

## TFT LCD Preliminary Specification

# MODEL NO.: N154C5-L01

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

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

Note :

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| 記錄                         | 工作                              | 審核                                   | 角色                           | 投票     |
|----------------------------|---------------------------------|--------------------------------------|------------------------------|--------|
| 2006-11-01<br>19:19:07 CST | Approve by Dept.<br>Mgr.(QA RA) | tomy_chen(陳永一<br>/52720/54140/43150) | Department<br>Manager(QA RA) | Accept |
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**REVISION HISTORY**

| Version | Date         | Page<br>(New) | Section | Description                                 |
|---------|--------------|---------------|---------|---------------------------------------------|
| Ver 1.0 | Sep. 08. '06 | All           | All     | Preliminary specification 1.0 first issued. |
| Ver 1.1 | Oct. 24. '06 | All           | All     | Update EE, OPT, ME spec                     |

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## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

N154C5-L01 is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1440 x 900 WXGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

### 1.2 FEATURES

- Thin and light weight
- WXGA+ (1440 x 900 pixels) resolution
- DE (Data Enable) only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock
- Support EDID Structure Version 1.3

### 1.3 APPLICATION

- TFT LCD Notebook

### 1.4 GENERAL SPECIFICATIONS

| Item               | Specification             | Unit  | Note |
|--------------------|---------------------------|-------|------|
| Outline Dimension  | 344(W) x 222 (H)          | mm    | (1)  |
| Active Area        | 331.56 (H) x 207.225 (V)  | mm    |      |
| Bezel Opening Area | 335 (H) x 210.7 (V)       | mm    |      |
| Driver Element     | a-si TFT active matrix    | -     | -    |
| Pixel Number       | 1440 x R.G.B. x 900       | pixel | -    |
| Pixel Pitch        | 0.23025 (H) x 0.23025 (V) | mm    | -    |
| Pixel Arrangement  | RGB vertical stripe       | -     | -    |
| Display Colors     | 262,144                   | color | -    |
| Transmissive Mode  | Normally white            | -     | -    |
| Surface Treatment  | Hard coating (3H), Glare  | -     | -    |

### 1.5 MECHANICAL SPECIFICATIONS

| Item                            |               | Min.                                                                                                           | Typ. | Max.  | Unit | Note |
|---------------------------------|---------------|----------------------------------------------------------------------------------------------------------------|------|-------|------|------|
| Module Size                     | Horizontal(H) | 343.5                                                                                                          | 344  | 344.5 | mm   | (1)  |
|                                 | Vertical(V)   | 221.5                                                                                                          | 222  | 222.5 | mm   |      |
|                                 | Depth(D)      | ---                                                                                                            | 6.2  | 6.5   | mm   |      |
| Weight                          |               | ---                                                                                                            | 560  | 575   | g    | -    |
| I/F connector mounting position |               | The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal. |      |       |      |      |

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

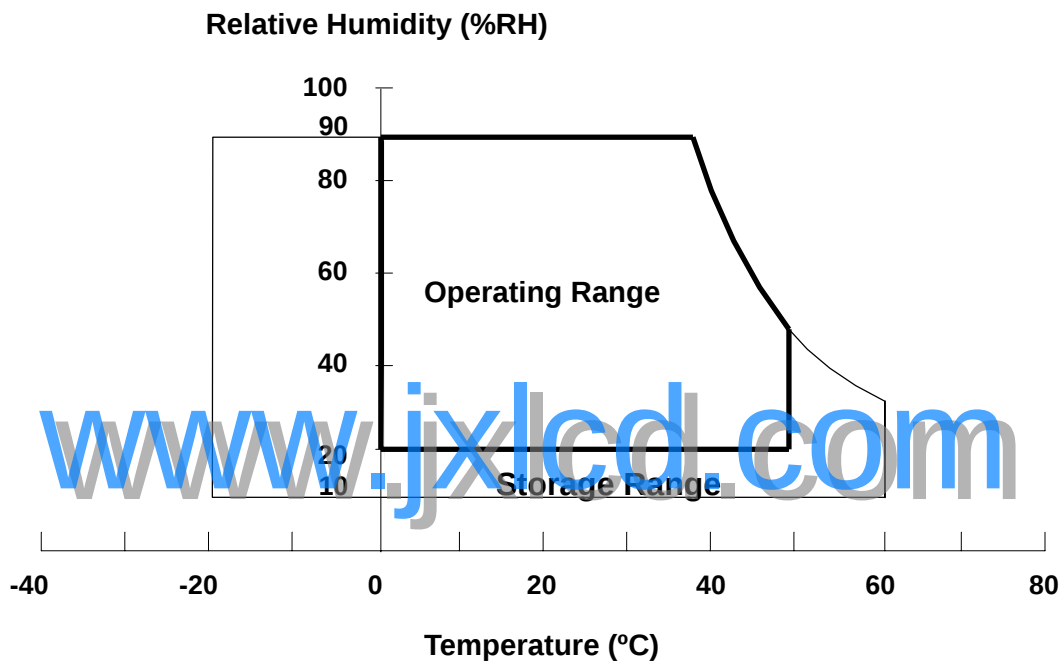
| Item                          | Symbol           | Value |       | Unit | Note     |
|-------------------------------|------------------|-------|-------|------|----------|
|                               |                  | Min.  | Max.  |      |          |
| Storage Temperature           | T <sub>ST</sub>  | -20   | +60   | °C   | (1)      |
| Operating Ambient Temperature | T <sub>OP</sub>  | 0     | +50   | °C   | (1), (2) |
| Shock (Non-Operating)         | S <sub>NOP</sub> | -     | 200/2 | 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 surface should be 0 °C min. and 50 °C max.



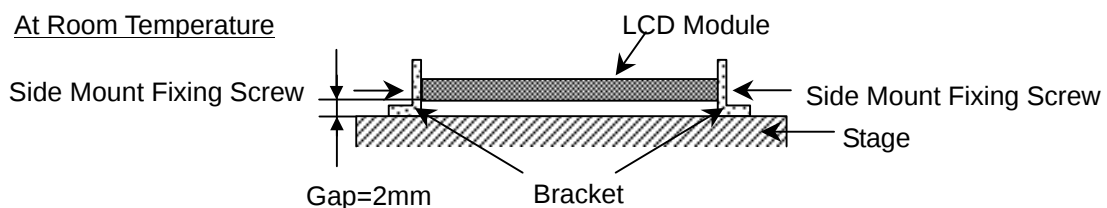
Note (3) 1 time for ± X, ± Y, ± Z. for Condition (200G / 2ms) is half Sine Wave,.

Note (4) 10~200 Hz, 0.5hr/cycle 1cycle for 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.

The fixing condition is shown as below:

At Room Temperature



## 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  | +4.0                 | V    | (1)  |
| Logic Input Voltage  | V <sub>IN</sub> | -0.3  | V <sub>CC</sub> +0.3 | V    |      |

### 2.2.2 BACKLIGHT UNIT

| Item           | Symbol         | Value |      | Unit              | Note                              |
|----------------|----------------|-------|------|-------------------|-----------------------------------|
|                |                | Min.  | Max. |                   |                                   |
| Lamp Voltage   | V <sub>L</sub> | -     | 2.5K | V <sub>RMS</sub>  | (1), (2), I <sub>L</sub> = 6.0 mA |
| Lamp Current   | I <sub>L</sub> | 2.0   | 7.0  | mA <sub>RMS</sub> |                                   |
| Lamp Frequency | F <sub>L</sub> | 45    | 80   | KHz               | (1), (2)                          |

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 lamp (Refer to Section 3.2 for further information).

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### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

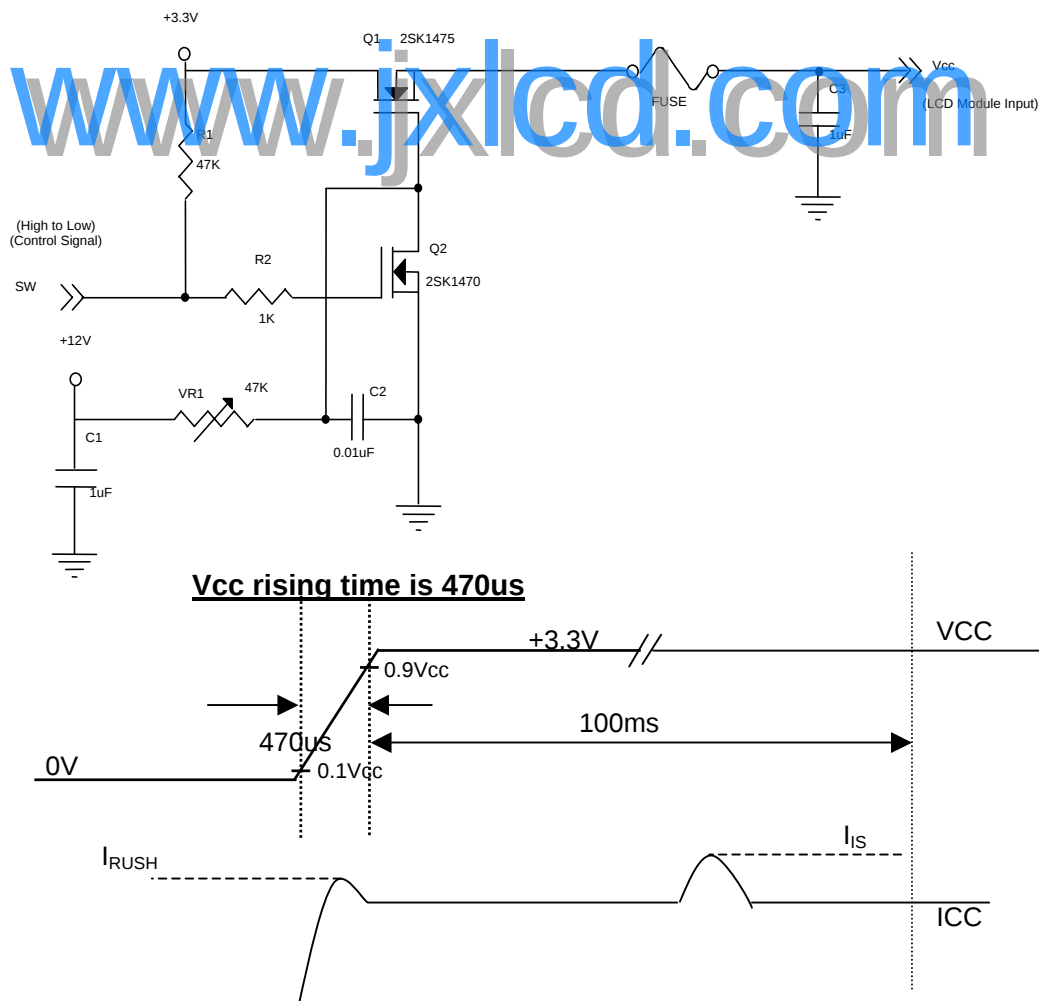
| Parameter                              | Symbol                | Value           |      |       | Unit | Note                          |
|----------------------------------------|-----------------------|-----------------|------|-------|------|-------------------------------|
|                                        |                       | Min.            | Typ. | Max.  |      |                               |
| Power Supply Voltage                   | V <sub>CC</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                 | I <sub>CC</sub> | 300  | 360   | mA   | (3)a                          |
|                                        | Black                 |                 | 440  | 500   | 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>      | -               | TBD  | -     | W    | (4)                           |

Note (1) The ambient temperature is Ta = 25 ± 2 °C.

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

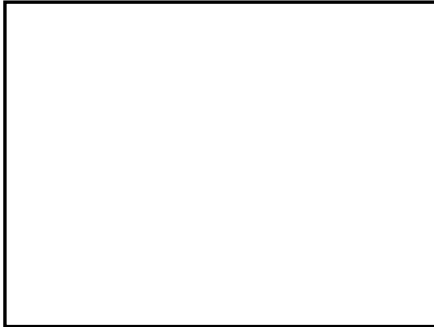
I<sub>IS</sub>: the maximum current of the first 100ms after power-on

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



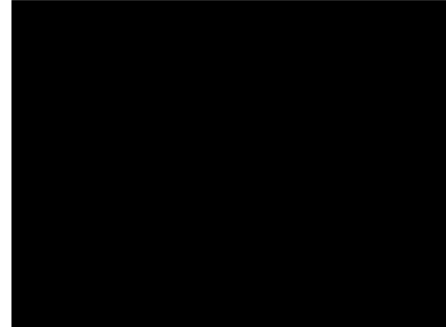
Note (3) The specified power supply current is under the conditions at  $V_{CC} = 3.3 \text{ V}$ ,  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ ,  $f_v = 60 \text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



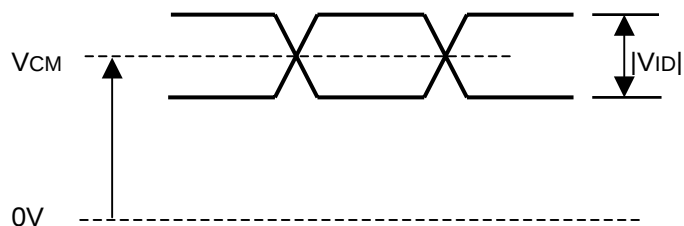
Active Area

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

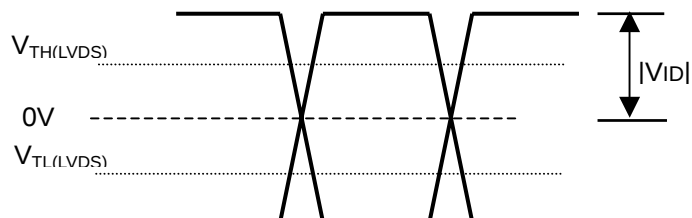
- (a)  $V_{CC} = 3.3 \text{ V}$ ,  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ ,  $f_v = 60 \text{ Hz}$ ,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.
- (d) The inverter used is provided from TBD. Please contact them for detail information. CMO doesn't provide the inverter in this product.

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

**Single Ended**



**Differential**

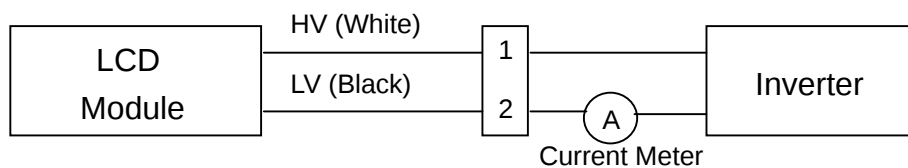


### 3.2 BACKLIGHT UNIT

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

| Parameter            | Symbol   | Value  |      |                               | Unit              | Note                        |
|----------------------|----------|--------|------|-------------------------------|-------------------|-----------------------------|
|                      |          | Min.   | Typ. | Max.                          |                   |                             |
| Lamp Input Voltage   | $V_L$    | 657    | 730  | 803                           | $V_{RMS}$         | $I_L = 6.0 \text{ mA}$      |
| Lamp Current         | $I_L$    | 2.0    | 6.0  | 7.0                           | $\text{mA}_{RMS}$ | (1)                         |
| Lamp Turn On Voltage | $V_S$    | -      | -    | 1460 (25 $^{\circ}\text{C}$ ) | $V_{RMS}$         | (2)                         |
|                      |          | -      | -    | 1600 (0 $^{\circ}\text{C}$ )  | $V_{RMS}$         | (2)                         |
| Operating Frequency  | $F_L$    | 45     | 55   | 80                            | KHz               | (3)                         |
| Power Consumption    | $P_L$    | -      | 4.38 | -                             | W                 | (4), $I_L = 6.0 \text{ mA}$ |
| Lamp Life Time       | $L_{BL}$ | 15,000 | -    | -                             | Hrs               | (5)                         |

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



Note (2) The voltage that must be larger than  $V_S$  should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note (3) The lamp frequency may generate 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.

Note (4)  $P_L = I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$  and  $I_L = 6.0 \text{ mA}_{RMS}$  until one of the following events occurs:

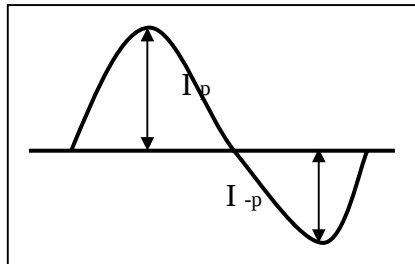
- When the brightness becomes 50% of its original value.
- When the effective ignition length becomes 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

- The asymmetry rate of the inverter waveform should be 10% below;

- b. The distortion rate of the waveform should be within  $\sqrt{2} \pm 10\%$ ;
- c. The ideal sine wave form shall be symmetric in positive and negative polarities.



\* Asymmetry rate:

$$|I_p - I_{-p}| / I_{rms} * 100\%$$

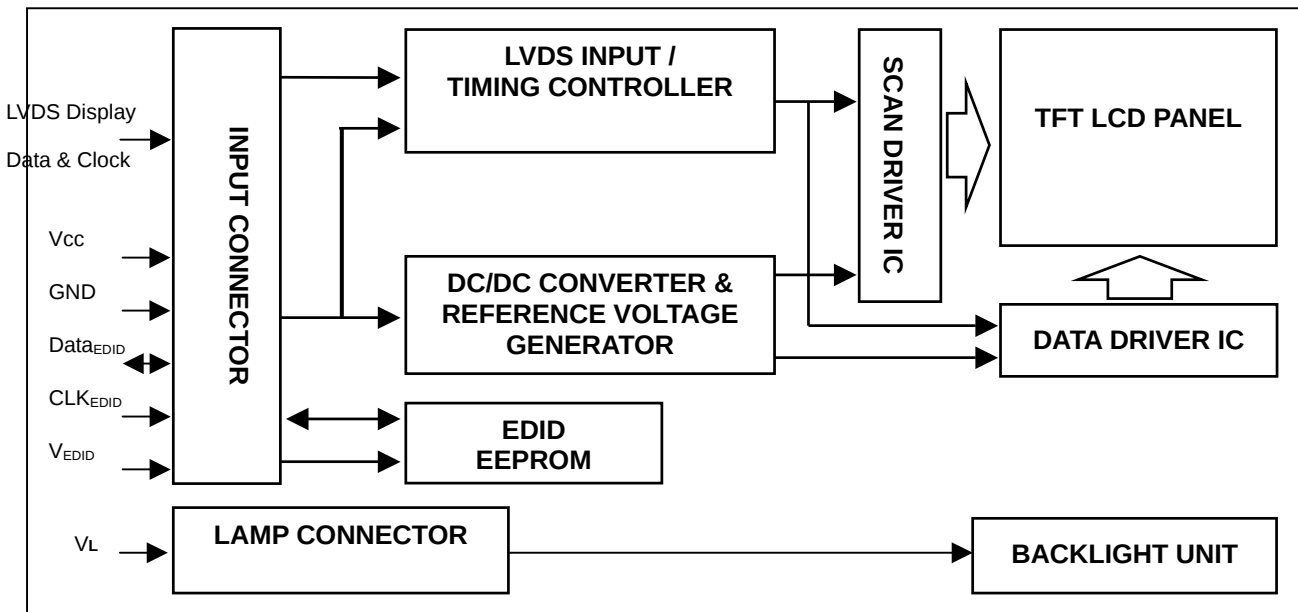
\* Distortion rate

$$I_p \text{ (or } I_{-p}) / I_{rms}$$

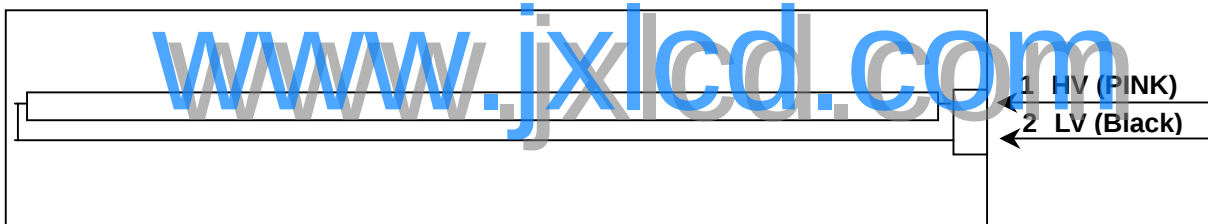
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#### 4. BLOCK DIAGRAM

##### 4.1 TFT LCD MODULE



##### 4.2 BACKLIGHT UNIT



## 5. INPUT TERMINAL PIN ASSIGNMENT

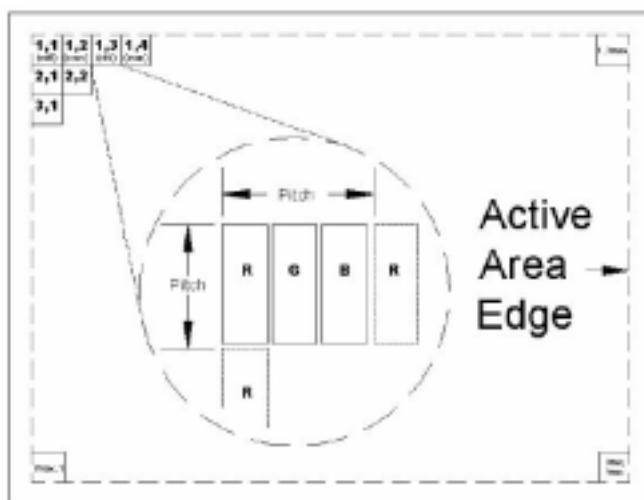
### 5.1 TFT LCD MODULE

| Pin | Symbol               | Description                         | Polarity | Remark |
|-----|----------------------|-------------------------------------|----------|--------|
| 1   | Vss                  | Ground                              |          |        |
| 2   | Vcc                  | Power Supply +3.3 V (typical)       |          |        |
| 3   | Vcc                  | Power Supply +3.3 V (typical)       |          |        |
| 4   | V <sub>EDID</sub>    | DDC 3.3V Power                      |          |        |
| 5   | NC                   | Non-Connection                      |          |        |
| 6   | CLK <sub>EDID</sub>  | DDC Clock                           |          |        |
| 7   | DATA <sub>EDID</sub> | DDC Data                            |          |        |
| 8   | RX00-                | LVDS Differential Data Input (Odd)  | Negative |        |
| 9   | RX00+                | LVDS Differential Data Input (Odd)  | Positive |        |
| 10  | Vss                  | Ground                              |          |        |
| 11  | RX01-                | LVDS Differential Data Input (Odd)  | Negative |        |
| 12  | RX01+                | LVDS Differential Data Input (Odd)  | Positive |        |
| 13  | Vss                  | Ground                              |          |        |
| 14  | RX02-                | LVDS Differential Data Input (Odd)  | Negative |        |
| 15  | RX02+                | LVDS Differential Data Input (Odd)  | Positive |        |
| 16  | Vss                  | Ground                              |          |        |
| 17  | RXOC-                | LVDS Clock Data Input (Odd)         | Negative |        |
| 18  | RXOC+                | LVDS Clock Data Input (Odd)         | Positive |        |
| 19  | Vss                  | Ground                              |          |        |
| 20  | RxE0-                | LVDS Differential Data Input (Even) | Negative |        |
| 21  | RxE0+                | LVDS Differential Data Input (Even) | Positive |        |
| 22  | Vss                  | Ground                              |          |        |
| 23  | RxE1-                | LVDS Differential Data Input (Even) | Negative |        |
| 24  | RxE1+                | LVDS Differential Data Input (Even) | Positive |        |
| 25  | Vss                  | Ground                              |          |        |
| 26  | RxE2-                | LVDS Differential Data Input (Even) | Negative |        |
| 27  | RxE2+                | LVDS Differential Data Input (Even) | Positive |        |
| 28  | Vss                  | Ground                              |          |        |
| 29  | RXEC-                | LVDS Clock Data Input (Even)        | Negative |        |
| 30  | RXEC+                | LVDS Clock Data Input (Even)        | Positive |        |

Note (1) Connector Part No.: JAE-FI-XB30SRL-HF11 or equivalent

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent

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



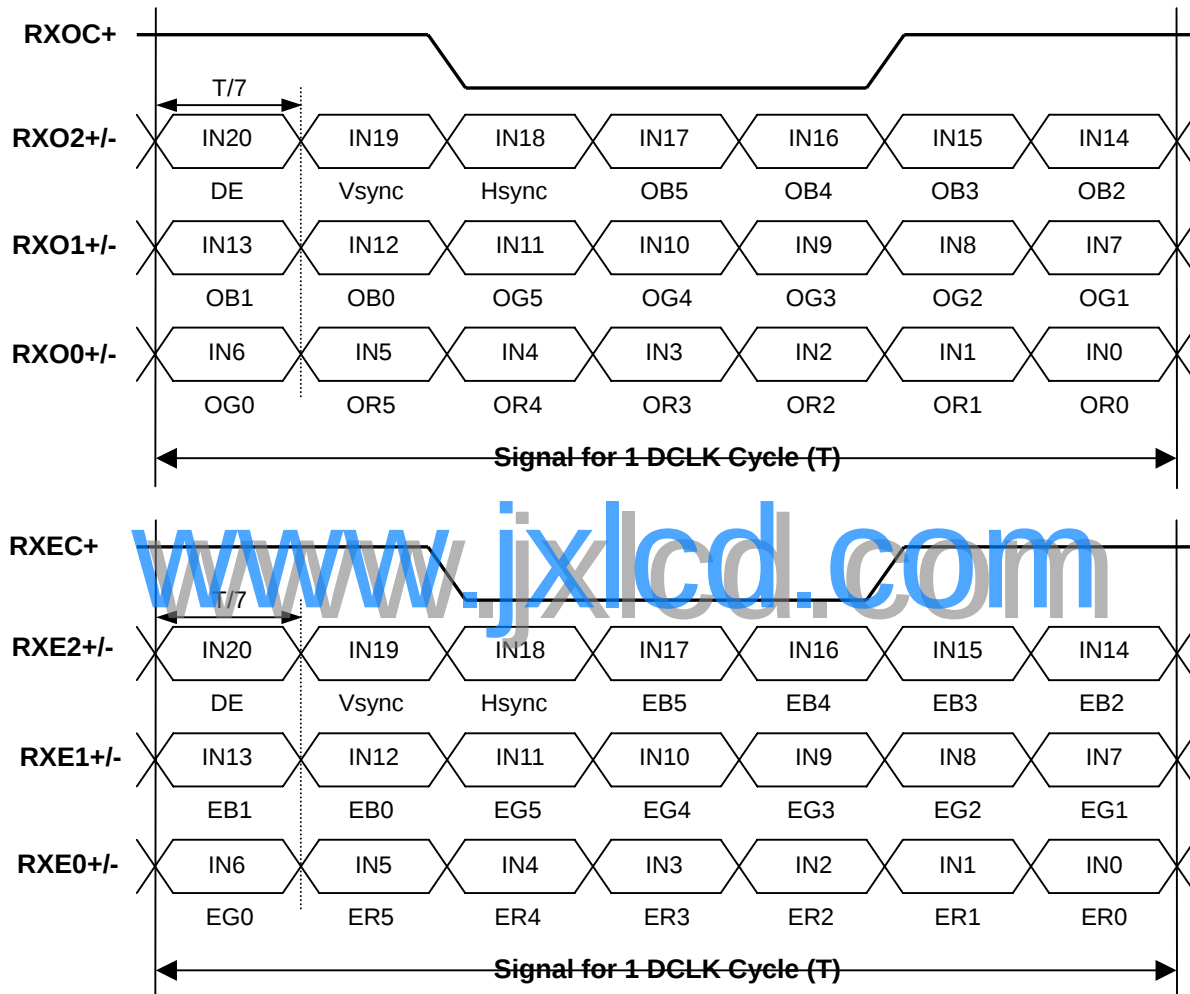
## 5.2 BACKLIGHT UNIT

| Pin | Symbol | Description  | Color |
|-----|--------|--------------|-------|
| 1   | HV     | High Voltage | Pink  |
| 2   | LV     | Ground       | Black |

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

## 5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



#### 5.4 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  | 1  | 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  | 1  | 1     | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(62)     | 0           | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Green(63)           | 0             | 0           | 0  | 0  | 0  | 1  | 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  | 1  | 1    | 1  | 1  | 0  | 1  |    |
|                     | Blue(62)      | 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  | 1  | 1  | 1    | 1  | 1  | 1  |    |    |

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

## 5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD 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 (N154C5-L01)                 | 43             | 01000011          |
| 11                  | 0B              | ID product code (hex LSB first; N154C5-L01)  | 15             | 00010101          |
| 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)        | 32             | 00110010          |
| 17                  | 11              | Year of manufacture (fixed year code)        | 10             | 00010000          |
| 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              | Active area horizontal 33.156cm              | 21             | 00100001          |
| 22                  | 16              | Active area vertical 20.7225cm               | 15             | 00010101          |
| 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              | 7E             | 01111110          |
| 26                  | 1A              | Bx1 Bx0 By1 By0 Wx1 Wx0 Wy1 Wy0              | C0             | 11000000          |
| 27                  | 1B              | Rx= 0.595                                    | 98             | 10011000          |
| 28                  | 1C              | Ry= 0.343                                    | 57             | 01010111          |
| 29                  | 1D              | Gx= 0.320                                    | 51             | 01010001          |
| 30                  | 1E              | Gy= 0.538                                    | 89             | 10001001          |
| 31                  | 1F              | Bx= 0.152                                    | 26             | 00100110          |
| 32                  | 20              | By= 0.129                                    | 21             | 00100001          |
| 33                  | 21              | Wx= 0.313                                    | 50             | 01010000          |
| 34                  | 22              | Wy= 0.329                                    | 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 ("88.75MHz", According to VESA CVT Rev1.1)    | AB | 10101011 |
| 55 | 37 | # 1 Pixel clock (hex LSB first)                                                           | 22 | 00100010 |
| 56 | 38 | # 1 H active ("1440")                                                                     | A0 | 10100000 |
| 57 | 39 | # 1 H blank ("160")                                                                       | A0 | 10100000 |
| 58 | 3A | # 1 H active : H blank ("1440 : 160")                                                     | 50 | 01010000 |
| 59 | 3B | # 1 V active ("900")                                                                      | 84 | 10000100 |
| 60 | 3C | # 1 V blank ("26")                                                                        | 1A | 00011010 |
| 61 | 3D | # 1 V active : V blank ("900 : 26")                                                       | 30 | 00110000 |
| 62 | 3E | # 1 H sync offset ("48")                                                                  | 30 | 00110000 |
| 63 | 3F | # 1 H sync pulse width ("32")                                                             | 20 | 00100000 |
| 64 | 40 | # 1 V sync offset : V sync pulse width ("3 : 6")                                          | 36 | 00110110 |
| 65 | 41 | # 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48 : 32 : 3 : 6") | 00 | 00000000 |
| 66 | 42 | # 1 H image size ("332 mm")                                                               | 4C | 01001100 |
| 67 | 43 | # 1 V image size ("207 mm")                                                               | CF | 11001111 |
| 68 | 44 | # 1 H image size : V image size ("332 : 207")                                             | 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 "N154C5-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 ("5")                                                           | 35 | 00110101 |
| 80 | 50 | # 2 4th character of name ("4")                                                           | 34 | 00110100 |
| 81 | 51 | # 2 5th character of name ("C")                                                           | 43 | 01000011 |
| 82 | 52 | # 2 6th character of name ("5")                                                           | 35 | 00110101 |
| 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 "N154C3-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 ("5")                                    | 35 | 00110101 |
| 116 | 74 | # 4 4th character of name ("4")                                    | 34 | 00110100 |
| 117 | 75 | # 4 5th character of name ("C")                                    | 43 | 01000011 |
| 118 | 76 | # 4 6th character of name ("5")                                    | 35 | 00110101 |
| 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                                                           | 73 | 01110011 |

## 6 INTERFACE TIMING

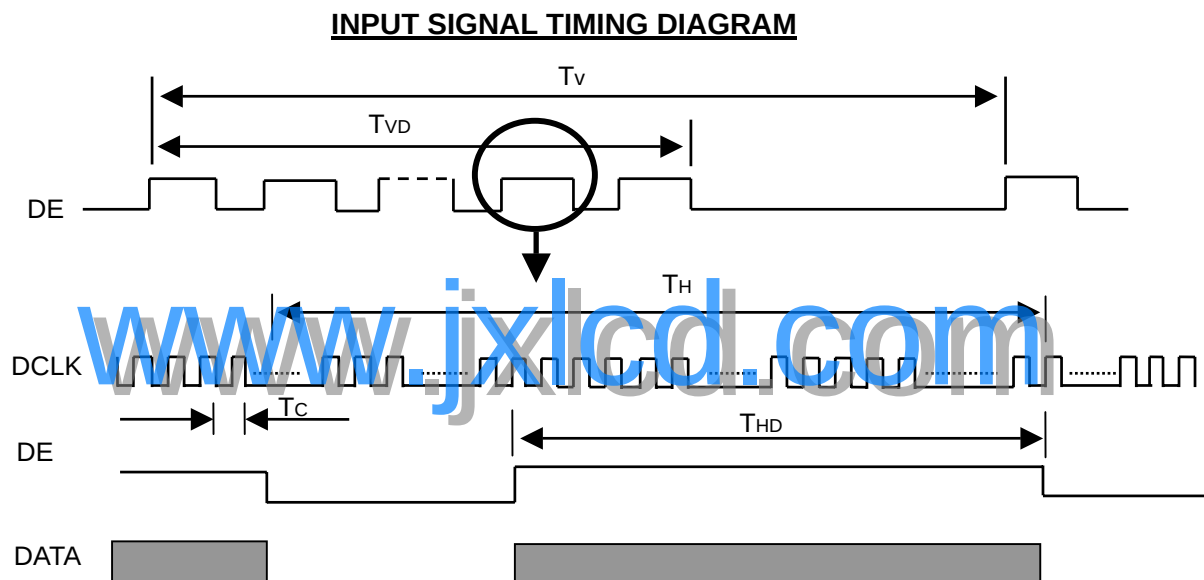
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

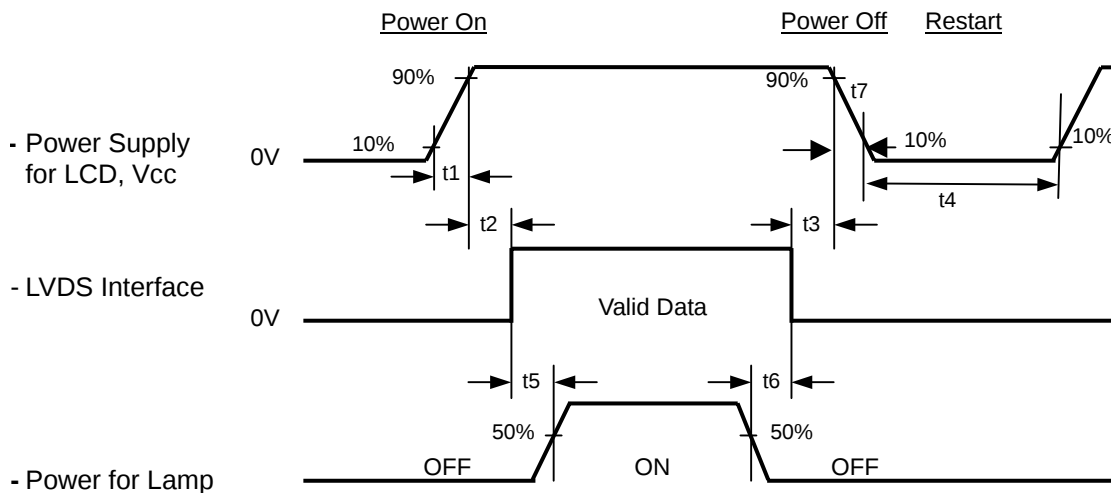
| Signal | Item                              | Symbol | Min.   | Typ. | Max.   | Unit | Note |
|--------|-----------------------------------|--------|--------|------|--------|------|------|
| DCLK   | Frequency                         | 1/Tc   | 25     | 44.5 | 60     | MHz  | (2)  |
| DE     | Vertical Total Time               | TV     | 910    | 926  | 1500   | 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     | 760    | 800  | 880    | Tc   | (2)  |
|        | Horizontal Active Display Period  | THD    | 720    | 720  | 720    | Tc   | (2)  |
|        | Horizontal Active Blanking Period | THB    | TH-THD | 80   | TH-THD | Tc   | (2)  |

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

(2) 2 channels LVDS input.



## 6.2 POWER ON/OFF SEQUENCE



### Timing Specifications:

|     |    |        |
|-----|----|--------|
| 0.5 | t1 | 10 ms  |
| 0   | t2 | 50 ms  |
| 0   | t3 | 50 ms  |
|     | t4 | 500 ms |
|     | t5 | 200 ms |
|     | t6 | 200 ms |

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 inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter 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 5 t7 300 ms.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

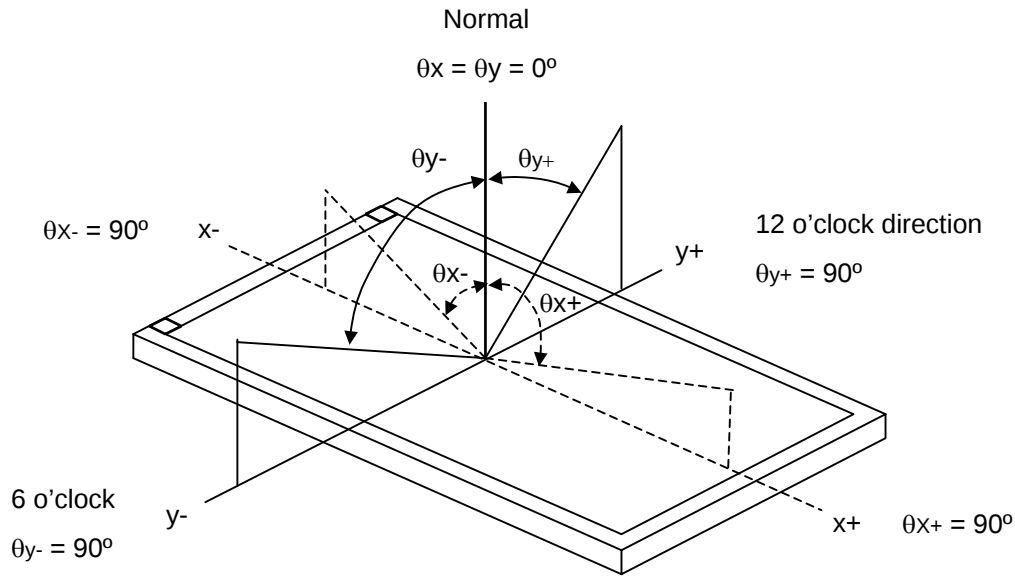
| Item                       | Symbol                                                        | Value | Unit |
|----------------------------|---------------------------------------------------------------|-------|------|
| Ambient Temperature        | Ta                                                            | 25±2  | °C   |
| Ambient Humidity           | Ha                                                            | 50±10 | %RH  |
| Supply Voltage             | V <sub>CC</sub>                                               | 3.3   | V    |
| Input Signal               | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |       |      |
| Inverter Current           | I <sub>L</sub>                                                | 6.0   | mA   |
| Inverter Driving Frequency | F <sub>L</sub>                                                | 61    | KHz  |
| Inverter                   | Sumida-H05-4915                                               |       |      |

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (5).

### 7.2 OPTICAL SPECIFICATIONS

| Item                                       | Symbol           | Condition                                                    | Min.         | Typ.  | Max.         | Unit              | Note     |
|--------------------------------------------|------------------|--------------------------------------------------------------|--------------|-------|--------------|-------------------|----------|
| Contrast Ratio                             | CR               | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing Normal Angle | 300          | 500   | -            | -                 | (2), (5) |
| Response Time                              | T <sub>R</sub>   |                                                              | -            | 3     | 8            | ms                | (3)      |
|                                            | T <sub>F</sub>   |                                                              | -            | 7     | 12           | ms                |          |
| Central Luminance of White                 | L <sub>C</sub>   |                                                              | 230          | 275   |              | cd/m <sup>2</sup> | (4), (5) |
| Average Luminance of White<br>( 5 points ) | L <sub>AVE</sub> |                                                              | 220          | 260   | -            | cd/m <sup>2</sup> | (4), (5) |
| White Variation                            | $\delta W$ 5pts  |                                                              | -            | -     | 1.3          | -                 | (5), (6) |
| Color Chromaticity                         | Red              | R <sub>x</sub>                                               | TYP<br>-0.03 | 0.595 | TYP<br>+0.03 | -                 | (1)      |
|                                            |                  | R <sub>y</sub>                                               |              | 0.343 |              | -                 |          |
|                                            | Green            | G <sub>x</sub>                                               |              | 0.320 |              | -                 |          |
|                                            |                  | G <sub>y</sub>                                               |              | 0.538 |              | -                 |          |
|                                            | Blue             | B <sub>x</sub>                                               |              | 0.152 |              | -                 |          |
|                                            |                  | B <sub>y</sub>                                               |              | 0.129 |              | -                 |          |
|                                            | White            | W <sub>x</sub>                                               |              | 0.313 |              | -                 |          |
|                                            |                  | W <sub>y</sub>                                               |              | 0.329 |              | -                 |          |
| Viewing Angle                              | Horizontal       | $\theta_{x+}$                                                | 40           | 45    | -            | Deg.              |          |
|                                            |                  | $\theta_{x-}$                                                | 40           | 45    | -            |                   |          |
|                                            | 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.

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

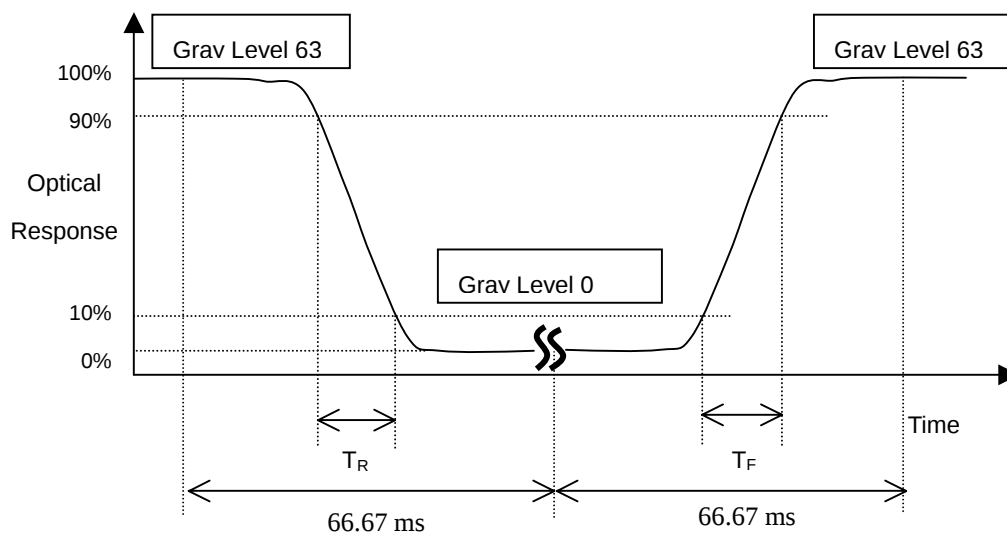
$L_{63}$ : Luminance of gray level 63

$L_0$ : Luminance of gray level 0

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

**CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).**

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



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

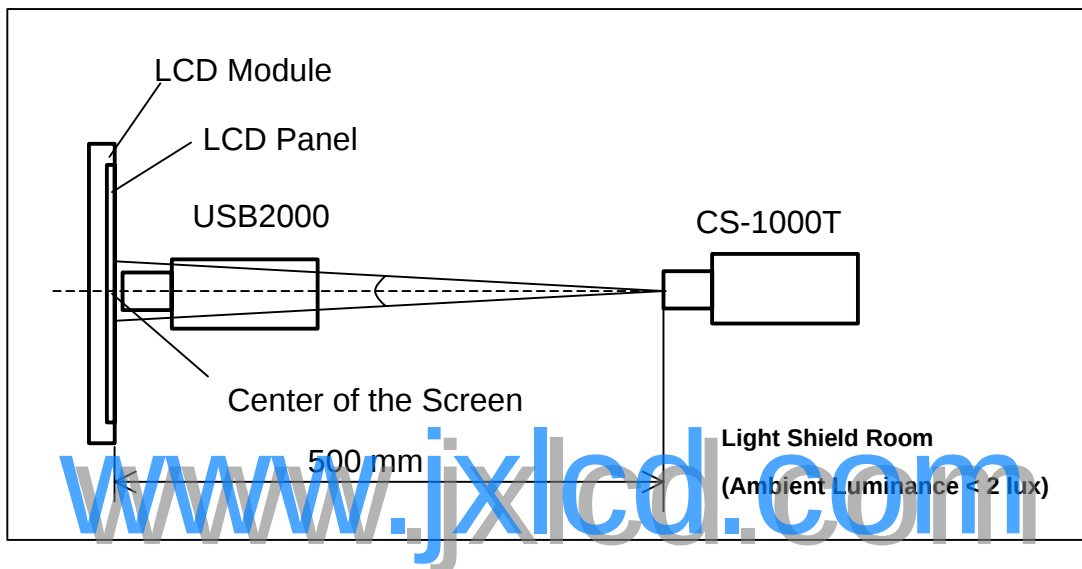
Measure the luminance of gray level 63 at 5 points

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

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

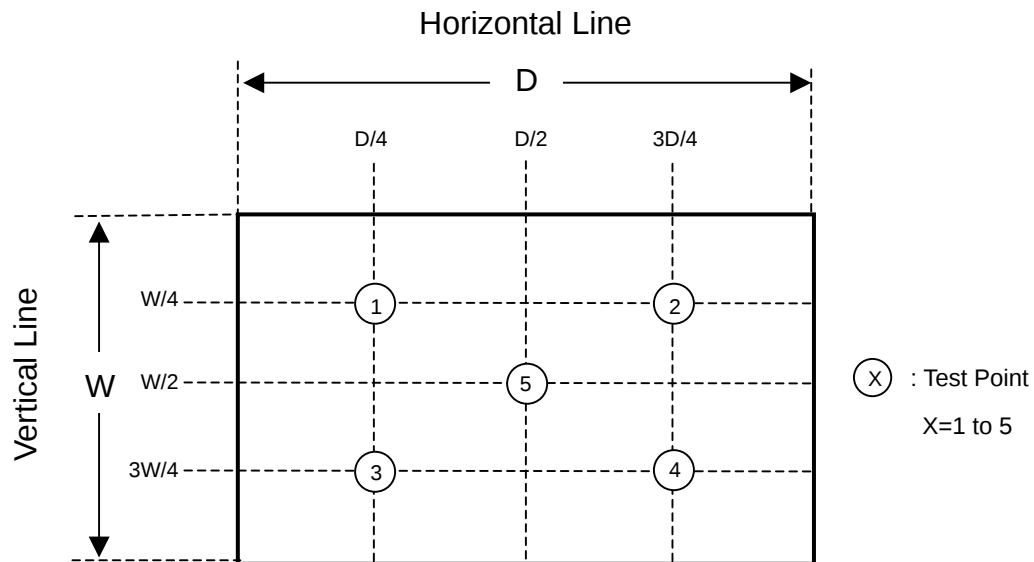
The LCD module should be stabilized at given temperature for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 15 minutes in a windless room.



Note (6) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 63 at 5 points

$$\delta W_{5p} = \text{Maximum } [L(1) \sim L(5)] / \text{Minimum } [L(1) \sim L(5)]$$



Active Area

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## 8 PRECAUTIONS

### 8.1 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.

### 8.2 STORAGE PRECAUTIONS

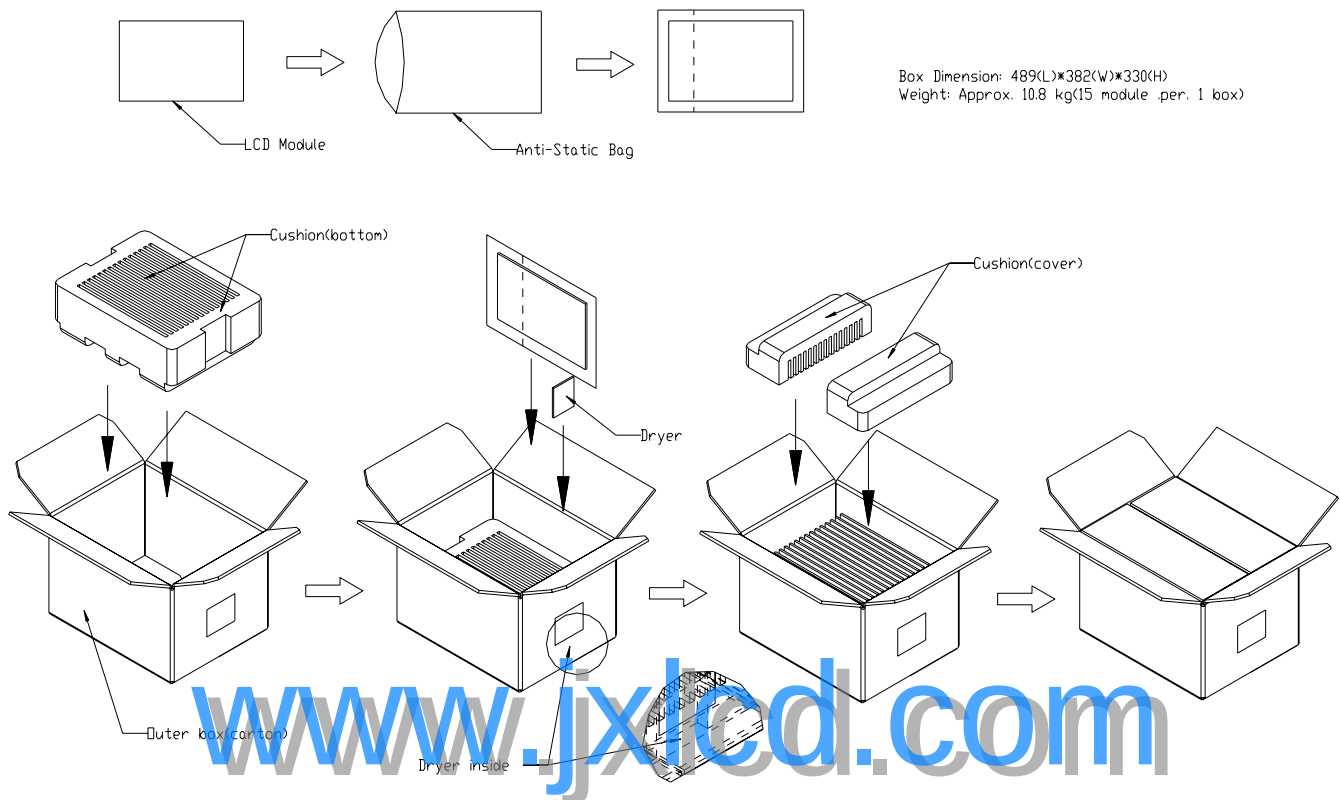
- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the 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.

### 8.3 OPERATION PRECAUTIONS

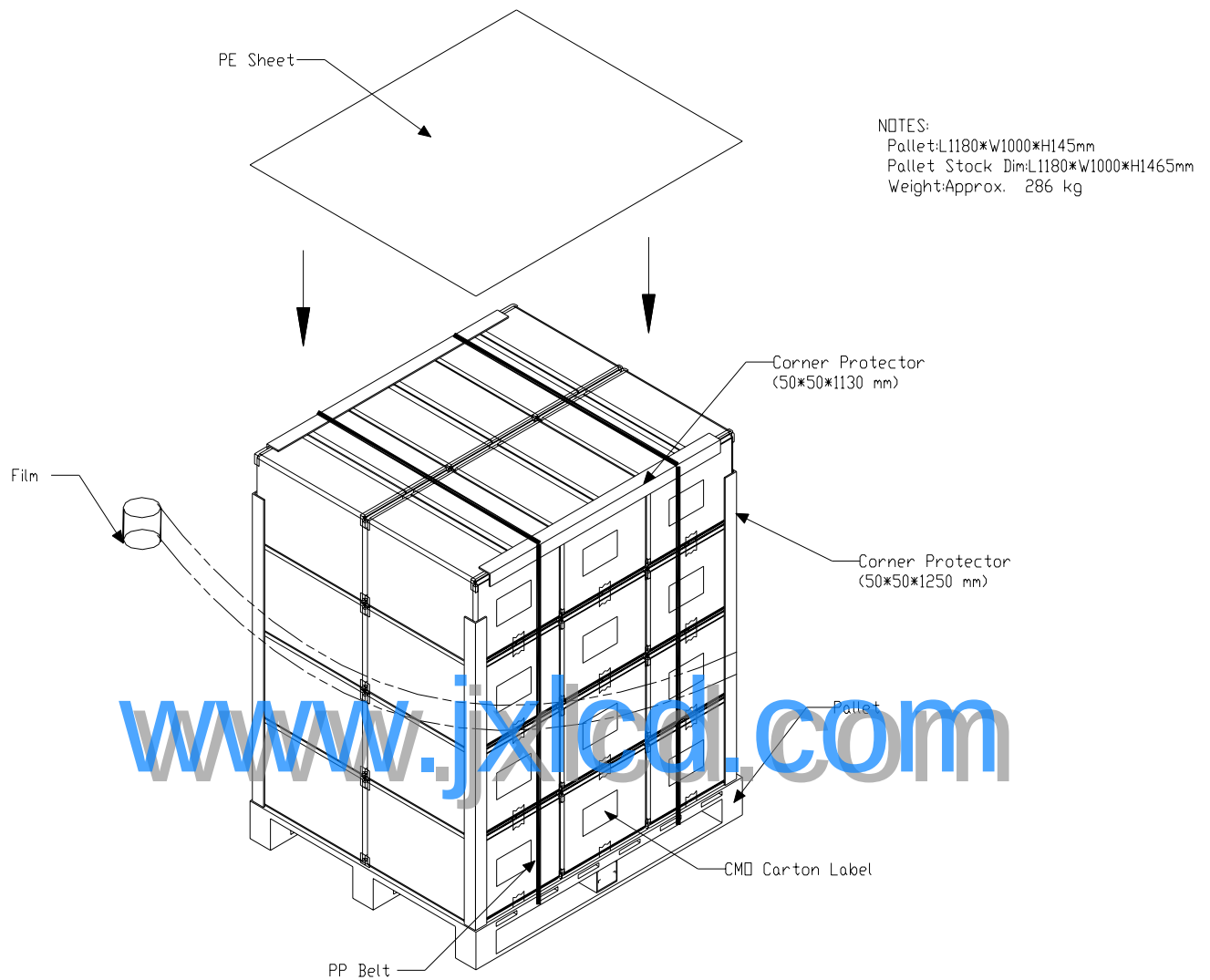
- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000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

## 9. PACKING

### 9.1 CARTON



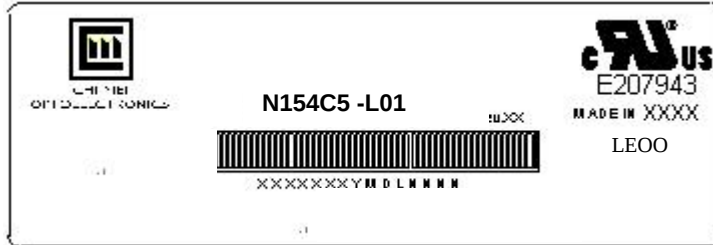
## 9.2 PALLET



## 10 DEFINITION OF LABELS

### 10.1 CMO MODULE LABEL

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



(a) Model Name: N154C5-L01

(b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.

(c) Serial ID: XXXXXXYYMDLNNN



(d) Production Location: MADE IN XXXX. XXXX stands for production location.

(e) UL logo: LEOO especially stands for panel manufactured by CMO NingBo satisfying UL requirement.

The panel without LEOO mark stands for manufactured by CMO Taiwan satisfying UL requirement.

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

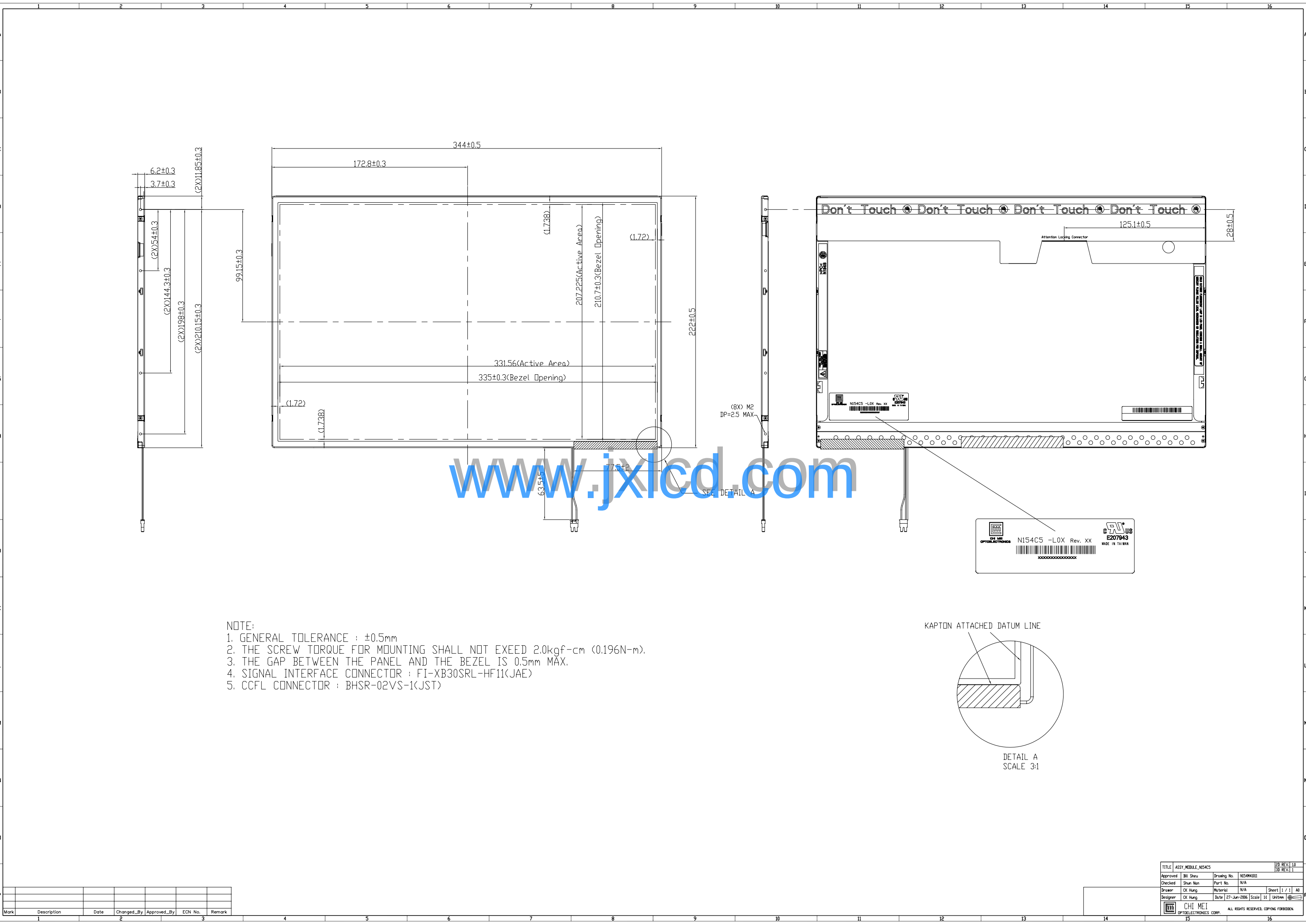
## 10.2 CARTON LABEL



The image shows a template for a carton label. It features the CHI MEI logo at the top left, followed by the text "CHI MEI OPTOELECTRONICS". Below this are four lines for text entry: "P.O.NO.", "Part ID.", "Model Name", and "Carton ID." followed by "Quantities". At the bottom center, it says "Made in XXXX". To the right of this is a yellow circular logo with "GP" inside, and below it, the text "Rolls". The entire label is enclosed in a black border.

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

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| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|------|-------------|------|------------|-------------|---------|--------|
| 1    |             |      |            |             |         |        |
| 2    |             |      |            |             |         |        |
| 3    |             |      |            |             |         |        |

| TITLE ASSY_MODULE_N154CS      |           |             |             |       |       | PD REV. 1.0                            |
|-------------------------------|-----------|-------------|-------------|-------|-------|----------------------------------------|
| Approved                      | Bill Shou | Drawing No. | N154M4011   |       |       | 3D REV. 1.1                            |
| Checked                       | Shun Nan  | Part No.    | N/A         |       |       |                                        |
| Drawn                         | CK Hung   | Material    | N/A         | Sheet | 1 / 1 | A0                                     |
| Designer                      | CK Hung   | Date        | 27-Jun-2006 | Scale | 1:1   | Unit:mm                                |
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