晶采光電科技股份有限公司
AMPIRE CO., LTD.

# SPECIFICATIONS FOR LCD MODULE

| | |
|---|---|
| CUSTOMER | |
| CUSTOMER PART NO. | |
| AMPIRE PART NO. | AM-800600K7MZQW-A1H |
| APPROVED BY | |
| DATE | |

☐ Preliminary Specification
☑ Formal Specification

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

This Specification is subject to change without notice

## RECORD OF REVISION

| Revision Date | Page | Contents | Editor |
|---|---|---|---|
| 2024/05/22 | - | New Release | Tank |

# 1. INSTRUCTION

Ampire 10.4” Display Module is a color active matrix TFT-LCD that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD panel, a driving circuit. This TFT-LCD has a high resolution (800(R.G.B) x 600) and can display up to 262,144 colors.

## 1.1 Features

(1) Construction : a-Si TFT-LCD with driving system, White LED Backlight.

(2) LCD type : Transmissive , Normally Black

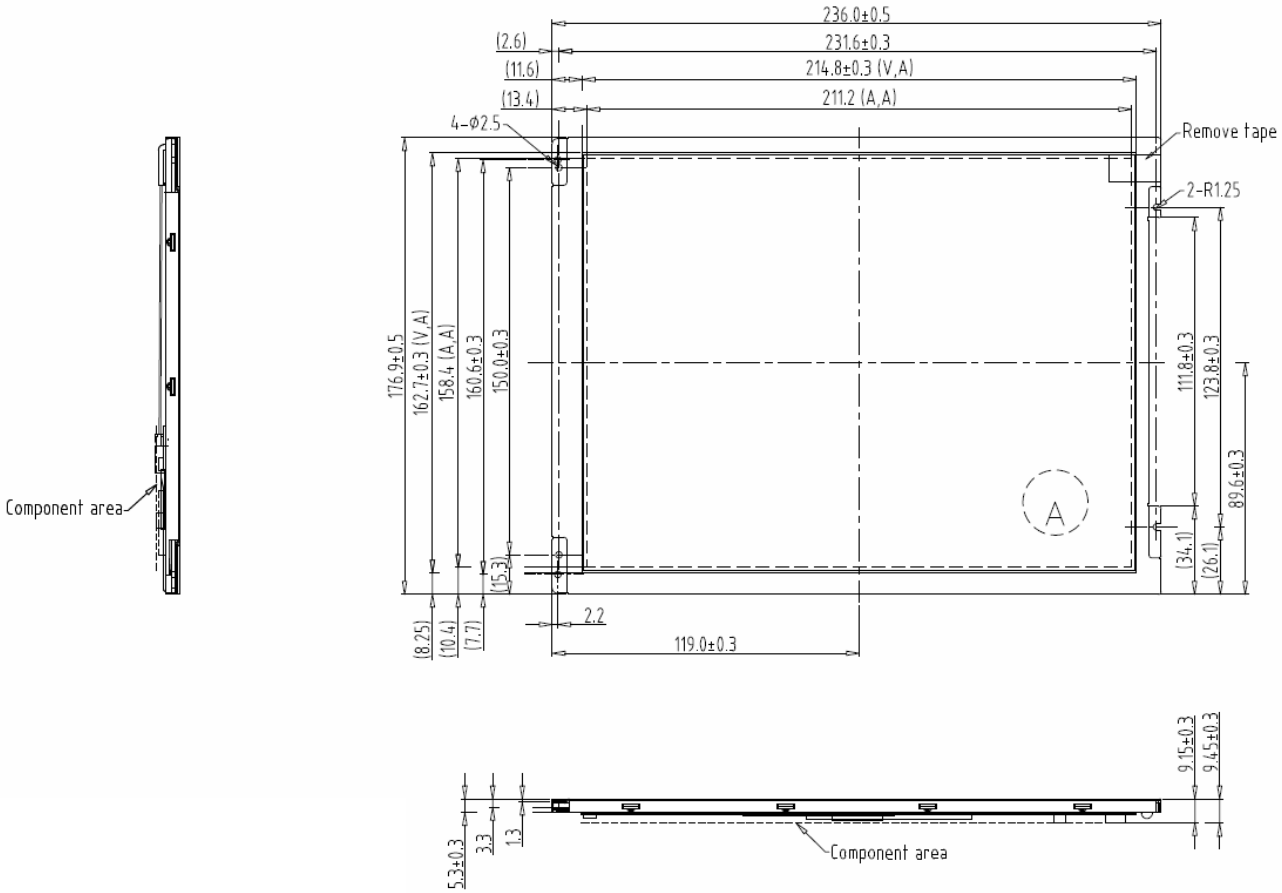
(3) Number of the Colors : 262K colors (R,G,B 6 bit digital each)

(4) LVDS Interface.

(5) LCD Power Supply Voltage: 3.3V single power input, built-in power supply circuit.

## 2. PHYSICAL SPECIFICATIONS

| Item | Specifications | Unit |
|---|---|---|
| Display Resolution(dot) | 800RGB (W) x 600(H) | dots |
| Active Area | 211.2 (W) x 158.4(H) | mm |
| Pixel Pitch | 0.264 (W) x 0.264 (H) | mm |
| Color Configuration | R.G.B -stripe | |
| Backlight Unit | LED | |
| Display Color | 262,144 | colors |



## 3. ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Supply Voltage Range | VDD | -0.3 | 3.96 | V | GND=0V |
| Voltage range at any terminal | VIN | -0.3 | VDD+0.3 | V | Note 2 |
| Supply Voltage Range | VLED | -0.3 | 14 | V | |
| Operating Temperature | Top | -20 | 70 | ℃ | |
| Storage Temperature | Tstg | -30 | 80 | ℃ | |

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

Note 2 : VIN represents IN0±, IN1±, IN2±, CLK±

## 4. OPTICAL CHARACTERISTICS

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Response Time | | $T_r + T_f$ | Θ=Φ=0° | - | 35 | 45 | ms | (1)(4) |
| Contrast Ratio | | CR | | 1000 | 1200 | - | - | (1)(3) |
| Viewing Angle | | ΘT | CR≧10 | 78 | 88 | - | degree | (1)(2) |
| | | ΘB | | 78 | 88 | - | | |
| | | ΘL | | 78 | 88 | - | | |
| | | ΘR | | 78 | 88 | - | | |
| Luminance | | L | Θ=Φ=0° | **400** | **500** | - | $cd/m^2$ | (1)(7) |
| Luminance Uniformity | | ΔL | | 75 | 80 | - | % | (1)(6) |
| Color Chromaticity | Red | Rx | | Typ. -0.05 | 0.599 | Typ. +0.05 | - | (1)(5) |
| | | Ry | | | 0.323 | | - | |
| | Green | Gx | | | 0.335 | | - | |
| | | Gy | | | 0.593 | | - | |
| | Blue | Bx | | | 0.152 | | - | |
| | | By | | | 0.115 | | - | |
| | White | Wx | | | 0.305 | | - | |
| | | Wy | | | 0.335 | | - | |

Note(1) Definition of optical measurement system

The optical characteristics should be measured in dark room. The optical characteristics are measured at the center point of the LCD screen.

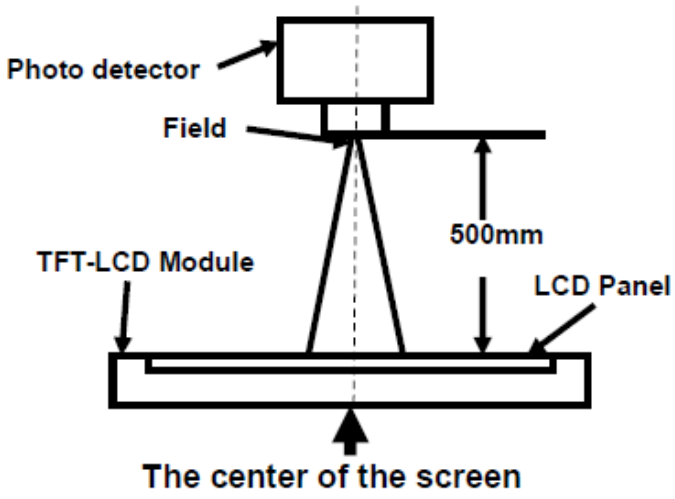



Fig1.Measurement Set Up

Note(2) Definition of viewing angle range and measurement system. Viewing angle is measured at the center point of the LCD.

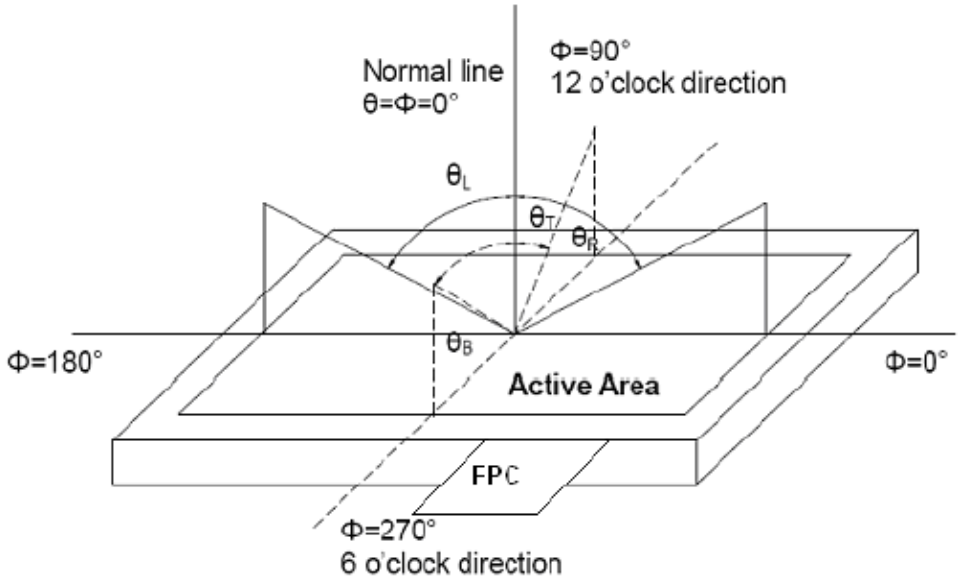


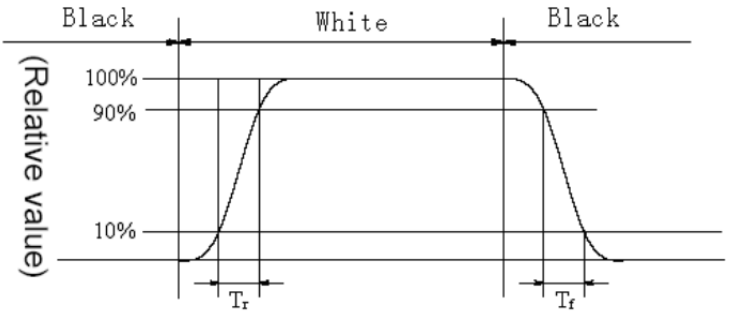

Fig2.Measurement viewing angle

Note(3) Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

Note(4) Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (Tr) is the time between photo detector output intensity changed from 10% to 90%. And fall time (Tf) is the time between photo detector output intensity changed from 90% to 10%.




Note(5) Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note(6) Definition of Luminance Uniformity

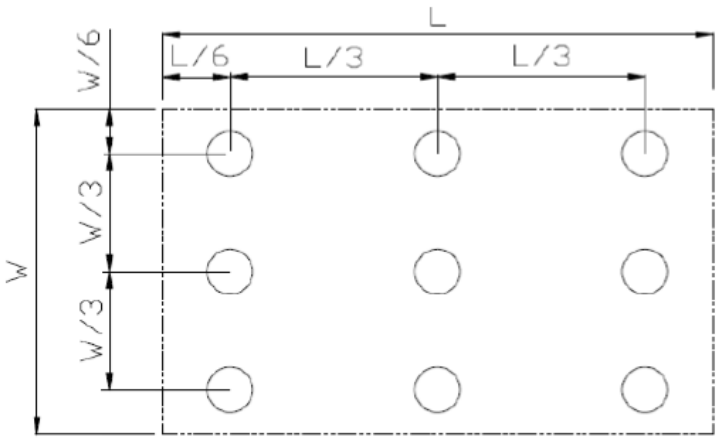
Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/Lmax

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

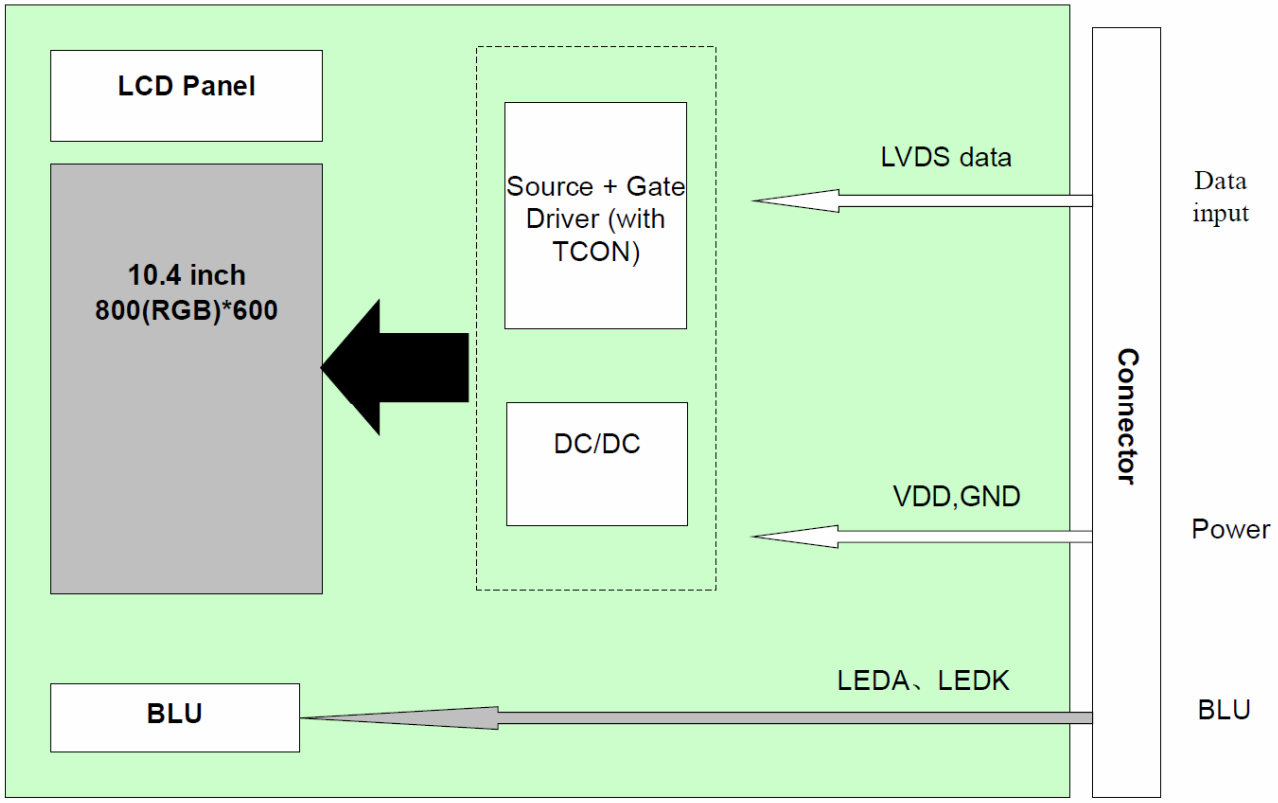
L-------Active area length; W-----Active area width




Note(7) Definition of Luminance:

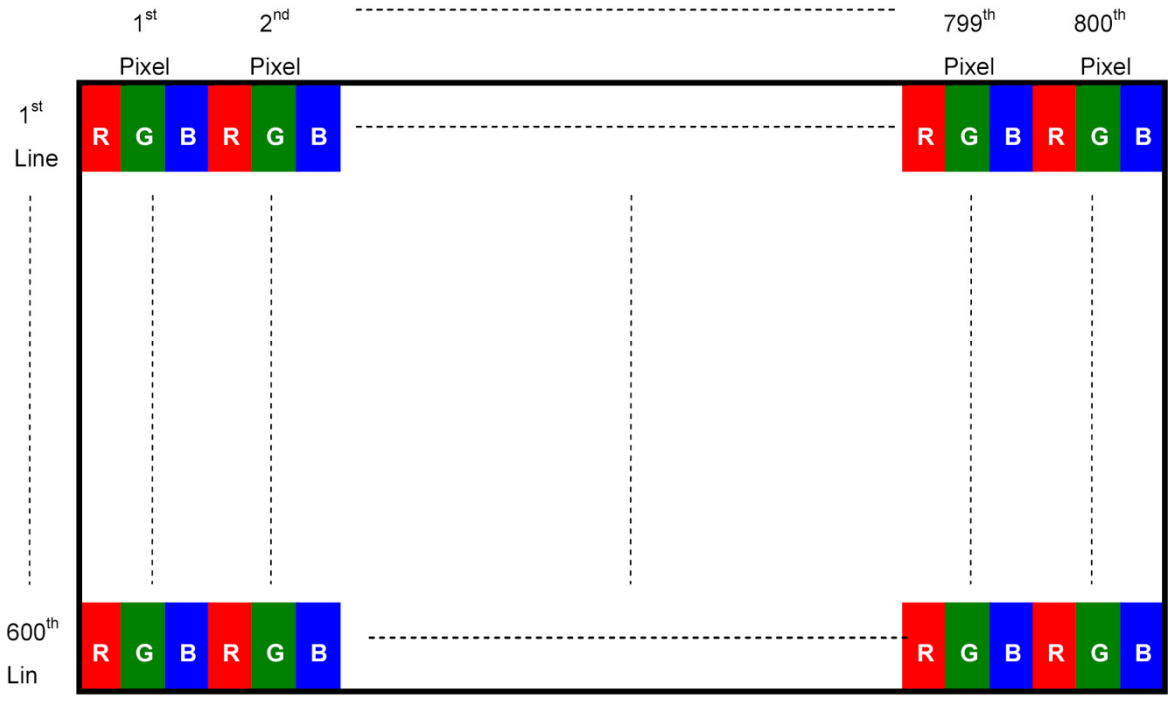
Measure the luminance of white state at center point.

## 5. Block Diagram




### 5.1 LCD Pixel Format

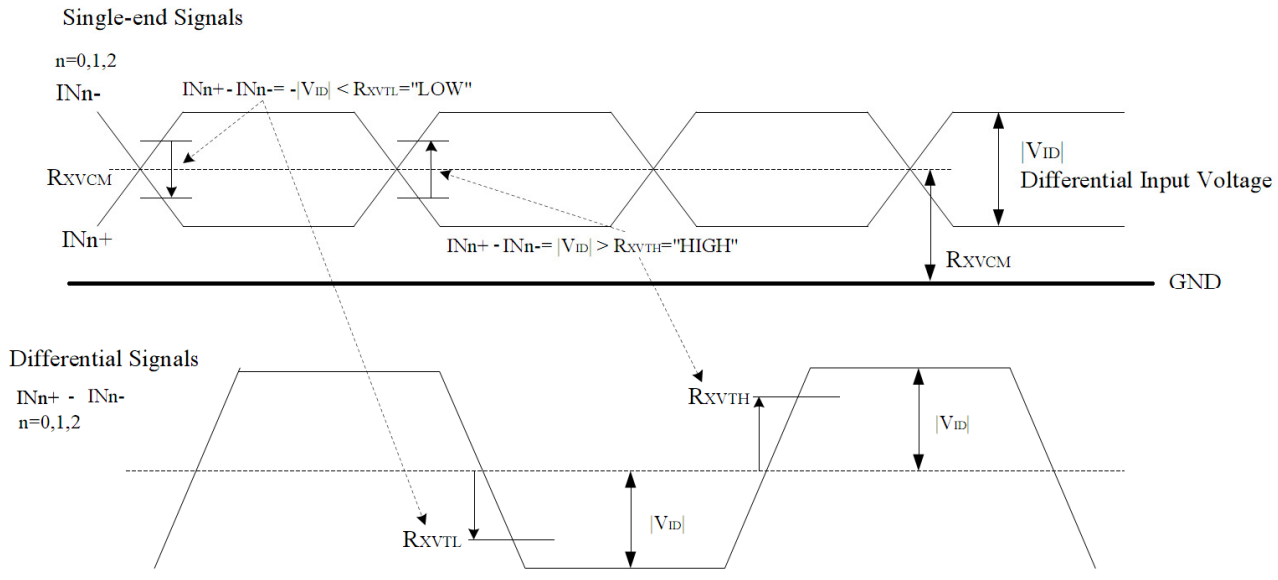
Following figure shows the relationship between input signal and LCD pixel format.



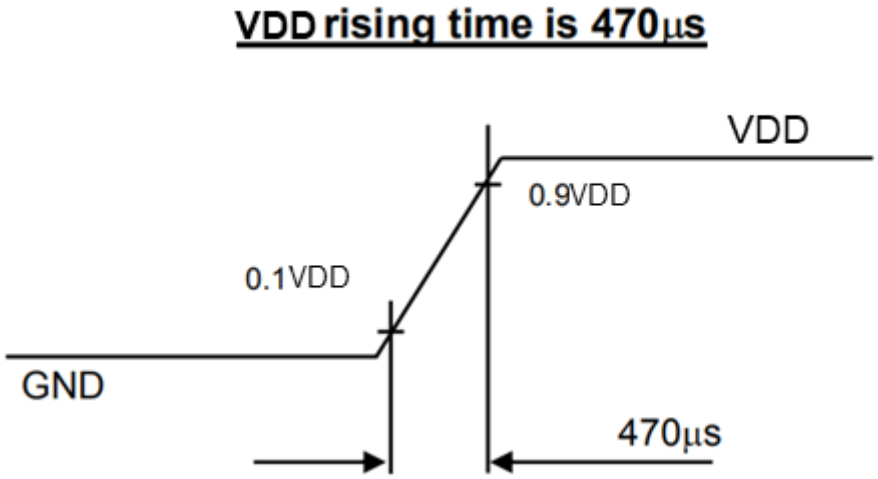
## 6. ELECTRICAL CHARACTERISTICS

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Supply Voltage | | VDD | 3.0 | 3.3 | 3.6 | V | Include ripple |
| LVDS Differential input high threshold | | RxVTH | - | - | +37 | mV | LVDS Differential input high threshold |
| LVDS Differential input low threshold | | RxVTL | -37 | - | - | mV | |
| LVDS Differential input low threshold | | RxVTL | -37 | - | - | mV | |
| Differential input voltage | | \| VID \| | 0.1 | - | 0.4 | V | |
| LVDS input common mode voltage | | RxVCM | 600 | 1200 | 1300 | mV | RXVCM+\|VID\|<=1650mV<br>RXVCM-\|VID\|>=400mV |
| Power Consumption | 60Hz | P | -- | T.B.D | -- | mW | White pattern |
| VDD rush current | | Irush | - | - | 1.5 | A | |

Note1: LVDS DC characteristics



Note2: Inrush current test condition



## 7. Backlight Driving Circuit

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{LED}$ | 10.8 | 12.0 | 12.6 | V | |
| Input Current | $I_{LED}$ | -- | T.B.D. | -- | mA | 100% duty |
| Forward Current | $I_F$ | - | T.B.D. | - | mA | Note 1 |
| Forward Voltage | $V_F$ | - | T.B.D. | - | V | Note 1 |
| Backlight Power Consumption | $W_{BL}$ | - | T.B.D. | - | mW | Note 1 |
| LED life time | | - | 50000 | - | Hrs | |

Note(1) LED connection of backlight shown as below:

**T.B.D.**

Note(2) One LED: IF = T.B.D mA. Total LED back-light driving current

Note(3) If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.

Note(4) Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.

Note(5) The backlight must be driven by constant current source.

Note(6) Brightness to be decreased to 50% of the initial value.

Note(7) When LCM is operated over 40℃ ambient temperature, the **IF** should be follow :

**T.B.D.**

## 8. INTERFACE

**LVDS CN:**

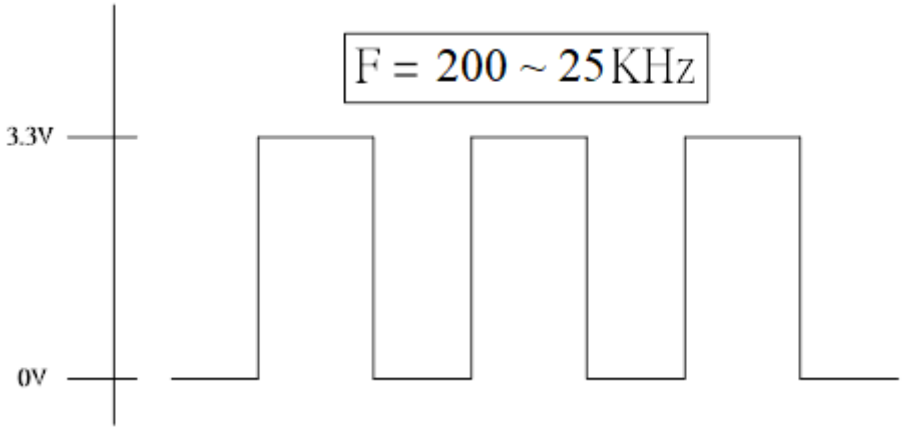
Matching connector of Hirose DF19K-20P-1H (56)

| Pin no | Symbol | Function |
|---|---|---|
| 1 | VDD | Power supply for digital circuit (3.3V) |
| 2 | VDD | Power supply for digital circuit (3.3V) |
| 3 | GND | Power Ground |
| 4 | GND | Power Ground |
| 5 | IN0- | Transmission Data of Pixels 0 |
| 6 | IN0+ | Transmission Data of Pixels 0 |
| 7 | GND | Power Ground |
| 8 | IN1- | Transmission Data of Pixels 1 |
| 9 | IN1+ | Transmission Data of Pixels 1 |
| 10 | GND | Power Ground |
| 11 | IN2- | Transmission Data of Pixels 2 |
| 12 | IN2+ | Transmission Data of Pixels 2 |
| 13 | GND | Power Ground |
| 14 | CLK- | Sampling Clock |
| 15 | CLK+ | Sampling Clock |
| 16 | GND | Power Ground |
| 17 | NC | No Connection |
| 18 | NC | No Connection |
| 19 | GND | Power Ground |
| 20 | GND | Power Ground |

**LED Driver CN:**

| Pin no | Symbol | Function |
|---|---|---|
| 1 | VLED | Voltage for LED circuit (12V) |
| 2 | LED_EN | LED Backlight Unit ON/OFF. (3.3V)<br>High level: ON; Low level: OFF. |
| 3 | GND | Power Ground |
| 4 | VADJ | Adjust the LED brightness by PWM (3.3V) |

Note : VADJ maximum/minimum voltage and frequency maximum/minimum value as below.

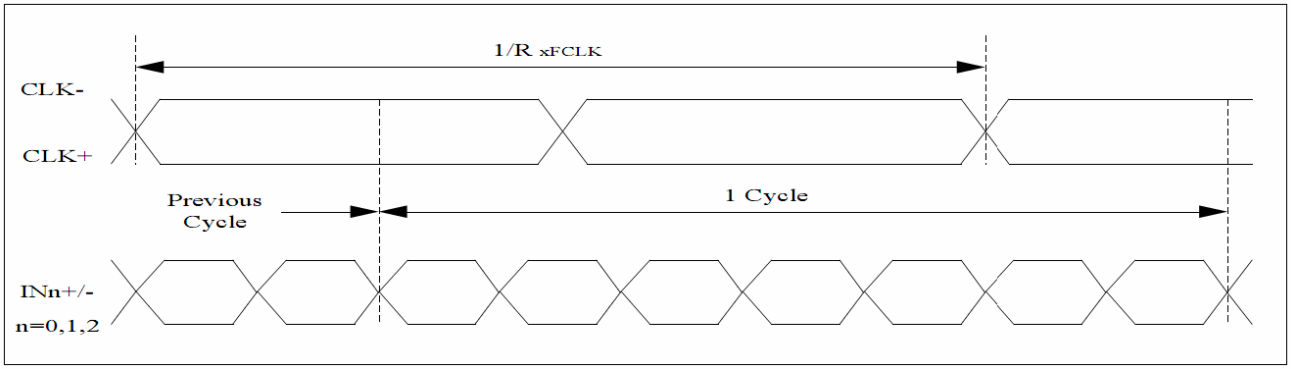


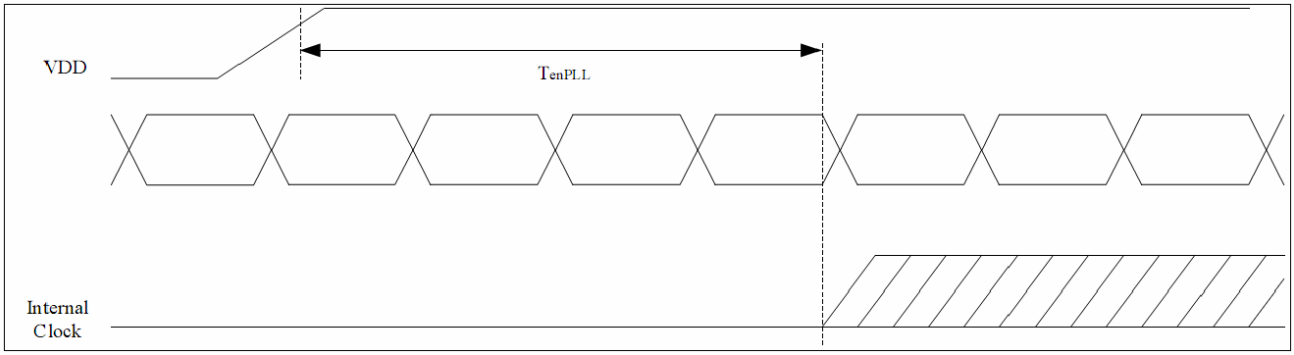
# 9. Timing Characteristic of the LVDS

## 9.1 AC characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Dclk Frequency | $R_{XFCLK}$ | 33.1 | - | 62.4 | MHZ | |
| Input Data Skew Margin | $T_{RSKM}$ | -0.2 | - | 0.2 | UI | \|VID\| = 200mV<br>RxVCM = 1.2V<br>1UI=1/(RxFCLKx7) |
| Clock High Time | $T_{LVCH}$ | - | 3.5/(7*RXFCLK) | - | ns | |
| Clock Low Time | $T_{LVCL}$ | - | 3.5/(7*RXFCLK) | - | ns | |
| PLL Wake-up Time | $T_{emPLL}$ | - | - | 150 | us | |

**Table 9.1.1 AC characteristics**



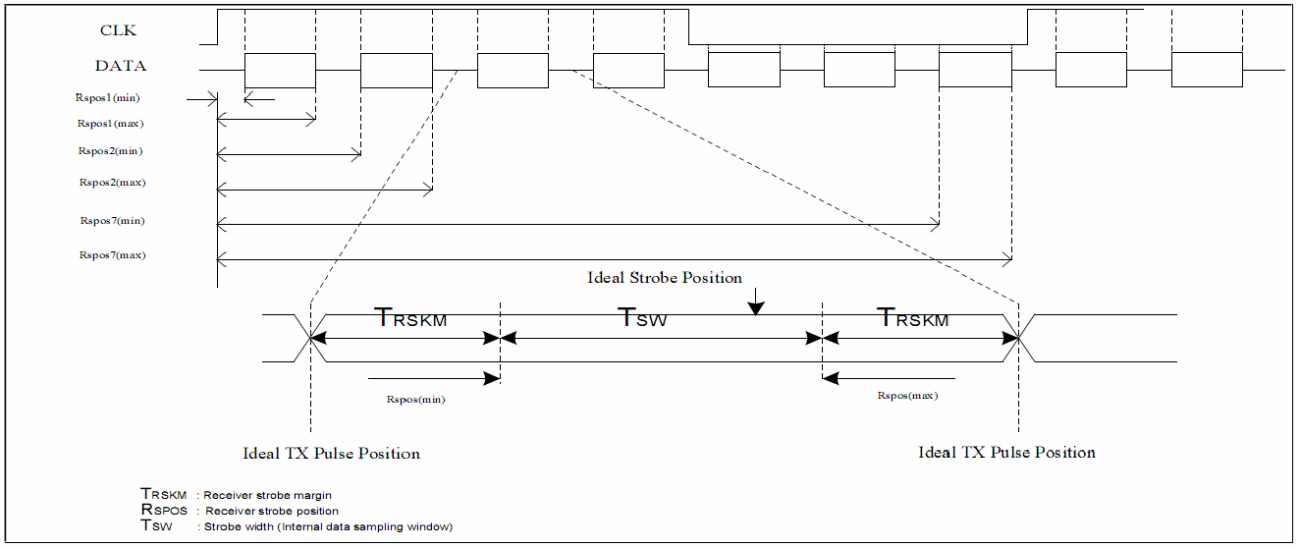




**Figure 9.1.1 AC characteristics**

## 9.2 Data Input Timing Parameter Setting

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| DCLK frequency | | Fclk | 33.1 | 39.6 | 62.4 | MHz | Tclk=1/Fclk |
| Horizontal section | Horizontal total | TH | 890 | 1000 | 1300 | Tclk | |
| | Horizontal blanking | THC | 90 | 200 | 500 | Tclk | |
| | Valid Data Width | THD | | 800 | | Tclk | |
| Vertical section | Vertical total | TV | 620 | 660 | 800 | TH | |
| | Vertical blanking | TVC | 20 | 60 | 200 | TH | |
| | Valid Data Width | TVD | | 600 | | TH | |
| Frame Rate | | F | | 60 | | HZ | |

**Table 9.2.1 Data Input Timing Parameter Setting**

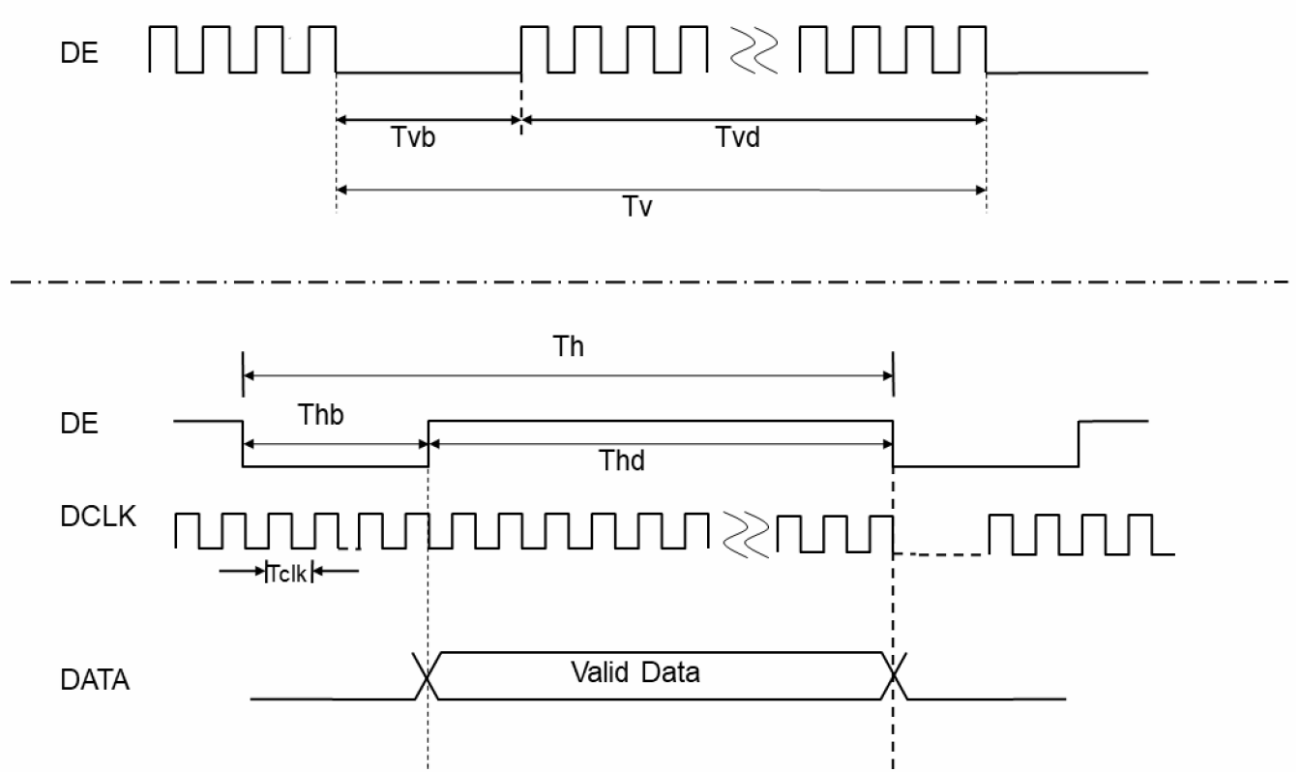



**Figure 9.2.1 Data Input Timing**

## 9.3 LVDS data mapping

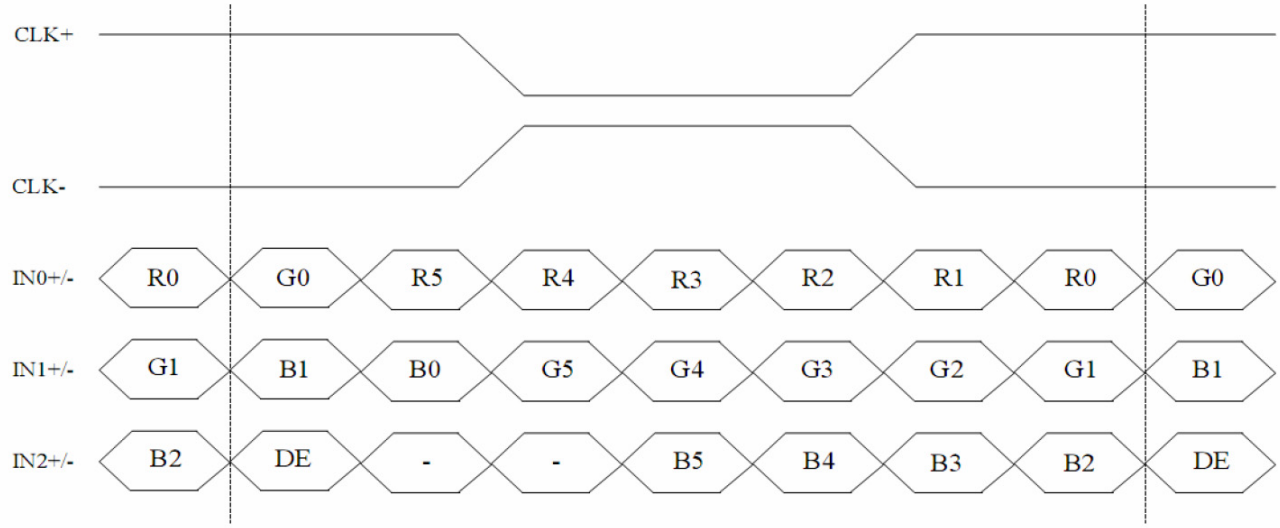



**Figure 9.3.1 LVDS data mapping (VESA standard)**

## 10. Power ON/OFF Sequence

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| VDD 10% to VDD 90% | Tp0 | 1 | - | 5 | ms | |
| VDD to signal starting | Tp1 | 20 | - | 50 | ms | |
| Signal starting to backlight on | Tp2 | 200 | - | - | ms | |
| Signal off to VDD | Tp3 | 50 | - | 100 | ms | |
| Backlight off to signal off | Tp4 | 200 | - | - | ms | |
| To next VDD | Tp5 | 2 | - | - | S | |

**Table 10.1 Power on/off sequence**

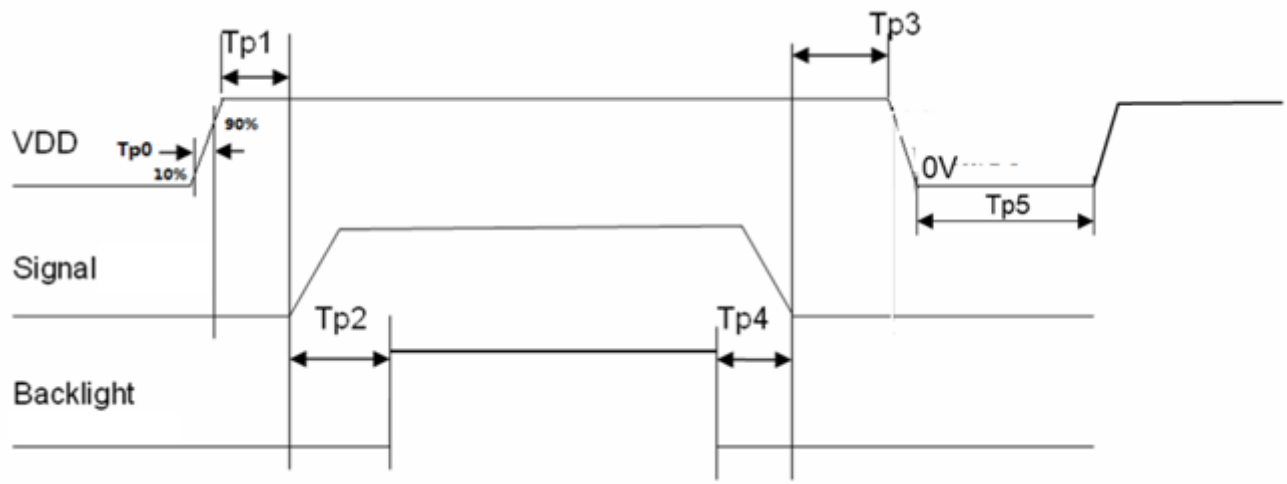



**Figure 10.1 Power on/off sequence**

Note(1) The low level of these signals and analog powers are GND level.

Note(2) All of the power and signals should be kept at GND level before power on. If there are residual voltages on them, the LCD might not work properly.

Note(3) The power on/off sequence is the first version. It will be updated when the design is fixed.

Note(4) LEDA/K is the voltage applied to backlight. Keep it turned off until the display has stabilized.

## 11. Reliability Test

| Test Item | Test Conditions | Note |
|---|---|---|
| High Temperature Operation | 70±3°C , t=240 hrs | |
| Low Temperature Operation | -20±3°C , t=240 hrs | |
| High Temperature Storage | 80±3°C , t=240 hrs | 1,2 |
| Low Temperature Storage | -30±3°C , t=240 hrs | 1,2 |
| Thermal Shock Test | -20°C ~ 25°C ~ 70°C<br>30 min. ~ 5 min. ~ 30 min. ( 1 cycle )<br>Total 5 cycle | |
| Humidity Test | 60 °C, Humidity 90%, 240 hrs | 1,2 |
| Vibration Test (Packing) | Sweep frequency : 10 ~ 55 ~ 10 Hz/1min<br>Amplitude : 0.75mm<br>Test direction : X.Y.Z/3 axis<br>Duration : 30min/each axis | 2 |

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

Note(2) The module should be inspired after 1 hour storage in normal conditions (15~35℃, 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 initial value.

# 12. USE PRECAUTIONS

## 12.1 Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

## 12.2 Installing precautions

1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

## 12.3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

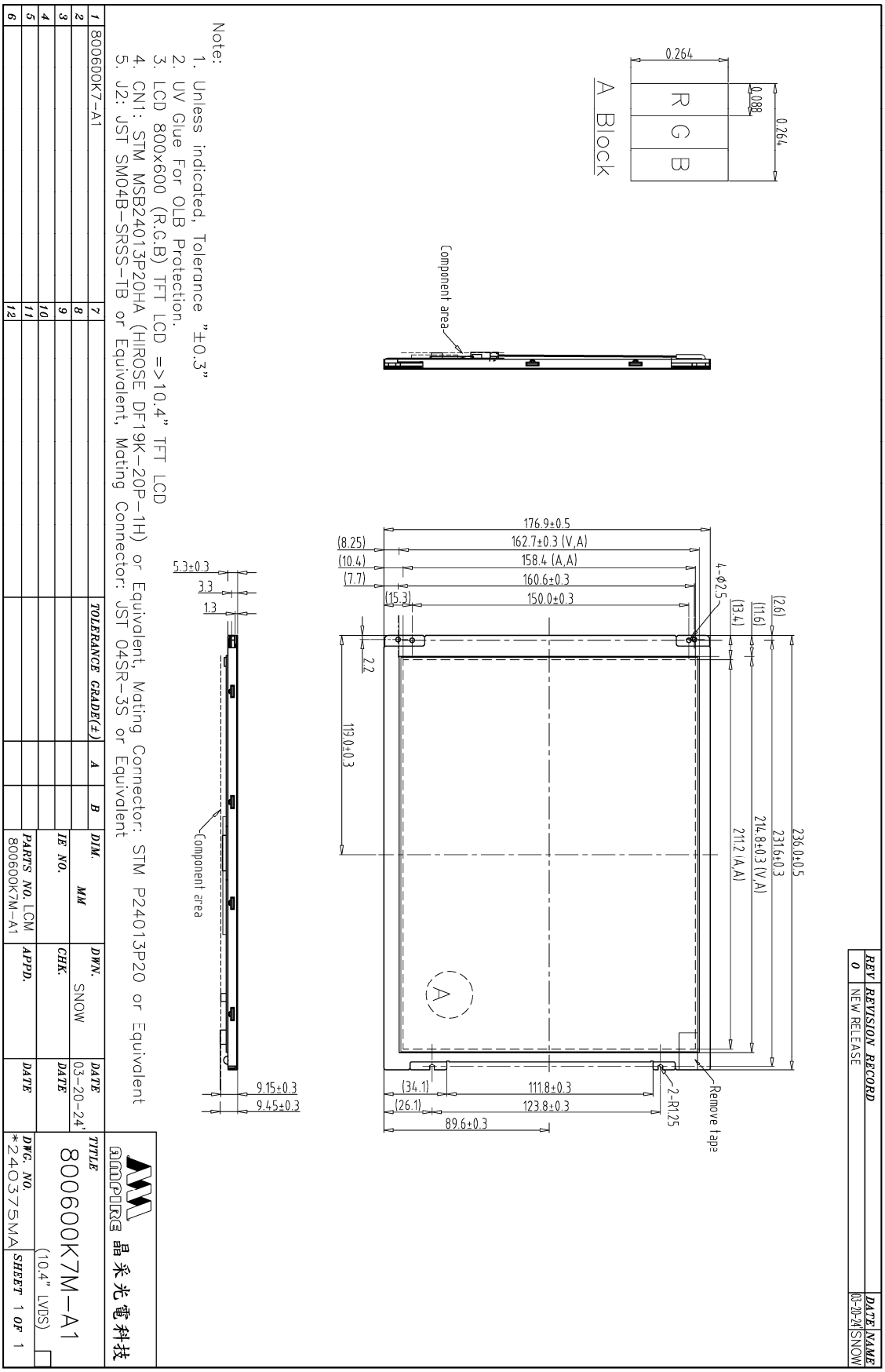
### 12.4 Operating precautions

1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.
3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.
4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.
5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.
6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.
7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.
8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

### 12.5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
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
3) AMIPRE will provide one year warranty for all products and three months warrantee for all repairing products.

## 13. OUTLINE DIMENSION



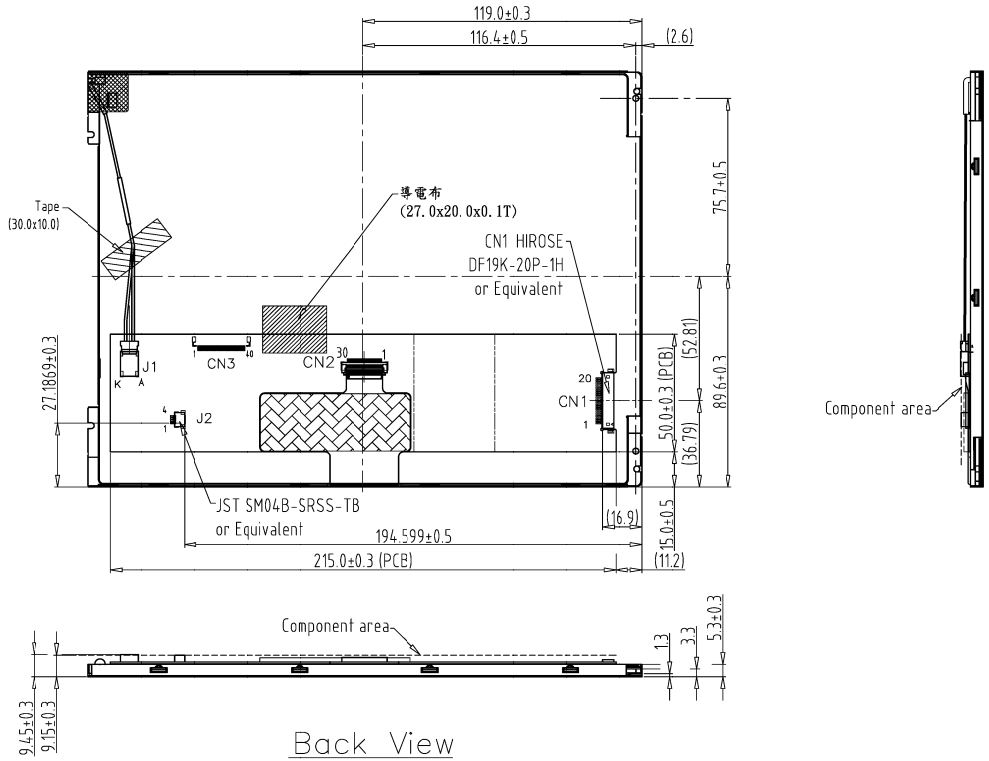
| REV | REVISION RECORD | DATE | NAME |
|---|---|---|---|
| 0 | NEW RELEASE | 03-20-24' | SNOW |

J2

| | |
|---|---|
| 1 | VLED |
| 2 | LED_EN |
| 3 | GND |
| 4 | ADJ |

CN1

| | | | |
|---|---|---|---|
| 1 | VDD | 11 | IN2− |
| 2 | VDD | 12 | IN2+ |
| 3 | GND | 13 | GND |
| 4 | GND | 14 | CLK− |
| 5 | IN0− | 15 | CLK+ |
| 6 | IN0+ | 16 | GND |
| 7 | GND | 17 | NC. |
| 8 | IN1− | 18 | NC. |
| 9 | IN1+ | 19 | GND |
| 10 | GND | 20 | GND |







Note:

1. Unless indicated, Tolerance "±0.3"
2. UV Glue For OLB Protection.
3. LCD 800x600 (R.G.B) TFT LCD =>10.4" TFT LCD
4. CN1: STM MSB24013P20HA (HIROSE DF19K−20P−1H) or Equivalent, Mating Connector: STM P24013P20 or Equivalent
5. J2: JST SM04B−SRSS−TB or Equivalent, Mating Connector: JST 04SR−3S or Equivalent

| | | | | TOLERANCE GRADE(±) | A | B | DIM. MM | DWN. SNOW | DATE 03-20-24' |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 800600K7-A1 | 7 | | | | | | | |
| 2 | | 8 | | | | | | | |
| 3 | | 9 | | | | | IE NO. | CHK. | DATE |
| 4 | | 10 | | | | | | | |
| 5 | | 11 | | | | | PARTS NO. LCM-1 800600K7M-A1 | APPD. | DATE |
| 6 | | 12 | | | | | | | |

AMPIRE 晶采光電科技

TITLE: 800600K7M−A1 (10.4" LVDS)

DWG. NO. *240376MA | SHEET 1 OF 1

## 14. Package

**T.B.D.**