



## TFT LCD Approval Specification

# MODEL NO.: V201V4 - T01

Customer: \_\_\_\_\_

Approved by: \_\_\_\_\_

Note:

|                      |     |
|----------------------|-----|
| LCD TV Head Division |     |
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|-----------|------------|----------|----------|
|           | DDIII      | DDII     | DDI      |
| Approval  | Approval   | Approval | Approval |
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OPTOELECTRONICS CORP.

Issued Date: Mar. 31, 2005

Model No.: V201V4-T01

**Approval****REVISION HISTORY**

| Version | Date          | Page<br>(New) | Section | Description                              |
|---------|---------------|---------------|---------|--|
| Ver 2.1 | Mar. 31, 2005 | All           | All     | Approval Specification was first issued. |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V201V4-T01 is a 20.1" TFT Liquid Crystal Display module with 4U type-CCFL Backlight unit and 1ch-TTL interface. This module supports 640 x 480 VGA format and can display true 16.2M colors (6-bit+FRC/color).

### 1.2 FEATURES

- High brightness ( 450 nits)
- High contrast ratio (400:1)
- Fast response time
- High color saturation NTSC 75%
- VGA ( 640 x 480 pixels) resolution
- TTL Interface

### 1.3 APPLICATION

- TFT LCD TVs

### 1.4 GENERAL SPECIFICATIONS

| Item                   | Specification                                | Unit  | Note |
|------------------------|--|-------|------|
| Active Area            | 408 (H) x 306 (V)                            | mm    | (1)  |
| Bezel Opening Area     | 412 (H) x 310 (V)                            | mm    |      |
| Driver Element         | a-si TFT active matrix                       | -     | -    |
| Pixel Number           | 640 x R.G.B. x 480                           | pixel | -    |
| Pixel Pitch(Sub Pixel) | 0.2125 (H) x 0.6375 (V)                      | mm    | -    |
| Pixel Arrangement      | RGB vertical stripe                          | -     | -    |
| Display Colors         | 16.2M  | color | -    |
| Display Operation Mode | Transmissive mode / Normally white           | -     | -    |
| Surface Treatment      | Anti-reflective coating + Anti-glare coating | -     | -    |

### 1.5 MECHANICAL SPECIFICATIONS

| Item        | Min.          | Typ.  | Max.  | Unit | Note                           |
|-------------|---------------|-------|-------|------|--------------------------------|
| Module Size | Horizontal(H) | 465.0 | 466.0 | mm   | Module Size                    |
|             | Vertical(V)   | 329.0 | 329.3 | mm   |                                |
|             | Depth(D)      | 34.48 | 35.48 | mm   | From front frame to rear plate |
| Weight      | 2360          | 2460  | 2560  | g    | -                              |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol           | Value |      | Unit | Note     |
|-------------------------------|------------------|-------|------|------|----------|
|                               |                  | Min.  | Max. |      |          |
| Storage Temperature           | T <sub>ST</sub>  | -20   | +60  | °C   | (1)      |
| Operating Ambient Temperature | T <sub>OP</sub>  | 0     | 50   | °C   | (1), (2) |
| Shock (Non-Operating)         | S <sub>NOP</sub> | -     | 50   | G    | (3), (5) |
| Vibration (Non-Operating)     | V <sub>NOP</sub> | -     | 1.0  | G    | (4), (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40\text{ }^{\circ}\text{C}$ ).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40\text{ }^{\circ}\text{C}$ ).

(c) No condensation.

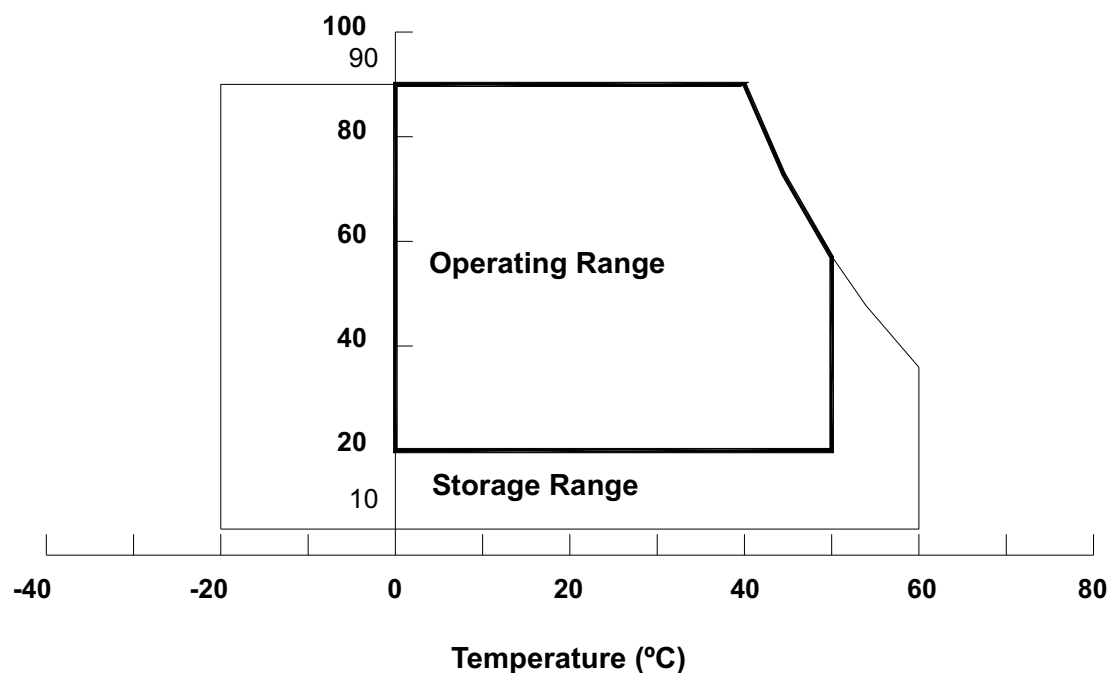
Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 60 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 60 °C. The range of operating temperature may degrade in case of improper thermal management in your product design.

Note (3) 11 ms, half sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 500 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

**Relative Humidity (%RH)**



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item                 | Symbol          | Value |      | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
|                      |                 | Min.  | Max. |      |      |
| Power Supply Voltage | V <sub>cc</sub> | -0.3  | 6.0  | V    |      |

### 2.2.2 BACKLIGHT UNIT

| Item         | Symbol         | Value |      | Unit             | Note |
|--------------|----------------|-------|------|------------------|------|
|              |                | Min.  | Max. |                  |      |
| Lamp Voltage | V <sub>w</sub> | —     | 3000 | V <sub>RMS</sub> |      |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

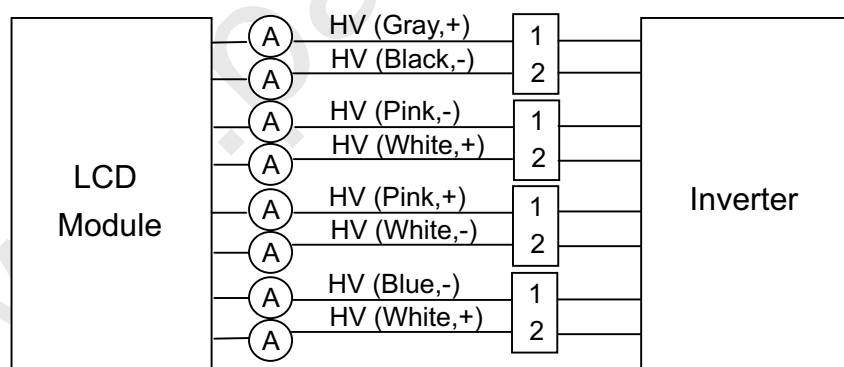
| Parameter            |                              | Symbol          | Value |      |      | Unit | Note |
|----------------------|------------------------------|-----------------|-------|------|------|------|------|
|                      |                              |                 | Min.  | Typ. | Max. |      |      |
| Power Supply Voltage |                              | VGH             | 23.5  | 24   | 24.5 | V    |      |
|                      |                              | VGL             | -6.0  | -5.6 | -5.0 | V    |      |
|                      |                              | VAA             | 9.7   | 10   | 10.3 | V    |      |
|                      |                              | V33V(3.3V)      | 3.0   | 3.3  | 3.6  | V    |      |
|                      |                              | VREF            | 9.25  | 9.3  | 9.34 | V    |      |
| Power Supply Current |                              | IGH             | -     | 3    | -    | mA   |      |
|                      |                              | IGL             | -     | 3    | -    | mA   |      |
|                      |                              | IAA             | -     | 150  | -    | mA   |      |
|                      |                              | I3.3V           | -     | 70   | -    | mA   |      |
| CMOS interface       | Input High Threshold Voltage | V <sub>IH</sub> | 2.7   | -    | 3.3  | V    |      |
|                      | Input Low Threshold Voltage  | V <sub>IL</sub> | 0     | -    | 0.7  | V    |      |

#### 3.2 BACKLIGHT UNIT

##### 3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS (Ta = 25 ± 2 °C)

| Parameter             | Symbol          | Value  |        |      | Unit              | Note                   |
|-----------------------|-----------------|--------|--------|------|-------------------|------------------------|
|                       |                 | Min.   | Typ.   | Max. |                   |                        |
| Lamp Voltage          | V <sub>W</sub>  | -      | 1490   | -    | V <sub>RMS</sub>  | I <sub>L</sub> = 5.5mA |
| Lamp Current          | I <sub>L</sub>  | 5.0    | 5.5    | 6.0  | mA <sub>RMS</sub> | (1)                    |
| Lamp Starting Voltage | V <sub>S</sub>  | -      | -      | 2250 | V <sub>RMS</sub>  | (2), Ta = 0 °C         |
|                       |                 | -      | -      | 2110 | V <sub>RMS</sub>  | (2), Ta = 25 °C        |
| Operating Frequency   | F <sub>O</sub>  | 50     | -      | 70   | KHz               | (3)                    |
| Lamp Life Time        | L <sub>BL</sub> | 50,000 | 60,000 | -    | Hrs               | (4)                    |

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:



Note (2) The lamp starting voltage V<sub>S</sub> should be applied to the lamp for more than 1 second under starting up duration. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

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Issued Date: Mar. 31, 2005

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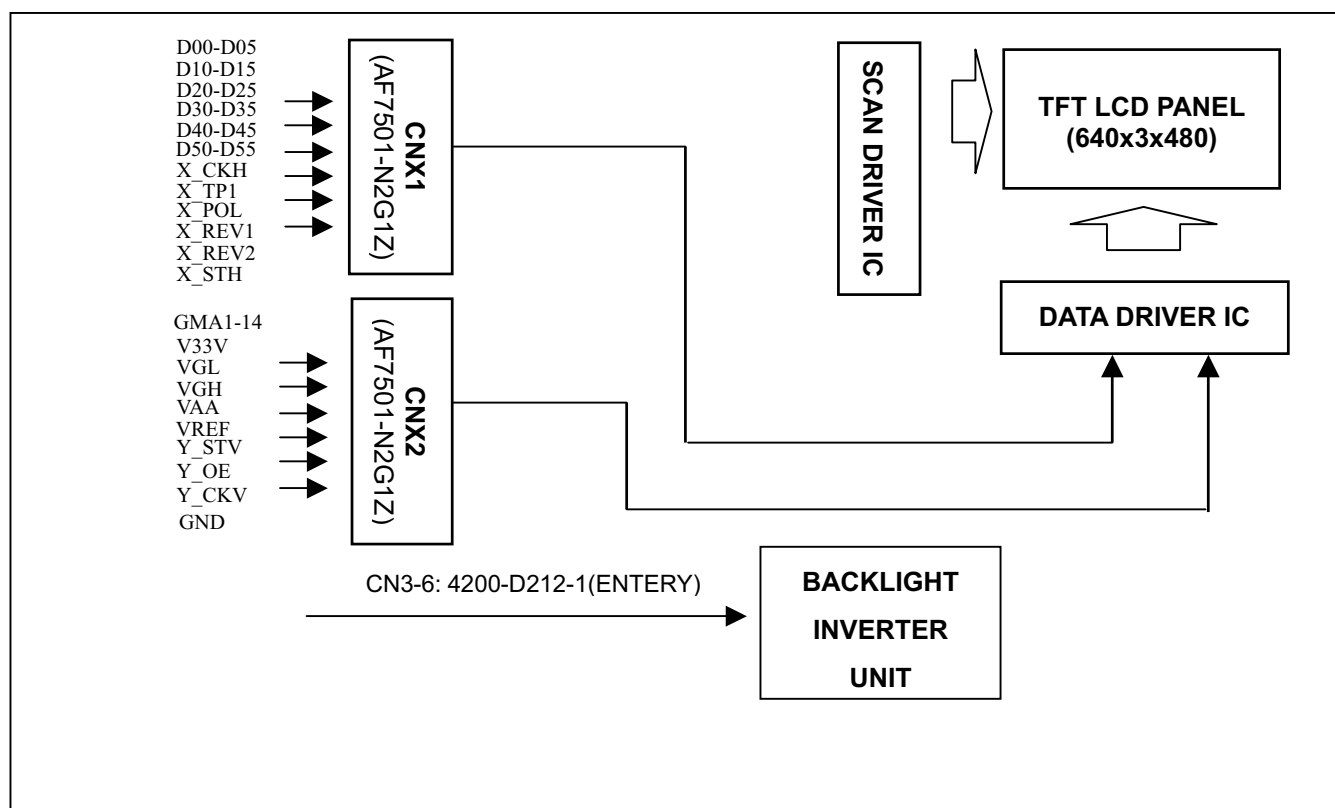
**Approval**

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point.) as the time in which it continues to operate under the condition  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_L = 5.0 \sim 6.0 \text{ mA}_{\text{RMS}}$ .



## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE





## 5. INTERFACE PIN CONNECTION

### 5.1 TFT LCD MODULE

#### CNX1 Connector Pin Assignment

| Pin No. | Name   | Description             | Pin No. | Name  | Description       |
|---------|--------|-------------------------|---------|-------|-------------------|
| 1       | VSS    | Ground                  | 26      | X_POL | polarity invert   |
| 2       | X_D00  | Even R                  | 27      | X_TP1 | Latch             |
| 3       | X_D01  |                         | 28      | X_CKH | Data driver clock |
| 4       | X_D02  |                         | 29      | VSS   | Ground            |
| 5       | X_D03  |                         | 30      | NC    | No Connection     |
| 6       | X_D04  |                         | 31      | X_D30 | Odd R             |
| 7       | X_D05  | Ground                  | 32      | X_D31 |                   |
| 8       | VSS    |                         | 33      | X_D32 |                   |
| 9       | X_D10  |                         | 34      | X_D33 |                   |
| 10      | X_D11  |                         | 35      | X_D34 |                   |
| 11      | X_D12  | Even G                  | 36      | X_D35 | Ground            |
| 12      | X_D13  |                         | 37      | VSS   |                   |
| 13      | X_D14  |                         | 38      | X_D40 |                   |
| 14      | X_D15  |                         | 39      | X_D41 |                   |
| 15      | VSS    |                         | 40      | X_D42 | Odd G             |
| 16      | X_D20  | Even B                  | 41      | X_D43 |                   |
| 17      | X_D21  |                         | 42      | X_D44 |                   |
| 18      | X_D22  |                         | 43      | X_D45 |                   |
| 19      | X_D23  |                         | 44      | VSS   | Ground            |
| 20      | X_D24  | Ground                  | 45      | X_D50 | Odd B             |
| 21      | X_D25  |                         | 46      | X_D51 |                   |
| 22      | VSS    |                         | 47      | X_D52 |                   |
| 23      | X_STHI | Data driver start pulse | 48      | X_D53 |                   |
| 24      | X_REV1 | Data reversion 1        | 49      | X_D54 |                   |
| 25      | X_REV2 | Data reversion 2        | 50      | X_D55 |                   |

**CNX2 Connector Pin Assignment**

| Pin No. | Name  | Description         | Pin No. | Name  | Description               |
|---------|-------|---------------------|---------|-------|---------------------------|
| 1       | GND   | Ground              | 26      | GND   | Ground                    |
| 2       | V33V  | Logic Power supply  | 27      | NC    | No Connection             |
| 3       | V33V  |                     | 28      | NC    | No Connection             |
| 4       | GND   | Ground              | 29      | VGH   | Driver Power supply       |
| 5       | GND   | Ground              | 30      | VGH   |                           |
| 6       | VREF  | Gamma Power supply  | 31      | GND   | Ground                    |
| 7       | VAA   | Driver Power supply | 32      | VGL   | Driver Power supply       |
| 8       | VAA   |                     | 33      | VGL   |                           |
| 9       | VAA   |                     | 34      | GND   | Ground                    |
| 10      | GND   | Ground              | 35      | GND   | Ground                    |
| 11      | GMA1  | Gamma Voltage       | 36      | NC    | No Connection             |
| 12      | GMA2  |                     | 37      | NC    | No Connection             |
| 13      | GMA3  |                     | 38      | NC    | No Connection             |
| 14      | GMA4  |                     | 39      | V33V  | Logic Power supply        |
| 15      | GMA5  |                     | 40      | V33V  |                           |
| 16      | GMA6  |                     | 41      | V33V  |                           |
| 17      | GMA7  |                     | 42      | V33V  |                           |
| 18      | GND   | Ground              | 43      | GND   | Ground                    |
| 19      | GMA8  | Gamma Voltage       | 44      | GND   | Ground                    |
| 20      | GMA9  |                     | 45      | GND   | Ground                    |
| 21      | GMA10 |                     | 46      | NC    | No Connection             |
| 22      | GMA11 |                     | 47      | NC    | No Connection             |
| 23      | GMA12 |                     | 48      | Y_CKV | Scan driver clock         |
| 24      | GMA13 |                     | 49      | Y_OE  | Scan driver output enable |
| 25      | GMA14 |                     | 50      | Y_STV | Scan driver start pulse   |

Note (1) CNX1 、 2 Connector Part No.: AF7501-N2G1Z or compatible

## 5.2 BACKLIGHT UNIT

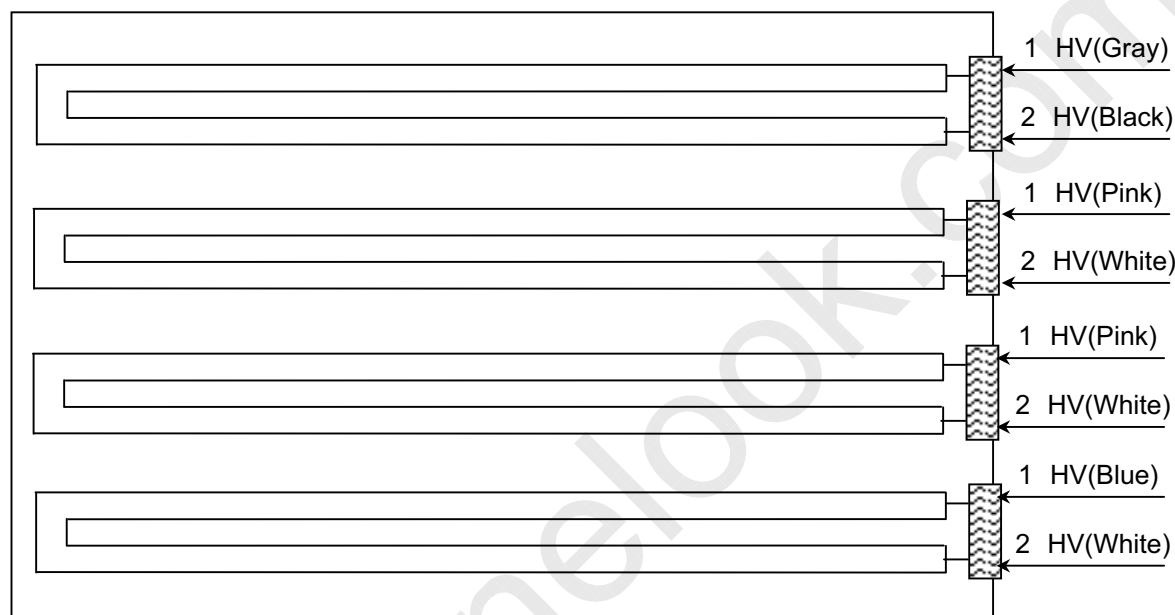
The pin configuration for the housing and leader wire is shown in the table below.

CN3-CN6(Housing): BHR-04VS-1

| Pin No | Signal name | Feature      | Wire Color            |
|--------|-------------|--------------|-----------------------|
| 1      | HV          | High Voltage | Gray / Pink / Blue    |
| 2      | HV          | High Voltage | Black / White / White |

Note (1) The backlight interface housing for high voltage side is a model BHR-04VS-1, manufactured by JST.

The mating header on inverter part number is SM02(12.0)B-BHS-1-TB.



### 5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color               |                 | Data Signal |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |
|---------------------|-----------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
|                     |                 | Red         |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    | Blue |    |    |    |    |    |    |    |
|                     |                 | 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  |
|                     | 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  |
|                     | 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  |
|                     | 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  |
|                     | 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  |
|                     | 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   | Red(0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Red(253)        | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red(254)        | 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(255)        | 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 | Green(0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Green(253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green(254)      | 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(255)      | 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  | Blue(0) / Dark  | 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(1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|                     | Blue(2)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 1  | 0  | 0  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :               | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Blue(253)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(254)       | 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(255)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 6. INTERFACE TIMING

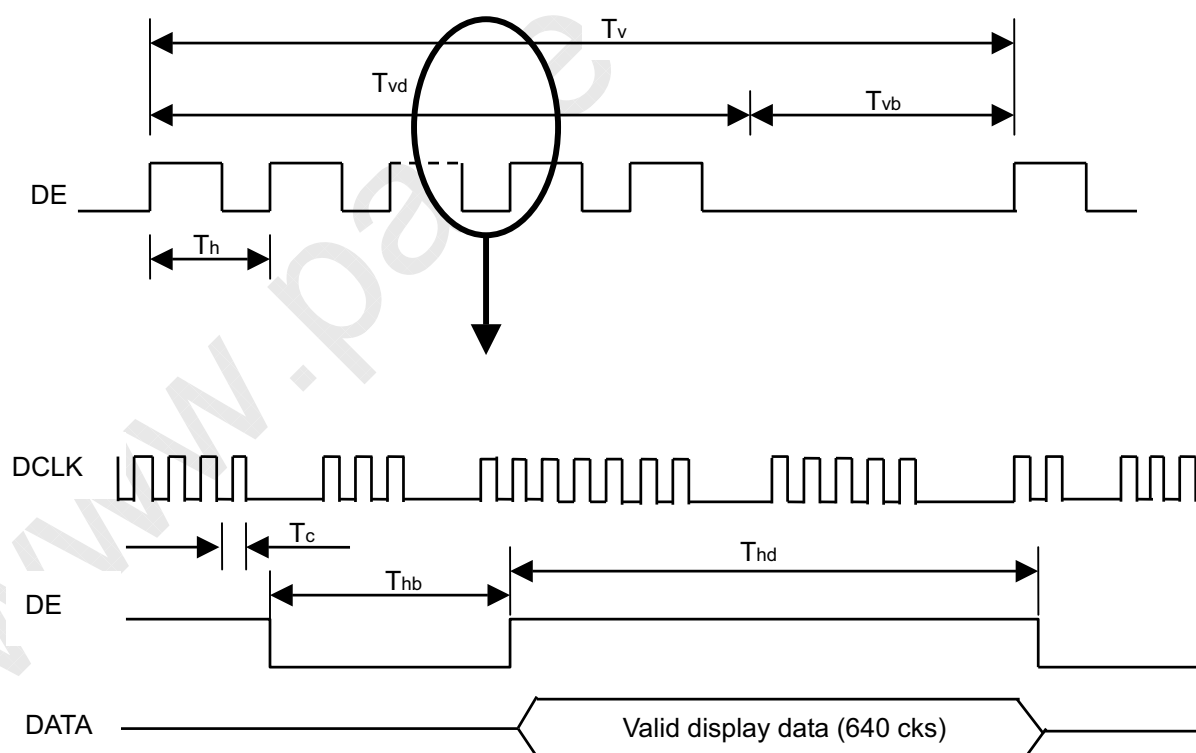
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

| Signal                         | Item       | Symbol | Min. | Typ. | Max. | Unit | Note       |
|--------------------------------|------------|--------|------|------|------|------|------------|
| Clock                          | Frequency  | 1/Tc   | 20   | 25   | 30   | MHz  |            |
| Vertical Active Display Term   | Frame Rate | Fr     | 50   | 60   | 70   | Hz   |            |
|                                | Total      | Tv     | 500  | 525  | 550  | Th   | Tv=Tvd+Tvb |
|                                | Display    | Tvd    | 480  | 480  | 480  | Th   |            |
|                                | Blank      | Tvb    | 20   | 45   | 70   | Th   |            |
| Horizontal Active Display Term | Total      | Th     | 700  | 800  | 900  | Tc   | Th=Thd+Thb |
|                                | Display    | Thd    | 640  | 640  | 640  | Tc   |            |
|                                | Blank      | Thb    | 60   | 160  | 260  | Tc   |            |

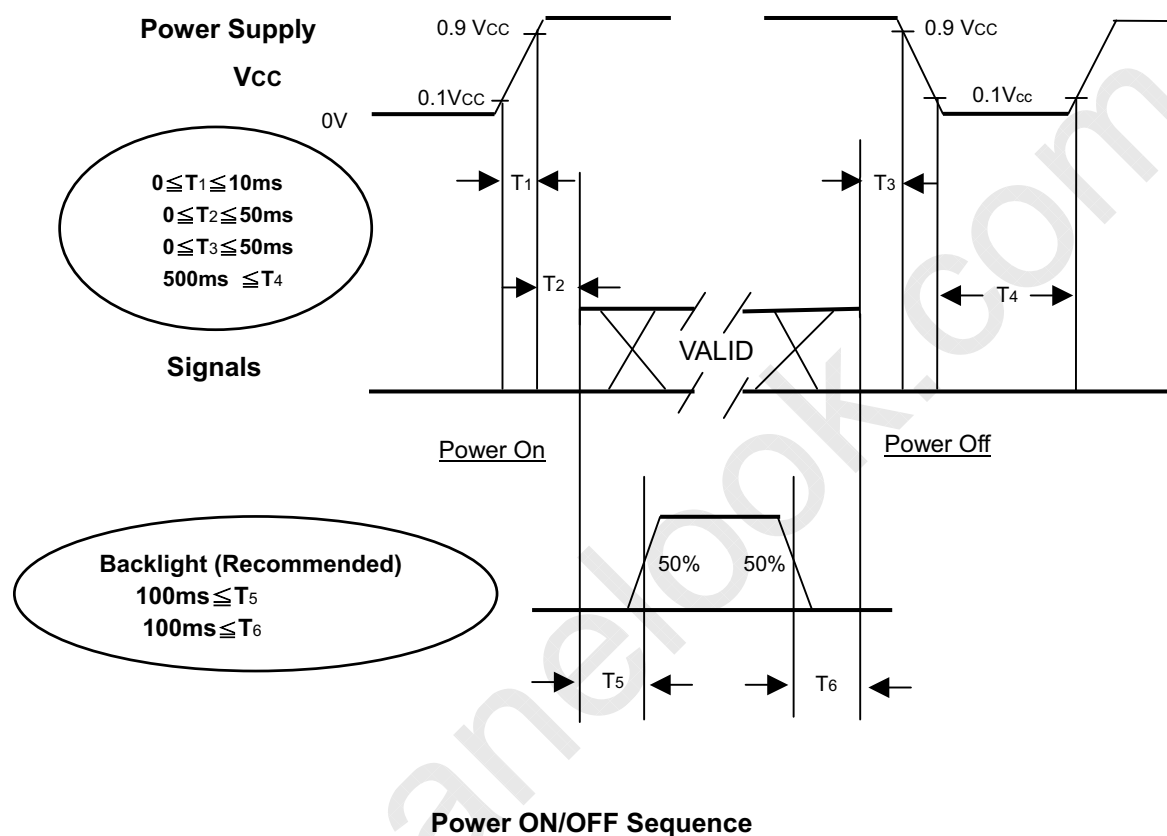
Note (1) Since this module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

### INPUT SIGNAL TIMING DIAGRAM



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                             | Symbol  | Value   | Unit |
|----------------------------------|---|---------|------|
| Ambient Temperature              | Ta  | 25±2    | °C   |
| Ambient Humidity                 | Ha  | 50±10   | %RH  |
| Input Signal                     | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |         |      |
| Lamp Current                     | I <sub>L</sub>  | 5.5±0.5 | mA   |
| Oscillating Frequency (Inverter) | F <sub>W</sub>  | 56±3    | KHz  |

### 7.2 OPTICAL SPECIFICATIONS

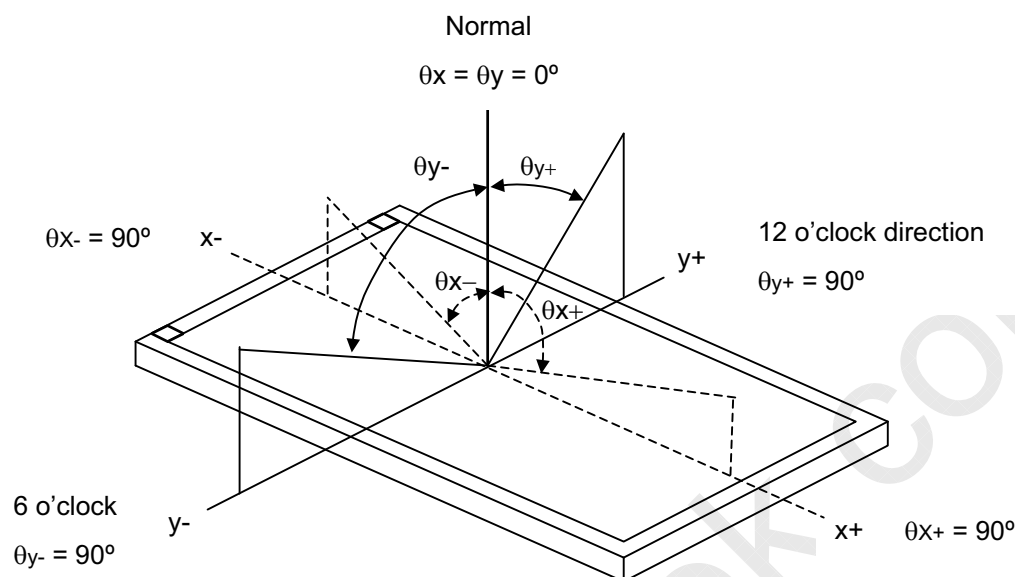
The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item                      |             | Symbol           | Condition  | Min.  | Typ.  | Max.  | Unit              | Note     |         |
|---------------------------|-------------|------------------|--|-------|-------|-------|-------------------|----------|---------|
| Contrast Ratio            |             | CR               | $\theta_x=0^\circ, \theta_Y=0^\circ$<br>Viewing Normal Angle | 300   | 400   | -     | -                 | Note(2)  |         |
| Response Time             |             | T <sub>R</sub>   |  | -     | 5     | -     | ms                | Note(3)  |         |
|                           |             | T <sub>F</sub>   |  | -     | 11    | -     | ms                |          |         |
| Center Luminance of White |             | L <sub>C</sub>   |  | 400   | 450   | -     | cd/m <sup>2</sup> | Note(4)  |         |
| White Variation           |             | δW               |  | -     | -     | 1.6   | -                 | Note(7)  |         |
| Cross Talk                |             | CT               |  | -     | -     | 4     | %                 | Note(5)) |         |
| Color Chromaticity        | Red         | R <sub>x</sub>   |  | 0.617 | 0.647 | 0.677 | -                 | Note(6)  |         |
|                           |             | R <sub>y</sub>   |  | 0.300 | 0.330 | 0.360 | -                 |          |         |
|                           | Green       | G <sub>x</sub>   |  | 0.243 | 0.273 | 0.303 | -                 |          |         |
|                           |             | G <sub>y</sub>   |  | 0.571 | 0.601 | 0.631 | -                 |          |         |
|                           | Blue        | B <sub>x</sub>   |  | 0.113 | 0.143 | 0.173 | -                 |          |         |
|                           |             | B <sub>y</sub>   |  | 0.036 | 0.066 | 0.096 | -                 |          |         |
|                           | White       | W <sub>x</sub>   |  | 0.255 | 0.285 | 0.315 | -                 |          |         |
|                           |             | W <sub>y</sub>   |  | 0.263 | 0.293 | 0.323 | -                 |          |         |
|                           | Color Gamut |                  |  |       | 70    | 75    | -                 |          | %       |
| Viewing Angle             | Horizontal  | θ <sub>x</sub> + |  | CR≥10 | 70    | 80    | -                 | Deg.     | Note(1) |
|                           |             | θ <sub>x</sub> - |  |       | 70    | 80    | -                 |          |         |
|                           | Vertical    | θ <sub>y</sub> + |  |       | 60    | 70    | -                 |          |         |
|                           |             | θ <sub>y</sub> - |  |       | 60    | 70    | -                 |          |         |



Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

Viewing angles are measured by Eldim EZ-Contrast 160R



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

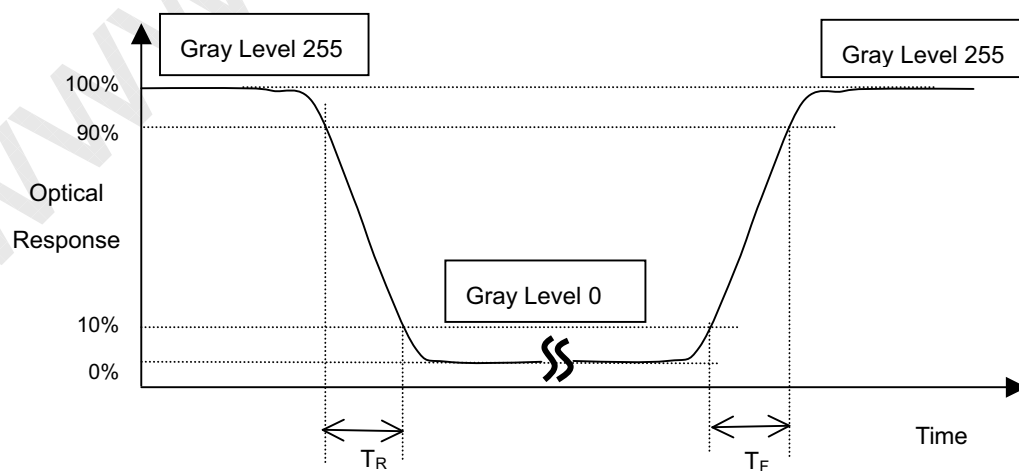
$L_{255}$ : Luminance of gray level 255

$L_0$ : Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):



Note (4) Definition of Luminance of White ( $L_C$ ,  $L_{AVE}$ ):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$  is corresponding to the luminance of the point X at the figure in Note (7).

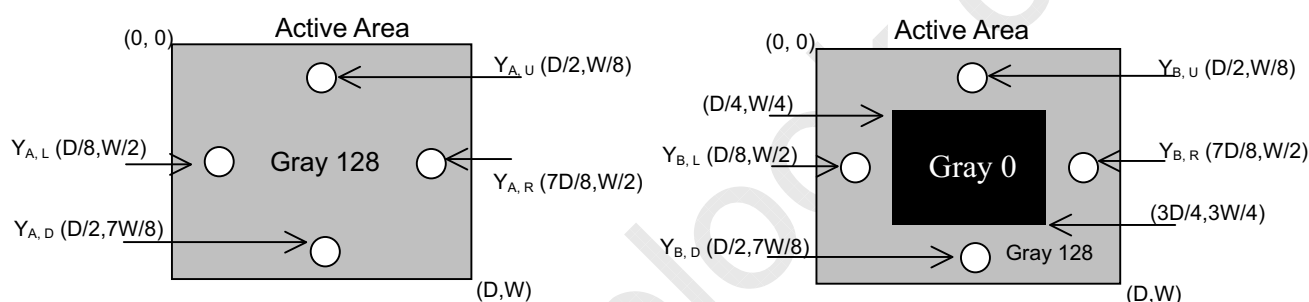
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

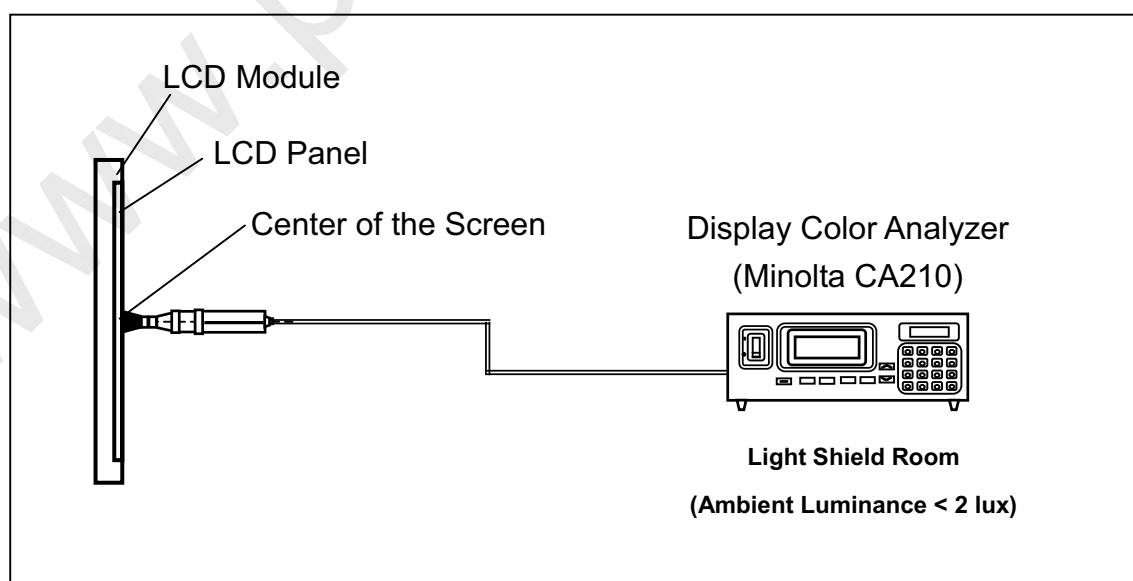
$Y_A$  = Luminance of measured location without gray level 0 pattern ( $\text{cd/m}^2$ )

$Y_B$  = Luminance of measured location with gray level 0 pattern ( $\text{cd/m}^2$ )



Note (6) Measurement Setup:

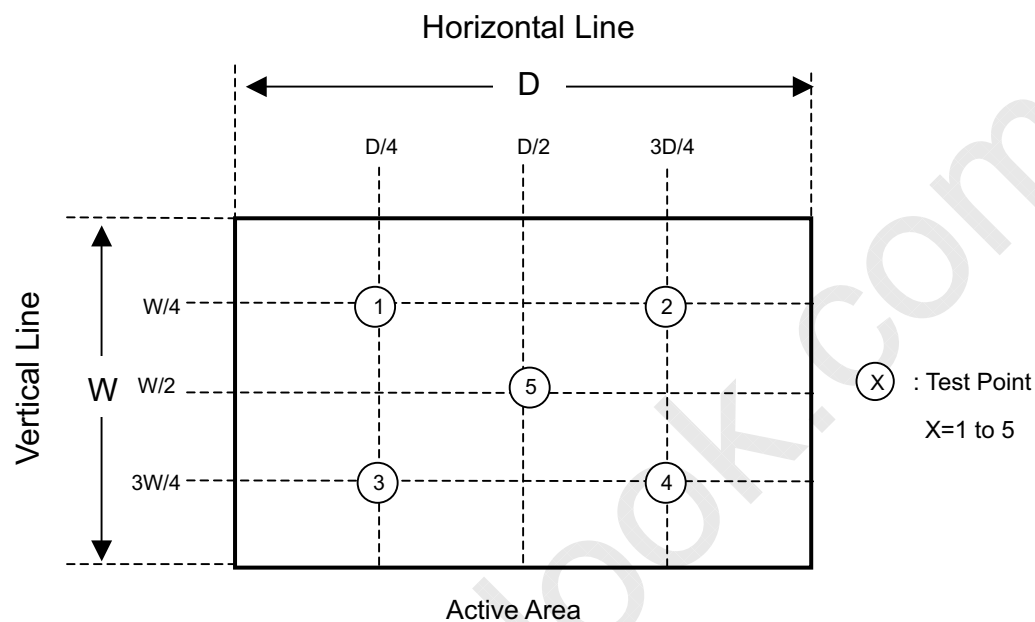
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]}$$



## 8. PRECAUTIONS

### 8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.  
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

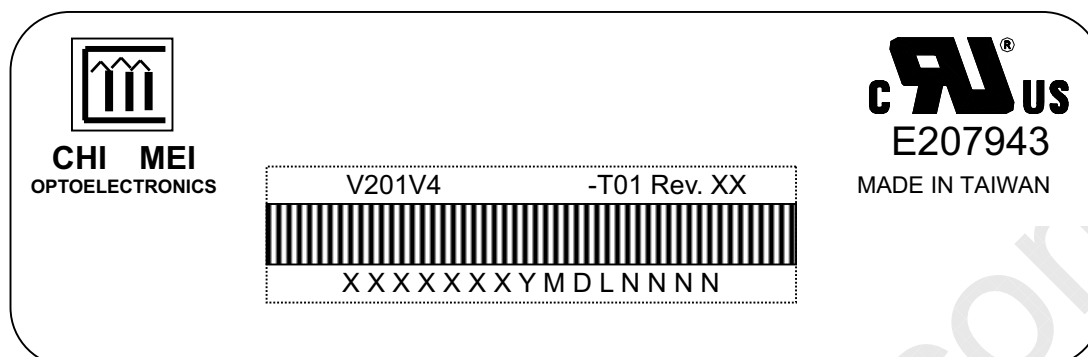
### 8.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.
- (2) 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.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

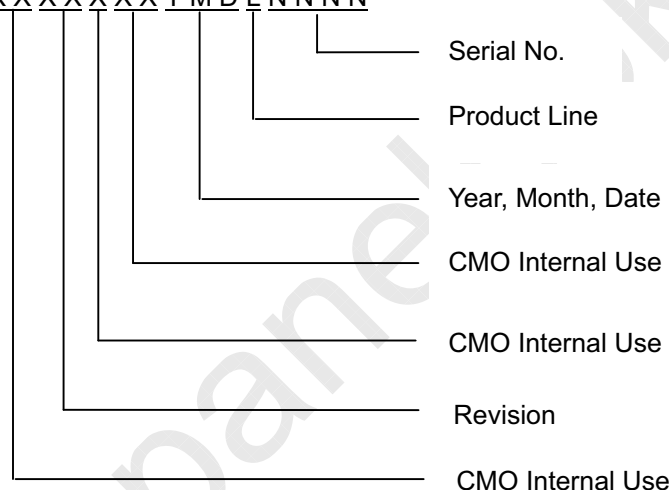
## 9. DEFINITION OF LABELS

### 9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: V201V4-T01  
 (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.  
 (c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 0~9, for 2000~2009  
 Month: 1~9, A~C, for Jan. ~ Dec.  
 Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I, O, and U.  
 (b) Revision Code: Cover all the change  
 (c) Serial No.: Manufacturing sequence of product  
 (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

## 10. PACKAGING

### 10.1 PACKING SPECIFICATIONS

- (1) 6 LCD TV modules / 1 Box
- (2) Box dimensions : 582(L) X 493 (W) X 440 (H)
- (3) Weight : approximately 17.5Kg ( 6 modules per box)

### 10.2 PACKING METHOD

Figures10-1 and 10-2 are the packing method

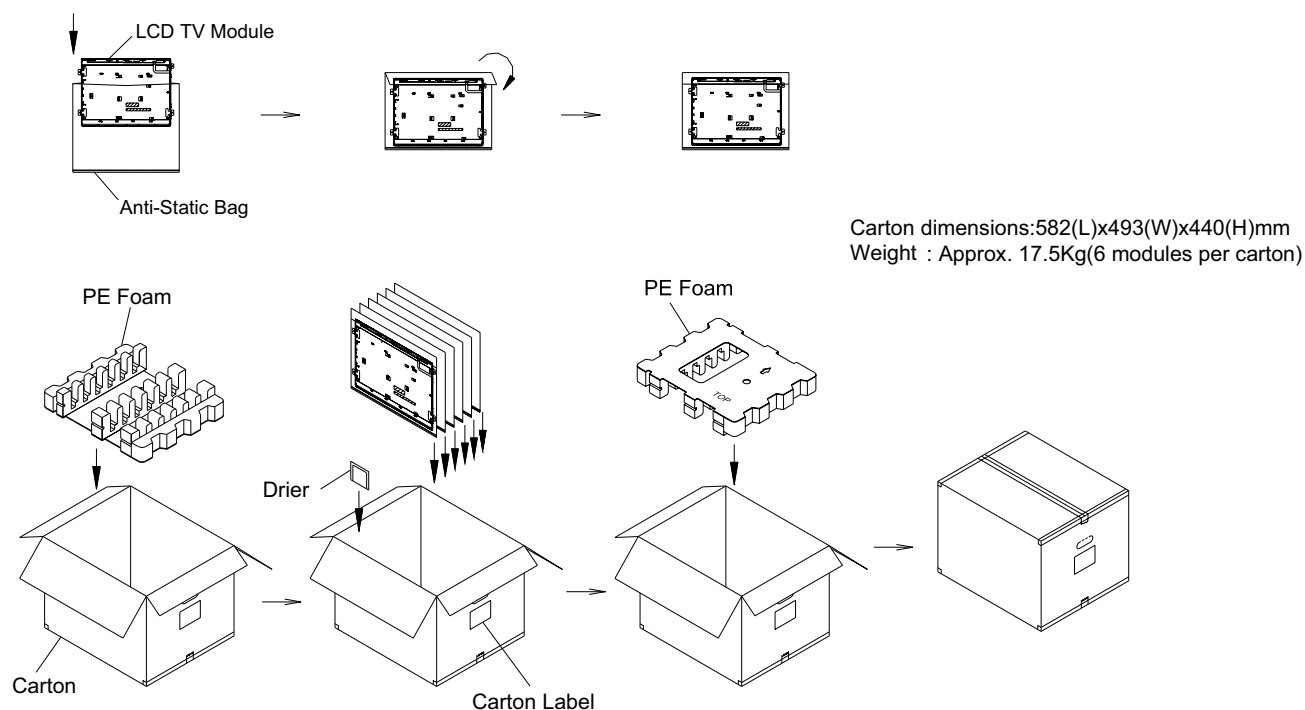


Figure.10-1 packing method

Corner Protector:L1250\*50mm\*50mm

Pallet:L1000\*W1180\*H143mm

Corrugated Fiberboard:L1000\*W1180mm

Pallet Stack:L1000\*W1180\*H1463mm

Gross:227kg

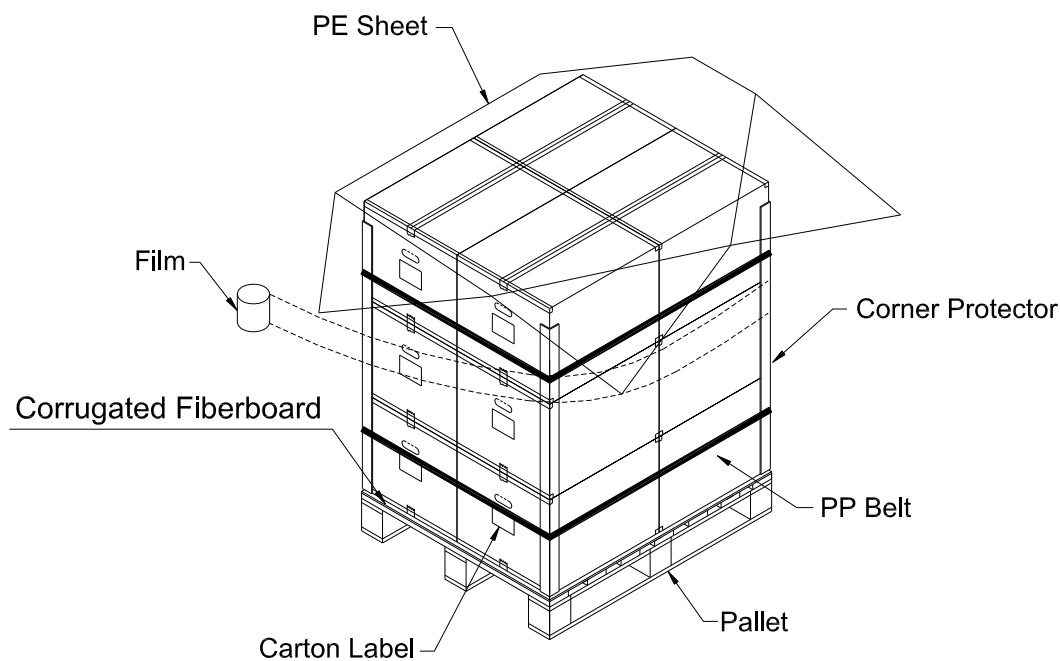


Figure.10-2 packing method





