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Chunghwa Picture Tubes, Ltd.

Technical Specification

| | | |
|------|---|---------------------|
| To | : | Samrterglass |
| Date | : | 160629 |

CPT TFT-LCD
CLAA 121MQ01CW

ACCEPTED BY :

| APPROVED BY | CHECKED BY | PREPARED BY |
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|----------|--------------------------------------|-------------|-------------------|
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|----------|--------------------------------------|-------------|-------------------|

Modification Record List

| Revision Notice | Description | Page | Rev. Date |
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| 0.1 | Modified Overview | 4 | 2015.02.11 |
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| 0.2 | Modified Backlight | 8 | 2015.07.21 |
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| 0.6 | ELECTRICAL CHARACTERISTICS | 6~7 | 2016.04.26 |
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1. OVERVIEW

CLAA121MQ01CW is 12.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 6 bit digital data (6 bit+Hi-FRC), 800×600, 16.7M-color images are displayed on the 12.1" diagonal screen. Input power voltage is 3.3V for LCD driving. Converter for backlight is included in this module. General specifications are summarized in the following table:

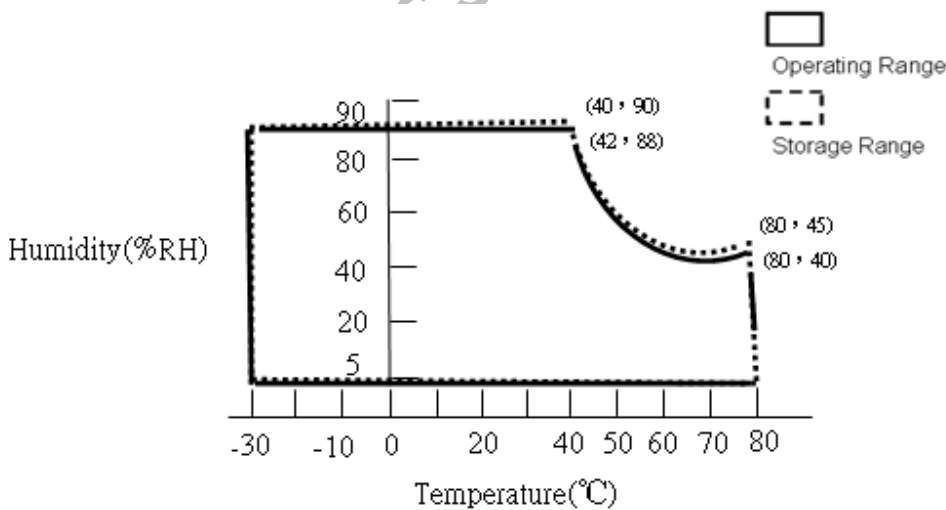
| ITEM | SPECIFICATION |
|--------------------------------|---|
| Display Area(mm) | 246.0(H)x184.5(V) |
| Number of Pixels | 800(H)x600(V) |
| Pixel Pitch(mm) | 0.3075(H)x0.3075(V) |
| Color Pixel Arrangement | RGB vertical stripe |
| Display Mode | Normally white, TN |
| Number of Colors | 16.7M (6 Bit+Hi-FRC) |
| Brightness(cd/m ²) | 360 cd/m ² (Min.) · 450 cd/m ² (Typ.) |
| Contrast Ratio | 800 (Typ.) |
| Viewing Angle | 160/140 (Typ.) |
| Viewing Direction | 6 o'clock(Gray level inversion) |
| Surface Treatment | AG, 3H |
| Power consumption(W) | 6.825W (Typ.) |
| Interface Connection | LVDS |
| Module Size(mm) | 263.6(W)x208.2(H)x9.2(D) (Typ.) |
| Module Weight(g) | 525g (TYP) |
| Backlight Unit | LED (White-LED) |

2. ABSOLUTE MAXIMUM RATINGS

| ITEM | SYMBOL | MIN. | MAX. | UNIT | REMARK |
|---|---------|------|------|------|----------------|
| Power Supply Voltage for LCD | VCC | 0 | 4.0 | V | |
| Logic Input Voltage | VI | 0 | 4.0 | V | |
| Backlight Power Supply Voltage | VLED | 0 | 14 | V | |
| Backlight ON-OFF Voltage | LED_EN | 0 | 7 | V | |
| Backlight Dimming Control Input Voltage | LED_PWM | 0 | 7 | V | |
| Operation Temperature | Top | -30 | 80 | °C | |
| Storage Temperature | Tstg | -30 | 80 | °C | 1). 2). 3). 5) |

[Note]

- 1)The relative temperature and humidity range are as below sketch, 90%RHMax.($T_a \leq 40^\circ\text{C}$).
- 2).The maximum wet bulb temperature $\leq 39^\circ\text{C}$ ($T_a > 40^\circ\text{C}$) and without dewing.
- 3).If you use the product in an environment which over the definition of temperature and humidity too long to effect the result of eye-etching.
- 4) Test Condition: IEC 61000-4-2 VESD_t: Contact discharge to input connector; VESD_c: Contact discharge to module
- 5). If you operate the product in normal temperature range, the center surface of front side panel should be under 80°C .



3. ELECTRICAL CHARACTERISTICS

(1).TFT-LCD

| ITEM | | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|--|----------------------------|-----------|-------------------|----------|-------------------------|------|--------------------|
| LCD Power Voltage | | VCC | 3.0 | 3.3 | 3.6 | V | |
| LCD Power Current | | ICC | - | 250 | 350 | mA | *1) |
| LCD Rush Current | | VCC_Irush | | | 2 | A | *3) |
| Logic Input Voltage (LVDS: IN+,IN-) | Common Voltage | VCM | $\frac{ VID }{2}$ | - | $2.4 - \frac{ VID }{2}$ | V | *2) |
| | Differential Input Voltage | VID | 200 | - | 600 | mV | *2) |
| | Threshold Voltage (HIGH) | VTH | - | - | 100 | mV | *2) VCM = +1.2V |
| | Threshold Voltage (LOW) | VTL | -100 | - | - | mV | |
| 1 Data time | | UI | - | tclk*1/7 | - | tclk | *4) |
| LVDS clock to data skew | | tskew | - | - | 300 | ps | *4) |
| input data eye width | | teyew | 2254 | - | - | ps | *4) |
| Logic Input Voltage | VIH | 0.7*DVDD | - | DVDD | V | | |
| | VIL | GND | - | 0.3*DVDD | V | | |
| Power consumption | | P | | 0.825 | 1.26 | W | |

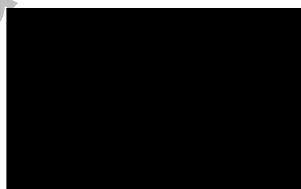
【 Note 】

*1)TYP. specification : Gray-level test Pattern (TYP Freq. @3.3V)

MAX. specification : Black test Pattern (TYP Freq. @3.3V)

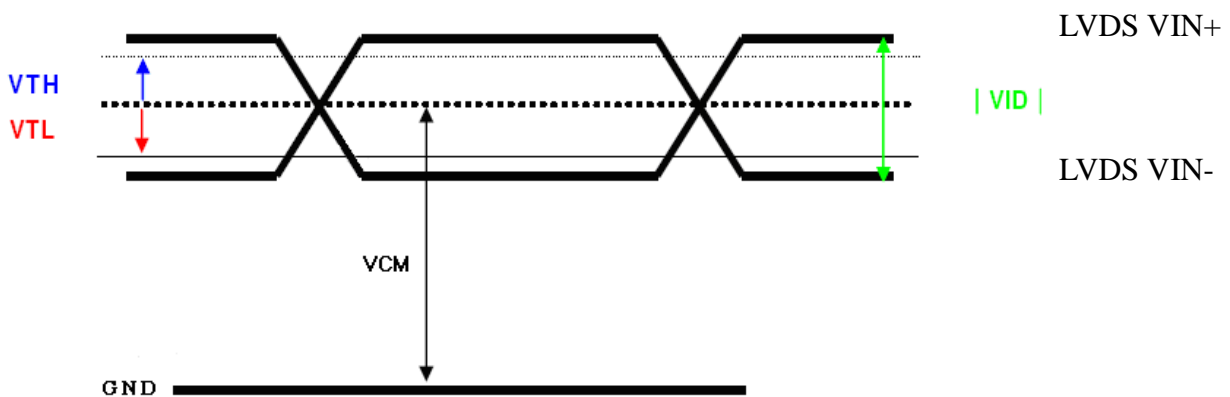


Gray-level Pattern



Black Pattern

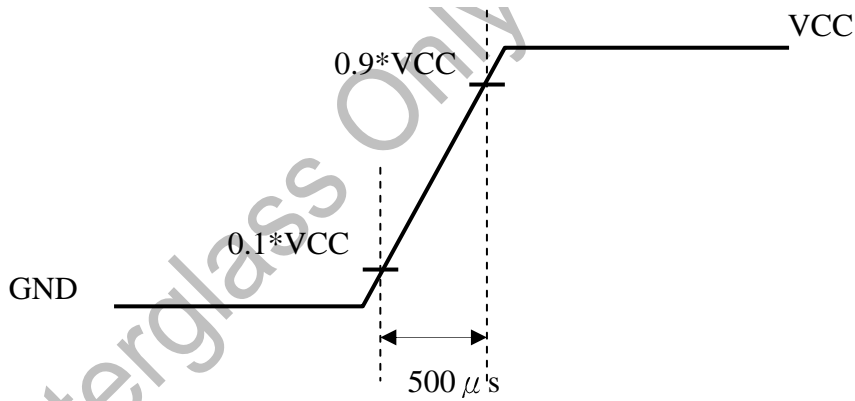
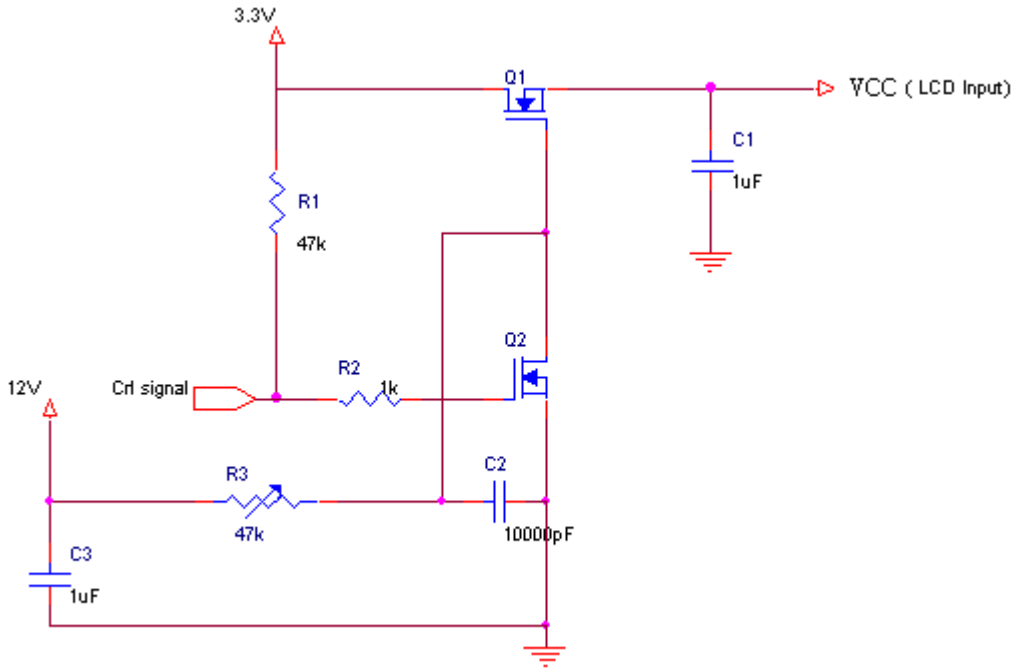
*2) LVDS Signal Definite :



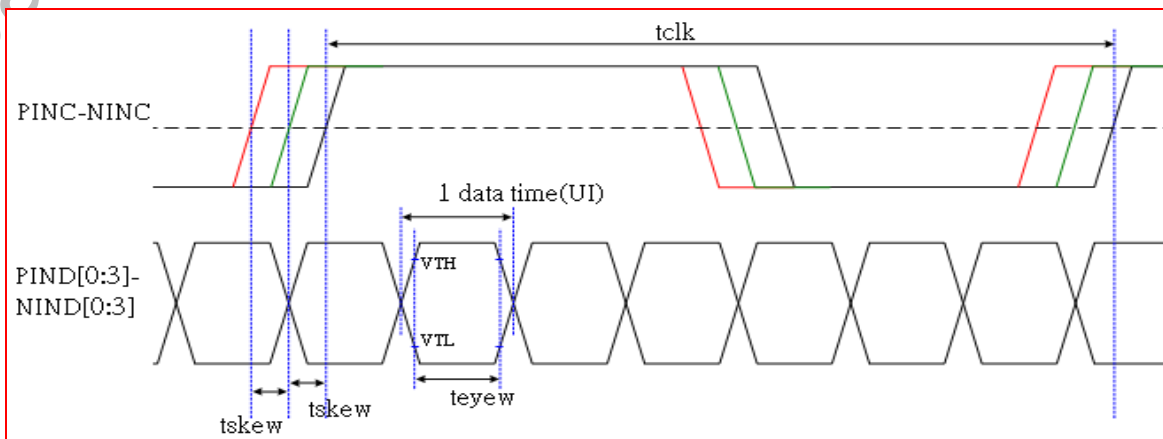
VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

*3) Irush measure condition



*4)The following condition is base on operation frequency at 50.05MHz



(2).Backlight

1. Electrical specification (single LED)

Ta=25°C (Ta: ambient temperature)

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | REMARK |
|-------------------|--------|-----|-------|-----|------|----------|
| Forward Voltage | VF | 2.8 | - | 3.4 | V | IF=56mA |
| Forward Current | IF | - | 56 | - | mA | 1) |
| Power consumption | W | - | 179.2 | - | mW | IF =56mA |

2. life time

| ITEM | min | typ | max | UNIT | REMARK |
|-----------------------|-------|-------|-----|------|--------------|
| LIFE TIME(Backlight) | 50000 | 70000 | -- | hrs | 2) , 3) , 4) |

[Note]

- 1).If dimming function is required, it is strongly recommended to adopt pulse width modulation (PWM).If not, linear decrease of the driving current will affect the optical characteristics
- 2).Parameter guideline for LED driving is under stable conditions at 25°C (Room Temperature) and IF=56mA
- 3). Definition of the lamp life time: Luminance (L) under 50% of specification.
- 4). When the ambient temperature Ta overstep 25°C , it will serious damage life time.

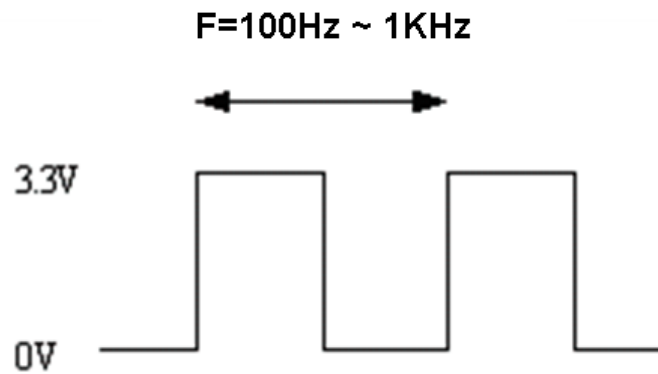
(3).Converter Specification for Backlight

Ta = 25°C

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|-------------------------------|------------|------|------|------|------|------|
| LED Driver Input Voltage | VLED | 10.8 | 12.0 | 13.2 | V | |
| LED Driver Input Current | IVLED | - | 500 | 550 | mA | *1) |
| LED Rush Current | VLED_Irush | | | 2 | A | *3) |
| Dimming Control | High | 2.4 | -- | 5.5 | V | |
| | Low | 0 | | 0.8 | | |
| PWM Frequency | LED_PWM | 100 | 200 | 1K | Hz | *2) |
| Duty Ratio | | 5 | - | 100 | % | |
| ON/OFF Control | High | 2.4 | | 5.5 | V | |
| | Low | 0 | | 0.8 | | |
| Power Consumption (Backlight) | BLW | -- | 6 | 7.26 | W | |

*1) Maximum LED Driver Input Current at 10.8V Input Voltage/PWM Duty 100%.

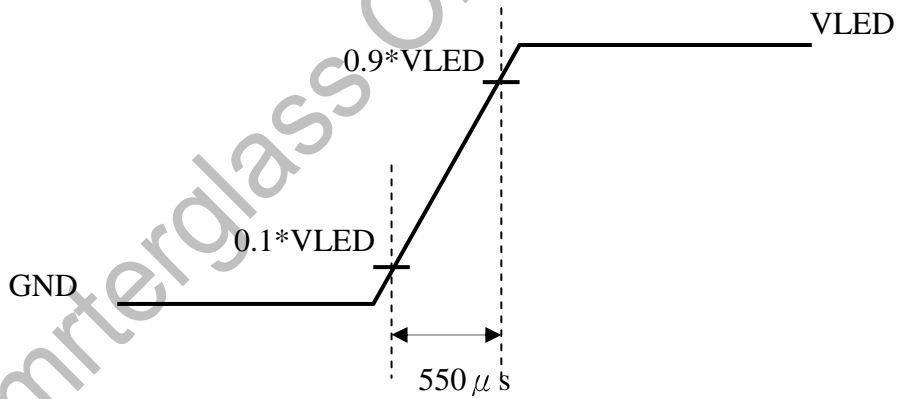
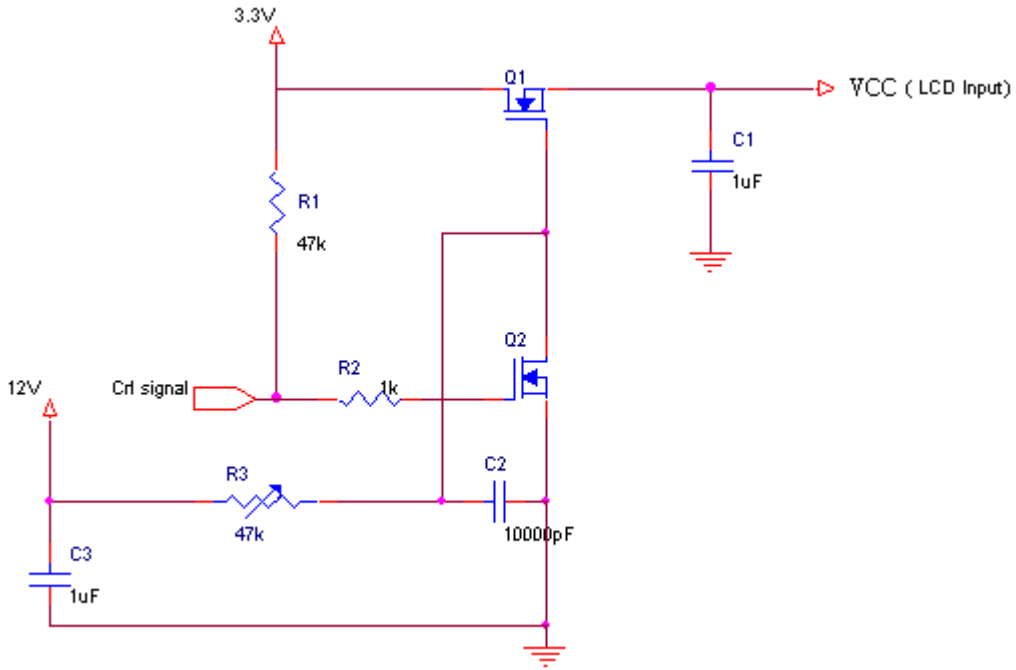
*2) The ADJ adjust signal level is 0~3.3V , operation frequency:100Hz~1KHz ◦



The ADJ can adjust LED BL brightness , where Duty and Luminance are in direct ratio.



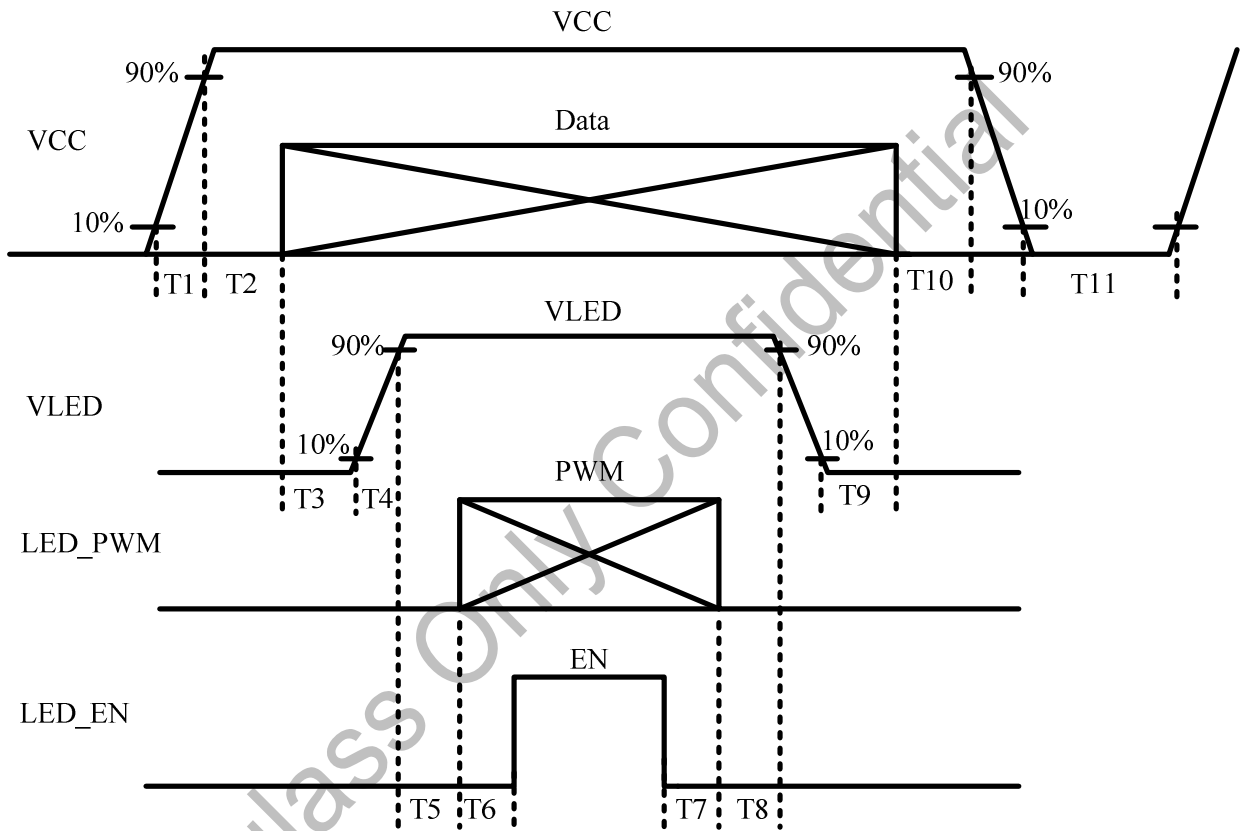
*3) Irush measure condition



(4). Power and Signal sequence

Power Sequence :

| | | |
|--|--------------------------|---------------------------|
| $0.50 \text{ ms} \leq T1 \leq 10 \text{ ms}$ | $200 \text{ ms} \leq T3$ | $10 \text{ ms} \leq T8$ |
| $0.01 \text{ ms} < T2 \leq 50 \text{ ms}$ | $10 \text{ ms} \leq T5$ | $200 \text{ ms} \leq T9$ |
| $0.50 \text{ ms} \leq T4 \leq 10 \text{ ms}$ | $10 \text{ ms} \leq T6$ | $500 \text{ ms} \leq T11$ |
| $0.01 \text{ ms} < T10 \leq 50 \text{ ms}$ | $0 \text{ ms} \leq T7$ | |



Data: NIND0 ~ NIND3 , PIND0 ~ PIND3 , NINC , PINC , DENA

4. INTERFACE PIN CONNECTION

(1) CN1 (Data Signal and Power Supply)

Outlet connector: MSB240420HD (STM)

Plug connector: P240240 (STM) or equivalent

| PIN # | SYMBOL | FUNCTION |
|-------|-----------|---|
| 1 | VCC | +3.3V Power Supply |
| 2 | VCC | +3.3V Power Supply |
| 3 | GND | GND |
| 4 | GND | GND |
| 5 | RXIN0- | Negative LVDS Differential Data Input |
| 6 | RXIN0+ | Positive LVDS Differential Data Input |
| 7 | GND | GND |
| 8 | RXIN1- | Negative LVDS Differential Data Input |
| 9 | RXIN1+ | Positive LVDS Differential Data Input |
| 10 | GND | GND |
| 11 | RXIN2- | Negative LVDS Differential Data Input |
| 12 | RXIN2+ | Positive LVDS Differential Data Input |
| 13 | GND | GND |
| 14 | RXCLK IN- | Negative LVDS Differential Clock Input |
| 15 | RXCLK IN+ | Positive LVDS Differential Clock Input |
| 16 | GND | GND |
| 17 | RXIN3- | Negative LVDS Differential Data Input |
| 18 | RXIN3+ | Positive LVDS Differential Data Input |
| 19 | NC | NC |
| 20 | SEL | Input Mode Select :6-bits(3.3V) / VESA 8-bits(GND) |

- 1) Please keep the NC Pin and don't connect it to GND or other signals.
- 2) GND Pin must connect to the ground, don't let it be a vacant pin.

(2) CN2 (Backlight)

Outlet connector: CR03-P05H2B-2-E3500 (CONN-TEK)

Plug connector: CR03-S05C3HF-018 or equivalent

| PIN # | SYMBOL | FUNCTION |
|-------|---------|--|
| 1 | VLED | +12V Power Supply |
| 2 | GND | GND |
| 3 | LED_EN | ON : 3.3V / OFF: 0V & NC (*1) |
| 4 | LED_PWM | Light Dimming Control : PWM Input for Dimming: L : 0V / H : 5V Freq : 100-2000Hz Duty : 5%-100% |
| 5 | NC | NC |

*1) Enable High=2.4 to 5.5V, Low=0 to 0.8V or Open.

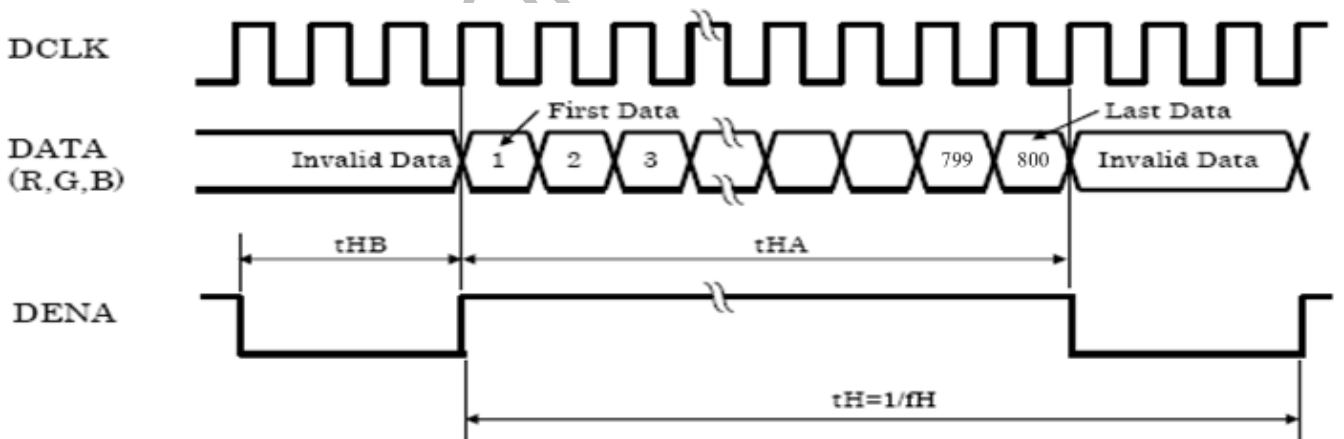
5. INTERFACE TIMING

(1) Timing Specifications

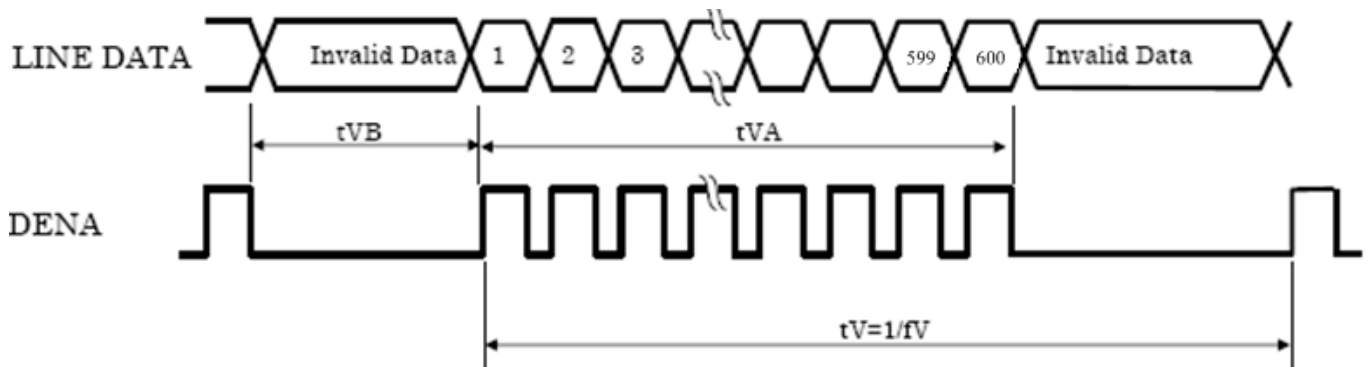
| ITEM | | | SYMBOL | MIN. | TYP. | MAX. | UNIT | |
|------------|------------|------------|---------------------------|------|-------|-------|-------|------|
| LCD Timing | DCLK | | Frequency | fCLK | 32.18 | 39.6 | 50.05 | MHz |
| | | | Cycle | tCLK | 19.98 | 25.25 | 31.07 | ns |
| | DENA | Horizontal | Horizontal total time | tH | 900 | 1000 | 1100 | tCLK |
| | | | Horizontal effective time | tHA | 800 | | | tCLK |
| | | | Horizontal blank time | tHB | 100 | 200 | 300 | tCLK |
| | | Vertical | Vertical total time | tV | 650 | 660 | 700 | tH |
| | | | Vertical effective time | tVA | 600 | | | tH |
| | | | Vertical blank time | tVB | 50 | 60 | 100 | tH |
| | Frame rate | | | Fv | 55 | 60 | 65 | Hz |

(2) Timing Chart

a. Horizontal Timing

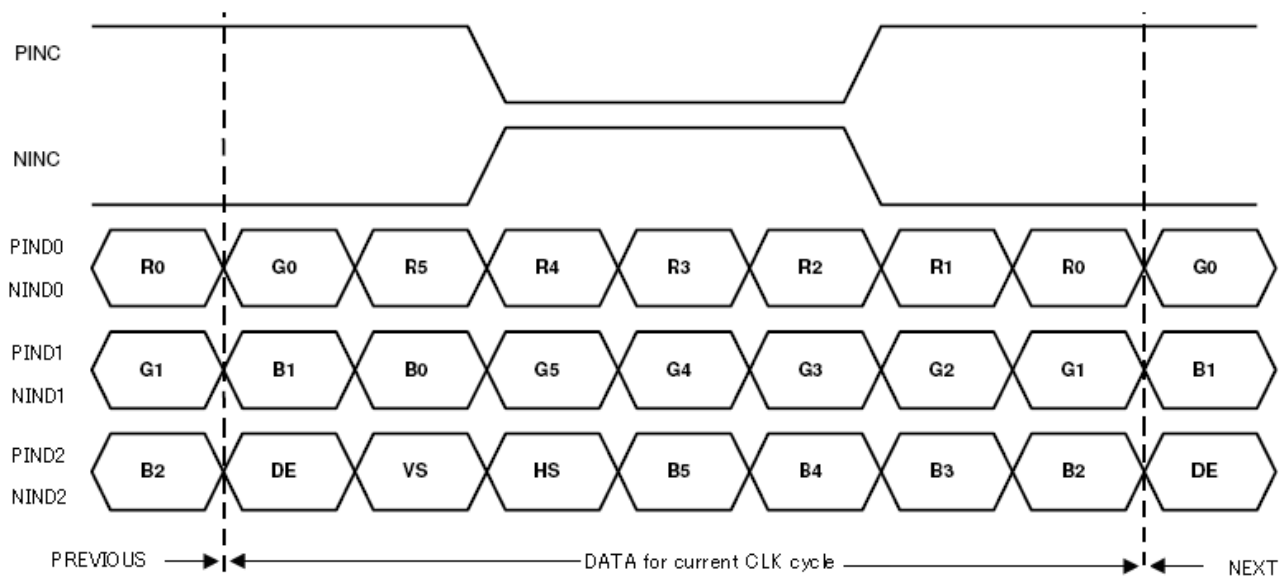


b. Vertical Timing

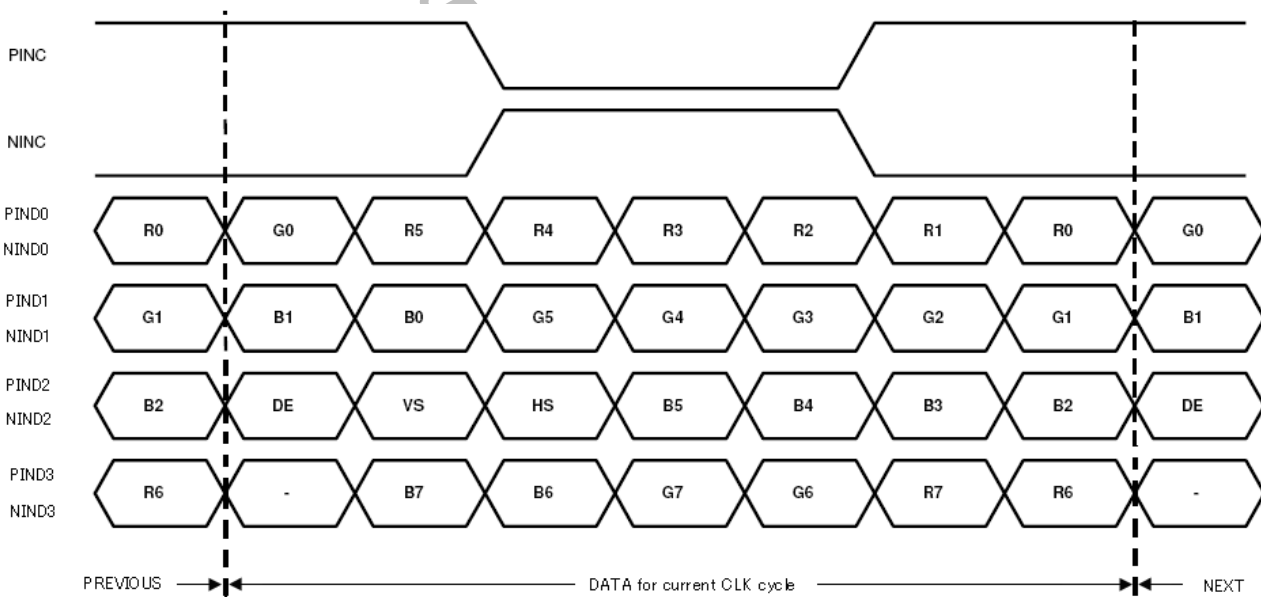


(3) LVDS DATA : Timing Chart

6bits LVDS input



8bits LVDS input



(4) Color Data Assignment

6bits 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 |
| | | MS B | | | | | LS B | MS B | | | | | LS B | MS B | | | | | LS B |
| 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(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 | 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(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 | 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(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 | 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 |

8bits input

| COLOR | INPUT DATA | R DATA | | | | | | | | G DATA | | | | | | | | B DATA | | | | | | | |
|-------------|------------|--------|---|---|---|---|---|----|---|--------|---|---|---|---|---|----|---|--------|---|---|---|---|---|---|---|
| | | R | R | R | R | R | R | R | R | G | G | G | G | G | G | G | G | B | B | B | B | B | B | B | B |
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | | | | | | | | LS | | | | | | | | LS | | | | | | | | | |
| | | | | | | | | B | | | | | | | | B | | | | | | | | | |
| 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(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 | |
| | 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 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 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 | |
| | 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 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| GREEN | GREEN(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 | 0 | 1 | 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 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 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 | |
| GREEN(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| BLUE | BLUE(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 | 1 | |
| | BLUE(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | BLUE(254) | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |

[Note]

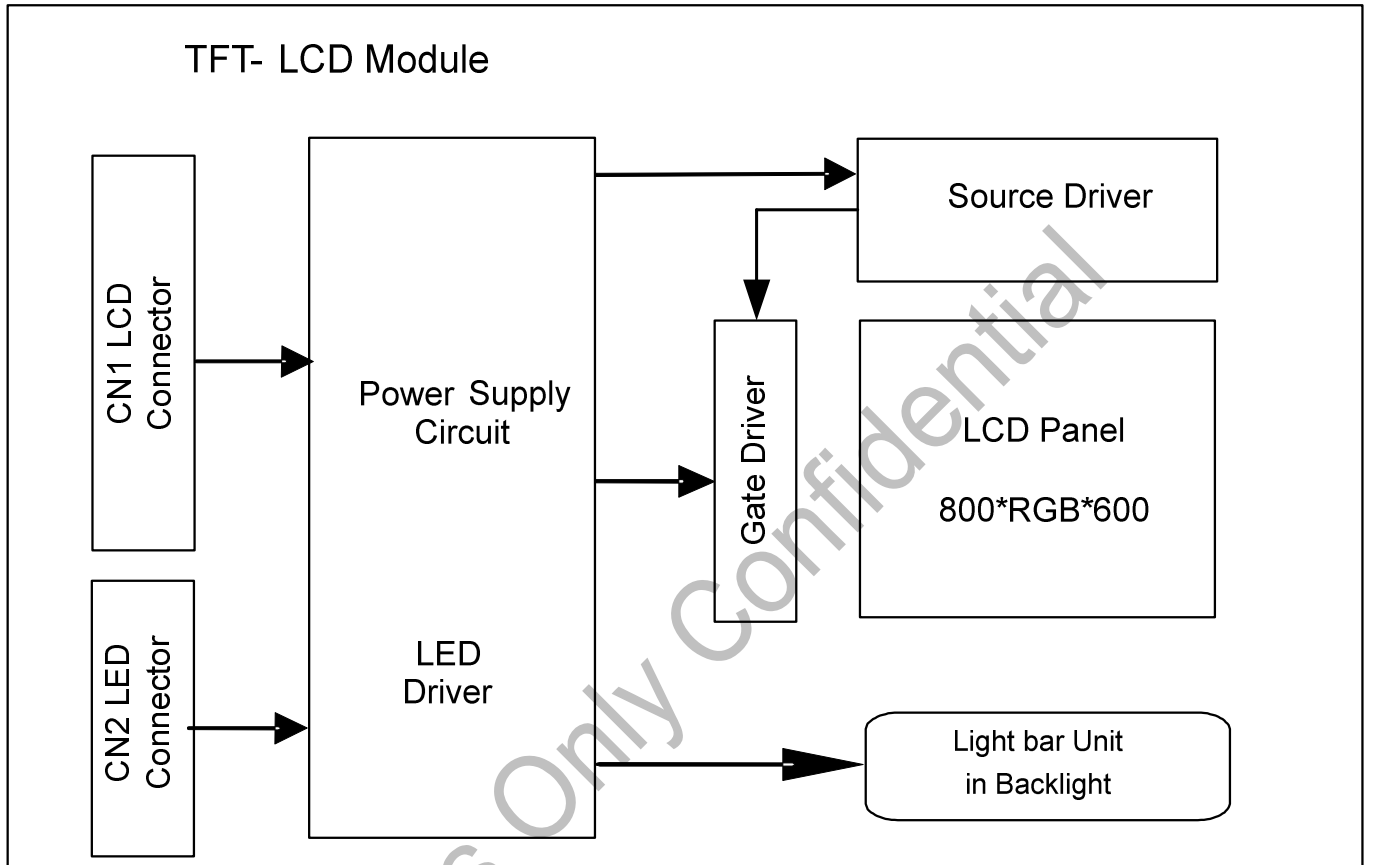
1) Definition of gray scale:

Color (n): n indicates gray scale level; higher n means brighter level.

2) Data: 1-High, 0-Low.

3) This assignment is applied to both odd and even data.

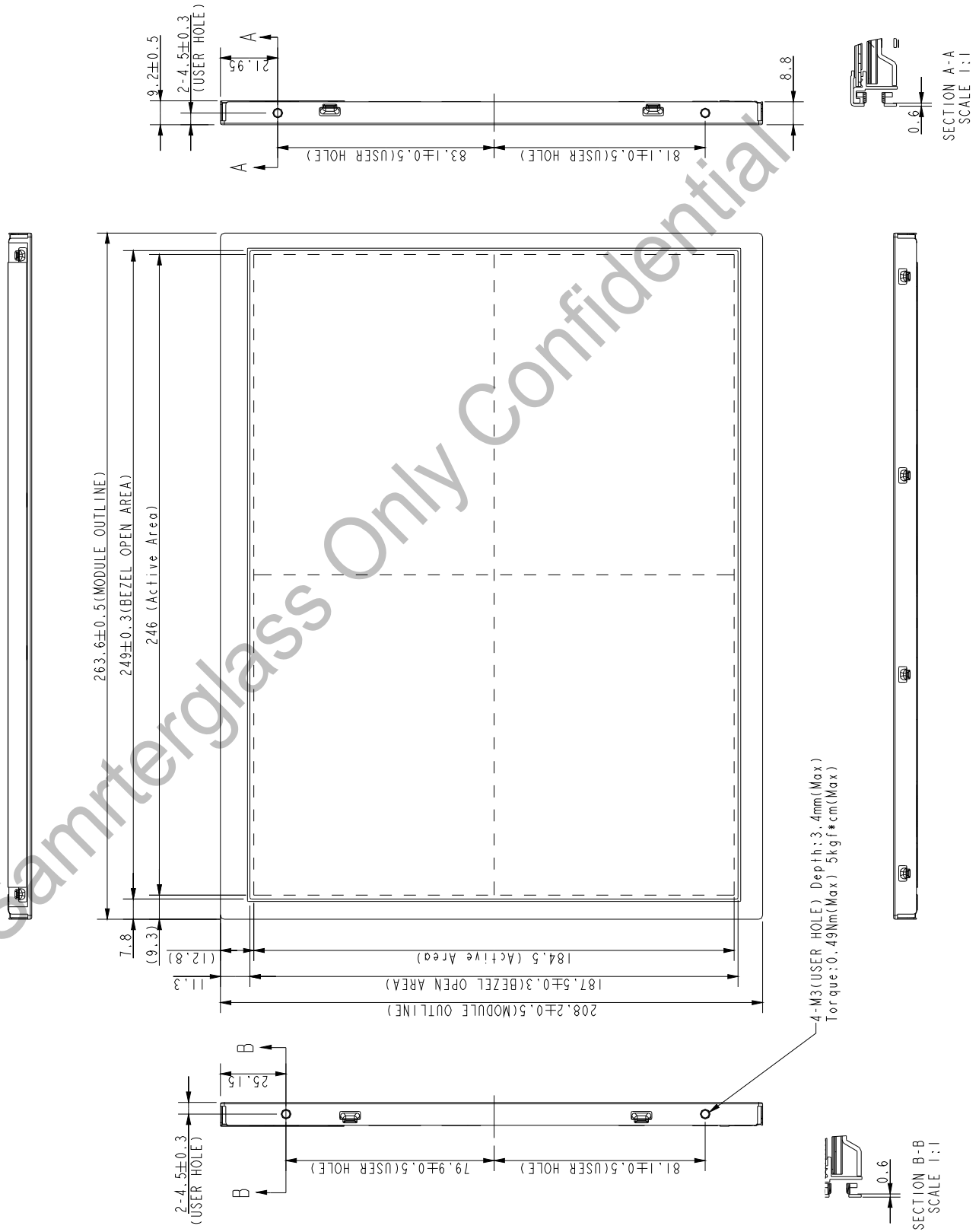
6. BLOCK DIAGRAM



7. MECHANICAL SPECIFICATION

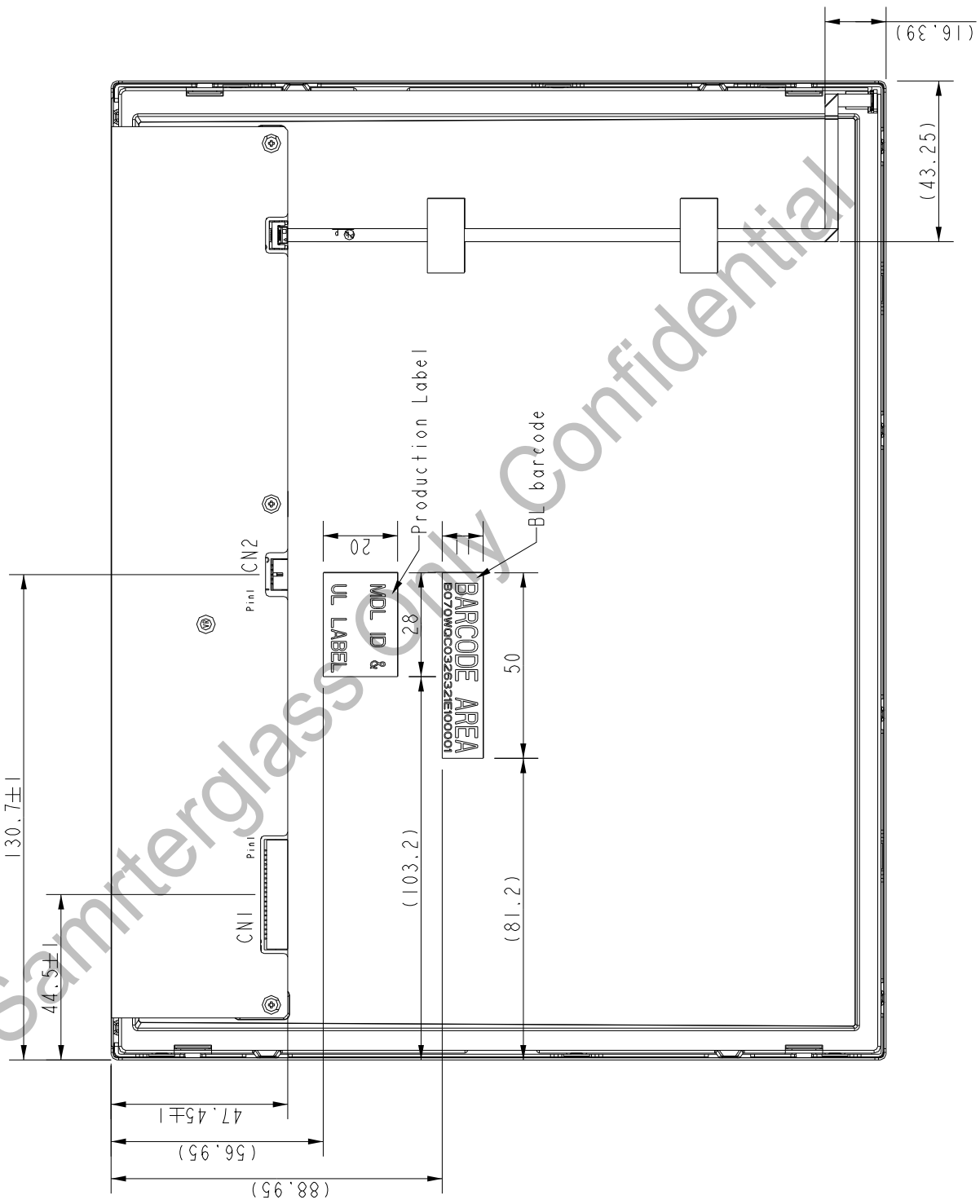
(1) Front side (Tolerance is ±0.5mm unless noted)

Unit: mm



(2) Rear side (Tolerance is $\pm 0.5\text{mm}$ unless noted)

Unit: mm



NOTE:
1. CN 1: MSB240420HD 20PIN 信盛
2. CN 2: CR03-P05H2B-2-E3500 5PIN 物新

8. OPTICAL CHARACTERISTICS

Ta=25°C , VCC=3.3

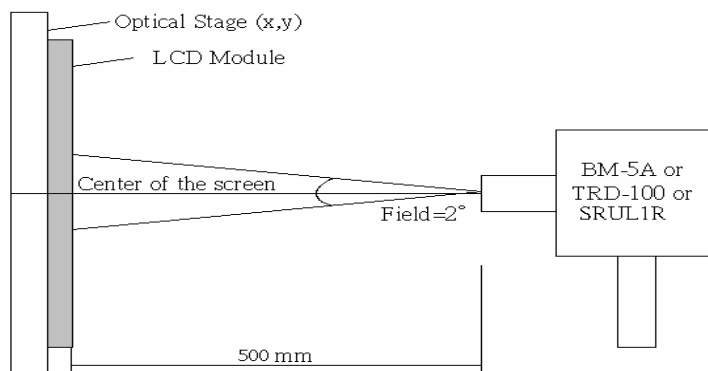
| ITEM | | SYMBOL | CONDITION | min | typ | max | UNIT | REMARK |
|-------------------|------------|------------|---------------------------|---------|---------|---------|-------------------|--------|
| Contrast Ratio | | CR | $\theta = \psi = 0^\circ$ | 600 | 800 | -- | -- | *1) 2) |
| Luminance(CEN) | | L | $\theta = \psi = 0^\circ$ | 360 | 450 | -- | cd/m ² | *1) 3) |
| 9P Uniformity | | ΔL | $\theta = \psi = 0^\circ$ | 75 | 80 | -- | % | *1) 3) |
| Response Time | | Tr | $\theta = \psi = 0^\circ$ | -- | 9 | -- | ms | *5) |
| | | Tf | $\theta = \psi = 0^\circ$ | -- | 16 | -- | | |
| Crosstalk | | CT | $\theta = \psi = 0^\circ$ | 0 | -- | 1 | % | *6) |
| Viewing Angle | Horizontal | ψ | $CR \geq 10$ | -70~70 | -80~80 | -- | Deg. | *4) |
| | Vertical | θ | | -60~60 | -70~70 | -- | Deg. | |
| Color Coordinates | White | X | $\theta = \psi = 0^\circ$ | (0.263) | (0.313) | (0.363) | Color Coordinates | *3) |
| | | Y | | (0.279) | (0.329) | (0.379) | | |
| | Red | X | | (0.589) | (0.639) | (0.689) | | |
| | | Y | | (0.295) | (0.345) | (0.395) | | |
| Green | X | (0.290) | (0.340) | (0.390) | | | | |
| | Y | (0.538) | (0.588) | (0.638) | | | | |
| Blue | X | (0.097) | (0.147) | (0.197) | | | | |
| | Y | (0.031) | (0.081) | (0.131) | | | | |
| Gamut | | CG | $\theta = \psi = 0^\circ$ | 55 | 60 | | | -- |
| Gamma | | γ | VESA | 2.0 | 2.2 | 2.4 | -- | *7) |

[Note]

Definition of these measurement items is as follows:

1) Setup of Measurement Equipment

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.



2).Definition of Contrast Ratio:

$$CR = \text{ON (White) Luminance} / \text{OFF (Black) Luminance}$$

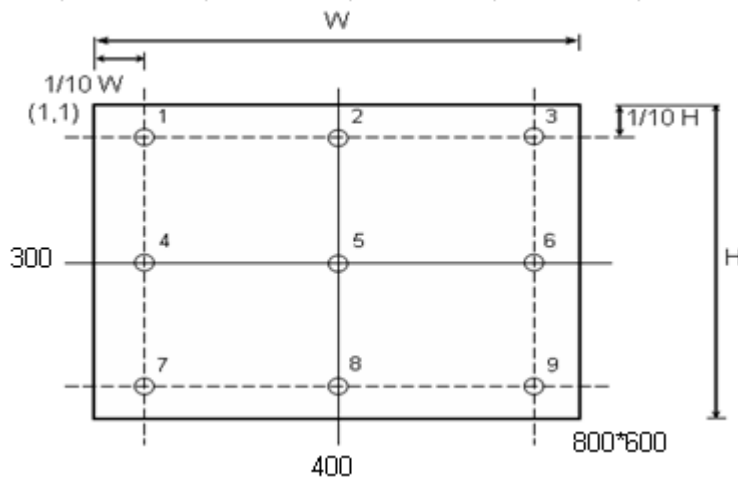
3).Definition of Luminance and Luminance uniformity:

Center Luminance: measuring the luminance of the point no. 5

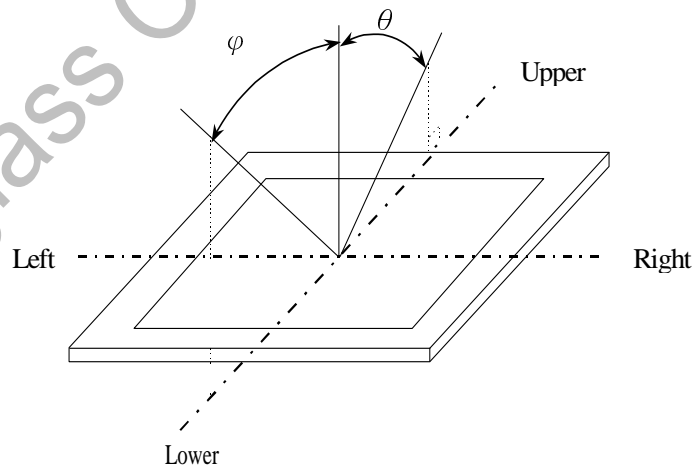
Average Luminance: measuring average luminance of points no.1-no.9

Color Coordinate measuring of the point no. 5

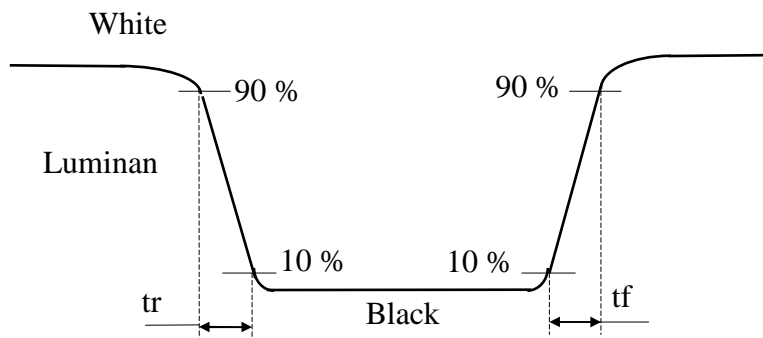
Uniformity: $\Delta L = [L (\text{Min})/L (\text{Max})] \times 100 \%$



4).Definition of Viewing Angle (θ, ψ):



5) Definition of Response Time:

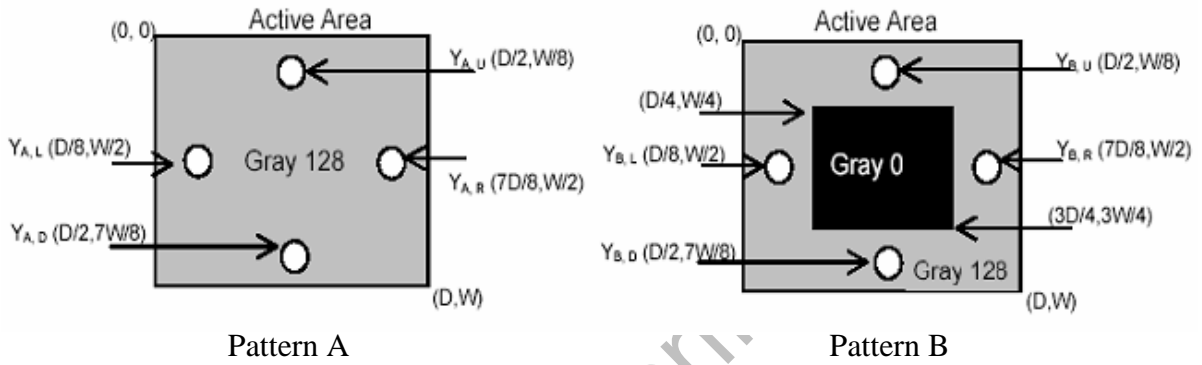


6) Definition of crosstalk:

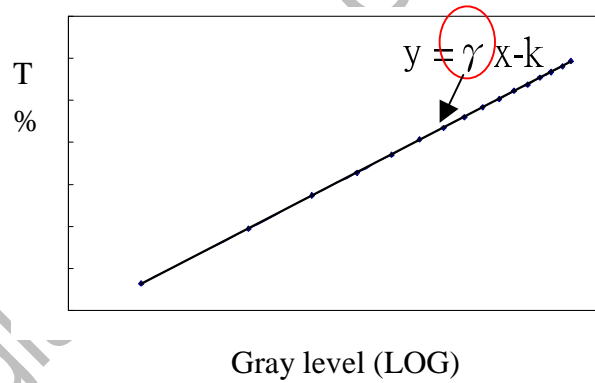
$$CT = | Y_B - Y_A | / Y_A \times 100 (\%)$$

Y_A : The luminance of measured position at pattern A

Y_B : The luminance of measured position at pattern B with Gray level 0



7) Definition of Gamma (γ), follow VESA standard sampling every 16 gray level (0,16,32,...,224,240,255)



9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

| TEST ITEMS | CONDITIONS |
|---|---|
| High Temperature High Humidity Operation | 60°C; 90%RH; 240hrs (No condensation) |
| High Temperature Operation | 80°C; 240hrs |
| High Temperature Storage | 80°C; 240hrs |
| Low Temperature Operation | -30°C; 240hrs |
| Low Temperature Storage | -30°C; 240hrs |
| Thermal Shock | Between -30°C (1hr) ~ 80°C (1hr); 100 Cycles |

(2) Shock & Vibration

| ITEMS | CONDITIONS |
|------------------------------------|---|
| SHOCK (NON-OPERATION) N_1 | Shock level:(180G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs |
| SHOCK (NON-OPERATION) N_2 | Shock level:(50G) Waveform: half sinusoidal wave, 11ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs |
| VIBRATION (NON-OPERATION) N) | Vibration level: 14.7m/s ² (1.5G) zero to peak Waveform: sinusoidal Frequency range: 5 to 500 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 5 to 500Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hr, total 3 hours) |

(3) ESD

| TEST ITEM | CONDITIONS | Note |
|-----------------------|--|------|
| ESDESD (Power Off) | Connector : 1. 200 pF , 0 Ω , ±250 V 2. contact mode for each pin | 2 |
| | Module : 1. 150 pF , 330 Ω , ±15K V (Air mode) , ±8KV(Contact mode) 2. Air mode, test 25 times for each test point Contact mode, 25 times for each test point | 1 |
| ESDESD (Power On) | Module : 1. 150 pF , 330 Ω , ±8K V 、 ±15K V (Air mode) 2. 150 pF , 330 Ω , ±6KV 、 ±8KV (Contact mode) 3. Air mode, test 25 times for each test point 4. Contact mode, 25 times for each test point | 1 |

Note :

1. Air: LCD glass, contact: metal bezel

2. Connector pins

(4) Judgment standard

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

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

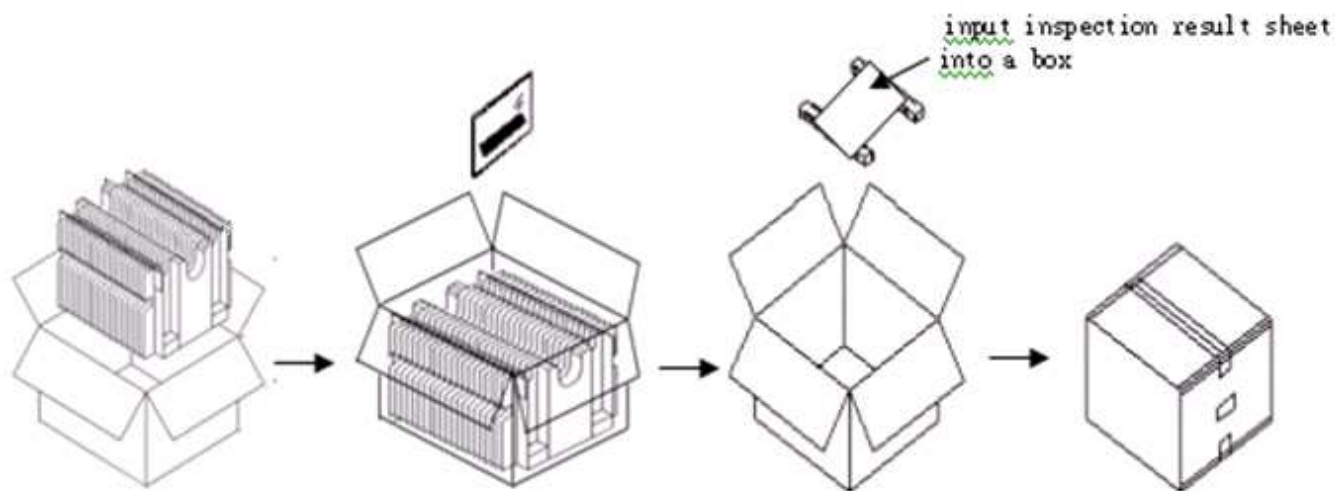
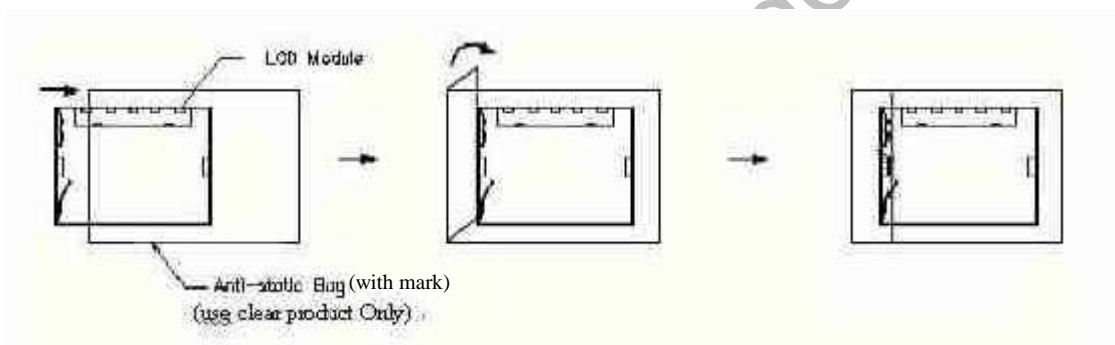
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10. Packaging specification

1. PACKAGING

- PACKING SPECIFICATIONS
- 20 LCD modules (max.) / 1 Box
- 18 box (max.) / 1 pallet
- Box dimensions: 435(L) X373(W)X315(H)
- Weight: approximately 14.2Kg (20 modules per box)

2. PACKING Method



Top/Bottom Cap:

Top Cap :1150(L)X 900(W) X 840(H)mm

Bottom Cap: 1150(L)X 900(W) X105(H)mm

Cover Protector: 945(L)X 50 X 50mm

Pallet: 1150(L) X 900(W) X 130(H) mm

Pallet stack: 1150(L) X 900(W) X1075(H) mm

Gross Weight: 265.6Kg

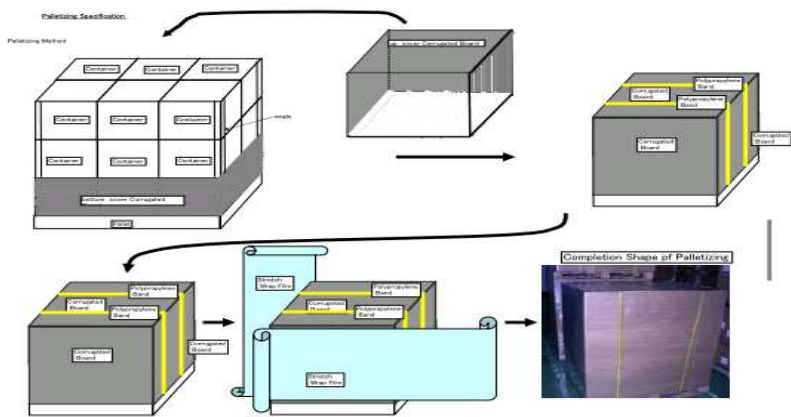


Figure2-2 packing method

11. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

(1) ASSEMBLY PRECAUTION

- 1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
- 2) Please design display housing in accordance with the following guide lines.
 - a) Housing case must be destined 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 1.0 mm 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) 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.
- 3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
- 4) 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.
- 5) Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
- 6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- 7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- 8) 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.

(2) OPERATING PRECAUTIONS

- 1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- 2) 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.
- 3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
- 4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
- 5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.
- 6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

(3) PRECAUTIONS WITH ELECTROSTATICS

- 1) 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.
- 2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

- 1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C ~40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
- 2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C 90%RH.
- 3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

(5) SAFETY PRECAUTIONS

- 1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- 2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

(6) OTHERS

- 1) 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.
- 2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

3) 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) Packing 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.)

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