

## TFT LCD Preliminary Specification

# MODEL NO.: N14006 - L01

Customer:

Approved by:

Note:

| 核准時間                   | 部門          | 審核                     | 角色       | 投票     |
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**REVISION HISTORY**

| Version | Date         | Page (New) | Section | Description                                       |
|---------|--------------|------------|---------|---|
| 1.0     | Nov. 27, '08 | All        | All     | Preliminary specification was first issued.       |
| 1.1     | Mar. 24, '09 | 31         | N/A     | Update Outline Drawing                            |
| 1.2     | Apr. 30, '09 | 17         | 6.2     | Update PWM Control Duty Ratio Min from 20% to 10% |

## 1 GENERAL DESCRIPTION

### 1.1 OVERVIEW

N14006 - L01 is a 14.0" TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1600 x (3 RGB) x 900 WXGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The converter module for backlight is built in.

### 1.2 FEATURES

- HD+ (1600 x 900 pixels) resolution
- LED Backlight and Converter embedded
- DE only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock
- RoHS compliance

### 1.3 APPLICATION

- TFT LCD Notebook

### 1.4 GENERAL SPECIFICATIONS

| Item               | Specification                              | Unit  | Note |
|--------------------|--|-------|------|
| Active Area        | 309.60(H) X 174.15(V) (14.0 inch Diagonal) | mm    | (1)  |
| Bezel Opening Area | 314.04 (H) x 177.45 (V)                    | mm    |      |
| Driver Element     | a-si TFT active matrix                     | -     | -    |
| Pixel Number       | 1600 x R.G.B. x 900                        | pixel | -    |
| Pixel Pitch        | 0.1935 (H) x 0.1935 (V)                    | mm    | -    |
| Pixel Arrangement  | RGB vertical stripe                        | -     | -    |
| Display Colors     | 262,144                                    | color | -    |
| Transmissive Mode  | Normally white                             | -     | -    |
| Surface Treatment  | Anti-Glare                                 | -     | -    |

### 1.5 MECHANICAL SPECIFICATIONS

| Item        | Min.          | Typ.  | Max.  | Unit  | Note |     |
|-------------|---------------|-------|-------|-------|------|-----|
| Module Size | Horizontal(H) | 323   | 323.5 | 324.0 | mm   | (1) |
|             | Vertical(V)   | 191.5 | 192   | 192.5 | mm   |     |
|             | Depth(D)      | --    | --    | 5.2   | mm   |     |
| Weight      | --            | --    | 375   | 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> | -     | 220/2 | G/ms | (3), (5) |
| Vibration (Non-Operating)     | V <sub>NOP</sub> | -     | 1.5   | G    | (4), (5) |

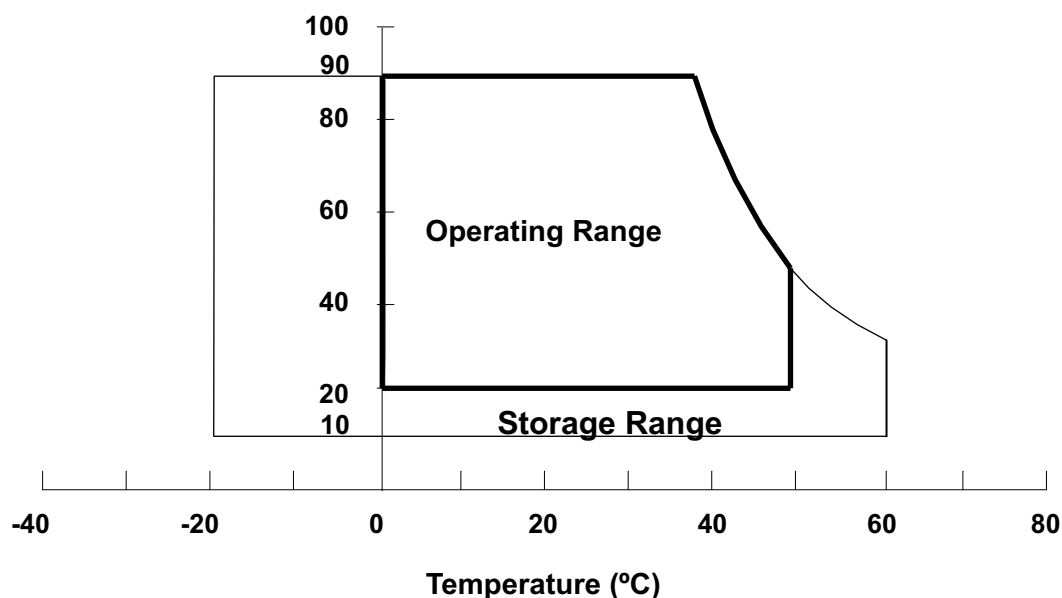
Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 °C Min. and 60 °C Max..

#### Relative Humidity (%RH)

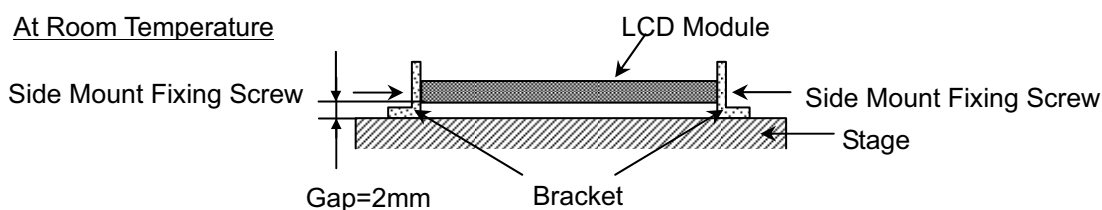


Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave..

Note (4) 10 ~ 500 Hz, 30 min / Cycle, 1 cycles for each X, Y, Z axis.

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.

The fixing condition is shown as below:



**2.2 ELECTRICAL ABSOLUTE RATINGS****2.2.1 TFT LCD MODULE**

| Item                 | Symbol   | Value |              | Unit | Note |
|----------------------|----------|-------|--------------|------|------|
|                      |          | Min.  | Max.         |      |      |
| Power Supply Voltage | $V_{CC}$ | -0.3  | +4.0         | V    | (1)  |
| Logic Input Voltage  | $V_{IN}$ | -0.3  | $V_{CC}+0.3$ | V    |      |

**2.2.2 BACKLIGHT UNIT**

| Item                               | Symbol | Value |        | Unit | Note     |
|------------------------------------|--------|-------|--------|------|----------|
|                                    |        | Min.  | Max.   |      |          |
| LED Light Bar Power Supply Voltage | $V_L$  | -45   | (31.5) | V    | (1), (2) |
| LED Light Bar Power Supply Current | $I_L$  | 0     | (125)  | mA   |          |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

### 3 ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE

 $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ 

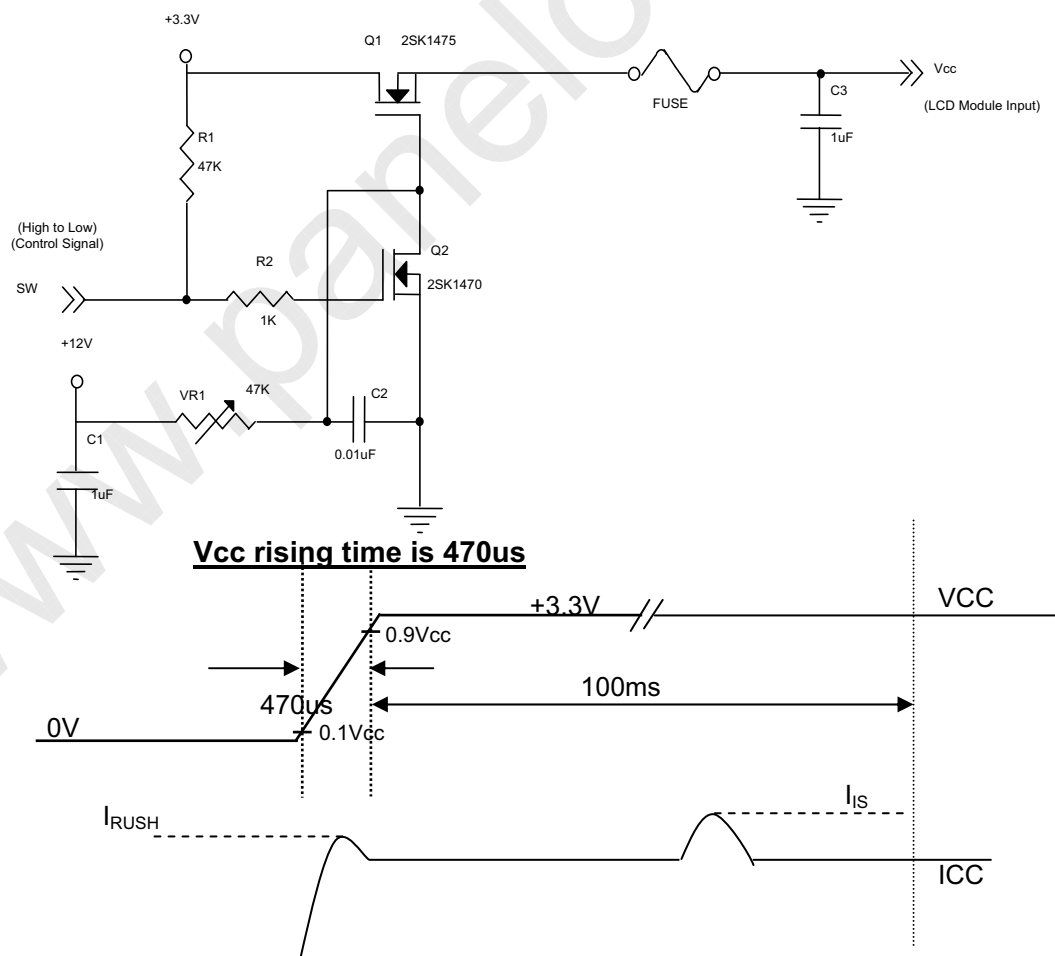
| Parameter                              | Symbol                | Value |      |       | Unit | Note                          |
|--|-----------------------|-------|------|-------|------|-------------------------------|
|  |                       | Min.  | Typ. | Max.  |      |                               |
| Power Supply Voltage                   | V <sub>CCS</sub>      | 3.0   | 3.3  | 3.6   | V    | -                             |
| Permissible Ripple Voltage             | V <sub>RP</sub>       |       | 50   |       | mV   | -                             |
| Rush Current                           | I <sub>RUSH</sub>     |       |      | 1.5   | A    | (2)                           |
| Initial Stage Current                  | I <sub>IS</sub>       |       |      | 1.0   | A    | (2)                           |
| Power Supply Current                   | White                 | (TBD) | 230  | (TBD) | mA   | (3)a                          |
|  | Black                 | (TDB) | 310  | (TBD) | mA   | (3)b                          |
| LVDS Differential Input High Threshold | V <sub>TH(LVDS)</sub> |       |      | +100  | mV   | (5),<br>V <sub>CM</sub> =1.2V |
| LVDS Differential Input Low Threshold  | V <sub>TL(LVDS)</sub> | -100  |      |       | mV   | (5)<br>V <sub>CM</sub> =1.2V  |
| LVDS Common Mode Voltage               | V <sub>CM</sub>       | 1.125 |      | 1.375 | V    | (5)                           |
| LVDS Differential Input Voltage        | V <sub>ID</sub>       | 100   |      | 600   | mV   | (5)                           |
| Terminating Resistor                   | R <sub>T</sub>        |       | 100  |       | Ohm  |                               |
| Power per EBL WG                       | P <sub>EBL</sub>      | -     | 1.82 | -     | W    | (4)                           |

Note (1) The ambient temperature is  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ .

Note (2) I<sub>RUSH</sub>: the maximum current when VCC is rising

I<sub>IS</sub>: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black



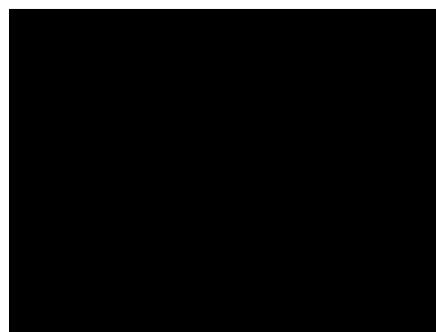
Note (3) The specified power supply current is under the conditions at  $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^\circ\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black



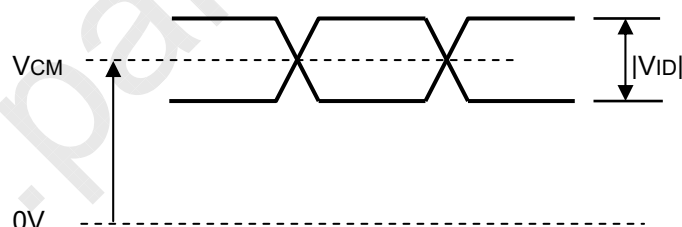
Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the converter input power. Test conditions are as follows.

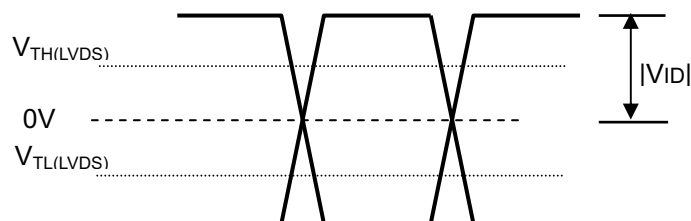
- (a)  $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^\circ\text{C}$ ,  $f_v = 60\text{ Hz}$ ,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.

Note (5) The parameters of LVDS signals are defined as the following figures.

Single Ended



Differential



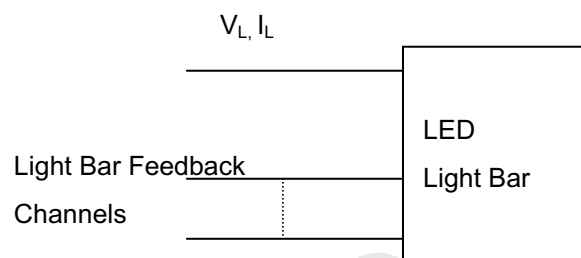


## 3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Parameter                          | Symbol          | Value  |      |        | Unit            | Note                           |
|------------------------------------|-----------------|--------|------|--------|-----------------|--------------------------------|
|                                    |                 | Min.   | Typ. | Max.   |                 |                                |
| LED light bar Power Supply Voltage | V <sub>L</sub>  | 24.3   | 28.8 | 31.5   | V <sub>dc</sub> | (1), (2)                       |
| LED light bar Power Supply Current | I <sub>L</sub>  | 95     | 100  | 105    | mA              |                                |
| LED Life Time                      | L <sub>BL</sub> | 15,000 | -    | -      | Hrs             | (4)                            |
| Power Consumption                  | P <sub>L</sub>  | 2.3085 | 2.88 | 3.3075 | W               | (3), I <sub>L</sub> = 100.0 mA |

Note (1) LED light bar configuration is shown as below:



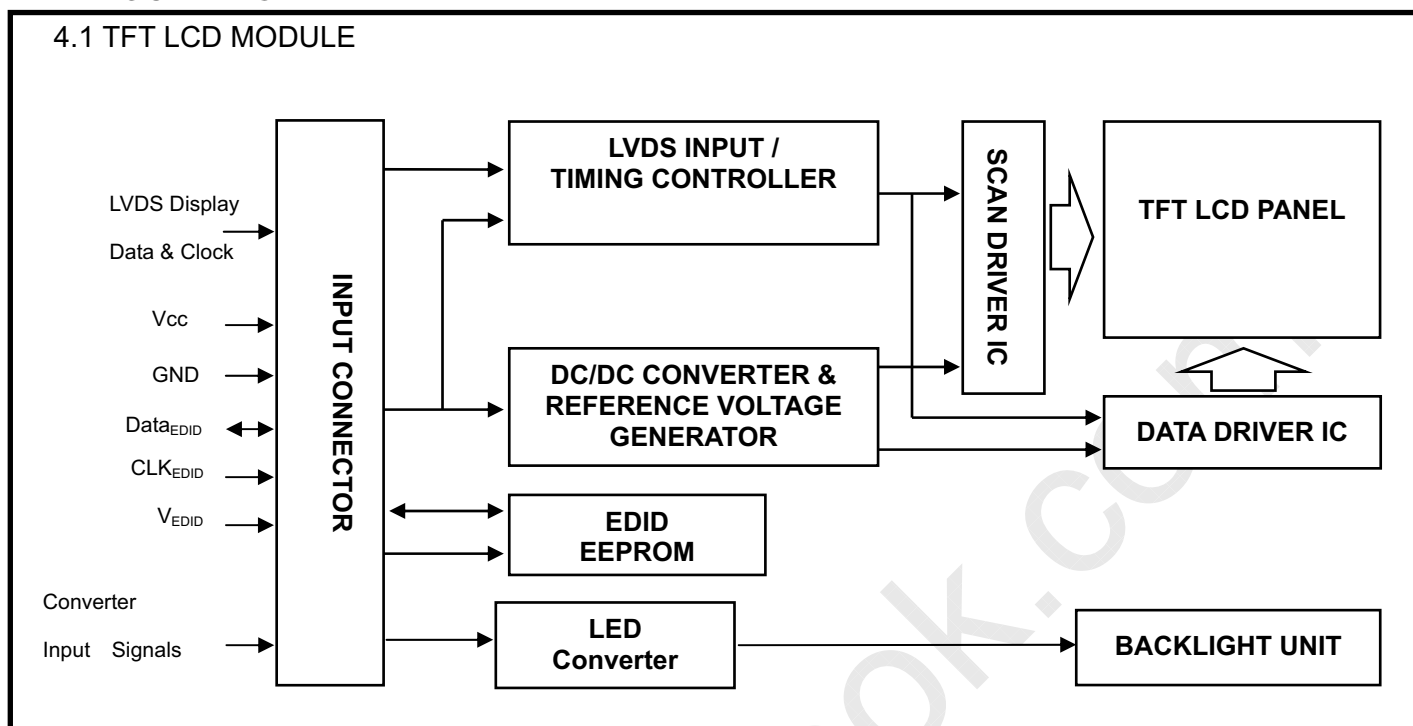
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3)  $P_L = I_L \times V_L$

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and I<sub>L</sub> = 20 mA(Per EA) until the brightness becomes ≤ 50% of its original value.

## 4 BLOCK DIAGRAM

## 4.1 TFT LCD MODULE



## 5 INPUT TERMINAL PIN ASSIGNMENT

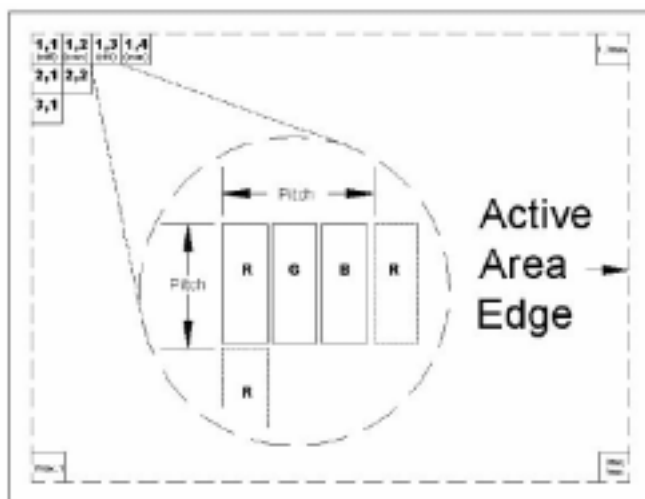
### 5.1 TFT LCD MODULE

| Pin | Symbol      | Description                            | Polarity | Remark |
|-----|-------------|--|----------|--------|
| 1   | Reserve     | Non connection                         |          |        |
| 2   | VCCS        | Power Supply +3.3 V                    |          |        |
| 3   | VCCS        | Power Supply +3.3 V                    |          |        |
| 4   | V EEDID     | DDC +3.3 V                             |          |        |
| 5   | Reserve     | Non connection                         |          |        |
| 6   | Clk EEDID   | DDC Clock                              |          |        |
| 7   | DATA EEDID  | DDC Data                               |          |        |
| 8   | Odd_Rin0-   | LVDS Differential Data Input (Odd)     | Negative |        |
| 9   | Odd_Rin0+   | LVDS Differential Data Input (Odd)     | Positive |        |
| 10  | VSS         | Ground                                 |          |        |
| 11  | Odd_Rin1-   | LVDS Differential Data Input (Odd)     | Negative |        |
| 12  | Odd_Rin1+   | LVDS Differential Data Input (Odd)     | Positive |        |
| 13  | VSS         | Ground                                 |          |        |
| 14  | Odd_Rin2-   | LVDS Differential Data Input (Odd)     | Negative |        |
| 15  | Odd_Rin2+   | LVDS Differential Data Input (Odd)     | Positive |        |
| 16  | VSS         | Ground                                 |          |        |
| 17  | Odd_ClkIN-  | LVDS Clock Data Input (Odd)            | Negative |        |
| 18  | Odd_ClkIN+  | LVDS Clock Data Input (Odd)            | Positive |        |
| 19  | VSS         | Ground                                 |          |        |
| 20  | Even_Rin0-  | LVDS Differential Data Input (Even)    | Negative |        |
| 21  | Even_Rin0+  | LVDS Differential Data Input (Even)    | Positive |        |
| 22  | VSS         | Ground                                 |          |        |
| 23  | Even_Rin1-  | LVDS Differential Data Input (Even)    | Negative |        |
| 24  | Even_Rin1+  | LVDS Differential Data Input (Even)    | Positive |        |
| 25  | VSS         | Ground                                 |          |        |
| 26  | Even_Rin2-  | LVDS Differential Data Input (Even)    | Negative |        |
| 27  | Even_Rin2+  | LVDS Differential Data Input (Even)    | Positive |        |
| 28  | VSS         | Ground                                 |          |        |
| 29  | Even_ClkIN- | LVDS Clock Data Input (Even)           | Negative |        |
| 30  | Even_ClkIN+ | LVDS Clock Data Input (Even)           | Positive |        |
| 31  | LED_GND     | LED Ground                             |          |        |
| 32  | LED_GND     | LED Ground                             |          |        |
| 33  | LED_GND     | LED Ground                             |          |        |
| 34  | Reserve     | Non connection                         |          |        |
| 35  | LED_PWM     | PWM Control Signal of LED Converter    |          |        |
| 36  | LED_EN      | Enable Control Signal of LED Converter |          |        |
| 37  | NC          | Non connection                         |          |        |
| 38  | LED_VCCS    | LED Power                              |          |        |
| 39  | LED_VCCS    | LED Power                              |          |        |
| 40  | LED_VCCS    | LED Power                              |          |        |

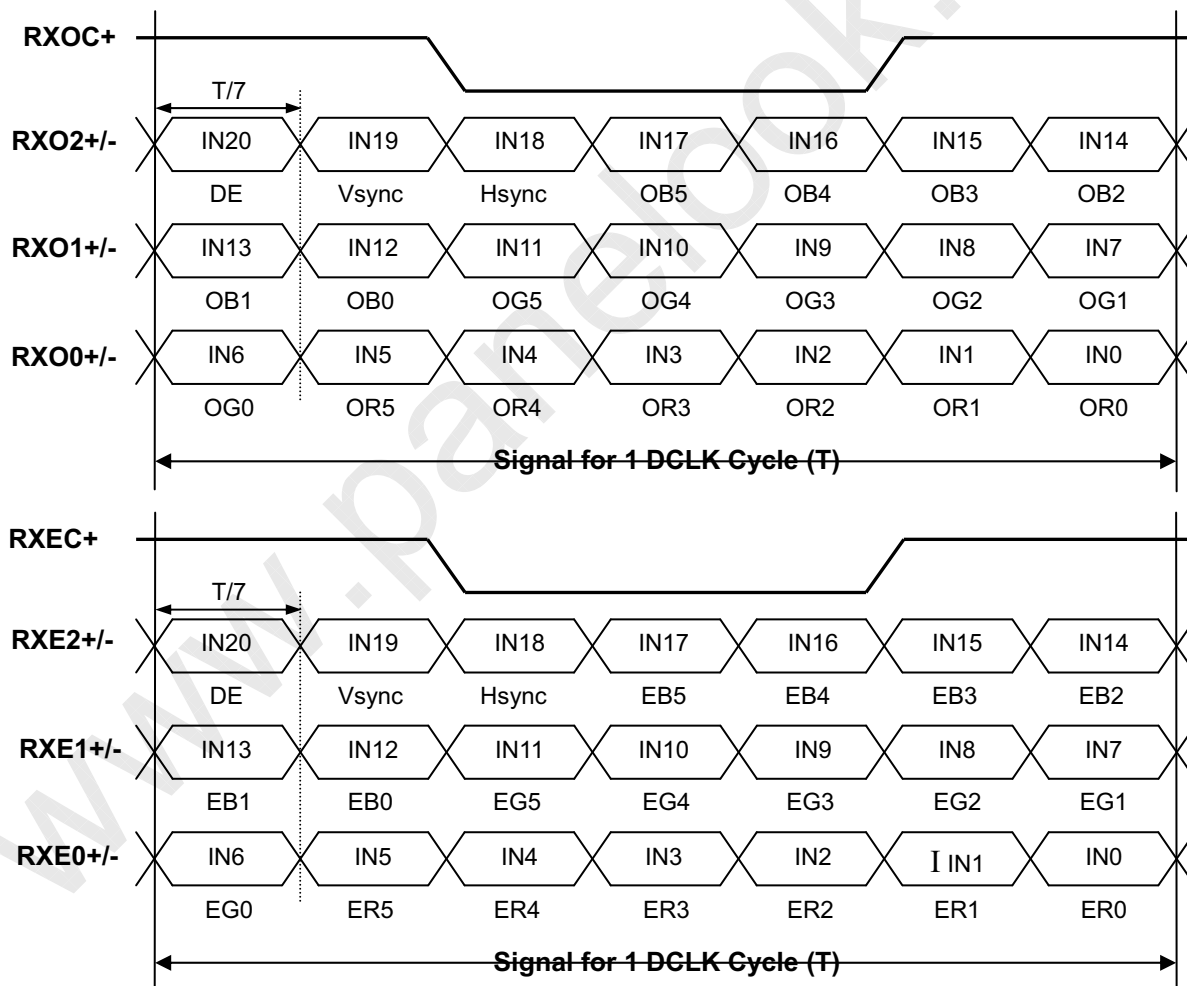
Note (1) Connector Part No.: I-PEX 20455-040E-12 or equivalent

Note (2) User's connector Part No: I-PEX 20453-040T-01 or equivalent

Note (3) The first pixel is odd as shown in the following figure.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL



### 5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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 |    |    |    |    |    |
|                     |               | R5          | R4 | R3 | R2 | R1 | R0 | G5    | G4 | G3 | G2 | G1 | G0 | 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  |
|                     | Red           | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 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  |
|                     | Blue          | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan          | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta       | 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   | Red(0)/Dark   | 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  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)        | 0           | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Red(61)       | 1           | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(62)       | 1           | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Red(63)             | 1             | 1           | 1  | 1  | 1  | 1  | 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  |
|                     | Green(1)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Green(61)     | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(62)     | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Green(63)           | 0             | 0           | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 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  |
|                     | Blue(1)       | 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  | 1  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Blue(61)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(62)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
| Blue(63)            | 0             | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  |    |

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

## 5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

| Byte #<br>(decimal) | Byte #<br>(hex) | Field Name and Comments                      | Value<br>(hex) | Value<br>(binary) |
|---------------------|-----------------|--|----------------|-------------------|
| 0                   | 0               | Header                                       | 00             | 00000000          |
| 1                   | 1               | Header                                       | FF             | 11111111          |
| 2                   | 2               | Header                                       | FF             | 11111111          |
| 3                   | 3               | Header                                       | FF             | 11111111          |
| 4                   | 4               | Header                                       | FF             | 11111111          |
| 5                   | 5               | Header                                       | FF             | 11111111          |
| 6                   | 6               | Header                                       | FF             | 11111111          |
| 7                   | 7               | Header                                       | 00             | 00000000          |
| 8                   | 8               | EISA ID manufacturer name ("CMO")            | 0D             | 00001101          |
| 9                   | 9               | EISA ID manufacturer name (Compressed ASCII) | AF             | 10101111          |
| 10                  | 0A              | ID product code (N140O6-L01)                 | 46             | 01000110          |
| 11                  | 0B              | ID product code (hex LSB first; N140O6-L01)  | 14             | 00010100          |
| 12                  | 0C              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 13                  | 0D              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 14                  | 0E              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 15                  | 0F              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 16                  | 10              | Week of manufacture (fixed week code)        | 04             | 00000100          |
| 17                  | 11              | Year of manufacture (fixed year code)        | 13             | 00010011          |
| 18                  | 12              | EDID structure version # ("1")               | 01             | 00000001          |
| 19                  | 13              | EDID revision # ("3")                        | 03             | 00000011          |
| 20                  | 14              | Video I/P definition ("digital")             | 80             | 10000000          |
| 21                  | 15              | Max H image size ("30.96cm")                 | 1F             | 00011111          |
| 22                  | 16              | Max V image size ("17.415cm")                | 11             | 00010001          |
| 23                  | 17              | Display Gamma (Gamma = "2.2")                | 78             | 01111000          |
| 24                  | 18              | Feature support ("Active off, RGB Color")    | 0A             | 00001010          |
| 25                  | 19              | Rx1 Rx0 Ry1 Ry0 Gx1 Gx0 Gy1 Gy0              | A5             | 10100101          |
| 26                  | 1A              | Bx1 Bx0 By1 By0 Wx1 Wx0 Wy1 Wy0              | 78             | 01111000          |
| 27                  | 1B              | Rx=0.6154                                    | 9D             | 10011101          |
| 28                  | 1C              | Ry=0.3377                                    | 56             | 01010110          |
| 29                  | 1D              | Gx=0.3252                                    | 53             | 01010011          |
| 30                  | 1E              | Gy=0.6067                                    | 9B             | 10011011          |
| 31                  | 1F              | Bx=0.169                                     | 2B             | 00101011          |
| 32                  | 20              | By=0.0809                                    | 14             | 00010100          |
| 33                  | 21              | Wx=0.3186                                    | 51             | 01010001          |
| 34                  | 22              | Wy=0.3283                                    | 54             | 01010100          |
| 35                  | 23              | Established timings 1                        | 00             | 00000000          |
| 36                  | 24              | Established timings 2                        | 00             | 00000000          |
| 37                  | 25              | Manufacturer's reserved timings              | 00             | 00000000          |
| 38                  | 26              | Standard timing ID # 1                       | 01             | 00000001          |
| 39                  | 27              | Standard timing ID # 1                       | 01             | 00000001          |
| 40                  | 28              | Standard timing ID # 2                       | 01             | 00000001          |

|    |    |   |    |          |
|----|----|---|----|----------|
| 41 | 29 | Standard timing ID # 2  | 01 | 00000001 |
| 42 | 2A | Standard timing ID # 3  | 01 | 00000001 |
| 43 | 2B | Standard timing ID # 3  | 01 | 00000001 |
| 44 | 2C | Standard timing ID # 4  | 01 | 00000001 |
| 45 | 2D | Standard timing ID # 4  | 01 | 00000001 |
| 46 | 2E | Standard timing ID # 5  | 01 | 00000001 |
| 47 | 2F | Standard timing ID # 5  | 01 | 00000001 |
| 48 | 30 | Standard timing ID # 6  | 01 | 00000001 |
| 49 | 31 | Standard timing ID # 6  | 01 | 00000001 |
| 50 | 32 | Standard timing ID # 7  | 01 | 00000001 |
| 51 | 33 | Standard timing ID # 7  | 01 | 00000001 |
| 52 | 34 | Standard timing ID # 8  | 01 | 00000001 |
| 53 | 35 | Standard timing ID # 8  | 01 | 00000001 |
| 54 | 36 | Detailed timing description # 1 Pixel clock ("107.8MHz", According to VESA CVT Rev1.1)    | 20 | 00100000 |
| 55 | 37 | # 1 Pixel clock (hex LSB first)   | 2A | 00101010 |
| 56 | 38 | # 1 H active ("1600")   | 40 | 01000000 |
| 57 | 39 | # 1 H blank ("304")   | 30 | 00110000 |
| 58 | 3A | # 1 H active : H blank ("1600 : 304")   | 61 | 01100001 |
| 59 | 3B | # 1 V active ("900")  | 84 | 10000100 |
| 60 | 3C | # 1 V blank ("44")  | 2C | 00101100 |
| 61 | 3D | # 1 V active : V blank ("900 : 44")   | 30 | 00110000 |
| 62 | 3E | # 1 H sync offset ("91")  | 5B | 01011011 |
| 63 | 3F | # 1 H sync pulse width ("61")   | 3D | 00111101 |
| 64 | 40 | # 1 V sync offset : V sync pulse width ("6 : 11")   | 6B | 01101011 |
| 65 | 41 | # 1 H sync offset : H sync pulse width : V sync offset : V sync width ("91: 61 : 6 : 11") | 00 | 00000000 |
| 66 | 42 | # 1 H image size ("310 mm")   | 36 | 00110110 |
| 67 | 43 | # 1 V image size ("174 mm")   | AE | 10101110 |
| 68 | 44 | # 1 H image size : V image size ("310 : 174")   | 10 | 00010000 |
| 69 | 45 | # 1 H boarder ("0")   | 00 | 00000000 |
| 70 | 46 | # 1 V boarder ("0")   | 00 | 00000000 |
| 71 | 47 | # 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives                   | 18 | 00011000 |
| 72 | 48 | Detailed timing description # 2   | 00 | 00000000 |
| 73 | 49 | # 2 Flag  | 00 | 00000000 |
| 74 | 4A | # 2 Reserved  | 00 | 00000000 |
| 75 | 4B | # 2 FE (hex) defines ASCII string (Model Name "N140O6-L01", ASCII)                        | FE | 11111110 |
| 76 | 4C | # 2 Flag  | 00 | 00000000 |
| 77 | 4D | # 2 1st character of name ("N")   | 4E | 01001110 |
| 78 | 4E | # 2 2nd character of name ("1")   | 31 | 00110001 |
| 79 | 4F | # 2 3rd character of name ("4")   | 34 | 00110100 |
| 80 | 50 | # 2 4th character of name ("0")   | 30 | 00110000 |
| 81 | 51 | # 2 5th character of name ("O")   | 4F | 01001111 |
| 82 | 52 | # 2 6th character of name ("6")   | 36 | 00110110 |
| 83 | 53 | # 2 7th character of name ("-")   | 2D | 00101101 |
| 84 | 54 | # 2 8th character of name ("L")   | 4C | 01001100 |
| 85 | 55 | # 2 9th character of name ("0")   | 30 | 00110000 |
| 86 | 56 | # 2 9th character of name ("1")   | 31 | 00110001 |

|     |    |  |    |          |
|-----|----|--|----|----------|
| 87  | 57 | # 2 New line character indicates end of ASCII string               | 0A | 00001010 |
| 88  | 58 | # 2 Padding with "Blank" character                                 | 20 | 00100000 |
| 89  | 59 | # 2 Padding with "Blank" character                                 | 20 | 00100000 |
| 90  | 5A | Detailed timing description # 3                                    | 00 | 00000000 |
| 91  | 5B | # 3 Flag   | 00 | 00000000 |
| 92  | 5C | # 3 Reserved   | 00 | 00000000 |
| 93  | 5D | # 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)            | FE | 11111110 |
| 94  | 5E | # 3 Flag   | 00 | 00000000 |
| 95  | 5F | # 3 1st character of string ("C")                                  | 43 | 01000011 |
| 96  | 60 | # 3 2nd character of string ("M")                                  | 4D | 01001101 |
| 97  | 61 | # 3 3rd character of string ("O")                                  | 4F | 01001111 |
| 98  | 62 | # 3 New line character indicates end of ASCII string               | 0A | 00001010 |
| 99  | 63 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 100 | 64 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 101 | 65 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 102 | 66 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 103 | 67 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 104 | 68 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 105 | 69 | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 106 | 6A | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 107 | 6B | # 3 Padding with "Blank" character                                 | 20 | 00100000 |
| 108 | 6C | Detailed timing description # 4                                    | 00 | 00000000 |
| 109 | 6D | # 4 Flag   | 00 | 00000000 |
| 110 | 6E | # 4 Reserved   | 00 | 00000000 |
| 111 | 6F | # 4 FE (hex) defines ASCII string (Model Name "N140O6-L01", ASCII) | FE | 11111110 |
| 112 | 70 | # 4 Flag   | 00 | 00000000 |
| 113 | 71 | # 4 1st character of name ("N")                                    | 4E | 01001110 |
| 114 | 72 | # 4 2nd character of name ("1")                                    | 31 | 00110001 |
| 115 | 73 | # 4 3rd character of name ("4")                                    | 34 | 00110100 |
| 116 | 74 | # 4 4th character of name ("0")                                    | 30 | 00110000 |
| 117 | 75 | # 4 5th character of name ("O")                                    | 4F | 01001111 |
| 118 | 76 | # 4 6th character of name ("6")                                    | 36 | 00110110 |
| 119 | 77 | # 4 7th character of name ("-")                                    | 2D | 00101101 |
| 120 | 78 | # 4 8th character of name ("L")                                    | 4C | 01001100 |
| 121 | 79 | # 4 9th character of name ("0")                                    | 30 | 00110000 |
| 122 | 7A | # 4 9th character of name ("1")                                    | 31 | 00110001 |
| 123 | 7B | # 4 New line character indicates end of ASCII string               | 0A | 00001010 |
| 124 | 7C | # 4 Padding with "Blank" character                                 | 20 | 00100000 |
| 125 | 7D | # 4 Padding with "Blank" character                                 | 20 | 00100000 |
| 126 | 7E | Extension flag   | 00 | 00000000 |
| 127 | 7F | Checksum   | 8C | 10001100 |



## 6. CONVERTER SPECIFICATION

### 6.1 ABSOLUTE MAXIMUM RATINGS

| Symbol          | Ratings     |
|-----------------|-------------|
| LED_VCCS        | -0.3V~28.0V |
| LED_PWM, LED_EN | -0.3V~5.5V  |

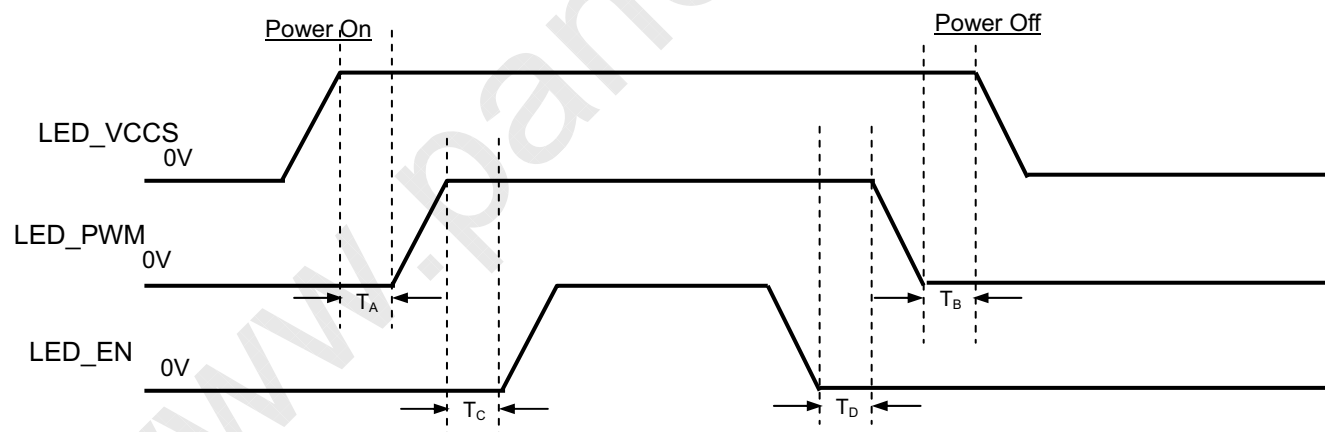
### 6.2 RECOMMENDED OPERATING RATINGS

| Parameter                              | Symbol              | Value |      |       | Unit | Note |
|--|---------------------|-------|------|-------|------|------|
|  |                     | Min.  | Typ. | Max.  |      |      |
| Converter Input power supply voltage   | LED_Vccs            | 6     | 12.0 | 21.0  | V    |      |
| EN Control Level                       | Backlight on        | 2.0   | ---  | 5     | V    |      |
|  | Backlight off       | 0     | ---  | 0.8   | V    |      |
| PWM Control Level                      | PWM High Level      | 2.0   | ---  | 5.5   | V    |      |
|  | PWM Low Level       | 0     | ---  | 0.15  | V    |      |
| PWM Control Duty Ratio                 |                     | 10    |      | 100   | %    |      |
| PWM Control Permissible Ripple Voltage | V <sub>PWM_pp</sub> |       |      | 100   | mV   |      |
| PWM Control Frequency                  | f <sub>PWM</sub>    | 190   | 210  | 230   | Hz   |      |
| Converter Input Current                | LED_VCCS=Min        | (TBD) | 557  | (TBD) | mA   | (1)  |
|  | LED_VCCS=Typ        | (TBD) | 270  | (TBD) |      | (1)  |
|  | LED_VCCS=Max        | (TBD) | 150  | (TBD) | mA   | (1)  |

Note (1) The specified LED power supply current is under the conditions at "LED\_VCCS = Min, Typ, Max",

T<sub>a</sub> = 25 ± 2 °C, f<sub>PWM</sub> = 200 Hz, Duty=100%.

### 6.3 LED BACKLIGHT CONTROL ON/OFF SEQUENCE



Timing Specifications:

$$T_A \geq (0\text{ms})$$

$$T_B \geq (0\text{ms})$$

$$T_C \geq (10\text{ms})$$

$$T_D \geq (0\text{ms})$$

Note (1) Please follow the LED backlight power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller

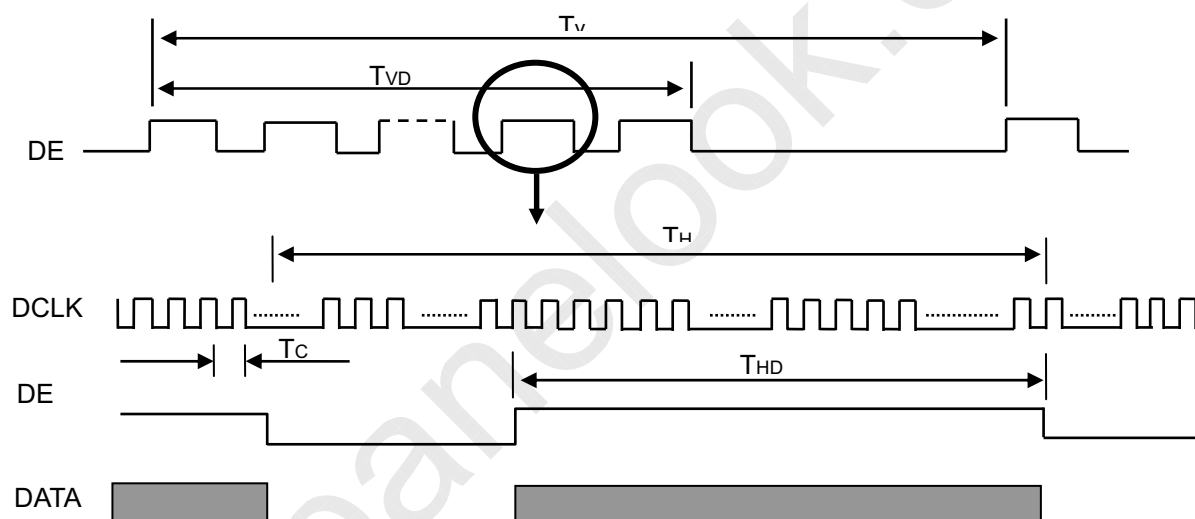
## 7. INTERFACE TIMING

### 7.1 INPUT SIGNAL TIMING SPECIFICATIONS

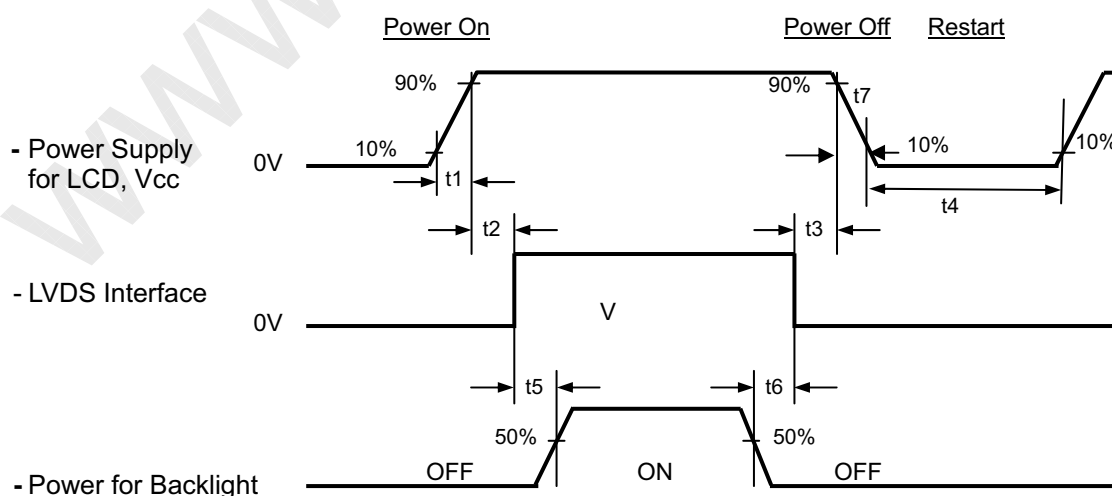
The specifications of input signal timing are as the following table and timing diagram.

| Signal | Item                              | Symbol | Min.   | Typ. | Max.   | Unit | Note |
|--------|-----------------------------------|--------|--------|------|--------|------|------|
| DCLK   | Frequency                         | 1/Tc   | 44     | 48.4 | 51.3   | MHz  | (2)  |
| DE     | Vertical Total Time               | TV     | 903    | 926  | 990    | TH   | -    |
|        | Vertical Active Display Period    | TVD    | 900    | 900  | 900    | TH   | -    |
|        | Vertical Active Blanking Period   | TVB    | TV-TVD | 26   | TV-TVD | TH   |      |
|        | Horizontal Total Time             | TH     | 1680   | 1760 | 1800   | Tc   | (2)  |
|        | Horizontal Active Display Period  | THD    | 1600   | 1600 | 1600   | Tc   | (2)  |
|        | Horizontal Active Blanking Period | THB    | TH-THD | 160  | TH-THD | Tc   | (2)  |

#### INPUT SIGNAL TIMING DIAGRAM



### 7.2 POWER ON/OFF SEQUENCE



## Timing Specifications:

$$0.5 < t_1 \leq 10 \text{ msec}$$

$$0 < t_2 \leq 50 \text{ msec}$$

$$0 < t_3 \leq 50 \text{ msec}$$

$$t_4 \geq 500 \text{ msec}$$

$$t_5 \geq 200 \text{ msec}$$

$$t_6 \geq 200 \text{ msec}$$

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow  $(50\mu\text{s}) \leq t_7 \leq 10 \text{ ms}$ .

## 8 OPTICAL CHARACTERISTICS

### 8.1 TEST CONDITIONS

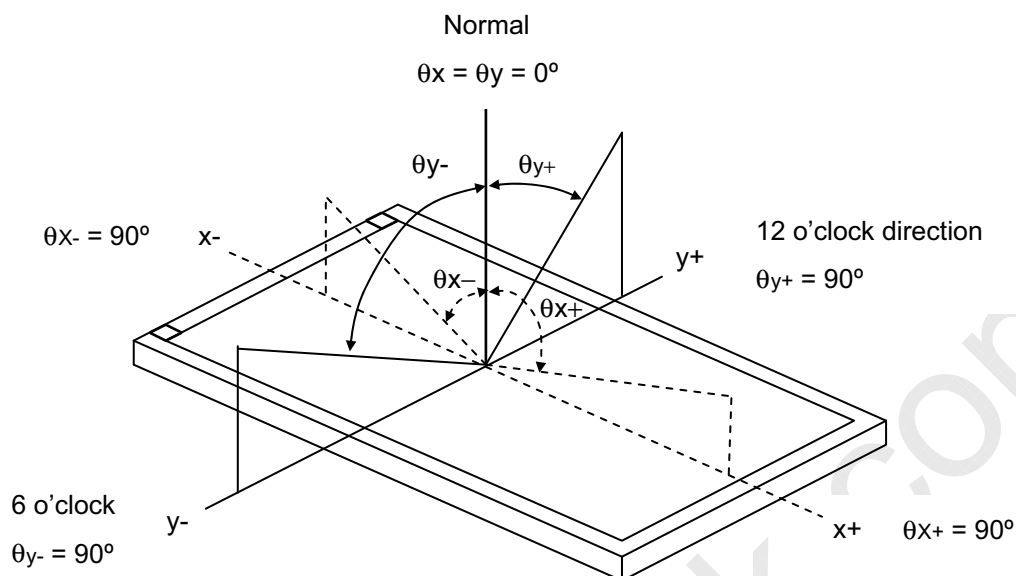
| Item                        | Symbol  | Value | Unit |
|-----------------------------|---|-------|------|
| Ambient Temperature         | T <sub>a</sub>  | 25±2  | °C   |
| Ambient Humidity            | H <sub>a</sub>  | 50±10 | %RH  |
| Supply Voltage              | V <sub>CC</sub>   | 3.2   | V    |
| Input Signal                | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |       |      |
| LED Light Bar Input Current | I <sub>L</sub>  | 100   | mA   |

The relative measurement methods of optical characteristics are shown in 8.2 The following items should be measured under the test conditions described in 8.1 and stable environment shown in Note (6).

### 8.2 OPTICAL SPECIFICATIONS

| Item                       |            | Symbol           | Condition   | Min.  | Typ.    | Max.  | Unit              | Note     |    |    |   |
|----------------------------|------------|------------------|---|-------|---------|-------|-------------------|----------|----|----|---|
| Contrast Ratio             |            | CR               | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing Normal<br>Angle | 400   | 500     | -     | -                 | (2), (6) |    |    |   |
| Response Time              |            | T <sub>R</sub>   |   | -     | 3       | 5     | ms                | (3)      |    |    |   |
|                            |            | T <sub>F</sub>   |   | -     | 7       | 11    | ms                |          |    |    |   |
| Average Luminance of White |            | L <sub>AVE</sub> |   | 170   | 200     | -     | cd/m <sup>2</sup> | (4), (6) |    |    |   |
| White Variation            |            | $\delta W$       |   | -     | 1.4     | 1.6   | -                 | (5),(6)  |    |    |   |
| Color Chromaticity         | Red        | R <sub>x</sub>   | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing Normal<br>Angle | -0.03 | (0.618) | +0.03 | -                 | (1), (6) |    |    |   |
|                            |            | R <sub>y</sub>   |   |       | (0.348) |       | -                 |          |    |    |   |
|                            | Green      | G <sub>x</sub>   |   |       | (0.332) |       | -                 |          |    |    |   |
|                            |            | G <sub>y</sub>   |   |       | (0.588) |       | -                 |          |    |    |   |
|                            | Blue       | B <sub>x</sub>   |   |       | (0.157) |       | -                 |          |    |    |   |
|                            |            | B <sub>y</sub>   |   |       | (0.080) |       | -                 |          |    |    |   |
|                            | White      | W <sub>x</sub>   |   |       | 0.313   |       | -                 |          |    |    |   |
|                            |            | W <sub>y</sub>   |   |       | 0.329   |       | -                 |          |    |    |   |
| Viewing Angle              | Horizontal | $\theta_{x+}$    | CR≥10   | 40    | 45      | -     | Deg.              |          |    |    |   |
|                            |            | $\theta_{x-}$    |   |       |         |       |                   |          |    |    |   |
|                            | Vertical   | $\theta_{y+}$    |   |       |         |       |                   |          | 15 | 20 | - |
|                            |            | $\theta_{y-}$    |   |       |         |       |                   |          | 40 | 45 | - |

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



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

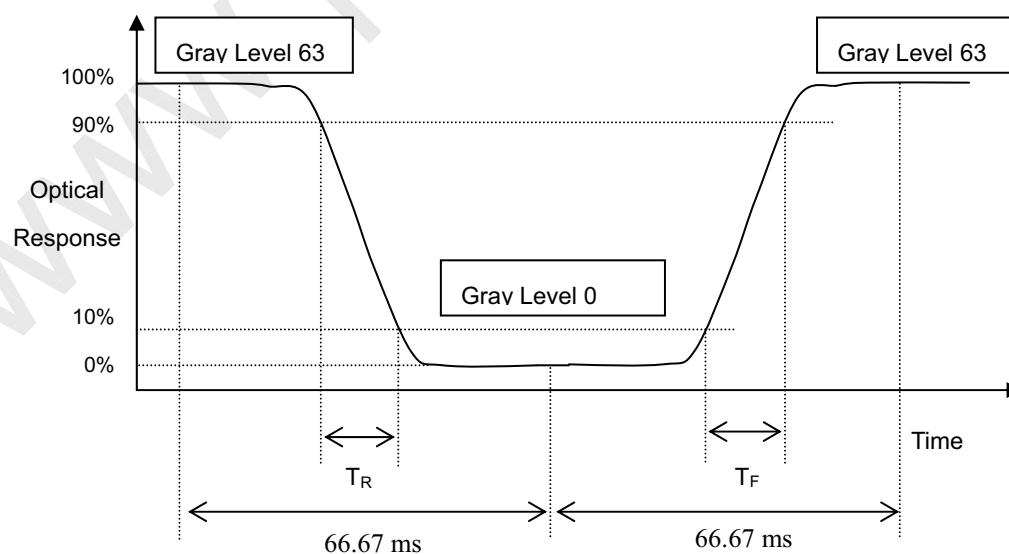
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$CR = CR(5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

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



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

Measure the luminance of gray level 63 at 5 points

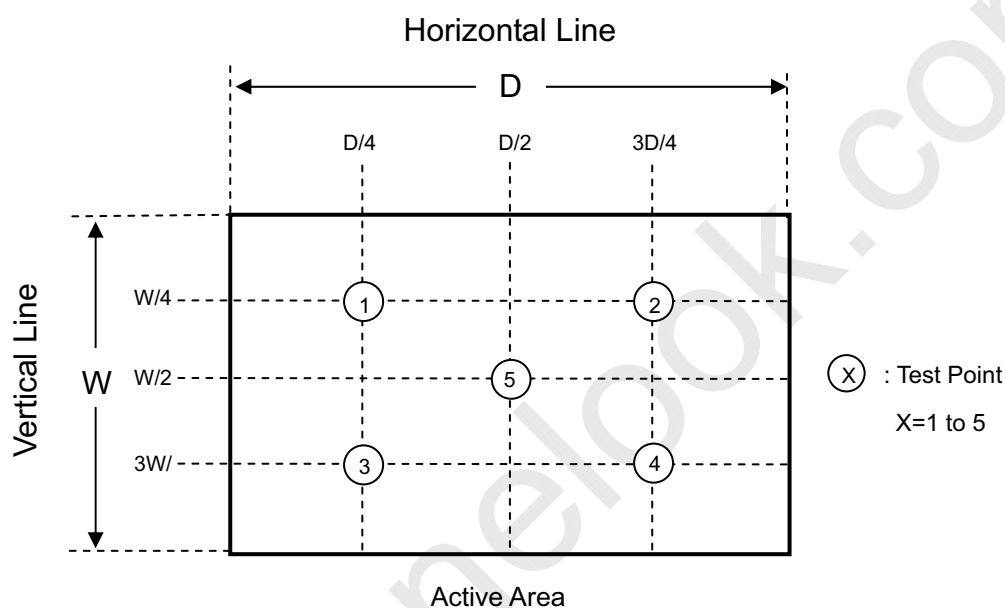
$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (5).

Note (5) Definition of White Variation ( $\delta W$ ):

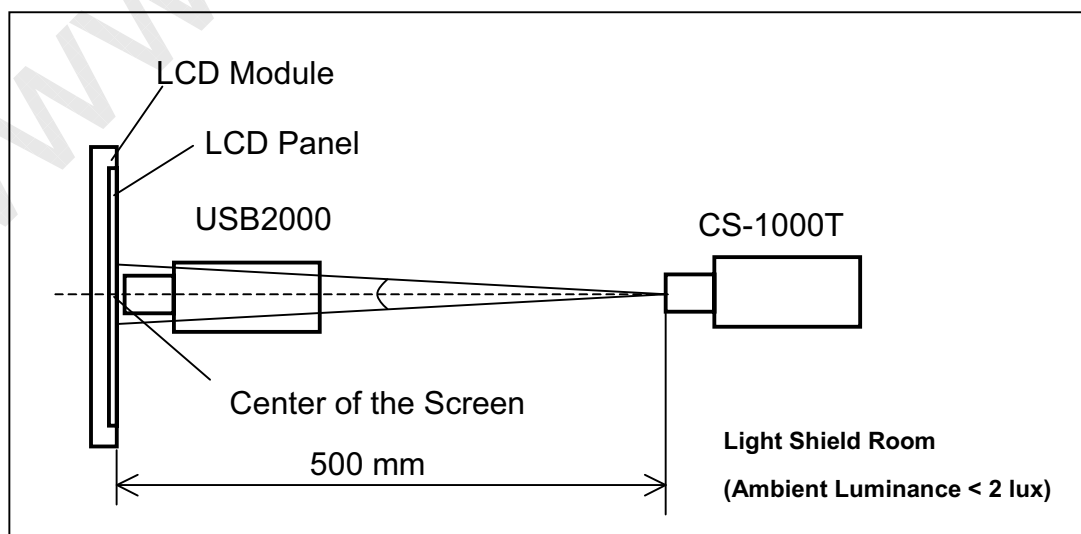
Measure the luminance of gray level 63 at 5 points

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



Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 15 minutes in a windless room.



## 9 PRECAUTIONS

### 9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.
- (12) To avoid wireless noise interference, please keep the antenna away from LCD control board.

### 9.2 SAFETY PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

### 9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

### 9.4 OTHERS PRECAUTIONS

- (1) When fixed patterns are displayed for a long time, remnant image is likely to occur.

### 9.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.



## 10 PACKAGING

## 10.1 CARTON

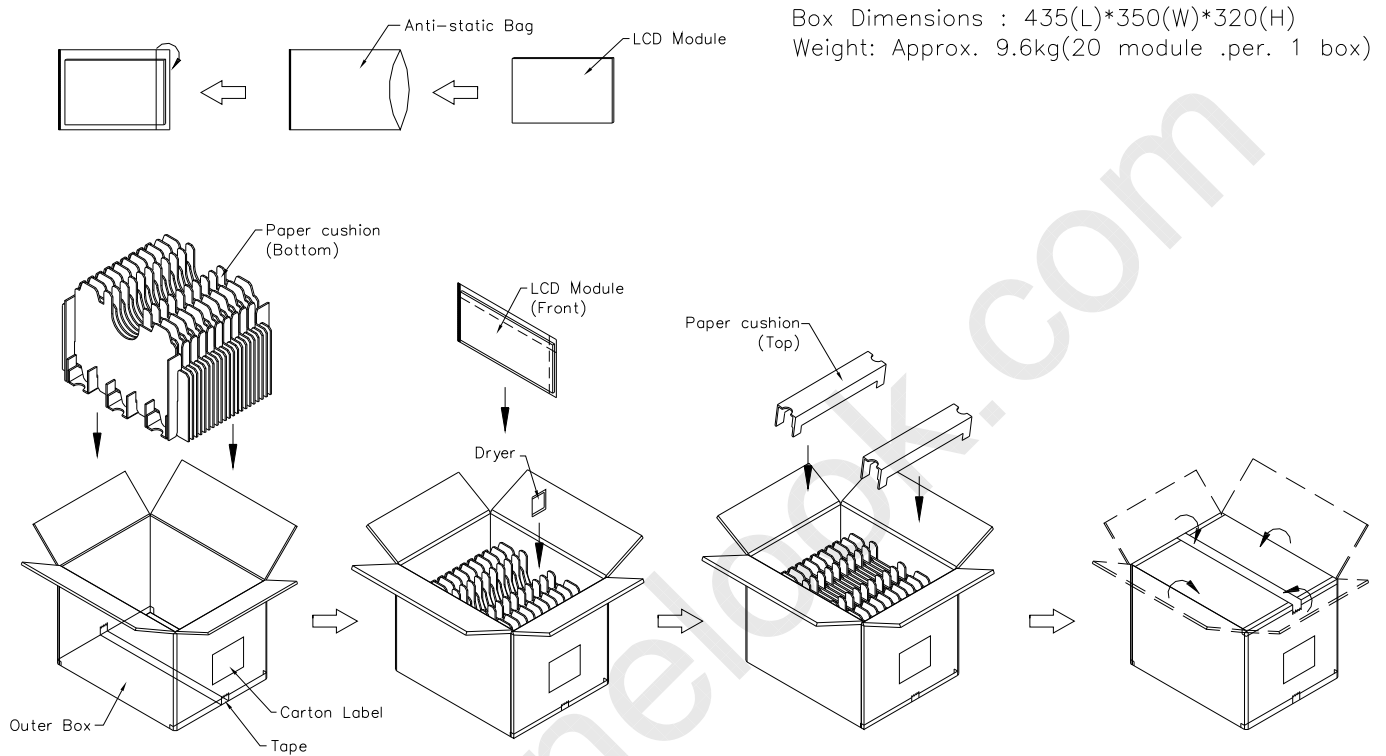
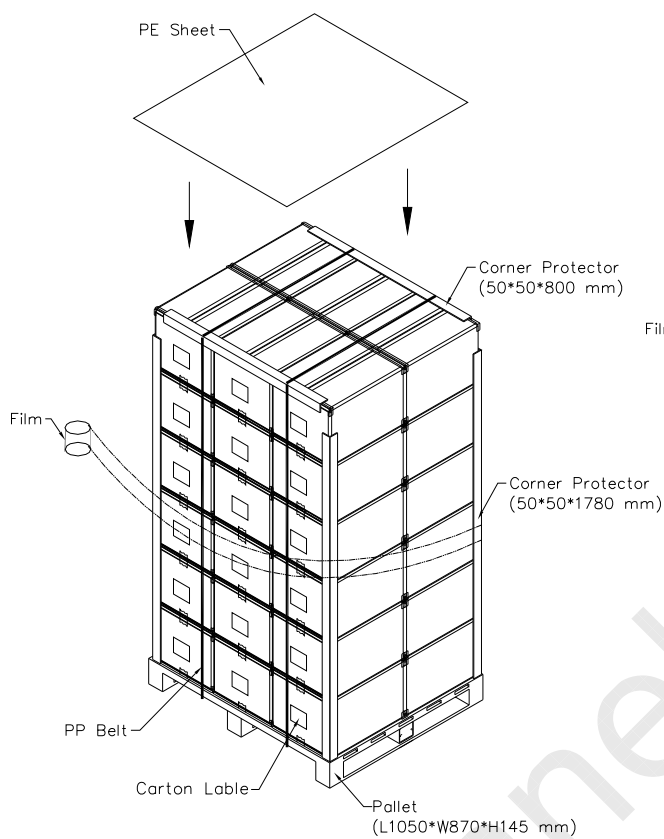


Figure. 10-1 Packing method

## 10.2 PALLET

## Sea &amp; Land Transportation



## Air Transportation

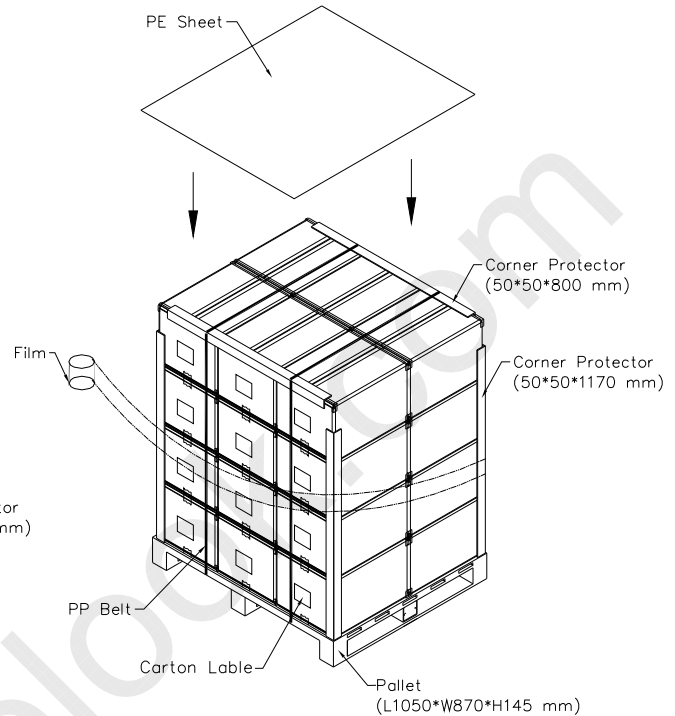
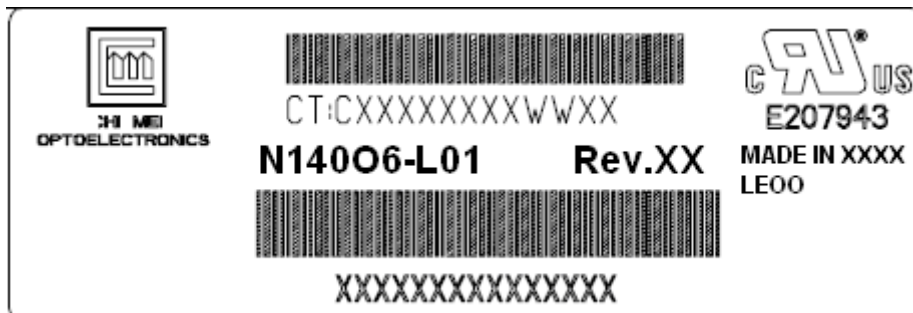


Figure. 10-2 Packing method

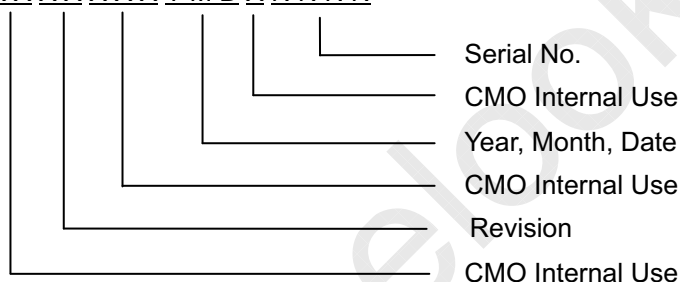
## 11 DEFINITION OF LABELS

### 11.1 CMO MODULE LABEL

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



- (a) Model Name: N14006 - L01-
- (b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.
- (c) Serial ID: X X X X X X X Y M D X N N N N



- (d) Production Location: MADE IN XXXX. XXXX stands for production location.
- (e) UL/CB logo: "LEOO" especially stands for panel manufactured by CMO Ningbo satisfying UL/CB requirement. "LEOO" is the CMO's UL factory code for Ningbo factory.

Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009  
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

## 11.2 CMO CARTON LABEL

CMO carton label is as below:



The image shows a template for a CMO carton label. It features a blue header with the CHI MEI logo and the text "CHI MEI OPTOELECTRONICS". Below the header, there are four horizontal lines for inputting information: "PO.NO.", "Part ID.", "Model Name", and "Carton ID.". To the right of the "Carton ID." line, the word "Quantities" is written. In the center of the label, the letters "CMO" are printed in a large, light blue font. At the bottom, there is a "Made in XXXX" label and a "GP RoHS" logo.

(a) Production location: Made In XXXX. XXXX stands for production location.

