# LCD Module Technical Specification

First Edition
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Final Revision
******

Type No. **T-51863D150J-FW-A-AA**

**OPTREX CORPORATION**


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APPROVED

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

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|---|---|---|---|
| | | | |

# 1. APPLICATION

This specification applies to color TFT-LCD module, T-51863D150J-FW-A-AA.



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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.

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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-51863D150J-FW-A-AA is 15.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) modules composed of LCD panel, driver ICs, control circuit, and backlight unit.

By applying 6 bit or 8 bit digital data, 1024 × 768, 262k-color or 16.7M-color images are displayed on the 15.0" diagonal screen. Input power voltage is 3.3 V for LCD driving.
The type of data and control signals are digital and transmitted via LVDS interface per Typ. 65 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) | 304.1 (H) × 228.1 (V)<br>(15.0-inch diagonal) |
| Number of Dots | 1024 × 3 (H) × 768 (V) |
| Pixel Pitch (mm) | 0.297 (H) × 0.297 (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$^2$) | 250 |
| Wide Viewing Angle Technology | Optical Compensation Film |
| Viewing Angle (CR ≥ 10) | -75~75° (H)  -60~50° (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) | 326.0 (W) × 255.0 (H) × 15.9 (D) |
| Module Mass (g) | 1290 |
| 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 | 2500 | Vrms |
| Lamp Current | IL | 0 | 10.0 | mArms |
| Lamp Frequency | FL | -- | 100 | kHz |
| Operation Temperature (Panel) Note 1,2) | $T_{op(Panel)}$ | –20 | 70 | °C |
| Operation Temperature (Ambient) Note 2) | $T_{op(Ambient)}$ | –20 | 70 | °C |
| Storage Temperature Note 2) | $T_{stg}$ | –20 | 80 | °C |

[Note]

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

2) Top,Tstg ≤ 40°C : 90%RH max. without condensation

Top,Tstg > 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

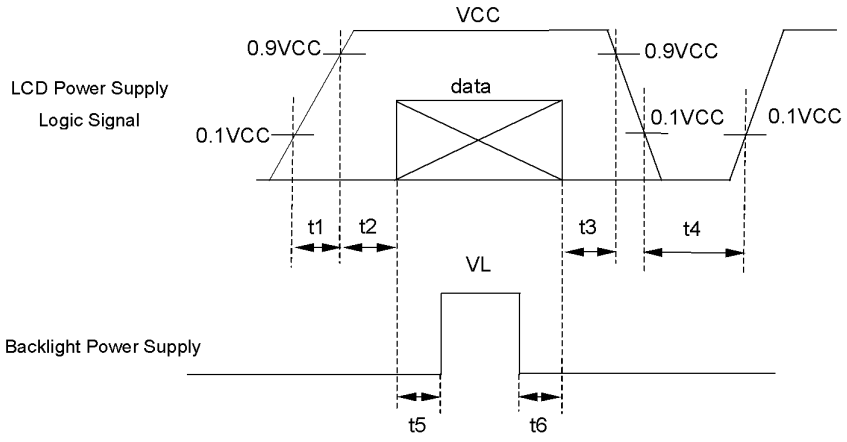
| ITEM | | SYMBOL | MIN. | TYP. | MAX. | UNIT | Remarks |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage for LCD | | VCC | 3.0 | 3.3 | 3.6 | V | *1) |
| Power Supply Current for LCD | | ICC | -- | 410 | 700 | mA | *2) |
| Permissive Input Ripple Voltage | | VRP | -- | -- | 100 | mVp-p | VCC = +3.3 V |
| 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:

t1 ≤ 10 ms  200 ms ≤ t4

0 < t2 ≤ 50 ms  200 ms ≤ t5

0 < t3 ≤ 50 ms  0 ≤ t6

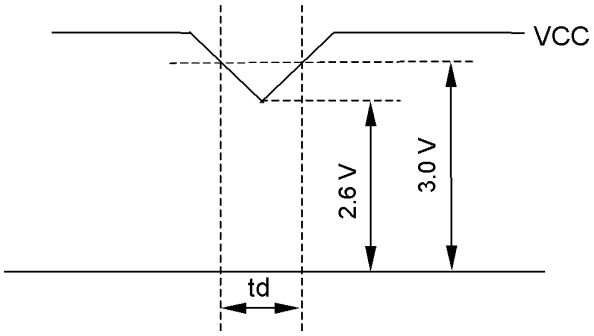



data: RGB DATA, DCLK, DENA, MODE, SC

VCC-dip conditions:

1) When 2.6 V ≤ VCC < 3.0 V, td ≤ 10 ms
2) When VCC < 2.6 V

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




*2) Typical current condition:

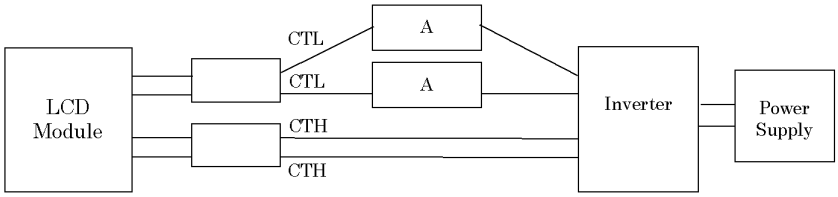
64-gray-bar-pattern(6 bit)
256-gray-bar-pattern(8 bit)
768 line mode
VCC = +3.3 V, $f_H$ = 48.4 kHz, $f_V$ = 60 Hz, $f_{CLK}$ = 65 MHz

(2) Backlight Ta = 25°C

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | Remarks |
|---|---|---|---|---|---|---|
| Lamp Voltage | VL | -- | 620 | -- | Vrms | IL = 6.5 mArms |
| Lamp Current | IL | 3.5 | 6.5 | 8.0 | mArms | *2),*6) |
| Lamp Frequency | FL | 40 | -- | 70 | kHz | *3) |
| Starting Lamp Voltage | VS | 1300 | -- | -- | Vrms | Ta = 25°C |
| | | 1500 | -- | -- | Vrms | Ta = 0°C |
| | | 1650 | -- | -- | Vrms | Ta = –20°C |
| Lamp Life Time | LT | 50000 | -- | -- | h | *4),*5) IL = 6.5 mArms, Continuous Operation |

*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.

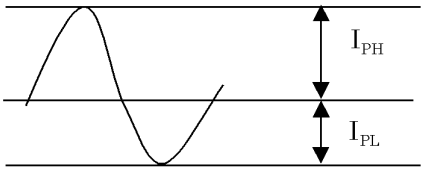
*4) Lamp life time is defined as the time either when the brightness becomes 50% of the initial value, or when the starting lamp voltage does not meet the value specified in this table.

*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 = $| I_{PH} - I_{PL} |$ / Irms × 100(%)
The ratio of wave height = $I_{PH}$(or $I_{PL}$) / Irms

CURRENT WAVE FORM

## 5. INTERFACE PIN CONNECTION

(1) CN 1(Interface Signal)

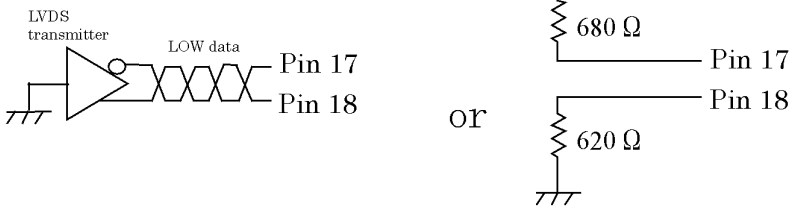
Used Connector: DF14H-20P-1.25H(56)(HIROSE)

Corresponding connector: DF14-20S-1.25C(HIROSE)

| 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: BHSR-02VS-1(JST)

Inverter-side connector: SM02B-BHSS(LF)(SN) (JST)

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

[Note]

VBLH-VBLL = VL

(3) CN 3(Backlight)

Backlight-side connector: BHR-02VS-1(JST)

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

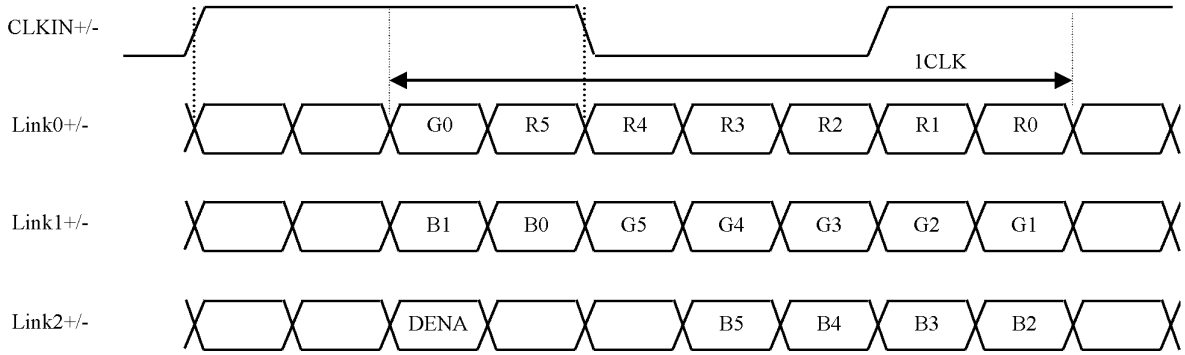
| Pin No. | Symbol | Function |
|---|---|---|
| 1, 2 | CTL | VBLL (Low Voltage) |

[Note]

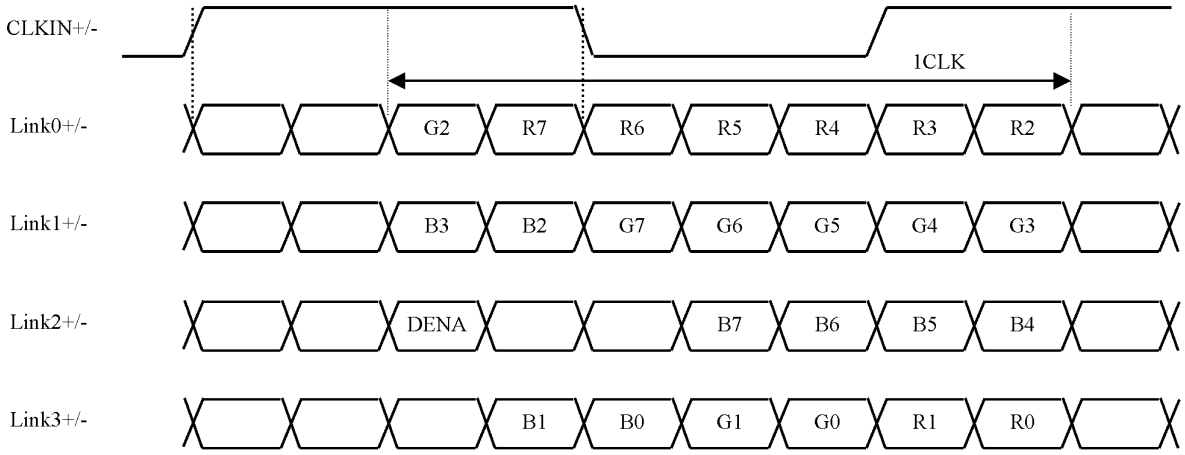
VBLH-VBLL = VL

## (4) ISP data mapping

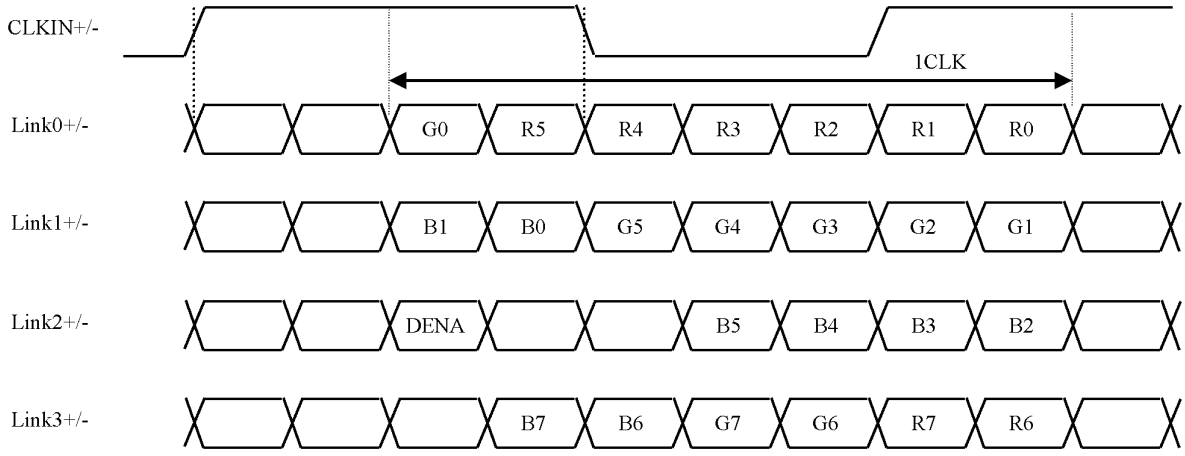
a. ISP 6 bit compatibility mode(6 bit input)




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

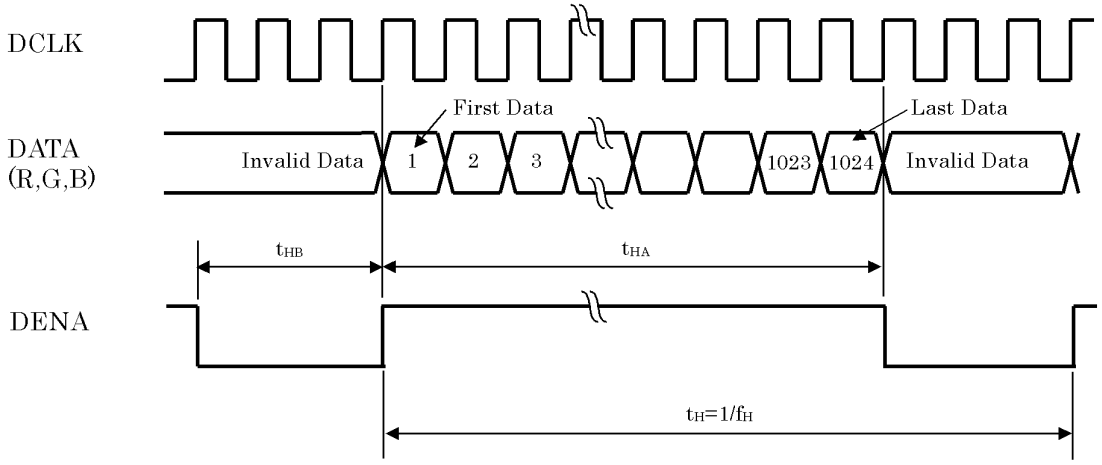
| ITEM | | | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | | $f_{CLK}$ | 50 | 65 | 80 | MHz |
| | Period | | $t_{CLK}$ | 12.5 | 15.4 | 20 | ns |
| DENA | Horizontal | Active Time | $t_{HA}$ | 1024 | 1024 | 1024 | $t_{CLK}$ |
| | | Blanking Time | $t_{HB}$ | 20 | 320 | 511 | $t_{CLK}$ |
| | | Frequency | $f_H$ | 42.4 | 48.4 | 60 | kHz |
| | | Period | $t_H$ | 16.6 | 20.7 | 23.6 | μs |
| | Vertical | Active Time | $t_{VA}$ | 768 | 768 | 768 | $t_H$ |
| | | Blanking Time | $t_{VB}$ | 3 | 38 | -- | $t_H$ |
| | | Frequency | $f_V$ | 55 | 60 | 75 | Hz |
| | | Period | $t_V$ | 13.3 | 16.7 | 18.2 | ms |

[Note]

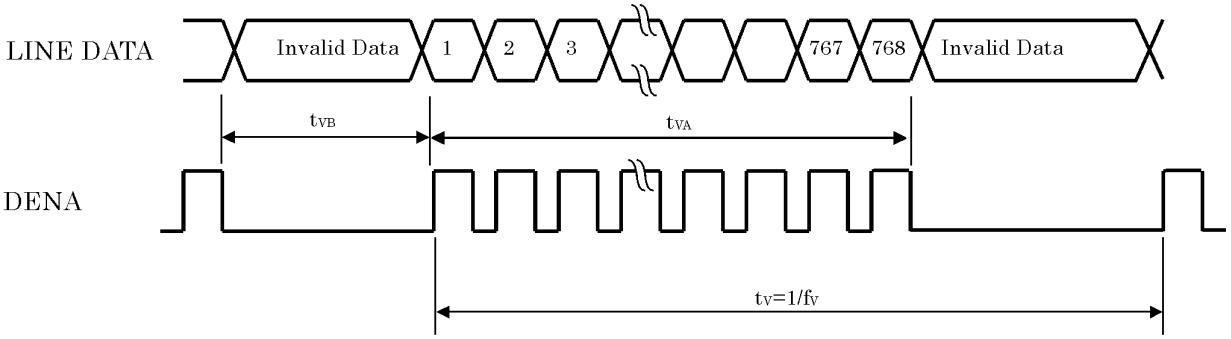
1) DENA (Data Enable) shall always be positive polarity as shown in the timing specification.
2) DCLK shall appear during all invalid period.
3) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84B(Thine).
4) $t_{VA} + t_{VB} \leq 1024$
5) In case of blanking time fluctuation, please use following.
   $t_{VBn} > t_{VBn-1} - 3(t_H)$

(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 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 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.

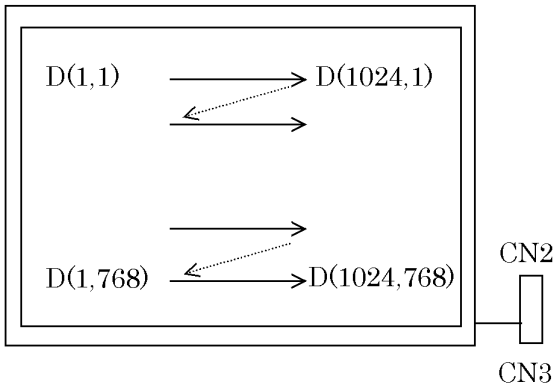
2) Data

1:High, 0: Low

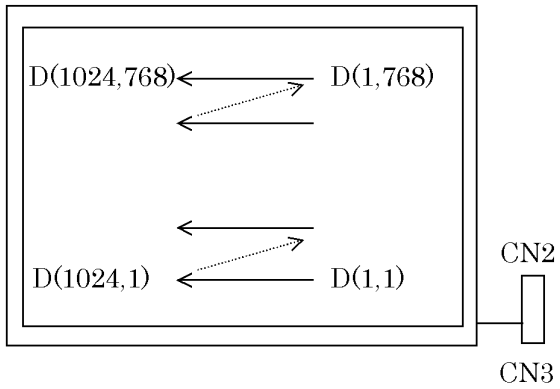
(4) Display Position and Scan Direction

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

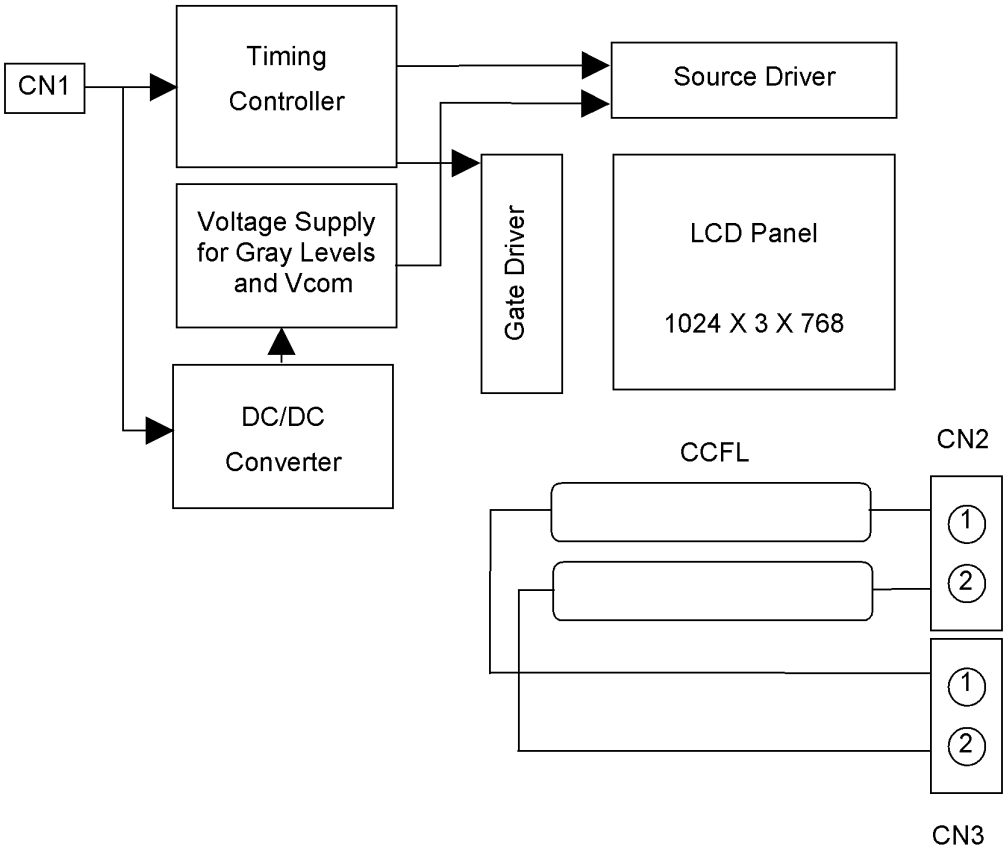
SC: Low




SC: High

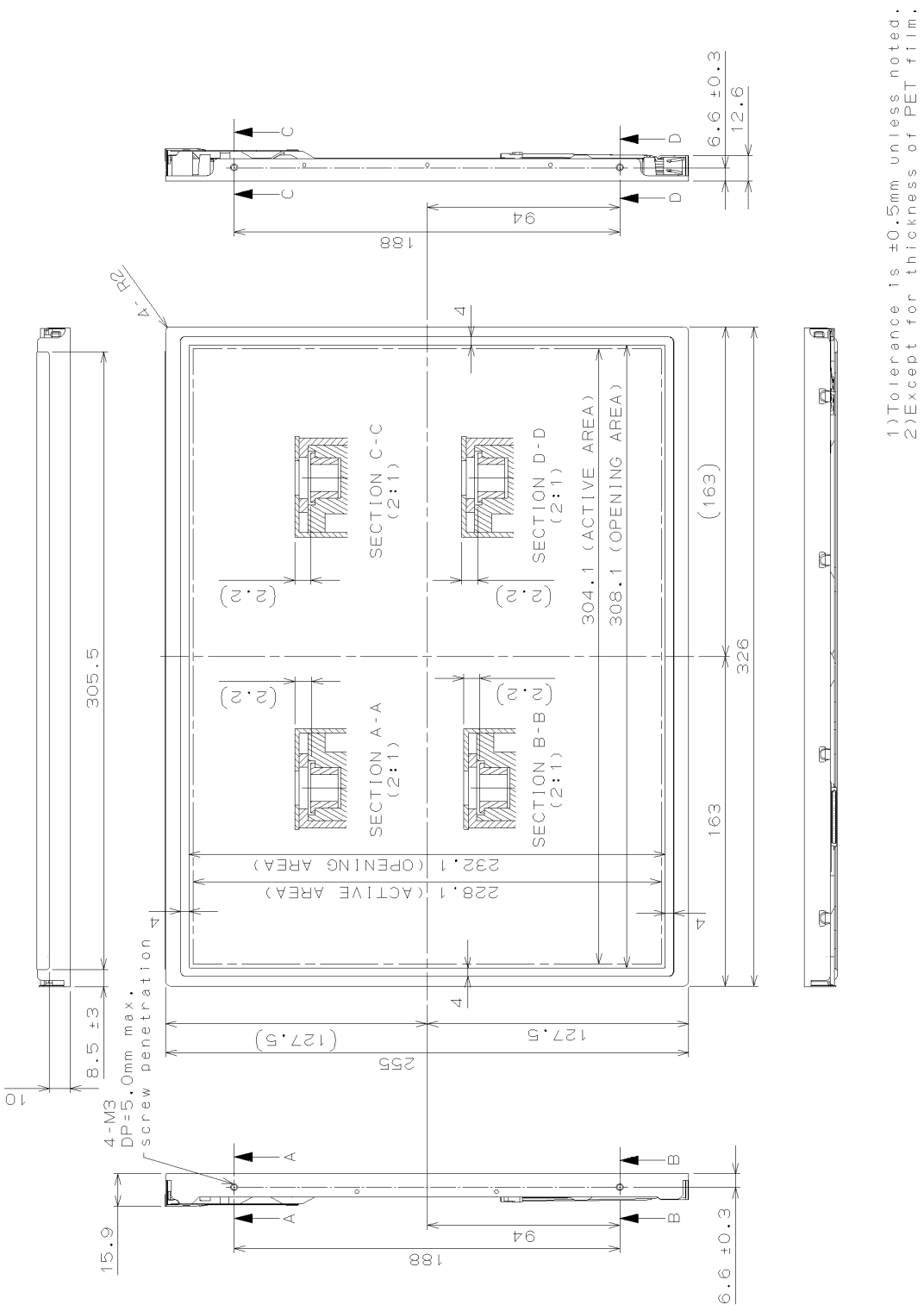


# 7. BLOCK DIAGRAM



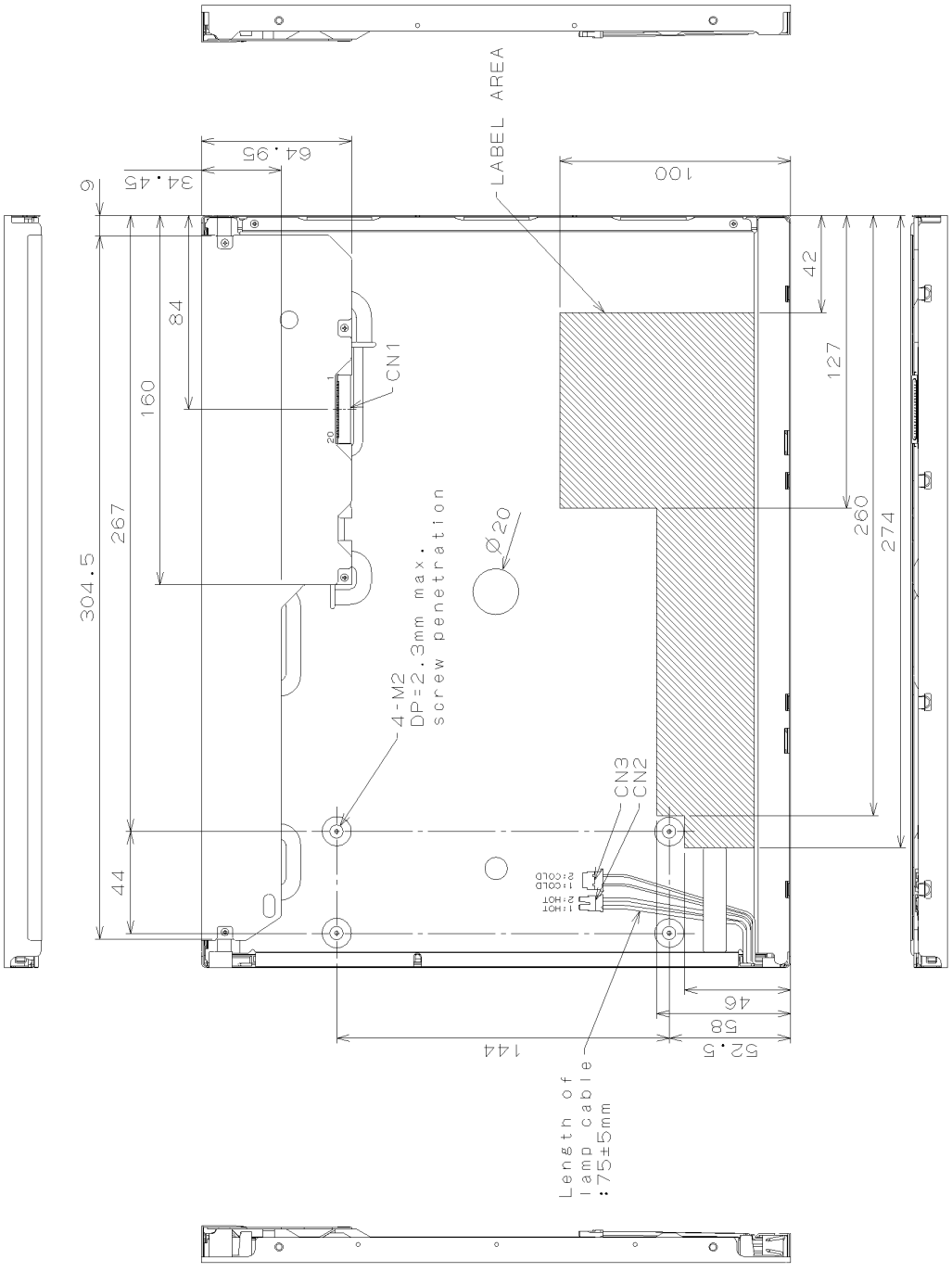
# 8. MECHANICAL SPECIFICATIONS

(1)Front side




(Unit:mm)

(2)Rear side




(Unit:mm)

## 9. OPTICAL CHARACTERISTICS

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

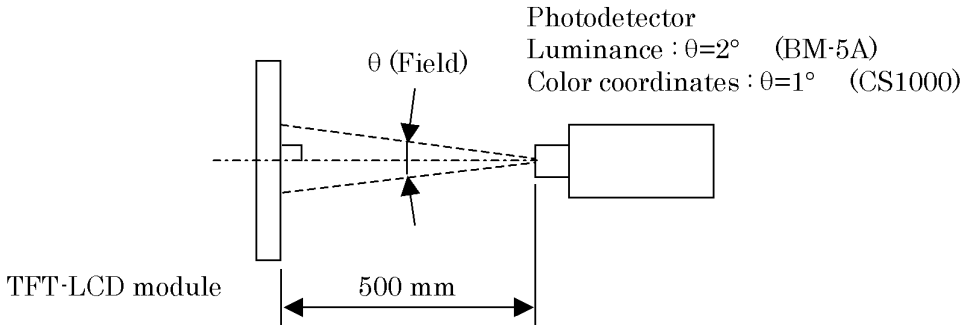
| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | Remarks |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | $\theta_V$=0°, $\theta_H$=0° | 300 | 450 | -- | -- | *1)*2)*6) |
| Luminance | | Lw | $\theta_V$=0°, $\theta_H$=0° | 200 | 250 | -- | cd/m$^2$ | *1)*3)*6) |
| Luminance Uniformity | | ΔLw | $\theta_V$=0°, $\theta_H$=0° | -- | -- | 30 | % | *1)*4)*6) |
| Response Time | | tr | $\theta_V$=0°, $\theta_H$=0° | -- | 6 | -- | ms | *1)*5)*6) |
| | | tf | $\theta_V$=0°, $\theta_H$=0° | -- | 19 | -- | ms | *1)*5)*6) |
| Viewing Angle | Horizontal | $\theta_H$ | CR ≥ 10 | -65~65 | -75~75 | -- | ° | *1)*6) |
| | Vertical | $\theta_V$ | | -50~40 | -60~50 | -- | ° | *1)*6) |
| | Horizontal | $\theta_H$ | CR ≥ 5 | -70~70 | -80~80 | -- | ° | *1)*6) |
| | Vertical | $\theta_V$ | | -70~60 | -80~70 | -- | ° | *1)*6) |
| Image Sticking | | tis | 2 h | -- | -- | 2 | s | *7) |
| Color Coordinates | Red | Rx | $\theta_V$=0°, $\theta_H$=0° | 0.575 | 0.605 | 0.635 | -- | *1)*6) |
| | | Ry | | 0.310 | 0.340 | 0.370 | | |
| | Green | Gx | | 0.281 | 0.311 | 0.341 | | |
| | | Gy | | 0.535 | 0.565 | 0.595 | | |
| | Blue | Bx | | 0.124 | 0.154 | 0.184 | | |
| | | By | | 0.100 | 0.130 | 0.160 | | |
| | 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 = 6.5 mArms, Inverter frequency: 50 kHz

Measurement method for luminance and color coordinates is as follows.

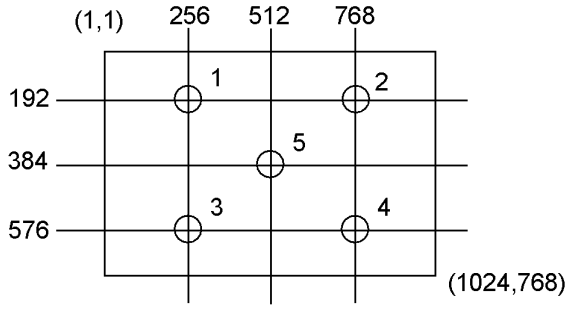



The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

*1) Measurement Point

Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center

Luminance Uniformity: point 1~5 shown in a figure below



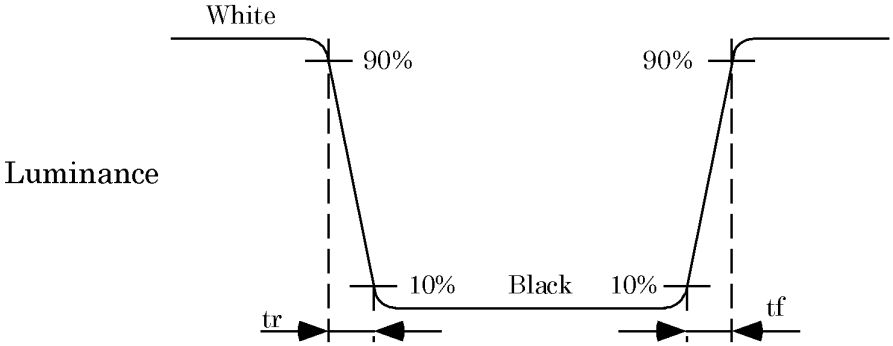

*2) Definition of Contrast Ratio

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

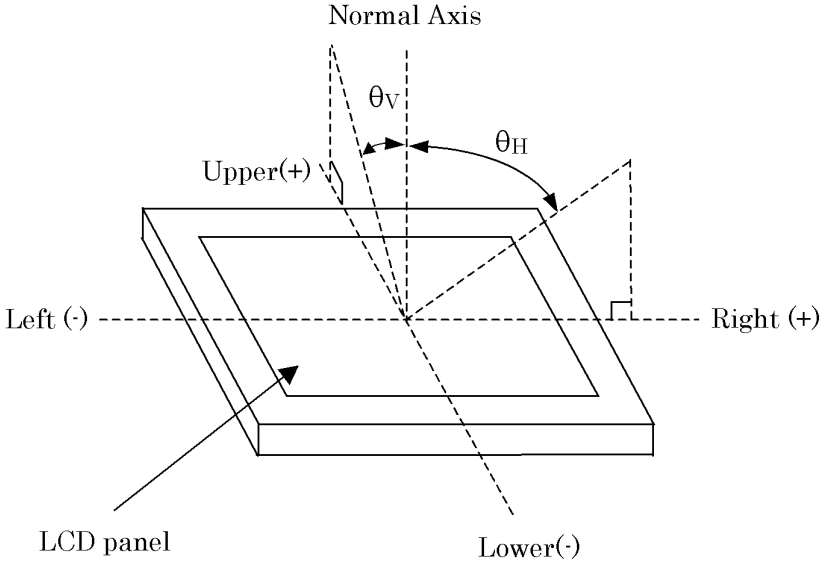
*3) Definition of Luminance Uniformity

$\Delta Lw=[Lw(MAX)/Lw(MIN)-1] \times 100$

*4) Definition of Response Time

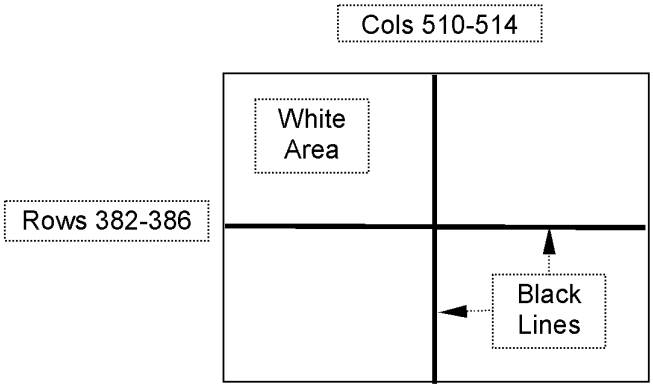



*5) Definition of Viewing Angle($\theta_V$, $\theta_H$)



*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.




TEST PATTERN FOR IMAGE STICKING TEST

## 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: 980 m/s$^2$ (100 G)<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$^2$ (1.0 G) zero to peak<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)

## 12. OTHER FEATURE

This LCD module complies with RoHS*) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

# 13. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products;

### (1) ASSEMBLY PRECAUTION

a. Please mount the LCD module by using mounting hole with a screw clamping torque less than 0.5 Nm. Please do not bend or wrench the LCD module in assembling. Please do not drop, bend or twist the LCD module in handling. Please mount the invertor circuit board by using mounting hole of rear side with a screw clamping torque less than 0.2 Nm.

b. Please design display housing in accordance with the following guide lines.

(a) Housing case must be designed carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.

(b) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.

(c) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.

(d) Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.

(e) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.

(f) To avoid local elevation/decrease of temperature, considering location of heating element, heat release, thermal design should be done.

c. Please do not push or scratch LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

d. Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.

e. Please wipe off LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.

f. Please wipe off drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

g. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

h. Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

i. Please handle metal frame carefully because edge of metal frame is very sharp.

j. Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

k. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.
l. Be sure to connect the cables and the connectors correctly.

### (2) OPERATING PRECAUTIONS

a. Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
b. Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.
c. LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
d. The interface signal speed is very high. Please pay attention to transmission line design and other high speed signal precautions to satisfy signal specification.
e. A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
f. Please pay attention not to display the same pattern for very long time. Image might stick on LCD. Even if image sticking happens, it may disappear as the operation time proceeds.
g. Please obey the same safe instructions as ones being prepared for ordinary electronic products.

### (3) PRECAUTIONS WITH ELECTROSTATICS

a. This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.
b. Please remove protection film very slowly from the surface of LCD module to prevent from electrostatics occurrence.

### (4) STORAGE PRECAUTIONS

a. Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C90% RH.
b. Please do not leave the LCDs in the environment of low temperature; below -20°C.

### (5) SAFETY PRECAUTIONS

a. When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.
c. Be sure to turn off the power supply when inserting or disconnecting the cable.
d. Inverter should be designed carefully so as not to keep working in case of detecting over current or open circuit on the lamp.

### (6) OTHERS

a. A strong incident light into LCD panel might cause display characteristics changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays.
b. Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
c. For the packaging box, please pay attention to the followings;
   (a) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
   (b) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
   (c) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
   (d) Packaging box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)

# PACKAGING SPECIFICATION

## 1. PACKAGING BOX

| | |
|---|---|
| material: | cardboard |
| construction: | See Fig. 1 |
| max. packaging number: | 10 pcs. |
| dimension: | 488 (W) × 395 (H) × 361 (D)[mm] |
| mass(including 10 modules): | 17.4 kg |
| label: | Labels are put on the box.(See Fig. 2, 3, 4) |

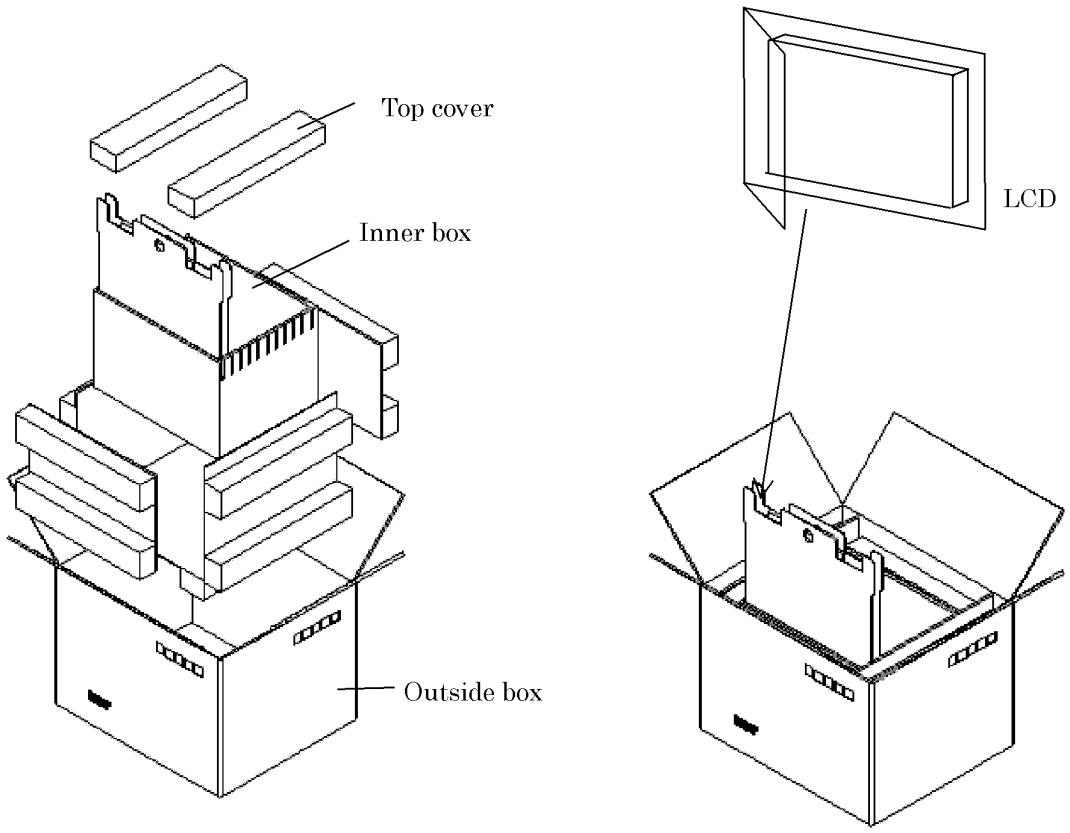



Fig.1 Illustration of packaging box structure

| Product name | Packaging number |
|---|---|
| Bar-code | Bar-code |
| Serial No. | Serial No. |
| Bar-code | Bar-code |
| Serial No. | Serial No. |
| Bar-code | Bar-code |
| Serial No. | Serial No. |
| Bar-code | Bar-code |
| Serial No. | Serial No. |
| Bar-code | Bar-code |
| Serial No. | Serial No. |
| Bar-code | Bar-code |

Fig.2 Label1

| | |
|---|---|
| | Box No. |
| | Mass |
| PKG ID<br>Bar-code | |
| Special<br>Bar-code | |
| Quantity<br>Bar-code | |
| Trans ID<br>Bar-code | |
| Special<br>Bar-code | |

Fig.3 Label 2

Consignee

Product name

Product name of consignee

Order No.

Box No.

Place of production

Bar-code

Shipping date

Fig.4 Label 3

**OPTREX**

TFT - LCD : AA150XN01

T-51863D150J-FW-A-AA

**P / O NO. 123456789**

**C / S 001 OF 005**

MADE IN JAPAN

001 JA1BK4144

2001/11/15

Fig.5 Sample of Label3

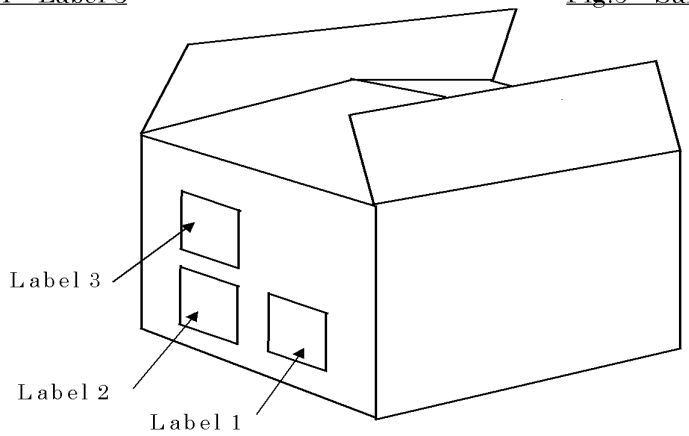



Fig.6 Location of Labels

## 2. LOCATION OF LABEL ON THE PACKAGING BOX

●Labels are put on the box.(See Fig.6)

## 3. PACKAGING FORM OF PRODUCT

- Each of LCD module is packed in anti-electrostatic bag(Fig.7)
- Packed LCD module is put in the packaging box.(Fig.8)
  The packaging box accumulates maximum 10 modules.
- Upper protector is put on the products and shut the box.(Fig.9)

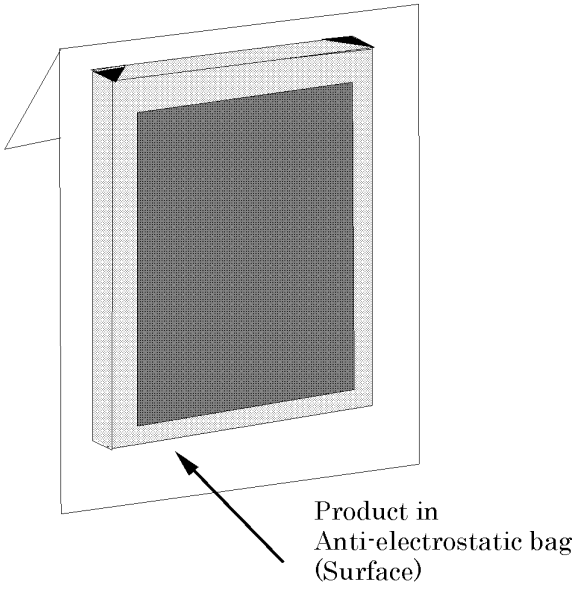



Fig.7

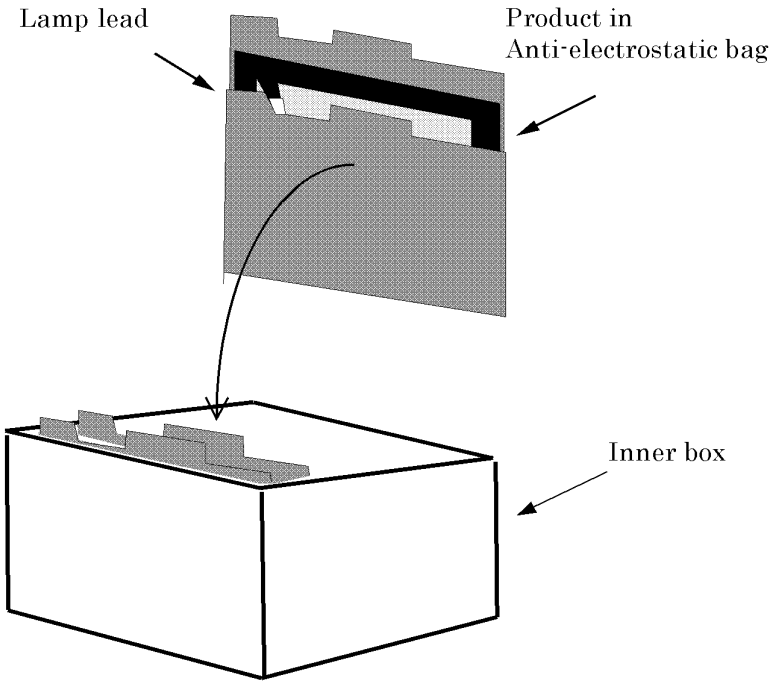



Fig.8

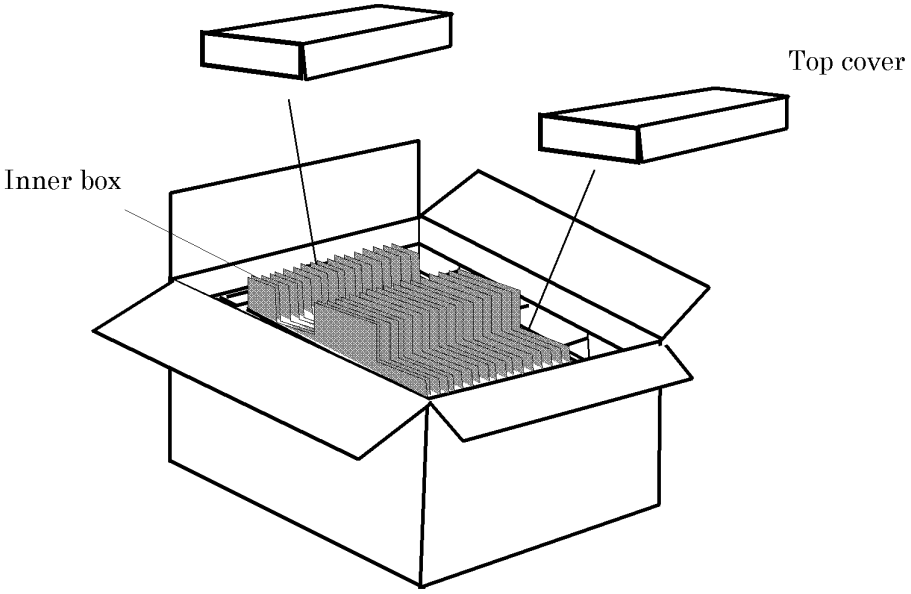


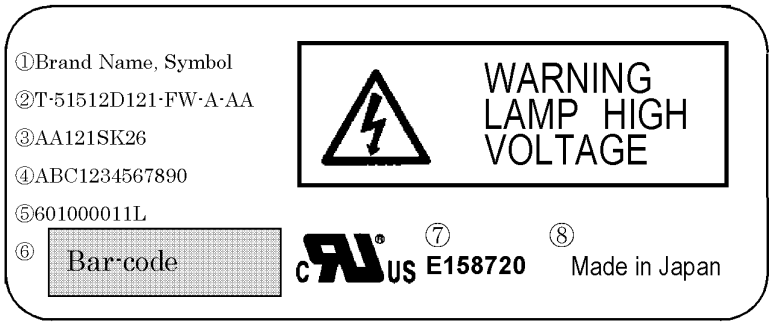

Fig.9

## 4. CAUTIONS OF SHIPPING & STORAGE

- Do not turn the packaging upside down while storage and transportation. The boxes should not be piled up more than 5.
- Handle with care. Keep off from rain & dew.
- Keep off from direct sunlight exposure. Please store under room temperature & low humidity in original packaging condition when they were shipped.
- Keep other cautions described in handling manual.

## PRODUCTS NUMBER LABELING FORMS

Products number label is constructed as below;




①Brand Name, Symbol
②Products Name of Optrex
③Products Name
④Production Key Number(13Digits)
⑤Date Code
(Serial Number, Factory Sign)
⑥Bar-code of Date Code
⑦UL File No.
⑧Production Country

① Brand Name, Symbol

OPTREX

② Products Name of Optrex

ex. T-51512D121-FW-A-AA

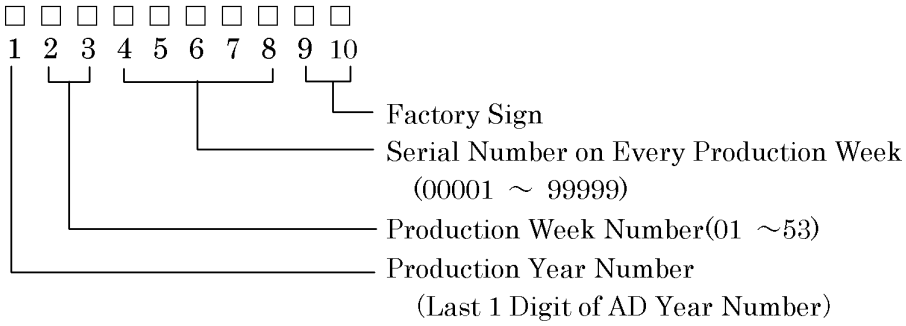
③ Products Name

ex.1: AA121SK26 ex.2: AA150XA03 B

④ Production Key Number(13Digits)

(ID Number for Production Control)

⑤ Date Code (Serial Number, Factory Sign)




・Date Code is constructed by 9 Digits as below;

1st Digit : Production Year Number (Last 1 Figure of AD Year)

2nd～3rd Digit : Production Week Number in a Year
(A Year is divided to 53 weeks from Monday to Saturday)

4th～8th Digit : Serial Number on Every Production Weeks.
( 00001 ～ 99999 )
These are numbered in order according to Production Name.

9th～10th Digit : Factory Sign ( on the Module Test Process)
( 1L: Shisui Factory Line, 1W: CPT Fab-1, 1R: CPT Fab-2,
1U: CPT Wujiang-LCM-1, 1V:CPT Wujiang-LCM-2)

⑥Bar-code(Date Code)

Bar-code Line for computer reading Date Code mentioned as above.

⑦UL File No.

MDTI: E158720, CPT: E194548

⑧Production Country

MDTI: Made in Japan, CPT: Made in Taiwan/China

# LAMP UNIT for 15.0"XGA

## 1. APPLICATION

This technical literature applies to the replaceable lamp unit that is the maintenance parts for 15.0"XGA TFT-LCD module industrial use(model name:T-51863D150J-FW-A-AA)

## 2. MECHANICAL CHARACTERISTICS

| Item | Specification | Remarks |
|---|---|---|
| Outline Dimension of Reflector | 324±0.6 ×7.0±0.1×8.3±0.1(mm) | Except wire |
| Mass | 22±3(g)(MAX) | With wire and connector |
| Lamp Diameter | ϕ2.4 (mm) | |

See DRAWING OF OUTLINE DIMENTIONS

## 3. ENVIRONMENTAL CONDITIONS

| Item | Operation | | Non Operation | | Remarks |
|---|---|---|---|---|---|
| | MIN | MAX | MIN | MAX | |
| Ambient Temperature | -20℃ | 70℃ | -20℃ | 80℃ | No Condensation |

Top,Tstg≤ 40°C : 90%RH max. without condensation

Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

## 4. ABSOLUTE MAXIMUM RATINGS

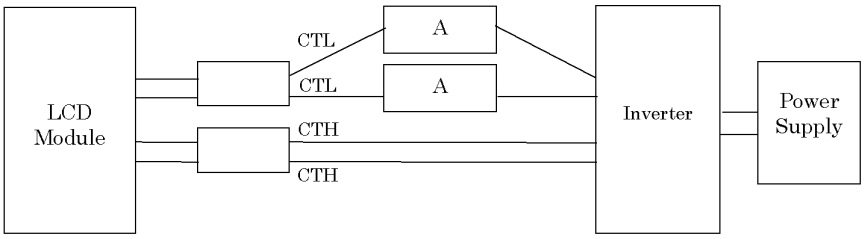
| Item | Symbol | MIN | MAX | UNIT |
|---|---|---|---|---|
| Lamp Current | IL | 0 | 10.0 | mArms |
| Lamp Voltage | VS | 0 | 2500 | Vrms |
| Lamp Frequency | FL | 0 | 100 | kHz |

## 5. ELECTRICAL CHARACTERISTICS

| Item | Symbol | Condition | MIN | TYP | MAX | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Lamp Current | IL | Ta =25°C | 3.5 | 6.5 | 8.0 | mArms | |
| Lamp Voltage | VL | Ta =25°C | - | 620 | - | Vrms | |
| Starting Lamp Voltage | VS | Ta =25°C | 1300 | - | - | Vrms | |
| | | Ta =0°C | 1500 | - | - | Vrms | |
| | | Ta =-20°C | 1650 | - | - | Vrms | |
| Lamp Frequency | FL | Ta =25°C, IL = 6.5 mArms | 40 | - | 70 | kHz | |

*1) These values are shown by TDK using CXA-0384 inverter.

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



## 6. OPTICAL CHARACTERISTICS

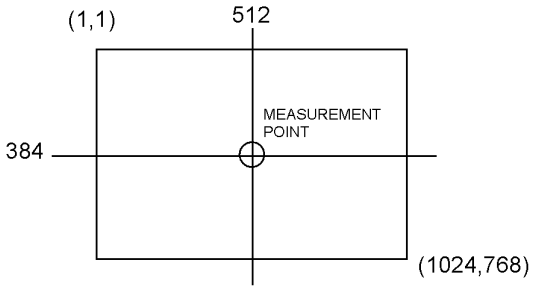
Ta=25°C, 60±10%RH

| Item | Symbol | MIN | TYP | MAX | Unit | Remarks |
|---|---|---|---|---|---|---|
| Luminance | Lw | 200 | 250 | -- | cd/m² | Measurement point shown in the figure below |
| Color Coordinates (White) | Wx | 0.283 | 0.313 | 0.343 | - | |
| | Wy | 0.299 | 0.329 | 0.359 | - | |

[Conditions]

IL=6.5 mArms, Inverter frequency: 50 kHz

[Measurement Point]




These items are measured when lamp units are assembled into T-51863D150J-FW-A-AA, and using CS1000(MINOLTA) for color coordinates, and CS1000 or BM-5A(TOPCON) for Luminance under the dark room condition (no ambient light) after more than 30 minutes from turning on the lamp unless noted.

## 7. LIFE TIME OF THE LAMP UNIT

Environmental Conditions are as follows:

Ambient temperature is 25±5°C.

Lamp Current is 6.5 mArms.

| | |
|---|---|
| Continuous Operation | 50,000 h |
| Number of turning on and off | 100,000 times (30 sec ON-OFF) |

(1) 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 the table of section 5.

(2) The life time of the backlight depends on the ambient temperature. The life time will decrease under low/high temperature.

(3) Following standards should be satisfied

- No flickers should be allowed.
- Decrease in luminous length that is caused by lamp blacking is within 11 mm from the edge of the lamp.

## 8. INTERFACE PIN CONNECTION

(1) Backlight-side connector: BHSR-02VS-1(JST)
Inverter-side connector: SM02B-BHSS(LF)(SN) (JST)

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

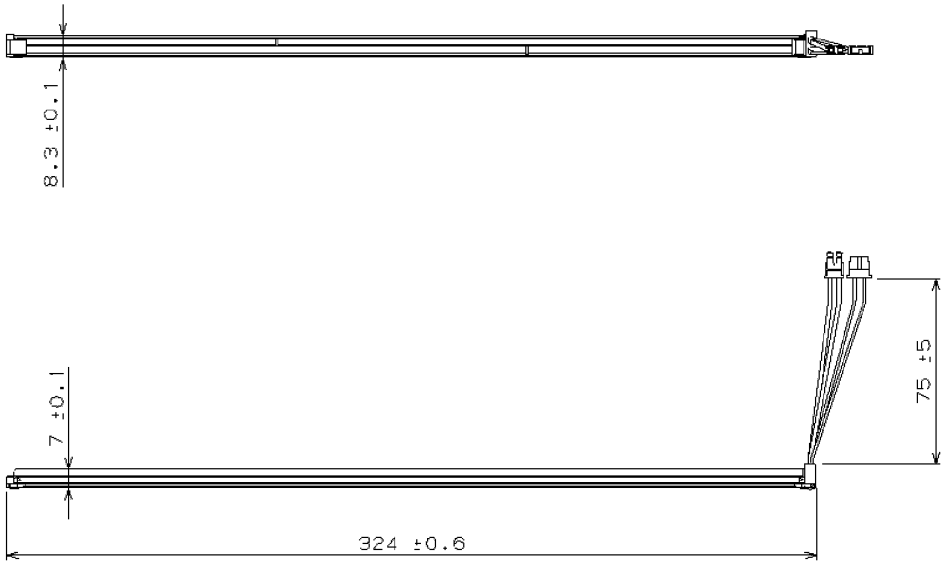
[Note] VBLH-VBLL = VL

(2) Backlight-side connector: BHR-02VS-1(JST)
Inverter-side connector: SM02(4.0)B-BHS(LF)(SN) (JST)

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

[Note] VBLH-VBLL = VL

## 9. DRAWING OF OUTLINE DIMENTIONS



## 10. METHOD OF REPLACING THE LAMP UNIT

(1) Precautions

Please pay attention to the following items while replacing the Lamp Unit.

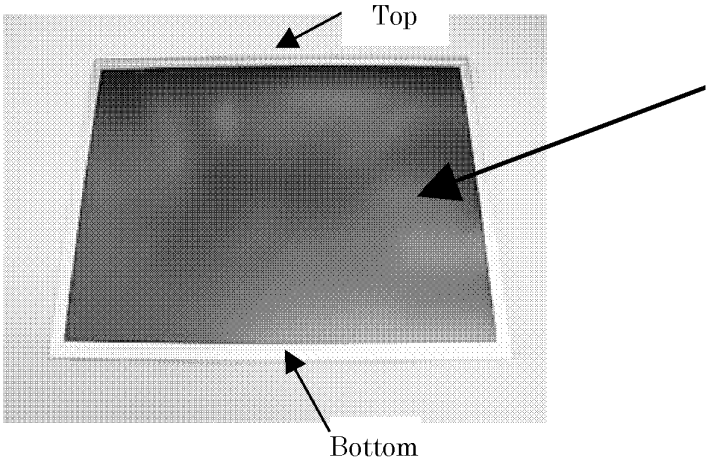
a. Please do not damage the LCD Panel Surface, and do not touch it with bare hands. (Wearing gloves is recommended.)

b. Please be careful with electrostatics, and work in clean environment to prevent entering dust and/or foreign matters that will cause bad display image.

c. Please be careful of the edge of the frame metal.

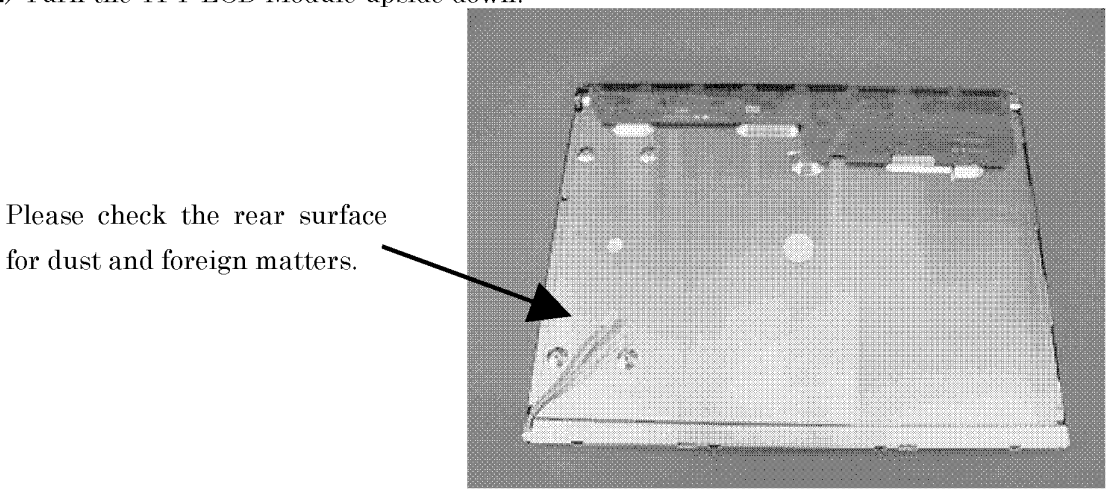
(2) Method of replacing the Lamp Unit

1)Put the TFT-LCD Module on the table.(LCD Panel Surface is upside.)




Picture 1

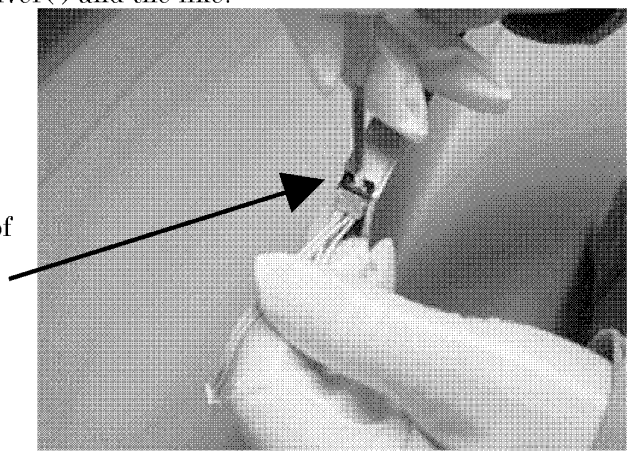
2) Turn the TFT-LCD Module upside down.




Picture 2

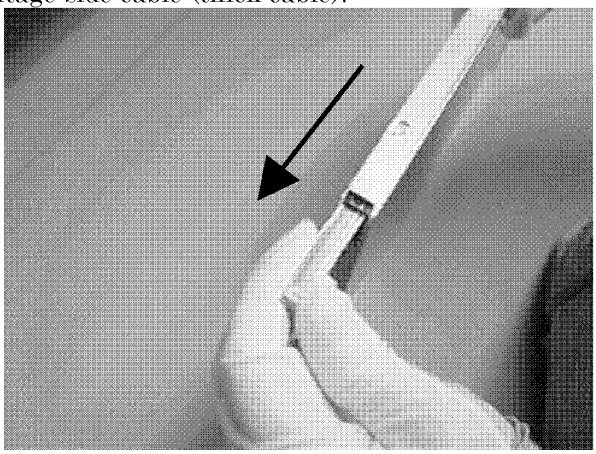
3) Stand the TFT-LCD Module up and push down the latch of rubber holder with that Lamp Unit fastens using a screw driver(-) and the like.

Push down the latch of rubber holder.



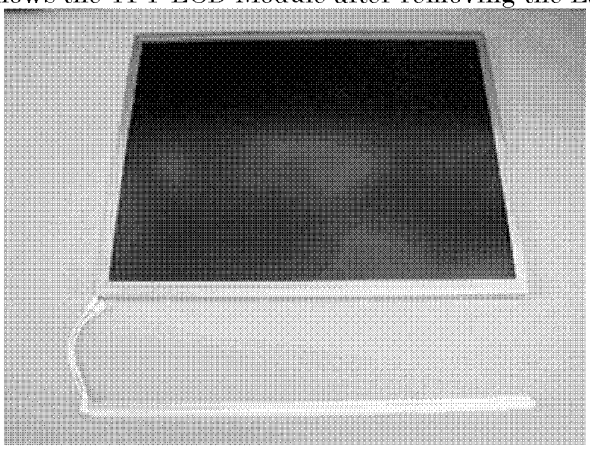
Picture 3

4) Pull the low voltage side cable□(thin cable) slowly and remove the Lamp Unit.□Do not tug at the high voltage side cable (thick cable).



Picture 4

5) Picture 5 shows the TFT-LCD Module after removing the Lamp Unit□



Picture 5

6) Prepare to insert the new Lamp Unit.

Open the package and take the new Lamp Unit out.

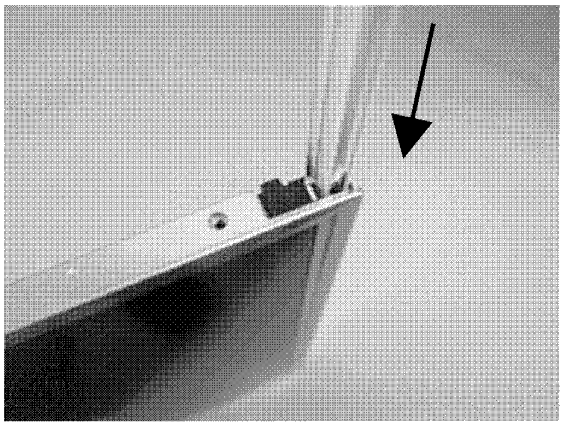
Check the new Lamp Unit for dust and foreign matters.

7) Stand the TFT-LCD module up and insert the new Lamp Unit.

The light guide and reflector sheet should be inside of the Lamp Unit.

Please be careful not to hurt your hands from the edge of the Lamp Unit.

Please pay attention to insert direction.

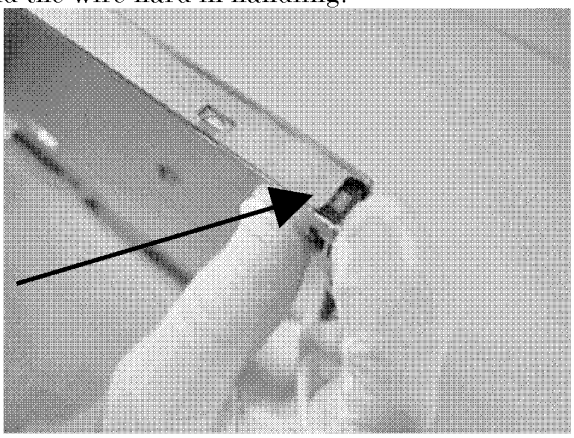


Picture 6

8) Please insert Lamp Unit. After inserting the Lamp Unit, please check that the Lamp Unit is fastened with the latch of rubber holder.

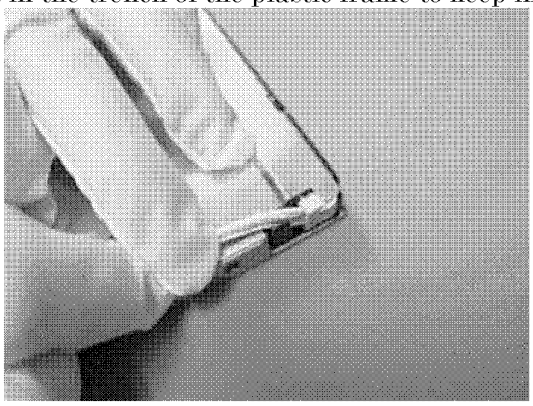
Please be careful not to tug at and bend the wire hard in handling.

Please check that the Lamp Unit is fastened with the latch of rubber holder.



Picture 7

9) Put the lamp cables in the trench of the plastic frame to keep inside of the module.



Picture 8

10) After replacing the Lamp Units, please check the following items.

Appearance of TFT-LCD Module is not changed after replacing Lamp Unit.

(See. Picture 1 and Picture 2)

There is no damage, dust, or foreign matters on the LCD Panel Surface.
Install the TFT-LCD Module then check turning on the lamps.