# ZETTLER DISPLAYS

# SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

| CUSTOMER APPROVAL | | | |
|---|---|---|---|
| ※ **PART NO. :** ATM1040L10A(ZETTLER DISPLAYS) VER2.1 | | | |
| **APPROVAL** | | **COMPANY CHOP** | |
| **CUSTOMER COMMENTS** | | | |

| ZETTLER DISPLAYS ENGINEERING APPROVAL | | |
|---|---|---|
| **DESIGNED BY** | **CHECKED BY** | **APPROVED BY** |
| GZC | XW | GuZH |

## REVISION HISTORY

| REVISION | REVISION DATE | PAGE | CONTENTS |
|---|---|---|---|
| PRELIMINARY | 2019-05-17 | -- | FIRST ISSUE |
| | 2019-05-24 | 7 | CHANGE THE BL POWER OUTPUT |
| | 2019-06-04 | 3,6,16 | UPDATE THE LCM ENVIRONMENT TEMPERTURE |
| VER1.0 | 2019-07-09 | 6,7,20 | UPDATE BACK LIGHT INFORMATION ACCORDING TO REAL OBJECTS |
| VER2.0 | 2020-05-26 | 7,20 | CHANGE THE CONNECTOR ON THE BACKLIGHT CABLE TO PHR-2 |
| VER2.1 | 2025-01-02 | 17,18 | UPDATE PRECAUTIONS |

# Table of Contents

## 1. FEATURES

ATM1040L10A is a transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This panel has a 10.4 inches diagonally measured active display area with resolution 1024 x 768. This product is composed of a TFT LCD panel, polarizers, driver ICs, glass cover-plate, FPC and PCBA.

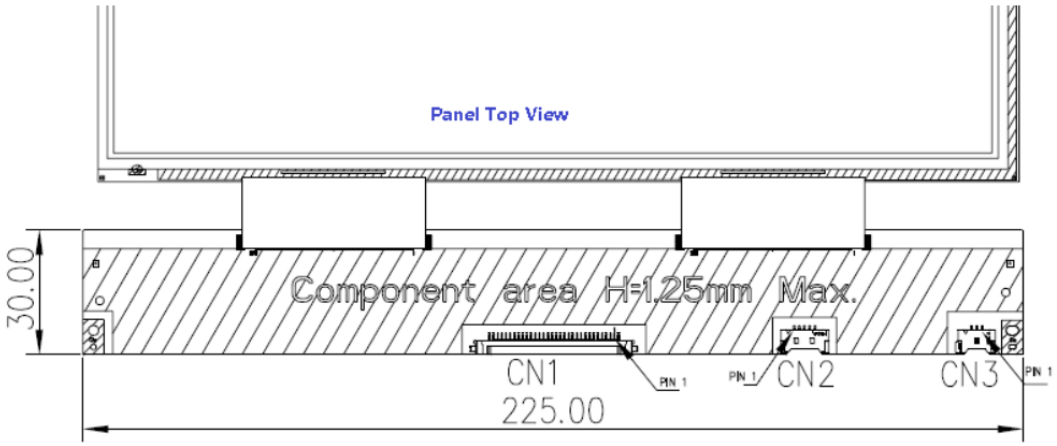
## 2. GENERAL SPECIFICATIONS

| Item | Description | Unit |
|---|---|---|
| Display Size | 10.4 | inch |
| Display Type | Transmissive, a-Si | - |
| Active Area (HxV) | 210.432 (H) x 157.824 (V) | mm |
| Number of Dots (HxV) | 1024 x RGB x 768 | dot |
| Pixel Pitch(HxV) | 0.2055 x 0.2055 | mm |
| Color Arrangement | RGB Stripe | - |
| Color Numbers | 256K/16.7 M | - |
| Outline Dimension (HxVxT) | 238.6 (H) x 175.8 (V) x 6.5 (D) | mm |
| NTSC (CIE1931) (Under C light) | 60 (Typ.) | % |
| Response Time | ≤30 | ms |
| Viewing Angle (Light On) (R/U/L/D) | CR≧10 @ R/L/U/D(80°/80°/80°/80°) (Typ.) | |
| Surface Treatment | HC | |
| Contrast Ratio (Light On) | 1000:1 (Typ) | |
| Operation Temperature | -30~80 | ℃ |
| Storage Temperature | -30~80 | ℃ |
| Interface | LVDS | |
| Weight | TBD | g |
| Panel power consumption | TBD | W |

# 3. PIN DESCRIPTION

## 3.1 Connector

There are 3 connectors on PCBA, location & Pin1 is showed on below figure.




Connectors' type:

1.CN1 : Input LVDS CONN,30pins, P-two , 187098-30091

2.CN2: Input BL power CONN,5pins, Cillux,CI4205M2HRD-NH→(No connect)

3.CN3: Output BL power CONN, 3pins, Cillux,CI4203M2HRD-NH→(No connect)

## 3.2 PIN assignment

### 3.2.1 Connector 1 :

A 30pin connector of P-two 187098-30091 is used for the module electronics interface. And a special plug needed for connecting this connector, the recommended model is P-two 187130-30xx or JAE FI-X30H.

| No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | NC | I | Reserved as BIST function for INX test | 1 |
| 2 | GND | P | Ground | |
| 3 | Rin3+ | I | Positive LVDS differential data input (+) | |
| 4 | Rin3- | I | Negative LVDS differential data input (-) | |
| 5 | GND | P | Ground | |
| 6 | CLK+ | I | Clock signal (+) | |
| 7 | CLK- | I | Clock signal (-) | |
| 8 | GND | P | Ground | |
| 9 | Rin2+ | I | Positive LVDS differential data input (+) | |
| 10 | Rin2- | I | Negative LVDS differential data input (-) | |
| 11 | GND | P | Ground | |
| 12 | Rin1+ | I | Positive LVDS differential data input (+) | |
| 13 | Rin1- | I | Negative LVDS differential data input (-) | |
| 14 | GND | P | Ground | |
| 15 | Rin0+ | I | Positive LVDS differential data input (+) | |

| | | | | |
|---|---|---|---|---|
| 16 | Rin0- | I | Negative LVDS differential data input (-) | |
| 17 | GND | P | Ground | |
| 18 | NC | - | No Connection | |
| 19 | GND | P | Ground | |
| 20 | SEL6/8 | I | Selection for 6 bits/8bit LVDS data input<br>Low or NC : 8 bit input mode<br>High : 6 bit input mode | 2 |
| 21 | NC | I | Reversed as EE_WP for OTP function | 3 |
| 22 | NC | I | Reversed as EE_SDA for OTP function | 3 |
| 23 | NC | I | Reversed as EE_SCL for OTP function | 3 |
| 24 | Reverse | I | Reverse panel function (Display rotation) | 4 |
| 25 | GND | P | Ground | |
| 26 | GND | P | Ground | |
| 27 | GND | P | Ground | |
| 28 | VDD | P | Power supply: + 3.3V | |
| 29 | VDD | P | Power supply: + 3.3V | |
| 30 | VDD | P | Power supply: + 3.3V | |

Note:

1. Pin1 is reversed as BIST function for test, don't connect signal to this pin, keep floating.
2. SEL6/8 is used for selecting 6bit/8bit LVDS data input, L or NC: 8bit; High: 6bit.
3. Pin21,22,23 are used as SPI interface for OTP function, don't connect any signal to these pin, and don't short them, keep floating.
4. Reverse pin is used for selecting scanning direction.

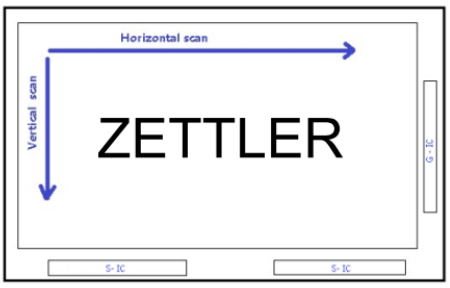



Fig. 1 Normal scan (Pin24, Reverse = Low or NC)


Fig. 2 Reverse scan (Pin24, Reverse = High)

### 3.2.2 Connector 2: CviLux,CI4205M2HRD-NH

5-pin connector is used for input power & control signals for BL converter power IC

| No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | -- | -- | -- | -- |
| 2 | -- | -- | -- | -- |
| 3 | -- | -- | -- | -- |
| 4 | -- | -- | -- | -- |
| 5 | -- | -- | -- | -- |

### 3.2.3 Connector 3: CviLux,CI4203M2HRD-NH

3-pin connector is used for output power to BL module.

| No | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | -- | -- | -- | -- |
| 2 | -- | -- | -- | -- |
| 3 | -- | -- | -- | -- |

## 4. ABSOLUTE MAXIMUM RATING

| Item | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Power Supply Voltage | VDD | -0.3 | 3.6 | V | |
| | LED_VCCS | -0.3 | 25 | V | |
| Storage Temperature | Tstg | -30 | +80 | ℃ | |
| Operating Temperature | Topr | -30 | +80 | ℃ | |

Note:
(1) All of the voltages listed above are with respective to GND= 0V
(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

# 5. DC CHARCTERISTICS

## 5.1 Parameter

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Power voltage | VDD | 3.0 | 3.3 | 3.6 | V | |
| | LED_VCCS | 11 | 12 | 13 | V | |
| Input logic high voltage | $V_{IH}$ | 3.0 | 3.3 | 3.6 | V | 1 |
| Input logic low voltage | $V_{IL}$ | 0 | - | 0.5 | V | |
| Current for Power | $I_{VDD}$ | - | 250 | - | mA | $V_{CC}$ =3.3V at 60 HZ, all White |
| | $I_{LED\_VCCS}$ | - | - | - | A | |
| LED_EN Control Level | BL On | - | - | - | V | |
| | BL Off | - | - | - | V | |
| LED_PWM Control Level | PWM High Level | - | - | - | V | |
| | PWM Low Level | - | - | - | V | |
| LED_PWM Control Frequency | $f_{PWM}$ | - | - | - | Hz | 2 |

(GND=0V, TA=25 oC)
Note 1: Including signal: SEL6/8 & Reverse
Note 2: LED_PWM duty >10%.

## 5.2 BL power output

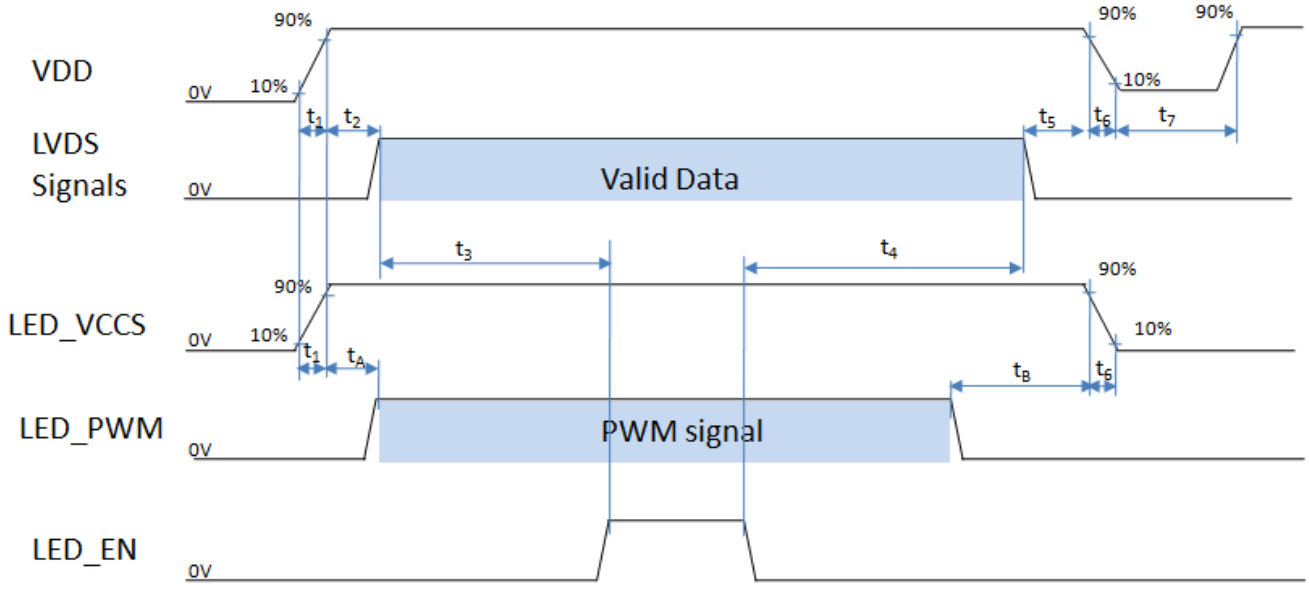
| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Voltage for LED backlight | LED+ | 19.6 | 21 | 23.8 | V | red wire |
| Current for LED backlight | LED- | 350 | 360 | 420 | mA | black wire |

Note 1:The recommended connector is JST B2B-PH-K-S or compatible.

**5.3 Power Sequence**

The power sequence specifications are shown as the following table and diagram.

| Symbol | Value | | Unit |
|---|---|---|---|
| | Min. | Max. | |
| $t_1$ | 1 | 20 | ms |
| $t_2$ | 10 | 50 | ms |
| $t_3$ | 200 | 500 | ms |
| $t_4$ | 200 | 500 | ms |
| $t_5$ | 50 | 200 | ms |
| $t_6$ | 0 | 20 | ms |
| $t_7$ | 500 | - | ms |
| $t_A$ | 0 | 50 | ms |
| $t_B$ | 0 | 50 | ms |



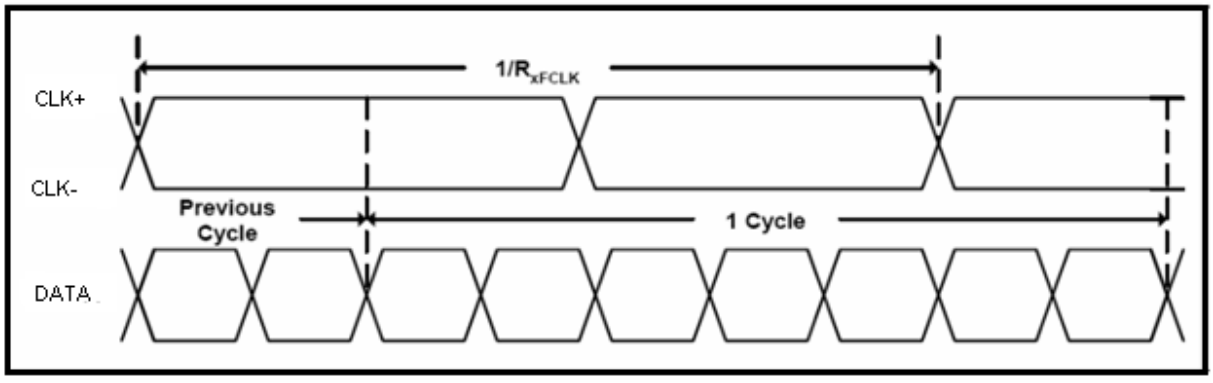

Note 1: Please don't plug the interface cable of on when system is turned on.
Note 2: Please avoid floating state of the interface signal during signal invalid period.
Note 3: It is recommended that the backlight power must be turned on after the power supply for LCD and the interface signal is valid.

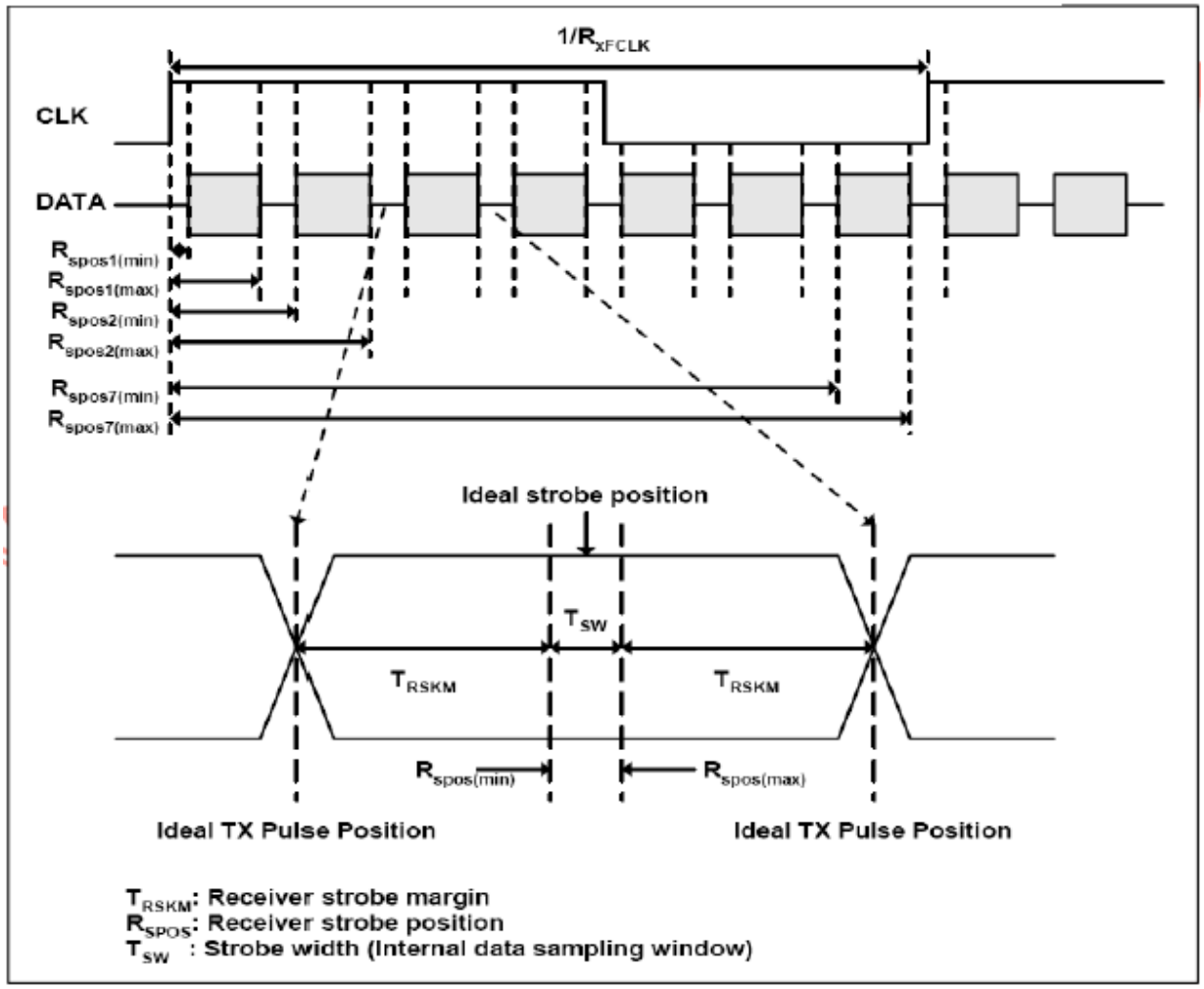
# 6.LVDS SIGNAL TIMING CHARACTERISTICS

## 6.1AC Electrical Characteristics

| Parameter | Symbol | Min | Typ | Max | Units | Condition |
|---|---|---|---|---|---|---|
| Clock frequency | RxFCLK | 26.2 | 51.2 | 71 | MHz | |
| Input data skew margin | TRSKM | 500 | 500 | 1/(2*RxFCLK) | ps | Typical value for 1024*600 resolution |
| Clock high time | TLVCH | | 4/(7xRxFCLK) | | ns | \|VID\|=400mv RxVCM=1.2V RxFCLK=71MHz VDD_LVDS=3.3V |
| Clock low time | TLVCL | | 3/(7xRxFCLK) | | ns | |
| VSD setup time | TenPLL | 0 | TenPLL | 150 | us | |

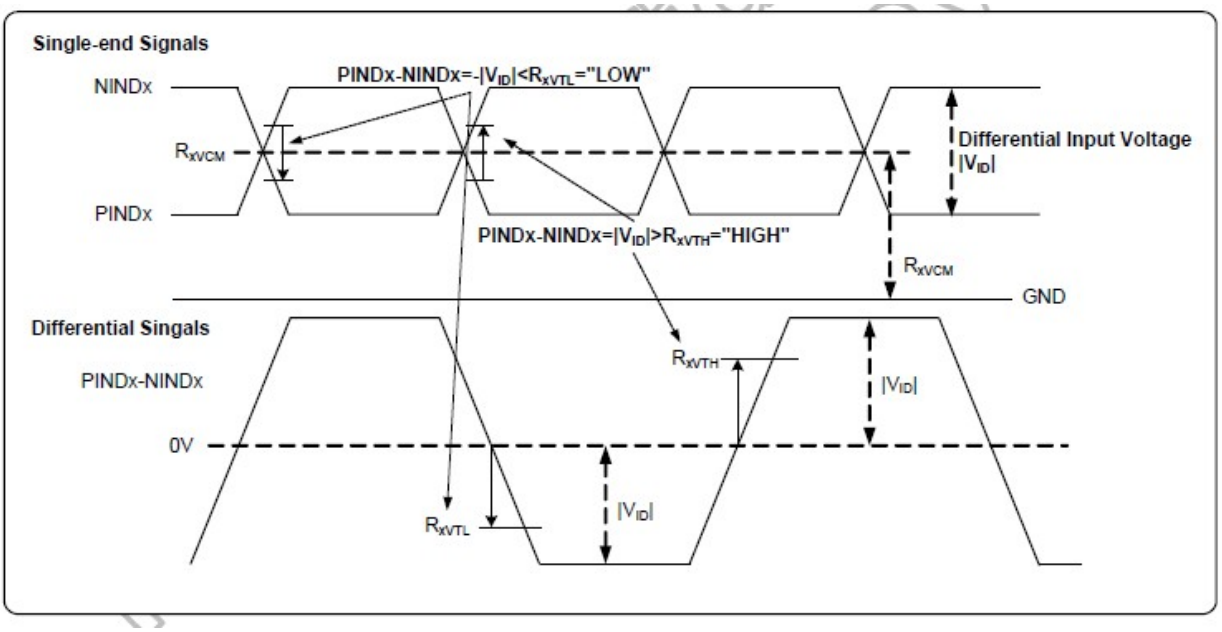
## 6.2 Input Clock and Data Timing Diagram






### 6.3 DC Electrical Characteristics

| Parameter | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| LVDS Differential input high Threshold voltage | $R_{xVTH}$ | - | - | +100 | mV | $R_{XVCM}$=1.2V |
| LVDS Differential input low Threshold voltage | $R_{xVTL}$ | -100 | - | - | mV | |
| Input Voltage range (Singled-end) | $R_{xVIN}$ | 0 | - | VDD-1.2+ $\|V_{ID}\|/2$ | V | |
| LVDS Differential input common mode voltage | $R_{xVCM}$ | $\|V_{ID}\|/2$ | - | VDD-1.2 | V | |
| LVDS Differential voltage | $\|V_{ID}\|$ | 0.2 | - | 0.6 | V | |

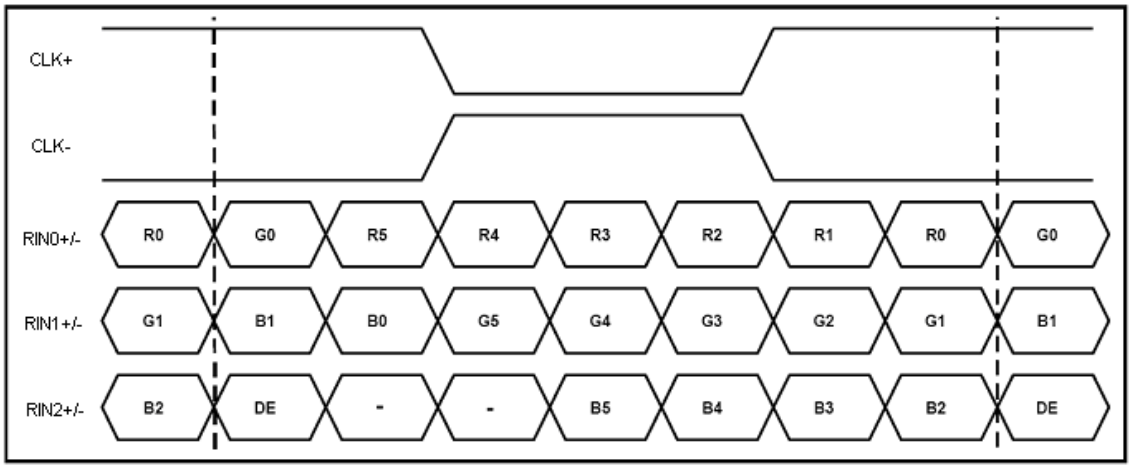



### 6.4 Data Timing

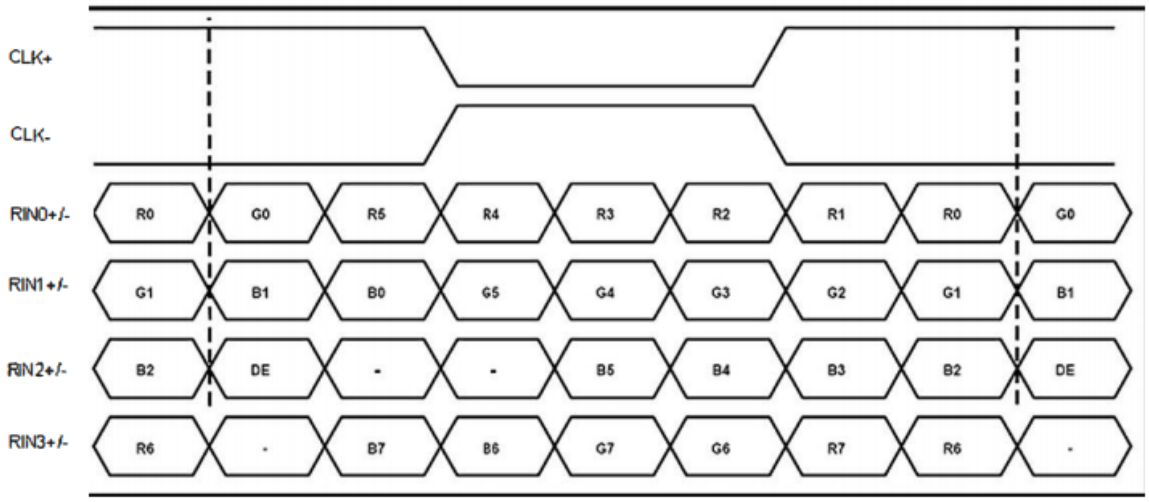
| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| DCLK frequency | fclk | 52 | 65 | 71 | MHz |
| Horizontal display area | thd | | 1024 | | DCLK |
| HSD period | th | 1114 | 1344 | 1400 | DCLK |
| HSD blanking | thb+thfp | 90 | 320 | 376 | DCLK |
| Vertical display area | tvd | | 768 | | $T_H$ |
| VSD period | tv | 778 | 806 | 845 | $T_H$ |
| VSD blanking | tvbp+tvfp | 10 | 38 | 77 | $T_H$ |

### 6.5 LVDS Data Input Format

SEL6/8 = “High” for 6 bits LVDS Input



SEL6/8 = “Low” or “NC” for 8 bits LVDS Input



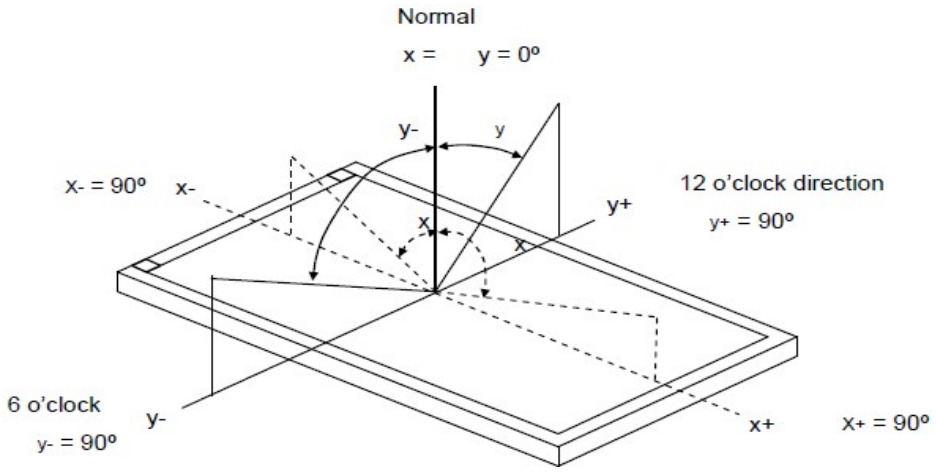
# 7. OPTICAL CHARACTERISTICS

## 7.1 Optical Specification

The relative measurement methods of optical characteristics are shown

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity (CIE 1931) FOG Only with C-light | Red | Rx | $q_x$=0°, $q_Y$ =0° R=G=B=255 Gray scale | Typ – 0.03 | 0.651 | Typ + 0.03 | - | C Light Source (1),(5) (6),(7),(8) |
| | | Ry | | | 0.332 | | | |
| | Green | Gx | | | 0.288 | | | |
| | | Gy | | | 0.564 | | | |
| | Blue | Bx | | | 0.138 | | | |
| | | By | | | 0.125 | | | |
| | White | Wx | | | 0.31 | | | |
| | | Wy | | | 0.30 | | | |
| Color gamut | | C.G | | 55 | 61.2 | - | % | |
| luminance | | L | | 1000 | 1200 | - | cd/m2 | VIETE BLU |
| Life time | | LT | | 30000 | 50000 | | H | (1),(4),(6) |
| Contrast Ratio | | CR | | 800 | 1000 | - | - | (2) |
| Response Time | | $T_{R+}T_F$ | $q_x$=0°, $q_Y$ =0° | - | 25 | 35 | ms | (3),(6) |
| Viewing Angle | Horizontal | X+ | CR ≥ 10 | 75 | 80 | - | Deg. | (1),(5),(6) |
| | | X- | | 75 | 80 | - | | |
| | Vertical | y+ | | 75 | 80 | - | | |
| | | y- | | 75 | 80 | - | | |

Note (1) Definition of Viewing Angle (_x, _y):




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

The contrast ratio can be calculated by the following expression. Contrast Ratio (CR) = L255 / L0

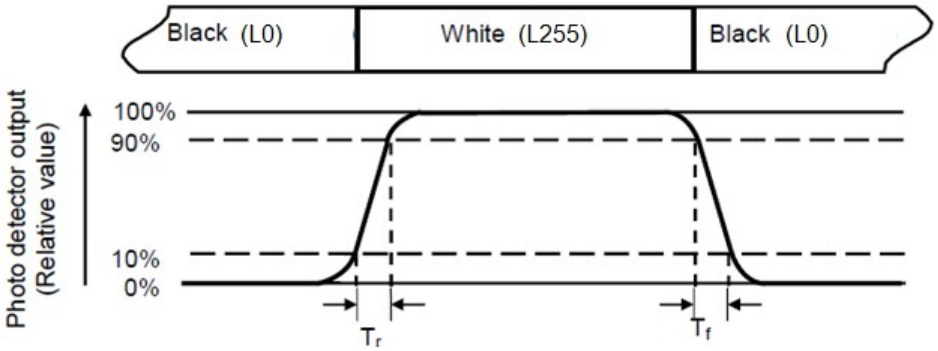
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) 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%.
RT = RT (5)
RT (X) is corresponding to the Response Time of the point X at Figure in Note (6).

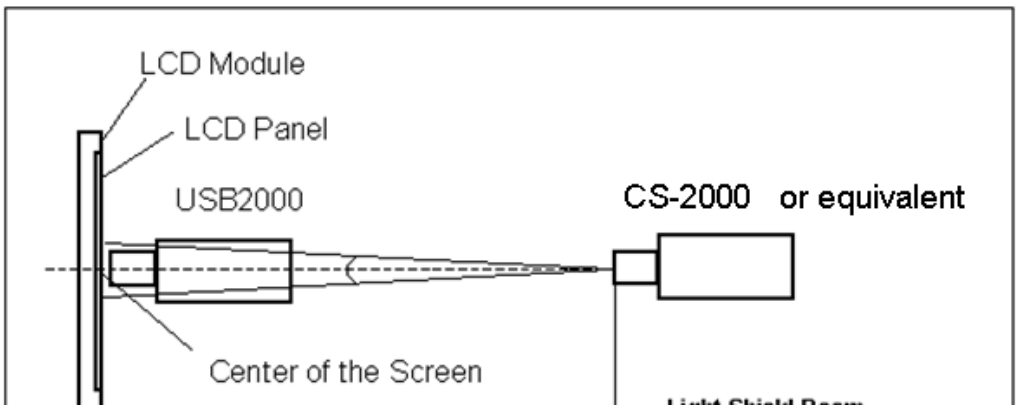



Note (4) Definition of Luminance of White (LC):

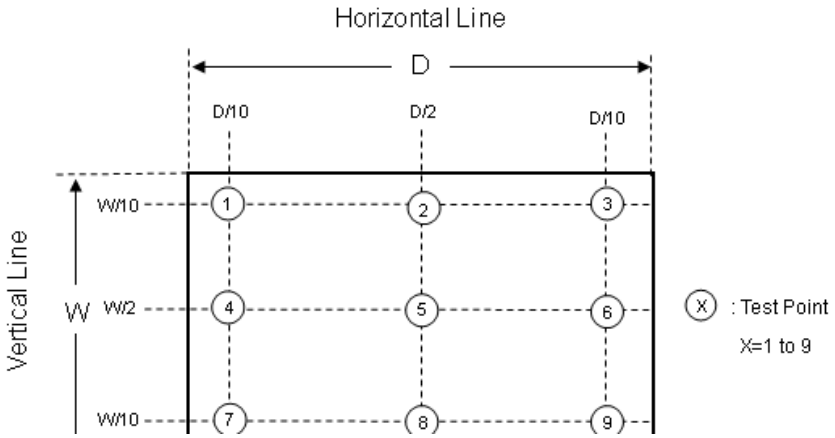
Measure the luminance of gray level 255 at center point
LC = L (5)
L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.

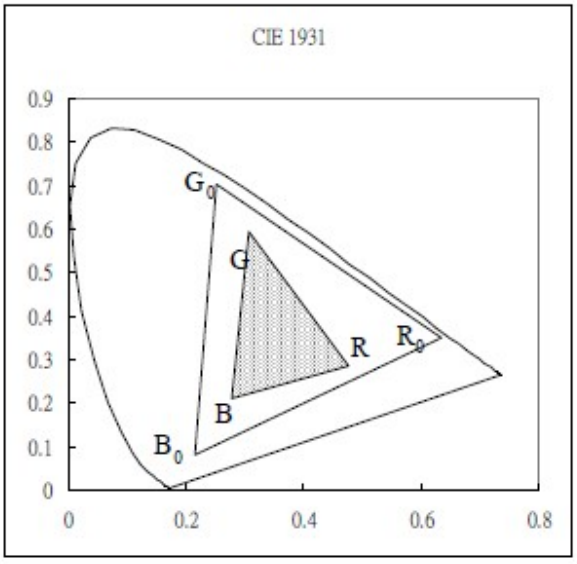


Note (6) Definition of White Variation (_W):
Measure the luminance of gray level 255 at 9 points




Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

Note (8) Definition of color gamut (C.G%):
C.G%= R G B / R0 G0 B0,*100%
R0, G0, B0 : color coordinates of red, green, and blue defined by NTSC, respectively.
R, G, B : color coordinates of module on 255 gray levels of red, green, and blue, respectively.
R0 G0 B0 : area of triangle defined by R0, G0, B0
R G B: area of triangle defined by R, G, B



## 8. QUALITY ASSURANCE

| No. | Test Items | Test Condition | Note |
|---|---|---|---|
| 1 | High Temperature Storage | 80℃, 240hrs | Note 1, 2 |
| 2 | Low Temperature Storage | -30℃, 240hrs | Note 1, 2 |
| 3 | High Temperature Operation | 80℃, 240hrs | Note 1, 2 |
| 4 | Low Temperature Operation | -30℃, 240hrs | Note 1, 2 |
| 5 | High Temperature and High Humidity Storage | 60℃, 90%RH, 240hrs | Note 1, 2 |
| 6 | Thermal Shock | -30℃/0.5h ~ +80℃/0.5h for a total 100 cycles | Note 1, 2 |
| 7 | Electro Static Discharge | C=150pF,R=330Ω, 5point/panel Air:±4Kv, 5times | Note 2 |
| 8 | Package Drop Test | Drop in 1 corner,3 edges,6 surfaces, 1 time/direction Height follow ISTA(1A) 0kg≦ W<10kg：76cm, 10kg≦ W<19kg：61cm, 19kg≦ W <28kg：46cm, 28kg≦ W<45kg：31cm, | Note 2 |

Note 1: The test samples have recovery time for 2 hours at room temperature before the function check. In the standard conditions, there is no display function NG issue occurred.

Note 2: After the reliability test, the product only guarantees operation, but don’t guarantee all of the cosmetic specification.

# 9. PRECAUTIONS

1. When design the product with this LCD Module, make sure the viewing angle matches to its purpose of usage.
2. As LCD panel is made of glass substrate, dropping the LCD module or banging it against hard objects may cause cracking or fragmentation. Especially at corners and edges.
3. Although the polarizer of this LCD Module has the anti-glare coating, always be careful not to scratch its surface. Use of a plastic cover is recommended to protect the surface of polarizer.
4. If the LCD module is stored below specified temperature, the LC material may freeze and be deteriorated. If it is stored above specified temperature, the molecular orientation of the LC material may change to Liquid state and it may not revert to its original state. And also excessive temperature and humidity could cause polarizer peel off or bubble. Therefore, the LCD module should always be stored within specified temperature and humidity range.
   If the LCD modules will be stored for a long time, the recommend temperature/humidity for the storage environment is:

   Temperature : 15℃ ~ 35℃ ／Relatively humidity: ≤80%
5. Meanwhile please follow other requirements below for storage:
   -Store with no touch on display surface by the anything else. If possible, store the LCD in the packaging situation when it was delivered.
   -If the original package is opened, please store in an anti-static polyethylene bag and seal it so as not to get fresh air outside enter into it.
   - LCD modules shall be stored in a dark place. And it shall not be exposed to sunlight nor fluorescent light in storage.

   Note: If the storage time is over 1 year, the golden fingers of FPC might be slightly oxidized, but it won't affect the electrical performance, customer can use rubber to clean the golden fingers before assembly or directly assemble the display.
6. Saliva or water droplets must be wiped off immediately as those may leave stains or cause color changes if is remained there for a long time. And water vapor will cause corrosion of ITO electrodes.
   If the surface of LCD panel needs to be cleaned, wipe it swiftly with cotton or other soft dry cloth. If it is not still clean enough, blow a breath on the surface and wipe again.
   If needed, please just moisten cloth with one of the following solvents:
   - Isopropyl alcohol
   - Ethyl alcohol

   Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
   - Water
   - Ketone
   - Aromatic solvents
7. The module should be driven according to the specified ratings to avoid malfunction and permanent damage. Applying DC voltage cause a rapid deterioration of LC material. Make sure to apply alternating waveform by continuous application of the M signal. Especially the power ON/OFF sequence should be kept to avoid latch-up of driver LSIs and DC charge up to LCD panel.
8. Mechanical Considerations
   a) LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.
   b) Do not tamper in any way with the tabs on the metal frame.
   c) Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
9. Static Electricity
   a) Operator

Wear the electrostatics shielded clothes because human body may be statically charged if not ware shielded clothes. Never touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.

   b) Equipment

There is a possibility that the static electricity is charged to the equipment, which has a function of peeling or friction action (ex: conveyer, soldering iron, working table). Earth the equipment through proper resistance (electrostatic earth: $1x10^8$ ohm).
Only properly grounded soldering irons should be used.
If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

c) Floor

Floor is the important part to drain static electricity, which is generated by operators or equipment.
There is a possibility that charged static electricity is not properly drained in case of insulating floor. Set the electrostatic earth (electrostatic earth: $1x10^8$ ohm).

d) Humidity

Proper humidity helps in reducing the chance of generating electrostatic charges. Humidity should be kept between 50%RH and 80%RH.

e) Transportation/storage

The storage materials also need to be anti-static treated because there is a possibility that the human body or storage materials such as containers may be statically charged by friction or peeling.
The modules should be kept in antistatic bags or other containers resistant to static for storage.

f) Soldering

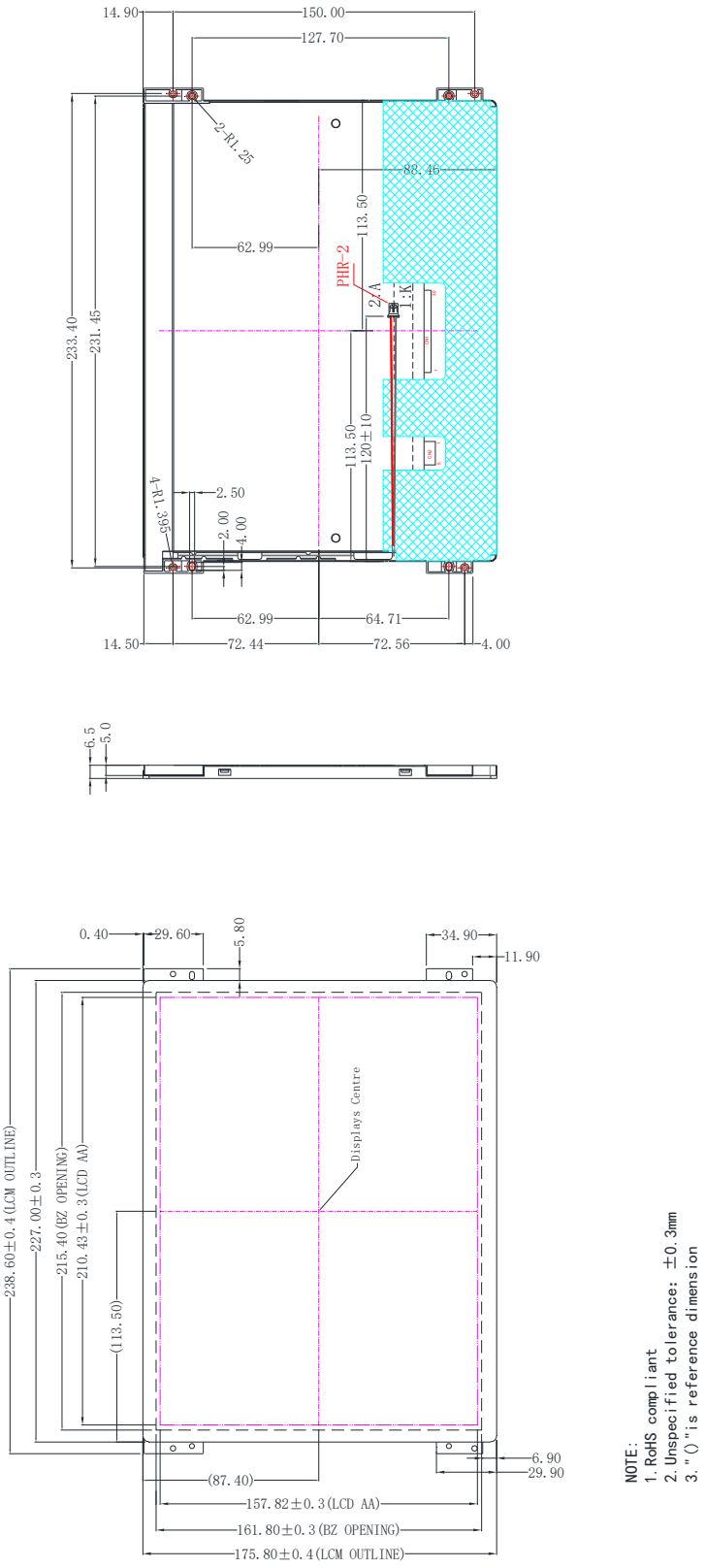
Soldering anything to this TFT display would void the warranty.

g) Others

The laminator (protective film) is attached on the surface of LCD panel to prevent it from scratches or stains. It should be peeled off slowly using static eliminator.
Static eliminator should also be installed to the workbench to prevent LCD module from static charge.

10. Operation
    a) Driving voltage should be kept within specified range; excess voltage shortens display life.
    b) Response time increases with decrease in temperature.
    c) Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear “fractured”.
    d) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear “fractured”.
11. If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. The toxicity is extremely low but caution should be exercised at all the time.
12. Disassembling the LCD module can cause permanent damage and it should be strictly avoided.
13. LCD retains the display pattern when it is applied for long time (Image retention). To prevent image retention, do not apply the fixed pattern for a long time. Image retention is not a deterioration of LCD. It will be removed after display pattern is changed.
14. Do not use any materials, which emit gas from epoxy resin (hardener for amine) and silicone adhesive agent (dealcohol or deoxym) to prevent discoloration of polarizer due to gas.
15. Avoid the exposure of the module to the direct sunlight or strong ultraviolet light for a long time.

## 10. MECHANICAL DRAWING



## 11. PACKAGING DRAWING

*T.B.D.*