*Shanghai SVA - NEC Liquid Crystal Display Co., Ltd.*

# TFT COLOR LCD MODULE

（ COMMON ）

## SVA190WX1

## (05TB)(K)(L)(M)

## 48cm (19.0W Type)

## WXGA+

## LVDS Interface (2port)

(Version 2.0)

2

***Published by***

Product Technology Department

**SVA - NEC** Liquid Crystal Display Co., Ltd.

| ***Approved by*** | ***Date*** |
|---|---|
| ***Checked by*** | ***Date*** |
| ***Prepared by*** | ***Date*** |
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| ***Confirmed by*** | ***Date*** |
|---|---|

# INTRODUCTION

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## • HANDLING OF DOUBTFUL POINTS

Any question arising out of, or in connection with, this SPECIFICATION or any matter not stipulated herein will be settled each time upon consultation between both parties.

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# 1. OUTLINE

## 1.1 STRUCTURE AND PRINCIPLE

SVA190WX1-05TB（K）(L)(M) module is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight.

The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays.

The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

## 1.2 APPLICATIONS

• Monitor for PC

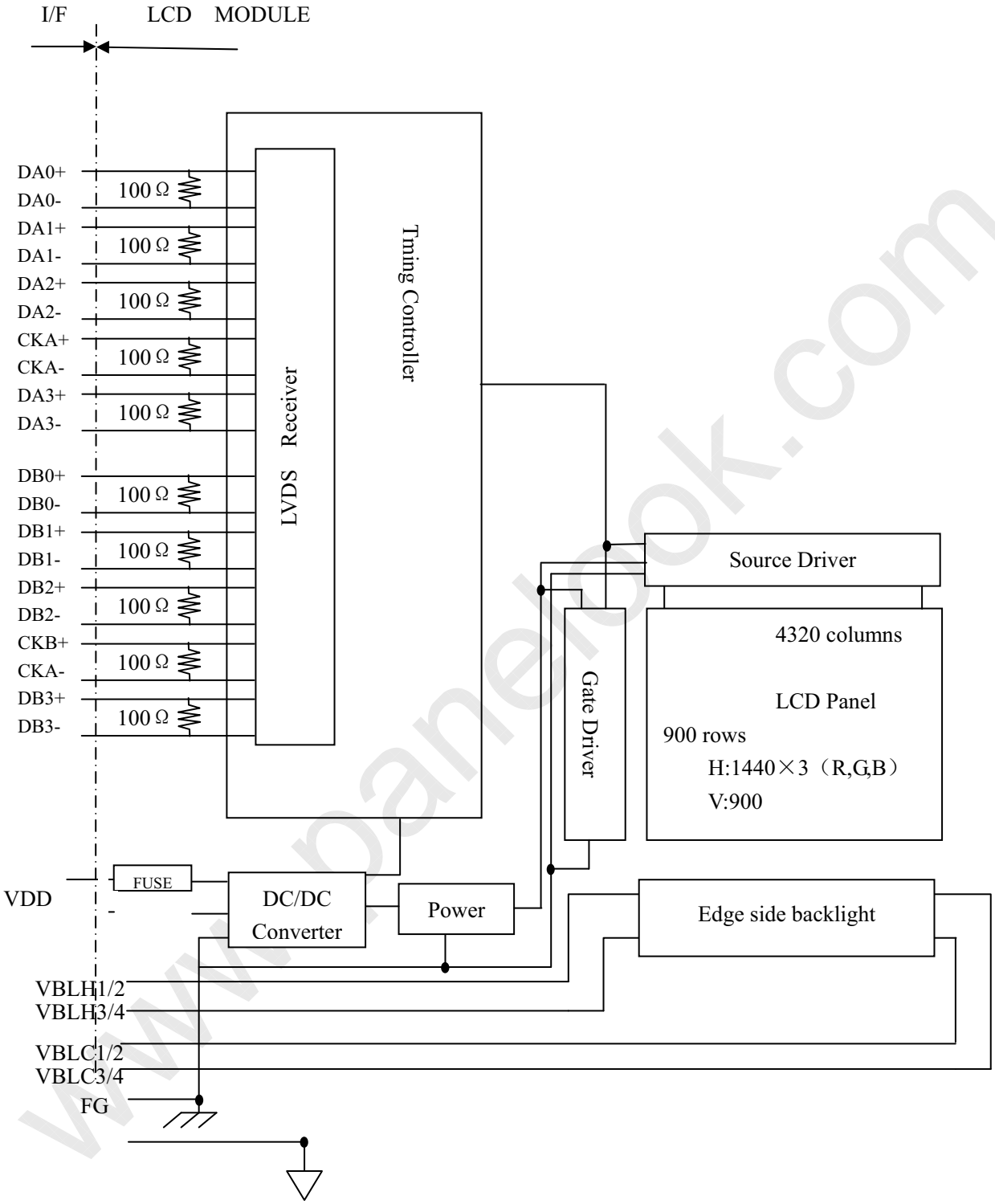
## 1.3 FEATURES

• a-Si TFT active matrix
• LVDS interface
• R.G.B input 8bit, 16.77 millions colors (6bit+Hi-FRC)
• Resolution WXGA+:(1,440×900 pixels)
• Viewing angle:45°/45°(L/R); 25°/45° (U/D)
• Module size: 428.0(H) ×278.0(V) ×16.5 (D)mm
• High response time (Ton+Toff=5 ms）
• High gamut: (against NTSC 72%typ.)
• Edge light type backlight (4 CCFL lamps)
• RoHS compliance
• TCO’03 compliance

## 2. GENERAL INFORMATION

| | |
|---|---|
| Display area | 408.24 (H) x 255.15 (V)mm (typ.), [48.0 cm (19.0 inches)] |
| Drive system | a-Si TFT active matrix |
| Display color | 16.77M colors (6bit+Hi-FRC) |
| Pixel | 1,440 (H) x 900(V) pixels |
| Pixel arrangement | RGB (Red dot、Green dot、 Blue dot) vertical stripe |
| Pixel pitch | 0.2835 (W) x 0.2835 (H) mm |
| Module size | 428.0±0.5(H) ×278.0±0.5 (V) ×16.5(D)mm |
| Weight | 2150g (typ.) |
| Contrast ratio | 600:1(typ.) |
| Viewing angle<br>(At the contrast ratio 10：1) | • Horizontal:45°/45°(L/R);<br>• Vertical: 25°/45° (U/D) |
| Designed viewing direction | • Viewing angle with optimum grayscale (γ=2.2): normal axis |
| Color gamut | At LCD panel center<br>72 % (typ.) [against NTSC color space] |
| Response time | Ton (white 90%→black 10%) + Toff (black 10%→white 90%) 5 ms (typ.) |
| Luminance | At IBL = 6.5mArms / lamp<br>250cd/m$^2$(typ.) |
| Transmissive Mode | Normally White |
| Surface Treatment | AG Type |
| Signal system | LVDS 2port<br>[ RGB :8-bit, Dot clock (CLK), Data enable (DE)] |
| Power supply voltage | LCD panel signal processing board：5.0V |
| Backlight | Edge light type： 4 cold cathode fluorescent lamps ( Inverter less) |
| Power consumption | At IBL=6.5mArms / lamp and checkered flag pattern<br>20 W (typ.) |

## 3. BLOCK DIAGRAM




Note: System ground(GND), FG (Frame ground) in the product should be connected together in customer equipment.

# 4. DETAILED SPECIFICATION

## 4.1 MECHANICAL SPECIFICATIONS

| Parameter | Specification | Unit |
|---|---|---|
| Module size | 428.0± 0.5 (W) × 278.0 ± 0.5 (H) × 16.5 (D) | mm |
| Display area | 408.24(H) x 255.15 (V) mm (typ.), [48.0 cm (19.0 inches)] | mm |
| Display dot number | 1440×3(H) ×900(V) | - |
| Pixel pitch | 0.2835(H)×0.2835(V) | mm |
| Dot pitch | 0.0945(H) ×0.2835(V) | mm |
| Color arrangement | RGB (Red dot、Green dot、 Blue dot) vertical stripe | - |
| Display color | 16,777,216(6bit+Hi FRC) | color |
| Weight | 2150 (typ.) | g |

## 4.2 ABSOLUTE MAXIMUM RATINGS

| Parameter | | Symbol | Rating | Unit | Remarks |
|---|---|---|---|---|---|
| Power supply voltage | Power voltage | VDD | -0.3 ~+6.0 | V | Ta = 25°C |
| | Lamp voltage | VBLH | 666~814 | Vrms | Ta = 25°C |
| Lamp current | | IBL | 3.0~8.0 | mArms | Ta = 25°C,for each lamp |
| Lamp Oscillation frequency | | FO | 30~80 | kHz | Ta = 25°C |
| Input voltage for signals | | VI | -0.3~3.3 | V | Ta = 25°C Note1 |
| Storage temperature | | Tst | -20 ~ +60 | °C | - |
| Front surface | | Top | 0 ~ +50 | °C | |
| Relative humidity | | RH | ≤95 | % | Ta ≤40° C |
| | | | ≤85 | | 40° C < Ta≤50° C |
| Operating altitude | | - | ≤4, 850 | m | 0° C≤Ta≤55° C |
| Storage altitude | | - | ≤13, 600 | m | -20° C≤Ta≤60° C |

Note1: Display signals are DA0+/-, DA1+/-, DA2+/-, DA3+/-, CKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-,and CKB+/-.

## 4.3 ELECTRICAL CHARACTERISTICS

### 4.3.1 Driving for LCD panel signal processing board

(Ta=25°C)

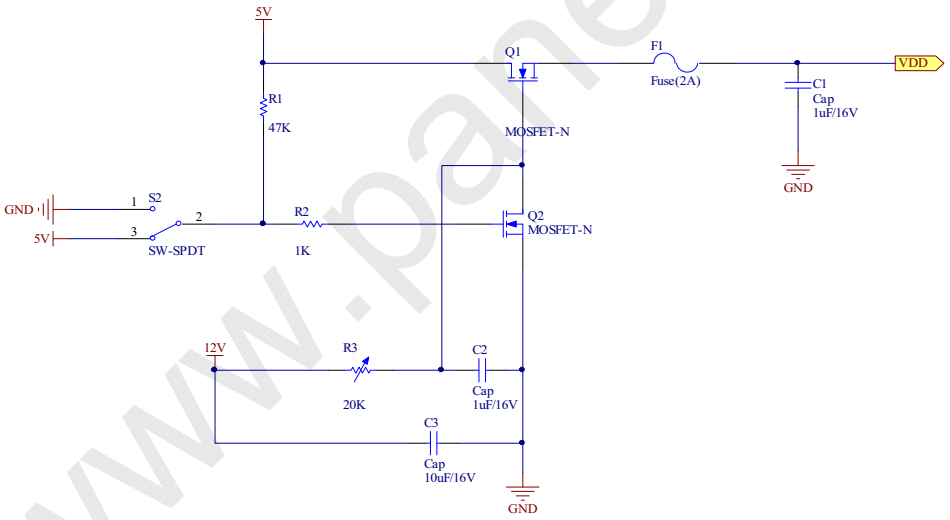
| Parameter | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Power supply voltage | | VDD | 4.5 | 5.0 | 5.5 | V | - |
| Power supply current | | IDD | - | 450 Note1 | 650 Note2 | mA | at VDD = 5.0V |
| Permissible ripple voltage | | VRP | - | - | 150 | mV | VDD |
| Differential input threshold voltage for LVDS receiver | Low | VTL | -100 | - | - | mV | at VCM = 1.2V Note3 |
| | High | VTH | - | - | +100 | mV | |
| Input voltage width for LVDS receiver | | VI | 0 | - | 3.3 | V | - |
| Terminal resistor | | RT | - | 100 | - | | |
| Rush current | | $I_{rush}$ | - | - | 3.0 | A | Note4 |

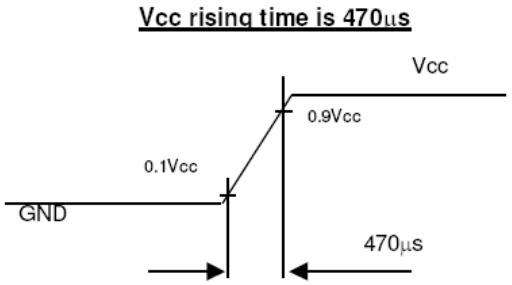
Note1: Checked flag pattern (EIAJ ED-2522)

Note2: Pattern for maximum current（2H1V dot inverse, 0/15 scale）

Note3: Common mode voltage for LVDS driver

Note4: Measurement Conditions:



### 4.3.2 Driving for backlight lamp

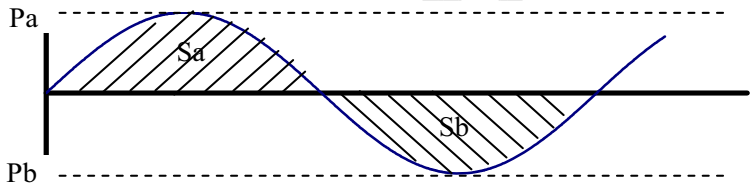
(Ta=25°C) Note1

| Parameter | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Lamp voltage | VBLH | - | 740 | - | Vrms | Note2、Note3 Il=6.5mA |
| Lamp current | IBL | 3.0 | 6.5 | 8.0 | mArms | Note3 |
| Lamp starting voltage (discharge stabilization voltage) | Vs | 1314 | - | - | Vrms | Ta = 25℃ Note2、Note3 |
| | | 1512 | - | - | Vrms | Ta =0℃ Note2、Note3 |
| Lamp oscillation frequency | FO | 30 | 50 | 80 | kHz | Note4 |

Note1: The backlight of this product is made up of 4-piece lamp. The specification above is only for each lamp.

Note2: The voltage timing cycle of each lamp should be set as the same phase. [Vs] and [VBLH] is the voltage between the high port and low port, the value is the characteristic of lamp. The starting voltage of inverter should be higher than the value. The possibility of not lighting exists by the lower voltage, so the suitable voltage should considered by the test.

Note3: The asymmetric ratio of working waveform for lamps (Lamp voltage peak ratio, Lamp current peak ratio and waveform area ratio) should be less than 5% (See the following figure). If the waveform is asymmetric, DC (Direct current) element applies into the lamp. In this case, a lamp lifetime may be shortened, because a distribution of a lamp enclosure substance inclines toward one side between low voltage terminal (Cold terminal) and high voltage terminal (Hot terminal).




$|Pa - Pb| / Pb \times 100 \leqslant 5\%$

$|Sa - Sb| / Sb \times 100 \leqslant 5\%$

Pa: Supply voltage/current peak for positive, Pb: Supply voltage/current peak for negative

Sa: Waveform space for positive part, Sb: Waveform space for negative part

Note4: In case "FO" is not the recommended value, beat noise may display on the screen, because of interference between "FO" and "1/th". Recommended value of "FO" is as following.

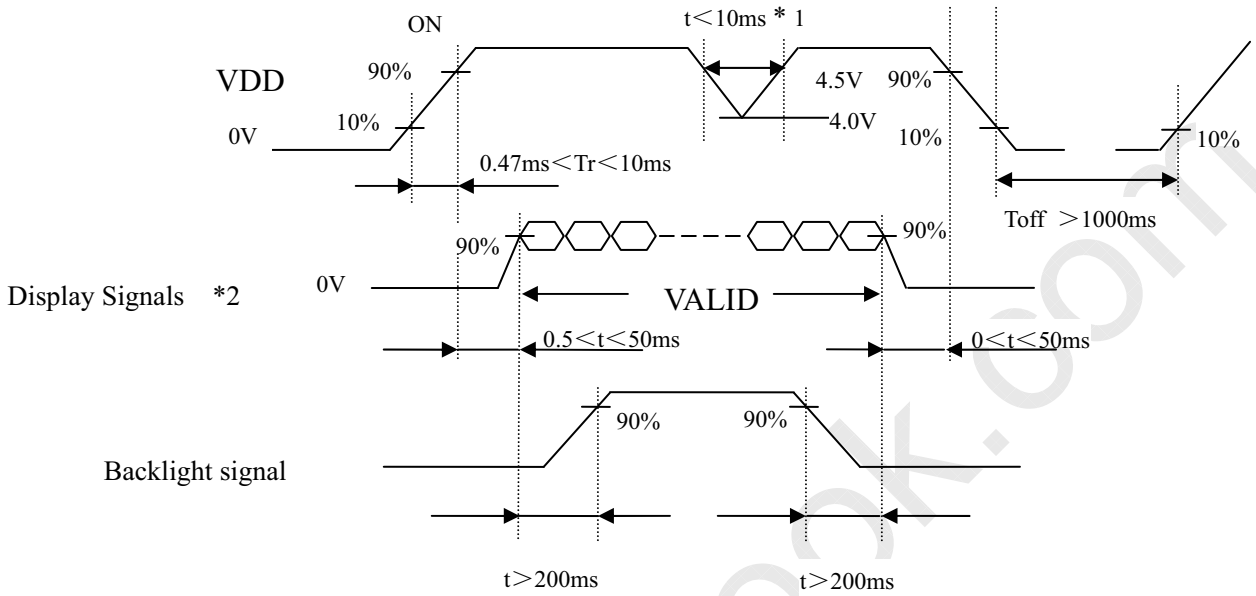
$FO = 1/4 \times 1/th \times (2n-1)$

Th: Horizontal signal period(See **"4. 8 .1 Timing characteristics".)**

n: Natural number (1, 2, 3 ……)

## 4.4 POWER SUPPLY VOLTAGE SEQUENCE AND RIPPLE

### 4.4.1 Power supply voltage sequence




*1. When VDD is on, but the value is lower than 4.5V, a protection circuit may work, then the module may not display.

*2 The signal line is not connected with the module, at the end of cable the terminal resistor of 100Ω should be added.

Note1: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) must be "0" voltage, exclude the VALID period (See above sequence diagram). If these signals are higher than 0.3 V, the internal circuit is damaged.

If some of display signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display signals, they should cut VDD.

Note2: When VDD is on, it should be set above 4.0V.

Note3: The backlight power supply voltage should be inputted within the valid period of display and function signals, in order to avoid unstable data display.

### 4.4.2 Power supply voltage ripple

When the power supply is designed, the next form can give the reference. If the voltage ripple is over the value in next form, the noise should be seen in display area.

Ripple (Measured at input terminal of power supply)

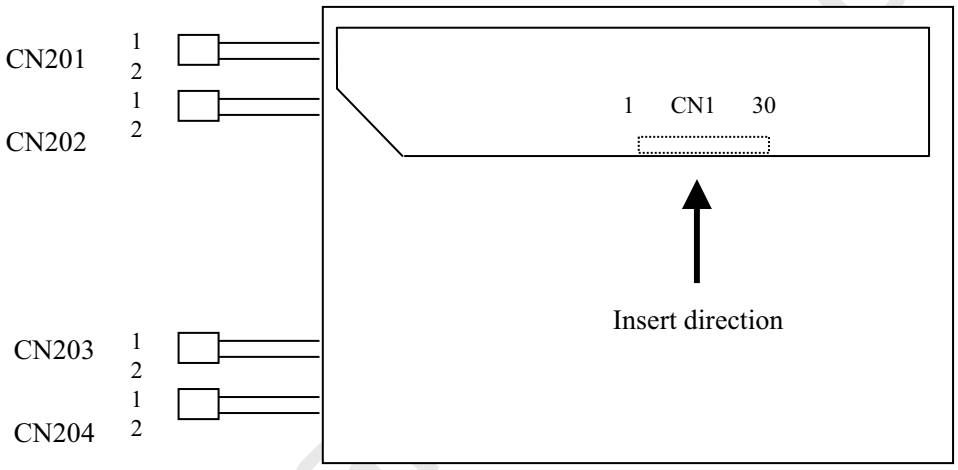
| | VDD(5V to drive the panel) |
|---|---|
| Ripple voltage | ≤150mVP-P（Including spike noise） |

### 4.4.3 Fuse

| Parameter | Fuse | | Rating | Fusing current | Remarks |
|---|---|---|---|---|---|
| | Type | Supplier | | | |
| VDD | F1206FA3000V032T | AEM | 3A<br>32V | - | |

Note1: There are different power supply systems from the power input terminal. The power supply capacity should be less than the fusing current. If the power supply capacity is above the fusing current, the fuse may blow in a short time, and then nasty smell, smoking and so on may occur.

### 4.4.4 Connectors for power supply and signals

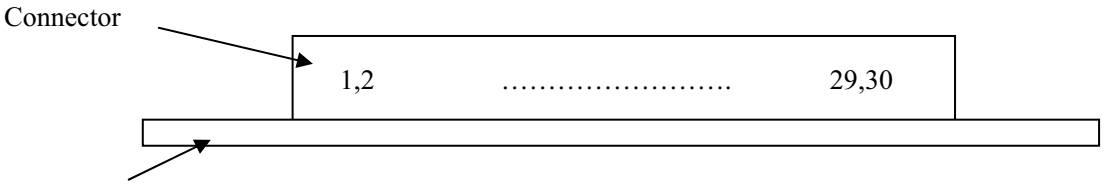


## 4.5 INTERFACE AND CONNECTOR PIN ALIGNMENT

CN1: FI-X30SSL-HF (Produced by JAE) or equivalent.

| Pin | Name | Description |
|---|---|---|
| 1 | RXO0- | Negative LVDS differential data input. Channel O0 (odd) |
| 2 | RXO0+ | Positive LVDS differential data input. Channel O0 (odd) |
| 3 | RXO1- | Negative LVDS differential data input. Channel O1 (odd) |
| 4 | RXO1+ | Positive LVDS differential data input. Channel O1 (odd) |
| 5 | RXO2- | Negative LVDS differential data input. Channel O2 (odd) |
| 6 | RXO2+ | Positive LVDS differential data input. Channel O2 (odd) |
| 7 | GND | Ground |
| 8 | RXOC- | Negative LVDS differential clock input. (odd) |
| 9 | RXOC+ | Positive LVDS differential clock input. (odd) |
| 10 | RXO3- | Negative LVDS differential data input. Channel O3(odd) |
| 11 | RXO3+ | Positive LVDS differential data input. Channel O3 (odd) |
| 12 | RXE0- | Negative LVDS differential data input. Channel E0 (even) |
| 13 | RXE0+ | Positive LVDS differential data input. Channel E0 (even) |
| 14 | GND | Ground |
| 15 | RXE1- | Negative LVDS differential data input. Channel E1 (even) |
| 16 | RXE1+ | Positive LVDS differential data input. Channel E1 (even) |
| 17 | GND | Ground |
| 18 | RXE2- | Negative LVDS differential data input. Channel E2 (even) |
| 19 | RXE2+ | Positive LVDS differential data input. Channel E2 (even) |
| 20 | RXEC- | Negative LVDS differential clock input. (even) |
| 21 | RXEC+ | Positive LVDS differential clock input. (even) |
| 22 | RXE3- | Negative LVDS differential data input. Channel E3 (even) |
| 23 | RXE3+ | Positive LVDS differential data input. Channel E3 (even) |
| 24 | GND | Ground |
| 25 | GND | Ground |
| 26 | NC | Not connection. |
| 27 | GND | Ground |
| 28 | VCC | +5.0V power supply |
| 29 | VCC | +5.0V power supply |
| 30 | VCC | +5.0V power supply |

CN1: The inserting side is as follows




CN201: BHSR-02VS-1/Locking (J.S.T Mfg. Co., Ltd.)
Adaptable connector: SM02B-BHSS-1-TB (J.S.T. Mfg Co., Ltd.)

| Pin No. | Signal name | Function |
|---|---|---|
| 1 | VH1 | High voltage input terminal for upper lamp(Cable color: Blue) |
| 2 | VL1 | Low voltage input terminal for upper lamp(Cable color: Black) |

CN202: BHSR-02VS-1 /Locking(J.S.T Mfg. Co., Ltd.)
Adaptable connector: SM02B-BHSS-1-TB (J.S.T. Mfg Co., Ltd.)

| Pin No. | Signal name | Function |
|---|---|---|
| 1 | VH2 | High voltage input terminal for upper lamp(Cable color: Pink) |
| 2 | VL2 | Low voltage input terminal for upper lamp(Cable color: White) |

CN203 : BHSR-02VS-1/Locking (J.S.T Mfg. Co., Ltd.)
Adaptable connector: SM02B-BHSS-1-TB (J.S.T. Mfg Co., Ltd.)

| Pin No. | Symbol name | Function |
|---|---|---|
| 1 | VH3 | High voltage input terminal for lower lamp(Cable color: Blue) |
| 2 | VL3 | Low voltage input terminal for lower lamp(Cable color: Black) |

CN204: BHSR-02VS-1/Locking (J.S.T Mfg. Co., Ltd.)
Adaptable connector: SM02B-BHSS-1-TB (J.S.T. Mfg Co., Ltd.)

| Pin No. | Symbol name | Function |
|---|---|---|
| 1 | VH4 | High voltage input terminal for lower lamp(Cable color: Pink) |
| 2 | VL4 | Low voltage input terminal for lower lamp(Cable color: White) |

Note1: The ports of VDD and GND should be all used. As for the input of LVDS, please use the twisted pair wire of the transmission impedance 100Ω.

Note2: System ground (GND), FG (Frame ground) and VBLC (Lamp low voltage terminal) in the product should be connected together in customer equipment.

## 4.6 LVDS I/F DATA CHART

| Input DATA | | | Transmitter pin | Transmitter DS90CF383,C385 or equivalent | | | CN1 pin | CN1 Symbol |
|---|---|---|---|---|---|---|---|---|
| Odd pixel data and control signals | RA0 | → | 51 | TXIN0 | | | | |
| | RA1 | → | 52 | TXIN1 | | TA1- | → 1 | DA0- |
| | RA2 | → | 54 | TXIN2 | | TA1+ | → 2 | DA0+ |
| | RA3 | → | 55 | TXIN3 | | | | |
| | RA4 | → | 56 | TXIN4 | | TB1- | → 3 | DA1- |
| | RA5 | → | 3 | TXIN6 | | TB1+ | → 4 | DA1+ |
| | GA0 | → | 4 | TXIN7 | | | | |
| | GA1 | → | 6 | TXIN8 | | TC1- | → 5 | DA2- |
| | GA2 | → | 7 | TXIN9 | | TC1+ | → 6 | DA2+ |
| | GA3 | → | 11 | TXIN12 | | | 7 | GND |
| | GA4 | → | 12 | TXIN13 | | TCLK1- | → 8 | CKA- |
| | GA5 | → | 14 | TXIN14 | | TCLK1+ | → 9 | CKA+ |
| | BA0 | → | 15 | TXIN15 | | | | |
| | BA1 | → | 19 | TXIN18 | | TD1- | → 10 | DA3- |
| | BA2 | → | 20 | TXIN19 | 1'ST | TD1+ | → 11 | DA3+ |
| | BA3 | → | 22 | TXIN20 | | | | |
| | BA4 | → | 23 | TXIN21 | | | | |
| | BA5 | → | 24 | TXIN22 | | | | |
| | RSVD | → | 27 | TXIN24 | | | | |
| | RSVD | → | 28 | TXIN25 | | | | |
| | DE | → | 30 | TXIN26 | | | | |
| | RA6 | → | 50 | TXIN27 | | | | |
| | RA7 | → | 2 | TXIN5 | | | | |
| | GA6 | → | 8 | TXIN10 | | | | |
| | GA7 | → | 10 | TXIN11 | | | | |
| | BA6 | → | 16 | TXIN16 | | | | |
| | BA7 | → | 18 | TXIN17 | | | | |
| | RSVD | → | 25 | TXIN23 | | | | |
| | CLK | → | 31 | CLKIN | | | | |
| Even pixel data | RB0 | → | 51 | TXIN0 | | | | |
| | RB1 | → | 52 | TXIN1 | | TA2- | → 12 | DB0- |
| | RB2 | → | 54 | TXIN2 | | TA2+ | → 13 | DB0+ |
| | RB3 | → | 55 | TXIN3 | | | 14 | GND |
| | RB4 | → | 56 | TXIN4 | | TB2- | → 15 | DB1- |
| | RB5 | → | 3 | TXIN6 | | TB2+ | → 16 | DB1+ |
| | GB0 | → | 4 | TXIN7 | | | 17 | GND |
| | GB1 | → | 6 | TXIN8 | | TC2- | → 18 | DB2- |
| | GB2 | → | 7 | TXIN9 | | TC2+ | → 19 | DB2+ |
| | GB3 | → | 11 | TXIN12 | | | | |
| | GB4 | → | 12 | TXIN13 | | TCLK2- | → 20 | CKB- |
| | GB5 | → | 14 | TXIN14 | | TCLK2+ | → 21 | CKB+ |
| | BB0 | → | 15 | TXIN15 | | | | |
| | BB1 | → | 19 | TXIN18 | | TD2- | → 22 | DB3- |
| | BB2 | → | 20 | TXIN19 | 2'nd | TD2+ | → 23 | DB3+ |
| | BB3 | → | 22 | TXIN20 | | | 24 | GND |
| | BB4 | → | 23 | TXIN21 | | | 25 | GND |
| | BB5 | → | 24 | TXIN22 | | | 26 | NC |
| | RSVD | → | 27 | TXIN24 | | | 27 | GND |
| | RSVD | → | 28 | TXIN25 | | | 28 | VDD |
| | RSVD | → | 30 | TXIN26 | | | 29 | VDD |
| | RB6 | → | 50 | TXIN27 | | | 30 | VDD |
| | RB7 | → | 2 | TXIN5 | | | | |
| | GB6 | → | 8 | TXIN10 | | | | |
| | GB7 | → | 10 | TXIN11 | | | | |
| | BB6 | → | 16 | TXIN16 | | | | |
| | BB7 | → | 18 | TXIN17 | | | | |
| | RSVD | → | 25 | TXIN23 | | | | |
| | CLK | → | 31 | CLKIN | | | | |

Note1: The lowest bit (RA0, GA0, BA0, RB0, GB0, BB0), the most upper bit (RA7, GA7, BA7, RB7, GB7, BB7)

Note2:Connecting cable between LCD panel's connector and transmitter should use 100Ω twisted line.

Note3: If only Hsync and Vsync, the product don't work. Make sure DE signal has been input.

## 4.7 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 16,777,216 colors in 256 scales. Also the relation between display colors and input data signals is as the following table.

| Display colors | | Data signal（0:Low level 、1:High Level） | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RA7 | RA6 | RA5 | RA4 | RA3 | RA2 | RA1 | RA0 | GA7 | GA6 | GA5 | GA4 | GA3 | GA2 | GA1 | GA0 | BA7 | BA6 | BA5 | BA4 | BA3 | BA2 | BA1 | BA0 |
| | | RB7 | RB6 | RB5 | RB4 | RB3 | RB2 | RB1 | RB0 | GB7 | GB6 | GB5 | GB4 | GB3 | GB2 | GB1 | GB0 | BB7 | BB6 | BB5 | BB4 | BB3 | BB2 | BB1 | BB0 |
| Basic color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Red scale | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | ↓ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | Bright | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green scale | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | ↓ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bule scale | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | ↑ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | ↓ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note: Combination with 8 bit (256 grayscale) R,G,B color signal , the color can be formed.

## 4.8 INTERFACE TIMING

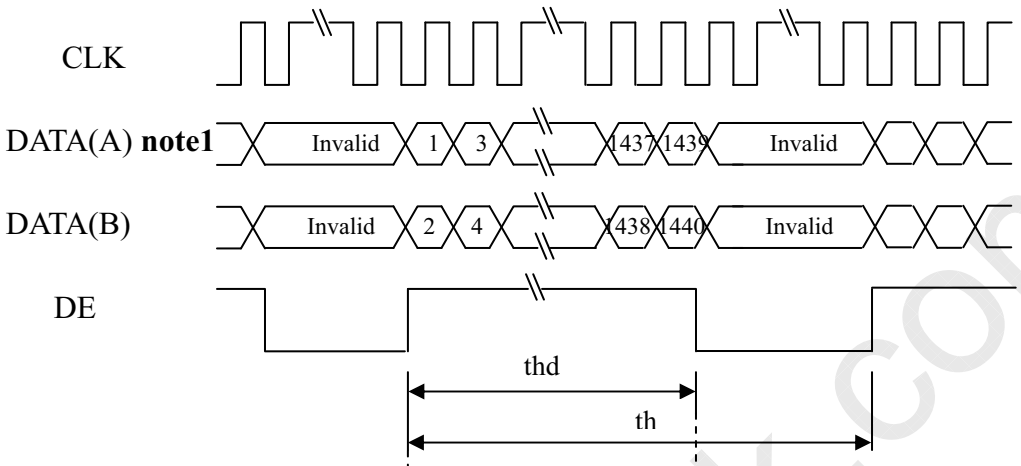
### 4.8.1 Timing specification

| Parameter | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | 1/tc | 34.4 | 44.45 | 74.25 | MHz | LVDS transmitter input |
| | | tc | 29.07 | 22.50 | 13.47 | ns | |
| | Rise time, Fall time | - | Refer to the timing characteristics of LVDS transmitter | | | ns | Note 1 |
| | Duty | - | | | | - | |
| Horizontal signals | Cycle | th | 148 | 18.0 | 26.5 | µs | 55.5kHz(typ.) |
| | | | 754 | 800 | 900 | CLK | |
| | Display period | thd | 720 | | | CLK | - |
| Vertical signals | Cycle | tv | 13.3 | 16.67 | 20 | ms | 60.0Hz(typ.) |
| | | | 912 | 926 | 1100 | H | |
| | Display period | tvd | 900 | | | H | - |
| DE/Data | Setup time | - | Refer to the timing characteristics of LVDS transmitter | | | ns | Note 1 |
| | Hold time | - | | | | ns | |
| | Rise time, Fall time | - | | | | ns | |

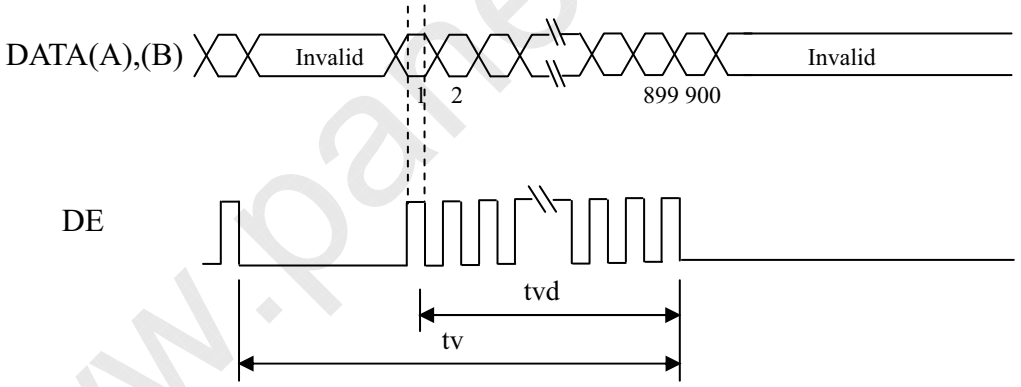
Note1: See the data sheet of LVDS transmitter.
Recommended transmitter:DS90CF383(National Semiconducter )

### 4.8.2 Input signal timing chart

Horizontal timing




Vertical timing




Note 1: DATA(A)=RA0-RA7,GA0-GA7,BA0-BA7

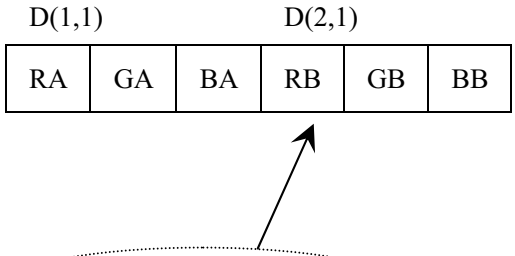
DATA(B)=RB0-RB7,GB0-GB7,BB0-BB7

### 4.8.3 Pixel DATA alignment of display image

The following chart is the coordinates of per pixel

Odd Pixel: RA= R DATA
GA= G DATA
BA= B DATA

Even Pixel : RB=R DATA
GB=G DATA
BB=B DATA




| | | | | |
|---|---|---|---|---|
| D(1,1) | D(2,1) | D(3,1) | ••• | D(1440,1) |
| D(1,2) | D(2,2) | D(3,2) | ••• | D(1440,2) |
| D(1,3) | D(2,3) | D(3,3) | ••• | D(1440,3) |
| • | • | • | ••• | • |
| • | • | • | ••• | • |
| • | • | • | ••• | • |
| D(1,900) | D(2,900) | D(2,900) | ••• | D(1440,900) |

## 4.9 OPTICS

### 4.9.1 Optical characteristics

Note1 ,Note2

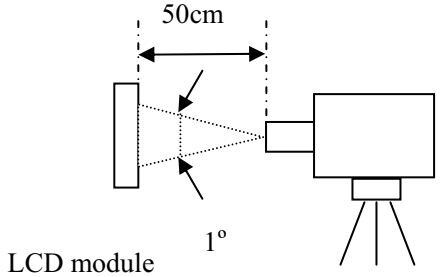
| Parameter Note1 | | Condition | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| Luminance | | White at center θR=0°, θL=0°, θU=0°, θD=0° | L | 200 | 250 | - | cd/ $m^2$ | - |
| Contrast ratio | | White/Black at center θR=0°, θL=0°, θU=0°, θD=0° | CR | (400) | 600 | - | - | Note3 |
| Luminance uniformity | | White θR=0°, θL=0°, θU=0°, θD=0 | LU | - | 1.25 | 1.33 | - | Note4 |
| Chromaticity | White | X coordinate | Wx | 0.283 | 0.313 | 0.343 | - | Note5 |
| | | Y coordinate | Wy | 0.299 | 0.329 | 0.359 | - | |
| | Red | X coordinate | Rx | 0.621 | 0.651 | 0.681 | - | |
| | | Y coordinate | Ry | 0.303 | 0.333 | 0.363 | - | |
| | Green | X coordinate | Gx | 0.267 | 0.297 | 0.327 | - | |
| | | Y coordinate | Gy | 0.572 | 0.602 | 0.632 | - | |
| | Blue | X coordinate | Bx | 0.112 | 0.142 | 0.172 | - | |
| | | Y coordinate | By | 0.047 | 0.077 | 0.107 | - | |
| Color gamut | | θR=0°, θL=0°, θU=0°, θD=0 At center,against NTSC | C | (70) | 72 | - | % | |
| Response time | | White to black | Ton | - | 1.3 | (2.6) | ms | Note6 Note7 |
| | | Black to white | Toff | - | 3.7 | (7.4) | ms | |
| | | Ton+ Toff | - | - | 5 | (10) | ms | |
| Viewing angle | Right | θU=0°, θD=0°,CR≥10 | θR | (35) | 45 | - | ° | Note8 |
| | Left | θU=0°, θD=0°,CR≥10 | θL | (35) | 45 | - | ° | |
| | Up | θR=0°, θL=0°,CR≥10 | θU | (15) | 25 | - | ° | |
| | Down | θR=0°, θL=0°,CR≥10 | θD | (35) | 45 | - | ° | |

Note1: The values in upper table are only initial characteristics.

Note2: Measurement conditions are as follows.

Ta=25°C， VDD=5.0V， IBL=6.5mArms/lamp， Display mode： WXGA+， Horizontal cycle=55.56KHz，Vertical cycle=60.0Hz

Optical characteristics are measured at luminance saturation after 30minutes from working the product in the dark room. Also measurement method for luminance is as follows.




Luminance Meter (TOPCON BM-5A)
Spectroradiometer(TOPCON SR-3)

Note 3: See**"4.9.2 Definition of contrast ratio".**

Note 4: See**"4.9.3 Definition of luminance uniformity".**

Note 5: CIE 1931 Chromaticity Diagram Standard.

Note 6: See **"4.9.4 Definition of response time".**

Note 7: See **"4.9.5 Definition of viewing angle".**

### 4.9.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

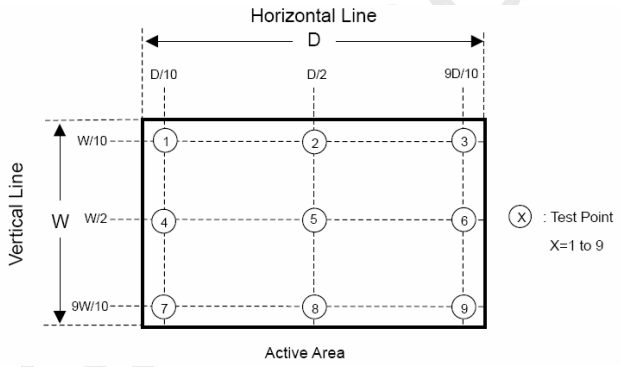
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

### 4.9.3 Definition of luminance uniformity

The luminance uniformity is calculated by using the following formula.

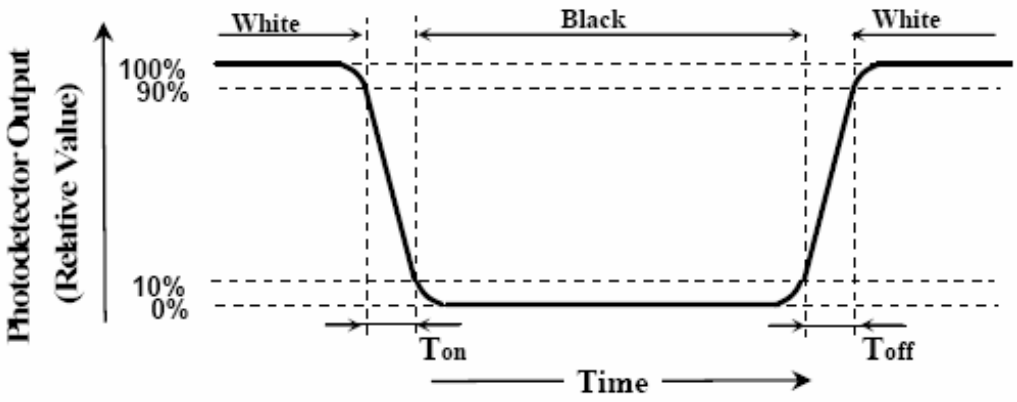
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑨}}{\text{Minimum luminance from ① to ⑨}}$$

The luminance is measured at near the 9 points shown below.

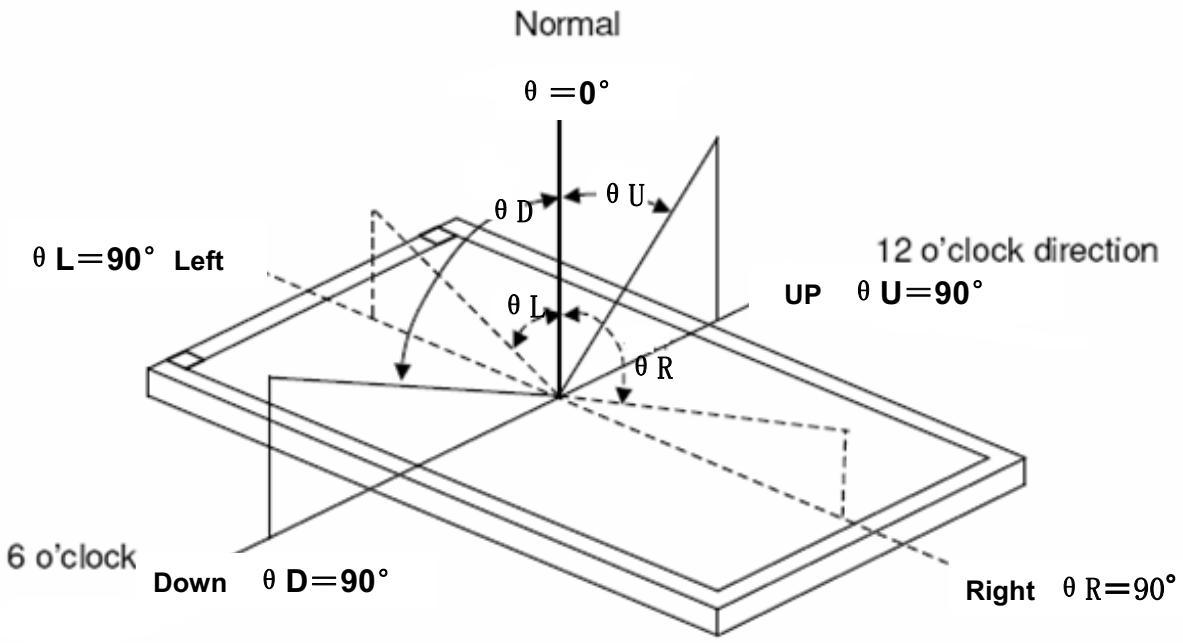



### 4.9.4 Definition of response time

Response time is measured, the luminance changes from "white" to "black", or "black" to "white" on the same screen point, by photo-detector. Ton is the time it takes the luminance change from 90% down to 10%. Also Toff is the time it takes the luminance change from 10% up to 90%. (See the following diagram.)



**4.9.5 Definition of viewing angle**

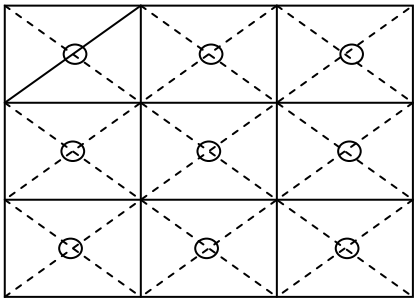


# 5. RELIABILITY TESTS

| Test items | | Condition |
|---|---|---|
| High temperature and humidity(Operation) | | ① 50±3℃,RH=80%,240hours<br>②Display data is black **Note1** |
| Low temperature (Operation) | | ① 0±3℃...240hours<br>② Display data is black |
| Thermal shock (Non operation) | | ① -20±3℃...30minutes<br>60±3℃ ...30minutes<br>② 100cycles,1hour/cycle<br>③ Temperature transition time is within 5 minutes. |
| ESD (operation) | | ① 150Pf,150Ω,±8kV（contact）<br>② 9 places on a panel surface(contact)<br>③10 times each place at 1 sec interval **Note2** |
| Vibration (Non operation) | | ① 10-200-10Hz， Sine wave， acceleration of 14.79m/s$^2$<br>② 30 minutes/cycle<br>③ X,Y,Z direction<br>④ 1 time each direction |
| Mechanical shock (Non operation) | | ① 490 m/s$^2$， 11ms<br>② ±X，±Y，±Z direction<br>③ 2 times each direction |
| Low pressure | operation | ①53.3kPa (Equivalent to altitude 4,850m）<br>② 0℃±3℃...24hours<br>③ 50℃±3℃...24hours |
| | non-operation | ① 15kPa (Equivalent to altitude 13,600m）<br>② -20℃±3℃...24hours<br>③ 60℃±3℃... 24hours |

Note1: Display and appearance are checked under environmental conditions equivalent to the inspection conditions of defect criteria.

Note2: See the following figure for discharge points.



# 6. ESTIMATED LUMINANCE LIFETIME

The luminance lifetime is the time from initial luminance to half-luminance.

**This lifetime is the estimated value, and is not guarantee value.**

| Condition | Luminance lifetime(MTTF) **Note1** | Unit |
|---|---|---|
| 25℃(Ambient temperature of the product)<br>Continuous operation and IBL=6.5mArms/lamp | 50000 | Hours |

Note1: MTTF is mean time to half-luminance. In case the product works under low temperature environment, the lifetime becomes short.

# 7. MARKINGS

The various markings are attached to this product. See "7.4 INDECATION LOCATIONS" for attachment positions.

## 7.1 PRODUCT LABEL

Note1

Product label

REV of label (K or M or L)

Model name

Lot number

OEM number


Country of manufacture

Note1: The meaning of lot number

•Example: 1111A104201001

| 11A6 | A | 1 | 08 | 9 | 09 | 005 |
|---|---|---|---|---|---|---|
| Internal use | Revision 1 letter (Alphabet) | Internal use | Manufacturing year 2 figures of the A.D. end numbers (e.g: A.D2004 is 04.) | Manufacturing month 1 letter | Manufacturing day | Production number Multi-letter (figure) |

Jan. to Sep.: Number of month
October: A
November: B
December: C

Note2: **Do not attach anything such as label and so on, on the product label!** In case repair the product, SVA-NEC needs the contents of Product label such as the lot number, inspection date and so on, to identify the warranty period with individual product. If SVA-NEC cannot decipher the contents of Product label, such repair shall be entitled to charge. Also SVA-NEC may give a new lot number to reconditioned products.

## 7.2 BARCODE LABEL

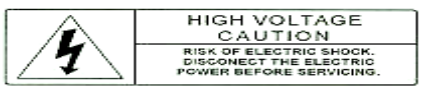
Barcode label

Barcode
(Label code: 39)

Panel number Note1

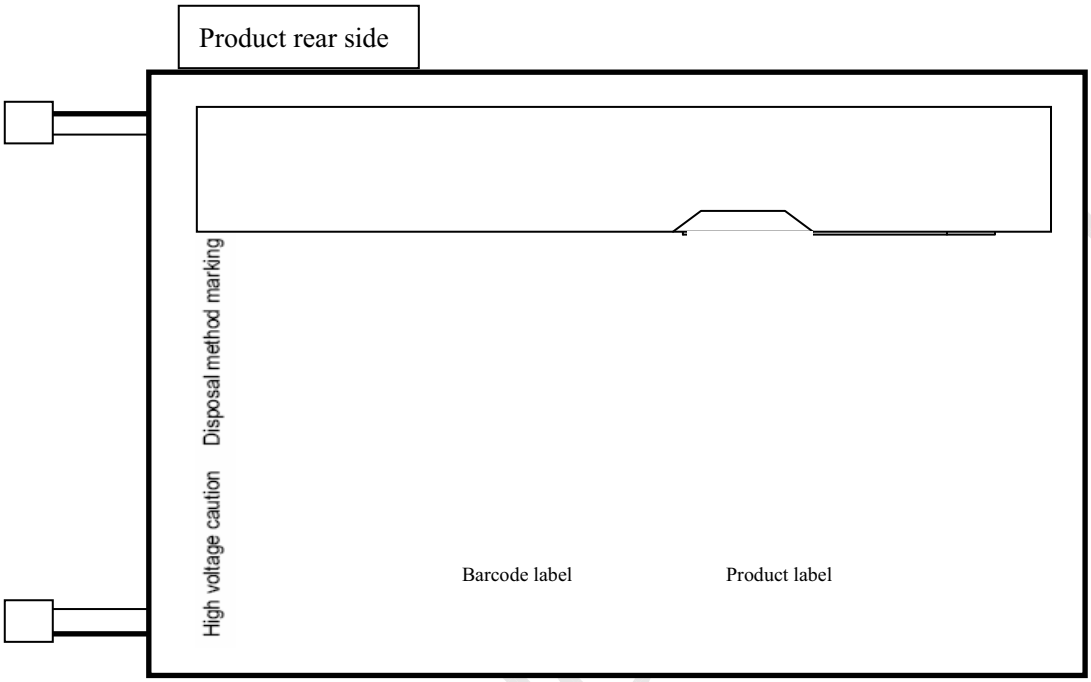
## 7.3 OTHER MARKINGS

High voltage caution marking




Disposal method marking for lamp

## 7.4 INDICATION LOCATIONS



# 8. PACKING, TRANSPORTATION AND DELIVERY

SVA-NEC will pack products to deliver to customer in accordance with SVA-NEC packing specifications, and will deliver products to customer in such a state that products will not suffer from a damage during transportation .The delivery conditions are as follows.

## 8.1 PACKING

(1) Packing box

5 products are packed up with the maximum in a packing box(See "**8.5 OUTLINE FIGURE FOR PACKING** ").

Products are put into a plastic bag for prevention of moisture.

The type name and quality are shown on outside of the packing box, either labeling or printing.

(2)Pallet Packing (See"**8.5 OUTLINE FIGURE FOR PACKING** ")

① Packing boxes are tired on a cardboard pallet.(6 boxes×3 tiers maximum)

②Cardboard sleeve and top cap are attached to the packing boxes, then they are fixed by a band.

## 8.2 INSPECTION RECORD SHEET

Inspection record sheets are included in the packing box with delivery products to customer. It is summarized to a number of products for pass/fail assessment.

## 8.3 TRANSPORTATION

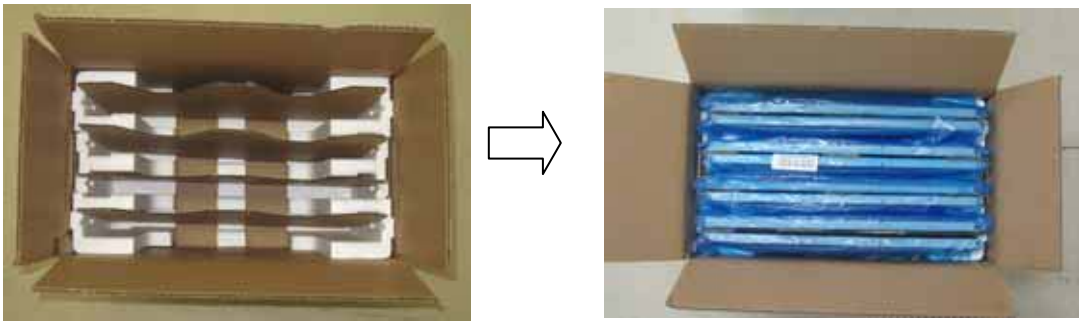
The product is transported by vehicle, aircraft or shipment in the state of pallet packing.

## 8.4 SIZE AND WEIGHT FOR PACKING BOX

| Parameter | Packing box | Unit |
|---|---|---|
| Size | 485（L）x280（W）x 330（H）(typ.) | mm |
| Weight | 2.15（typ.） | kg |
| Total weight | 18.8（typ.）<br>(with 8 products) | kg |

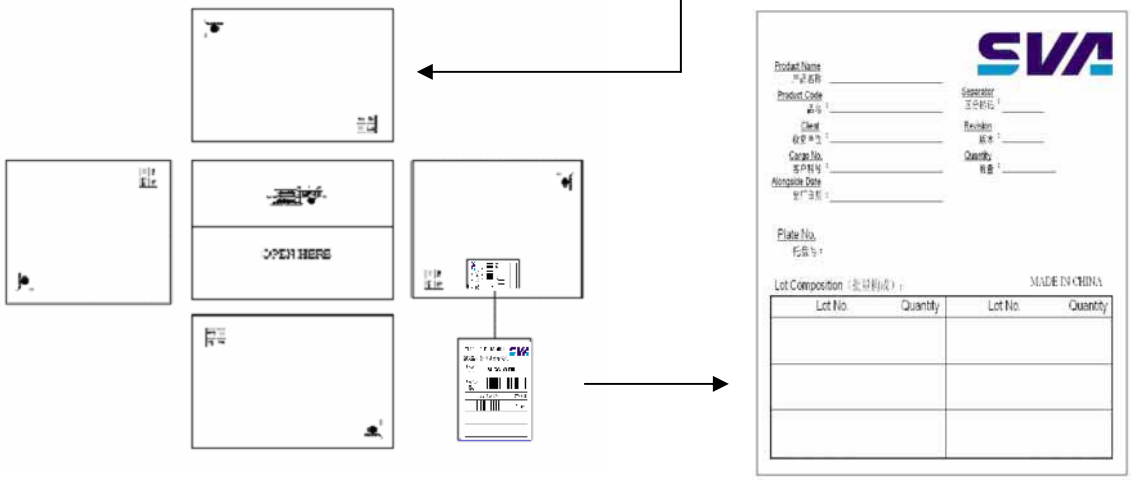
## 8.5 OUTLINE FIGURE FOR PACKING

8.5.1 Packing box



LCD module

Packing box

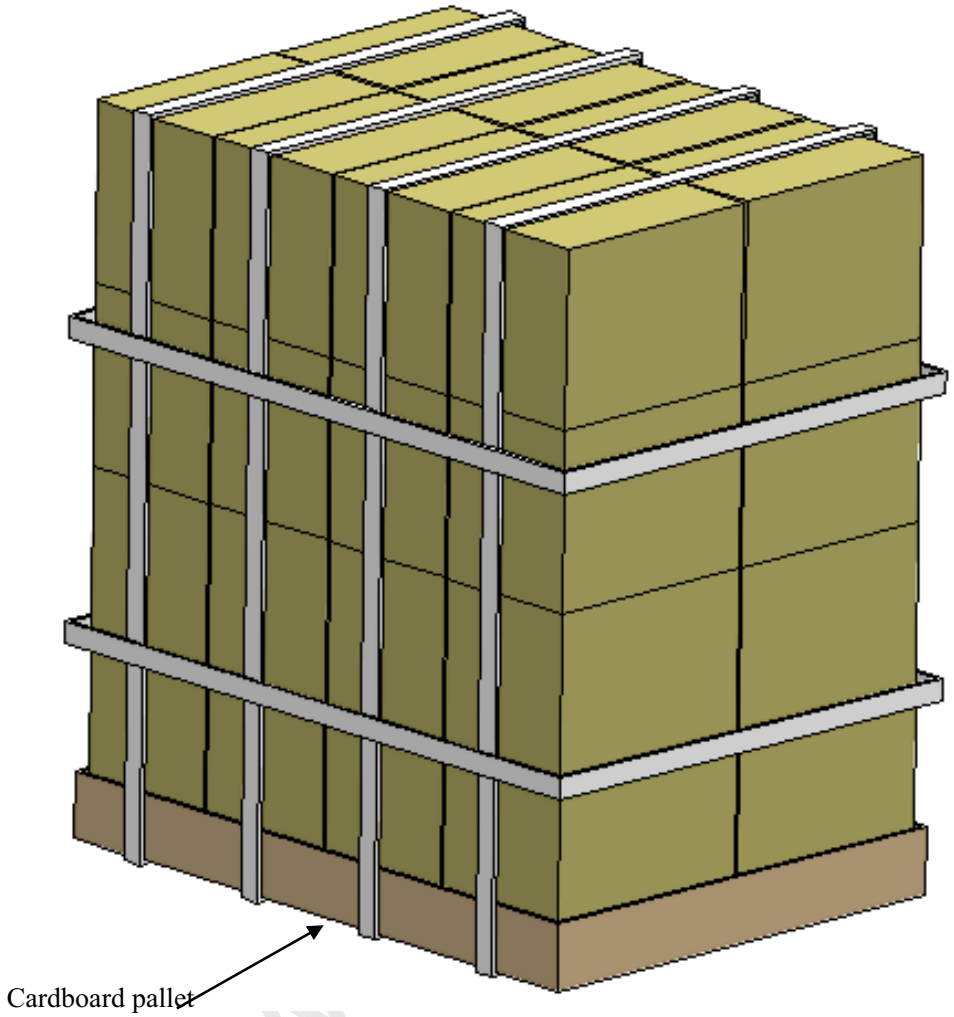


8.5.2 Pallet packing

Note: The ways for Packing and Shipping vary from different shipment volume, dependent on specific situations.

Packing boxes (8boxes×4 tiers maximum)

For reference:



# 9.PRECAUTIONS

## 9.1 MEANING OF CUTION SIGNS

The following caution signs have very important meaning .**Be sure to read "9.2 CAUTIONS" and "9.3 ATTENTIONS", after understanding these contents!**

This sign have the meaning that customer will be injured by himself or the product will sustain a damage, if customer has wrong operations.

This sign has the meaning that customer will get an electrical shock, if customer has wrong operations.

This sign has the meaning that customer will be injured by himself, if customer has wrong operations.

## 9.2 CAUTIONS

*** Do not touch lamp cables while turn on .Customers will be in danger of an electric shock**

*** Do not touch the working backlight and IC. Customers will be in danger of burn injury.**

*** Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass.(shock :To be not greater 294m/s$^2$ and to be not greater 11ms, Pressure: To be not greater 19.6N)**

## 9.3 ATTENTIONS 

9.3.1 Handling of the product

① Take hold of both ends without touch the circuit board when customer pulls out products (LCD modules) from inner packing box. If customer touches it, products may be broken down or out of adjustment, because of stress to mounting parts.

② Do not hook cables nor pull connection cables such as flexible cable and so on , for fear of damage.

③ If customer puts down the product temporarily, the product puts on flat subsoil as a display side turns down.

④ Take the measures of electrostatic discharge such as earth band, ionic shower and so on, when customer deal with the product, because products may be damaged by electrostatic.

⑤The torque for mounting screws must never exceed 0.34N-m. Higher torque values might result in distortion of the bezel.

⑥The product must be installed using mounting holes without undue stress such as bends or twist (See outline drawings).And do not add undue stress to any portion (such as bezel flat area) except mounting hole portion.

Bends or twist described above and undue stress to any portion except mounting hole portion may cause display un-uniformity.

⑦Do not press or rub on the sensitive display surface .If customer clean on the panel surface, SVA-NEC recommends using the cloth with ethanolic liquid such as screen cleaner for LCD.

⑧ Do not push-pull the interface connectors while the product is working, because wrong power sequence may break down the product.

⑨ Do not bend or unbend the lamp cable at the near part of the lamp holding rubber, to avoid the damage for high voltage side of the lamp. This damage may cause a lamp breaking and abnormal operation of high voltage circuit.

### 9.3.2 Environment

① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in antistatic pouch in room temperature, because of avoidance for dusts and sunlight, if customer stores the product.

② In order to prevent dew condensation occurring by temperature difference, the product packing box must be opened after leave under the environment of an unpacking room temperature enough. Because a situation of dew condensation occurring is changed by the environment temperature and humidity, evaluate the leaving time sufficiently. (Recommendation leaving time: 6 hour or more with packing state)

③ Do not operate in a high magnetic field .Circuit boards may be broken down by it.

④ This product is not designed as radiation hardened.

⑤ Use an original protection sheet on the product surface (polarizer). Adhesive type protection sheet should be avoided, because it may change color or properties of the polarizer.

### 9.3.3 Characteristics

**The following items are neither defects nor failures.**

① Response time, luminance and color may be changed by ambient temperature.

②The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.

③Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on operating time ,and especially low temperature, because the LCD has cold cathode fluorescent lamps.

④Do not display the fixed pattern for a long time because it may cause image sticking .Use a screen saver, if the fixed pattern is displayed on the screen.

⑤The display color may be changed by viewing angle because of the use of condenser sheet in the backlight.

⑥Optical characteristics may be changed by input signal timings.

⑦The interference noise of input signal frequency for this product and luminance control frequency of customer's backlight inverter may appear on a display. Set up luminance control frequency of backlight inverter so that the interference noise doses not appear.

### 9.3.4 Other

①All GND and VCC terminals should be used without a non-connected line.

②Do not disassemble a product or adjust volume without permission of SVA-NEC.

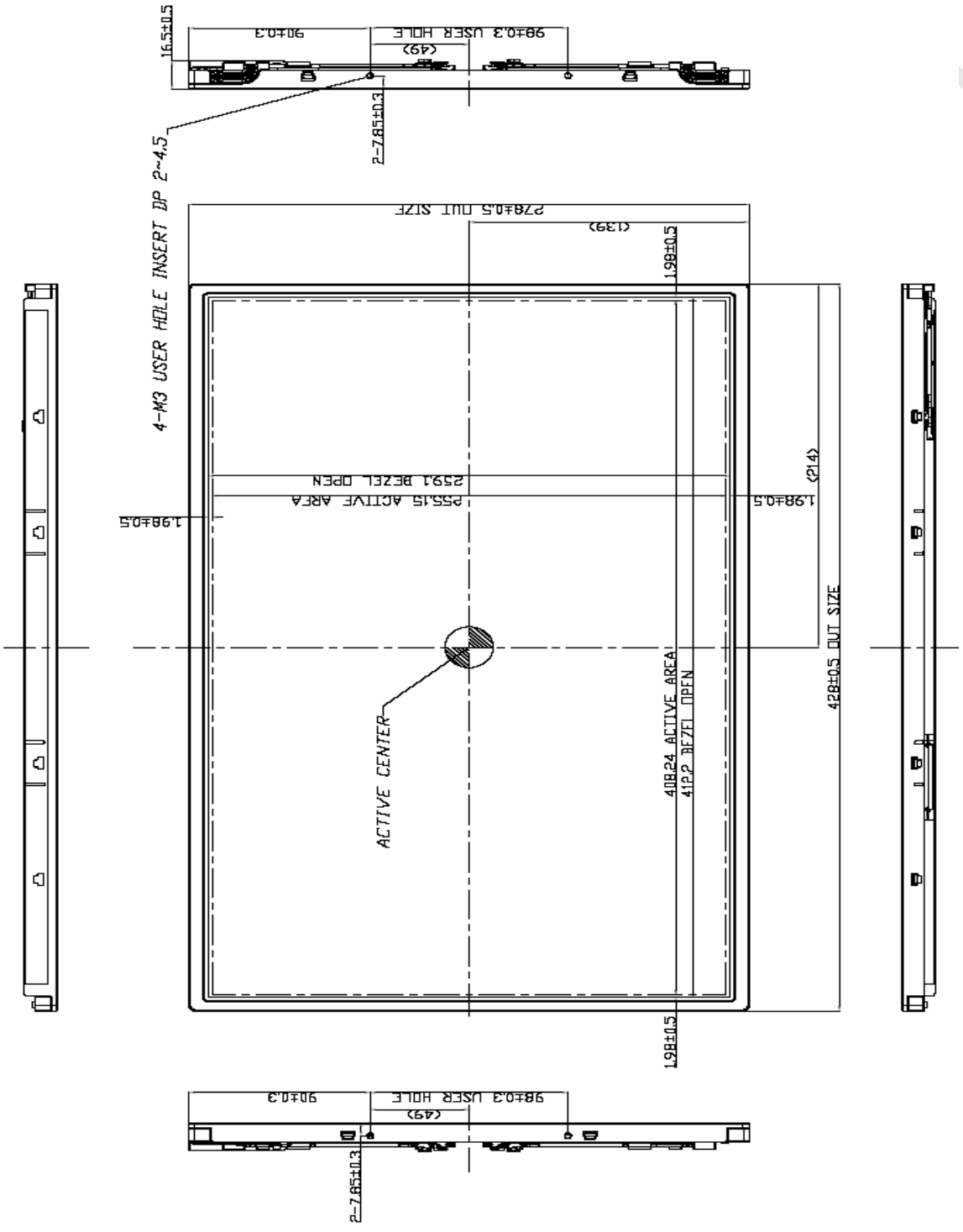
③Pay attention not to insert waste materials inside of products, if customer uses screw nails.

④Pack the product with original shipping package, because of avoidance of some damages during transportation, when customer returns it to SVA-NEC for repair and so on .

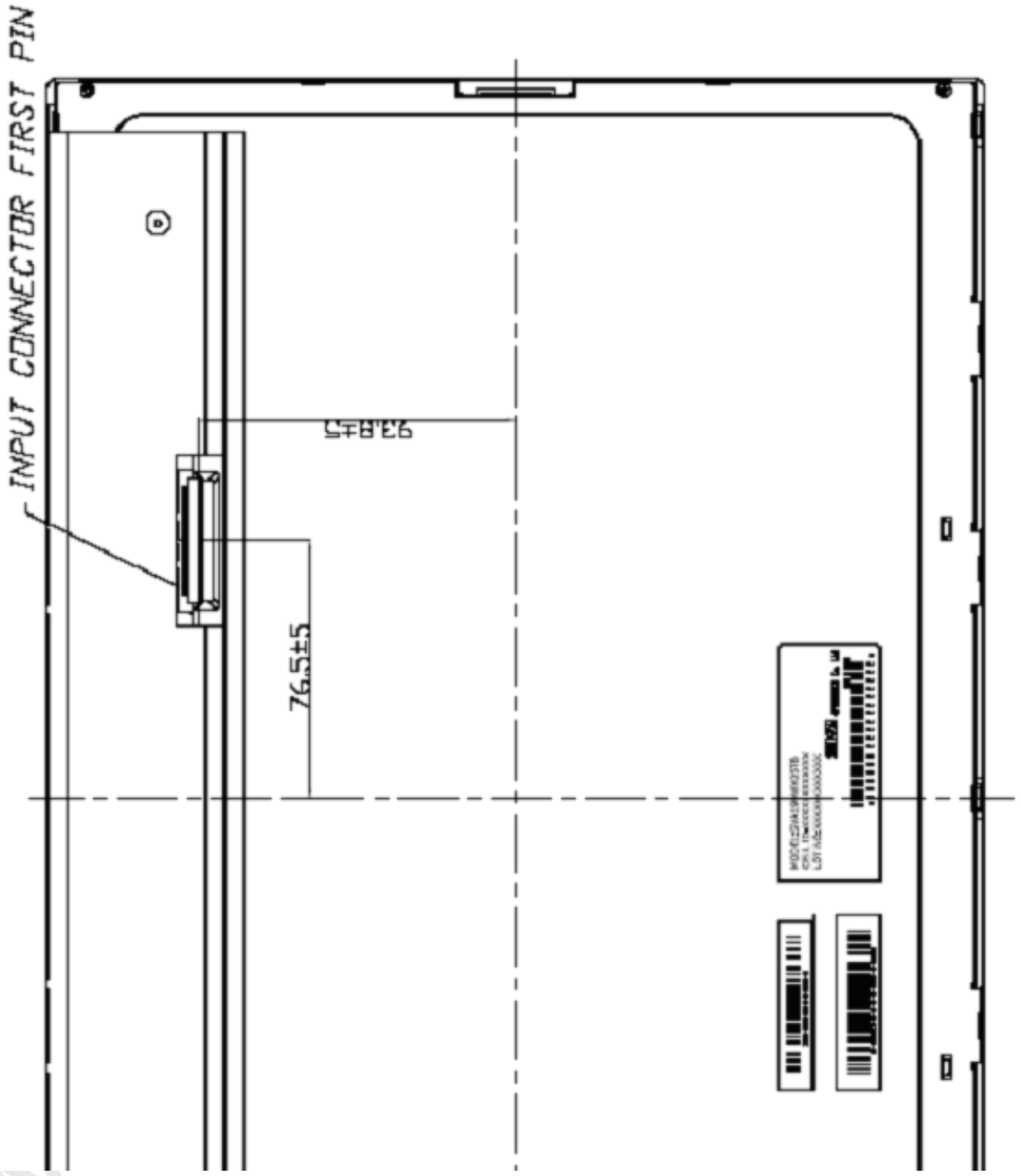
⑤Not only the module but also the equipment should be packed and transported as the module. becomes vertical .Otherwise, there is the fear that a display dignity decreases by an impact or vibrations.

# 10. OUTDRAWING

## 10.1 FRONT VIEW



10.2 REAR VIEW



| Rev | Revised date | Main Revision item and sign | Approved by | Checked by | Prepared by | Published date |
|---|---|---|---|---|---|---|
| 1.0 | 2009.1.19 | sign: 营业 江拯元 / 品管 于涛 | Nick Lv 2009.1.19 | Vincent 2009.1.19 | Qiu Yong 2009.1.19 | 2009.1.19 |
| 2.0 | | sign: 营业 / 品管<br>1.The Version of L and M is added. | | | | |