# TFT LCD Approval Specification

# MODEL NO.: N121X5 -L04

Customer : _____

Approved by : _____

Note :

| Liquid Crystal Display Division | |
|---|---|
| QRA Division. | OA Head Division. |
| Approval | Approval |
| 陳 94. 6. 6 永一 | 林 94. 6. 6 添仁 |

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## REVISION HISTORY

| Version | Date | Page (New) | Section | Description |
|---|---|---|---|---|
| Ver 2.0 | Jun. 06. '05 | All | All | Approval specification first issued. |

# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

N121X5 -L04 is a 12.1" TFT Liquid Crystal Display module with single CCFL Backlight unit and 20 pins LVDS interface. This module supports 1024 x 768 XGA 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
- XGA (1024 x 768 pixels) resolution
- DE (Data Enable) only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- Support EDID Structure Version 1 Revision 3

## 1.3 APPLICATION

- TFT LCD Notebook

## 1.4 GENERAL SPECIFICATI0NS

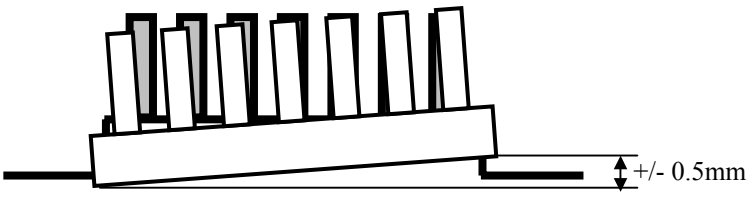
| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 245.76 (H) X 184.32 (V) | mm | (1) |
| Bezel Opening Area | 250.5 (H) x 188.9 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1024 x R.G.B. x 768 | pixel | - |
| Pixel Pitch | 0.24 (H) x 0.24 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 262,144 | color | - |
| Transmissive Mode | Normally white | - | - |
| Surface Treatment | Hard coating (3H), Anti-glare (Haze 25 %) | - | - |

## 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 260.5 | 261 | 261.5 | mm | (1) |
| | Vertical(V) | 197.5 | 198 | 198.5 | mm | |
| | Depth(D) | -- | 4.7 | 5.0 | mm | |
| Weight | | -- | 240 | 255 | g | - |

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

Note (2) Connector mounting position



## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

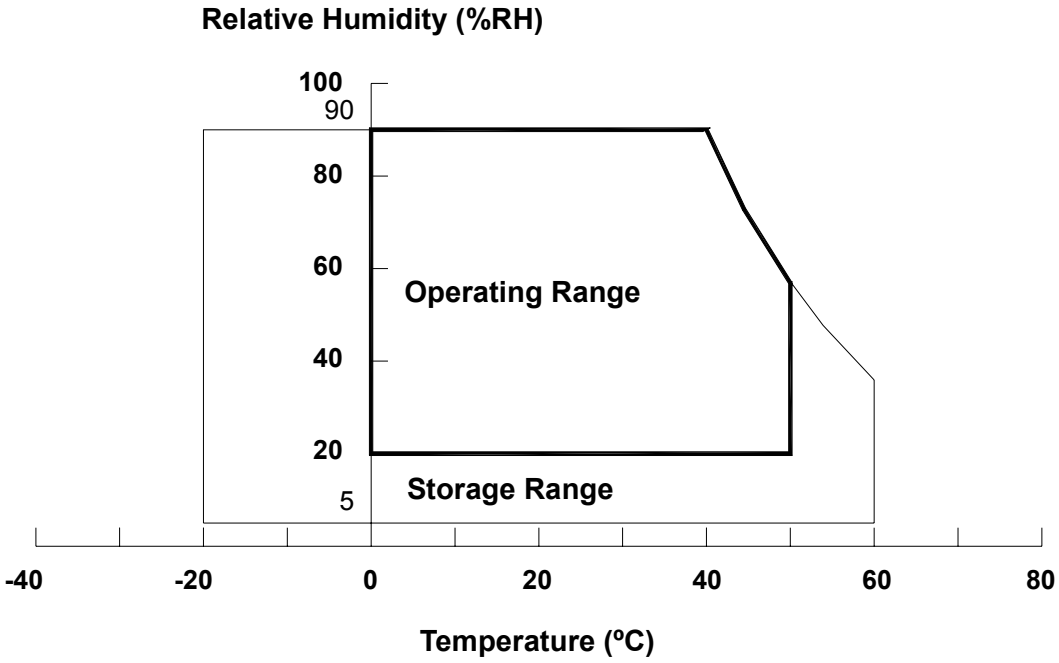
| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -20 | +60 | ºC | (1) |
| Operating Ambient Temperature | $T_{OP}$ | 0 | +50 | ºC | (1), (2) |
| Shock (Non-Operating) | $S_{NOP}$ | - | 220 | G | (3), (5) |
| Vibration (Non-Operating) | $V_{NOP}$ | - | 1.5 | G | (4), (5) |

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

(a) 90 %RH Max. (Ta ≦ 40 ºC).

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

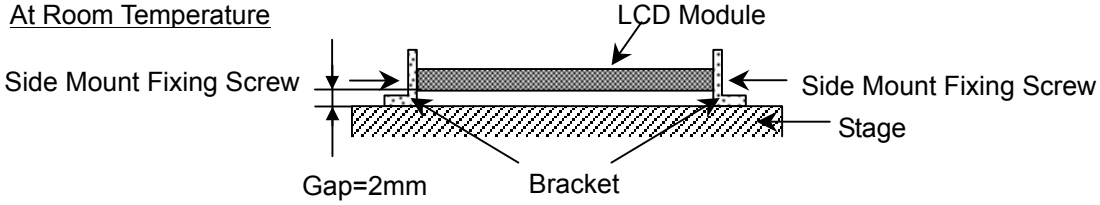
(c) No condensation .




Note (2) The temperature of panel surface should be 0 ºC Min. and 50 ºC Max.

Note (3) 2ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 0.5 Hr / Cycle, 1 cycles for each X, Y, Z. The fixing condition is shown as below:




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.

## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

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

### 2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Lamp Voltage | $V_L$ | - | 2.5K | $V_{RMS}$ | (1), (2), $I_L$ = 6.0 mA |
| Lamp Current | $I_L$ | - | 6.5 | $mA_{RMS}$ | (1), (2) |
| Lamp Frequency | $F_L$ | - | 80 | KHz | |

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).

## 3. ELECTRICAL CHARACTERISTICS

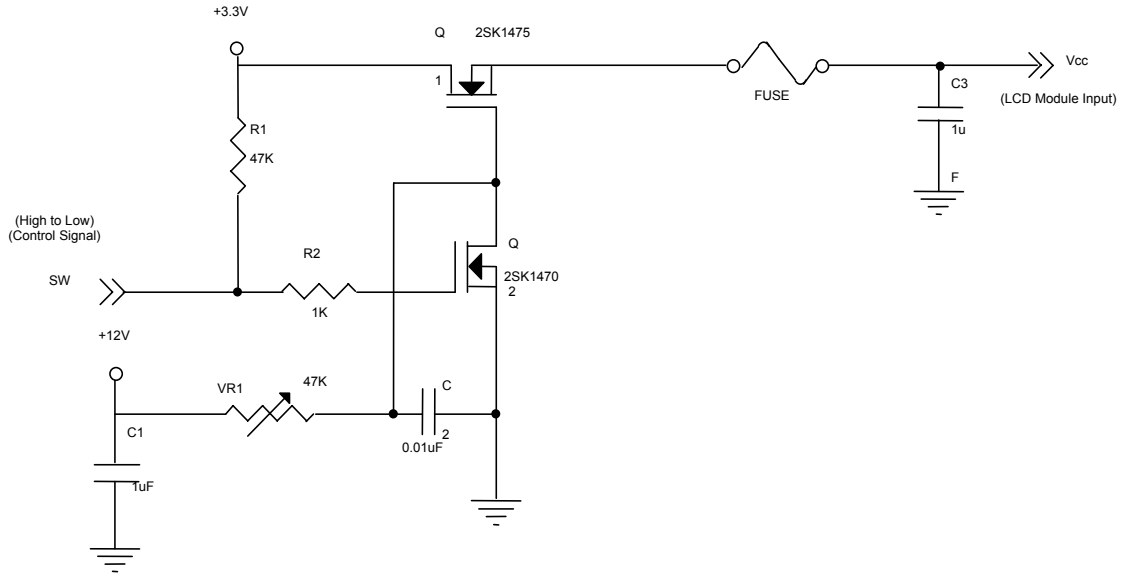
### 3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

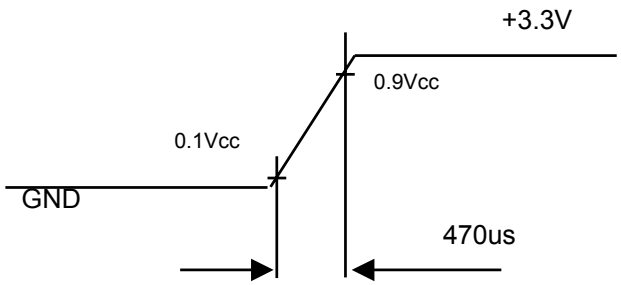
| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | Vcc | 3.0 | 3.3 | 3.6 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mV | - |
| Rush Current | | $I_{RUSH}$ | - | - | 1.5 | A | (2) |
| Power Supply Current | White | Icc | - | 230 | 270 | mA | (3)a |
| | Black | | - | 280 | 330 | mA | (3)b |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level | $V_{IH}$ | - | - | +100 | mV | - |
| | "L" Level | $V_{IL}$ | -100 | - | - | mV | - |
| Terminating Resistor | | $R_T$ | - | 100 | - | Ohm | - |

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

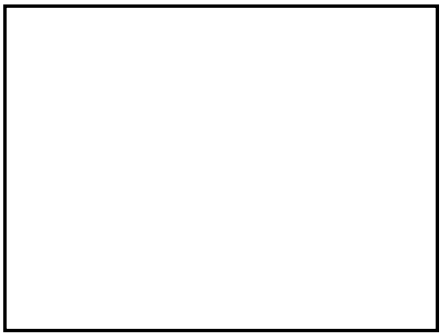



**Vcc rising time is 470us**



Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, DC Current and $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern

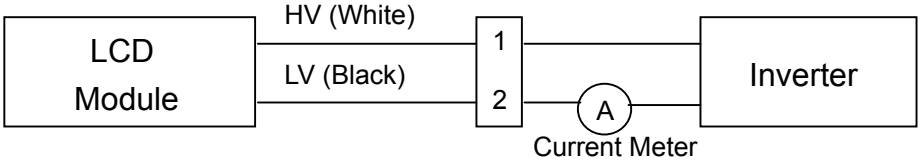
Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lamp Input Voltage | $V_L$ | 540 | 600 | 660 | $V_{RMS}$ | $I_L$ = 5.0 mA |
| Lamp Current | $I_L$ | 3.0 | 5.0 | 6.0 | $mA_{RMS}$ | (1),(7) |
| Lamp Turn On Voltage | $V_S$ | - | - | 1170 (25 °C) | $V_{RMS}$ | (2) |
| | | - | - | 1340 (0 °C) | $V_{RMS}$ | (2) |
| Operating Frequency | $F_L$ | 45 | - | 80 | KHz | (3) |
| Power Consumption | $P_L$ | - | 3.0 | - | W | (4), $I_L$ = 5.0 mA |
| Lamp Life Time | $L_{BL}$ | 10,000 | - | - | Hrs | (5) |

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




Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

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 Ta = 25 $\pm 2$ °C and $I_L = 6.0mA_{RMS}$ until one of the following events occurs:

(a) When the brightness becomes $\leqq$ 50% of its original value.

(b) When the effective ignition length becomes $\leqq$ 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.

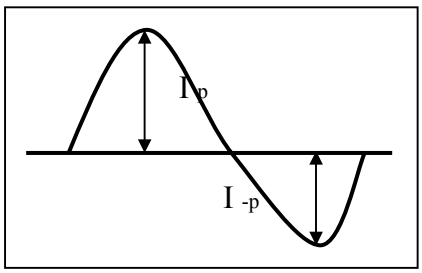
The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter, which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

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.

a. 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.



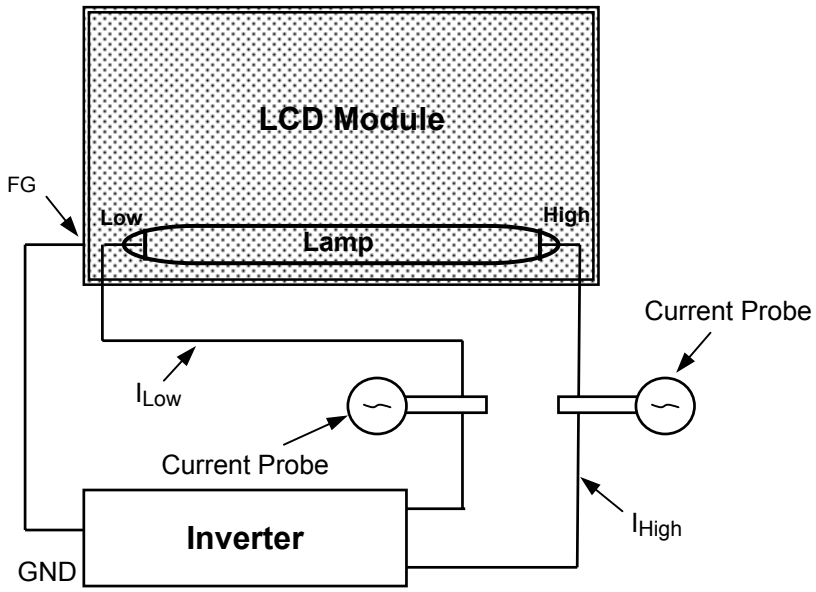

* Asymmetry rate:

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

* Distortion rate

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

Note (7) The lamp leakage current is measured by the current difference between in and out. And the measurement condition is as below:



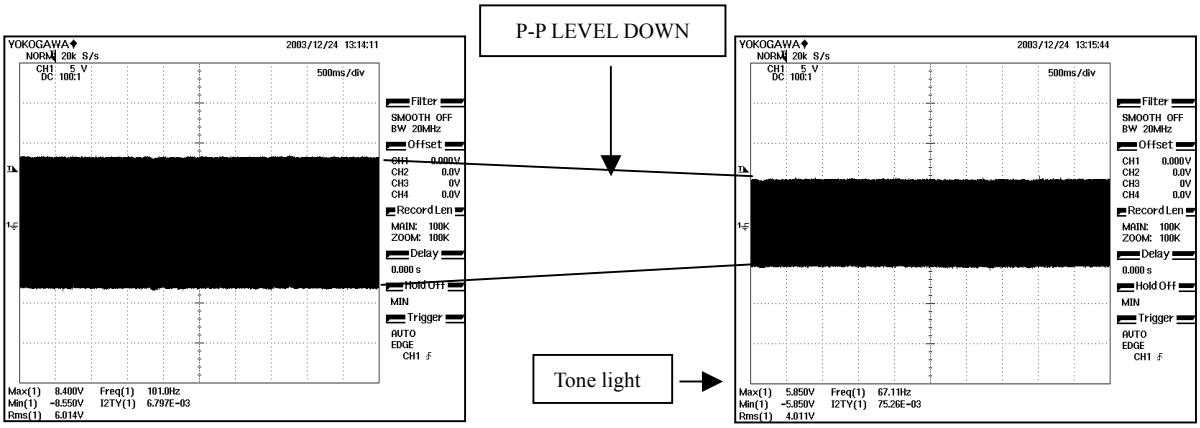

$I_{Leak(RMS)} = I_{High(RMS)} - I_{Low(RMS)}$

Note (8) About operating current min 2.0mA , lamp maker has some advice as below

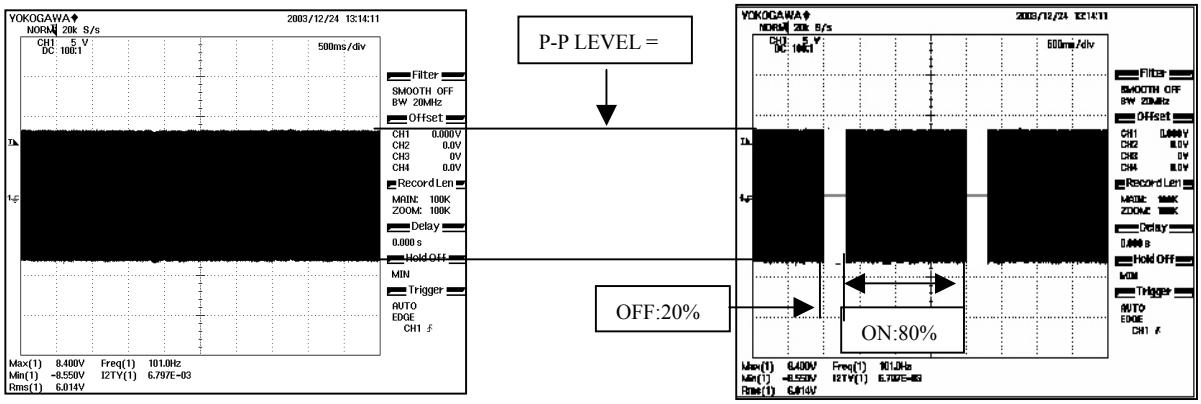
(Reference) Light quantity adjustment method

Explanation and comparison of the kind of tone light:

① Lamp current wave-like by the adjustment of the current.




② Lamp current wave-like by the adjustment of the burst.




Comparative table

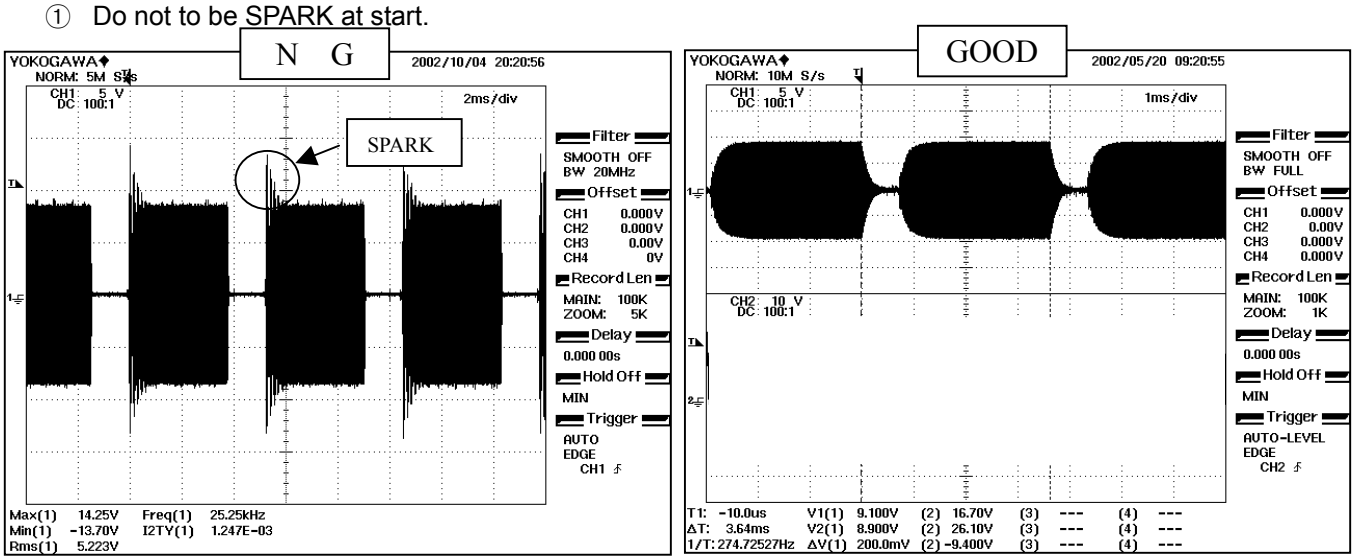
| Method | Backlight efficiency (INV＋LAMP) | Tone light rate (%) | Circuitry |
|---|---|---|---|
| ①current | Good ( 75 % ～ 85% ) | 58 | Complicated |
| ②burst | Bad ( 65 % ～ 75% ) | 10 | Easy |

Method of case that Lamp current MIN2.0mA is controlled.

It is the setting of minimum 2.0mA (MIN) to Lamp current 6.0mA in the lamp specification. The burst is excellent for circuitry. The marker proposes that pays attention to the following contents.

The attention point of the light with a touch of the burst:

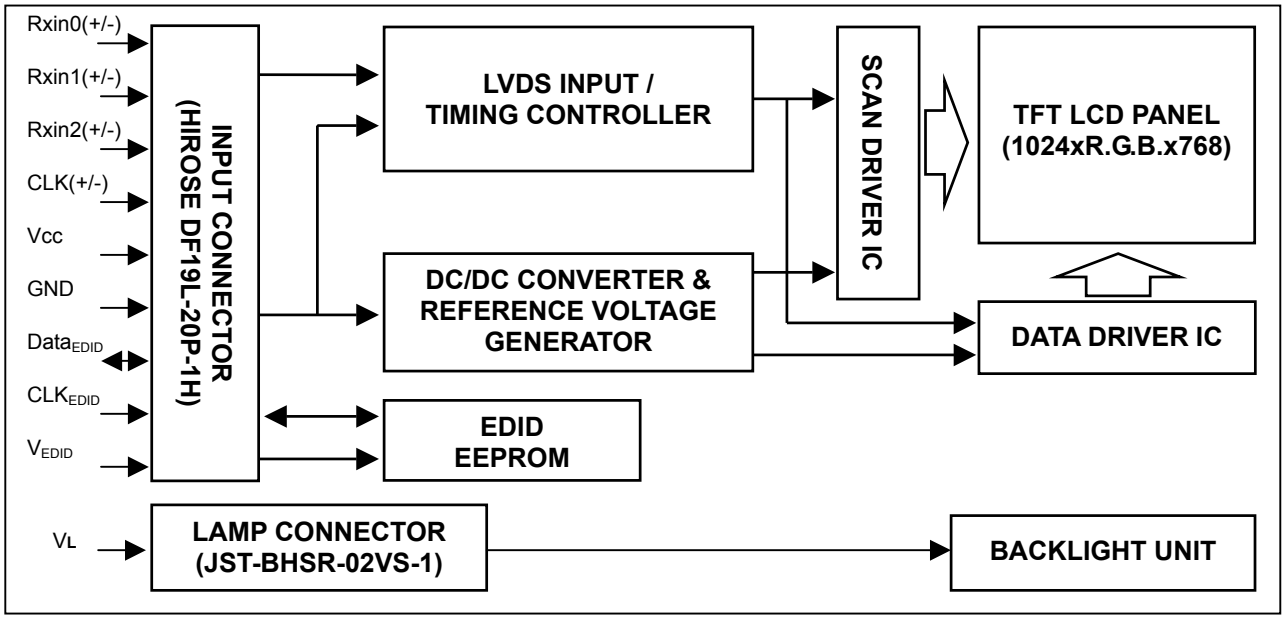
① Do not to be SPARK at start.



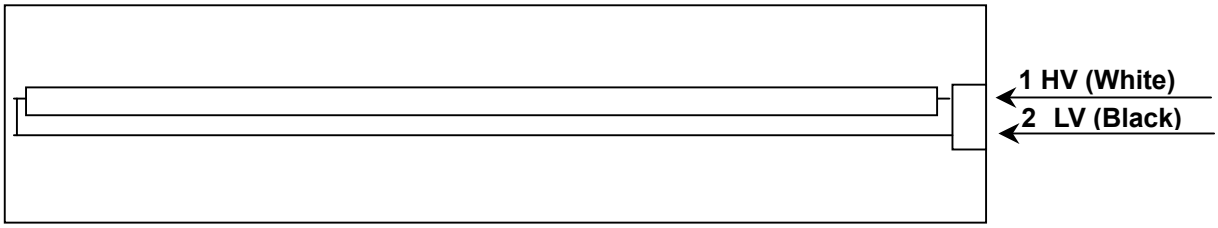

② PWM frequency does so that the frequency that is not able to divide the fixed number time, fixed number to lamp drive frequency is selected. (It is due to resonance noise occurrence prevention. ) Even the frequency that is using it for LCD avoids selecting it.

# 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 | $V_{EDID}$ | DDC 3.3V Power | | DDC 3.3V Power |
| 5 | NC | Non-Connection | | |
| 6 | $CLK_{EDID}$ | DDC Clock | | DDC Clock |
| 7 | $DATA_{EDID}$ | DDC Data | | DDC Data |
| 8 | Rxin0- | LVDS Differential Data Input | Negative | R0~R5,G0 |
| 9 | Rxin0+ | LVDS Differential Data Input | Positive | - |
| 10 | Vss | Ground | | |
| 11 | Rxin1- | LVDS Differential Data Input | Negative | G1~G5,B0,B1 |
| 12 | Rxin1+ | LVDS Differential Data Input | Positive | - |
| 13 | Vss | Ground | | |
| 14 | Rxin2- | LVDS Differential Data Input | Negative | B2~B5,DE,Hsync,Vsync |
| 15 | Rxin2+ | LVDS Differential Data Input | Positive | |
| 16 | Vss | Ground | | |
| 17 | CLK- | LVDS Clock Data Input | Negative | LVDS Level Clock |
| 18 | CLK+ | LVDS Clock Data Input | Positive | |
| 19 | Vss | Ground | | |
| 20 | Vss | Ground | | |

Note (1) The first pixel is even.

Note (2) Connector Part No.: HIROSE DF19L-20P-1H or equivalent

Note (3) User's connector Part No: HIROSE DF19G-20S-1C or equivalent

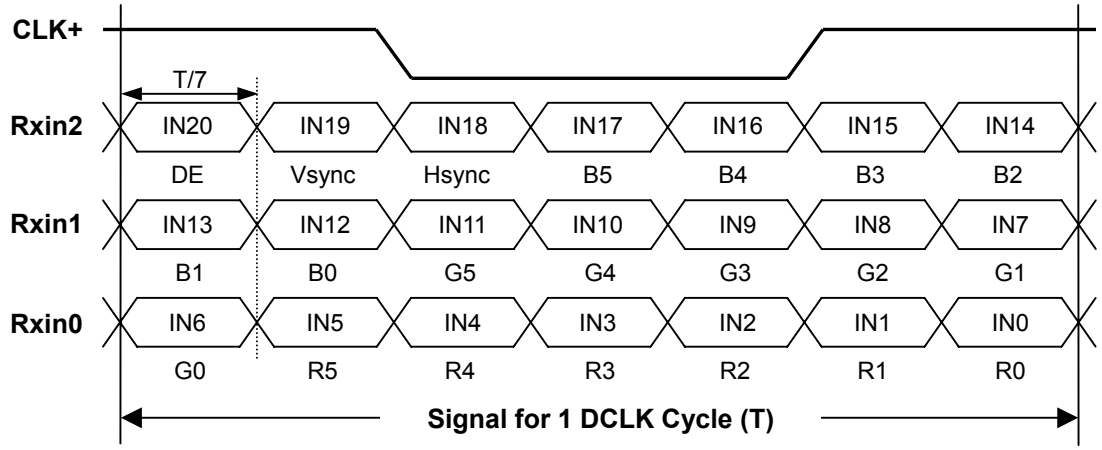
### 5.2 BACKLIGHT UNIT

| Pin | Symbol | Description | Color |
|---|---|---|---|
| 1 | HV | High Voltage | White |
| 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 | 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

## 5.5 EDID DATA STRUCTURE

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

| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (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 (N121X5-L04) | 05 | 00000100 |
| 11 | 0B | ID product code (hex LSB first; N121X5-L04) | 12 | 00010010 |
| 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 “00H” ) | 00 | 00000000 |
| 17 | 11 | Year of manufacture (fixed “00H” ) | 00 | 00000000 |
| 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 ( “24.576 cm” ) | 19 | 00011001 |
| 22 | 16 | Max V image size ( “18.432 cm” ) | 12 | 00010010 |
| 23 | 17 | Display Gamma (Gamma = ” 2.2” ) | 78 | 01111000 |
| 24 | 18 | Feature support ( “RGB, preferred timing” ) | 0A | 00001010 |
| 25 | 19 | Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0) | FE | 11111110 |
| 26 | 1A | Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0) | 65 | 01100101 |
| 27 | 1B | Red-x (Rx = “0.585”) | 95 | 10010101 |
| 28 | 1C | Red-y (Ry = “0.335”) | 55 | 01010101 |
| 29 | 1D | Green-x (Gx = “0.32”) | 51 | 01010001 |
| 30 | 1E | Green-y (Gy = “0.53”) | 87 | 10000111 |
| 31 | 1F | Blue-x (Bx = “0.15”) | 26 | 00100110 |
| 32 | 20 | Blue-y (By = “0.135”) | 22 | 00100010 |
| 33 | 21 | White-x (Wx = “0.313”) | 50 | 01010000 |
| 34 | 22 | White-y (Wy = “0.329”) | 54 | 01010100 |
| 35 | 23 | Established timings 1 | 00 | 00000000 |
| 36 | 24 | Established timings 2 (1024x768@60Hz) | 08 | 00001000 |
| 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 |

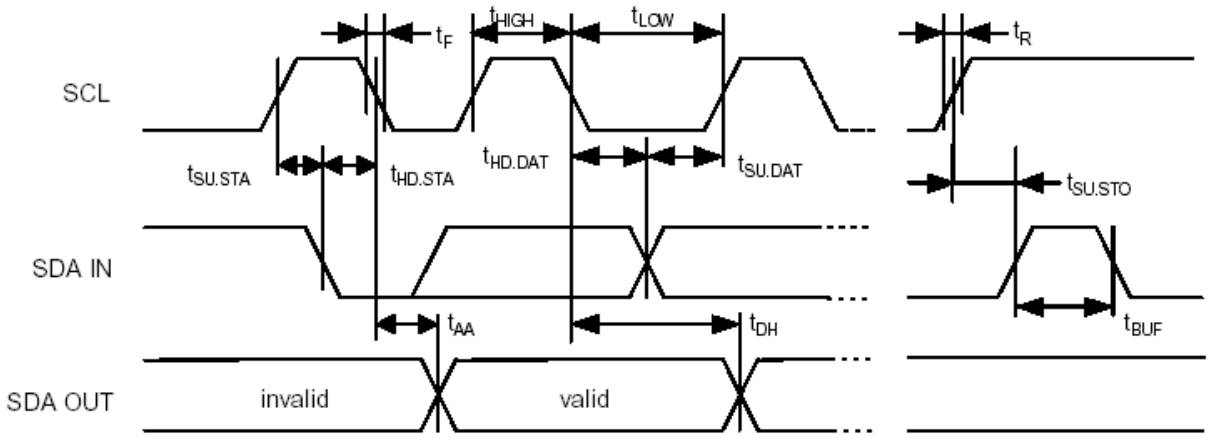
| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (binary) |
|---|---|---|---|---|
| 42 | 2A | Standard timing ID # 3 | 01 | 00000001 |
| 43 | 2B | Standard timing ID # 3 | 01 | 00000001 |
| 44 | 2C | Standard timing ID # 4 | 01 | 00000001 |
| 45 | 2D | Standard timing 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 ( “65 MHz” ) | 64 | 01100100 |
| 55 | 37 | # 1 Pixel clock (hex LSB first) | 19 | 00011001 |
| 56 | 38 | # 1 H active ( “1024” ) | 00 | 00000000 |
| 57 | 39 | # 1 H blank ( “320” ) | 40 | 01000000 |
| 58 | 3A | # 1 H active: H blank ( “1024 : 320” ) | 41 | 01000001 |
| 59 | 3B | # 1 V active (” 768” ) | 00 | 00000000 |
| 60 | 3C | # 1 V blank (” 38” ) | 26 | 00100110 |
| 61 | 3D | # 1 V active: V blank (” 768 : 38” ) | 30 | 00110000 |
| 62 | 3E | # 1 H sync offset (” 24” ) | 18 | 00011000 |
| 63 | 3F | # 1 H sync pulse width (” 136” ) | 88 | 10001000 |
| 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 (” 24 : 136 : 3 : 6” ) | 00 | 00000000 |
| 66 | 42 | # 1 H image size (” 245.76 mm” ) | F6 | 11110110 |
| 67 | 43 | # 1 V image size (” 184.32 mm” ) | B8 | 10111000 |
| 68 | 44 | # 1 H image size: V image size (” 245 : 184” ) | 00 | 00000000 |
| 69 | 45 | # 1 H boarder (” 0” ) | 00 | 00000000 |
| 70 | 46 | # 1 V boarder (” 0” ) | 00 | 00000000 |
| 71 | 47 | # 1 Flags (” Non-Interlace, Non-Stereo, Digital Separate” ) | 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 “N121X5-L04” , ASCII) | FE | 11111110 |
| 76 | 4C | # 2 Flag | 00 | 00000000 |
| 77 | 4D | # 2 1st character of string ( “N” ) | 4E | 01001110 |
| 78 | 4E | # 2 2nd character of string ( “1” ) | 31 | 00110001 |
| 79 | 4F | # 2 3rd character of string ( “2” ) | 32 | 00110010 |
| 80 | 50 | # 2 4th character of string ( “1” ) | 31 | 00110001 |
| 81 | 51 | # 2 5th character of string ( “X” ) | 58 | 01011000 |
| 82 | 52 | # 2 6th character of string ( “5” ) | 35 | 00110101 |
| 83 | 53 | # 2 7th character of string ( “-” ) | 2D | 00101101 |
| 84 | 54 | # 2 8th character of string ( “L” ) | 4C | 01001100 |
| 85 | 55 | # 2 9th character of string ( “0” ) | 30 | 00110000 |

| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (binary) |
|---|---|---|---|---|
| 86 | 56 | # 2 10th character of string ( “4” ) | 34 | 00110100 |
| 87 | 57 | # 2 New line character # 2 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 # 3 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 “N121X5-L04”, 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 ( “2” ) | 32 | 00110010 |
| 116 | 74 | # 4 4th character of name ( “1” ) | 31 | 00110001 |
| 117 | 75 | # 4 5th character of name ( “X” ) | 58 | 01011000 |
| 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 10th character of name ( “4” ) | 34 | 00110100 |
| 123 | 7B | # 4 New line character # 4 indicates end of Monitor name | 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 | BA | 10111010 |

## 5.6 EDID SIGINAL SPECIFICATION

(1) EDID Power

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Power supply voltage | Vcc | Read Operation | 2.2 | — | 5.5 | V |




(2) DC characteristics

| | | Symbol | Min. | Max. | Unit | Index |
|---|---|---|---|---|---|---|
| SCL, SDA terminal input voltage | High Voltage | VIH | 0.7 Vcc | — | V | |
| | Low Voltage | VIL | — | 0.3 Vcc | V | |
| Hysteresis Voltage | | VHYS | 0.05 VCC | — | V | |
| Output Voltage | | VOL1<br>VOL2 | — | 0.4<br>0.6 | V | IOL=3mA, CC=2.5V<br>IOL=6mA, CC=2.5V |
| Input Leak current (Vin =0.1V~VCC) | | ILI | -10<br>-10 | 10<br>50 | uA | WP=VSS<br>WP=VCC |
| Output Leak current | | ILO | -10 | 10 | uA | Vout =0.1V~VCC, WP=VSS |
| Terminal capacity(Input, Output) | | Cin, Cout | — | 10 | pF | VCC=5.0V<br>Ta=25$^0$C, Fclk=1.0MHz |
| Operating current | | ICC Write<br>ICC Read | — | 3<br>1 | mA | VCC=5.5V,<br>SCL=400KHz |
| Stillness current (SDA=SCL=VCC) (WP=VSS,A0,A1,A2=VSS) | | ICCS | — | 30<br>100 | uA | VCC=3.0V<br>VCC=5.5V |

(3) AC characteristics (VCC=2.5~5.5V standard operation mode)

| Item | Symbol | VCC=2.5V-5.5V (Standard operation mode) | | VCC=4.5V-5.5V (High-speed operation mode) | | | |
|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Min. | Max. | Unit | Index |
| Clock frequency | Fclk | — | 100 | — | 400 | KHz | |
| Clock High Time | THIGH | 4000 | — | 900 | — | ns | |
| Clock Low Time | TLOW | 4700 | — | 1300 | — | ns | |
| SDA, SCL falling time | TR | — | 1000 | — | 300 | ns | |
| SDA, SCL rising time | TF | — | 300 | — | 300 | ns | |
| START hold time | THD: STA | 4000 | — | 600 | — | ns | |
| START setup time | TSU: STA | 4700 | — | 600 | — | ns | |
| Data input hold time | THD: Data | 0 | — | 0 | — | ns | |
| Data input setup time | TSU: Data | 250 | — | 100 | — | ns | |
| STOP setup time | TSU: STO | 4700 | — | 600 | — | ns | |
| Output decision time from a clock | TAA | — | 3500 | 100 | 900 | ns | |
| Bus free time | TBUF | 4700 | — | 1300 | — | ns | |
| Rising time of Min VIH, VIL | TOF | — | 250 | 20 | 250 | ns | CB≦100pF |
| Spike oppression | TSP | — | 50 | — | 50 | ns | |
| A write-in cycle time | TWR | — | 10 | — | 10 | ms | Byte and page mode |
| The number of times of data rewriting | — | 1M | — | 1M | — | cycles | VCC=5.0V Ta=25$^0$C, |

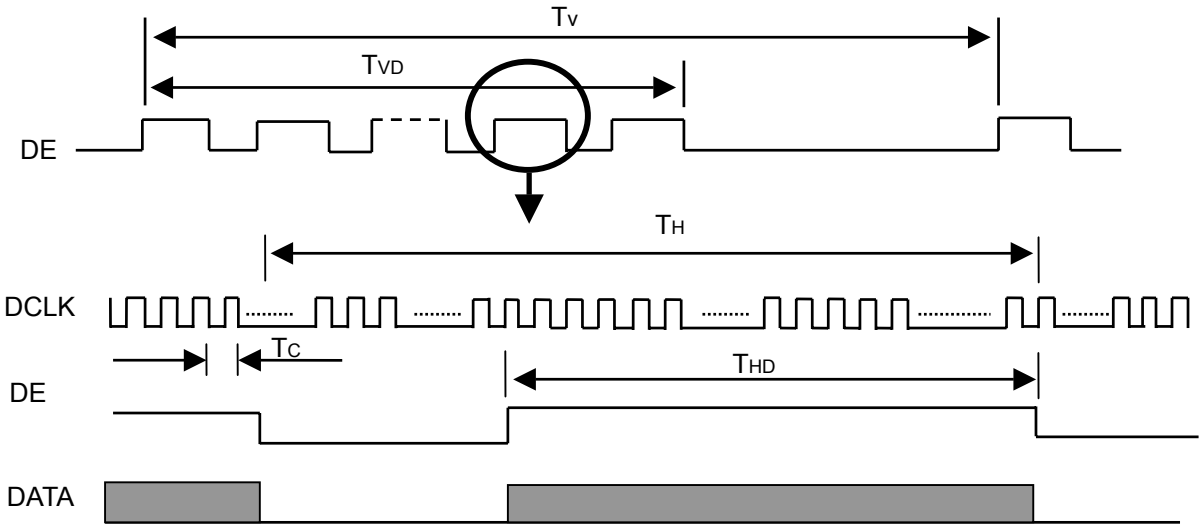
# 6. INTERFACE TIMING

## 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

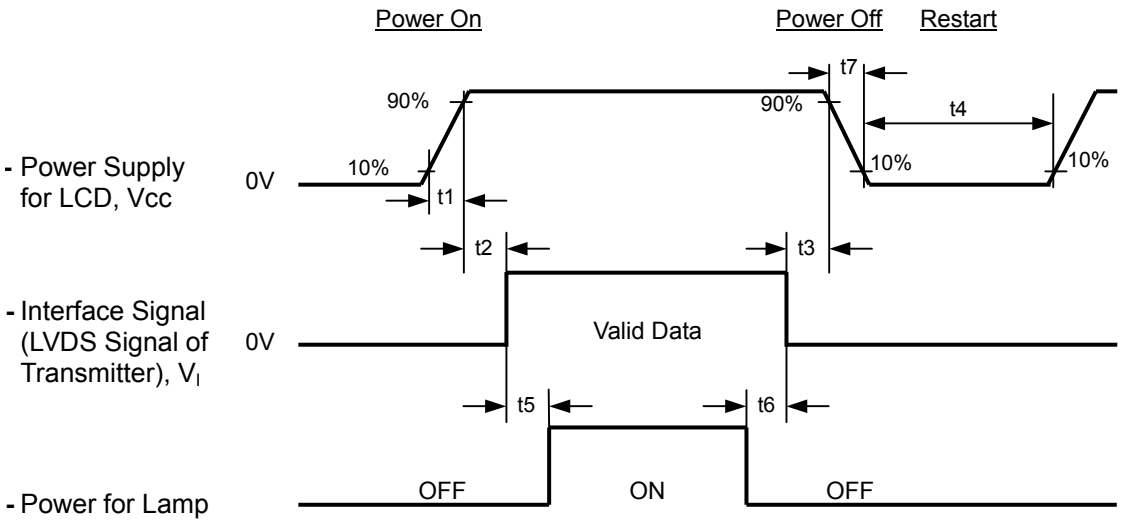
The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | 1/Tc | 50 | 65 | 68 | MHz | - |
| DE | Vertical Total Time | TV | 771 | 806 | 850 | TH | - |
| | Vertical Addressing Time | TVD | 768 | 768 | 768 | TH | - |
| | Horizontal Total Time | TH | 1200 | 1344 | 1500 | Tc | - |
| | Horizontal Addressing Time | THD | 1024 | 1024 | 1024 | Tc | - |

**INPUT SIGNAL TIMING DIAGRAM**



6.2 POWER ON/OFF SEQUENCE




Timing Specifications:

$0.5 \leqq t1 \leqq 10$ msec

$0 < t2 \leqq 50$ msec

$0 < t3 \leqq 50$ msec

$t4 \geqq 500$ msec

$t5 \geqq 200$ msec

$t6 \geqq 200$ msec

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) 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 had better to follow

$t7 \geqq 5$ msec

# 7. OPTICAL CHARACTERISTICS

## 7.1 TEST CONDITIONS

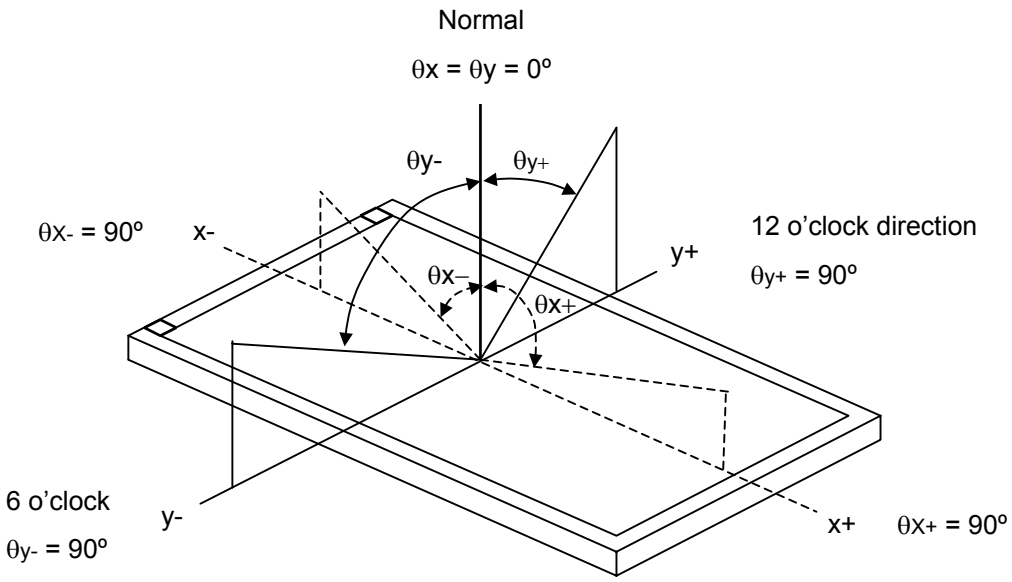
| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | $V_{CC}$ | 3.3 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Inverter Current | $I_L$ | 5.0 | mA |
| Inverter Driving Frequency | $F_L$ | 60 | 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 (6).

## 7.2 OPTICAL SPECIFICATIONS

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | $\theta_x$=0°, $\theta_Y$ =0° Viewing Normal Angle | 350 | 500 | - | - | (2), (5) |
| Response Time | | $T_R$ | | - | 5 | 10 | ms | (3) |
| | | $T_F$ | | - | 11 | 16 | ms | |
| Central Luminance of White | | $L_{AVE}$ | | 145 | 175 | - | cd/m$^2$ | (4), (5) |
| White Variation of 5 Points | | δW | | - | - | 1.25 | - | (5), (6) |
| Color Chromaticity | Red | Rx | | TYP -0.03 | 0.595 | TYP +0.03 | - | (1) |
| | | Ry | | | 0.338 | | - | |
| | Green | Gx | | | 0.320 | | - | |
| | | Gy | | | 0.533 | | - | |
| | Blue | Bx | | | 0.150 | | - | |
| | | By | | | 0.135 | | - | |
| | White | Wx | | | 0.313 | | - | |
| | | Wy | | | 0.329 | | - | |
| Viewing Angle | Horizontal | $\theta_x$+ | CR≥10 | 40 | 45 | - | Deg. | |
| | | $\theta_x$- | | 40 | 45 | - | | |
| | Vertical | $\theta_Y$+ | | 15 | 20 | - | | |
| | | $\theta_Y$- | | 40 | 45 | - | | |

Note (1) Definition of Viewing Angle (θx, θy):




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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

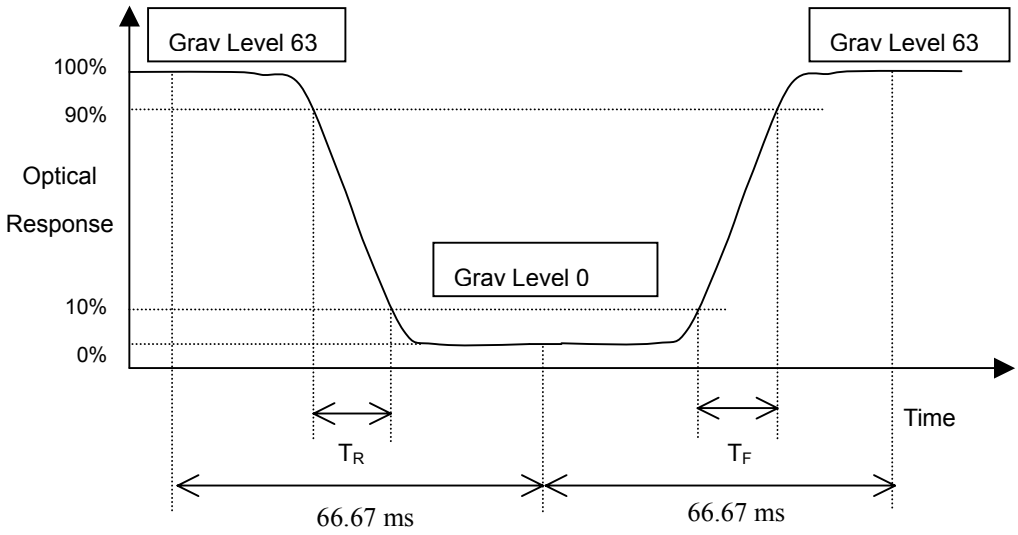
L63: Luminance of gray level 63

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 (7).

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



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

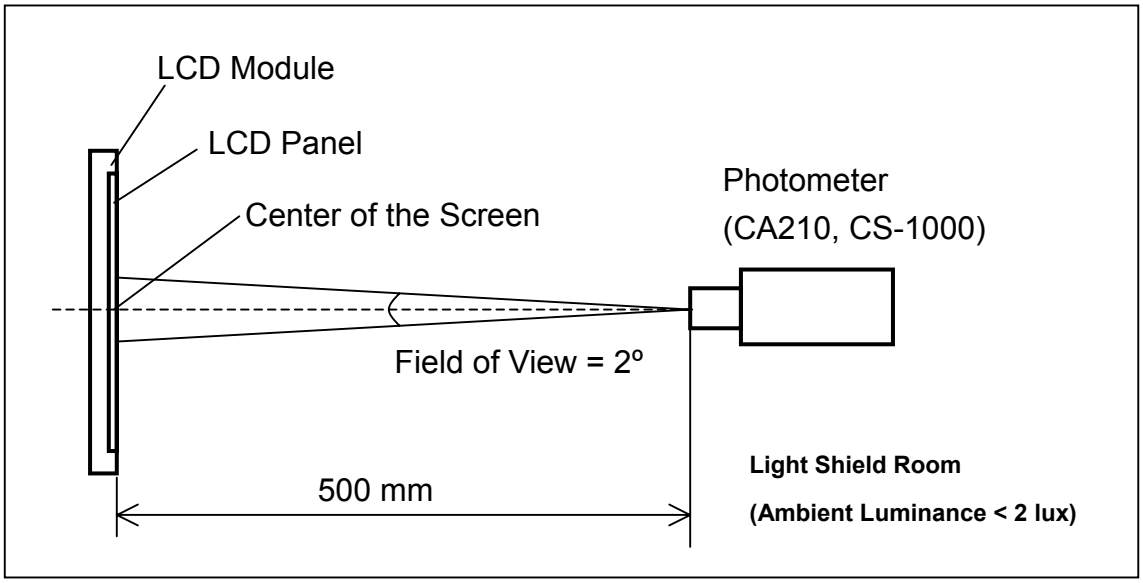
Measure the luminance of gray level 63 at 5 points

$L_{AVE}$ = [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:

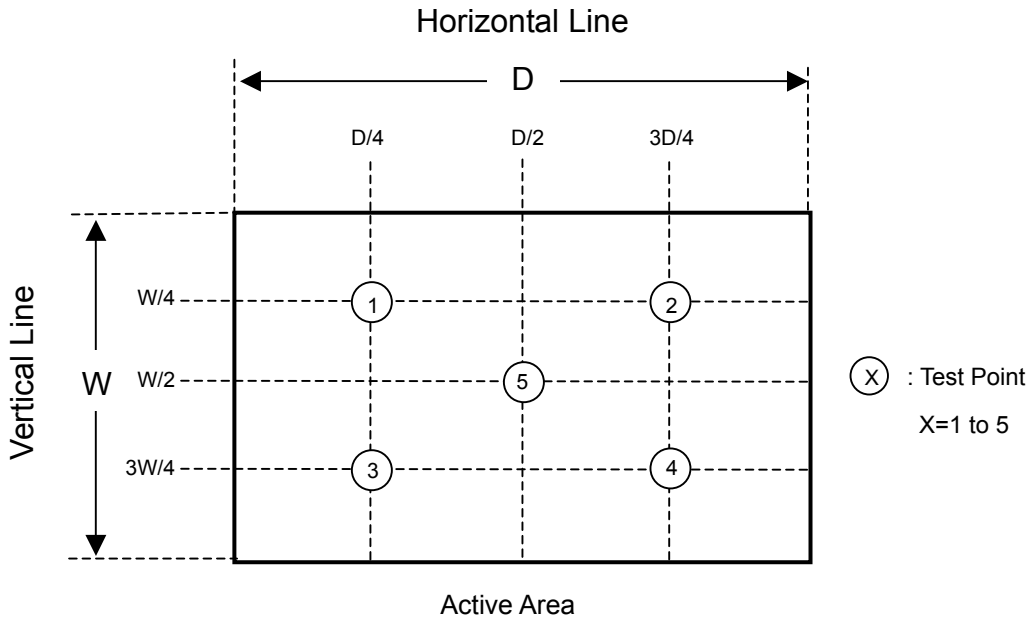
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



# 8. PRECAUTIONS

## 8.1 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 ºC. 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

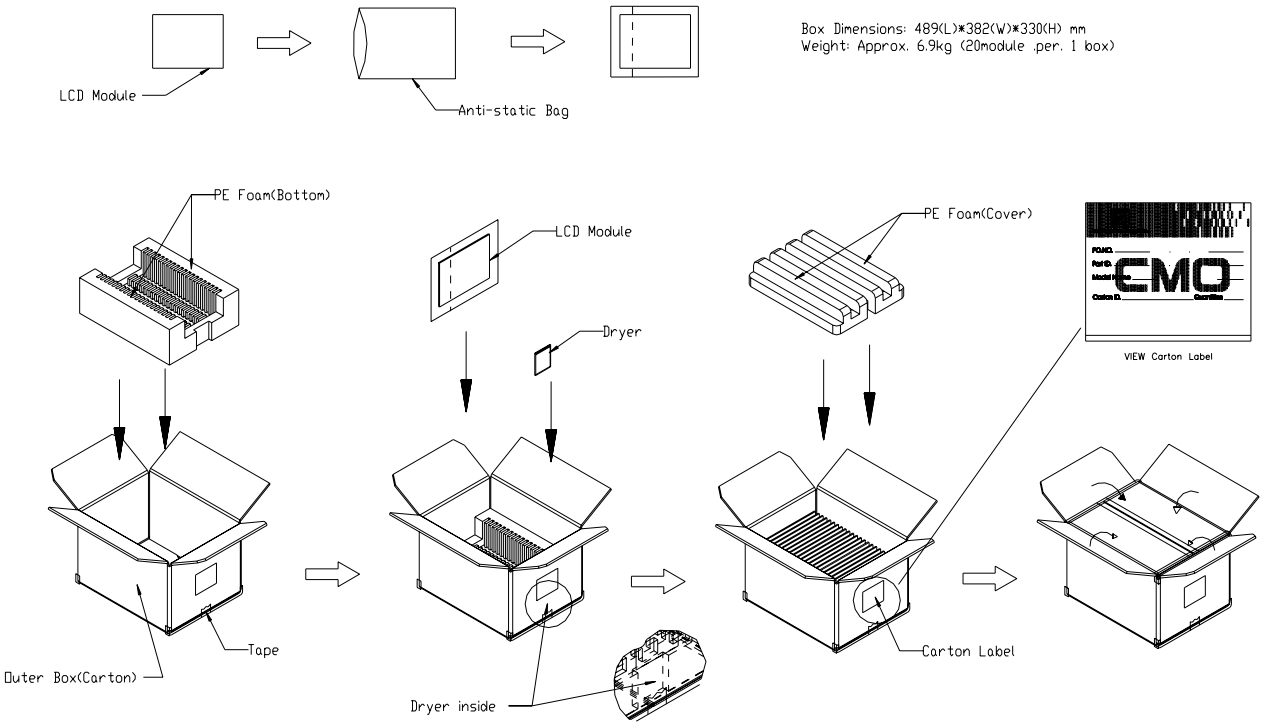
(1) Do not pull the I/F connector in or out while the module is operating.

(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.

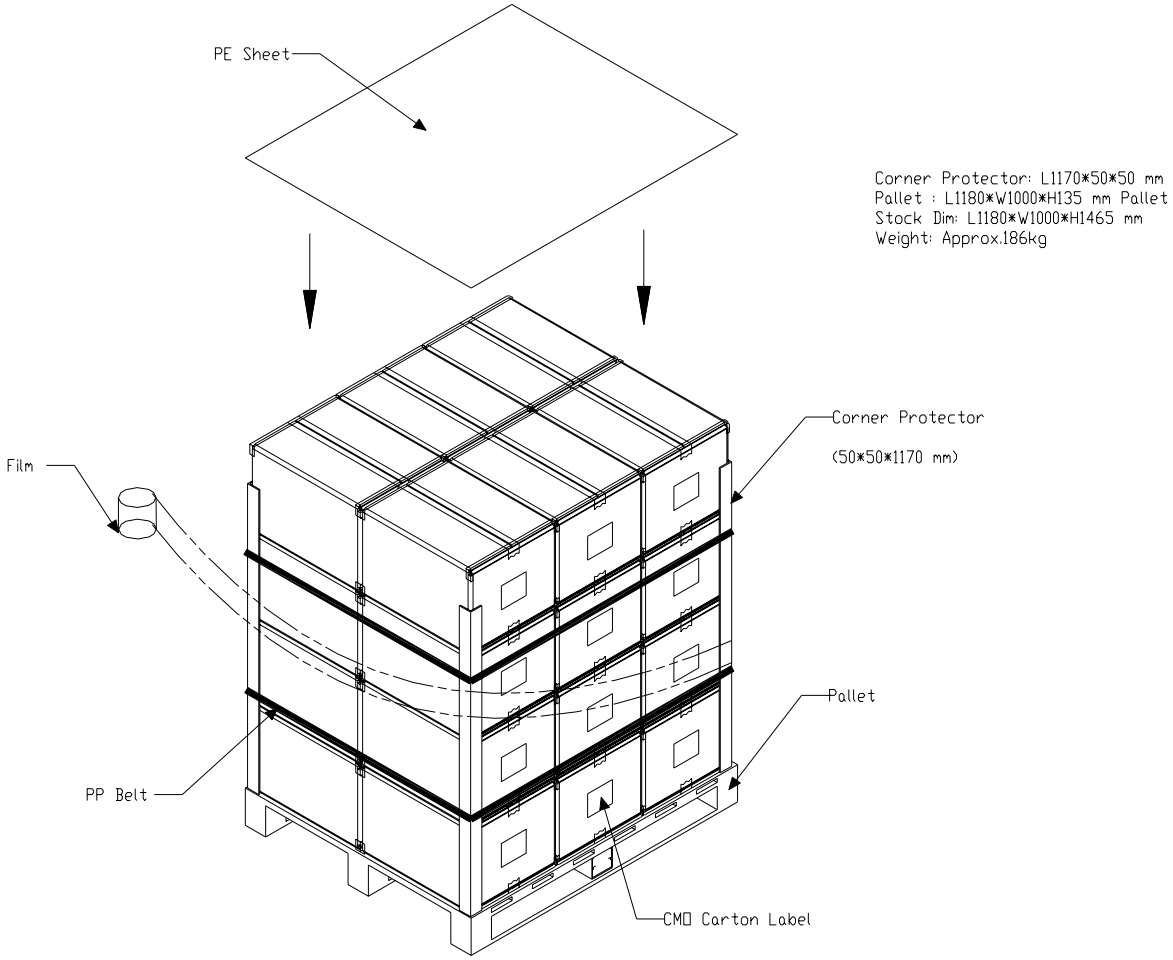
(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

# 9. PACKING

## 9.1 CARTON



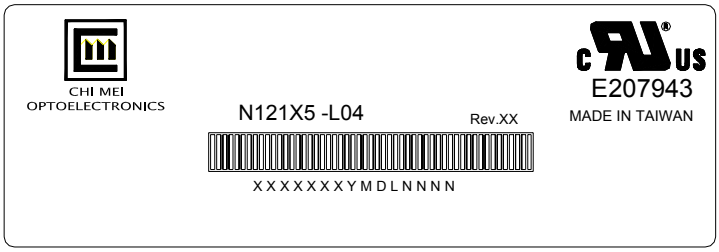
9.2 PALLET


PE Sheet
Corner Protector: L1170*50*50 mm
Pallet : L1180*W1000*H135 mm Pallet
Stock Dim: L1180*W1000*H1465 mm
Weight: Approx.186kg
Corner Protector
(50*50*1170 mm)
Film
Pallet
PP Belt
CMO Carton Label

# 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: N121X5 - L04

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

(c) Serial ID: X X X X X X Y M D X N N N N

- Serial No.
- CMO Internal Use
- Year, Month, Date
- CMO Internal Use
- Revision
- CMO Internal Use

Serial ID includes the information as below:

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

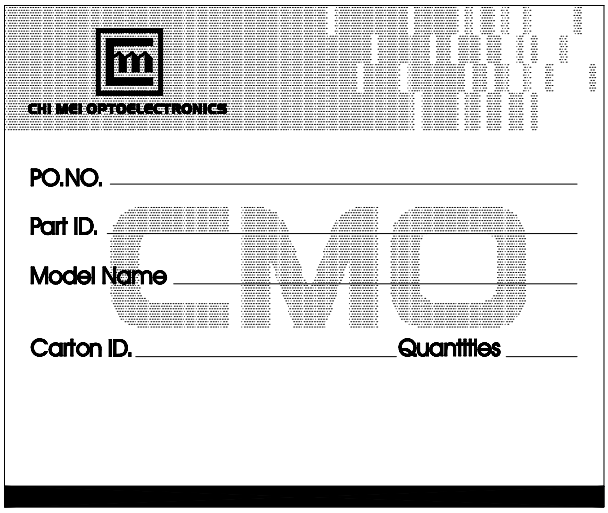
Month: 1~9, A~C, for Jan. ~ Dec.

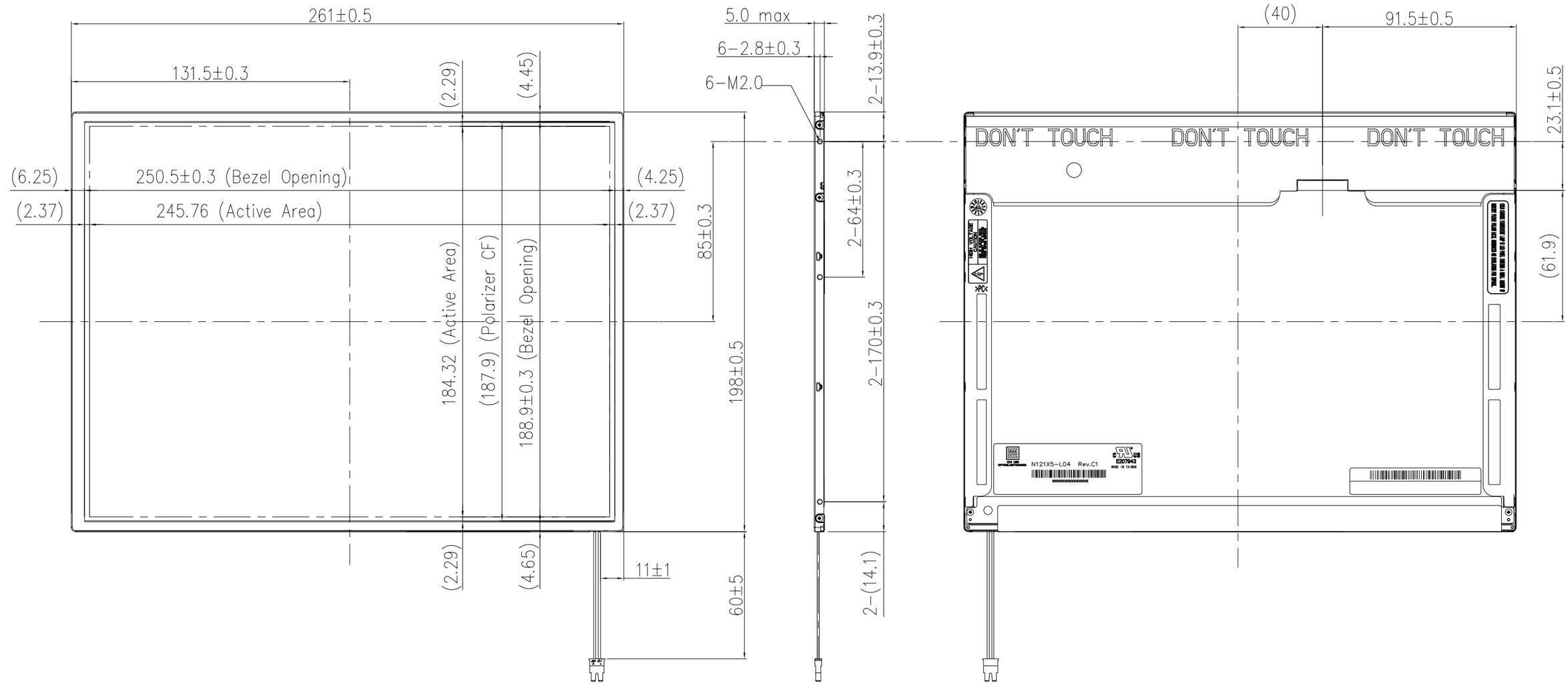
Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

## 10.2 CARTON LABEL






NOTES:

1."*" MARKS THE DESIGN CRITICAL DIMENSION.
2." Ⓟ" MARKS THE PROCESS CRITICAL DIMENSION.
3.MAX.SCREW LENGTH: 2.5 mm.
4.MAX.SCREW TORQUE: 2.0 kgf-cm.
5.SIGNAL INTERFACE CONNECTOR: DF19L-20P-1H (HIROSE)
6.CCFL CONNECTOR: BHSR-02VS-1 (JST)

| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TITLE | ASSY_MODULE_N121X5-L04 | | | | | 2D REV. | A |
| | | | | | | 3D REV. | |
| Approved | Bill Sheu | Drawing No. | N12154103A | | | | |
| Checked | Yule Sheu | Part No. | | | | | |
| Drawer | Mulciber Hsieh | Material | | | Sheet | 1 / 1 | A1 |
| Designer | Mulciber Hsieh | Date | 21-Mar-2005 | Scale | 1:1 | Unit: mm | |

CHI MEI OPTOELECTRONICS CORP.