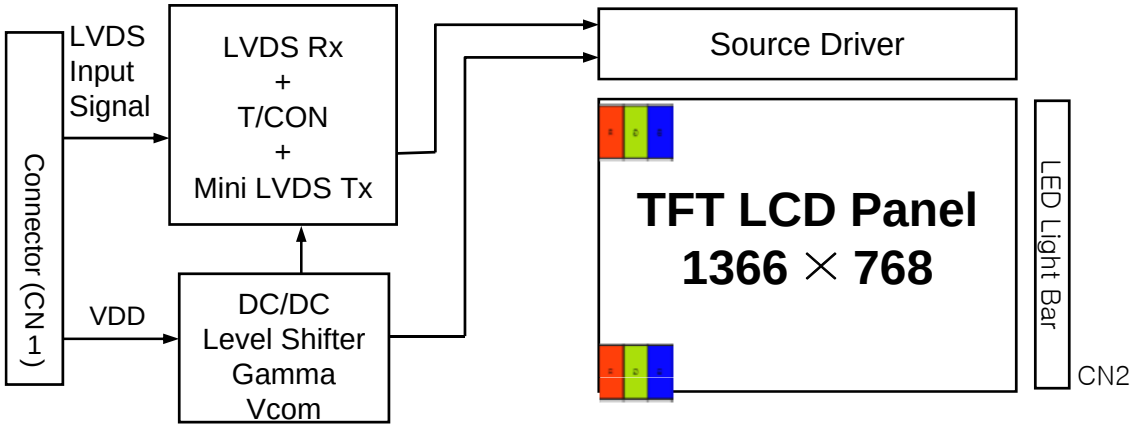
# Contents

# 1.0 GENERAL DESCRIPTION

## 1.1 Introduction

MV185WHM-N10 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
- ES 6.0 compliant
- Gamma correction

### 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 MV185WHM-N10.

<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 | 0.3(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 | TBD(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 | | |

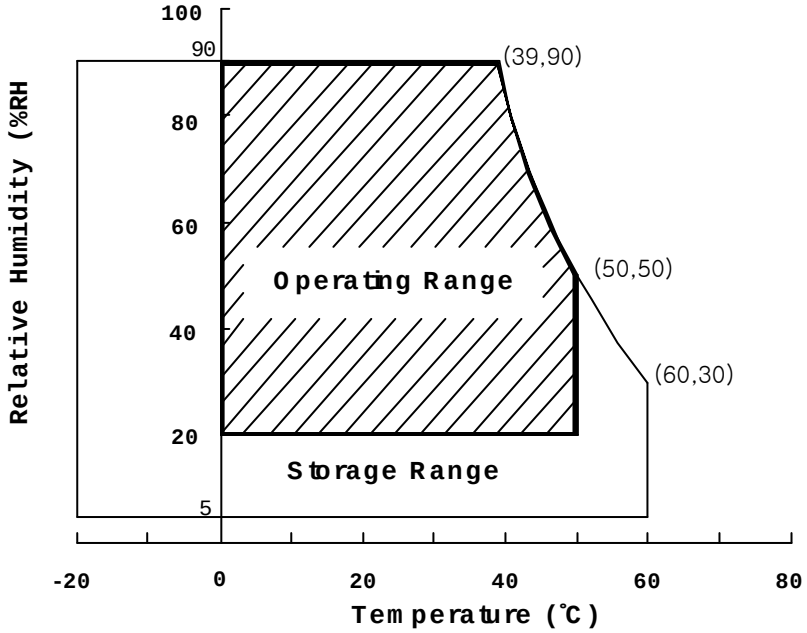
## 2.0 ABSOLUTE MAXIMUM RATINGS

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 | 7 | V | Ta = 25 ℃ |
| Logic Supply Voltage | $V_{IN}$ | VSS-0.3 | $V_{DD}$+0.3 | V | |
| LED Channel Current | $I_{BL}$ | - | 85 | mA | |
| Operating Temperature | $T_{OP}$ | 0 | +50 | ℃ | 1) |
| Storage Temperature | $T_{ST}$ | -20 | +60 | ℃ | 1) |

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 $^{O}$C max. and no condensation of water.



# 3.0 ELECTRICAL SPECIFICATIONS

## 3.1Electrical Specifications

< Table 3. Electrical specifications >

[Ta =25±2 ℃]

| Parameter | | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | 4.5 | 5.0 | 5.5 | V | Note1 |
| Power Supply Current | $I_{DD}$ | - | 900 | 1100 | mA | |
| In-Rush Current | $I_{RUSH}$ | - | 2 | 3 | A | Note 2 |
| Permissible Input Ripple Voltage | $V_{RF}$ | - | - | 300 | mV | Note1,3 |
| High Level Differential Input Threshold Voltage | $V_{IH}$ | - | - | +100 | mV | |
| Low Level Differential Input Threshold Voltage | $V_{IL}$ | -100 | - | - | mV | |
| Differential input voltage | $\|V_{ID}\|$ | 200 | - | 600 | mV | |
| Differential input common mode voltage | Vcm | 1.0 | 1.2 | 1.5 | | $V_{IH}$=100mV, $V_{IL}$=-100mV |
| LED Channel Voltage | $V_L$ | 17.4 | 18 | 19.8 | V | |
| LED Channel Current | $I_L$ | - | 85 | - | mA | |
| LED Lifetime | | 30,000 | - | - | Hrs | |
| Power Consumption | $P_D$ | - | 4.5 | 5.5 | W | @60Hz |
| | $P_{BL}$ | - | 6.12 | 6.73 | W | $I_L$=60 mA, Note 4 |
| | $P_{total}$ | - | 10.62 | 12.23 | 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 ($V_L$ × $I_L$) ×4(channel) excluding driver loss. (LED Light bar: 6S4P)

### 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 | - | 85 | - | mA | Note1,2, |
| LED Power Consumption | $P_{BL}$ | - | 6.12 | 6.73 | W | Note 3 |
| LED Life-Time | - | 30,000 | - | | 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 85mA
Note3: PBL=4 Input pins*VPIN ×IPIN
Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=85mA on condition of continuous operating at 25 ±2 ℃

# 4.0 OPTICAL SPECIFICATION

## 4.1 Overview

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 TOPCONE 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 5.0V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

## 4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 75.4MHz, $I_{BL}$ = 340mA, Ta =25±2 ℃]

< Table 5. Module Optical >

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle range | Horizontal | $\Theta_3$ | CR > 10 | 75 | 85 | - | Deg. | Note 1 |
| | | $\Theta_9$ | | 75 | 85 | - | Deg. | |
| | Vertical | $\Theta_{12}$ | | 70 | 80 | - | Deg. | |
| | | $\Theta_6$ | | 70 | 80 | - | Deg. | |
| Viewing Angle range | Horizontal | $\Theta_3$ | CR > 5 | 85 | - | - | Deg. | |
| | | $\Theta_9$ | | 85 | - | - | Deg. | |
| | Vertical | $\Theta_{12}$ | | 85 | - | - | Deg. | |
| | | $\Theta_6$ | | 85 | - | - | Deg. | |
| Luminance Contrast ratio | | CR | Θ = 0° (Center) Normal Viewing Angle | 700 | 1000 | - | | Note 2 |
| Luminance of White | | $Y_w$ | | 200 | 250 | - | cd/m² | Note 3 |
| White luminance uniformity | | ΔY | | 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 | $R_x$ | | | TBD | | | |
| | | $R_y$ | | | TBD | | | |
| | Green | $G_x$ | | | TBD | | | |
| | | $G_y$ | | | TBD | | | |
| | Blue | $B_x$ | | | TBD | | | |
| | | $B_y$ | | | TBD | | | |
| Color Gamut | | | | | 72 | | % | |
| Response Time | GTG | $T_r$ | | - | TBD | | ms | Note 6 |
| Cross Talk | | CT | | - | - | 2.0 | % | Note 7 |

**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. 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 9points / 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 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 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).

# 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 |

# 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 | CE | No connection | internal use |
| 3 | CTL | No connection | internal use |
| 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 | | |

**5.2 LVDS Interface ( Tx; THC63LVDF83A or Equivalent )**

**5.2.1 LVDS Interface**

| | Input Signal | Transmitter | | Interface | | MT185WHM-N20 (CN11) | Remark |
|---|---|---|---|---|---|---|---|
| | | Pin No. | Pin No. | System (Tx) | TFT-LCD (Rx) | Pin No. | |
| LVDS | OR0 | 51 | 48<br>47 | OUT0-<br>OUT0+ | RXO0-<br>RXO0+ | 1<br>2 | |
| | OR1 | 52 | | | | | |
| | OR2 | 54 | | | | | |
| | OR3 | 55 | | | | | |
| | OR4 | 56 | | | | | |
| | OR5 | 3 | | | | | |
| | OG0 | 4 | | | | | |
| | OG1 | 6 | 46<br>45 | OUT1-<br>OUT1+ | RXO1-<br>RXO1+ | 3<br>4 | |
| | OG2 | 7 | | | | | |
| | OG3 | 11 | | | | | |
| | OG4 | 12 | | | | | |
| | OG5 | 14 | | | | | |
| | OB0 | 15 | | | | | |
| | OB1 | 19 | | | | | |
| | OB2 | 20 | 42<br>41 | OUT2-<br>OUT2+ | RXO2-<br>RXO2+ | 5<br>6 | |
| | OB3 | 22 | | | | | |
| | OB4 | 23 | | | | | |
| | OB5 | 24 | | | | | |
| | Hsync | 27 | | | | | |
| | Vsync | 28 | | | | | |
| | DE | 30 | | | | | |
| | MCLK | 31 | 40<br>39 | CLK OUT-<br>CLK OUT+ | RXO CLK-<br>RXO CLK+ | 8<br>9 | |
| | OR6 | 50 | 38<br>37 | OUT3-<br>OUT3+ | RXO3-<br>RXO3+ | 10<br>11 | |
| | OR7 | 2 | | | | | |
| | OG6 | 8 | | | | | |
| | OG7 | 10 | | | | | |
| | OB6 | 16 | | | | | |
| | OB7 | 18 | | | | | |
| | RSVD | 25 | | | | | |

## 6.0 SIGNAL TIMING SPECIFICATION

6.1 The MV185WHM-N10 is operated by the DE only.

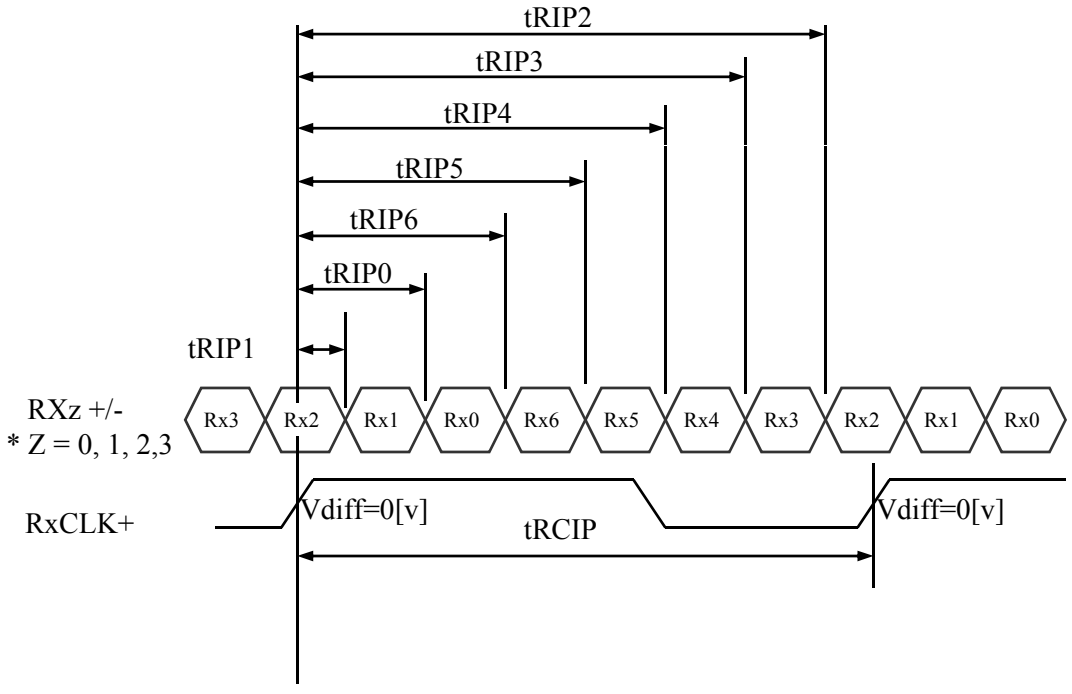
| Item | | Symbols | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | 50 | 75.4 | 95 | MHz |
| | High Time | Tch | - | 4/7Tc | - | |
| | Low Time | Tcl | - | 3/7Tc | - | |
| Frame Period | | Tv | 778 | 806 | 888 | lines |
| | | | 50 | 60 | 75 | Hz |
| | | | 20 | 16.7 | 13.3 | ms |
| Vertical Display Period | | Tvd | 768 | 768 | 768 | lines |
| One line Scanning Period | | Th | 1446 | 1560 | 1936 | clocks |
| Horizontal Display Period | | Thd | 1366 | 1366 | 1366 | clocks |
| Modulating frequency of input clock during SSC | | $F_{LVMOD}$(F=85MHz,$V_{IC}$=1.2V,$V_{ID}$=±200mV) | 10 | - | 300 | KHz |
| Maximum deviation of input clock during SSC | | $F_{LVDEV}$(F=85MHz,$V_{IC}$=1.2V,$V_{ID}$=±200mV) | -3 | - | +3 | % |

### 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>

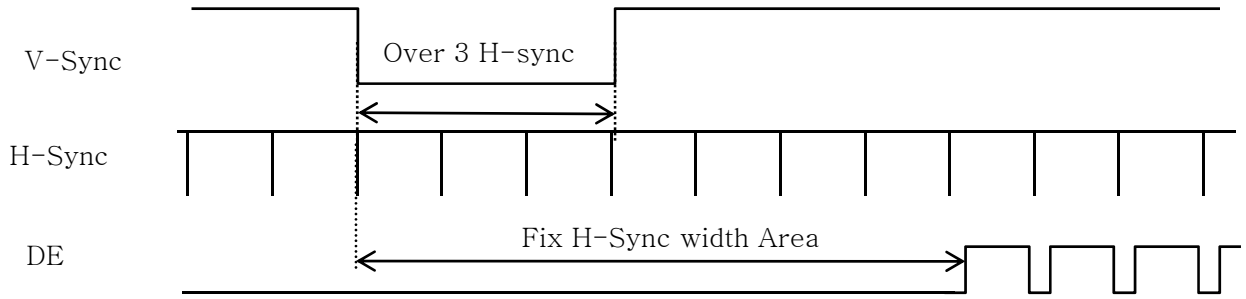
| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| CLKIN Period | tRCIP | 10.60 | 13.25 | 20.00 | nsec | |
| Input Data 0 | tRIP1 | -0.4 | 0.0 | +0.4 | nsec | |
| Input Data 1 | tRIP0 | tRCIP/7-0.4 | tRCIP/7 | tRCIP/7+0.4 | nsec | |
| Input Data 2 | tRIP6 | 2 ×tRCIP/7-0.4 | 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-)

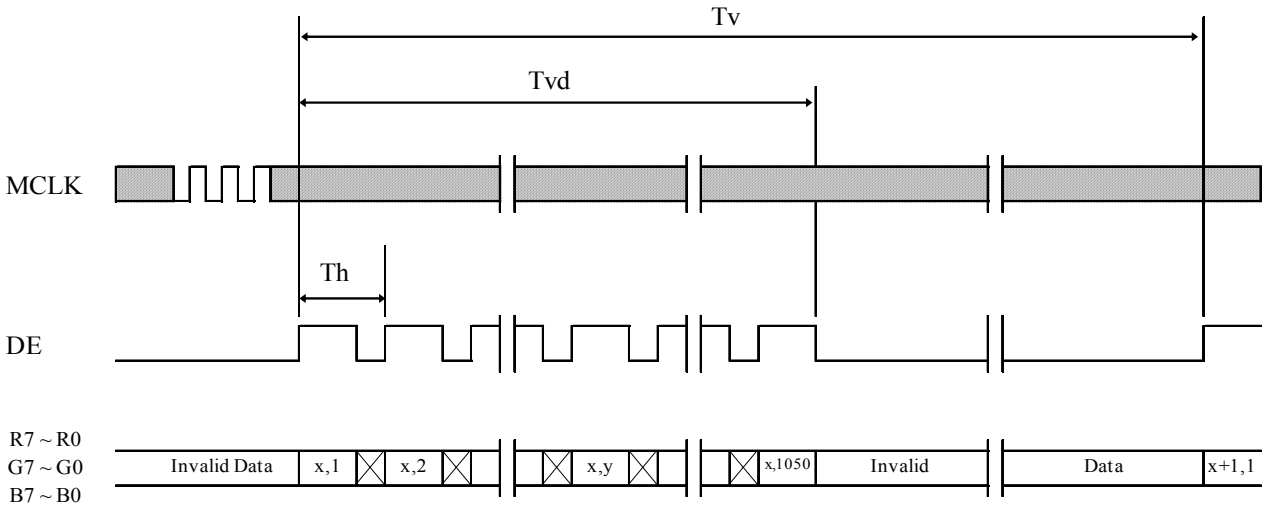
# 7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

## 7.1 Sync Timing Waveforms

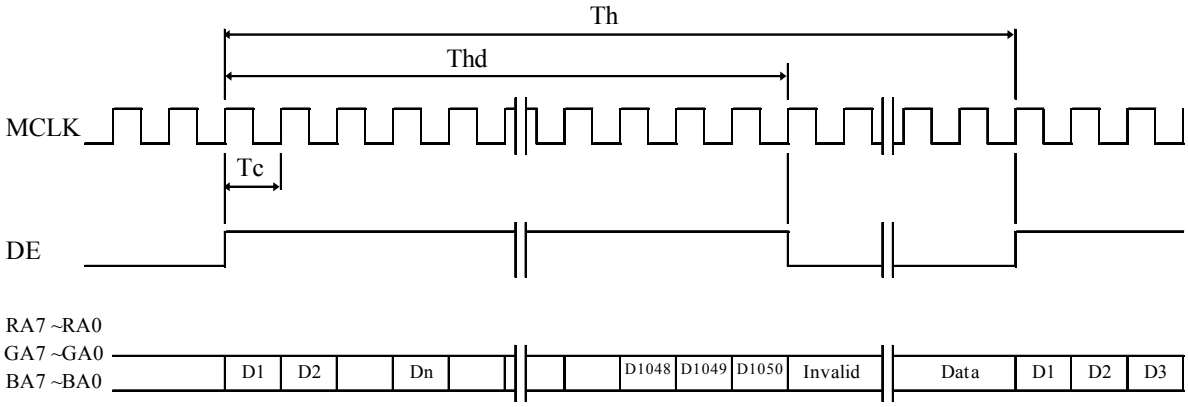


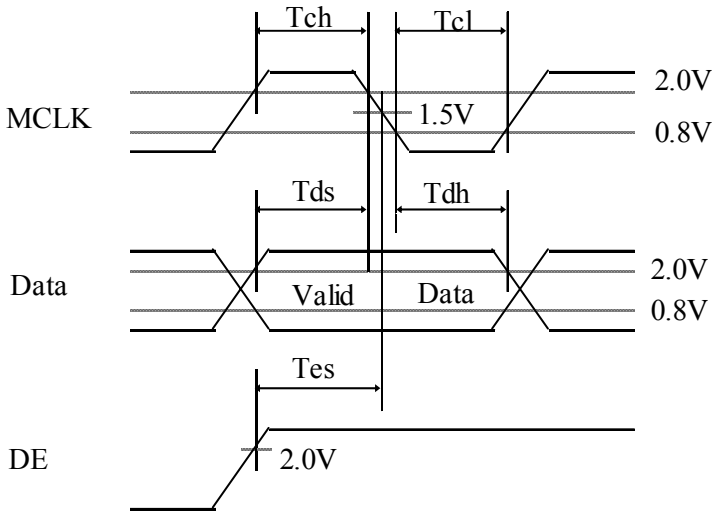

1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

## 7.2 Vertical Timing Waveforms



### 7.3 Horizontal Timing Waveforms



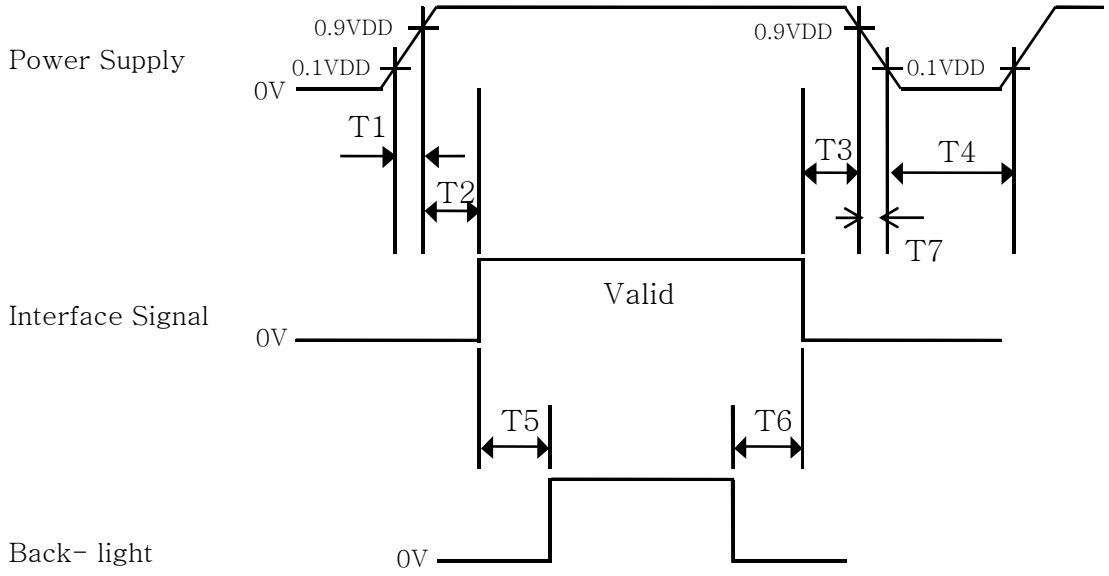



## 8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

| 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 | 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 |

## 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 ms ≤ T1 ≤ 10 ms
- 0 ≤ T2 ≤ 50 ms
- 0 ≤ T3 ≤ 50 ms
- 1 sec ≤ T4
- 200 ms ≤ T5
- 200 ms ≤ 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.

# 10.0 MECHANICAL CHARACTERISTICS

## 10.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model MV185WHM-N10. Other parameters are shown in Table 8.

<Table 8. Dimensional Parameters>

| Parameter | Specification | Unit |
|---|---|---|
| Dimensional outline | 430.4 ×254.6×10.9 | mm |
| Weight | TBD(typ.) | gram |
| Active area | 409.8(H) × 230.4(V) | mm |
| Pixel pitch | 0.3(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.

## 11.0 RELIABLITY 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 ℃, 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<br>Gravity / AMP<br>Period | 10 ~ 300 Hz, Sweep rate 30 min<br>1.5 G<br>X, Y, Z 30 min |
| 8 | Shock test (non-operating) | Gravity | 50G |
| | | Pulse width | 11msec, sine wave |
| | | Direction | ± X, ± Y, ± Z Once for each |
| 9 | Electro-static discharge test (non-operating) | Air : 150 pF, 330Ω, 15 KV<br>Contact : 150 pF, 330Ω, 8 KV | |
| 10 | Altitude test | Operating: 0 to 16400ft , 0 to 40˚ | |
| | | Non Operating: 0 to 40000ft, -20 to 40˚ | |

## 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.

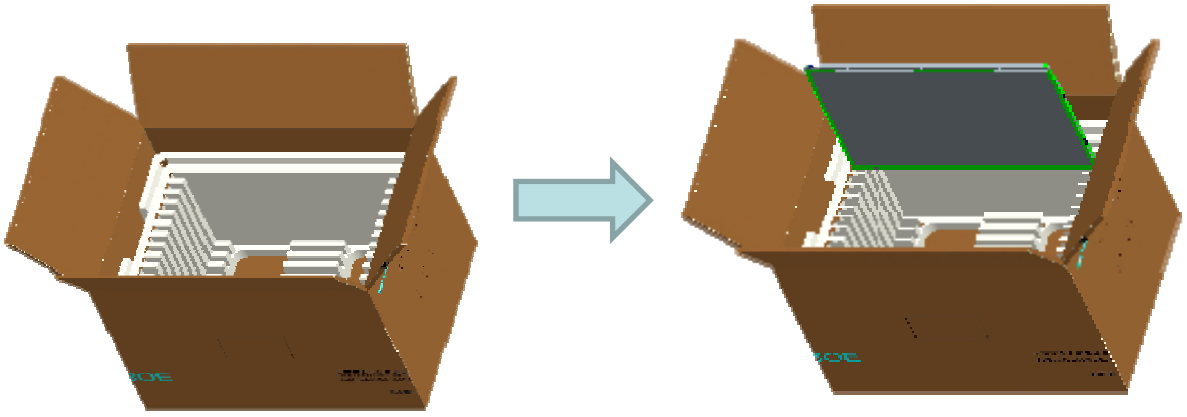
## 13.0 PRODUCT SERIAL NUMBER


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

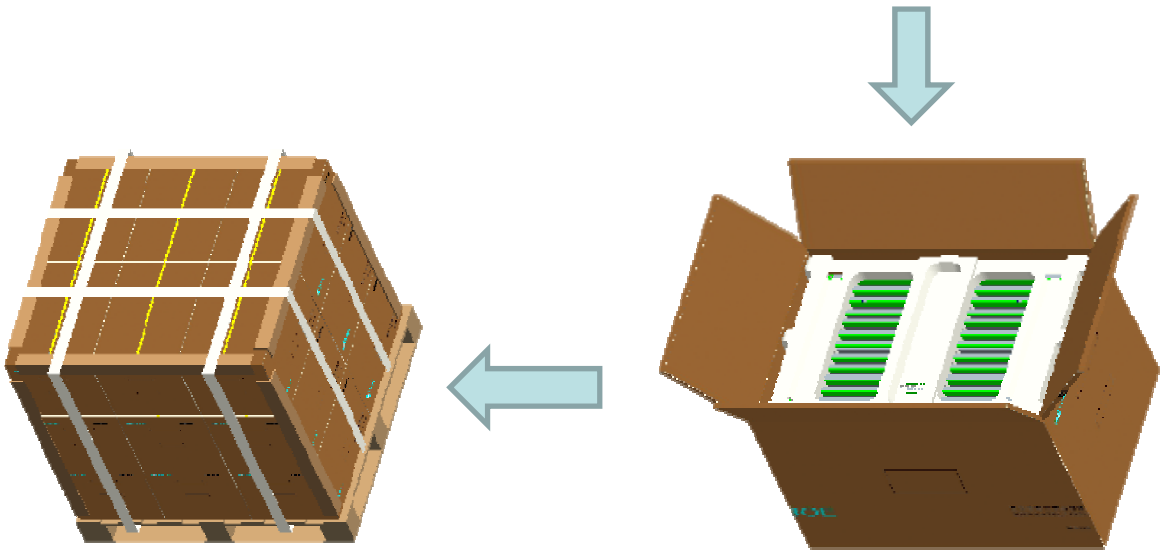
# 14.0 Packing

## 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 1 EPO cover in and seal the 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**

**14.2 Packing Note**

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

**14.3 Box label**

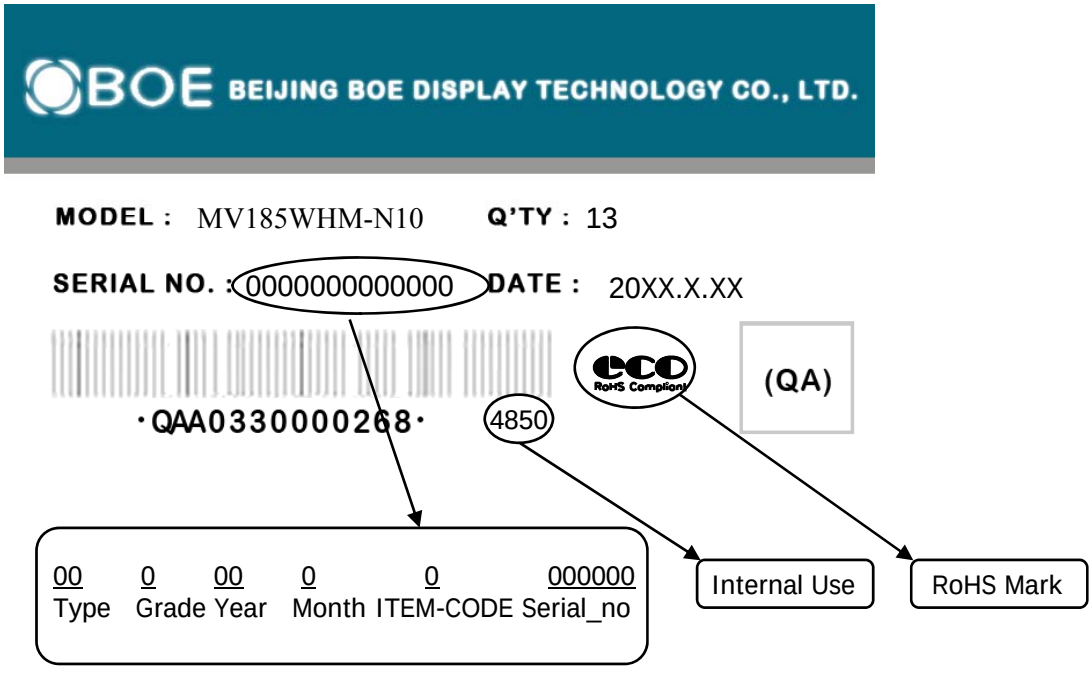
- Label Size : 108 mm (L) × 56 mm (W)
- Contents

  Model : MV185WHM-N10

  Q`ty : Module Q`ty in one box

  Serial No. : Box Serial No. See next page for detail description.

  Date : Packing Date



## 15.0 APPENDIX

**Figure 1. Measurement Set Up**

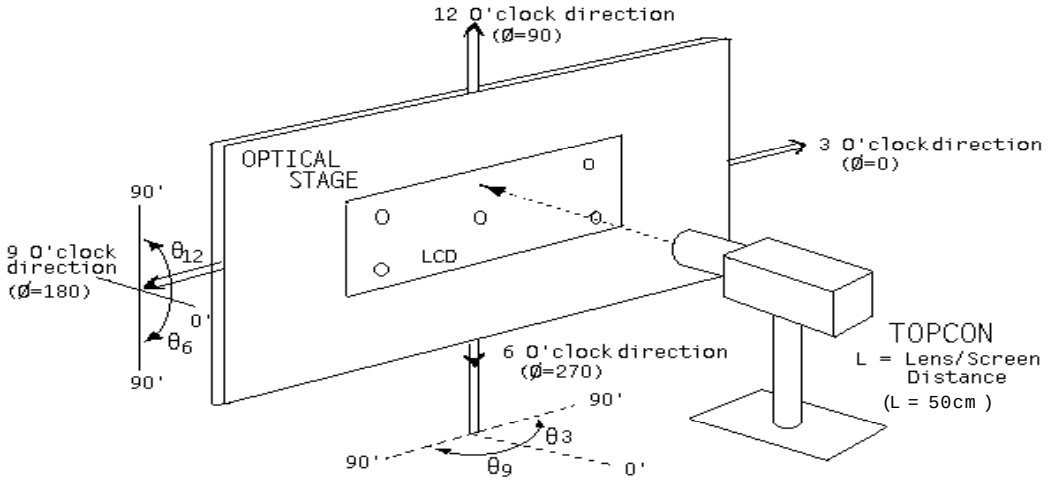



**Figure 2. White Luminance and Uniformity Measurement Locations (9 points)**

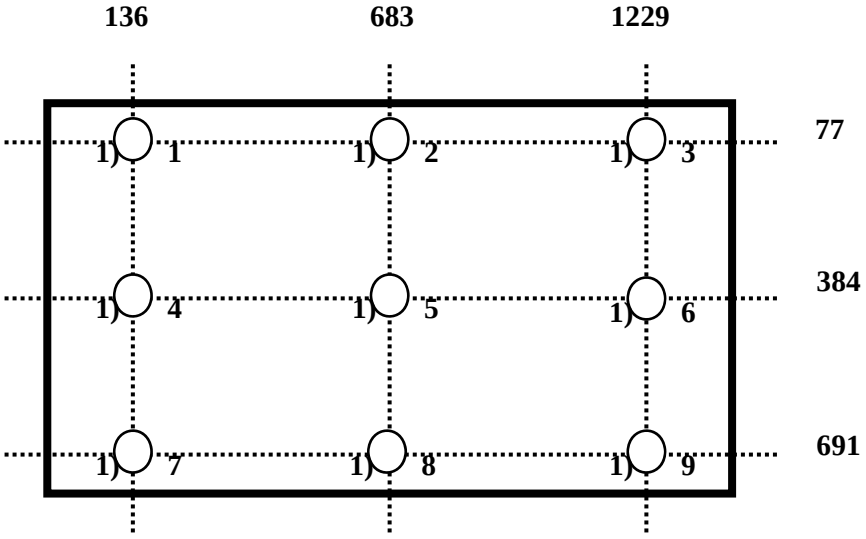


**Figure 3. Response Time Testing**

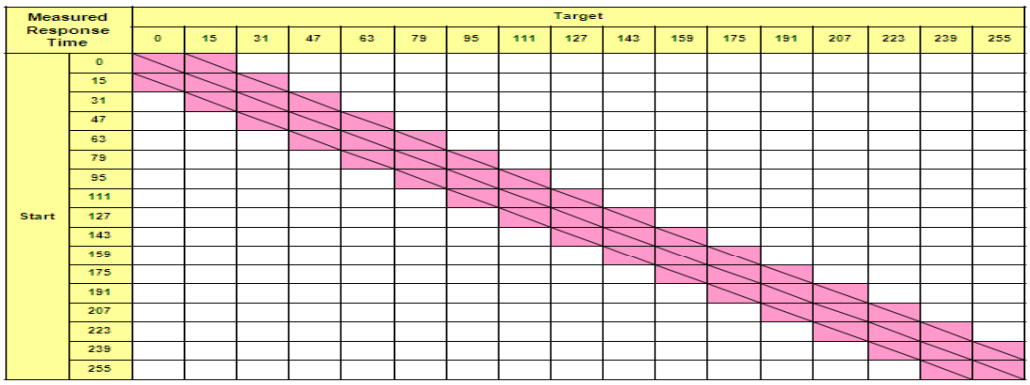
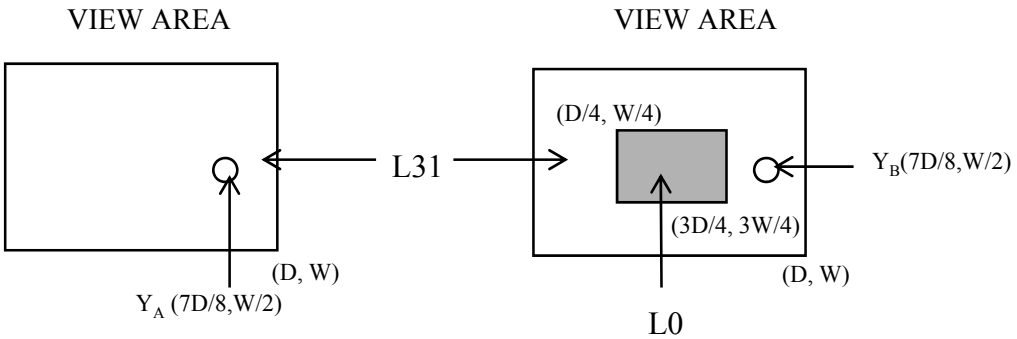



**Figure 4. Cross Modulation Test Description**




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

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

**Figure 5. TFT-LCD Module Outline Dimensions (Front view)**

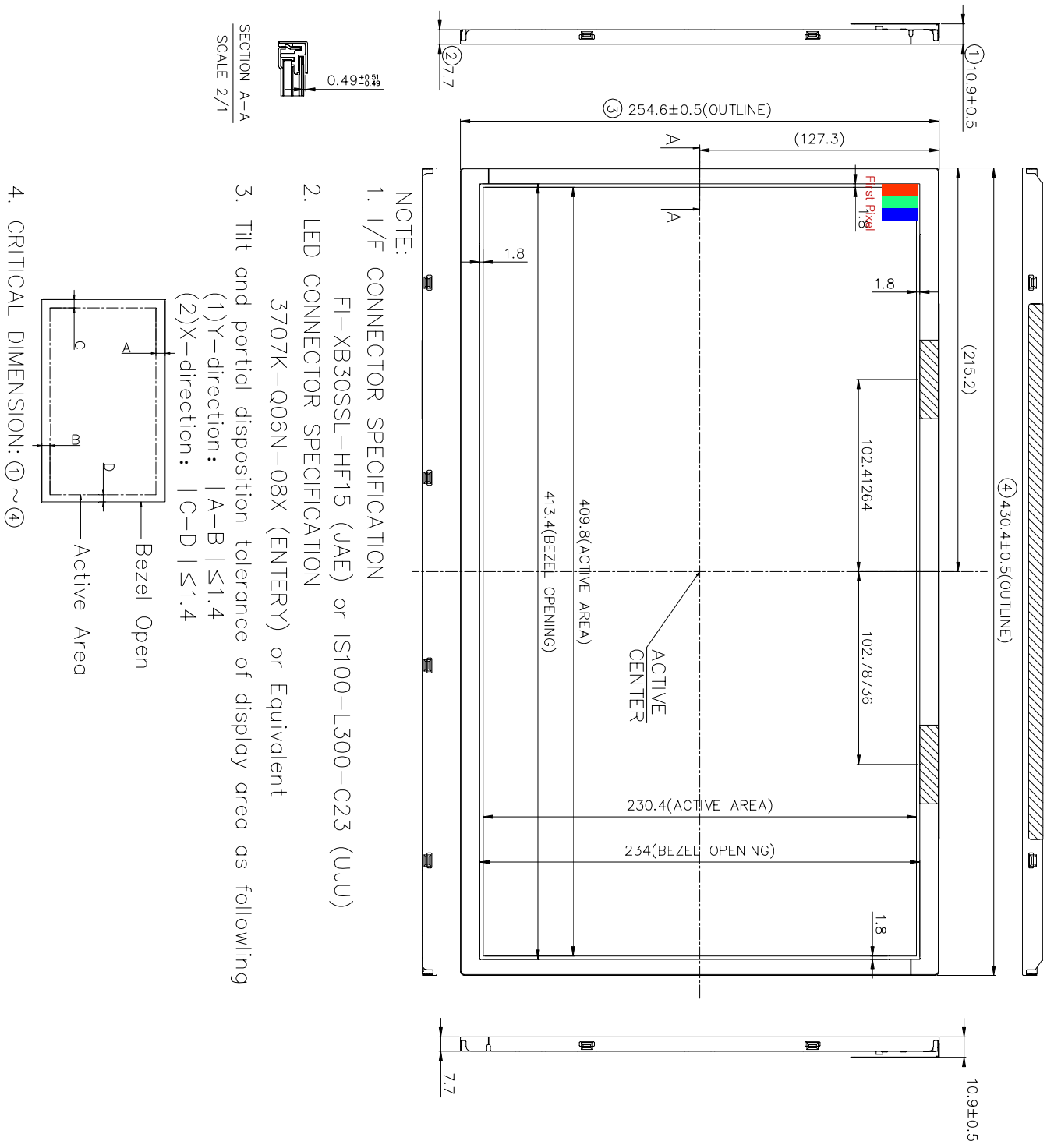


**Figure 6. TFT-LCD Module Outline Dimensions (Rear view)**