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TFT LCD Tentative Specification

MODEL NO.: M220Z3-L03

Customer : _____

Approved by : _____

Note :

| 記錄 | 工作 | 審核 | 角色 | 投票 |
|----------------------------|---------------------|-------------------------------|----------|--------|
| 2008-05-22 15:14:33 CST | PMMD II Director | kevin_wu(吳柏勳 /56520/54894) | Director | Accept |

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REVISION HISTORY

| Version | Date | Section | Description |
|----------------|-------------|----------------|---|
| Ver 0.0 | Mar,04'08 | All | M220Z3-L03 Specifications was first issued. |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M220Z3-L03 model is a 22 inch wide TFT-LCD module with a 4 LED Light-Bar Backlight Unit and a 30-pin 2ch-LVDS interface. This module supports 1680 x 1050 WSXGA⁺ (16:10 wide screen) mode and displays up to 16.7 millions colors. The Converter module for the Backlight Unit is built in.

1.2 FEATURES

- Super wide viewing angle
- High contrast ratio
- Fast response time
- WSXGA⁺ (1680 x 1050 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- White LED Backlight Unit
- Low power consumption

1.3 APPLICATION

- Workstation & desktop monitor
- Display terminals for AV application

1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|--------------------|----------------------------------|-------|------|
| Diagonal size | 558.68 | mm | |
| Active Area | 473.76x296.1 | mm | (1) |
| Bezel Opening Area | 477.7 (H) x 300.1 (V) | mm | |
| Driver Element | a-Si TFT active matrix | - | - |
| Pixel Number | 1680 x R.G.B. x 1050 | pixel | - |
| Pixel Pitch | 0.282(H) x 0.282(V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.7 millions | color | - |
| Transmissive Mode | Normally White | - | - |
| Surface Treatment | Hard coating (3H), AG (Haze 25%) | - | - |

1.5 MECHANICAL SPECIFICATIONS

| Item | Min. | Typ. | Max. | Unit | Note | |
|---------------------------------|--|-------|-------|-------|------|-----|
| Module Size | Horizontal(H) | 493.2 | 493.7 | 494.2 | mm | (1) |
| | Vertical(V) | 319.6 | 320.1 | 320.6 | mm | |
| | Depth(D) | 13 | 13.5 | 14 | mm | |
| Weight | | 1850 | 1900 | g | | |
| I/F connector mounting position | The mounting inclination of the connector makes the screen center within ± 0.5 mm as the horizontal. | | | | | |

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

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|-------------------------------|-------------------|--------|------|------|------------|
| | | Min. | Max. | | |
| Storage Temperature | T _{ST} | -20 | +60 | °C | (1) |
| Operating Ambient Temperature | T _{OP} | 0 | +50 | °C | (1), (2) |
| Shock (Non-Operating) | S _{NOP} | - | 50 | G | (3), (5) |
| Vibration (Non-Operating) | V _{NOP} | - | 1 | G | (4), (5) |
| LCD Cell Life Time | L _{CELL} | 50,000 | - | Hrs | MTBF based |

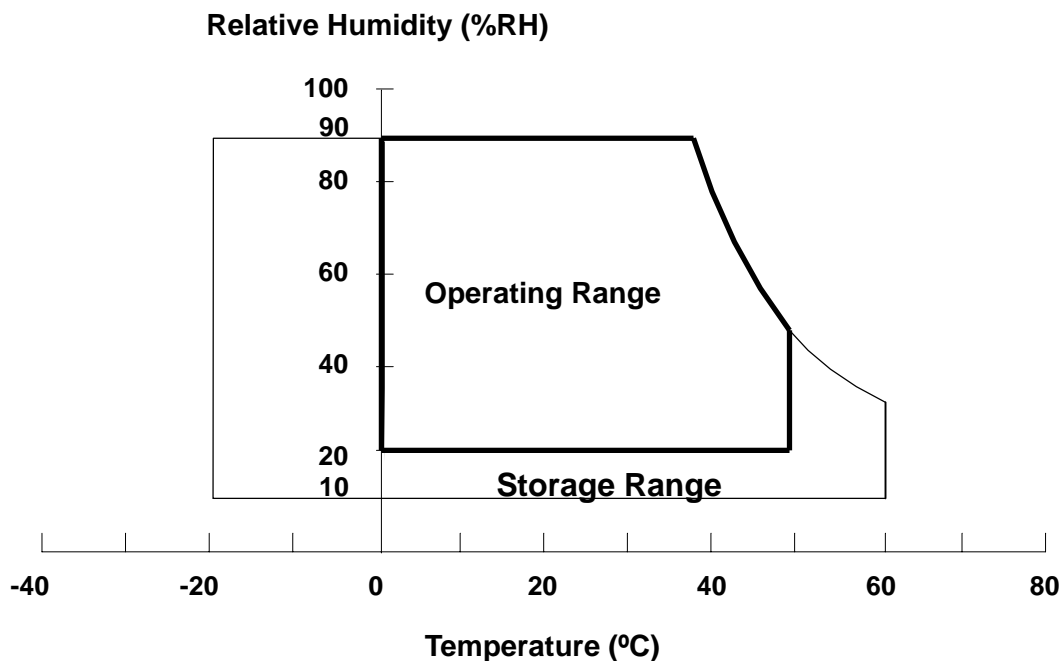
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90% RH Max. (Ta ≤ 40 °C).

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

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C Min. and 60 °C Max.



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

Note (4) 10 ~ 300 Hz, sweep rate 10 min / cycle , 30 min for X,Y,Z axis

Note (5) Upon the Vibration and Shock tests, the fixture used to hold the module must be firm and rigid enough to prevent the module from twisting or bending by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|--------|-------|------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | Vcc | -0.3 | +5.5 | V | (1) |

2.2.2 BACKLIGHT UNIT

| Item | Value | | | Unit | Note |
|-----------------------------|-------|-------|------|-----------------|----------|
| | Min. | Typ | Max. | | |
| LED Converter Input Voltage | - | (12) | | V _{DC} | |
| LED Converter Input Current | | (1.4) | | A _{DC} | (1), (2) |

Note (1) Permanent damage might occur if the module is operated at conditions exceeding the maximum values.

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

3. ELECTRICAL CHARACTERISTICS

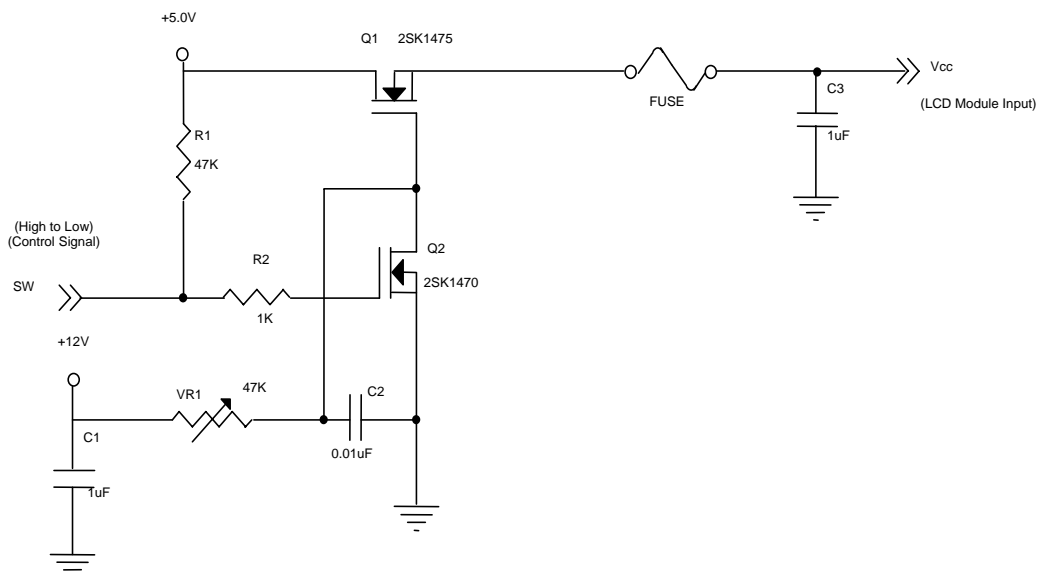
3.1.1 TFT LCD MODULE

Ta = 25 ± 2 °C

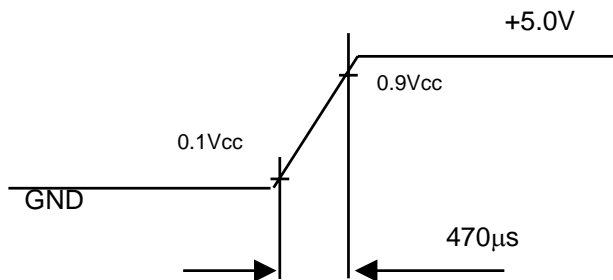
| Parameter | Symbol | Value | | | Unit | Note |
|---------------------------------|---|-------|------|------|------|------|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | V _{CC} | 4.5 | 5.0 | 5.5 | V | - |
| Ripple Voltage | V _{RP} | - | -- | 250 | mV | - |
| Rush Current | I _{RUSH} | - | -- | 3 | A | (2) |
| Power Supply Current | White | - | 630 | 819 | mA | (3)a |
| | Black | - | 1170 | 1521 | mA | (3)b |
| | f _V = 75Hz, V _{CC} =4.5V | - | 1330 | 1729 | mA | (4) |
| LVDS differential input voltage | V _{id} | 100 | - | 600 | mV | |
| LVDS common input voltage | V _{ic} | -- | 1.2 | -- | 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 $V_{cc} = 5.0\text{ V}$, $T_a = 25 \pm 2\text{ }^\circ\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

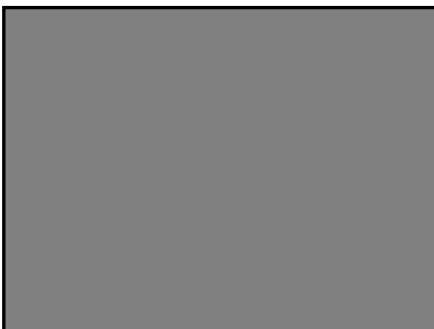
b. Black Pattern



Active Area

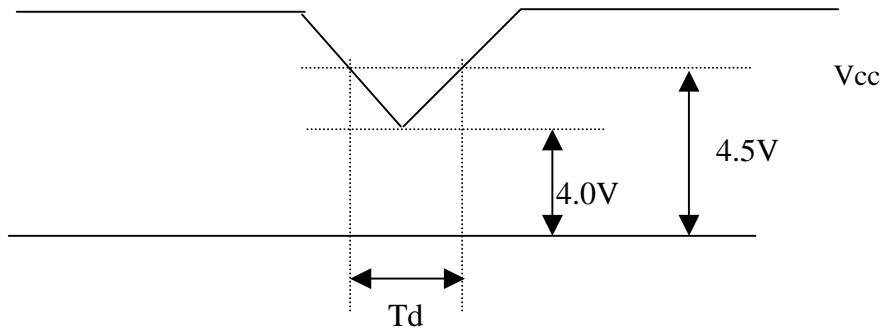
Note (4) The specified power supply current is under the conditions at $V_{cc} = 4.5\text{ V}$, $T_a = 25 \pm 2\text{ }^\circ\text{C}$, $f_v = 75\text{ Hz}$, whereas a power dissipation check pattern (Black Pattern) below is displayed.

Black Pattern



Active Area

3.1.2 Vcc Power Dip Condition:

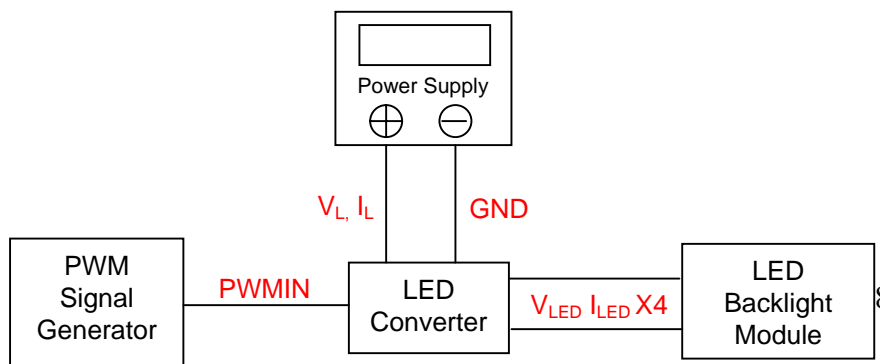


Dip condition: $4.0V \leq V_{cc} \leq 4.5V, T_d \leq 20ms$

3.2 BACKLIGHT UNIT

| Parameter | Symbol | Value | | | Unit | Note |
|-------------------------------|-----------|---------|--------|------|-----------|---|
| | | Min. | Typ. | Max. | | |
| (LED Converter Input Voltage) | V_L | | (12) | | V_{DC} | (Duty 100%) |
| (LED Converter Input Current) | I_L | | (1.4) | | A_{DC} | (Duty 100%) |
| Enable | EN | (0.5) | (3.3) | | V_{DC} | Power on :3.3V,typ. Power off :0.5V, typ |
| Brightness control | PWMIN | | (3.3) | | V_{DC} | Square Wave |
| | | | (1) | | KHz | |
| (LED Light Bar Input Voltage) | V_{LED} | | (33) | | V_{DC} | (1) |
| (LED Light Bar Input Current) | I_{LED} | | (120) | | mA_{DC} | (1) |
| (Power Consumption) | P_L | | (16.8) | | W | (2) |
| (LED Life Time) | L_{LED} | (20000) | | | Hrs | (3) |

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



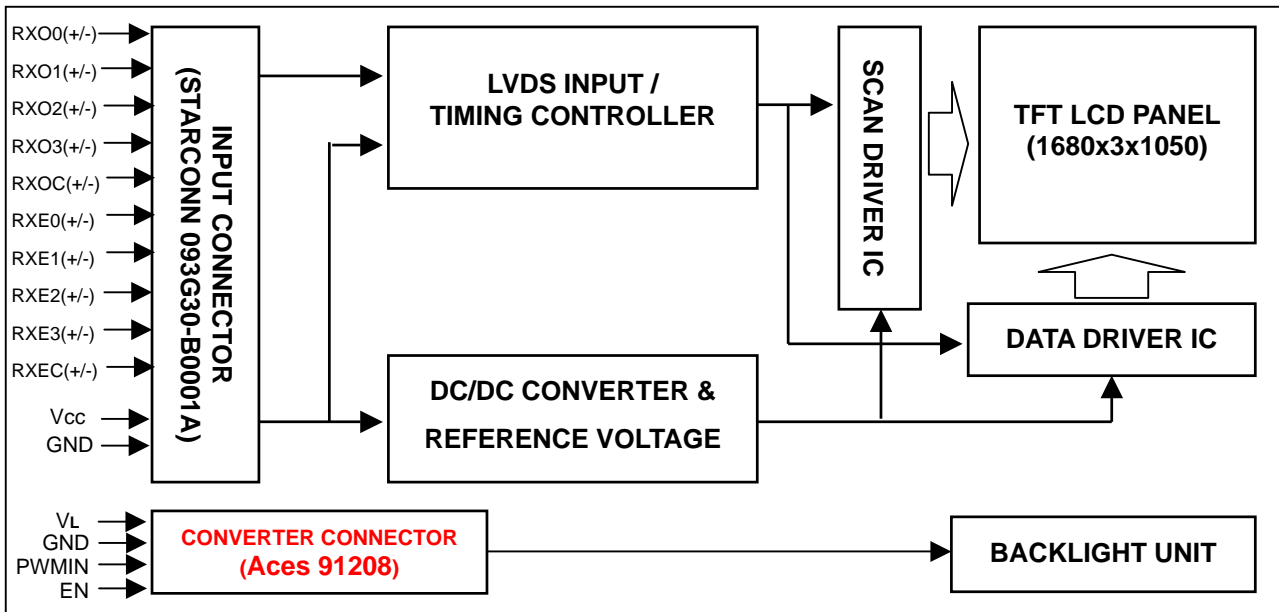
Note (2) $P_L = I_L \times V_L$

Note (3) The lifetime of LED is defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and $I = 20 \text{ mA}$ (Per EA) until one of the following events occurs:

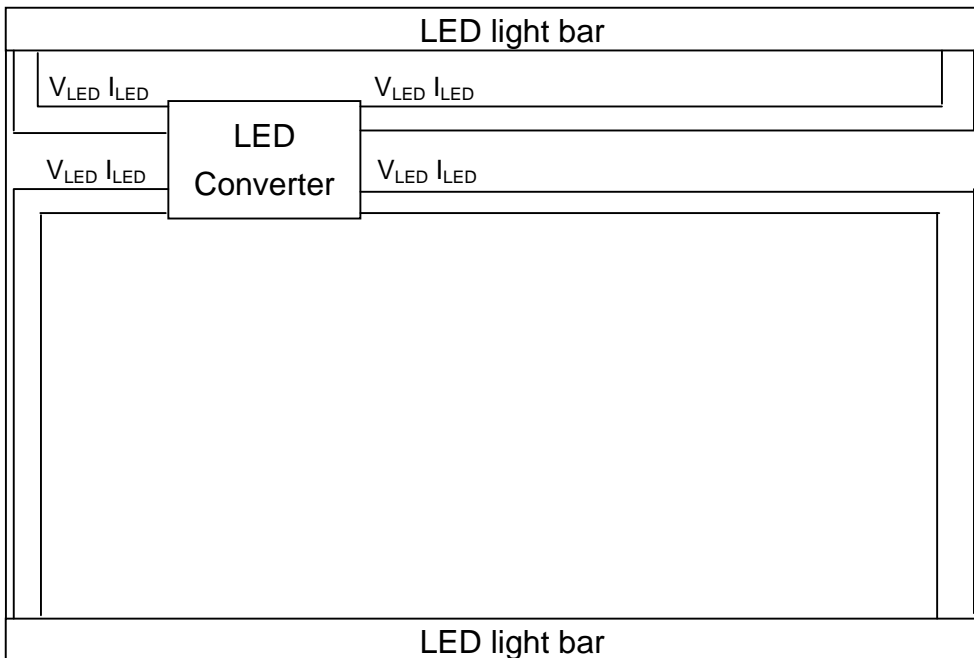
- (a) When the brightness becomes 50% of its original value.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

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

Note (1) Connector Part No.: 093G30-B0001A(STARCONN) or FI-X30SSL-HF(JAE) or EQUIVALENT.

Note (2) Mating Connector Part No.:FI-X30H ; FI-X30C* ; FI-X30M* ; FI-X30HL(-T),FI-X30C*L(-T) [JAE]

Note (3) The first pixel is odd.

Note (4) Input signal of even and odd clock should be the same timing.

5.2 LVDS DATA MAPPING TABLE

| SELLVDS = Low or Open | | | | | | | | |
|-----------------------|-------------|-----|-----|-----|-----|-----|-----|-----|
| 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 |

5.3 CONVERTER SPECIFICATION

5.3.1 Connector type

Input connector type: **Aces 91208**

Output connector: **Aces 91500-01201**

5.3.2 Input connector pin assignment

Input Connector pin assignment:

| Input connector | | Comments |
|-----------------|----------|--|
| Aces | 91208 | |
| Pin | Function | |
| 1 | VL | Input voltage Power Supply + (12V.typ) |
| 2 | VL | Input voltage Power Supply + (12V.typ) |
| 3 | VL | Input voltage Power Supply + (12V.typ) |
| 4 | VL | Input voltage Power Supply + (12V.typ) |
| 5 | GND | Ground |
| 6 | GND | Ground |
| 7 | GND | Ground |
| 8 | GND | Ground |
| 9 | PWMIN | Brightness control (PWM signal input, 1kHz. Typ, Active-low) |
| 10 | EN | Enable signal (Power of : 3.3V.typ, Power off : 0.5V.typ) |

5.4 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 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | 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 | Red(0) / 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 |
| | 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(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red(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 | |
| Gray Scale Of Green | Green(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 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(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(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green(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 | |
| Gray Scale Of Blue | Blue(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| Blue(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) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

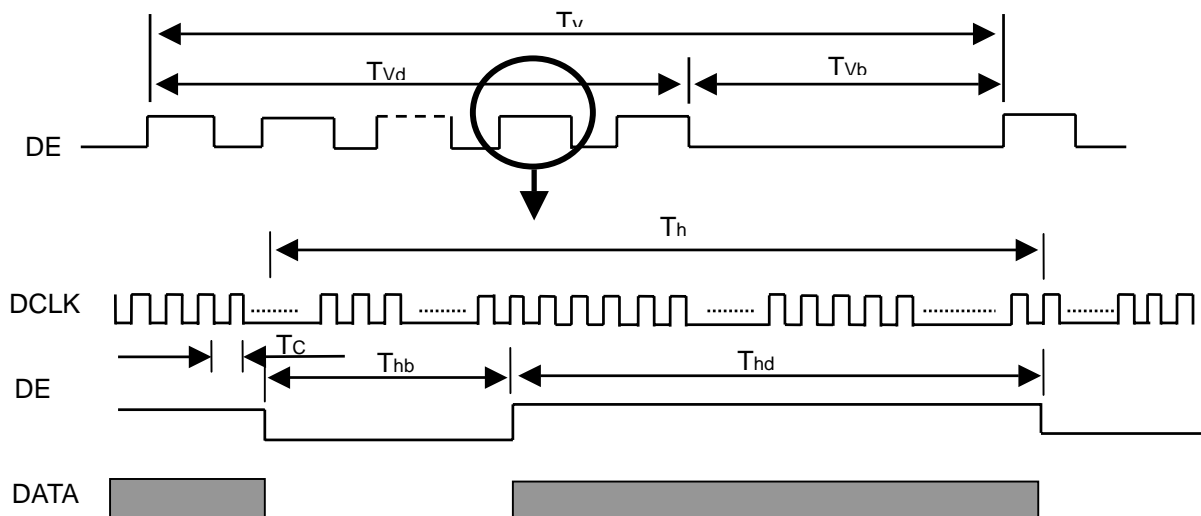
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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 | 50 | 59.5 | 82 | MHz | - |
| | Period | Tc | 13.4 | 16.8 | - | 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 | 50 | 60 | 76 | Hz | Tv=Tvd+Tvb |
| | Total | Tv | 1060 | 1080 | 1195 | Th | - |
| | Display | Tvd | 1050 | 1050 | 1050 | Th | - |
| | Blank | Tvb | Tv-Tvd | 30 | Tv-Tvd | Th | - |
| Horizontal Active Display Term | Total | Th | 890 | 920 | 1000 | Tc | Th=Thd+Thb |
| | Display | Thd | 840 | 840 | 840 | Tc | - |
| | Blank | Thb | Th-Thd | 80 | Th-Thd | Tc | - |

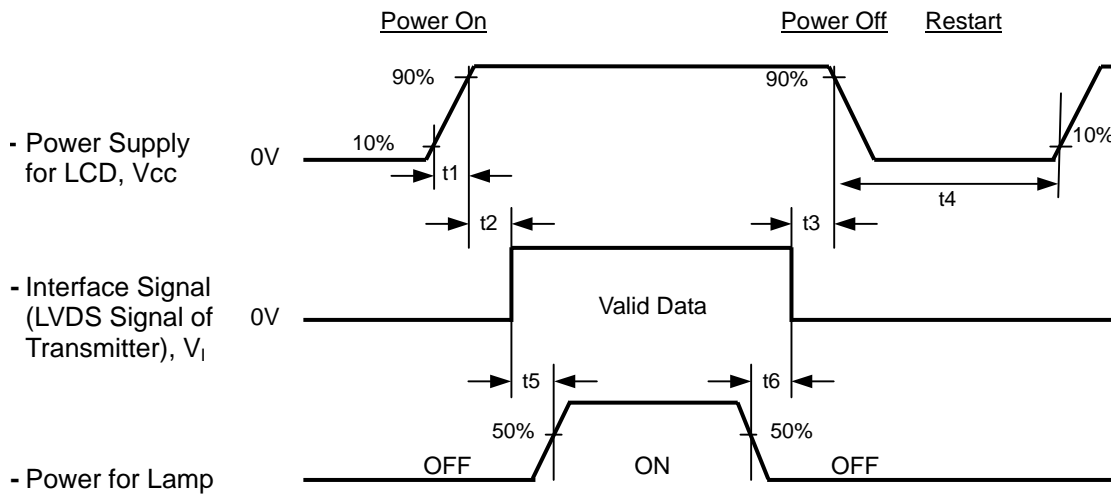
Note : (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



Timing Specifications:

| | |
|----------------------|----------|
| 0.5 < t ₁ | 10 msec |
| 0 < t ₂ | 50 msec |
| 0 < t ₃ | 50 msec |
| t ₄ | 500 msec |
| t ₅ | 450 msec |
| t ₆ | 90 msec |

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

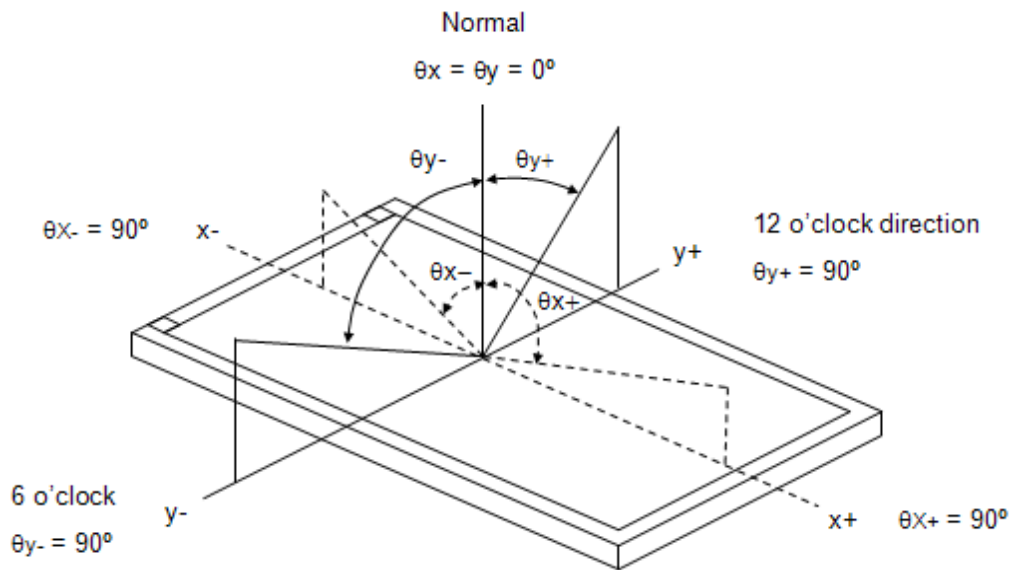
| Item | Symbol | Value | Unit |
|-------------------------------|---|-------|------------------|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | V _{CC} | 5.0 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| (LED Light Bar Input Voltage) | V _{LED} | (33) | V _{DC} |
| (LED Light Bar Input Current) | I _{LED} | (120) | mA _{DC} |

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 | Red | $\theta_x=0^\circ, \theta_y=0^\circ$ CS-1000T R=G=B=255 Grayscale | Typ (-0.05) | (0.664) | Typ (+0.05) | | (1), (5) | |
| | | | | (0.320) | | | | |
| | Green | | | (0.201) | | | | |
| | | | | (0.673) | | | | |
| | Blue | | | (0.153) | | | | |
| | | | | (0.086) | | | | |
| | White | | | 0.313 | | | | |
| | | | | 0.329 | | | | |
| Center Luminance of White | L _C | | (240) | (280) | --- | cd/m ² | (4), (5) | |
| Contrast Ratio | CR | | 700 | 1000 | --- | - | (2), (6) | |
| Response Time | T _R | $\theta_x=0^\circ, \theta_y=0^\circ$ | --- | 1.3 | 2.2 | ms | (3) | |
| | T _F | | | 3.7 | 5.8 | ms | | |
| White Variation | δW | $\theta_x=0^\circ, \theta_y=0^\circ$ | --- | 1.3 | 1.42 | - | (5), (6) | |
| Viewing Angle | Horizontal | CR>10 | | 75 | 85 | --- | Deg. | (1), (5) |
| | | | | 75 | 85 | --- | | |
| | Vertical | | | 70 | 80 | --- | | |
| | | | | 70 | 80 | --- | | |

Note (1) Definition of Viewing Angle (θ_x, θ_y):



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

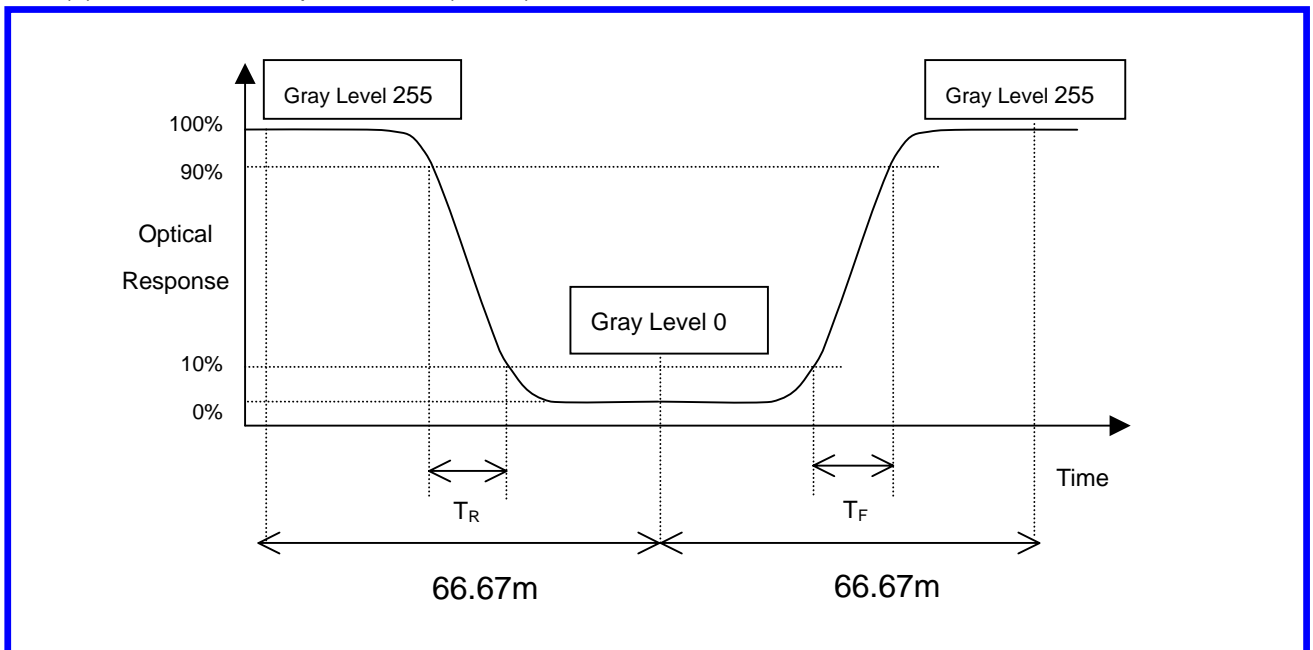
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR (7)}$$

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):



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

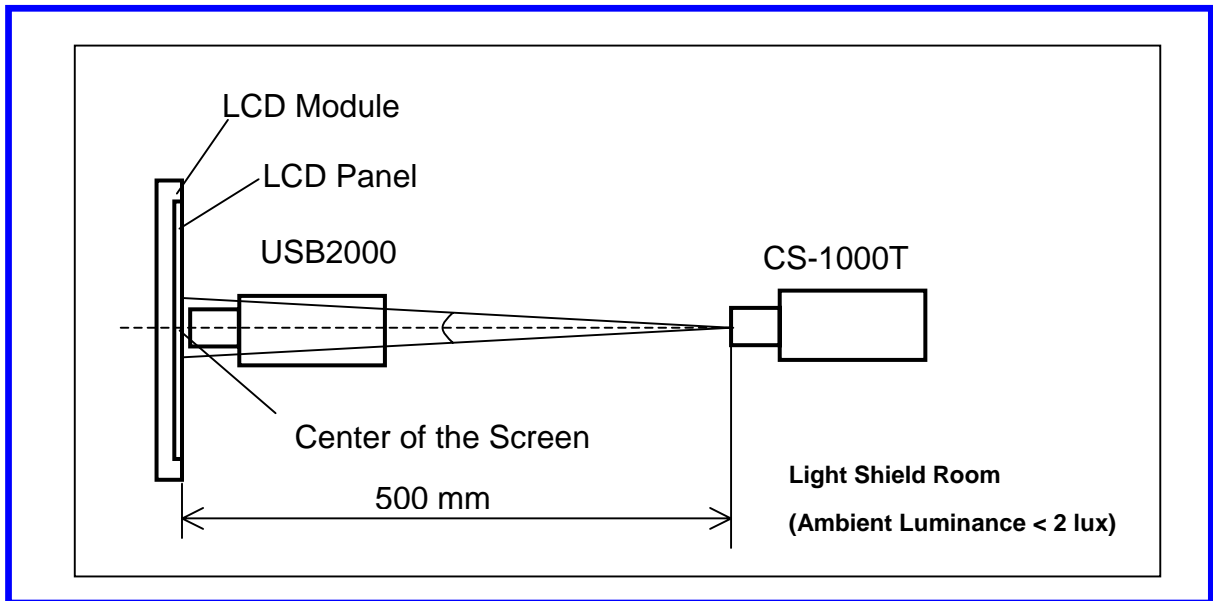
Measure the luminance of gray level 255 at center point

$$L_c = L(7)$$

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

Note (5) Measurement Setup:

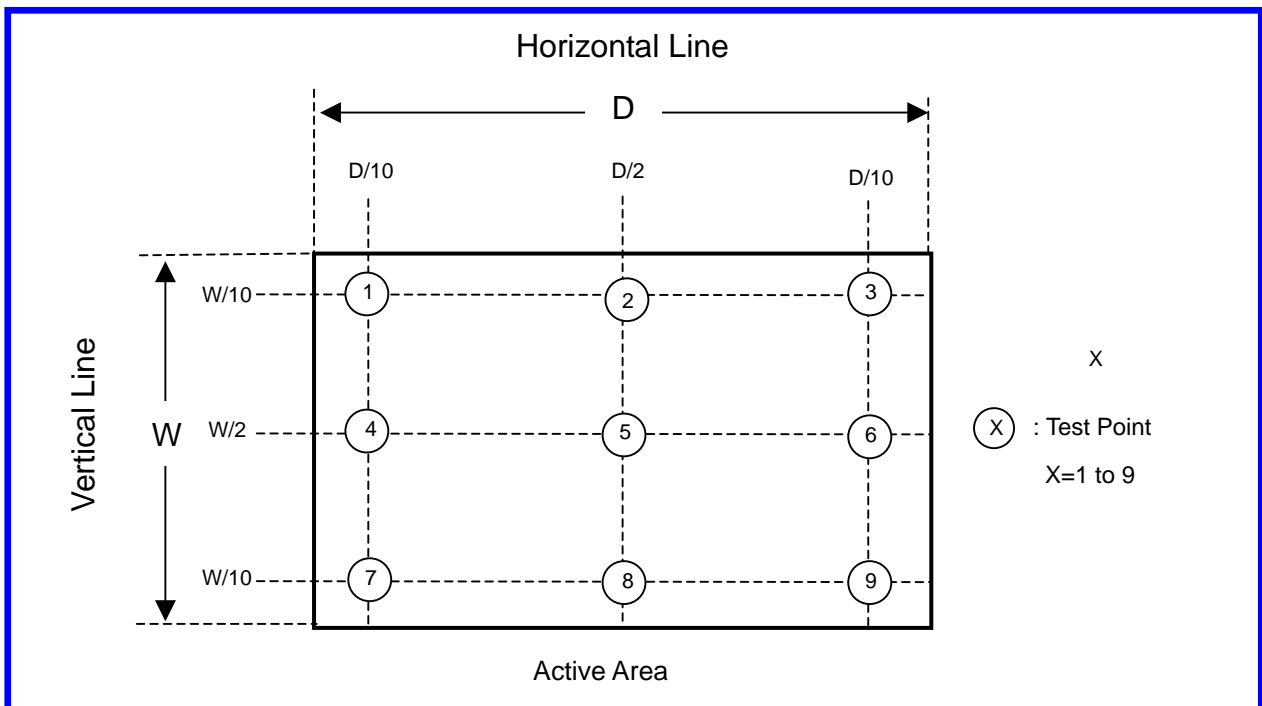
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



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

Measure the luminance of gray level 255 at 9 points

$$\delta W = \text{Maximum} [L(1) \sim L(9)] / \text{Minimum} [L(1) \sim L(9)]$$



8. PACKAGING

8.1 PACKING SPECIFICATIONS

- (1) 9 LCD modules / 1 Box
- (2) Box dimensions: 585(L) X 315 (W) X 440 (H) mm
- (3) Weight: 19.2 Kg (9 modules per box)

8.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items.

| Test Item | Test Conditions | Note |
|---------------|--|---------------|
| Vibration | ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y) | Non Operation |
| Dropping Test | 1 Angle, 3 Edge, 6 Face, 60cm | Non Operation |

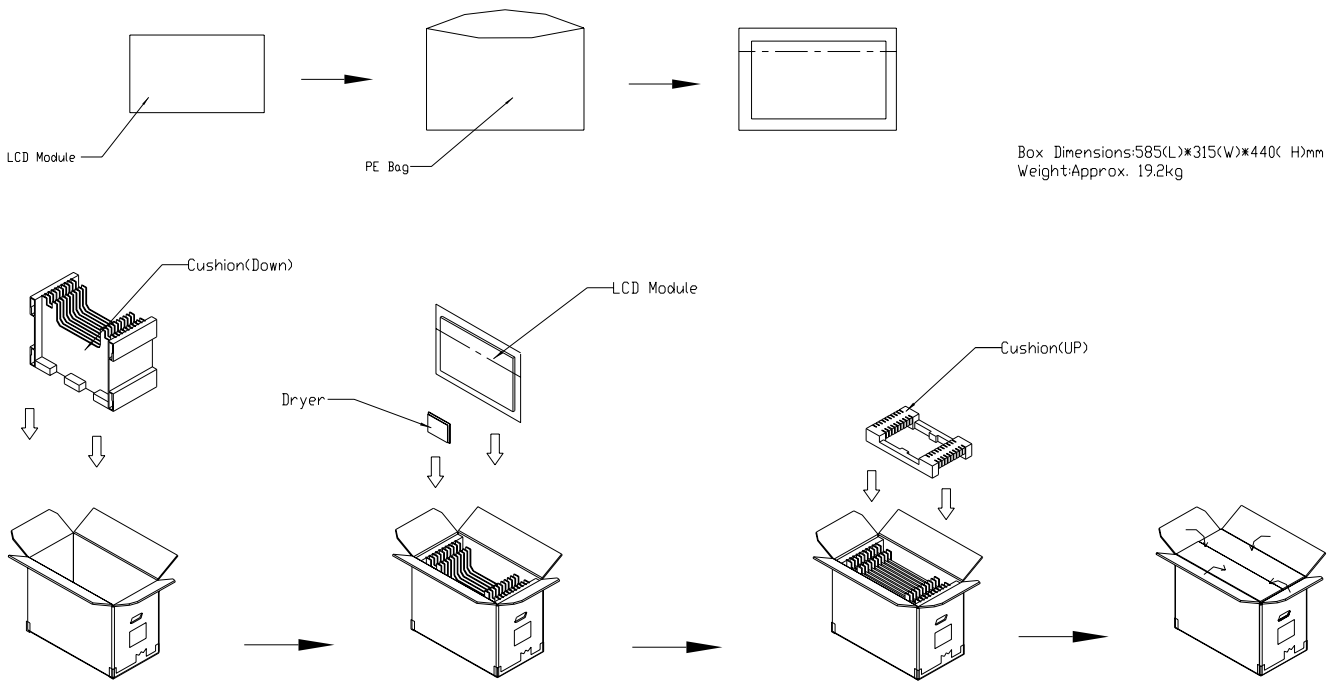


Figure. 8-1 Packing method

For ocean shipping

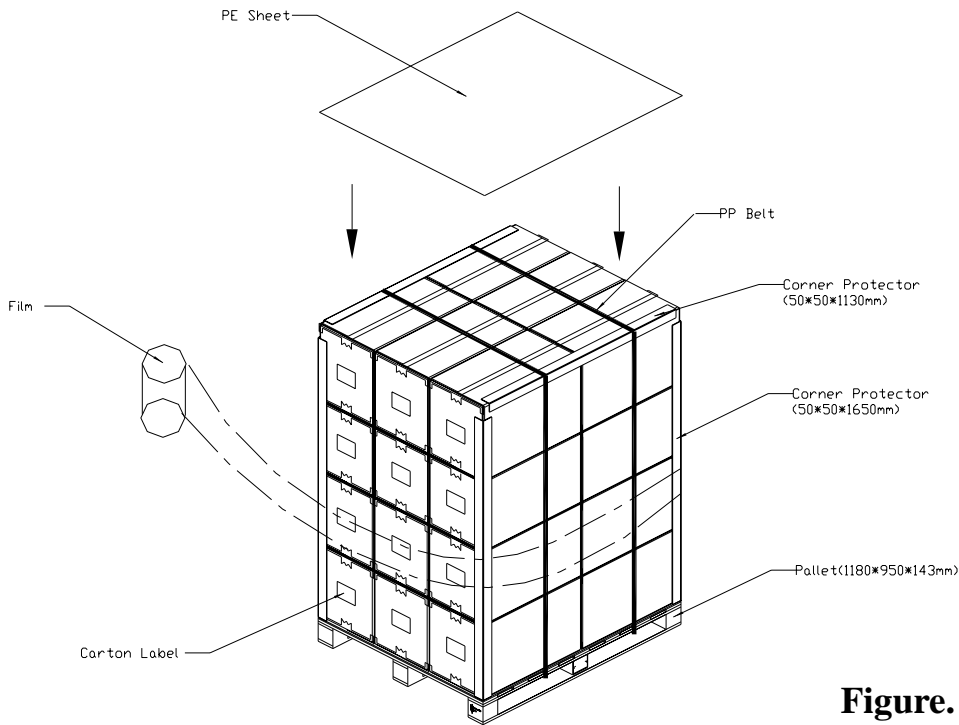


Figure. 8-2 Packing method

For air transport

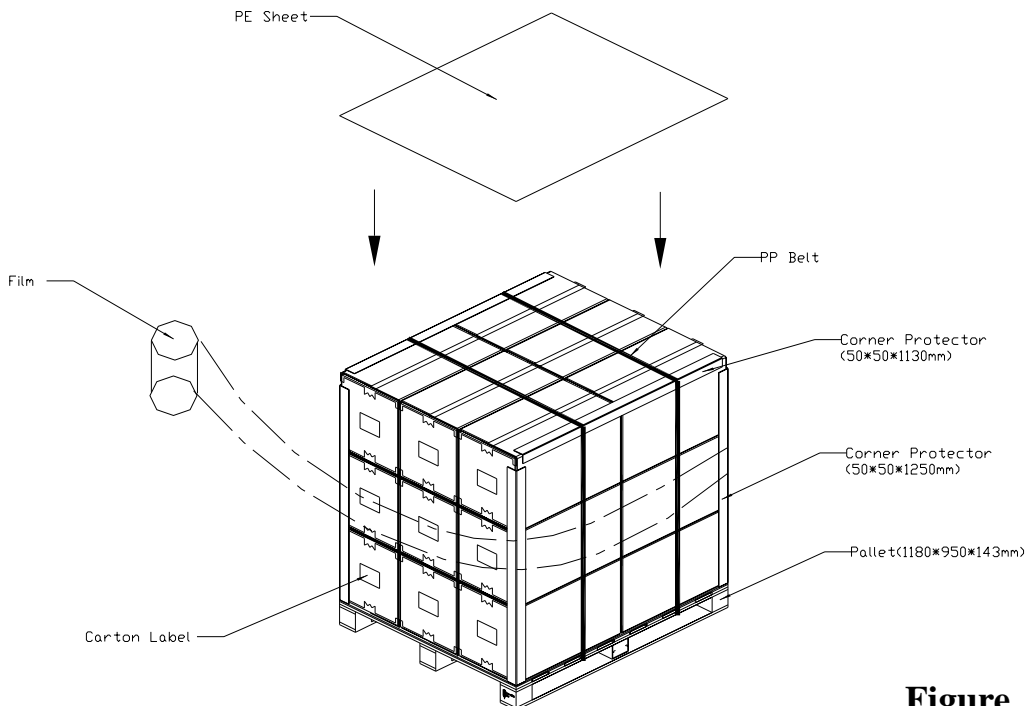


Figure. 8-3 Packing method

9. DEFINITION OF LABELS

9.1 CMO MODULE LABEL

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



- (a) Model Name: M220Z3-L03
- (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 | - |
| XX | CMO internal use | - |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: 1~12=1, 2, 3, ~, 9, A, B, C 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-22Z33-X-X-X-XX-L-XX-L-YMD-NNNN

| Code | Meaning | Description |
|-------|-----------------------|---|
| CM | Supplier code | CMO=CM |
| 22Z33 | Model number | M220Z3-L03=22Z33 |
| X | Revision code | C1=1, C2=2, |
| 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, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M |
| 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; Ningbo China=NP |
| L | Module line # | 1~12=0~C |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V |
| NNNN | Serial number | By LCD supplier |

10. PRECAUTIONS

10.1 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 10°C may reduce the display quality. For example, the response time will become slowly-

10.2 SAFETY PRECAUTIONS

- (1) 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.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

