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P0

2014.05.14

1 OF 29

NT156WHM-N10**Preliminary Product Specification****Rev. P0****HEFEI XINSHENG OPTOELECTRONICS TECHNOLOGY CO.,LTD**



REV

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NT156WHM-N10 Preliminary Product Specification

PAGE

2 OF 29

REVISION HISTORY

| REV. | ECN No. | DESCRIPTION OF CHANGES | DATE | PREPARED |
|------|---------|------------------------|------------|----------|
| P0 | - | Initial Release | 2014.05.14 | 张言萍 |

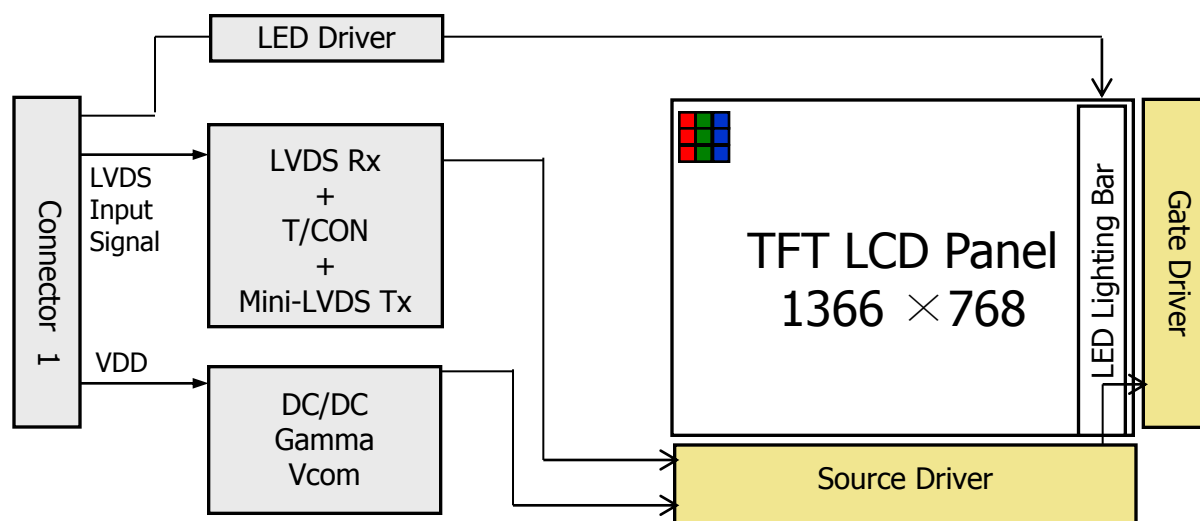
Contents

| No. | Items | Page |
|------|--|------|
| | REVISION HISTORY | 2 |
| | CONTENTS | 3 |
| 1.0 | General Description | 4 |
| 2.0 | Absolute Maximum ratings | 6 |
| 3.0 | Electrical specifications. | 7 |
| 4.0 | Optical specifications. | 10 |
| 5.0 | Interface Connection | 15 |
| 6.0 | Signal Timing waveforms | 19 |
| 7.0 | Signal Timing waveforms of interface signal | 21 |
| 8.0 | Input signals, Basic display colors & gray scale of colors | 23 |
| 9.0 | Power sequence | 24 |
| 10.0 | Connector description | 25 |
| 11.0 | Mechanical Characteristics | 26 |
| 12.0 | Reliability Test | 27 |
| 13.0 | Handling & Cautions. | 27 |
| 14.0 | Label | 28 |
| 15.0 | Packing information | 28 |
| 16.0 | Mechanical Outline Dimension | 31 |
| 17.0 | EDID Table | 33 |

1.0 GENERAL DESCRIPTION

1.1 Introduction

NT156WHM-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 15.6 inch diagonally measured active area with HD 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 262,144 colors. The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for Notebook PC. The LED Driver for back-light driving is built in this model. All input signals are LVDS interface compatible.



1.2 Features

- 1 Channel LVDS Interface with 1 pixel / clock
- Thin and light weight
- 6-bit color depth, display 262K colors
- Single LED Lighting Bar. (Down side/Horizontal Direction)
- Data enable signal mode
- Up/Down Mounting Frame
- Green Product (RoHS & Halogen free product)
- On board LED Driving circuit
- Low driving voltage and low power consumption
- On board EDID chip



1.3 Application

- Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model NT156WHM-N10. (listed in Table 1.)

<Table 1. General Specifications>

| Parameter | Specification | Unit | Remarks |
|---------------------|--|--------|---------|
| Active area | 344.23(H) × 193.54(V) | mm | |
| Number of pixels | 1366 (H) × 768 (V) | pixels | |
| Pixel pitch | 0.252 (H) X 0.252 (V) | mm | |
| Pixel arrangement | RGB Vertical stripe | | |
| Display colors | 262K | colors | |
| Display mode | Normally White | | |
| Dimensional outline | 359.5(H)*223.8(V) (W/PCB)*3.8(Max) 359.5(H)*206.5(V)*3.8(Max) | mm | |
| Weight | 400 (max) | g | |
| Surface treatment | Glare | | |
| Back-light | Lower Down side, 1-LED Lighting Bar type | | Note 1 |
| Power consumption | P _D : 1.0 (max) | W | |
| | P _{BL} :2.6(max) | W | |
| | P _{total} :3.6(max) | W | |

Notes : 1. LED Lighting Bar (36*LED Array)

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 >

Ta=25+/-2°C

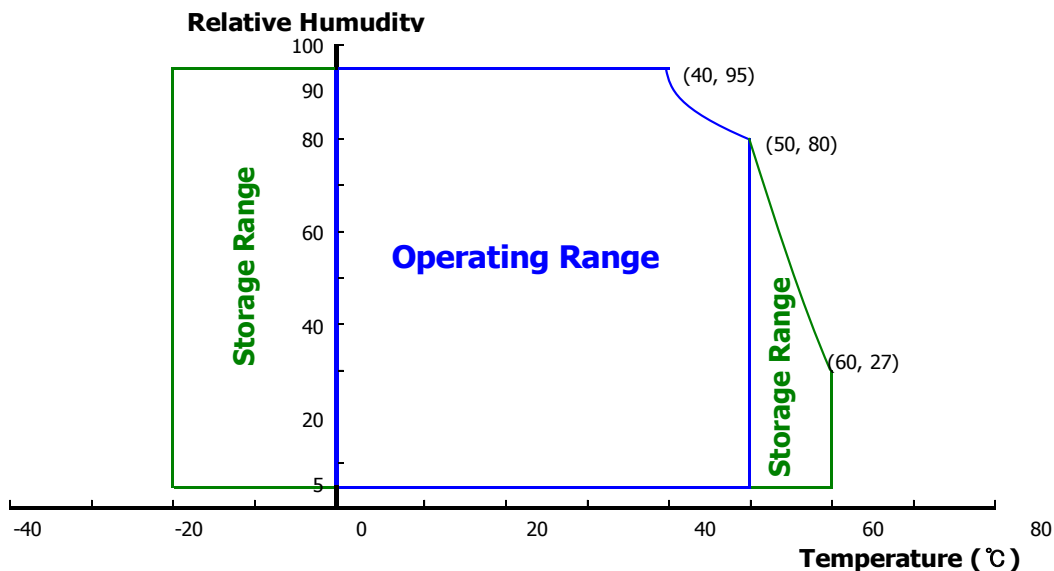
| Parameter | Symbol | Min. | Max. | Unit | Remarks |
|-----------------------|-----------------|----------------------|----------------------|------|---------|
| Power Supply Voltage | V _{DD} | -0.3 | 4.0 | V | Note 1 |
| Logic Supply Voltage | V _{IN} | V _{SS} -0.3 | V _{DD} +0.3 | V | |
| Operating Temperature | T _{OP} | 0 | +50 | °C | Note 2 |
| Storage Temperature | T _{ST} | -20 | +60 | °C | |

Notes : 1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.

2. Temperature and relative humidity range are shown in the figure below.

95 % RH Max. (40 °C ≥ Ta)

Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.





3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

Ta=25+/-2°C

| Parameter | | Min. | Typ. | Max. | Unit | Remarks |
|----------------------------------|--------------------|------|------|------|------|---------------------------|
| Power Supply Voltage | V _{DD} | 3.0 | 3.3 | 3.6 | V | Note 1 |
| Permissible Input Ripple Voltage | V _{RF} | - | - | 100 | mV | At V _{DD} = 3.3V |
| Power Supply Current | I _{DD} | - | TBD | - | mA | Note 1 |
| Differential Input Voltage | V _{ID} | 200 | - | 600 | mV | |
| Power Consumption | P _D | - | 0.8 | 1.0 | W | Note 1 |
| | P _{BL} | - | - | 2.6 | W | Note 2 |
| | P _{total} | - | - | 3.6 | 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 3.3V at 25°C.

a) Typ : Mosaic Pattern

b) Max : Skip sub pixel255

3.2 Backlight Unit

< Table 4. LED Driving guideline specifications >

Ta=25+/-2°C

| Parameter | | Min. | Typ. | Max. | Unit | Remarks | |
|-------------------------------------|----------------|------------------|--------|------|--------|---------|-----------------------|
| LED Forward Voltage | | V _F | - | - | 3.1 | V | - |
| LED Forward Current | | I _F | - | 20 | - | mA | - |
| LED Power Consumption | | P _{LED} | | - | 2.6 | W | Note 1 |
| LED Life-Time | | N/A | 15,000 | - | - | Hour | I _F = 20mA |
| Power supply voltage for LED Driver | | V _{LED} | 5 | 12 | 21 | V | |
| EN Control Level | Backlight on | | 2.5 | | 5.0 | V | |
| | Backlight off | | 0 | | 1.0 | V | |
| PWM Control Level | PWM High Level | | 2.5 | | 5.0 | V | |
| | PWM Low Level | | 0 | | 0.1 | V | |
| PWM Control Frequency | | F _{PWM} | 100 | - | 10,000 | Hz | |
| Duty Ratio | | - | 1 | - | 100 | % | Note3 |

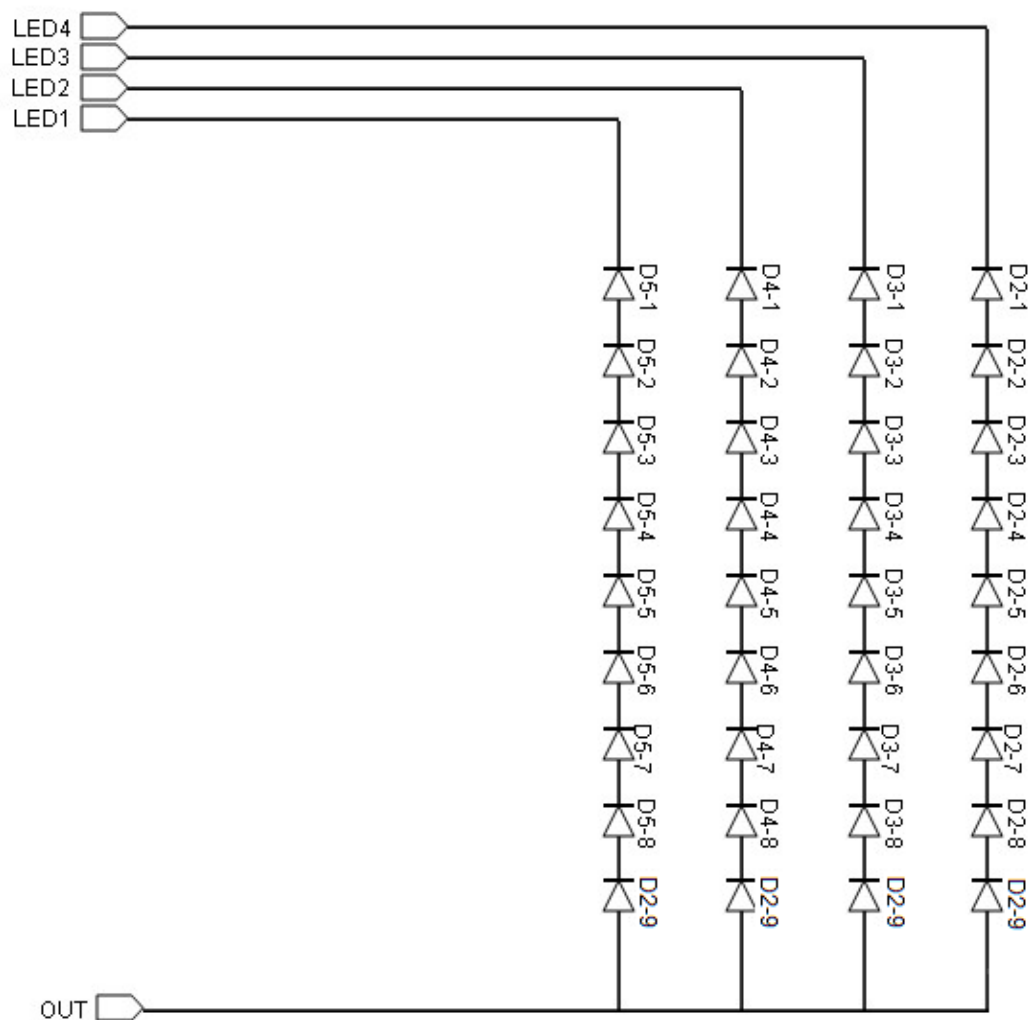
Notes : 1. Power supply voltage 12V for LED Driver

Calculator Value for reference $I_F \times V_F \times 36 / \text{efficiency} = P_{LED}$

2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

3. 1% duty cycle is achievable with a dimming frequency less than 1KHz.

3.3 LED structure



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 = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) 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 $\theta\Phi=0$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta\Phi=90$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta\Phi=180$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta\Phi=270$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be $3.3 \pm 0.3\text{V}$ at 25°C . Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

<Table 5. Optical Specifications>

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|----------------------------------|------------|---------------|-----------------------------------|-------|-------|-------|-------------------|--------|
| Viewing Angle range | Horizontal | Θ_3 | CR > 10 | - | 45 | - | Deg. | Note 1 |
| | | Θ_9 | | - | 45 | - | Deg. | |
| | Vertical | Θ_{12} | | - | 20 | - | Deg. | |
| | | Θ_6 | | - | 40 | - | Deg. | |
| Luminance Contrast ratio | | CR | $\Theta = 0^\circ$ | - | 500 | | | Note 2 |
| Luminance of White | 5 Points | Y_w | $\Theta = 0^\circ$ ILED = 20mA | 187 | 220 | - | cd/m ² | Note 3 |
| White Luminance uniformity | 5 Points | $\Delta Y5$ | | 80 | - | - | | Note 4 |
| | 13 Points | $\Delta Y13$ | | 65 | - | - | | |
| White Chromaticity | | x_w | $\Theta = 0^\circ$ | 0.283 | 0.313 | 0.343 | | Note 5 |
| | | y_w | | 0.299 | 0.329 | 0.359 | | |
| Reproduction of color | Red | x_R | $\Theta = 0^\circ$ | -0.03 | TBD | +0.03 | | |
| | | y_R | | | TBD | | | |
| | Green | x_G | | | TBD | | | |
| | | y_G | | | TBD | | | |
| | Blue | x_B | | | TBD | | | |
| | | y_B | | | TBD | | | |
| | | | | | | | | |
| Gamut | | | | | 45 | | % | |
| Response Time (Rising + Falling) | | T_{RT} | Ta= 25° C $\Theta = 0^\circ$ | - | 12 | - | ms | Note 6 |
| Cross Talk | | CT | $\Theta = 0^\circ$ | - | - | 2.0 | % | Note 7 |



Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles 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 (see FIGURE 1).

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) 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 luminance values of 5 point average across 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 : $\Delta Y = \text{Minimum Luminance of 5(or 13) points} / \text{Maximum Luminance of 5(or 13) points}$.
(see FIGURE 2 and FIGURE 3).

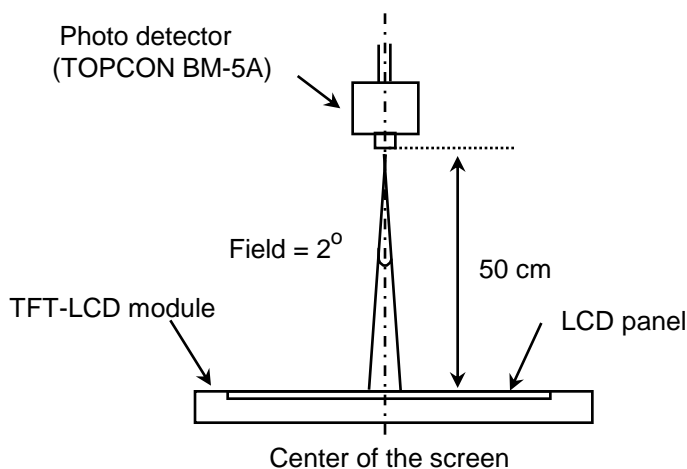
5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The electro-optical response time measurements shall be made as FIGURE 4 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_d .

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 5).

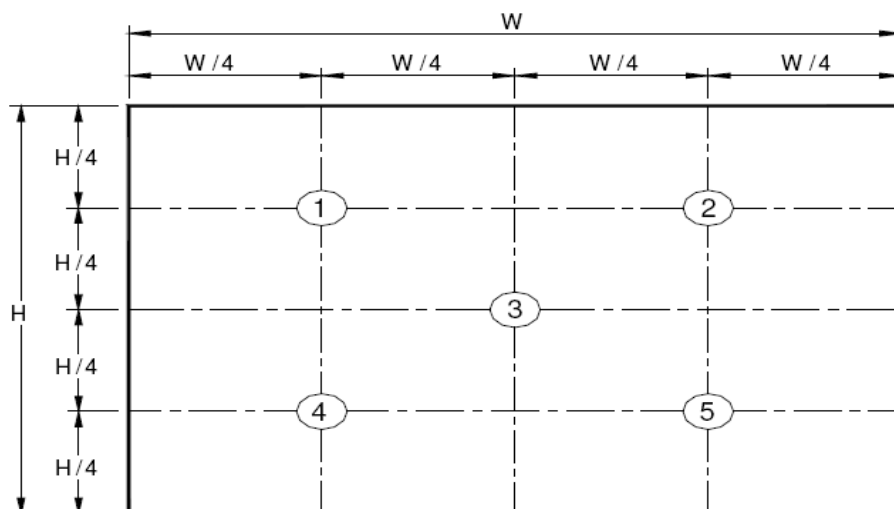
4.3 Optical measurements

Figure 1. Measurement Set Up



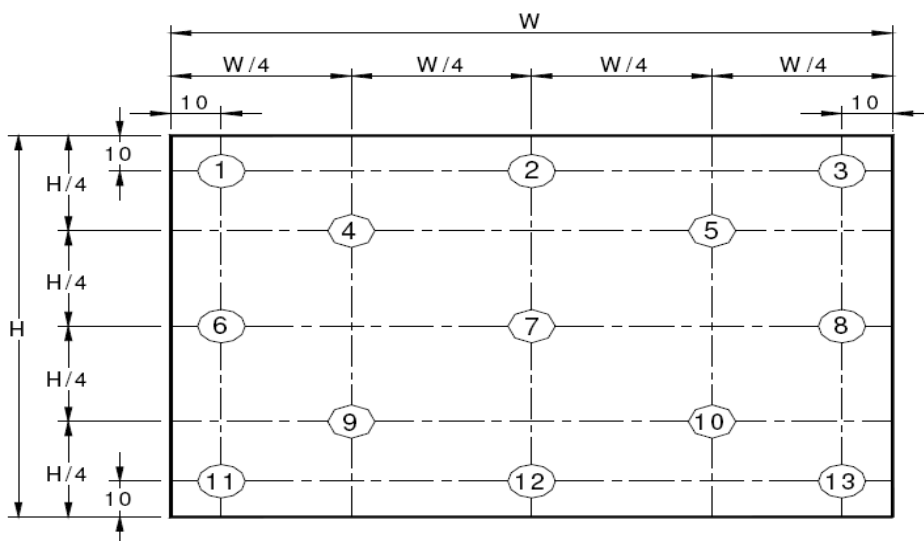
Optical characteristics measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (5 points)



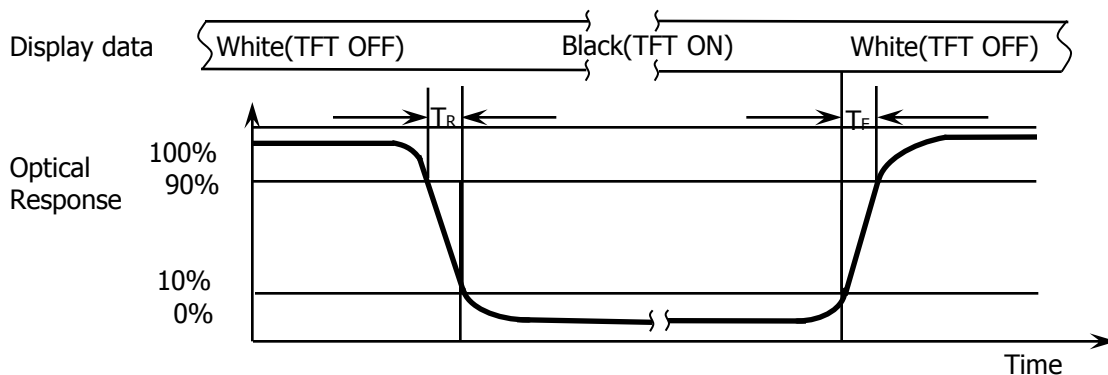
Center Luminance of white is defined as luminance values of center 5 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

Figure 3. Uniformity Measurement Locations (13 points)



The White luminance uniformity on LCD surface is then expressed as : $\Delta Y5 = \text{Minimum Luminance of five points} / \text{Maximum Luminance of five points}$ (see FIGURE 2) , $\Delta Y13 = \text{Minimum Luminance of 13 points} / \text{Maximum Luminance of 13 points}$ (see FIGURE 3).

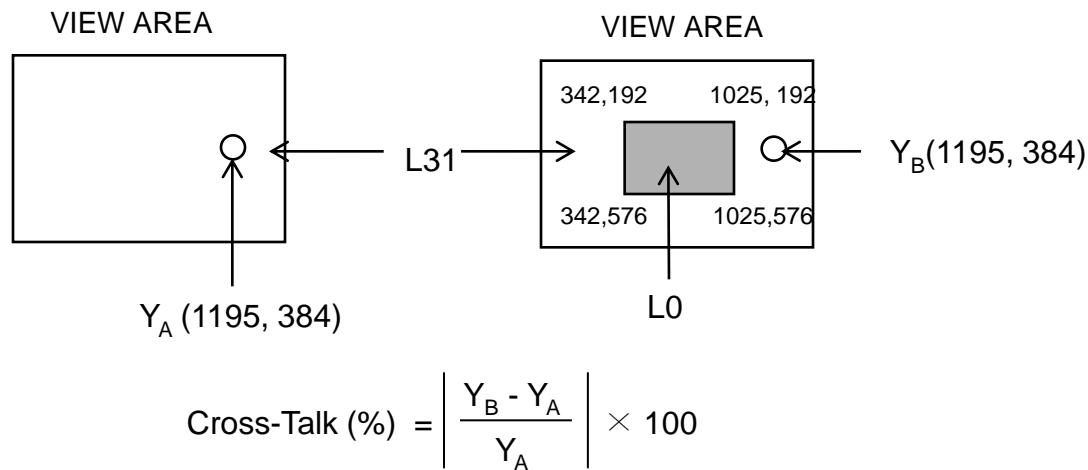
Figure 4. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 4 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_d and 90% to 10% is T_r .

| | | | |
|--|---|-----|------------------|
|  京东方 BOE | PRODUCT GROUP | REV | ISSUE DATE |
| | TFT- LCD PRODUCT | P0 | 2014.05.14 |
| SPEC. NUMBER | SPEC. TITLE NT156WHM-N10 Preliminary Product Specification | | PAGE 14 OF 29 |

Figure 5. Cross Modulation Test Description



Where:

Y_A = Initial luminance of measured area (cd/m²)

Y_B = Subsequent luminance of measured area (cd/m²)

The location measured will be exactly the same in both patterns

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 (Refer to FIGURE 5).

5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

The electronics interface connector is UJU IS050-L30B-C10 or Compatible.

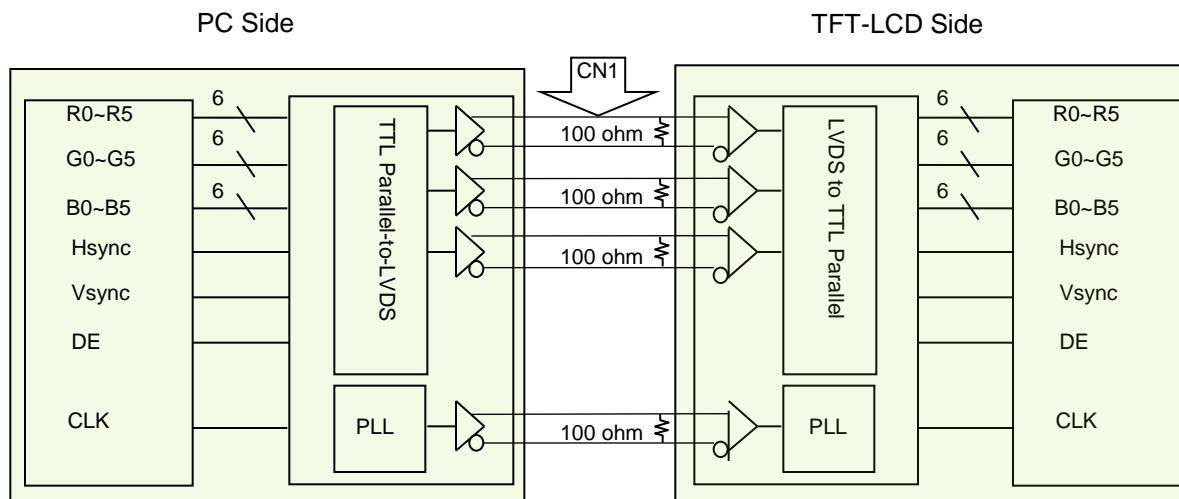
The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

| Terminal | Symbol | Functions |
|----------|-----------|-----------------------------------|
| Pin No. | Symbol | Description |
| 1 | NC | No Connection |
| 2 | VDDIN | Power Supply, 3.3V (typ.) |
| 3 | VDDIN | Power Supply, 3.3V (typ.) |
| 4 | VDC | VDC 3.3Vpower for EDID |
| 5 | NC | No Connection |
| 6 | CLK EDID | EDID Clock |
| 7 | Data EDID | EDID Data |
| 8 | RxIN0- | Transmission Data of 0 Negative - |
| 9 | RxIN0+ | Transmission Data of 0 Positive + |
| 10 | GND | Ground |
| 11 | RxIN1- | Transmission Data of 1 Negative - |
| 12 | RxIN1+ | Transmission Data of 1 Positive + |
| 13 | GND | Ground |
| 14 | RxIN2- | Transmission Data of 2 Negative - |
| 15 | RxIN2+ | Transmission Data of 2 Positive + |
| 16 | GND | Ground |
| 17 | RxCLKIN- | Sampling Clock of Negative - |
| 18 | RxCLKIN+ | Sampling Clock of Positive + |
| 19 | NC | No Connection |
| 20 | NC | No Connection |
| 21 | NC | No Connection |
| 22 | GND | Ground |
| 23 | NC | No Connection |
| 24 | NC | No Connection |
| 25 | GND | Ground |
| 26 | (CE) | No Connection |
| 27 | (CTL) | No Connection |
| 28 | GND | Ground |
| 29 | NC | No Connection |
| 30 | NC | No Connection |

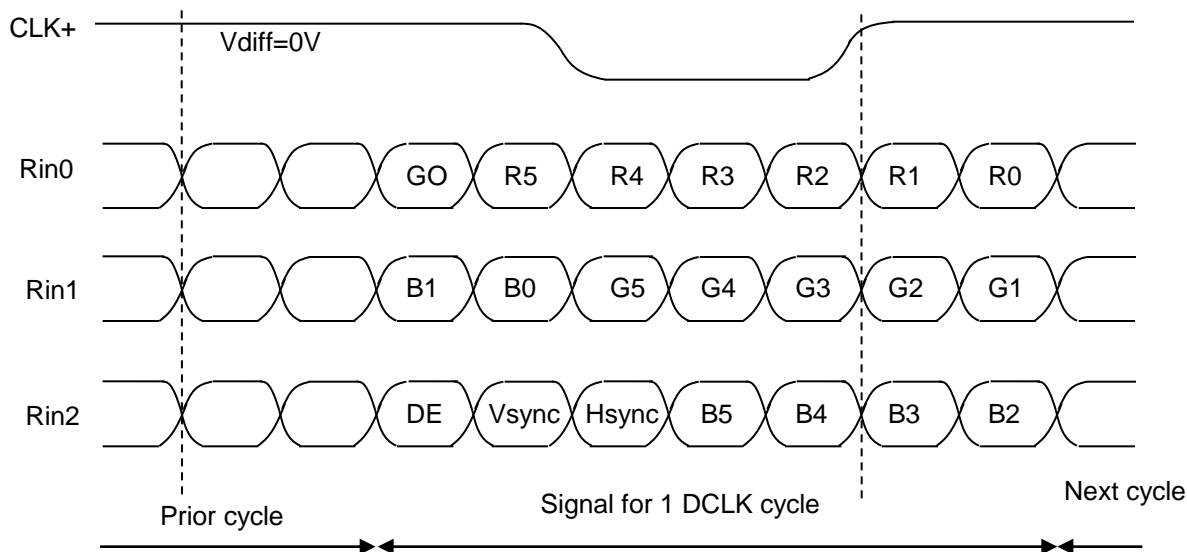
| Terminal | Symbol | Functions |
|----------|----------|-------------------------------------|
| Pin No. | Symbol | Description |
| 31 | VLED_GND | LED Ground |
| 32 | VLED_GND | LED Ground |
| 33 | VLED_GND | LED Ground |
| 34 | NC | No Connection |
| 35 | PWM | System PWM Signal Input |
| 36 | LED_EN | LED enable pin(+3.3V Input) |
| 37 | CABC | CABC enable pin (0:Bypass;1 Enable) |
| 38 | VLED | LED Power Supply 6V-21V |
| 39 | VLED | LED Power Supply 6V-21V |
| 40 | VLED | LED Power Supply 6V-21V |

5.2 LVDS Interface



Note. Transmitter : Thine THC63LVDM63A or equivalent.
Transmitter is not contained in Module.

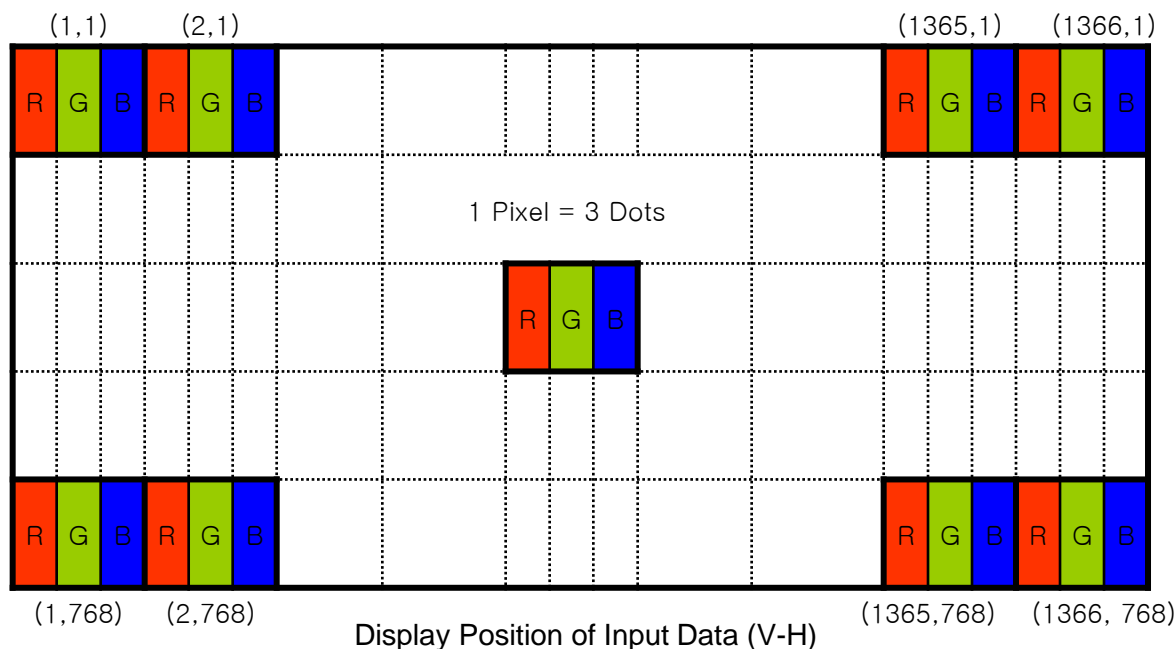
5.3.1LVDS Input signal



Note. Pin connection in case of using Thine THC63LVDM63A

5.3.2 Data Input Format

<Table 6. Pin Assignments for the BLU & LCM Connector>



5.4 Back-light & LCM Interface Connection

Interface Connector: CRT 098-10W10AO or Equivalent

<Table 7. Pin Assignments for the BLU & LCM Connector>

| Pin No. | Symbol | Description | Pin No. | Symbol | Description |
|---------|--------|------------------------|---------|--------|----------------------|
| 1 | LED1 | LED cathode connection | 6 | NC | No Connection |
| 2 | LED2 | LED cathode connection | 7 | NC | No Connection |
| 3 | LED3 | LED cathode connection | 8 | Vout | LED anode connection |
| 4 | LED4 | LED cathode connection | 9 | Vout | LED anode connection |
| 5 | NC | No Connection | 10 | Vout | LED anode connection |

6.0 SIGNAL TIMING SPECIFICATION

6.1 The NT156WHM-N10 is operated by the DE only.

| Item | | Symbols | Min | Typ | Max | Unit |
|---------------------------|-----------|---------|------|------|------|--------|
| Clock | Frequency | 1/Tc | 67.5 | 72.3 | 76.3 | MHz |
| | High Time | Tch | - | 4/7 | - | Tc |
| | Low Time | Tcl | - | 3/7 | - | Tc |
| Frame Period | | Tv | 778 | 790 | 802 | lines |
| | | | - | 60 | - | Hz |
| | | | - | 16.7 | - | ms |
| Vertical Display Period | | Tvd | 768 | 768 | 768 | lines |
| One line Scanning Period | | Th | 1446 | 1526 | 1586 | clocks |
| Horizontal Display Period | | Thd | 1366 | 1366 | 1366 | clocks |

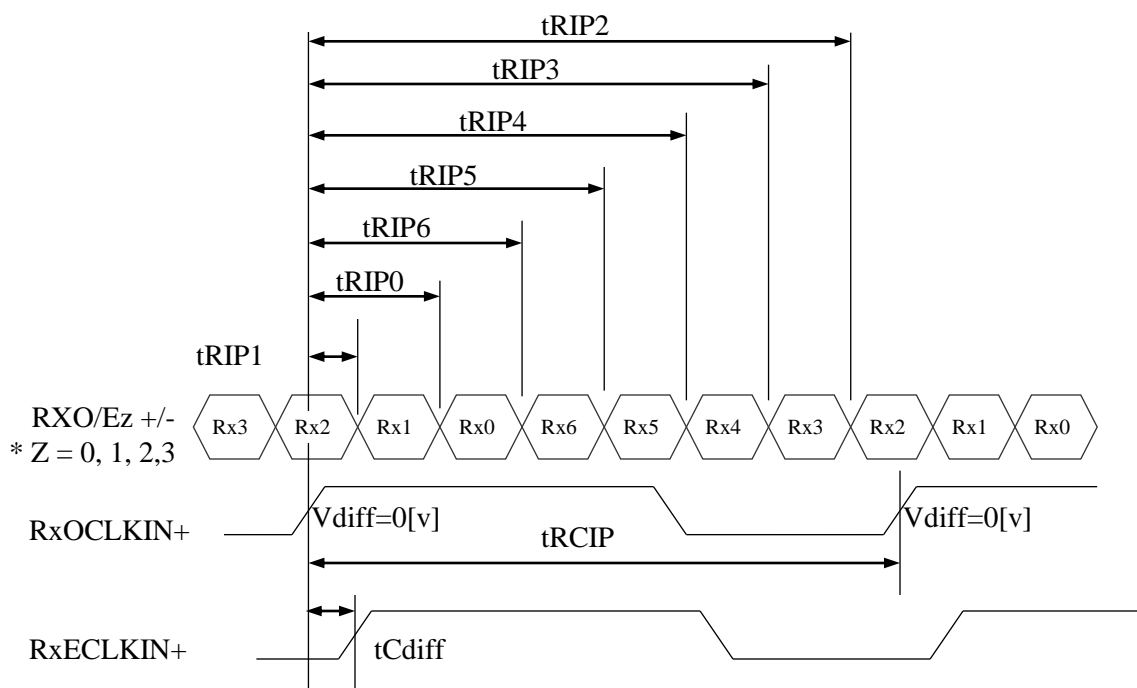
Note※: This Module can support low frame refresh rate 50Hz & 40Hz.

6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 8.

<Table 8. LVDS Rx Interface Timing Specification>

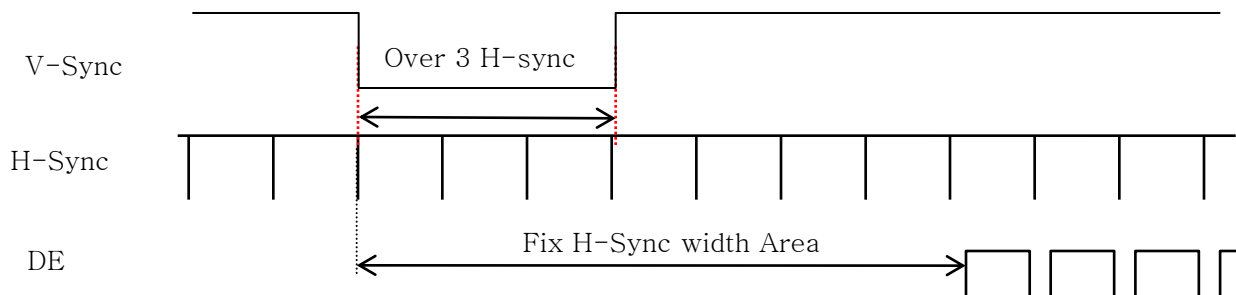
| Item | Symbol | Min | Typ | Max | Unit | Remark |
|----------------|--------|---------------------------------|---------------------------|---------------------------------|------|--------|
| CLKIN Period | tRCIP | - | 13.83 | 25 | nsec | |
| CLK Difference | tCdiff | -tRCIP*(3/7) | 0 | +tRCIP*(3/7) | 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 | $2 \times \text{tRCIP}/7 - 0.4$ | $2 \times \text{tRCIP}/7$ | $2 \times \text{tRCIP}/7 + 0.4$ | nsec | |
| Input Data 3 | tRIP5 | $3 \times \text{tRCIP}/7 - 0.4$ | $3 \times \text{tRCIP}/7$ | $3 \times \text{tRCIP}/7 + 0.4$ | nsec | |
| Input Data 4 | tRIP4 | $4 \times \text{tRCIP}/7 - 0.4$ | $4 \times \text{tRCIP}/7$ | $4 \times \text{tRCIP}/7 + 0.4$ | nsec | |
| Input Data 5 | tRIP3 | $5 \times \text{tRCIP}/7 - 0.4$ | $5 \times \text{tRCIP}/7$ | $5 \times \text{tRCIP}/7 + 0.4$ | nsec | |
| Input Data 6 | tRIP2 | $6 \times \text{tRCIP}/7 - 0.4$ | $6 \times \text{tRCIP}/7$ | $6 \times \text{tRCIP}/7 + 0.4$ | nsec | |



* Vdiff = (RXO/Ez+)-(RXO/Ez-),....,(RXO/ECLK+)-(RXO/ECLK-)

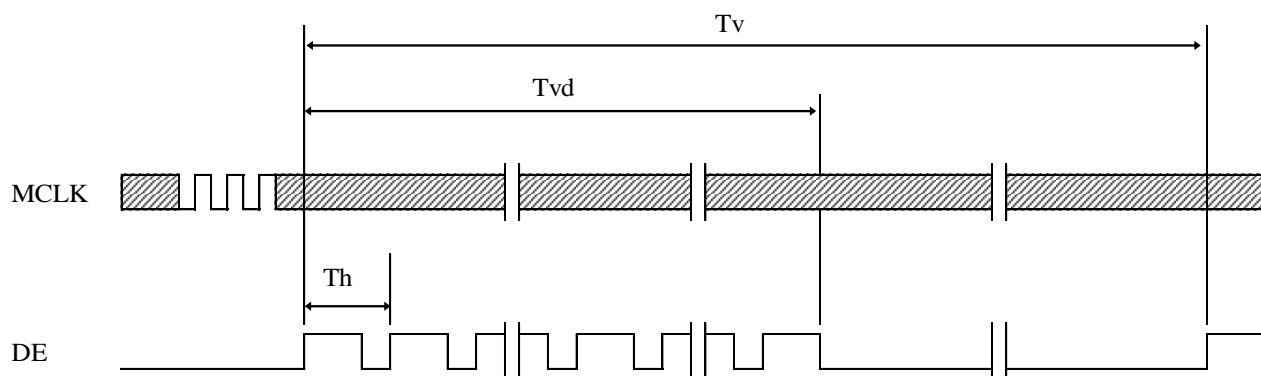
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms

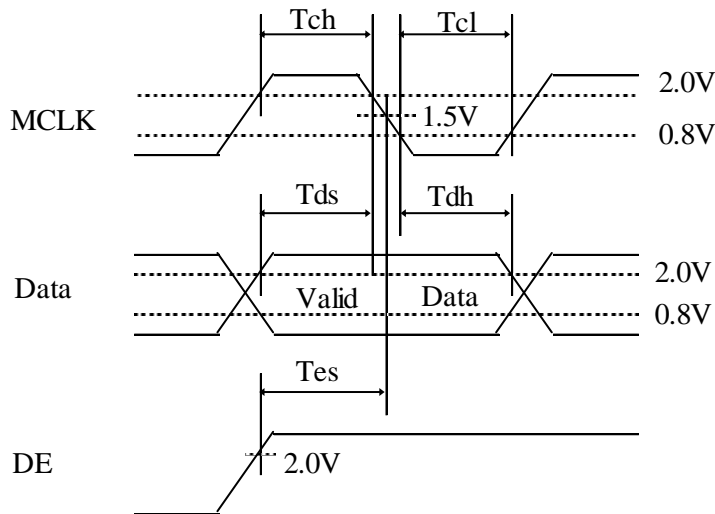
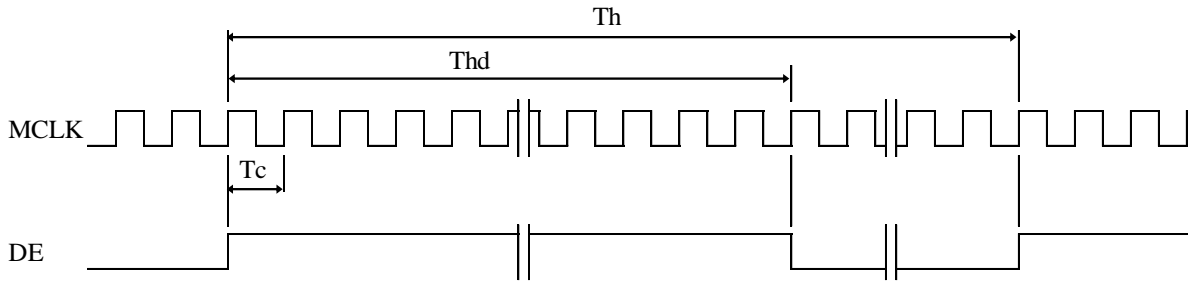


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



7.3 Horizontal Timing Waveforms

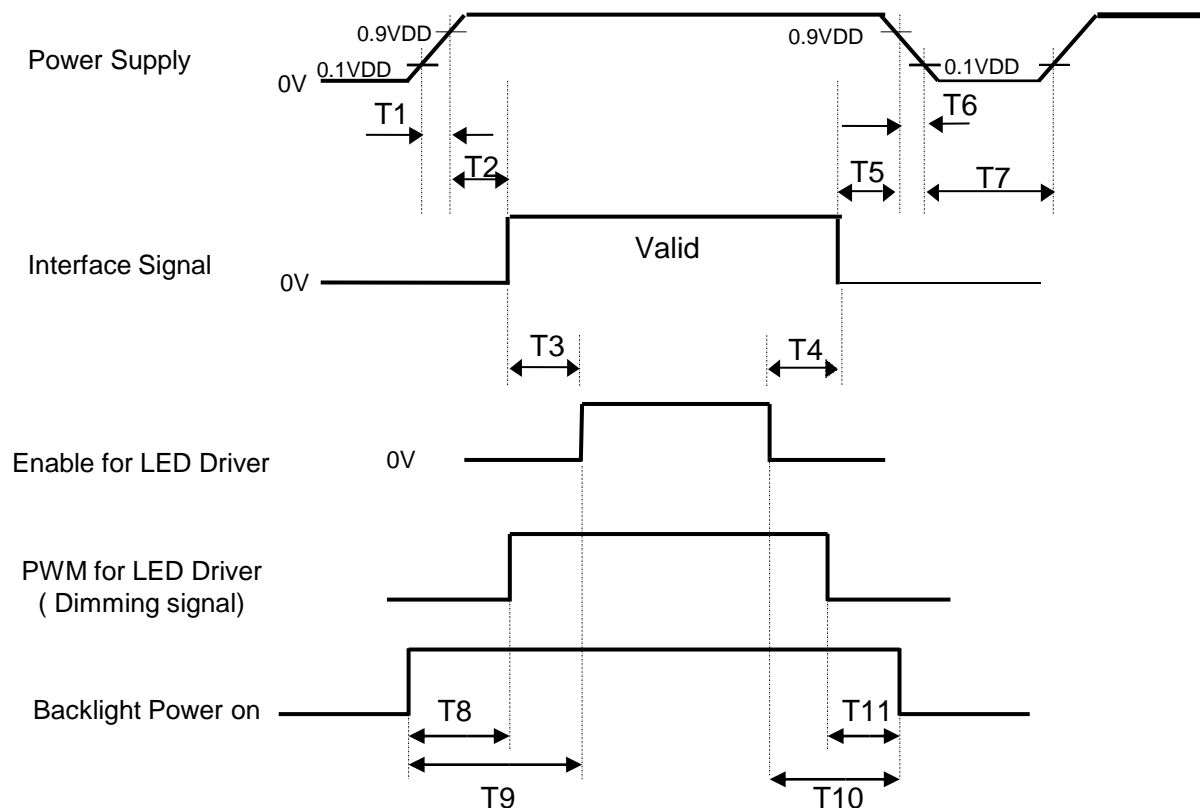


8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

| | Colors & Gray scale | Data signal | | | | | | | | | | | | | | | | | |
|-----------------------------|------------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | | R0 | R1 | R2 | R3 | R4 | R5 | G0 | G1 | G2 | G3 | G4 | G5 | B0 | B1 | B2 | B3 | B4 | B5 |
| Basic colors | Black | 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 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Light Blue | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Purple | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| Gray scale of Red | Black | 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 | 0 |
| | Darker | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | ↑ | | | | | | ↑ | | | | | | ↑ | | | | | |
| | ▽ | ↓ | | | | | | ↓ | | | | | | ↓ | | | | | |
| | Brighter | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ▽ | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | ↑ | | | | | | ↑ | | | | | | ↑ | | | | | |
| | ▽ | ↓ | | | | | | ↓ | | | | | | ↓ | | | | | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ▽ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | 1 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | △ | ↑ | | | | | | ↓ | | | | | | ↑ | | | | | |
| | ▽ | ↓ | | | | | | ↓ | | | | | | ↓ | | | | | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| | ▽ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray scale of White & Black | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | △ | ↑ | | | | | | ↑ | | | | | | ↑ | | | | | |
| | ▽ | ↓ | | | | | | ↓ | | | | | | ↓ | | | | | |
| | Brighter | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| | ▽ | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| | White | 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



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

- $0\text{ms} \leq T6 \leq 10\text{ms}$
- $150\text{ms} \leq T7$
- $0\text{ms} \leq T8$
- $0\text{ms} \leq T9$
- $0\text{ms} \leq T10$
- $0\text{ms} \leq T11$

Notes:

- When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
- Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

10.0 Connector Description

Physical interface is described as for the connector on LCM.

These connectors are capable of accommodating the following signals and will be following components.

10.1 TFT LCD Module

| Connector Name /Description | For Signal Connector |
|-----------------------------|-----------------------------------|
| Manufacturer | STM or Compatible |
| Type/ Part Number | MSAK24025P40G or Compatible |
| Mating housing/ Part Number | I-PEX 20455-040T-11 or Compatible |



11.0 MECHANICAL CHARACTERISTICS

11.1 Dimensional Requirements

FIGURE 6 shows mechanical outlines for the model NT156WHM-N10.
Other parameters are shown in Table 9.

<Table 9. Dimensional Parameters>

| Parameter | Specification | Unit |
|---------------------|--|------|
| Active Area | 344.23 (H) × 193.54(V) | |
| Number of pixels | 1366 (H) X 768 (V) (1 pixel = R + G + B dots) | |
| Pixel pitch | 0.252 (H) X 0.252 (V) | |
| Pixel arrangement | RGB Vertical stripe | |
| Display colors | 262K | |
| Display mode | Normally white | |
| Dimensional outline | 359.5(H)*223.8(V) (W/PCB)*3.8(Max) 359.5(H)*206.5(V)*3.8(Max) | mm |
| Weight | 400(Max) | gram |
| Back Light | Connector :CRT F10401-1092 | |
| | LED, Horizontal-LED Array type | |

11.2 Mounting

See FIGURE 6.

11.3 Glare and Polarizer Hardness.

The surface of the LCD has an glare coating to maximize readability and hard coating to reduce scratching.

11.4 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.



12.0 RELIABILITY TEST

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

<Table 10. Reliability test>

| 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, 240 hrs |
| 4 | High temperature operation test | Ta = 50 °C , 240 hrs |
| 5 | Low temperature operation test | Ta = 0 °C , 240 hrs |
| 6 | Thermal shock | Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle |
| 7 | Vibration test (non-operating) | 1.5G, 10~500Hz, Half Sine X,Y,Z / Sweep rate : 1 hour |
| 8 | Shock test (non-operating) | 220G, Half Sine Wave 2msec ± X, ± Y, ± Z Once for each direction |
| 9 | Electro-static discharge test (non-operating) | Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV |

13.0 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

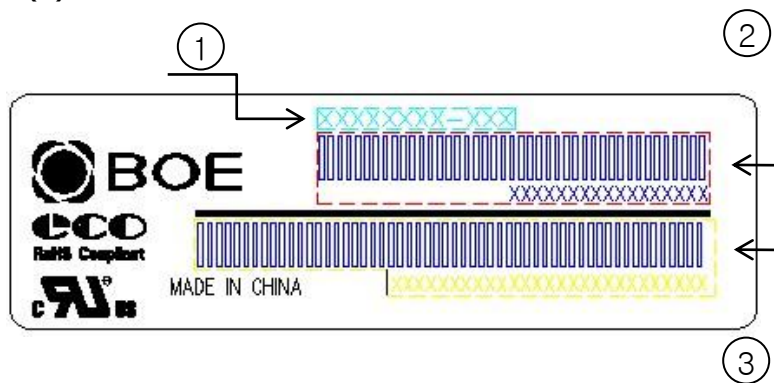
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(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.

14.0 LABEL

(1) Product label



序列号标注部分需打印, 说明如下:


1. **FG-CODE**(前12位)
2. **MDL ID** 及其条形码
3. **PPID** 及其条形码

Total Size:80×25mm

| Digit Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---------------|-----------------|---|-------|------|------|---|-------|--|---|----|----|------------------------|----|----|----|----|----|
| Code | S | L | S | 5 | 1 | 2 | 3 | 5 | 9 | 4 | 2 | 0 | 0 | 0 | 1 | D | B |
| Description | Model Code /GBN | | Grade | Line | Year | | Month | Model Extension Code (Last 4 Digits Of FG COD) | | | | Serial No 00001-ZZZZZZ | | | | | |

| | | | |
|--|---|-----|------------------|
|  京东方 BOE | PRODUCT GROUP | REV | ISSUE DATE |
| | TFT- LCD PRODUCT | P0 | 2014.05.14 |
| SPEC. NUMBER | SPEC. TITLE NT156WHM-N10 Preliminary Product Specification | | PAGE 29 OF 29 |

(2) High voltage caution label

| | | |
|---|--|---|
|  | HIGH VOLTAGE CAUTION | COLD CATHODE FLUORESCENT LAMP IN LCD PANEL CONTAINS A SMALL AMOUNT OF MERCURY. PLEASE FOLLOW LOCAL OR- DINANCES OR REGULATIONS FOR DISPOSAL. |
| | RISK OF ELECTRIC SHOCK. DISCONNECT THE ELECTRIC POWER BEFORE SERVICING | |

(3) Box label


**HEFEI XINSHENG OPTOELECTRONICS
TECHNOLOGY Co., LTD**

MODEL: XXXXXXXX-XX ①
QTY: XX ②

SERIAL NO: XXXXXXXXXXXXXX ③
DATE: XXXX/XX/XX ④

Box ID 条形码



XXXX-XXXXXX ⑤
XXXX ⑥
XXXXX ⑦

序列号标注部分需打印, 说明如下:

1. **FG-CODE**(前12位)
2. 产品数量
3. **Box ID**
4. 包装日期
5. 客户端段物料号(客户端)---暂不打印,预留空间
6. FG-Code后四位
7. 供应商代码 ---暂不打印

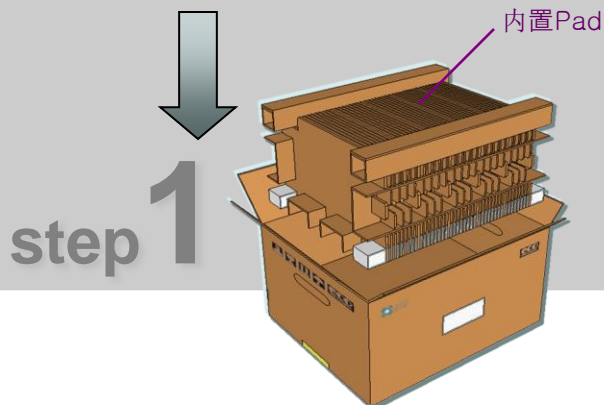
Total Size:110×55mm

| Digit | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-------------|--------------|---|-------|------|------|---|-------|---------------|----------|----|----|----|----|
| Code | S | L | S | 5 | 1 | 2 | 3 | D | 0 | 0 | 0 | 6 | 8 |
| Description | Products GBN | | Grade | Line | Year | | Month | Revision Code | SerialNo | | | | |

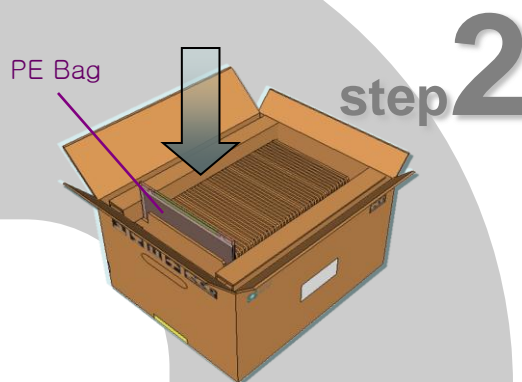
15.0 PACKING INFORMATION

15.1 Packing order

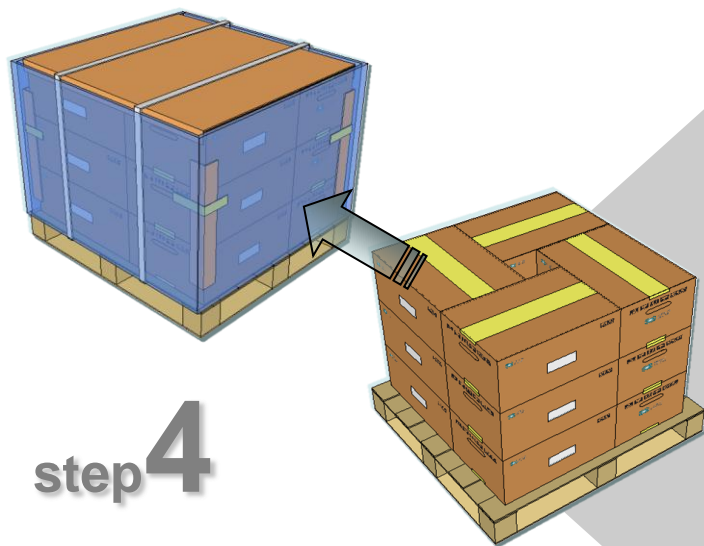
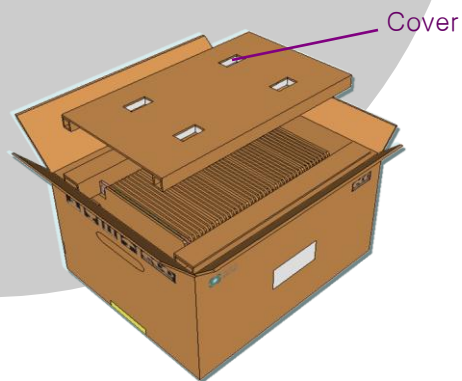
- Put Pad into the inner box



- Put module into the paper spacer and modules bundled by PE Bag



- Put Cover on the top of the pad



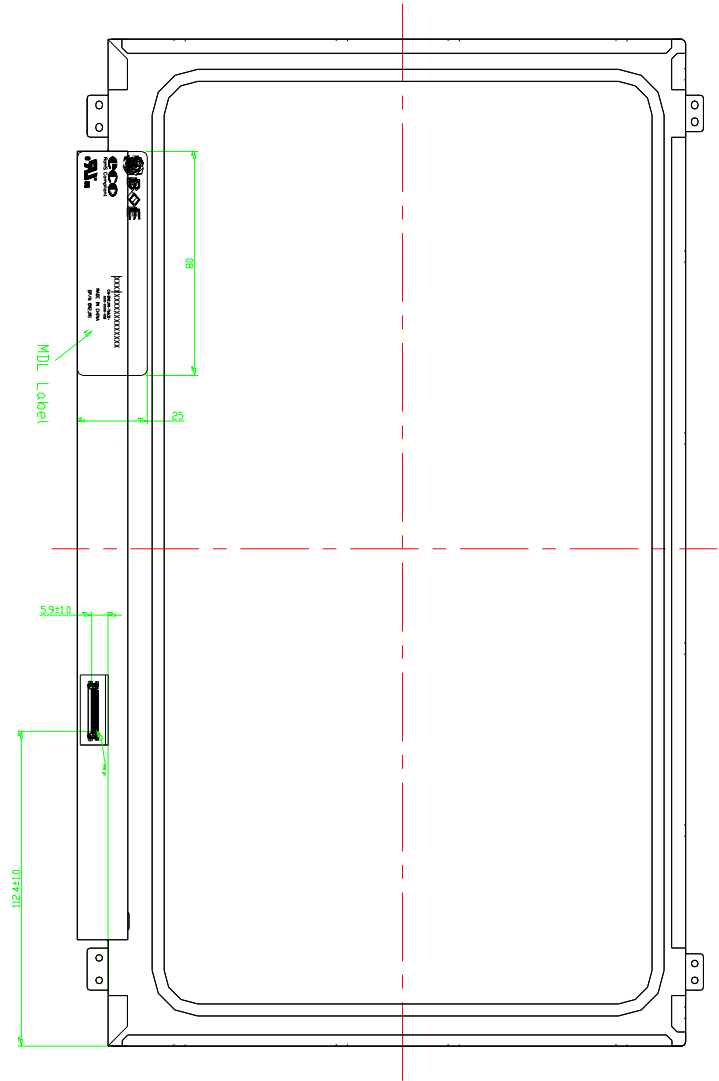
- 12ea Box/Pallet, 456ea MDL/Pallet

15.2 Notes

- Box Dimension:
- Package Quantity in one Box: pcs
- Total Weight: kg

| | | | |
|--------------|---|-----|------------------|
| | PRODUCT GROUP | REV | ISSUE DATE |
| | TFT- LCD PRODUCT | P0 | 2014.05.14 |
| SPEC. NUMBER | SPEC. TITLE NT156WHM-N10 Preliminary Product Specification | | PAGE 32 OF 29 |

Figure 7. TFT-LCD Module Outline Dimensions (Rear view)





17.0 EDID Table

TBD