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Type No. **T-55312D121J-FW-A-ABN**

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## OPTREX CORPORATION

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By \_\_\_\_\_

Signature :

Date :

Please return this specification within two month with your signature.  
If not returned within two month ,specification will be considered  
as having been accepted.

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## Revision History

| Rev. | Date | Page | Comment |
|------|------|------|---------|
|      |      |      |         |

# 1. APPLICATION

This specification applies to color TFT-LCD module, T-55312D121J-FW-A-ABN.

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OPTREX classifies the usage of the TFT-LCD module as follows. Please confirm the usage before using the product.

## (1) Standard Usage

Computers, office equipment, factory automation equipment, test and measurement equipment, communications, transportation equipment(automobiles, ships, trains, etc.), provided, however, that operation is not influenced by TFT-LCD directly.

## (2) Special Usage

Medical equipment, safety equipment, transportation equipment, provided, however, that TFT-LCD is necessary to its operation.

## (3) Specific Usage

Cockpit Equipment, military systems, aerospace equipment, nuclear reactor control systems, life support systems and any other equipment. OPTREX should make a contract that stipulate apportionment of responsibilities between OPTREX and our customer.

The product specified in this document is designed for "Standard Usage" unless otherwise specified in this document. If customers intend to use the product for applications other than those specified for "Standard Usage", they should first contact OPTREX sales representative for it's intended use in writing.

OPTREX has been making continuous effort to improve the reliability of its products. Customers should implement sufficient reliability design of their application equipments such as redundant system design, fail-safe functions, anti-failure features.

OPTREX assumes no responsibility for any damage resulting from the use of the product that does not comply with the instructions and the precautions specified in this document.

Please contact and consult a OPTREX sales representative for any questions regarding this product.

## 2. OVERVIEW

T-55312D121J-FW-A-ABN is 12.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, and backlight unit.

By applying 6 bit or 8 bit digital data, 1280 × 800, 262k-color or 16.7M-color images are displayed on the 12.1" diagonal screen. Input power voltage is 3.3V for LCD driving.

The type of data and control signals are digital and transmitted via LVDS interface per Typ. 71 MHz clock cycle.

Inverter for backlight is not included in this module. General specifications are summarized in the following table:

| ITEM                                   | SPECIFICATION                                  |
|--|--|
| Display Area (mm)                      | 261.12 (H) × 163.2 (V)<br>(12.1-inch diagonal) |
| Number of Dots                         | 1280 × 3 (H) × 800 (V)                         |
| Pixel Pitch (mm)                       | 0.204 (H) × 0.204 (V)                          |
| Color Pixel Arrangement                | RGB vertical stripe                            |
| Display Mode                           | Normally white TN                              |
| Number of Color                        | 262k(6 bit/color), 16.7M(8 bit/color)          |
| Luminance (cd/m <sup>2</sup> )         | 400  |
| Wide Viewing Angle Technology          | Optical Compensation Film                      |
| Viewing Angle (CR ≥ 10)                | -80~80°(H), -60~80°(V)                         |
| Surface Treatment                      | Anti-glare and hard-coating 3H                 |
| Electrical Interface                   | LVDS (6 bit/8 bit)                             |
| Optimum Viewing Angle (Contrast ratio) | 6 o'clock                                      |
| Module Size (mm)                       | 283.0 (W) × 185.1 (H) × 19.4 (D)               |
| Module Mass (g)                        | 860  |
| Backlight Unit                         | CCFL, 2-tubes, edge-light, replaceable         |

Characteristic value without any note is typical value.

### 3. ABSOLUTE MAXIMUM RATINGS

| ITEM  | SYMBOL                    | MIN. | MAX     | UNIT             |
|---|---------------------------|------|---------|------------------|
| Power Supply Voltage for LCD                          | VCC                       | 0    | 4.0     | V                |
| Logic Input Voltage                                   | VI                        | -0.3 | VCC+0.3 | V                |
| Lamp Voltage  | VL                        | 0    | 2000    | V <sub>rms</sub> |
| Lamp Current  | IL                        | 0    | 18      | mArms            |
| Lamp Frequency  | FL                        | --   | 80      | kHz              |
| Operation Temperature(Panel) <small>Note 1,2)</small> | T <sub>op</sub> (Panel)   | -20  | 70      | °C               |
| Operation Temperature(Ambient) <small>Note 2)</small> | T <sub>op</sub> (Ambient) | -20  | 70      | °C               |
| Storage Temperature <small>Note 2)</small>            | T <sub>stg</sub>          | -20  | 80      | °C               |

[Note]

1) Measured at the center of active area and at the center of panel back surface

2) Top, T<sub>stg</sub> ≤ 40°C : 90%RH max. without condensation

Top, T<sub>stg</sub> > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

### 4. ELECTRICAL CHARACTERISTICS

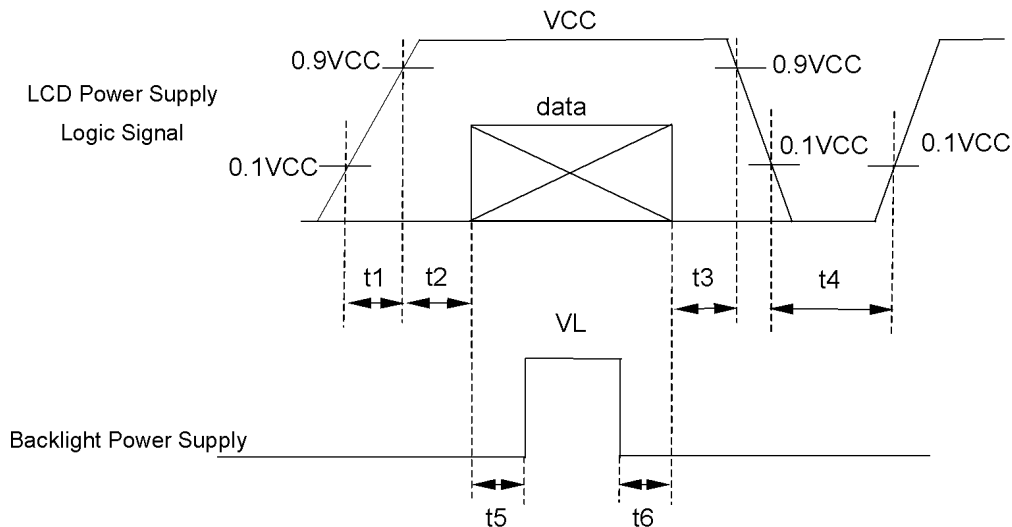
(1) TFT-LCD

Ambient temperature: Ta = 25°C

| ITEM                             | SYMBOL | MIN. | TYP. | MAX. | UNIT    | Remarks     |          |
|----------------------------------|--------|------|------|------|---------|-------------|----------|
| Power Supply Voltages for LCD    | VCC    | 3.0  | 3.3  | 3.6  | V       | *1)         |          |
| Power Supply Currents for LCD    | ICC    | --   | 550  | 950  | mA      | *2)         |          |
| Permissible Input Ripple Voltage | VRP    | --   | --   | 100  | mVp-p   | VCC = +3.3V |          |
| Logic Input Voltage              | High   | VIH  | 2.0  | --   | VCC+0.3 | V           | MODE, SC |
|                                  | Low    | VIL  | 0    | --   | 0.8     | V           | MODE, SC |

\*1) Power and signals sequence:

$$\begin{aligned}
 t_1 &\leq 10 \mu\text{s} & 200 \text{ ms} &\leq t_4 \\
 0 < t_2 &\leq 50 \text{ ms} & 200 \text{ ms} &\leq t_5 \\
 0 < t_3 &\leq 50 \text{ ms} & 0 &\leq t_6
 \end{aligned}$$

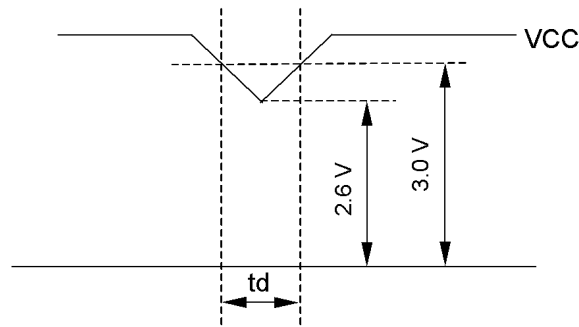


data: RGB DATA, DCLK, DENA, MODE, SC

VCC-dip conditions:

- 1) When  $2.6\text{ V} \leq VCC < 3.0\text{ V}$ ,  $t_d \leq 10\text{ ms}$
- 2) When  $VCC < 2.6\text{ V}$

VCC-dip conditions should also follow the power and signals sequence.



\*2) Typical current condition:

64-gray-bar pattern(6 bit)

256-gray-bar pattern(8 bit)

800 line mode

$VCC = +3.3\text{ V}$ ,  $f_H=49.4\text{ kHz}$ ,  $f_V=60\text{ Hz}$ ,  $f_{CLK}=71\text{ MHz}$

(2) Backlight

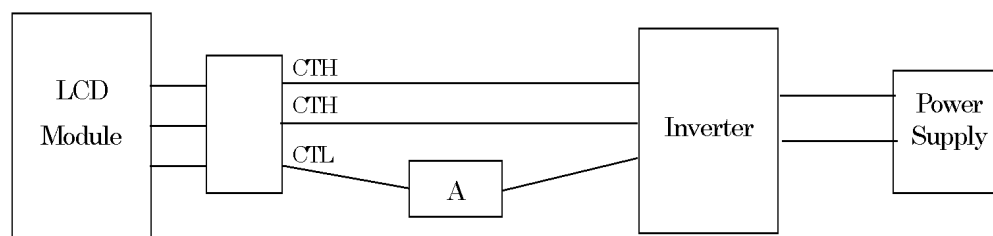
$T_a = 25^\circ\text{C}$

| ITEM                  | SYMBOL | MIN.  | TYP. | MAX. | UNIT  | Remarks   |
|-----------------------|--------|-------|------|------|-------|---|
| Lamp Voltage          | VL     | --    | 540  | --   | Vrms  | $I_L = 13.0\text{ mArms}$                                   |
| Lamp Current          | IL     | 6.0   | 13.0 | 15.0 | mArms | *2), *6)  |
| Lamp Frequency        | FL     | 35    | --   | 80   | kHz   | *3)   |
| Starting Lamp Voltage | VS     | 975   | --   | --   | Vrms  | $T_a = 25^\circ\text{C}$                                    |
|                       |        | 1150  | --   | --   |       | $T_a = 0^\circ\text{C}$                                     |
|                       |        | 1240  | --   | --   |       | $T_a = -20^\circ\text{C}$                                   |
| Lamp Life Time        | LT     | 50000 | --   | --   | h     | *4), *5), $I_L = 13.0\text{ mArms}$<br>Continuous operation |

[Note]

\*1) Please use synchronous inverter.

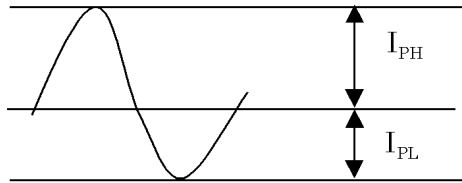
\*2) Lamp Current measurement method (The current meter is inserted in low voltage line.)



\*3) Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.

- \*4) Lamp life time is defined as the time either when the brightness becomes 50% of the initial value, or when the starting lamp voltage does not meet the value specified in this table.
- \*5) The life time of the backlight depends on the ambient temperature. The life time will decrease under low/high temperature.
- \*6) Please use the inverter which has symmetrical current wave form as follows,

The degree of unbalance: less than 10%  
 The ratio of wave height: less than  $\sqrt{2} \pm 10\%$



$I_{PH}$ : High side peak

$I_{PL}$ : Low side peak

The degree of unbalance =  $|I_{PH} - I_{PL}| / I_{rms} \times 100(\%)$   
 The ratio of wave height =  $I_{PH}(\text{or } I_{PL}) / I_{rms}$

CURRENT WAVE FORM

## 5. INTERFACE PIN CONNECTION

### (1) CN 1(Interface Signal)

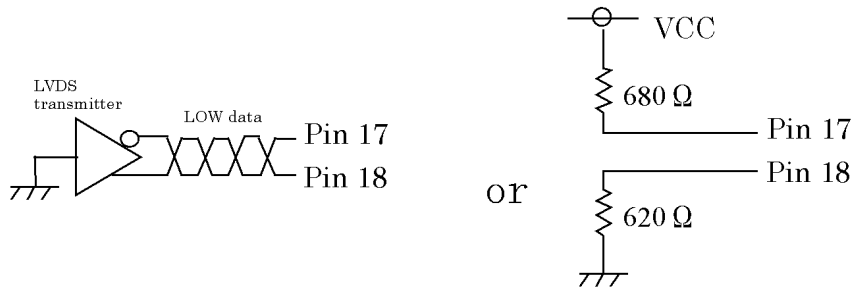
Used connector: FI-SE20P-HFE (JAE)

Corresponding connector: FI-S20S[for discrete Wire], FI-SE20ME[for FPC] (JAE)

| Pin No. | Symbol  | Function (ISP 6 bit compatibility mode)           |                            | Function (ISP 8 bit compatibility mode) |
|---------|---------|---|----------------------------|---|
|         |         | 6 bit input                                       | 8 bit input                |   |
| 1       | VCC     | +3.3 V Power supply                               |                            | ←                                       |
| 2       | VCC     | +3.3 V Power supply                               |                            | ←                                       |
| 3       | GND     | GND   |                            | ←                                       |
| 4       | GND     | GND   |                            | ←                                       |
| 5       | Link 0- | R0, R1, R2, R3, R4, R5, G0                        | R2, R3, R4, R5, R6, R7, G2 | R0, R1, R2, R3, R4, R5, G0              |
| 6       | Link 0+ | R0, R1, R2, R3, R4, R5, G0                        | R2, R3, R4, R5, R6, R7, G2 | R0, R1, R2, R3, R4, R5, G0              |
| 7       | GND     | GND   |                            | ←                                       |
| 8       | Link 1- | G1, G2, G3, G4, G5, B0, B1                        | G3, G4, G5, G6, G7, B2, B3 | G1, G2, G3, G4, G5, B0, B1              |
| 9       | Link 1+ | G1, G2, G3, G4, G5, B0, B1                        | G3, G4, G5, G6, G7, B2, B3 | G1, G2, G3, G4, G5, B0, B1              |
| 10      | GND     | GND   |                            | ←                                       |
| 11      | Link 2- | B2, B3, B4, B5, DENA                              | B4, B5, B6, B7, DENA       | B2, B3, B4, B5, DENA                    |
| 12      | Link 2+ | B2, B3, B4, B5, DENA                              | B4, B5, B6, B7, DENA       | B2, B3, B4, B5, DENA                    |
| 13      | GND     | GND   |                            | ←                                       |
| 14      | CLKIN-  | Clock -   |                            | ←                                       |
| 15      | CLKIN+  | Clock +   |                            | ←                                       |
| 16      | GND     | GND   |                            | ←                                       |
| 17      | Link3-  | See: *2)  | R0, R1, G0, G1, B0, B1     | R6, R7, G6, G7, B6, B7                  |
| 18      | Link3+  | See: *2)  | R0, R1, G0, G1, B0, B1     | R6, R7, G6, G7, B6, B7                  |
| 19      | MODE    | Low=ISP 6 bit compatibility mode                  |                            | High=ISP 8 bit compatibility mode       |
| 20      | SC      | Scan direction control (Low=Normal, High=Reverse) |                            | ←                                       |

\*1) The shielding case is connected with GND.

\*2) Recommended wiring of Pin 17,18 (6 bit input)



### (2) CN 2(Backlight)

Backlight-side connector: BHR-04VS-1 (JST)

Inverter-side connector: SM02(4.0)B-BHS(LF)(SN) (JST)

| Pin No. | Symbol | Function            |
|---------|--------|---------------------|
| 1, 2    | CTH    | VBLH (High Voltage) |
| 4       | CTL    | VBLL (Low Voltage)  |

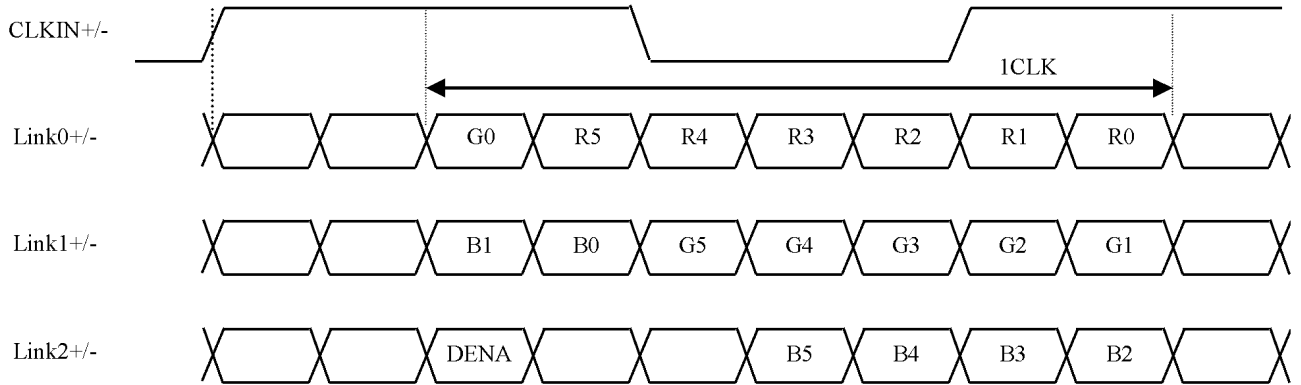
[Note]

$$VBLH \cdot VBLL = VL$$

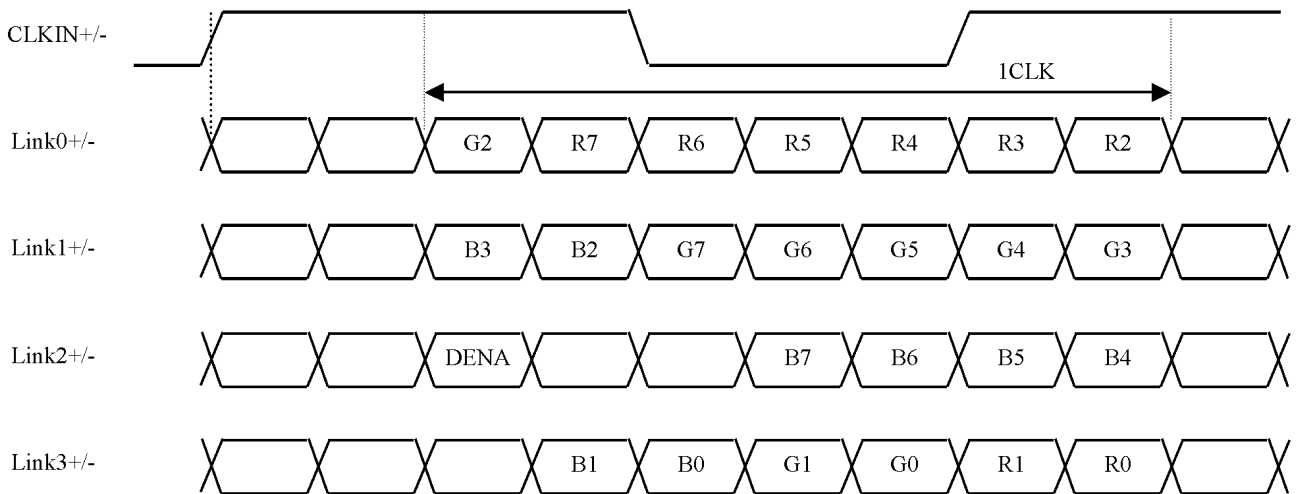


### (3) ISP data mapping

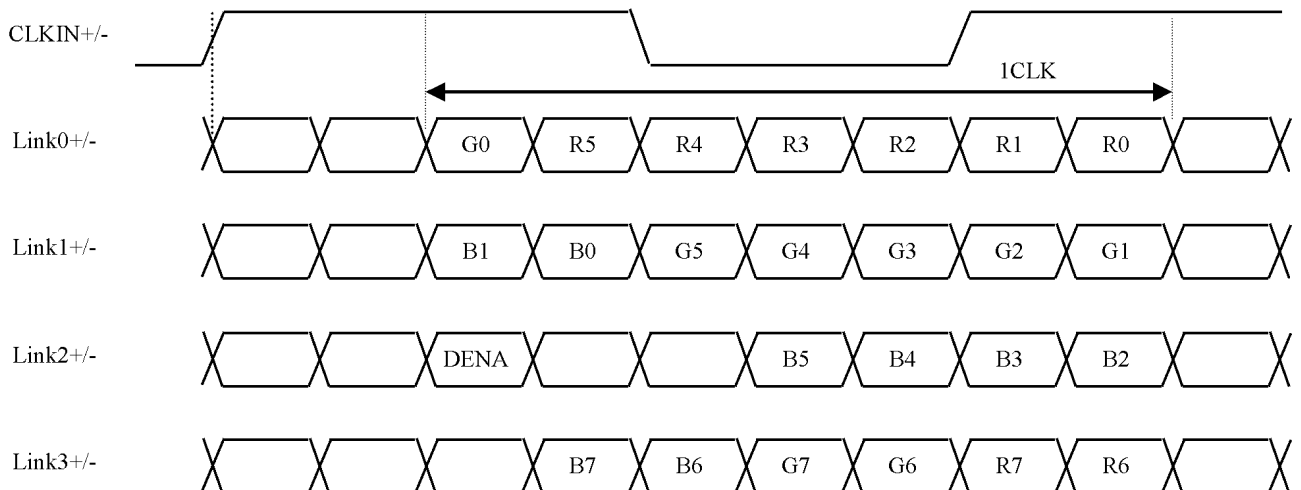
#### a. ISP 6 bit compatibility mode(6 bit input)



#### b. ISP 6 bit compatibility mode(8 bit input)



#### c. ISP 8 bit compatibility mode



## 6. INTERFACE TIMING

LVDS transmitter input signal

(1) Timing Specifications

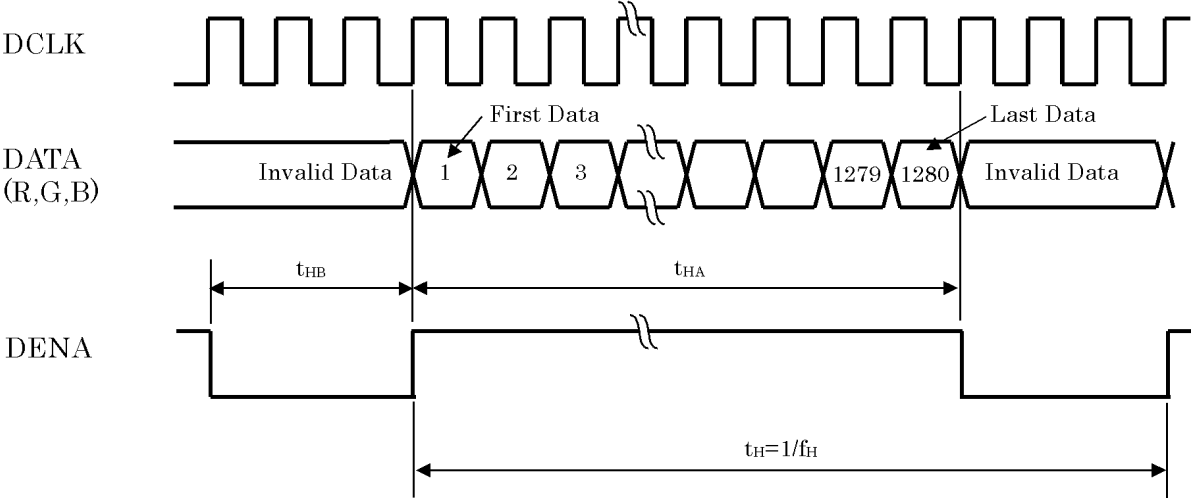
| ITEM |            | SYMBOL        | MIN      | TYP  | MAX  | UNIT |           |
|------|------------|---------------|----------|------|------|------|-----------|
| DCLK | Frequency  | $f_{CLK}$     | 50       | 71   | 80   | MHz  |           |
|      | Period     | $t_{CLK}$     | 12.5     | 14.1 | 20   | ns   |           |
| DENA | Horizontal | Active Time   | $t_{HA}$ | 1280 | 1280 | 1280 | $t_{CLK}$ |
|      |            | Blanking Time | $t_{HB}$ | 20   | 160  | --   | $t_{CLK}$ |
|      |            | Frequency     | $f_H$    | 42.4 | 49.4 | 60   | kHz       |
|      |            | Period        | $t_H$    | 16.6 | 20.3 | 23.6 | $\mu s$   |
|      | Vertical   | Active Time   | $t_{VA}$ | 800  | 800  | 800  | $t_H$     |
|      |            | Blanking Time | $t_{VB}$ | 3    | 23   | --   | $t_H$     |
|      |            | Frequency     | $f_V$    | 55   | 60   | 75   | Hz        |
|      |            | Period        | $t_V$    | 13.3 | 16.7 | 18.2 | ms        |

[Note]

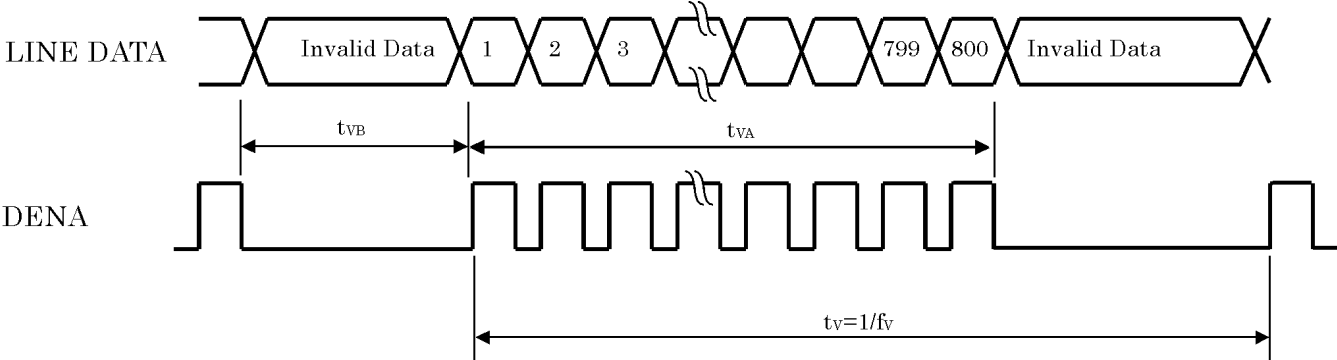
- 1) DENA (Data Enable) should always be positive polarity as shown in the timing specification.
- 2) DCLK should appear during all invalid period.
- 3) LVDS timing follows the timing specifications of LVDS receiver IC:  
THC63LVDF84B(Thine).
- 4) In case of blanking time fluctuation, please satisfy following condition.  
 $t_{VBn} > t_{VBn-1} - 3(t_H)$

(2) Timing Chart

a. Horizontal Timing Chart



b. Vertical Timing Chart



(3) Color Data Assignment

a. 6 bit input

| COLOR          |           | INPUT DATA |    |    |    |    |     |        |    |    |    |    |     |        |    |    |    |    |     |
|----------------|-----------|------------|----|----|----|----|-----|--------|----|----|----|----|-----|--------|----|----|----|----|-----|
|                |           | R DATA     |    |    |    |    |     | G DATA |    |    |    |    |     | B DATA |    |    |    |    |     |
|                |           | R5         | R4 | R3 | R2 | R1 | R0  | G5     | G4 | G3 | G2 | G1 | G0  | B5     | B4 | B3 | B2 | B1 | B0  |
|                |           | MSB        |    |    |    |    | LSB | MSB    |    |    |    |    | LSB | MSB    |    |    |    |    | LSB |
| BASIC<br>COLOR | BLACK     | 0          | 0  | 0  | 0  | 0  | 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   |
|                | GREEN(63) | 0          | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0   |
|                | BLUE(63)  | 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   |
| RED            | 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(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   |
| GREEN          | 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(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   |
| BLUE           | 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(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) Definition of gray scale

Color (n) ---n indicates gray scale level.

Higher n means brighter level.

2) Data

1:High, 0: Low

b. 8 bit input

| COLOR          |            | INPUT DATA |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|----------------|------------|------------|----|----|----|-----|----|----|----|--------|----|----|----|-----|----|----|----|--------|----|----|----|-----|----|----|----|
|                |            | R DATA     |    |    |    |     |    |    |    | G DATA |    |    |    |     |    |    |    | B DATA |    |    |    |     |    |    |    |
|                |            | R7         | R6 | R5 | R4 | R3  | R2 | R1 | R0 | G7     | G6 | G5 | G4 | G3  | G2 | G1 | G0 | B7     | B6 | B5 | B4 | B3  | B2 | B1 | B0 |
|                |            | MSB        |    |    |    | LSB |    |    |    | MSB    |    |    |    | LSB |    |    |    | MSB    |    |    |    | LSB |    |    |    |
| BASIC<br>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  |
|                | RED(255)   | 1          | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                | GREEN(255) | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                | BLUE(255)  | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  |
|                | CYAN       | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  |
|                | MAGENTA    | 1          | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  |
|                | YELLOW     | 1          | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                | WHITE      | 1          | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  |
| RED            | RED(1)     | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                | RED(2)     | 0          | 0  | 0  | 0  | 0   | 0  | 1  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                |            |            |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|                |            |            |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|                | RED(255)   | 1          | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
| GREEN          | GREEN(1)   | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                | GREEN(2)   | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 1  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
|                |            |            |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|                |            |            |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|                | GREEN(255) | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  |
| BLUE           | BLUE(1)    | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 1  |
|                | BLUE(2)    | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 1  | 0  |
|                |            |            |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|                |            |            |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |        |    |    |    |     |    |    |    |
|                | BLUE(255)  | 0          | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 0      | 0  | 0  | 0  | 0   | 0  | 0  | 0  | 1      | 1  | 1  | 1  | 1   | 1  | 1  | 1  |

[Note]

1) Definition of gray scale

Color (n) ---n indicates gray scale level.

Higher n means brighter level.

2) Data

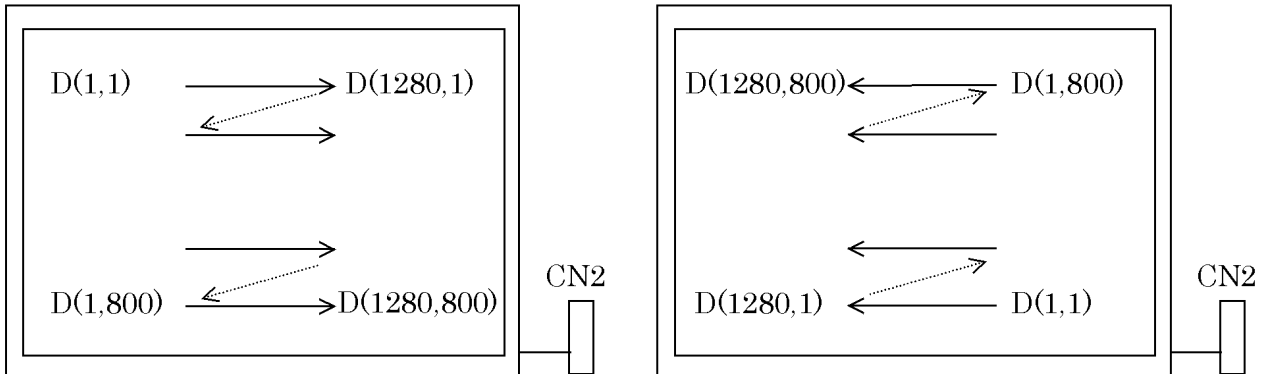
1:High, 0: Low

#### (4) Display Position and Scan Direction

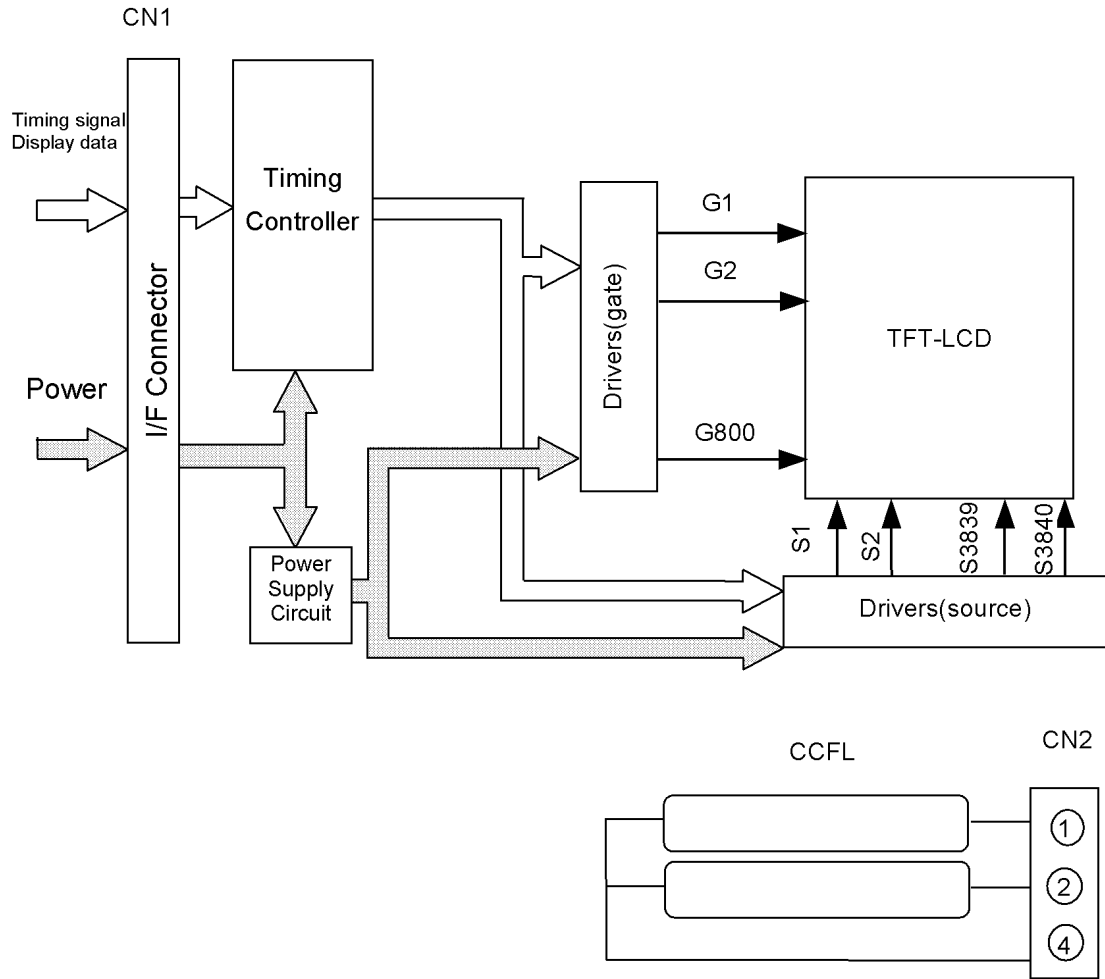
D(X,Y) shows the data number of input signal for LCD panel signal processing PCB.

SC: Low

SC: High



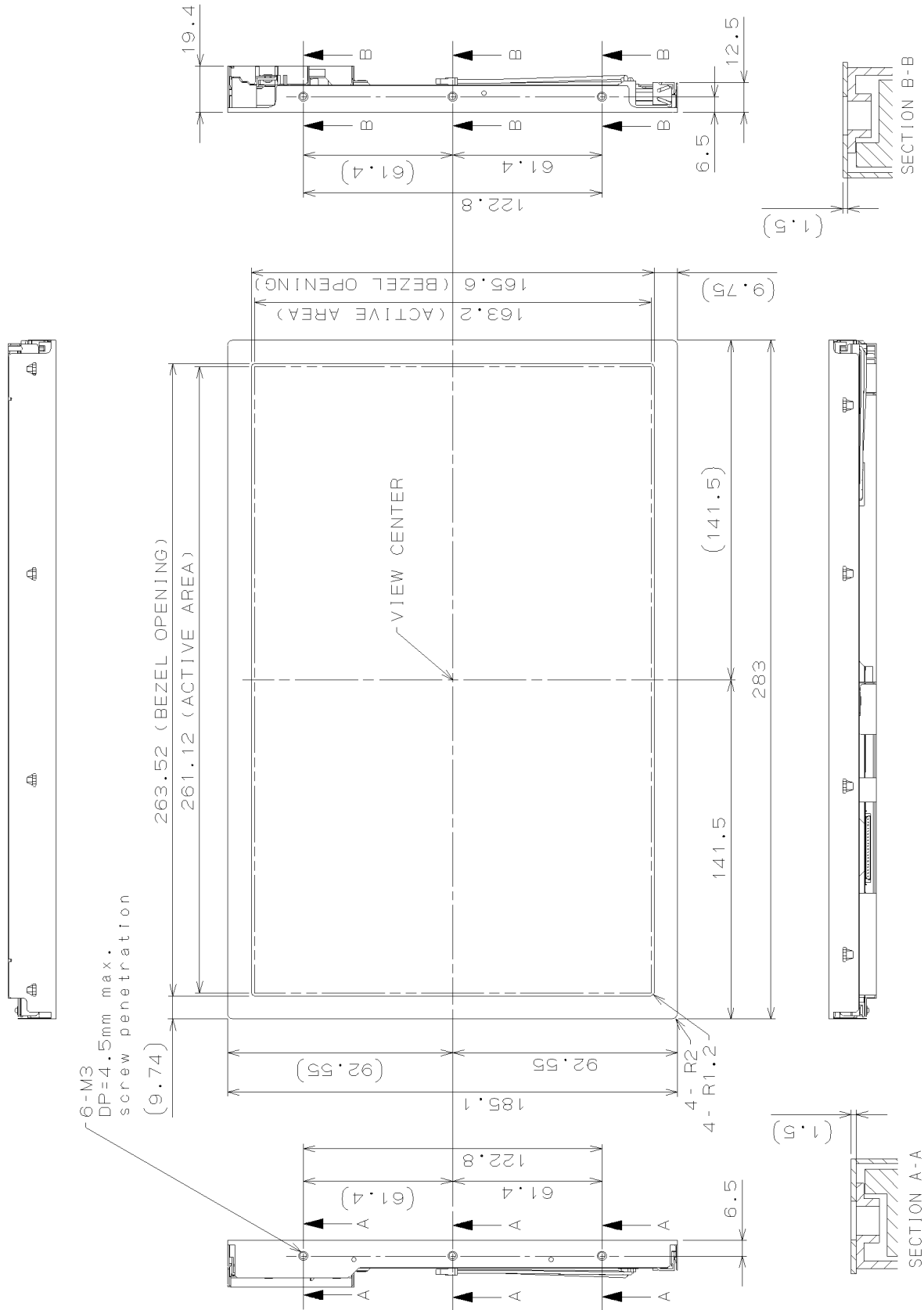
# 7. BLOCK DIAGRAM



Downloaded from [Elcodis.com](http://Elcodis.com) electronic components distributor

# 8. MECHANICAL SPECIFICATIONS

## (1) Front Side

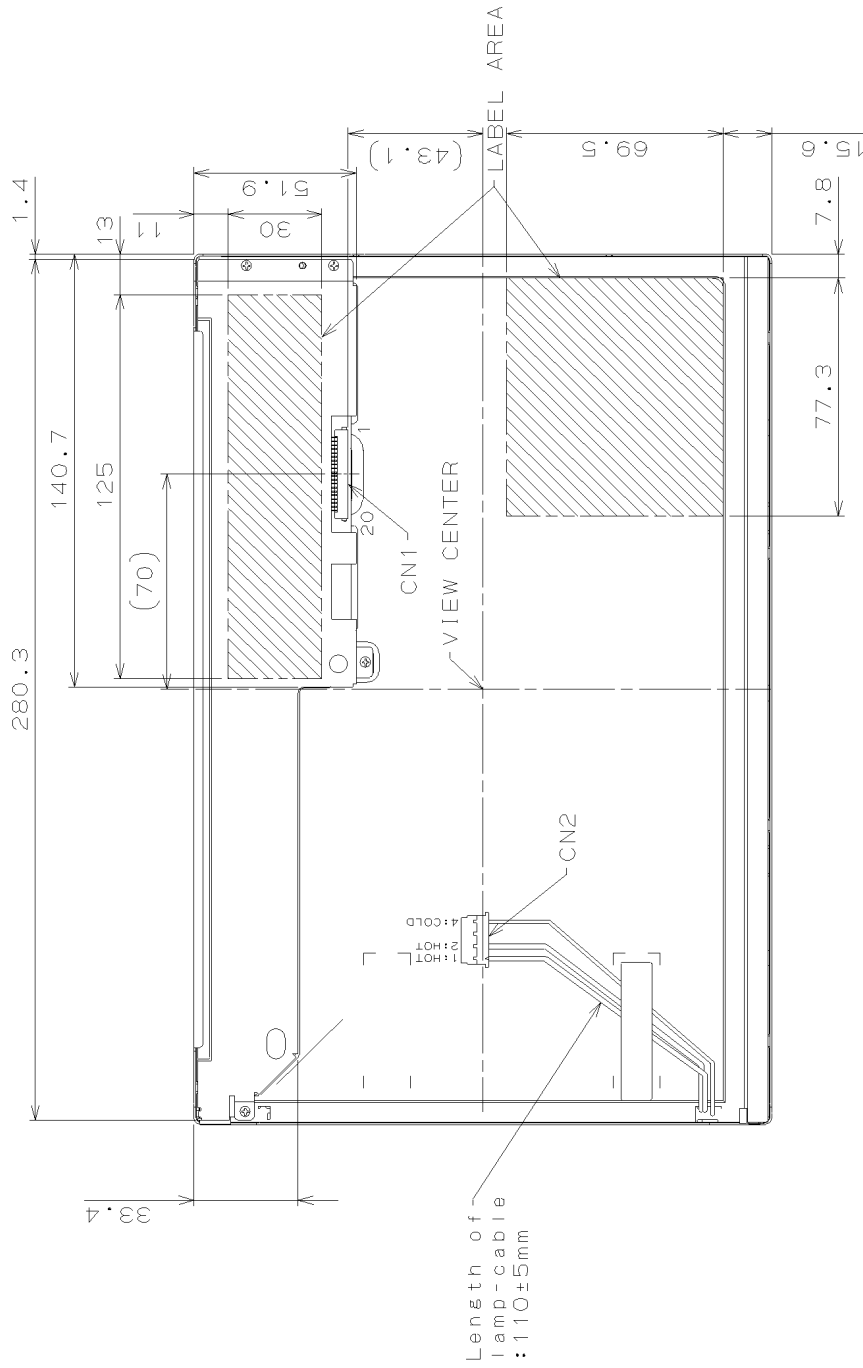


- 1) Tolerance is  $\pm 0.5$ mm unless noted.
- 2) Third angle projection

(Unit: mm)



(2) Rear Side



1) Tolerance is  $\pm 0.5\text{mm}$  unless noted.  
 2) Third angle projection

CN1: FI-SE20P-HFE(JAE)  
 CN2: BHR-04VS-1(JST)

(Unit:mm)

## 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, Input Signals: Typ. Values shown in Section 6

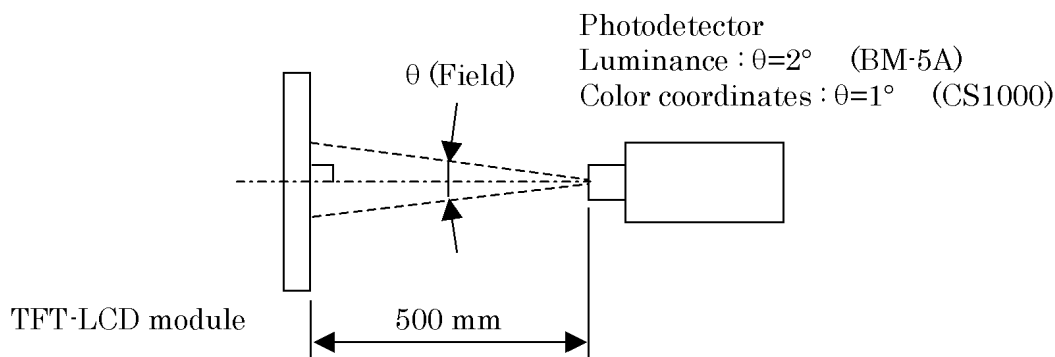
| ITEM                 | SYMBOL      | CONDITION                            | MIN                                  | TYP    | MAX    | UNIT              | Remarks   |        |
|----------------------|-------------|--------------------------------------|--------------------------------------|--------|--------|-------------------|-----------|--------|
| Contrast Ratio       | CR          | $\theta_V=0^\circ, \theta_H=0^\circ$ | 390                                  | 600    | --     | --                | *1)*2)*5) |        |
| Luminance            | Lw          | $\theta_V=0^\circ, \theta_H=0^\circ$ | 300                                  | 400    | --     | cd/m <sup>2</sup> | *1)*5)    |        |
| Luminance Uniformity | $\Delta Lw$ | $\theta_V=0^\circ, \theta_H=0^\circ$ | --                                   | --     | 30     | %                 | *1)*3)*5) |        |
| Response Time        | tr          | $\theta_V=0^\circ, \theta_H=0^\circ$ | --                                   | 4      | --     | ms                | *1)*4)*5) |        |
|                      | tf          | $\theta_V=0^\circ, \theta_H=0^\circ$ | --                                   | 12     | --     | ms                | *1)*4)*5) |        |
| Viewing Angle        | Horizontal  | $\theta_H$                           | CR $\geq 10$                         | -70~70 | -80~80 | --                | °         | *1)*5) |
|                      | Vertical    | $\theta_V$                           |                                      | -50~70 | -60~80 | --                | °         | *1)*5) |
|                      | Horizontal  | $\theta_H$                           | CR $\geq 5$                          | -70~70 | -80~80 | --                | °         | *1)*5) |
|                      | Vertical    | $\theta_V$                           |                                      | -70~70 | -80~80 | --                | °         | *1)*5) |
| Image sticking       | tis         | 2 h                                  | --                                   | --     | 2      | s                 | *6)       |        |
| Color Coordinates    | Red         | Rx                                   | $\theta_V=0^\circ, \theta_H=0^\circ$ | 0.543  | 0.573  | 0.603             | --        | *1)*5) |
|                      |             | Ry                                   |                                      | 0.299  | 0.329  | 0.359             |           |        |
|                      | Green       | Gx                                   |                                      | 0.298  | 0.328  | 0.358             |           |        |
|                      |             | Gy                                   |                                      | 0.506  | 0.536  | 0.566             |           |        |
|                      | Blue        | Bx                                   |                                      | 0.131  | 0.161  | 0.191             |           |        |
|                      |             | By                                   |                                      | 0.127  | 0.157  | 0.187             |           |        |
|                      | White       | Wx                                   |                                      | 0.283  | 0.313  | 0.343             |           |        |
|                      |             | Wy                                   |                                      | 0.299  | 0.329  | 0.359             |           |        |

[Note]

These items are measured using CS1000(MINOLTA) for color coordinates, EZContrast(ELDIM) for viewing angle and CS1000 or BM-5A(TOPCON) for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the lamp unless noted.

Condition: IL = 13.0 mArms, FL= 55 kHz

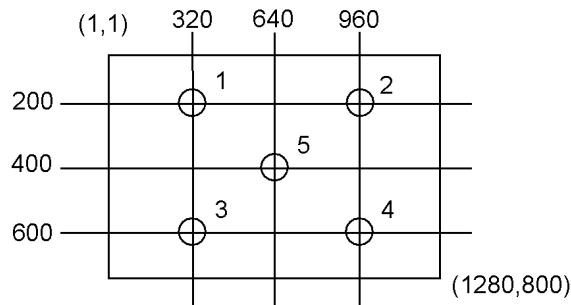
Measurement method for luminance and color coordinates is as follows.



The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

\*1) Measurement Point

Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center Luminance Uniformity: point 1□5 shown in a figure below



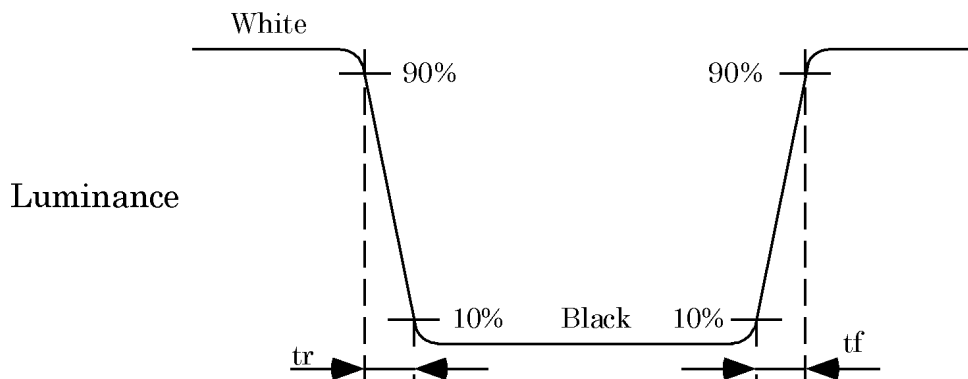
\*2) Definition of Contrast Ratio

CR= Luminance with all white pixels / Luminance with all black pixels

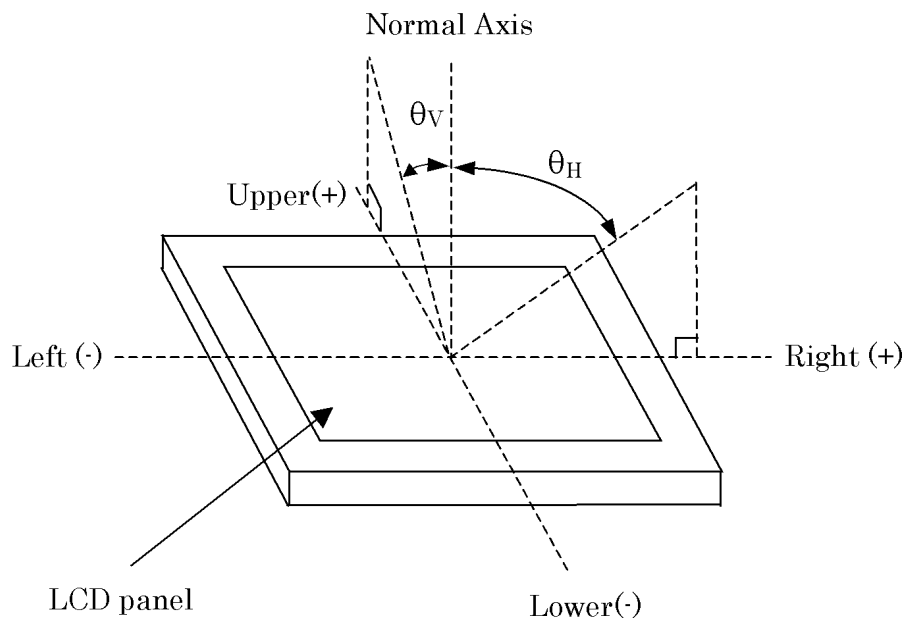
\*3) Definition of Luminance Uniformity

$$\Delta L_w = [L_w(\text{MAX}) / L_w(\text{MIN}) - 1] \times 100$$

\*4) Definition of Response Time

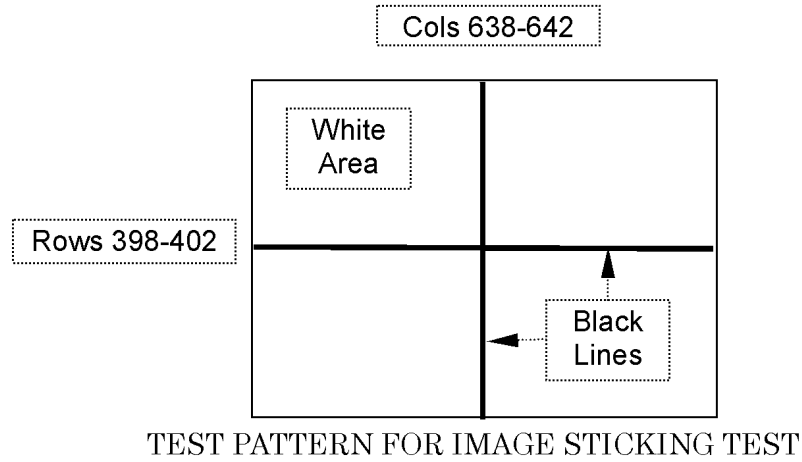


\*5) Definition of Viewing Angle ( $\theta_v$ ,  $\theta_H$ )



\*6) Image sticking:

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25°C.



## 10. RELIABILITY TEST CONDITION

### (1) Temperature and Humidity

| TEST ITEM                                   | CONDITIONS                                     |
|---|--|
| HIGH TEMPERATURE<br>HIGH HUMIDITY OPERATION | 40°C, 90%RH, 240 h<br>(No condensation)        |
| HIGH TEMPERATURE OPERATION                  | 70°C, 240 h                                    |
| LOW TEMPERATURE OPERATION                   | -20°C, 240 h                                   |
| HIGH TEMPERATURE STORAGE                    | 80°C, 240 h                                    |
| LOW TEMPERATURE STORAGE                     | -20°C, 240 h                                   |
| THERMAL SHOCK (NON-OPERATION)               | BETWEEN -20°C (1h) and 80°C(1h),<br>100 CYCLES |

### (2) Shock & Vibration

| ITEM                         | CONDITIONS   |
|------------------------------|--|
| SHOCK<br>(NON-OPERATION)     | Shock level: 1470 m/s <sup>2</sup> (150G)<br>Waveform: half sinusoidal wave, 2 ms<br>Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs  |
| VIBRATION<br>(NON-OPERATION) | Vibration level: 9.8 m/s <sup>2</sup> (1.0G)<br>Waveform: sinusoidal<br>Frequency range: 5 to 500 Hz<br>Frequency sweep rate: 0.5 octave /min<br>Duration: one sweep from 5 to 500 Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours) |

### (3) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image, no damage of the display function. (ex. no line defect)

Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)

## 11. INSPECTION STANDARDS

Inspection condition is as follows:

- Viewing distance: approximately 35 cm.
- Viewing angle: normal to the LCD panel  $\pm 10^\circ$  horizontal and vertical.
- Ambient temperature: approximately 25°C.
- Ambient light: 300 - 500 lx.

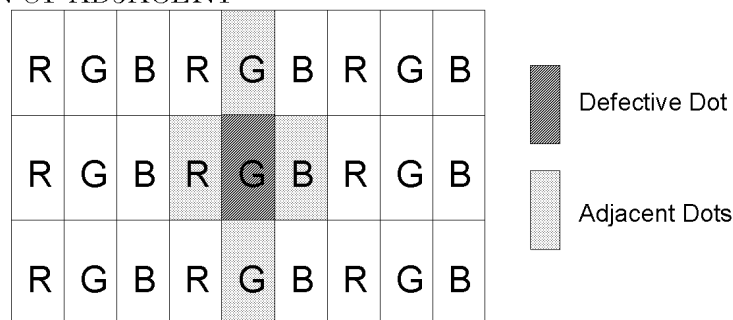
Bright Dot is defined as follows:

Visible through 5% transmission ND filter under the condition that black image (color 0) is on the display.

| DEFECT TYPE                                   |  | LIMIT  |            |
|---|--|--|------------|
| VISUAL DEFECT                                 | SCRATCH                                    | $0.01 \text{ mm} < W \leq 0.05 \text{ mm}$<br>$L \leq 10 \text{ mm}$ | $N \leq 4$ |
|   |  | $0.01 \text{ mm} < W$<br>$10 \text{ mm} < L$                         | $N = 0$    |
|   |  | $0.05 \text{ mm} < W$  | $N = 0$    |
|   | DENT                                       | $0.2 \text{ mm} < \phi \leq 0.4 \text{ mm}$                          | $N \leq 4$ |
|   |  | $0.4 \text{ mm} < \phi$  | $N = 0$    |
|   | BLACK SPOT<br>BUBBLE                       | $0.2 \text{ mm} < \phi \leq 0.4 \text{ mm}$                          | $N \leq 5$ |
|   |  | $0.4 \text{ mm} < \phi$  | $N = 0$    |
|   | LINT                                       | $L \leq 3 \text{ mm}$<br>$W \leq 0.1 \text{ mm}$                     | $N \leq 4$ |
| $3 \text{ mm} < L$<br>$W \leq 0.1 \text{ mm}$ |  | $N = 0$  |            |
| $0.1 \text{ mm} < W$                          |  | ACCORDING TO<br>BLACK SPOT   |            |
| ELECTRICAL DEFECT                             | BRIGHT DOT                                 | $N \leq 5$   |            |
|   | DARK DOT                                   | $N \leq 5$   |            |
|   | TOTAL DOT                                  | $N \leq 8$   |            |
|   | TWO ADJACENT DOT<br>BRIGHT DOT<br>DARK DOT | $\leq 2 \text{ PAIRS}$<br>$\leq 2 \text{ PAIRS}$                     |            |
|   | THREE OR MORE<br>ADJACENT DOT              | NOT ALLOWED  |            |
|   | LINE DEFECT                                | NOT ALLOWED  |            |

\*1) W: width, L: length,  $\phi$ : diameter, N: number

\*2) DEFINITION OF ADJACENT



The defects that are not defined above and considered to be problem shall be reviewed and discussed by both parties.