



Specifications for LCD module

| | |
|--------------------------|-------------------------------|
| Customer | |
| Customer part no. | |
| Ample part no. | AMA-121A05-DU8046-G018 |
| Approved by | |
| Date | |

Preliminary Specification

Formal Specification

AMPIRE CO., LTD.

**4F., No.116, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei
City221, Taiwan (R.O.C.)**

新北市汐止區新台五路一段 116 號 4 樓(東方科學園區 A 棟)

TEL:886-2-26967269 , FAX:886-2-26967196 or 26967270

| Approved by | Checked by | Organized by |
|-------------|------------|--------------|
| Kokai | Simon | Tank |

*This specification is subject to change without notice.

RECORD OF REVISION

| Revision Date | Page | Contents | Editor |
|---------------|------|-------------|--------|
| 2023/10/23 | - | New Release | Tank |

1. Features

12.1 TFT Liquid Crystal Display module is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 12.1 inch diagonally measured active display area with HD (1024 horizontal by 768 vertical pixels) resolution.

(1) Projective Capacitive Touch

- a. Interface : USB
- b. Touch Controller: EXC80W46
- c. Cover Lens :
 - i. Tempered Soda Lime Glass: T=1.8mm.
 - ii. Black border (Pantone :Black)

(2) Tape bonding between LCD and touch panel.

(3) ROHS.

2. Physical Specifications

| Item | Specifications | Remark |
|--------------------|--------------------------------|--------|
| LCD Size | 12.1 inch(Diagonal) | |
| Driver Element | a-Si TFT active matrix | |
| Display Resolution | 1024(W) x 3(RGB) x 768(H) dots | |
| Display Mode | Normally Black | |
| Dot Pitch | 0.240(W) x 0.240(H) mm | |
| Active Area | 245.76(W) x 184.32(H) mm | |
| Color Arrangement | RGB Vertical Stripe | |

3. Absolute Maximum Ratings

| Item | Symbol | Values | | Unit | Remark |
|--------------------------|--------|--------|-----|------|--------|
| | | Min | Max | | |
| LCD Power Voltage | VDD | -0.3 | 5.0 | V | |
| LED Driver Power Voltage | VLED | -0.3 | 14 | V | |
| Operation Temperature | TOP | -30 | 70 | °C | |
| Storage Temperature | TST | -30 | 80 | °C | |

Note(1) The absolute maximum rating values of this product are not allowed to be exceeded at any times.

Note(2) Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

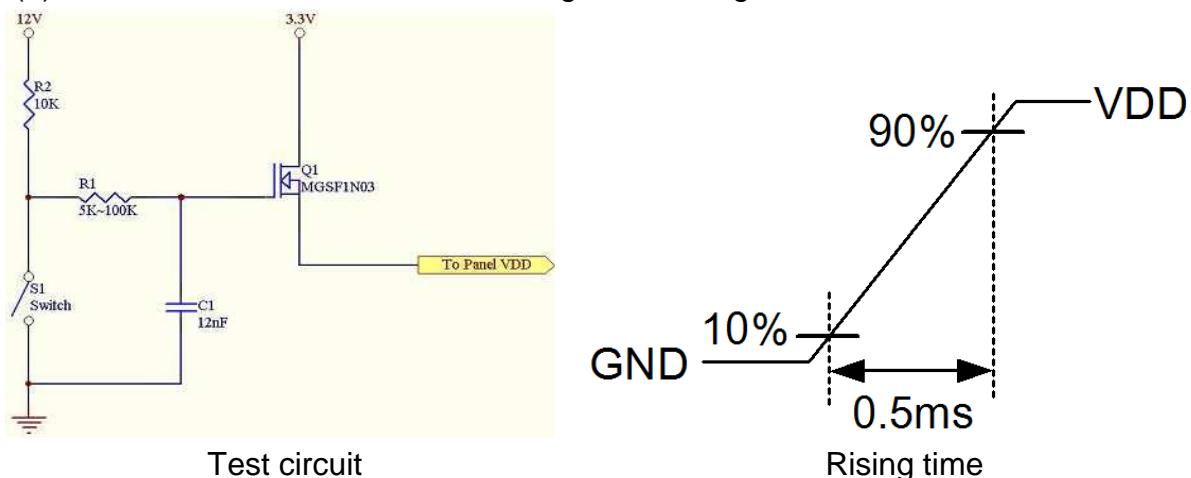
4. Electrical Specifications

4.1 TFT LCD module

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------------|--------|---------|-------|---------|------|--------------------------------|
| Supply Voltage | VDD | 3.0 | 3.3 | 3.6 | V | T _a =25°C |
| Logic Input Voltage | VIH | 0.8*VDD | -- | VDD | V | BIST, SEL68, reLR, reUD |
| | VIL | 0 | -- | 0.2*VDD | V | |
| Current of Power Supply | IDD | — | 0.242 | 0.364 | A | VDD =3.3V White pattern (L255) |
| VDD Power | PDD | — | 0.8 | 1.2 | W | VDD =3.3V White pattern (L255) |
| Inrush Current | IRUSH | — | — | 2.0 | A | Note(1),(2) |

Note(1) : The min. output current of the VDD (3.3V) supply should be more than 2.0A.

Note(2) : Inrush current test circuit and rising time setting



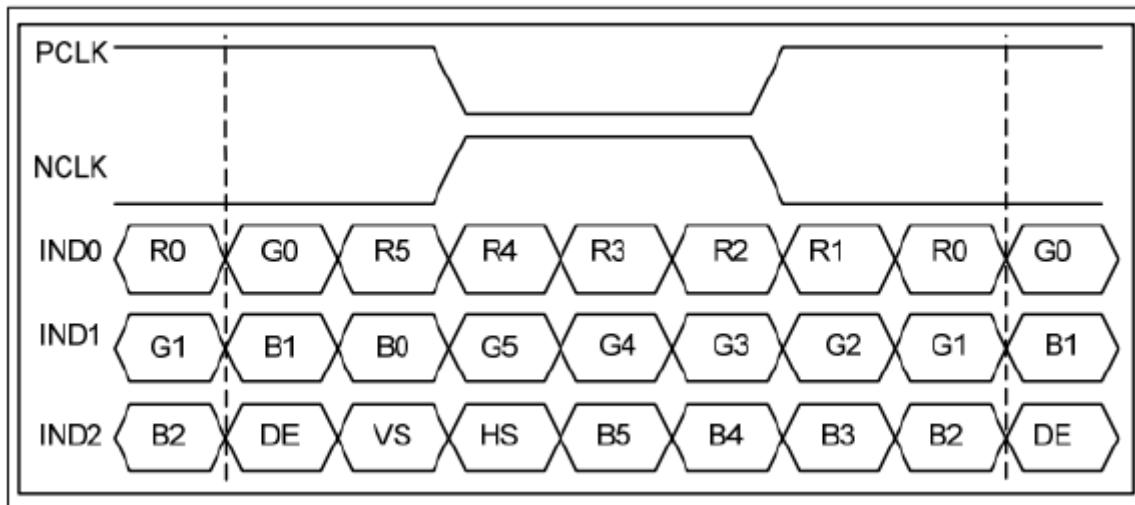
4.2 Switching Characteristics for LVDS Receiver

| Item | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|--|--------|------|------|---------------|------|---------------|
| Differential Input High Threshold | VTH | 100 | - | 300 | mV | |
| Differential Input Low Threshold | VTL | -300 | - | -100 | mV | |
| Differential Input Common Mode Voltage | VCM | 1.0 | 1.2 | $1.7- VID /2$ | V | |
| Input Current | IIN | -10 | | 10 | uA | RX+/-, RXC+/- |
| Differential Input Voltage | VID | 200 | | 600 | mV | |

4.3 Bit LVDS input

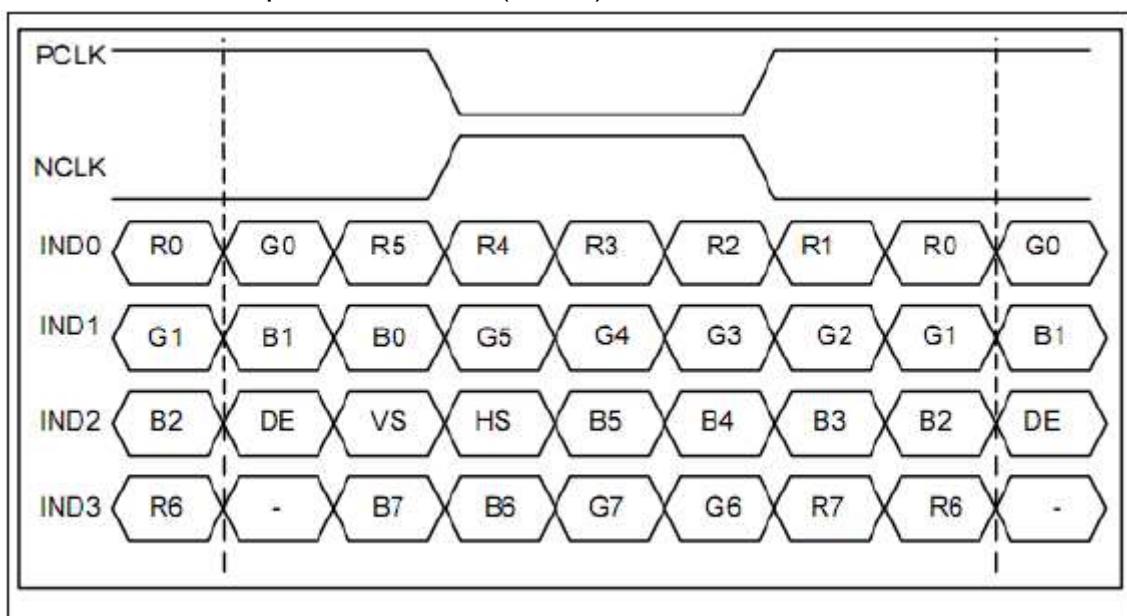
4.3.1 6bit LVDS input

Pin4 SEL68=0 : LVDS input data is 6bits (VESA)



4.3.2 8Bit LVDS input

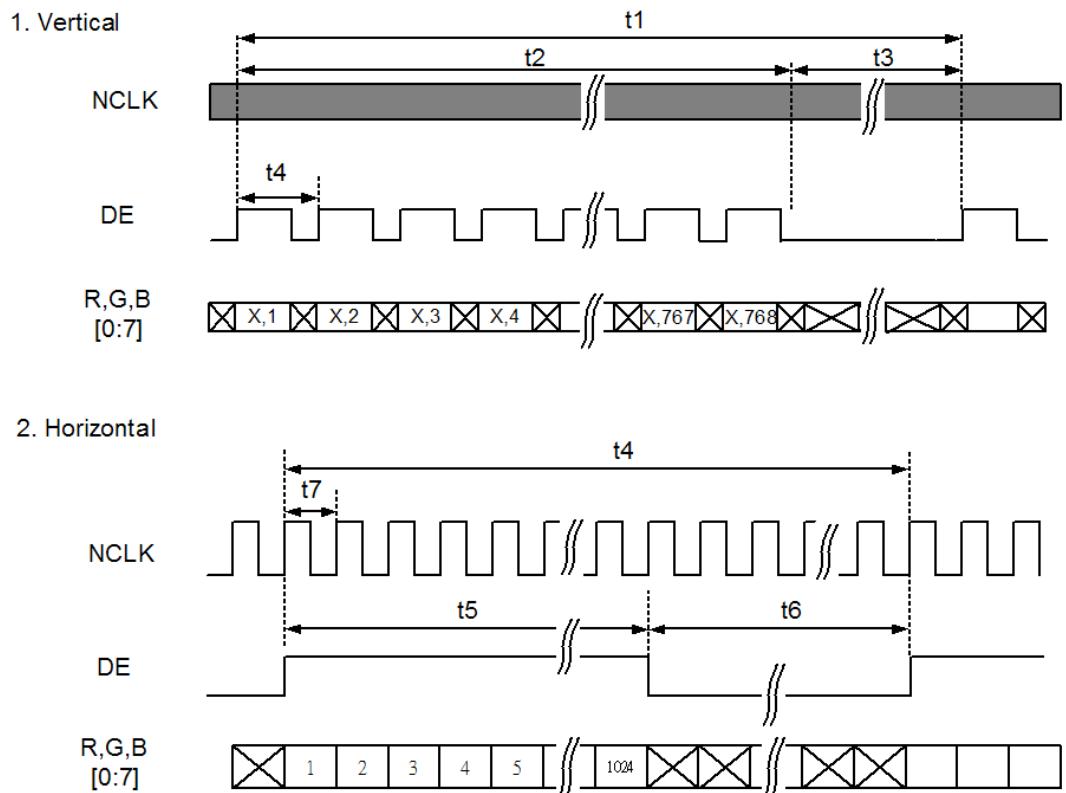
Pin4 SEL68=1 : LVDS input data is 8bits (VESA)



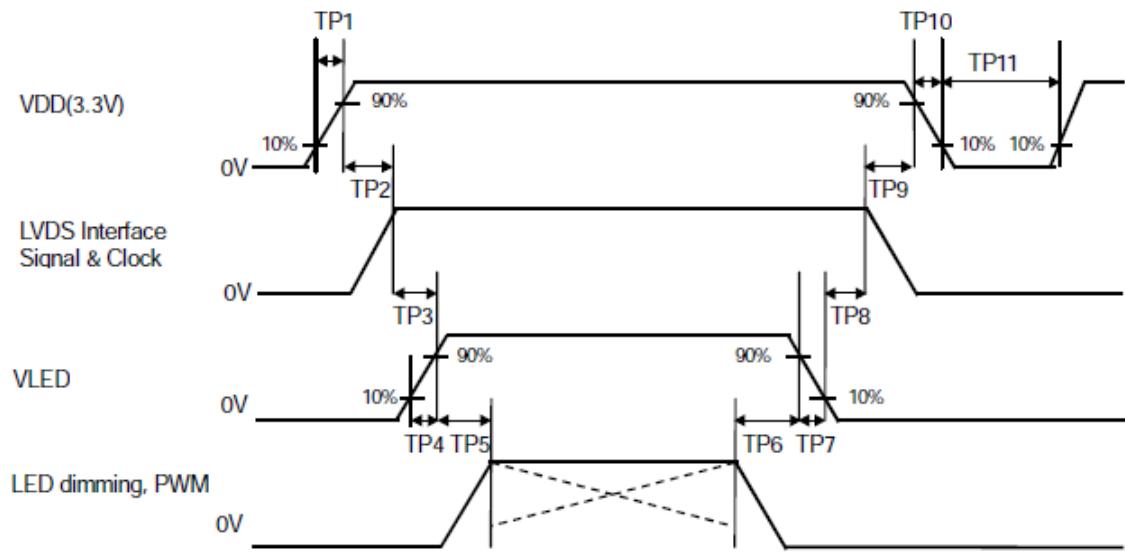
4.4 Interface Timing (DE mode)

| Item | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------|-----------|------|------|------|-------|
| Frame Rate | -- | 55 | 60 | 65 | Hz |
| Vertical Total Time | TV | 783 | 798 | 813 | line |
| Vertical Display Time | TVD | | 768 | | line |
| Vertical Blanking Time | TVB | 15 | 30 | 45 | line |
| Horizontal Total Time | TH | 1104 | 1124 | 1144 | clock |
| Horizontal Display Time | THD | | 1024 | | clock |
| Horizontal Blanking Time | THB | 80 | 10 | 120 | clock |
| Clock Rate | 1/ TClock | 51.2 | 53.8 | 56.2 | MHz |

Timing Diagram of Interface Signal (DE mode)



4.5 Power On / Off Sequence



| Item | Min. | Typ. | Max. | Unit |
|------|------|------|------|------|
| TP1 | 0.5 | -- | 10 | msec |
| TP2 | 0 | -- | 50 | msec |
| TP3 | 200 | -- | -- | msec |
| TP4 | 0.5 | -- | 10 | msec |
| TP5 | 10 | -- | -- | msec |
| TP6 | 10 | -- | -- | msec |
| TP7 | 0 | -- | 10 | msec |
| TP8 | 200 | -- | -- | msec |
| TP9 | 0 | -- | 50 | msec |
| TP10 | 1 | -- | 10 | msec |
| TP11 | 1000 | -- | -- | msec |

4.6 Backlight Unit

4.6.1 White LED Backlight

(For Design Reference only , The Backlight driving by built-in LED Driver)

| ITEM | SYMBOL | MIN | Typ | MAX | UNIT | CONDITION |
|-----------------------|--------|-----|------|-----|------|------------------|
| LED Backlight Voltage | V_F | -- | 22.4 | -- | V | For reference |
| LED Backlight Current | I_F | - | 412 | -- | mA | $Ta=25^{\circ}C$ |
| LED Life Time | | 80 | 100 | - | Khr | |

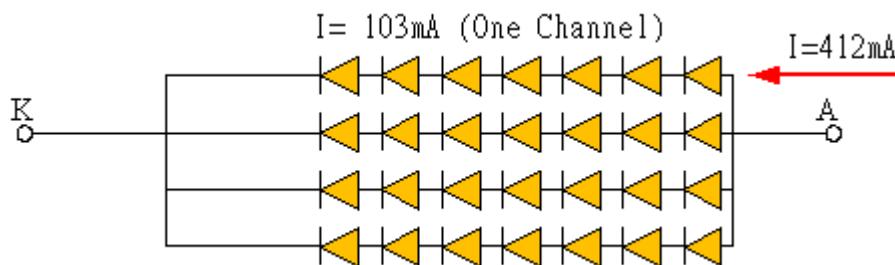
Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: V_F , I_F are defined for LED B/L.

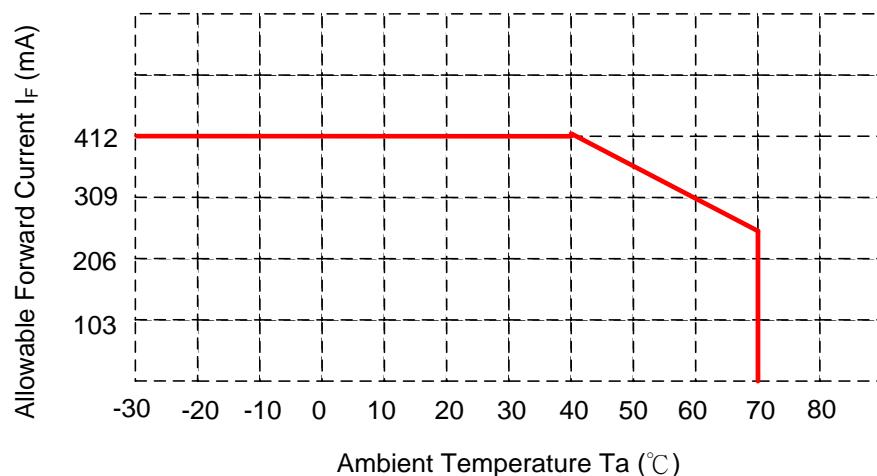
Note 3: If the module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 4: Operating life means brightness goes down to 50% minimum brightness. LED life time is estimated data. $Ta=25^{\circ}C$

Note 5: the structure of LED B/L shows as below.

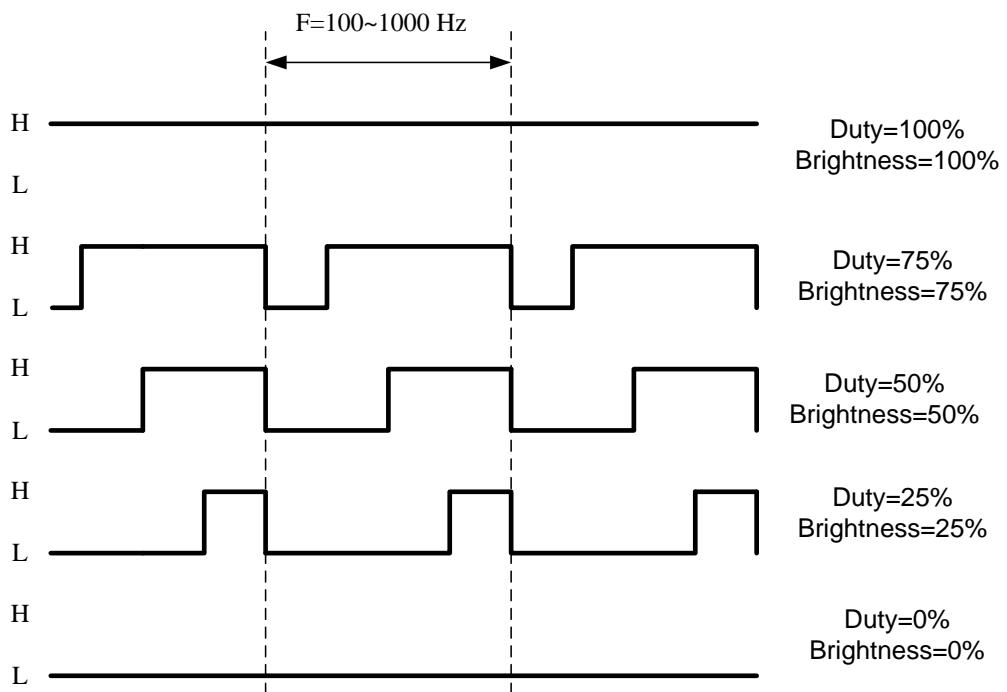


When LCM is operated over $40^{\circ}C$ ambient temperature, the I_F should be follow :



4.6.2 LED Driver

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|----------------------------------|-------------------|------|-------|----------------|------|---------------|
| Input Voltage | VL | 10.8 | 12.0 | 13.2 | V | |
| Input Current | I _{LED} | -- | (961) | -- | mA | 100% PWM duty |
| BLEN Logic High | V _{IH} | 2.5 | -- | V _L | V | |
| BLEN Logic Low | V _{IL} | 0 | -- | 0.4 | V | |
| V _{PDIM} Logic High | V _{IH} | 2.5 | -- | 5.5 | V | |
| V _{PDIM} Logic Low | V _{IL} | 0 | -- | 0.4 | V | |
| V _{PDIM} PWM Frequency | F _{PDIM} | 100 | 500 | 1000 | Hz | |
| V _{PDIM} PWM Duty Range | DR | 5 | -- | 100 | % | |



5. Interface

5.1 Interface Connector (Input signal):

STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE (or equivalent)

| Pin NO. | Symbol | Description | Note |
|---------|--------|---|---------|
| 1 | RX3+ | Differential Data Input, CH3 (Positive) | |
| 2 | RX3- | Differential Data Input, CH3 (Negative) | |
| 3 | BIST | Normal operation/BIST pattern select BIST="0": Normal operation BIST="1" : BIST mode | Note(1) |
| 4 | SEL68 | 6bit/8bit mode select SELB = "1" : LVDS input data is 8bits SELB = "0" : LVDS input data is 6bits | Note(1) |
| 5 | GND | Ground | |
| 6 | RXC+ | Differential Clock Input (Positive) | |
| 7 | RXC- | Differential Clock Input (Negative) | |
| 8 | GND | Ground | |
| 9 | RX2+ | Differential Data Input , CH2 (Positive) | |
| 10 | RX2- | Differential Data Input , CH2 (Negative) | |
| 11 | GND | Ground | |
| 12 | RX1+ | Differential Data Input , CH1 (Positive) | |
| 13 | RX1- | Differential Data Input, CH1 (Negative) | |
| 14 | GND | Ground | |
| 15 | RX0+ | Differential Data Input, CH0 (Positive) | |
| 16 | RX0- | Differential Data Input, CH0 (Negative) | |
| 17 | reLR | Left or right display control SHLR="1" : Right → Left SHLR="0" : Left → Right | Note(2) |
| 18 | reUD | Up / down display control UPDN="1" : Down → Up UPDN="0" : Up → Down | Note(2) |
| 19 | VDD | Power supply, 3.3V | |
| 20 | VDD | Power supply, 3.3V | |

Note(1) The high level voltage "1" is 3.3V, and the low level voltage "0" is GND.

Note(2) UPDN and SHLR control function

| reLR | reUD | Data shifting |
|------|------|---------------------|
| 1 | 0 | Right→Left, Up→Down |
| 0 | 0 | Left→Right, Up→Down |
| 1 | 1 | Right→Left, Down→Up |
| 0 | 1 | Left→Right, Down→Up |

5.2 Backlight Pin Assignment

Connector: FI-S8P-HEF JAE (or equivalent)

Mating Connector: FI-S8S (JAE)

| Pin NO. | Symbol | Description | Note |
|---------|-------------------|--|--------|
| 1 | VL | LED Driver input voltage | 12V |
| 2 | VL | LED Driver input voltage | 12V |
| 3 | VL | LED Driver input voltage | 12V |
| 4 | GNDL | LED Driver ground | Ground |
| 5 | GNDL | LED Driver ground | Ground |
| 6 | GNDL | LED Driver ground | Ground |
| 7 | BLEN | LED Driver Enable pin. High : LED Back-light ON Low : LED Back-light Low | 12V |
| 8 | V _{PDIM} | PWM input for Back-light brightness adjust | |

5.3 Touch Panel Controller Board Pin Assignment

Connector: SM12B-SHLS-TF(LF)(SN) JST (or equivalent)

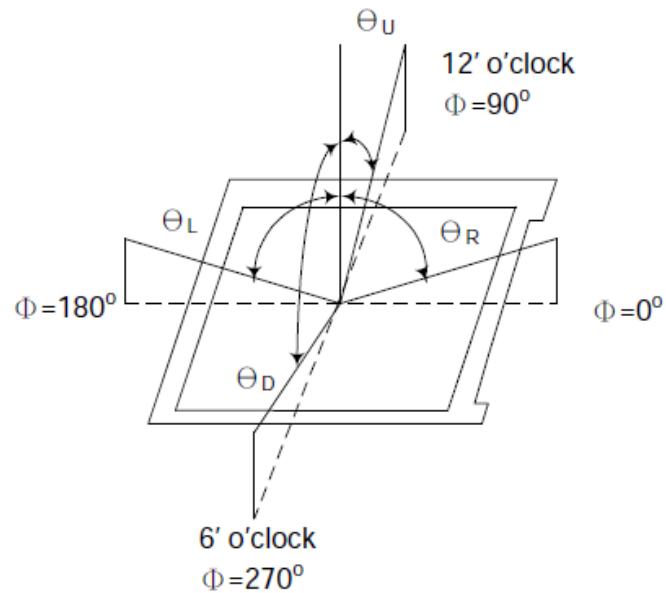
Mating Connector: SHLP-12V-S-B (JST)

| Pin NO. | Symbol | Description | UART | USB |
|---------|--------|--------------------------|----------------|-------|
| 1 | VDD5 | No connection | Do not Support | 5V |
| 2 | CKW | No connection | | NC |
| 3 | SC | No connection | | NC |
| 4 | GND | Ground | | GND |
| 5 | DIN | No connection | | NC |
| 6 | DOUT | No connection | | NC |
| 7 | TEST1 | No connection | | NC |
| 8 | TEST2 | No connection | | NC |
| 9 | RESET | Reset Signal, Active Low | | RESET |
| 10 | D- | USB D- | | D- |
| 11 | D+ | USB D+ | | D+ |
| 12 | VUSB | USB Power Supply | | 5V |

6. Optical Specifications

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | | |
|------------------------------|---------|-----------------------------|---------------|-------|------|-------------------|--------|--|--|
| Contrast | CR | | 600 | 900 | — | | (1)(2) | | |
| Response time | Rising | TR+TF | — | 30 | 40 | msec | (1)(3) | | |
| | Falling | | | | | | | | |
| White luminance (Center) | YL | | 480 | 600 | — | cd/m ² | (1)(4) | | |
| Color chromaticity (CIE1931) | White | Θ=0 Normal viewing angle | Typ. -0.05 | 0.296 | | | | | |
| | | | | 0.333 | | | | | |
| | Red | | | 0.666 | | | | | |
| | | | | 0.327 | | | | | |
| | Green | | | 0.278 | | | | | |
| | | | | 0.594 | | | | | |
| | Blue | | | 0.134 | | | | | |
| | | | | 0.121 | | | | | |
| | Hor. | | CR>10 | 80 | 85 | — | | | |
| | | | | 80 | 85 | — | | | |
| Viewing angle | Ver. | | | 80 | 85 | — | | | |
| | | | | 80 | 85 | — | | | |
| Brightness uniformity | | BUNI | Θ=0 | 70 | 80 | — | % (5) | | |
| Optima View Direction | | | | Free | | | (6) | | |

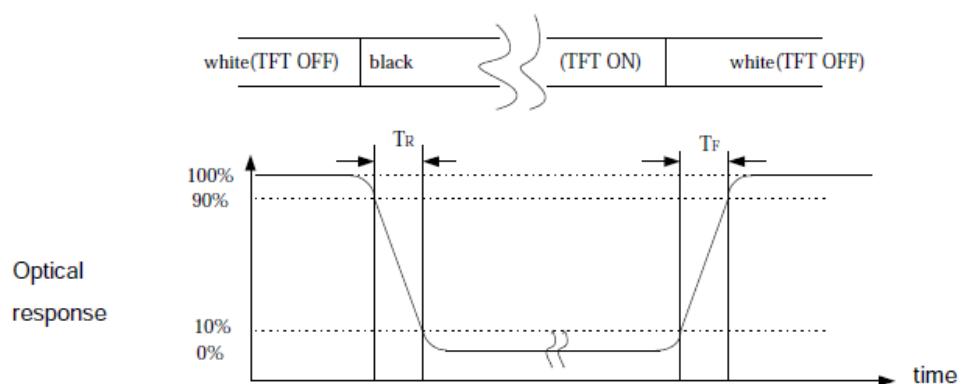
Note(1) Definition of Viewing Angle :



Note(2) Definition of Contrast Ratio (CR) : Measured at the center point of panel

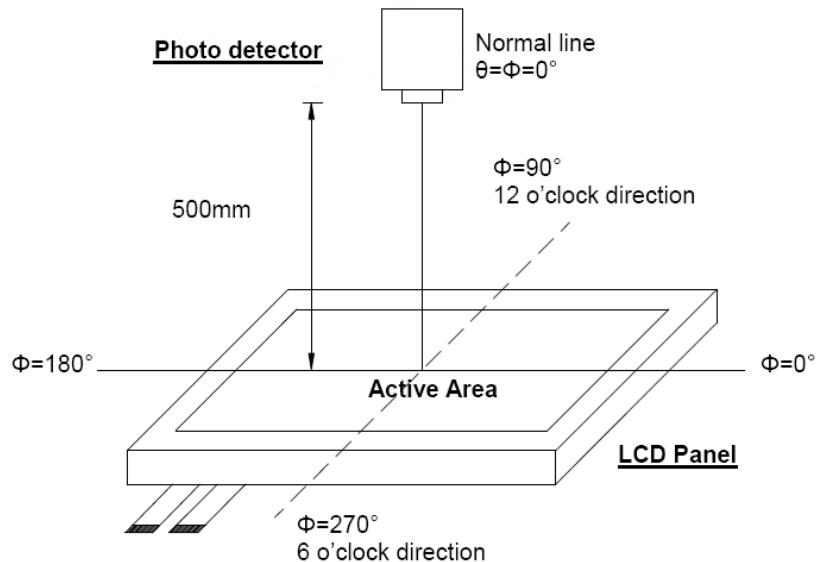
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note(3) Definition of Response Time : Sum of TR and TF



Note(4) Definition of optical measurement setup

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° / Height: 500mm.)



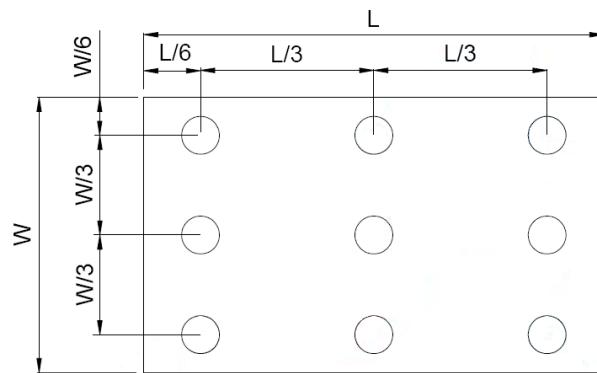
Note(5) Definition of brightness uniformity

Active area is divided into 9 measuring areas (Refer to bellow figure).

Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{\min}}{B_{\max}}$$

L ----- Active area length W ----- Active area width



Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

Note(6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

7. Touch Panel Unit

7.1 Basic Characteristic

| ITEM | SPECIFICATION |
|------------------------|-----------------------------------|
| Type | Projective Capacitive Touch Panel |
| Activation | 10-fingers or Signal-finger |
| X/Y Position Reporting | Absolute Position |
| Touch Force | No contact pressure required |
| Calibration | No need for calibration |
| Report Rate | Approx. 100 points/sec |
| Resolution | 16384 x 16384 |
| Interface | USB |
| Control IC | EXC80W46 |

Specify the normal operating condition

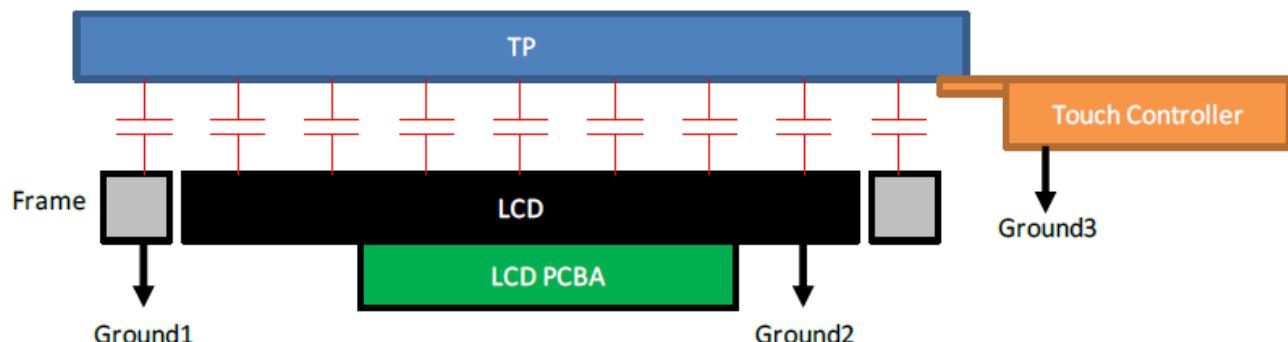
(GND=0V)

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------------------------|--------|---------|-------|------|------|------|
| Power Supply Voltage | VBUS | 4.75 | 5.0 | 5.25 | V | |
| Low Level Input Voltage | VIL | 0 | -- | 0.8 | V | 1 |
| High Level Input Voltage | VIH | 0.8*3.3 | -- | 3.3 | V | 1 |
| Power Consumption | IVDD | | T.B.D | | mA | |

Note 1: RESET

7.2 Grounding

TP needs to work in environment with stable stray capacitance. In order to minimize the variation in stray capacitance, all conductive mechanical parts must not be floating. Intermittent floating any conductive part around the touch sensor may cause significant stray capacitance change and abnormal touch function. It is recommended to keep all conductive parts having same electrical potential as the GND of the touch controller module.



GND1, GND2 and GND3 should be connected together to have the same ground

8. Reliability Test Conditions

| Test Item | Test Conditions | Note |
|----------------------------|---|------|
| High Temperature Operation | 70±3°C ,Dry t=240 hrs | |
| Low Temperature Operation | -30±3°C, Dry t=240 hrs | |
| High Temperature Storage | 80±3°C , Dry t=240 hrs | 1,2 |
| Low Temperature Storage | -30±3°C ,Dry t=240 hrs | 1,2 |
| Thermal Shock Test | -30°C ~ 25°C ~ 70°C 30 min. 5 min. 30 min. (1 cycle) Total 100 cycle(Dry) | 1,2 |
| Storage Humidity Test | 60 °C, Humidity 90%, 240 hrs | 1,2 |
| Vibration Test (Packing) | Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis | 2 |

Note(1) Condensation of water is not permitted on the module.

Note(2) The module should be inspected after 1 hour storage in normal conditions.
(15-35°C, 45-65%RH)

Note(3) The module shouldn't be tested over one condition, and all the tests are independent.

Note(4) All reliability tests should be done without the protective film.

Definitions of life end point:

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

9. General Precaution

9.1 Use Restriction

- (1) This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

9.2 Disassembling or Modification

- (1) Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. AMPIRE does not warrant the module, if customers disassemble or modify the module.

9.3 Breakage of LCD Panel

- (1) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
- (2) If liquid crystal contacts mouth or eyes, rinse out with water immediately.
- (3) If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
- (4) Handle carefully with chips of glass that may cause injury, when the glass is broken.

9.4 Electric Shock

- (1) Disconnect power supply before handling LCD module.
- (2) Do not pull or fold the LED cable.
- (3) Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

9.5 Absolute Maximum Ratings and Power Protection Circuit

- (1) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
- (2) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- (3) It's recommended to employ protection circuit for power supply.

9.6 Operation

- (1) Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
- (2) Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
- (3) When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
- (4) Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may cause deformation or color fading.
- (5) When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene or other adequate solvent.

9.7 Static Electricity

- (1) Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
- (2) Because LCD modules use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

9.8 Strong Light Exposure

- (1) The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

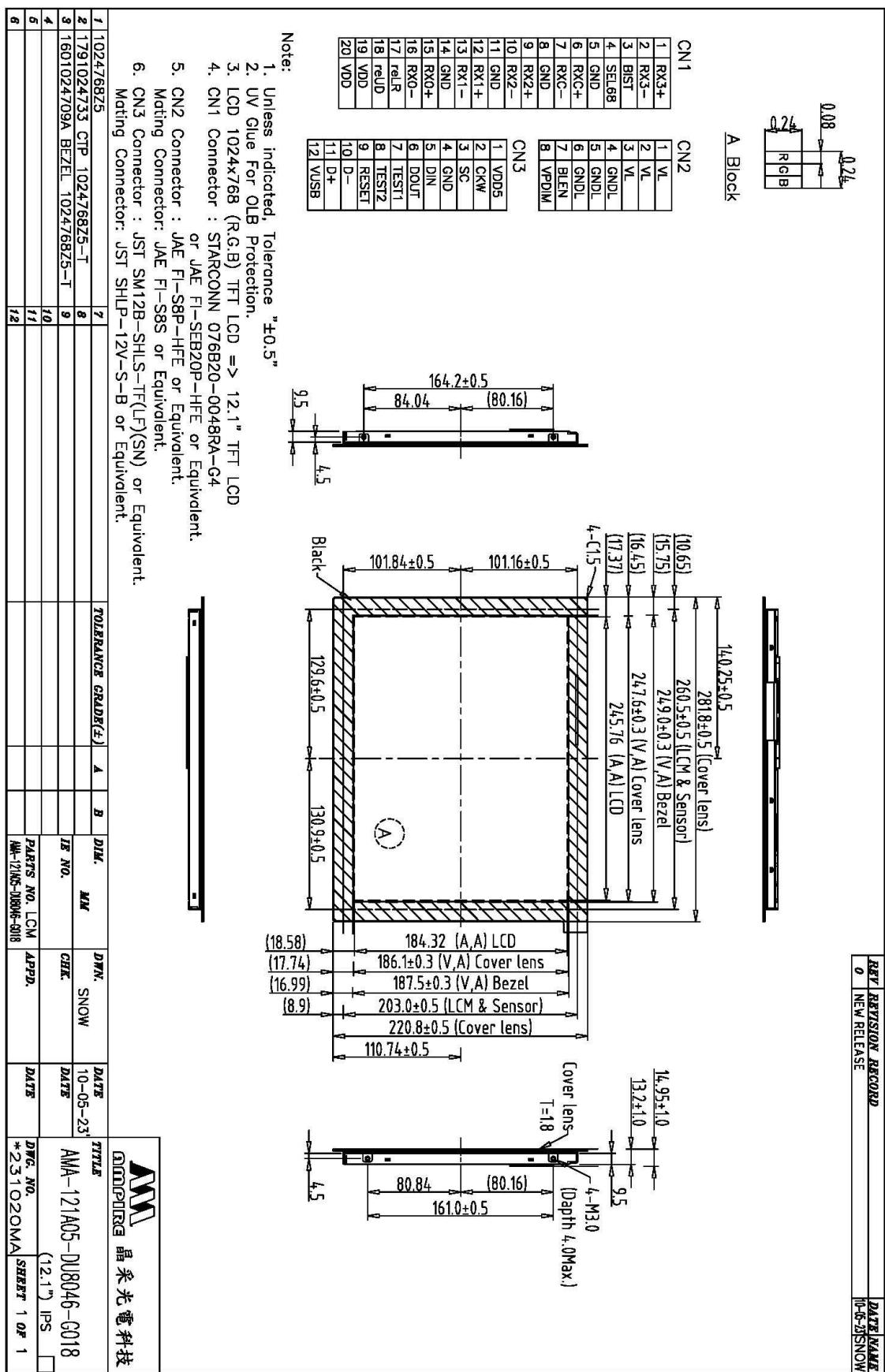
9.9 Disposal

- (1) When disposing LCD module, obey the local environmental regulations.

9.10 Others

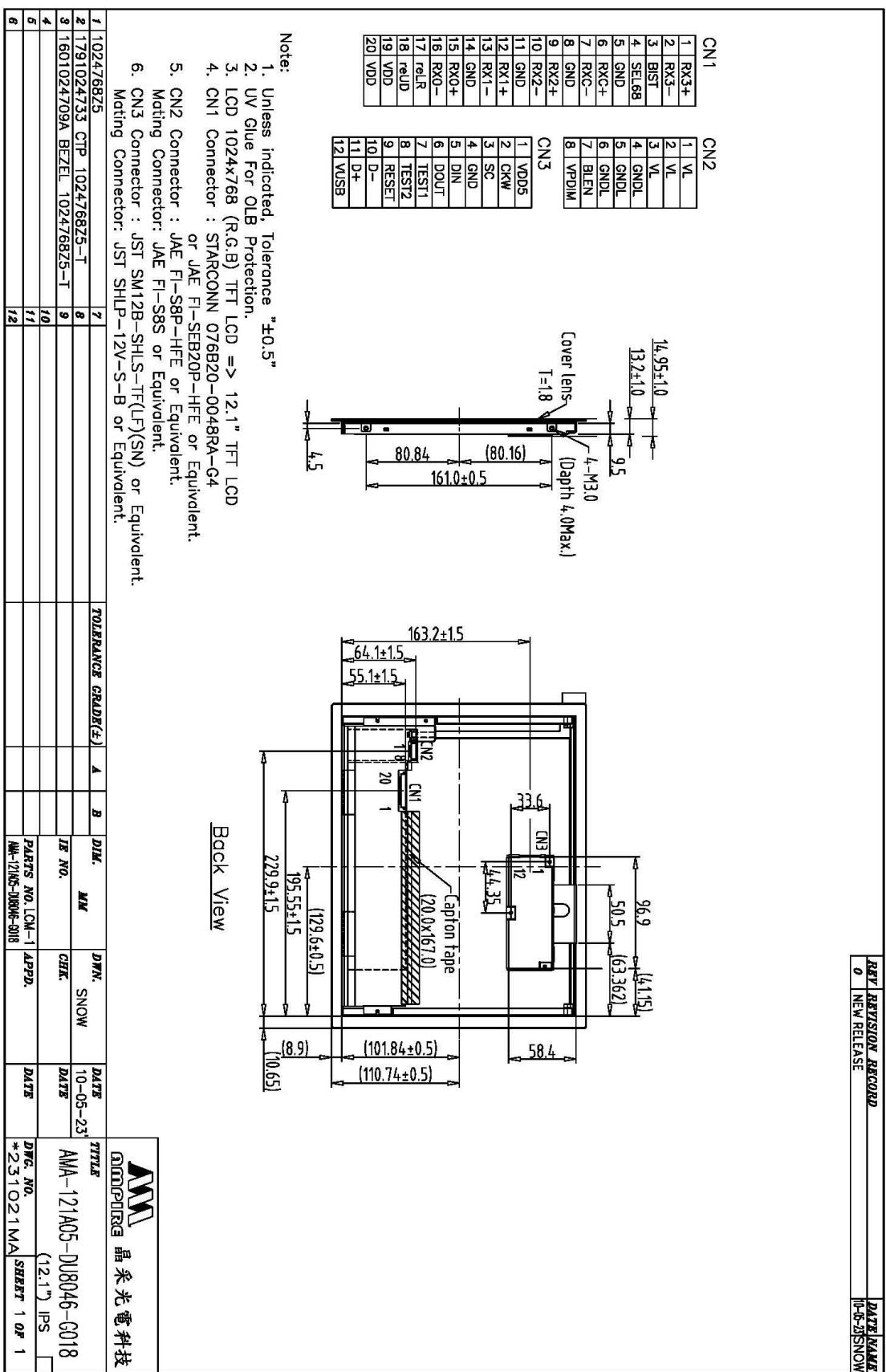
- (1) AMIPRE will provide one year warranty for all products and three months warranty for all repairing products.
- (2) Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver.

10. Outline Dimension



| | |
|---------------------|-------------|
| REV. RELEASE RECORD | DATE NAME |
| 0 | NEW RELEASE |

10-25-2018



11. Packing

