**CHI MEI**
OPTOELECTRONICS CORP.

# TFT LCD Approval Specification

# MODEL NO.: M201P1-L01

Customer: _____

Approved by: _____

Note:

| Liquid Crystal Display Division | |
| --- | --- |
| QRA Division. | OA Head Division. |
| Approval | Approval |
| | |

Version 2.1

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**Version 2.1**

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**Approval**

## REVISION HISTORY

| Version | Date | Section | Description |
|---------|------|---------|-------------|
| Ver 2.0 | Nov, 15, 05' | All | M201P1-L01 Specifications was first issued. |
| Ver 2.1 | Dec. 15. 05' | 7.2 | Color Chromaticity → Color Chromaticity (CIE 1931). |
| | | | Add Color Chromaticity (CIE 1976) R (Ru',Ry'), G(Gu',Gy') ,B(Bu',By') spec. |
| | | | $\theta_x=0°$, $\theta_Y =0°$ ; CS-1000 → $\theta_x=0°$, $\theta_Y =0°$ ; CS-1000T ; R=G=B=255 Grayscale |
| | | | Contrast Ratio: 450(Min.); 650(Typ.) → 450(Min.); 700(Typ.) |
| | | | View angle (Typ.): 75/75/75/60 → 80/80/80/80 |
| | | | (Min); 65/65/60/50 → 70/70/70/70 |
| | | | Add Note (7), Note (8) and Note (9) descriptions. |

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# 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

M201P1-L01 is an 20.1" TFT Liquid Crystal Display module with 4 CCFL Backlight unit and 30 pins 2ch-LVDS interface. This module supports 1400 x 1050 SXGA+ mode and can display 16.2M colors. The inverter module for Backlight is not built in.

### 1.2 FEATURES

- Wide viewing angle.

- High contrast ratio

- Super fast response time

- High color saturation

- SXGA+ (1400 x 1050 pixels) resolution

- DE (Data Enable) only mode

- LVDS (Low Voltage Differential Signaling) interface

- RoHS Compliance

### 1.3 APPLICATION

- TFT LCD Monitor

### 1.4 GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 408.24 (H) x306.18 (V)    (20.1" diagonal) | mm | (1) |
| Bezel Opening Area | 413.0(H) x 311.0(V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1400 x R.G.B. x 1050 | pixel | - |
| Pixel Pitch | 0.2916 (H) x 0.2916 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.2M | color | - |
| Transmissive Mode | Normally White | - | - |
| Surface Treatment | Anti - glare, Haze 25 , 3H | - | - |

### 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 431.5 | 432.0 | 432.5 | mm | (1) |
| | Vertical(V) | 331.0 | 331.5 | 332.0 | mm | |
| | Depth(D) | 16.0 | 16.5 | 17.0 | mm | |
| Weight | | - | - | 2900 | g | - |

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

**Approval**

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

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

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

    (a) 90 %RH Max. (Ta $\leq$ 40 ºC).

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

    (c) No condensation.

Note (2) The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.

**Relative Humidity (%RH)**



**Temperature (ºC)**
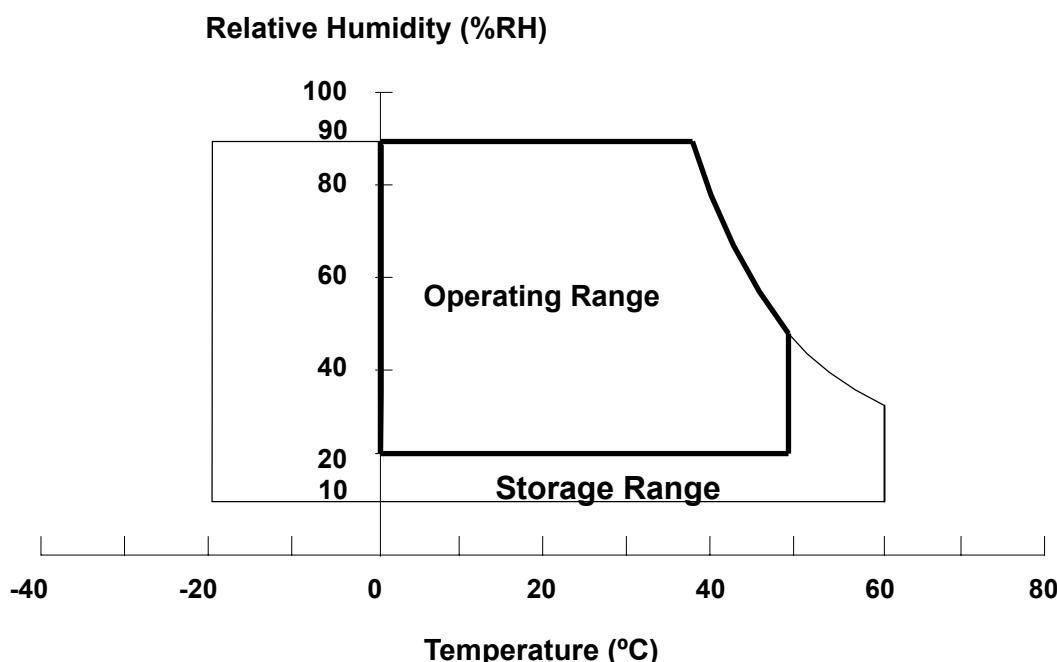
Note (3) 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough

    so that the module would not be twisted or bent by the fixture.

    The fixing condition is shown as below:

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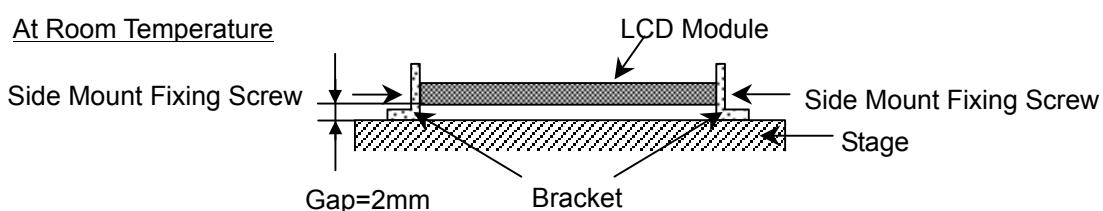
## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
| --- | --- | --- | --- | --- | --- |
| | | Min. | Max. | | |
| Power Supply Voltage | Vcc | -0.3 | +6.0 | V | (1) |
| Logic Input Voltage | $V_{IN}$ | -0.3 | 4.3 | V | |

### 2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
| --- | --- | --- | --- | --- | --- |
| | | Min. | Max. | | |
| Lamp Voltage | $V_L$ | | 2.5K | $V_{RMS}$ | (1), (2) |
| Lamp Current | $I_L$ | 4.0 | 7.5 | $mA_{RMS}$ | (1), (2) |
| Lamp Frequency | $F_L$ | 50 | 80 | KHz | |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation

should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

# 3. ELECTRICAL CHARACTERISTICS

## 3.1 TFT LCD MODULE

Ta = 25 ± 2 ℃

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | Vcc | 4.5 | 5.0 | 5.5 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mV | - |
| Rush Current | | $I_{RUSH}$ | - | - | 3.8 | A | (2) |
| Power Supply Current | White | Icc | - | 480 | 670 | mA | (3)a |
| | Black | | - | 800 | 1100 | mA | (3)b |
| | $f_V$ = 75Hz, Vcc=4.5V | | - | - | 1500 | mA | (4) |
| LVDS differential input voltage | | Vid | -100 | - | +100 | mV | |
| LVDS common input voltage | | Vic | - | 1.2 | - | V | |
| Logic "L" input voltage | | Vil | - | - | 0.8 | V | |

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:
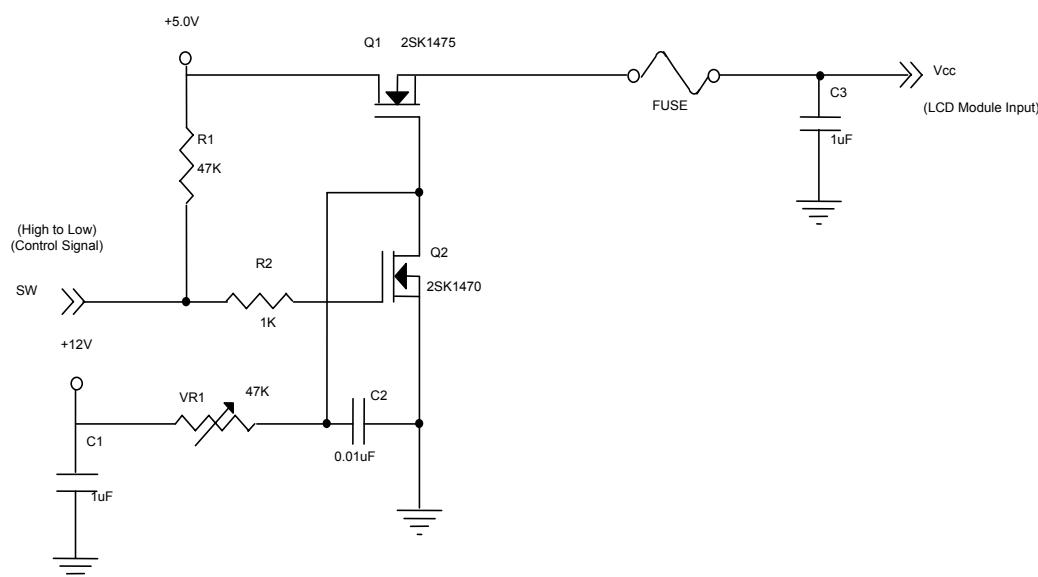


**Vcc rising time is 470μs**
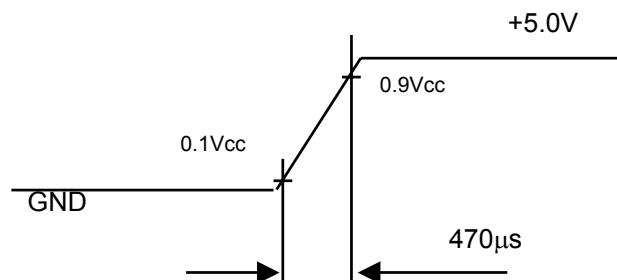
Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ℃, $f_v$ = 60

Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern                                      b. Black Pattern
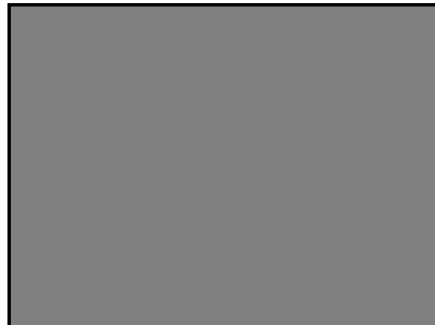


Active Area                                              Active Area

Note (4) The specified power supply current is under the conditions at Vcc = 4.5 V, Ta = 25 ± 2 ℃, $f_v$ = 75

Hz, whereas a power dissipation check pattern (Black Pattern) below is displayed.

Black Pattern
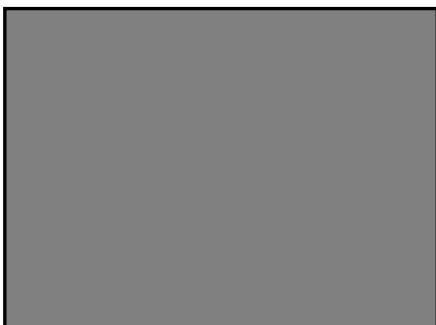


Active Area

## 3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ℃

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Lamp Input Voltage | $V_L$ | 697 | 775 | 853 | $V_{RMS}$ | $I_L$ = 7.0 mA |
| Lamp Current | $I_L$ | 4.0 | 7.0 | 7.5 | $mA_{RMS}$ | 1 |
| Lamp Turn On Voltage | $V_S$ | -- | -- | 1500(25℃) | $V_{RMS}$ | 2 |
| | | -- | -- | 1710(0℃) | $V_{RMS}$ | 2 |
| Operating Frequency | $F_L$ | 50 | -- | 80 | KHz | 3 |
| Lamp Life Time | $L_{BL}$ | 40000 | -- | -- | Hrs | 5 |
| Power Consumption | $P_L$ | -- | 21.70 | -- | W | (4), $I_L$ = 7.0mA |

Note 1    Lamp current is measured by utilizing high frequency current meters as shown below:



Current Meter
YOKOGAWA 2016
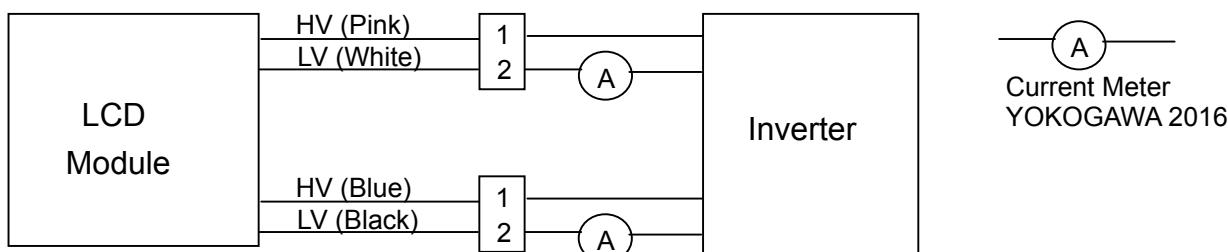
Note 2    The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note 3    The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note 4    $P_L = I_L \times V_L \times$ 4 CCFLs

Note 5    The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 $\pm$2 $^o$C and $I_L$ = 7.0 mArms until one of the following events occurs:

    a    When the brightness becomes or lower than 50% of its original value.

    b    When the effective ignition length becomes or lower than 80% of its original value. Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.

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

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

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

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

b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;

　c. The ideal sine wave form shall be symmetric in positive and negative polarities.
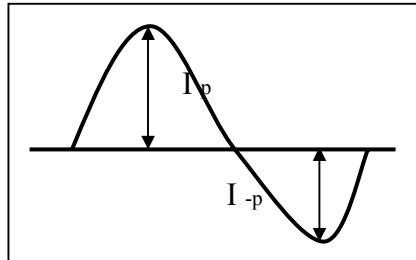
* Asymmetry rate:

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

* Distortion rate

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

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# 4. BLOCK DIAGRAM

## 4.1 TFT LCD MODULE

```
RXO0(+/-) ──►
RXO1(+/-) ──►
RXO2(+/-) ──►
RXO3(+/-) ──►
RXOC(+/-) ──►     INPUT CONNECTOR        LVDS INPUT /
RXE0(+/-) ──►     (JAE-FI-X30SSL-HF)   TIMING CONTROLLER  ──►  SCAN DRIVER IC  ──►  TFT LCD PANEL
RXE1(+/-) ──►                                                                      (1400x3x1050)
RXE2(+/-) ──►
RXE3(+/-) ──►
RXEC(+/-) ──►
NC        ──►                         DC/DC CONVERTER &                      DATA DRIVER IC
Vcc       ──►                         REFERENCE VOLTAGE
GND       ──►

VL  ──►   LAMP CONNECTOR                                    BACKLIGHT UNIT
          (JST-BHSR-02VS-1)
```

## 4.2 BACKLIGHT UNIT

```
                                              1  HV(Pink)
                                              2  LV(White)
                                              1  HV(Blue)
                                              2  LV(Black)



                                              1  HV(Pink)
                                              2  LV(White)
                                              1  HV(Blue)
                                              2  LV(Black)
```

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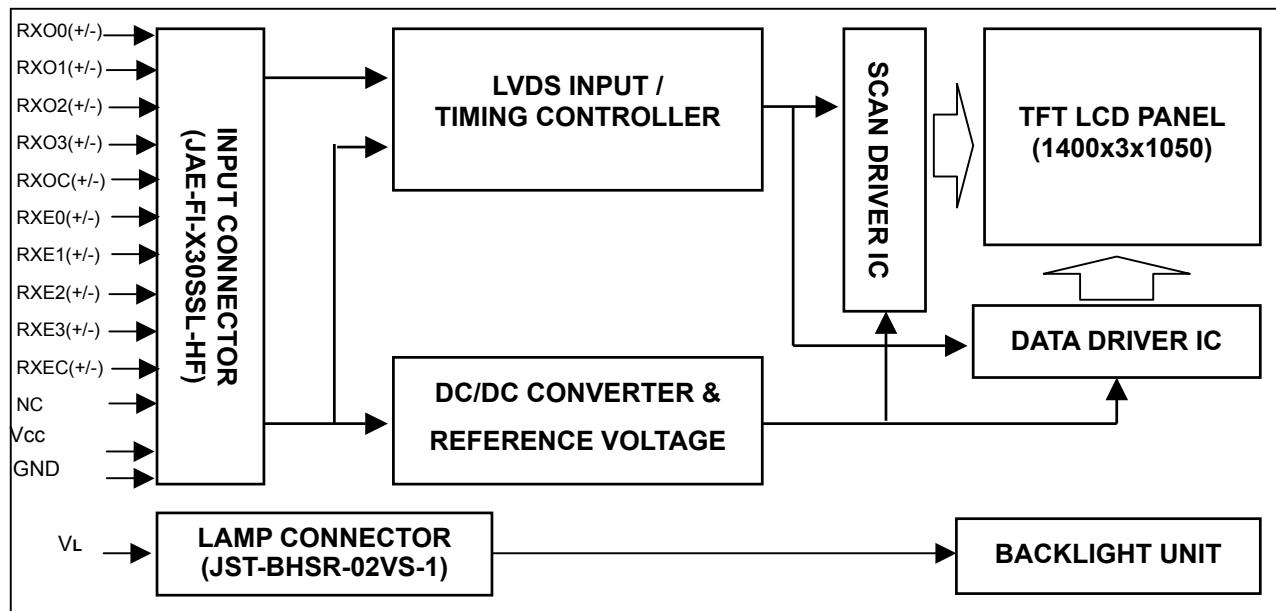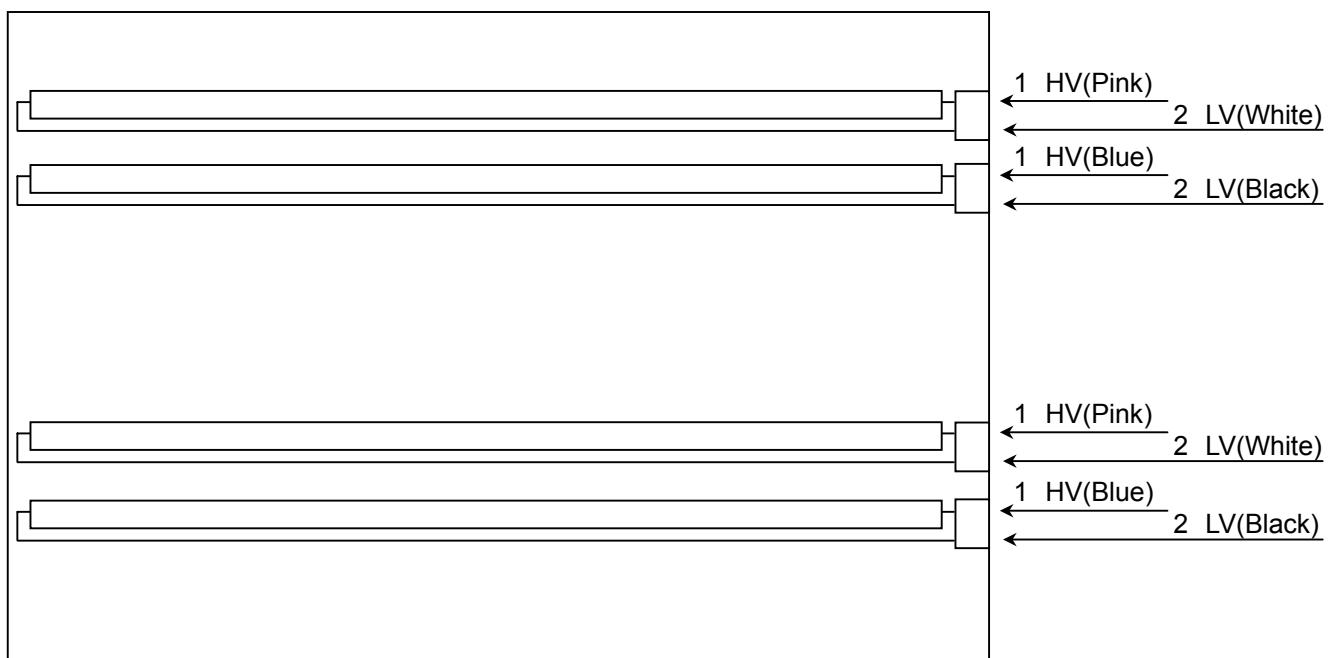
# 5. INPUT TERMINAL PIN ASSIGNMENT

## 5.1 TFT LCD MODULE

| 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 O3odd |
| 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 | NC | Not connection Should keep open. |
| 26 | NC | Not connection Should keep open. |
| 27 | NC | Not connection Should keep open. |
| 28 | VCC | +5.0V power supply |
| 29 | VCC | +5.0V power supply |
| 30 | VCC | +5.0V power supply |

Note 1 Connector Part No.: FI-X30SSL-HF JAE.

Note 2 The first pixel is odd.

Note 3 Input signal of even and odd clock should be the same timing.

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| LVDS interface receiver required input data mapping table | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LVDS Channel E0 | LVDS output | D7 | D6 | D4 | D3 | D2 | D1 | D0 |
| | Data order | EG0 | ER5 | ER4 | ER3 | ER2 | ER1 | ER0 |
| LVDS Channel E1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9 | D8 |
| | Data order | EB1 | EB0 | EG5 | EG4 | EG3 | EG2 | EG1 |
| LVDS Channel E2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
| | Data order | DE | NA | NA | EB5 | EB4 | EB3 | EB2 |
| LVDS Channel E3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5 | D27 |
| | Data order | NA | EB7 | EB6 | EG7 | EG6 | ER7 | ER6 |
| LVDS Channel O0 | LVDS output | D7 | D6 | D4 | D3 | D2 | D1 | D0 |
| | Data order | OG0 | OR5 | OR4 | OR3 | OR2 | OR1 | OR0 |
| LVDS Channel O1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9 | D8 |
| | Data order | OB1 | OB0 | OG5 | OG4 | OG3 | OG2 | OG1 |
| LVDS Channel O2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
| | Data order | DE | NA | NA | OB5 | OB4 | OB3 | OB2 |
| LVDS Channel O3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5 | D27 |
| | Data order | NA | OB7 | OB6 | OG7 | OG6 | OR7 | OR6 |

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## 5.2 BACKLIGHT UNIT

| Pin | Symbol | Description | Remark |
|---|---|---|---|
| 1 | HV | High Voltage | Pink |
| 2 | LV | Low Voltage | White |

| | | | |
|---|---|---|---|
| 1 | HV | High Voltage | Blue |
| 2 | LV | Low Voltage | Black |

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

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

## 5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color red, green and blue is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | R7 | R6 | G5 | G4 | G3 | G2 | G1 | G0 | R7 | R6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 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 | 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 |
| Gray Scale Of Red | Red0 / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red253 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red254 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green0 / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue0 / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue255 | 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    0: Low Level Voltage, 1: High Level Voltage

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## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| LVDS Clock | Frequency | Fc | - | 54 | 67.5 | MHz | - |
| | Period | Tc | 14.8 | 18.5 | - | ns | |
| | High Time | Tch | - | 4/7 | - | Tc | - |
| | Low Time | Tcl | - | 3/7 | - | Tc | - |
| LVDS Data | Setup Time | Tlvs | 600 | - | - | ps | - |
| | Hold Time | Tlvh | 600 | - | - | ps | - |
| Vertical Active Display Term | Frame Rate | Fr | 56 | 60 | 75 | Hz | Tv=Tvd+Tvb |
| | Total | Tv | 1051 | 1066 | 1300 | Th | - |
| | Display | Tvd | 1050 | 1050 | 1050 | Th | - |
| | Blank | Tvb | Tv-Tvd | 42 | Tv-Tvd | Th | - |
| Horizontal Active Display Term | Total | Th | 740 | 844 | 980 | Tc | Th=Thd+Thb |
| | Display | Thd | 700 | 700 | 700 | Tc | - |
| | Blank | Thb | Th-Thd | 144 | Th-Thd | Tc | - |

Note:    Because this module is operated by DE only mode, Hsync and Vsync input signals should be set

to low logic level or ground. Otherwise, this module would operate abnormally.

## INPUT SIGNAL TIMING DIAGRAM

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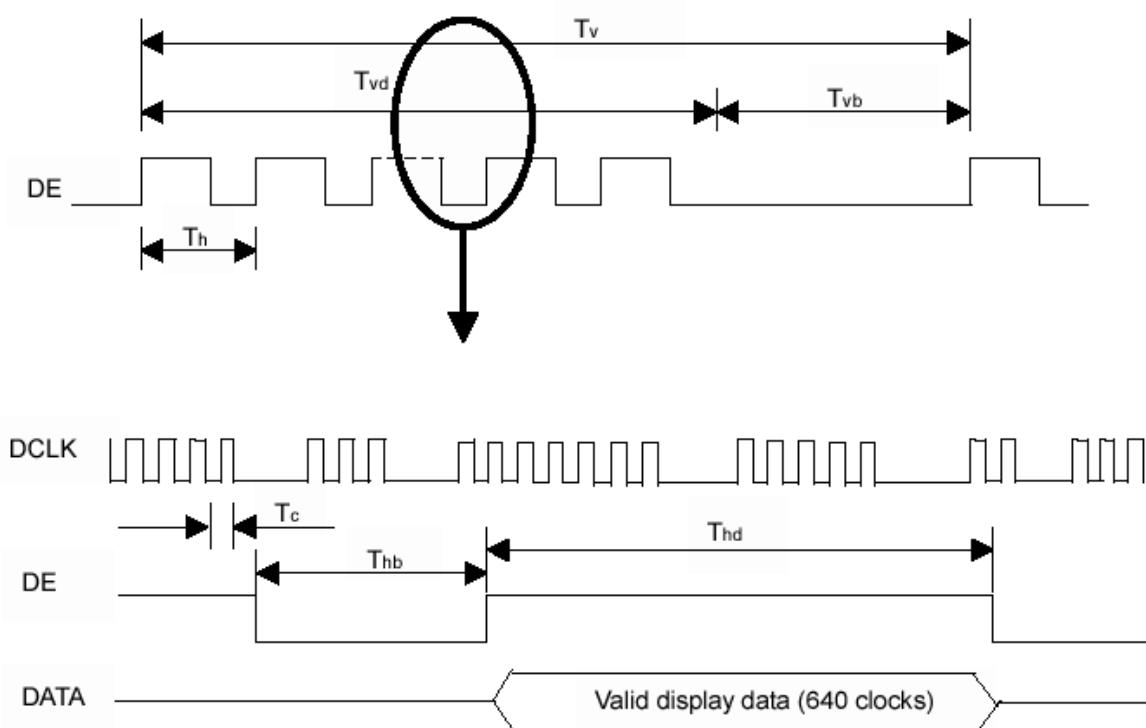
## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.

**Power Supply**

**Vcc**

0.5 ms≤T1≤10ms
0≤T2≤50ms
0≤T3≤50ms
500ms≤T4

**Signals**

0.9 Vcc
0.1Vcc
0V
T1
T3
0.9 Vcc
0.1VDD
T4
VALID

Power On
Power Off

**Backlight (Recommended)**
200 ms≤T5
90ms≤T6

50%   50%

T5
T6

**Power ON/OFF Sequence**
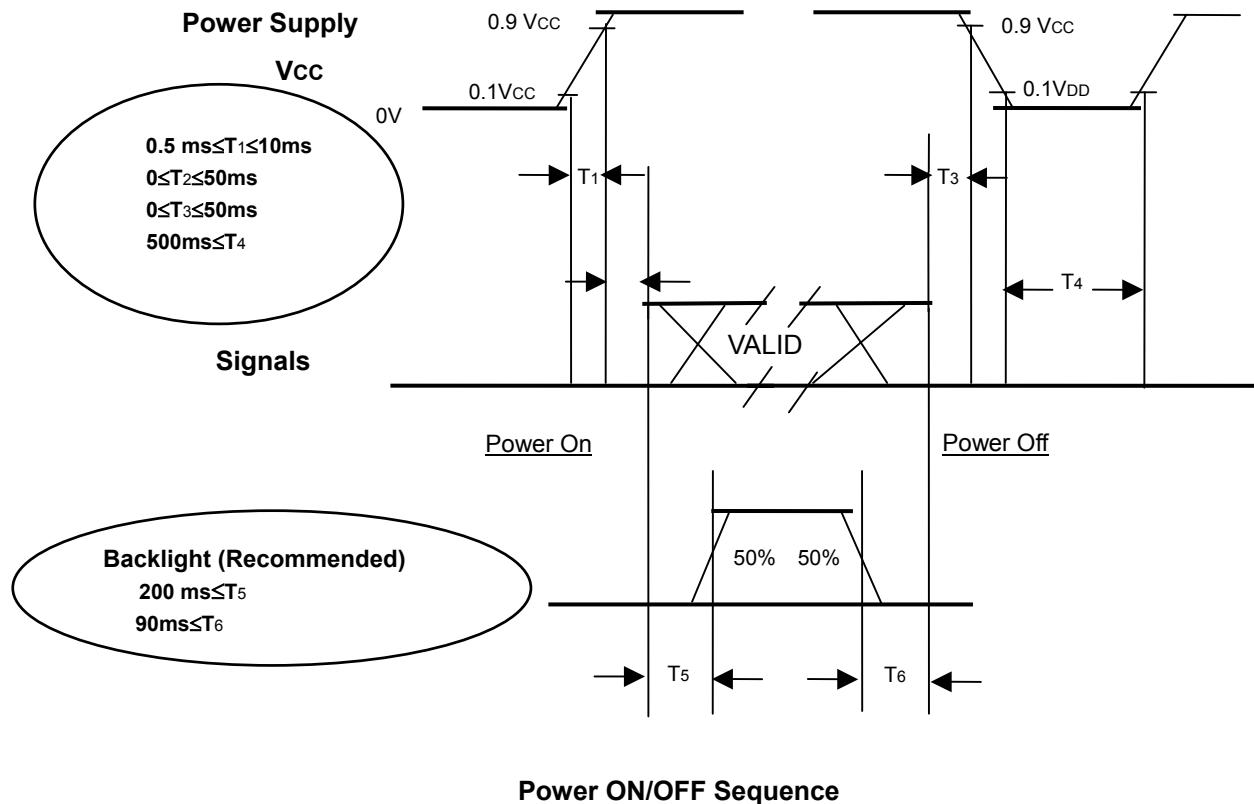
Note.

(1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

2 Please apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off, the display may, instantly, function abnormally.

3 In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

4 T4 should be measured after the module has been fully discharged between power of and on period.

5 Interface signal shall not be kept at high impedance when the power is on.

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## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | $^o$C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | Vcc | 5 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Lamp Current | $I_L$ | 7.0 | mA |
| Inverter Operating Frequency | $F_L$ | 61 | KHz |
| Inverter | Sumida H05 5307 | | |

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note 6.

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity (CIE 1931) | Red | Rx | $\theta_x=0°$, $\theta_Y=0°$ CS-1000T R=G=B=255 Grayscale | Typ. -0.03 | 0.638 | Typ. +0.03 | --- | (1), (5) |
| | | Ry | | | 0.348 | | | |
| | Green | Gx | | | 0.290 | | | |
| | | Gy | | | 0.591 | | | |
| | Blue | Bx | | | 0.143 | | | |
| | | By | | | 0.075 | | | |
| | White | Wx | | | 0.313 | | | |
| | | Wy | | | 0.329 | | | |
| Color Chromaticity (CIE 1976) | Red | Ru' | | 0.411 | 0.433 | --- | | |
| | | Rv' | | 0.503 | 0.531 | --- | | |
| | Green | Gu' | | --- | 0.122 | 0.140 | | |
| | | Gv' | | 0.548 | 0.559 | --- | | |
| | Blue | Bu' | | 0.150 | 0.158 | --- | | |
| | | Bv' | | --- | 0.187 | 0.224 | | |
| Center Luminance of White | | $L_C$ | | 230 | 300 | --- | cd/m$^2$ | (4), (5) |
| Contrast Ratio | | CR | $\theta_x=0°$, $\theta_Y=0°$ CS-1000T | 450 | 700 | --- | - | (2), (5) |
| Response Time | | $T_R$ | $\theta_x=0°$, $\theta_Y=0°$ | --- | 2 | 7 | ms | (3) |
| | | $T_F$ | | --- | 6 | 11 | | |
| Luminance Uniformity ( 9 points ) | | δW | $\theta_x=0°$, $\theta_Y=0°$ BM-5A | --- | 1.25 | 1.40 | - | (5), (6) |
| Viewing Angle | Horizontal | $\theta_x+$ | CR $\geqq$ 10 BM-5A | 70 | 80 | --- | Deg. | (1), (5) |
| | | $\theta_x-$ | | 70 | 80 | --- | | |
| | Vertical | $\theta_Y+$ | | 70 | 80 | --- | | |
| | | $\theta_Y-$ | | 70 | 80 | --- | | |
| Safety | Luminance uniformity – Angular dependence | | CS-1000T R=G=B= 255 Grayscale R=G=B= 0 Grayscale | --- | --- | 1.7 | --- | (7) |
| | Luminance contrast – Angular dependence | | | 0.8 | --- | --- | --- | (8) |
| | Colour uniformity – Angular dependence | | | --- | --- | 0.025 | --- | (7)(9) |

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Note (1) Definition of Viewing Angle $\theta x$, $\theta y$:
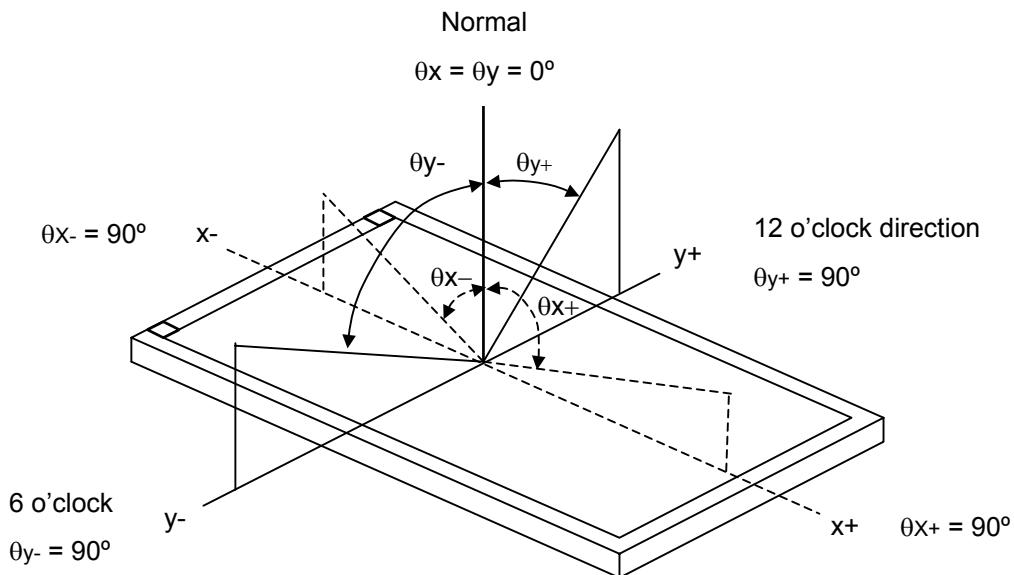


Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (7)

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

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

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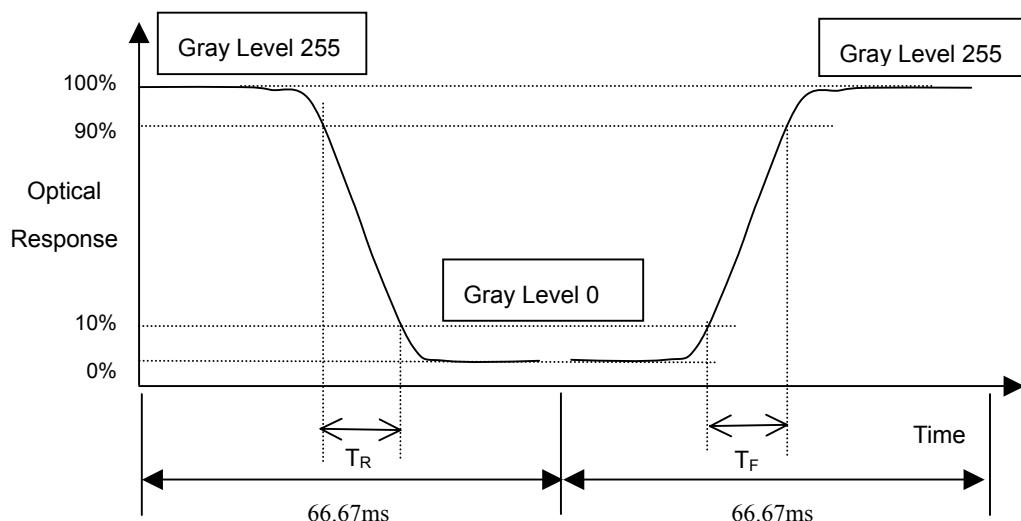
Note (4) Definition of Luminance of White $L_C$:

Measure the luminance of gray level 255 at center point

$L_C = L(7)$

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

Note (5) Measurement Setup:

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

LCD Module

LCD Panel

Center of the Screen

TOPCON/BM-5A

MINOLTA /CS-1000T

Field of View = 2º

500 mm

**Light Shield Room**

**(Ambient Luminance < 2 lux)**
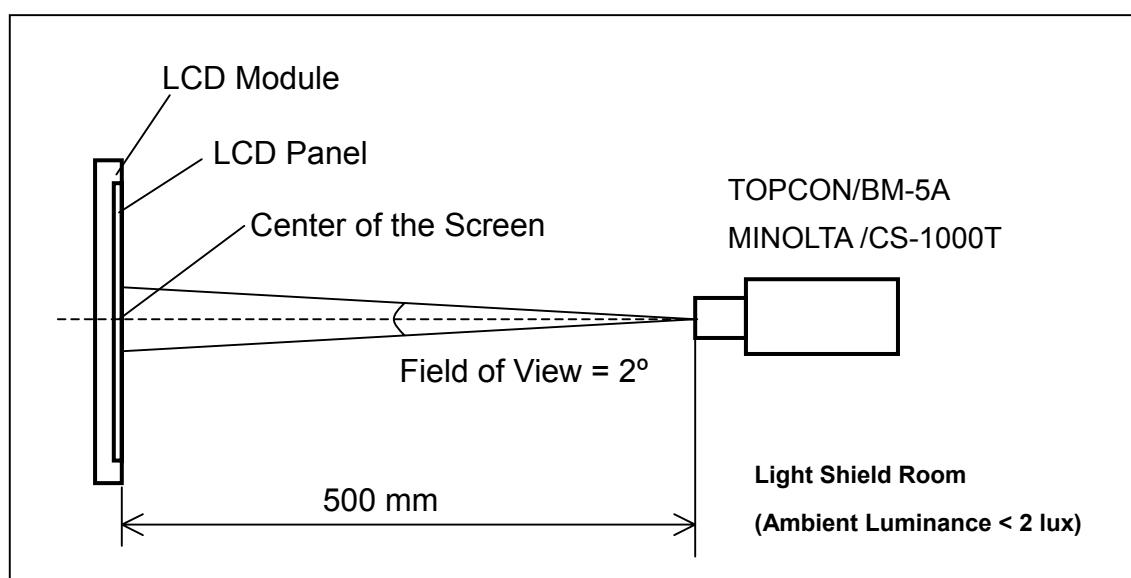
Note (6) Definition of White Variation δW:

Measure the luminance of gray level 255 at 13 points

δW = Maximum [(L 1), (L 2) ……(L 12), (L 13)] / Minimum [(L 1), (L 2) …… (L 12), (L 13)]

Horizontal Line

D

D/4    D/4    D/4    D/4

10mm

10mm

W/4

Vertical Line  W

W/4

W/4

W/4

①  ②  ③

④  ⑤

⑥  ⑦  ⑧

⑨  ⑩

⑪  ⑫  ⑬

Ⓧ  : Test Point

X=1 to 13

Active Area

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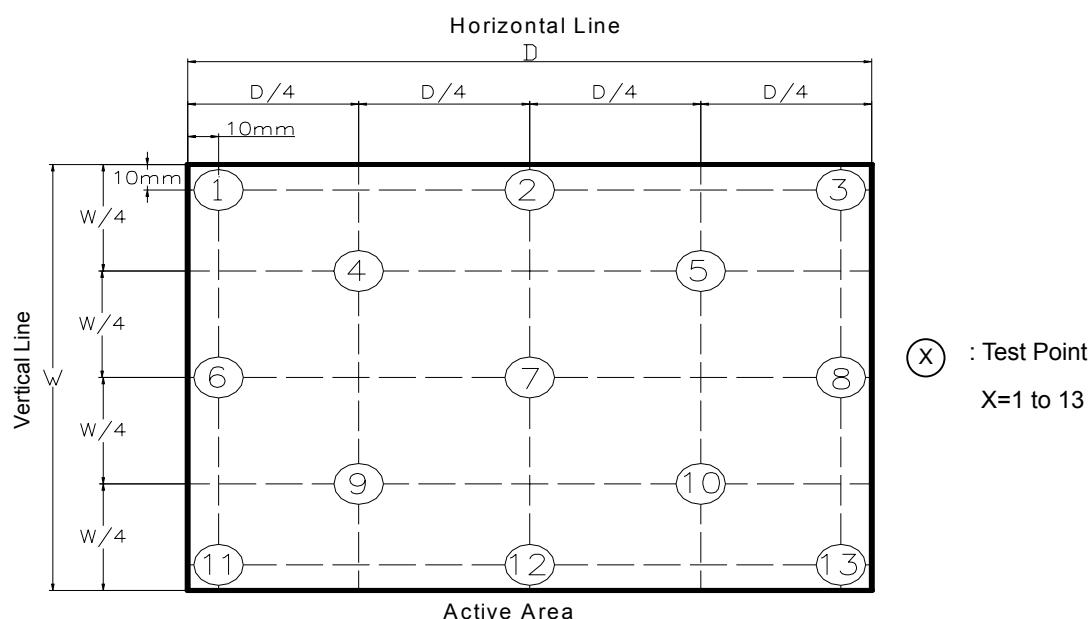
Note (7) Definition of Luminance Uniformity – Angular dependent：



Active Area
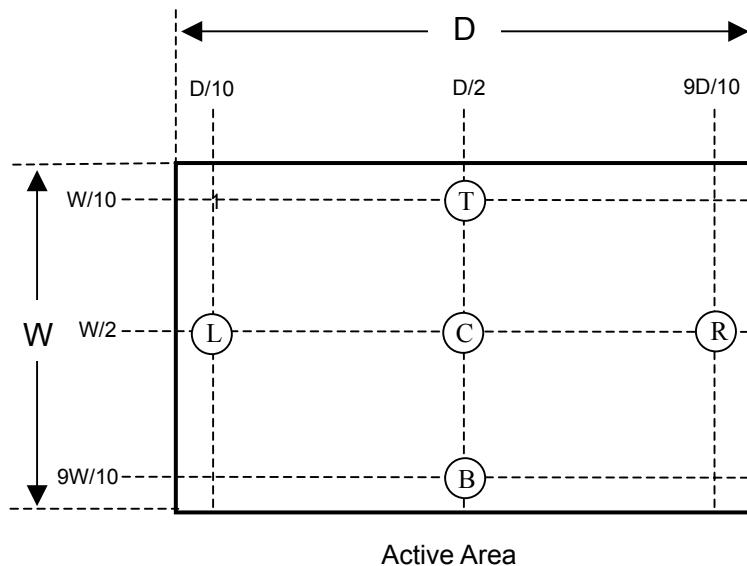
Luminance is measured at the center measurement position "C" on the LCD panel. The optical axis of meter shall be aligned with the normal of the panel surface. The measuring distance between the meter and the surface of the panel is defined as:

Md (cm) = diagonal of the panel (cm) X 1.5    with minimum distance 50 cm.

a. Horizontal - mode
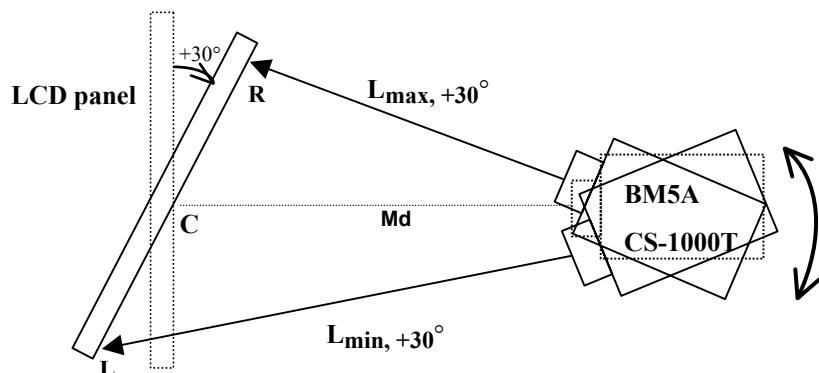


The LCD panel is then rotated to another azimuthal angle to -30°; and $L_{min, -30°}$ and $L_{max, -30°}$ are obtained by using the same procedure.

The Luminance Uniformity is calculated as follow:

$$((L_{max, +30°}/ L_{min, +30°})+( L_{max, -30°}/ L_{min, -30°})) / 2.$$

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b. Vertical - mode
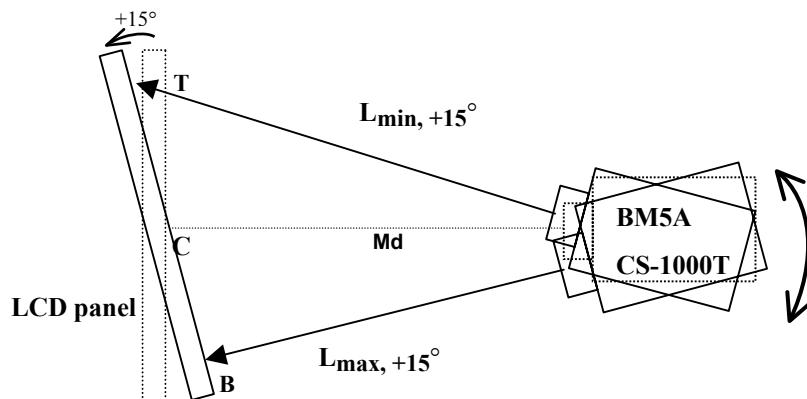


The LCD panel is then rotated to another azimuthal angle to -15°; and $L_{min, -15°}$ and $L_{max, -15°}$ are obtained by using the same procedure.

The Luminance Uniformity is calculated as follow:

$$L_{max, +15°} / L_{min, +15°}$$

$$L_{max, -15°} / L_{min, -15°}$$

The largest value shall be reported.

Note (8) Definition of Luminance Contrast – Angular dependent：



Active Area
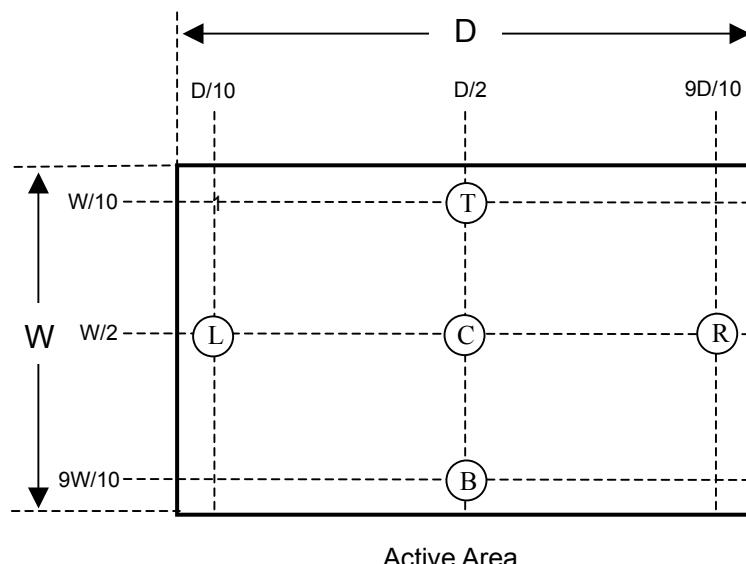
Luminance contrast is measured at the center point of the LCD panel "C" along with the normal of the display with the same distance described in Note 7. The display is then rotated around the vertical axis by changing its azimuthal axis to +30°; and this gives:

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$L_{255 \text{ G.L., }+30^\circ}$ and $L_{0 \text{ G.L., }+30^\circ}$.
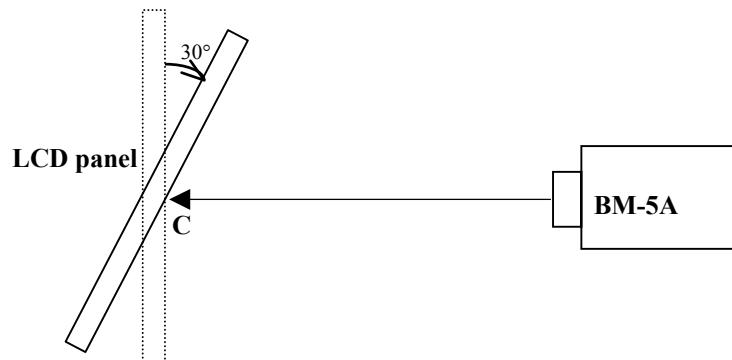


The LCD panel is then rotated to azimuthal angle to -30°; and $L_{0 \text{ G. L., }-30^\circ}$ and $L_{63 \text{ G.L., }-30^\circ}$ are obtained by using the same procedure. The Luminance Contrast is calculated:

$$(L_{255 \text{ G. L.}} - L_{0 \text{ G.L.}}) / (L_{255 \text{ G. L.}} + L_{0 \text{ G.L}})$$

For both +30° and -30°. The lowest value shall be reported.

Note (9) Definition of Colour uniformity – Angular dependence：

From Note (7), it can measure the data as below chart.

| | Measuring point R | | Measuring point L | | △u'v' |
|---|---|---|---|---|---|
| | u'$_R$ | v'$_R$ | u'$_L$ | v'$_L$ | |
| +30° | | | | | |
| -30° | | | | | |

$$\Delta u'v' = \sqrt{\left(u'_R - u'_L\right)^2 + \left(v'_R - v'_L\right)^2}$$

For both +30° and -30°. The largest value in △u'v' shall be reported.

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## 8. DEFINITION OF LABELS

### 8.1 CMO MODULE LABEL

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



(a) Model Name: M201P1-L01

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

| Code | Meaning | Description |
|------|---------|-------------|
| XX | CMO internal use | - |
| XX | Revision | Cover all the change |
| X | CMO internal use | - |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4…<br>Month: 1~12=1, 2, 3, ~, 9, A, B, C<br>Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U. |
| L | Product line # | Line 1=1, Line 2=2, Line 3=3, … |
| NNNN | Serial number | Manufacturing sequence of product |

(d) Customer's barcode definition:

Serial ID: CM-20P11-X-X-X-XX-L-XX-L-YMD-NNNN

| Code | Meaning | Description |
|------|---------|-------------|
| CM | Supplier code | CMO=CM |
| 19E5A | Model number | M190E5-L0A=19E5A |
| X | Revision code | Non ZBD: 0~9, ZBD: A~Z |
| X | Source driver IC code | Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, |
| X | Gate driver IC code | OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M |
| XX | Cell location | Tainan, Taiwan=TN |
| L | Cell line # | 1~12=0~C |
| XX | Module location | Tainan, Taiwan=TN |
| L | Module line # | 1~12=0~C |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4…<br>Month: 1~12=1, 2, 3, ~, 9, A, B, C<br>Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V |
| NNNN | Serial number | By LCD supplier |

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## 9. PRECAUTIONS

### 9.1 ASSEMBLY AND HANDLING PRECAUTIONS

1 Do not apply rough force such as bending or twisting to the module during assembly.

2 To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

3 It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

4 Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

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

6 Do not disassemble the module.

7 Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

8 It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

9 High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

10 When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

### 9.2 SAFETY PRECAUTIONS

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

2 If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

3 After the module's end of life, it is not harmful in case of normal operation and storage.

NOTES:
1. OUTLINE TOLERANCE: ±0.5mm.
2. I/F CONNECTER SPEC.: STARCONN 093G30-B0001A.
3. LAMP CONNECTER: JST BHSR-02VS-1.
4. SIDE MOUNT HOLE ROTATIONAL TORQUE MUST BE MAX. 5Kgf-cm.

Active Area 408.24X306.18

SECTION SIDE_MOUNT_HOLE-SIDE_MOUNT_HOLE
SCALE 2:1

SECTION COF-SIDE-COF-SIDE
SCALE 2:1

4-M3 TAP
LENGTH 6mm MAX
TORQUE 5kgf-cm MAX

4-M3 USER HOLES
MAX. SCREW LENGTH 6.0mm(max)

MAX. GAP 0.5mm

SIDE_MOUNT_HOLE

SIDE_MOUNT_HOLE

CONNECTOR: JST
BHSR-02VS-1

CONNECTOR 1: PIN1-PINK

PIN2-WHITE

CONNECTOR 2.: PIN1-BLUE

PIN2-BLACK

CONNECTOR: JST
BHSR-02VS-1

CONNECTOR 1: PIN1-PINK

PIN2-WHITE

CONNECTOR 2.: PIN1-BLUE

PIN2-BLACK

NOTES:
1. OUTLINE TOLERANCE:±0.5mm.
2. I/F CONNECTER SPEC.: Starconn 093G30-B0001A.
3. LAMP CONNECTER: JST BHSR-02VS-1.
4. SIDE MOUNT HOLE ROTATIONAL TORQUE MUST BE MAX. 5Kgf-cm.

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410

130.5 ±1(CONNECTOR 1st FUNCTION PIN POSITION)

50.4 ±1

116 ±1

(85.5)

(100)

116.1

Z=16.5mm

Z=11.9mm

35.9

| TITLE ASSY_MODULE_M20LP1-L01 | | | 2D REV. | |
| | | | 3D REV. 1.1+ | |
| Approved | Jenny | Drawing No. M201541015 | | |
| Checked | Rocky_Yang | Part No. TBD | | |
| Drawer | Taurus | Material TBD | | |
| Designer | Taurus | Date 13-Nov-2005 | Scale 1:1 | Sheet 2 / 2 A1 Unitmm |

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