

# Chefree Technology Corp.

## TFT COLOR LCD MODULE

**MODEL: CH121ILGL-001**

(Complied with RoHS)

LVDS interface

Version: P03

|                     |
|---------------------|
| Customer : _____    |
| Approved By : _____ |
| Date: _____         |

| CHEFREE  |         |         |
|----------|---------|---------|
| APPROVAL | CHECKER | PREPARE |
| Tim      | Mark    | Benson  |

## CONTENTS

|                                     |    |
|-------------------------------------|----|
| 1. RECORD OF REVISION.....          | 1  |
| 2. GENERAL DESCRIPTION.....         | 2  |
| 3. MECHANICAL CHARACTERISTICS ..... | 3  |
| 4. ABSOLUTE MAXIMUM RATINGS .....   | 7  |
| 5. PIXEL FORMAT IMAGE.....          | 8  |
| 6. OPTICAL CHARACTERISTICS .....    | 9  |
| 7. BACKLIGHT CHARACTERISTICS.....   | 13 |
| 8. ELECTRICAL CHARACTERISTICS.....  | 15 |
| 9. INTERFACE TIMINGS .....          | 21 |
| 10. POWER CONSUMPTION .....         | 23 |
| 11. RELIABILITY CONDITIONS.....     | 24 |
| 12. INTERFACE TIMINGS .....         | 25 |
| 13. GENERAL PRECAUTION.....         | 26 |

**1. RECORD OF REVISION**

| Rev | DATE       | PAGE | SUMMARY  |
|-----|------------|------|--|
| P01 | 2016.04.28 | ALL  | Preliminary specification was first issued.  |
| P02 | 2016.11.15 | ALL  | Modify: 2pcs Module 1pcs PP plate;20pcs/carton,  |
| P03 | 2022.04.05 | 7    | Modify: a.The supply voltage (Min.) of VDD is -0.3V.<br>b.The supply voltage(Max.) of VDD is 4V. |
| P03 | 2022.04.05 | 17   | Modify: a.The common mode voltage(Min.) is 0.7V. b.The common mode voltage(Max.) is 1.6V.        |
| P03 | 2022.04.05 | 21   | Modify: a.The H Total Time(Max) is 1400.<br>b.The V Total Time(Max) is 820.                      |
|     |            |      |  |

## 2.0 General Descriptions

### 2.1 Introduction

The CH121ILGL-001 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 backlight system, column driver and row driver circuit. This TFT LCD has a 12.1-inch diagonally measured active display area with XGA resolution (1024 horizontal by 768 vertical) pixels arrays.

### 2.2 Features

- 12.1" TFT LCD Panel
- LED Backlight System
- Supported XGA 1024x768 pixels resolution
- Compatible with RoHS standard

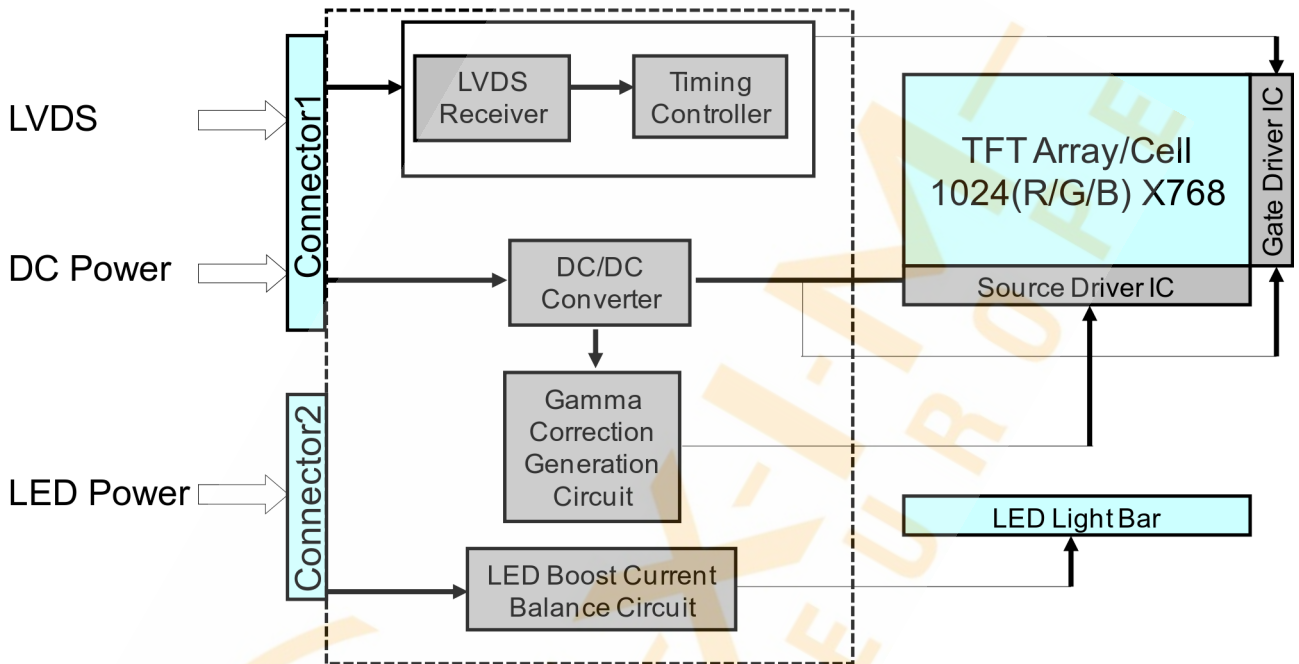
### 2.3 Product Summary

| Items                        | Specifications             | Unit               |
|------------------------------|----------------------------|--------------------|
| Screen Diagonal              | 12.1                       | Inch               |
| Active Area                  | 245.76 (H) x184.32 (V)     | mm                 |
| Pixels H x V                 | 1024(RGB) x768             | -                  |
| Pixel Pitch                  | 0.24(H)×0.24 (V)           | mm                 |
| Pixel Arrangement            | R.G.B. Vertical Stripe     | -                  |
| Display Mode                 | Normally White             | -                  |
| White Luminance              | 350 (TYP)                  | cd /m <sup>2</sup> |
| Contrast Ratio               | 800 (TYP)                  | -                  |
| Response Time                | 16 (TYP)                   | msec               |
| Input Voltage                | 3.3                        | V                  |
| Power Consumption            | 6.925 (Max)                | W                  |
| Weight                       | 545 (Max)                  | g                  |
| Outline Dimension            | 279.0(H) ×209.0(V) ×9.0(D) | mm                 |
| Electrical Interface (Logic) | LVDS                       | -                  |
| Support Color                | 262K/16.7M                 | -                  |
| Optimum Viewing Direction    | 6 o'clock                  | -                  |
| Surface Treatment            | Anti-glare & hardness 3H   | -                  |

2.4 Functional Block Diagram

Figure 1 shows the functional block diagram of the LCD module.

Figure 1 Block Diagram



### 3.0 Mechanical Characteristics

#### 3.1 Outline Drawing

Figure 18 Outline Drawing (Front Side)

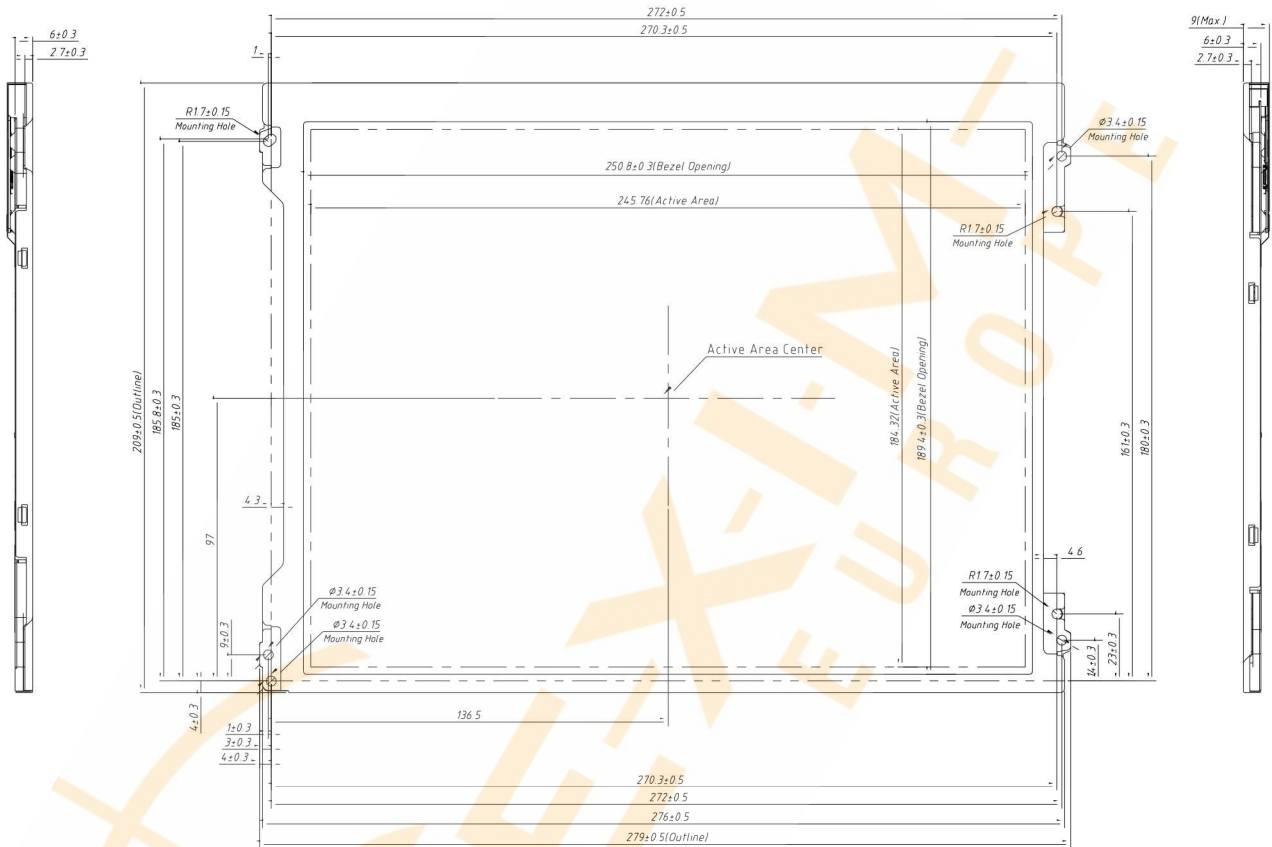
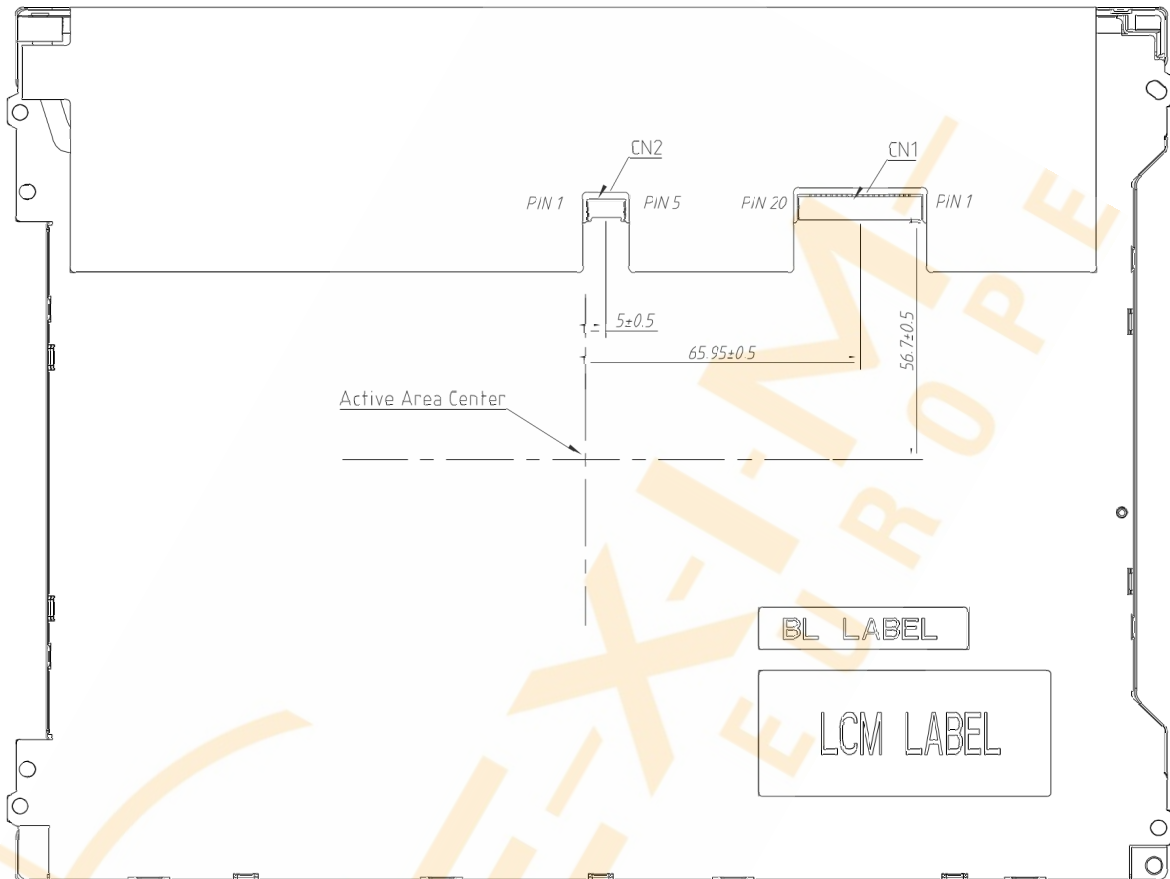


Figure 19 Outline Drawing (Back Side)

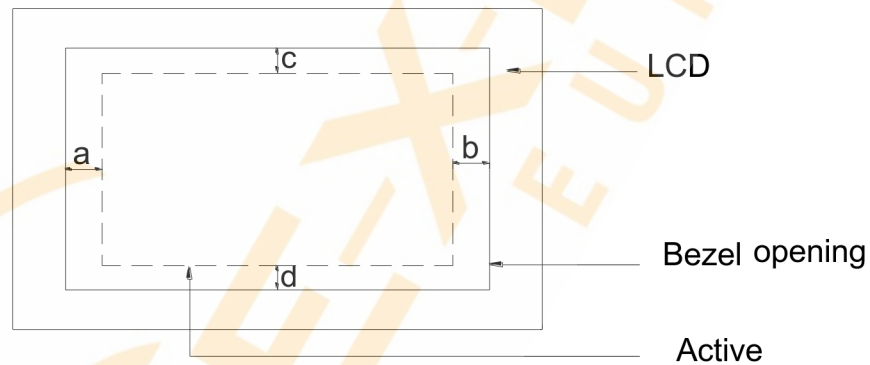


### 3.2 Dimension Specifications

**Table 12 Module Dimension Specifications**

| Item                 | Min.              | Typ.            | Max.              | Units |
|----------------------|-------------------|-----------------|-------------------|-------|
| Width                | 278.5             | 279.0           | 279.5             | mm    |
| Height               | 208.5             | 209.0           | 209.5             | mm    |
| Thickness            | 5.7(without PCBA) | 6(without PCBA) | 6.3(without PCBA) | mm    |
| Weight               | -                 | 518.7           | 545               | g     |
| BM :   a-b   &   c-d | ≤1.0              |                 |                   | mm    |

**Figure 20 BM Area**





#### 4.0 Absolute Maximum Ratings

**Table 1 Absolute Ratings of Environment**

| Item                  | Symbol          | Min. | Max. | Unit | Conditions      |
|-----------------------|-----------------|------|------|------|-----------------|
| Supply Voltage        | V <sub>DD</sub> | -0.3 | 4    | V    | (1)             |
| Operating Temperature | T <sub>OP</sub> | -20  | 70   | °C   | (1) (2) (3) (4) |
| Operating Humidity    | H <sub>OP</sub> | 10   | 85   | %RH  | -               |
| Storage Temperature   | T <sub>ST</sub> | -30  | 80   | °C   | -               |
| Storage Humidity      | H <sub>ST</sub> | 10   | 95   | %RH  | -               |

Note (1): Humidity: 85%RH Max. (T≤40°C) Note static electricity.

Maximum wet bulb temperature at 39°C or less. (T>40°C) No condensation.

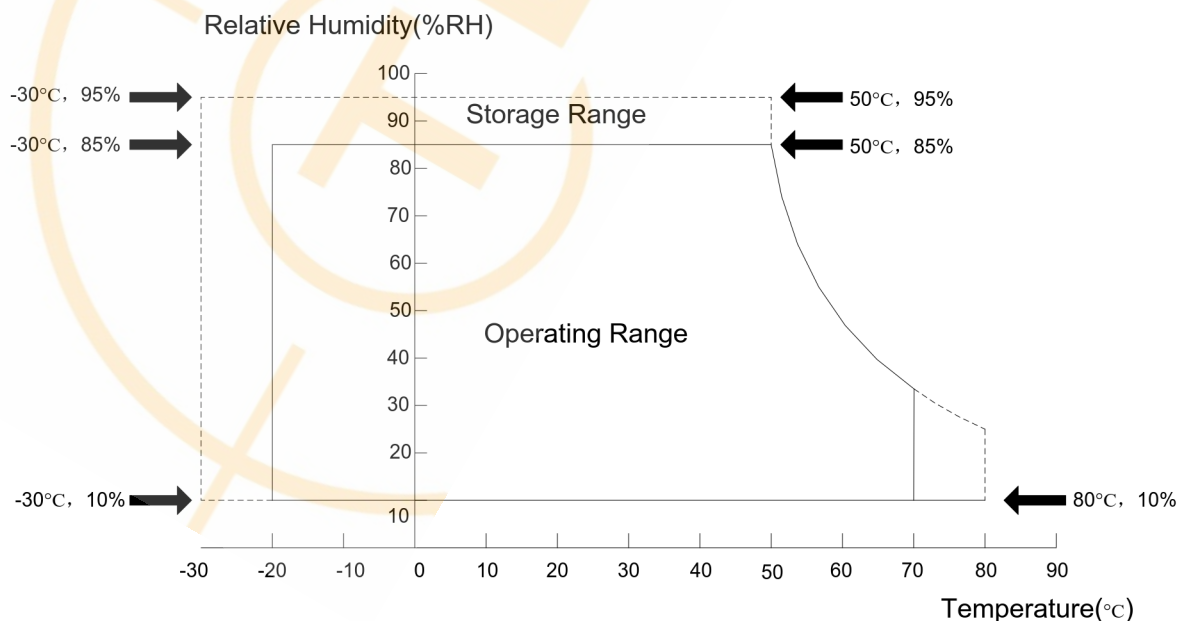
Note (2): There is a possibility of causing deterioration in the irregularity and others of the screen and the display fineness though the liquid crystal module doesn't arrive at destruction when using it at 80~85°C or -20°C.

Note (3): There is a possibility of causing the fineness deterioration by the prolonged use in the (high temperature) humidity environment (60% or more).

Note (4): In the operating temperature item, the low temperature side is the ambient temperature regulations. The high temperature side is the panel surface temperature regulations.

Note (5): Storage Range&Operating Range Picture:

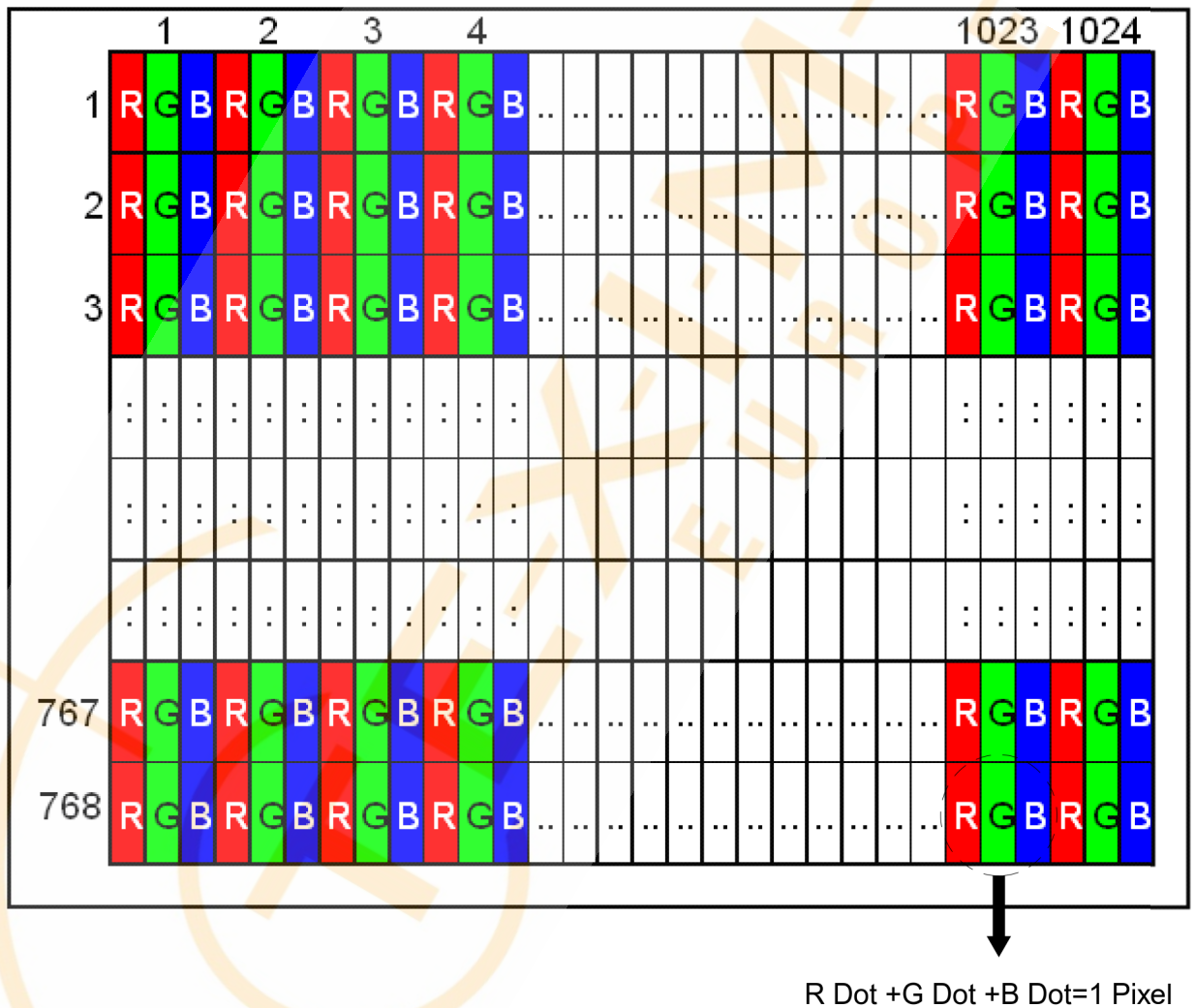
**Figure 2 Absolute Ratings of Environment of the LCD Module**



### 5.0 Pixel Format Image

Figure 1 shows the relationship of the input signals and LCD pixel format image.

Figure 3 Pixel Format



## 6.0 Optical Characteristics

The optical characteristics are measured under stable conditions as following notes

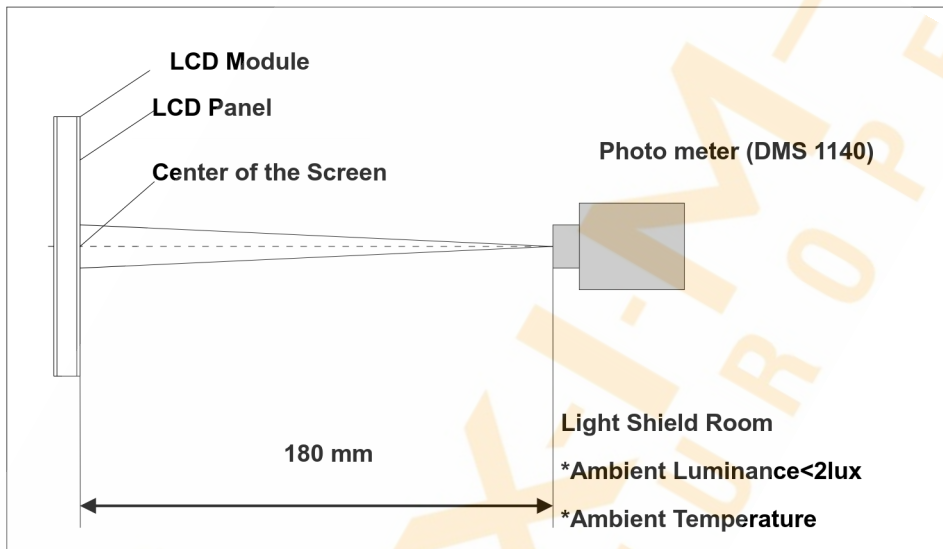
**Table 2 Optical Characteristics**

| Item                            | Conditions        | Min.          | Typ.  | Max.  | Unit              | Note                  |
|---------------------------------|-------------------|---------------|-------|-------|-------------------|-----------------------|
| Viewing Angle<br>(CR>10)        | Horizontal        | $\theta_{x+}$ | 70    | 80    | -                 | degree<br>(1),(2),(3) |
|                                 |                   | $\theta_{x-}$ | 70    | 80    | -                 |                       |
|                                 | Vertical          | $\theta_{y+}$ | 70    | 80    | -                 |                       |
|                                 |                   | $\theta_{y-}$ | 70    | 80    | -                 |                       |
| Contrast Ratio                  | Center            | 720           | 800   | -     | -                 | (1),(2),(4)           |
| Response Time                   | Rising (90%→10%)  | -             | 4     | 5.2   | ms                | (1),(2),(5)           |
|                                 | Falling (10%→90%) | -             | 12    | 15.6  |                   |                       |
|                                 | Rising + Falling  | -             | 16    | 20.8  |                   |                       |
| Color Chromaticity<br>(CIE1931) | White x           | 0.255         | 0.305 | 0.355 | -                 | (1),(2)               |
|                                 | White y           | 0.275         | 0.325 | 0.375 | -                 |                       |
|                                 | Red x             | 0.614         | 0.644 | 0.674 | -                 |                       |
|                                 | Red y             | 0.314         | 0.344 | 0.374 | -                 |                       |
|                                 | Green x           | 0.280         | 0.310 | 0.340 | -                 |                       |
|                                 | Green y           | 0.604         | 0.634 | 0.664 | -                 |                       |
|                                 | Blue x            | 0.122         | 0.152 | 0.182 | -                 |                       |
|                                 | Blue y            | 0.051         | 0.081 | 0.111 | -                 |                       |
| NTSC                            |                   | -             | 72    | -     | -                 |                       |
| White Luminance                 | 5 Points Average  | 315           | 350   | -     | cd/m <sup>2</sup> | (1),(2),(6)           |
| Luminance Uniformity            | 9 Points          | 75            | 80    | -     | %                 | (1),(2),(7)           |

Note (1) Measurement Setup:

The LCD module should be stabilized at given temperature(25°C) for 15 minutes to Avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.

Figure 4 Measurement Setup



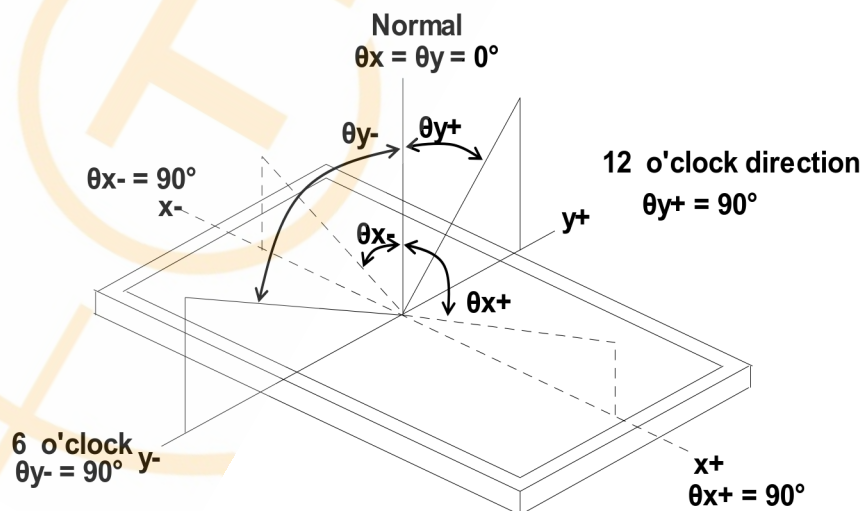
Note (2) The LED input parameter setting as: I\_LED: 240mA

V\_LED: 12V

PWM\_LED: Duty 100%

Note (3) Definition of Viewing Angle

Figure 5 Definition of Viewing Angle



Note (4) Definition Of Contrast Ratio (CR)

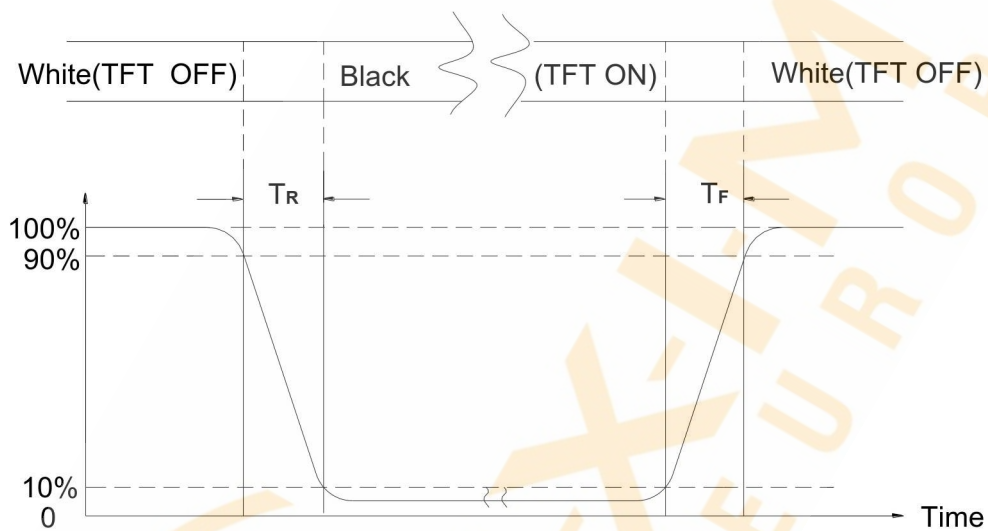
The contrast ratio can be calculated by the following expression

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

L255: Luminance of gray level L255, L0: Luminance of gray level 0

Note (5) Definition Of Response Time ( $T_R$ ,  $T_F$ )

**Figure 6 Definition of Response Time**



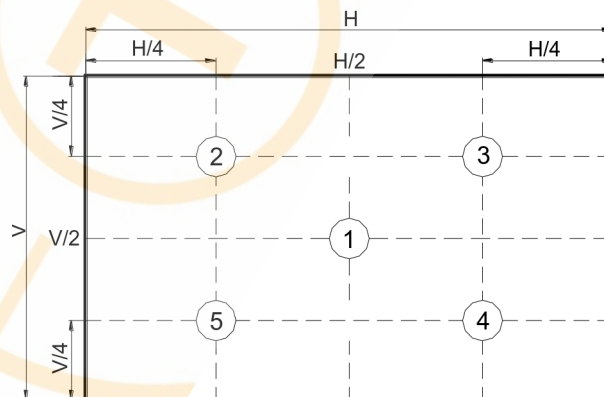
Note (6) Definition Of Luminance White

Measure the luminance of gray level L255 at center point (Ref.: Active Area)

$$\text{Display Luminance} = (L_1 + L_2 + L_3 + L_4 + L_5) / 5$$

H—Active area length, V—Active area width, L—Luminance

**Figure 7 Measurement Locations Of 5 Points**

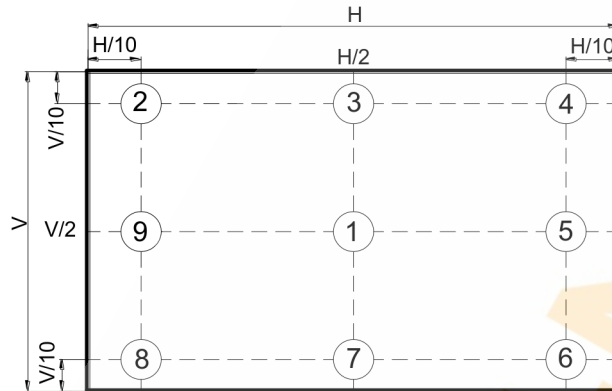


Note (7) Definition Of Luminance Uniformity (Ref.: Active Area)

Measure the luminance of gray level 255 at 9 points.

$$UNF(9pts) = \frac{\text{Min}(L1, L2, \Lambda L9)}{\text{Max}(L1, L2, \Lambda L9)}$$

**Figure 8 Measurement Locations of 9 Points**



## 7.0 Backlight Characteristics

### 5.1 Parameter Guideline Of LED Backlight

**Table 3 Parameter Guideline for LED Backlight**

| Item                  | Symbol              | Min.   | Typ. | Max.   | Units | Note   |   |
|-----------------------|---------------------|--------|------|--------|-------|--------|---|
| LED Input Voltage     | V <sub>LED</sub>    | 10.8   | 12   | 12.6   | V     | (2)    |   |
| LED Power Consumption | P <sub>LED</sub>    | -      | -    | 6.1    | W     | (2)    |   |
| LED Forward Voltage   | V <sub>F</sub>      | 2.8    | 3.3  | 3.6    | V     | (2)    |   |
| LED Forward Current   | I <sub>F</sub>      | -      | 60   | -      | m A   |        |   |
| PWM Signal Voltage    | V <sub>PWM_EN</sub> | High   | 4.5  | 5      | 5.5   |        | V |
|                       |                     | Low    | 0    | -      | 0.5   |        |   |
| LED Enable Voltage    | V <sub>LED_EN</sub> | High   | 2.0  | 5      | 5.5   |        | V |
|                       |                     | Low    | -    | 0      | 0.5   |        |   |
| Input PWM Frequency   | FPWM                | 200    | -    | 20,000 | Hz    |        |   |
| LED Life Time         | LT                  | 30,000 | -    | -      | Hours | (1)(2) |   |
| Duty Ratio            | PWM                 | 5      | -    | 100    | %     | (2)    |   |

Note (1) The LED life time define as the estimated time to 50% degradation of initial luminous.

Note (2) Operating temperature 25°C, humidity 55%RH.

**Table 4 Connector Name / Designation**

| Item      | Description  |
|-----------|--|
| Input LED | PCB Jack Connector model: MSB24038P5A<br>Manufactured by STM |
|           | PIN IDE Connector model: P24038P5                            |

**Table 5 Input LED Signal Pin Assignment**

| Pin # | Function             |
|-------|----------------------|
| 1     | VCC(12V input)       |
| 2     | GND                  |
| 3     | On/Off(5V-ON,0V-OFF) |
| 4     | Dimming(PWM)         |
| 5     | NC                   |



## 8.0 Electrical Characteristics

### 8.1 Interface Connector

**Table 6 Connector Name / Designation**

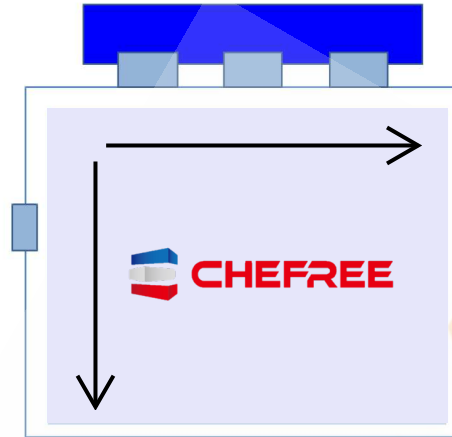
| Item   | Description  |
|--|--|
| FPC Down Connector<br>( 20pin pitch=1.25mm ) | PCB Jack Connector recommended model: MSB240420HE<br>Manufactured by STM |
|  | PIN IDE Connector model: P240420H  |

**Table 7 Signal Pin Assignment**

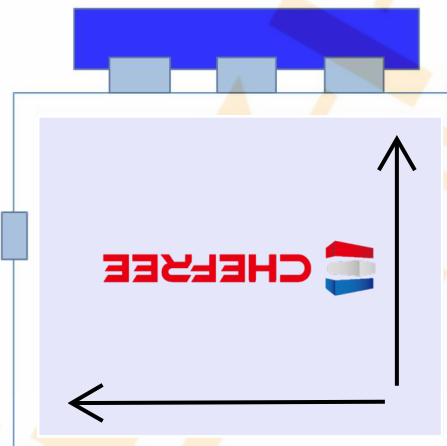
| Pin # | Symbol | Description   |
|-------|--------|---|
| 1     | VDD    | Power Supply, 3.3V (typical)  |
| 2     | VDD    | Power Supply, 3.3V (typical)  |
| 3     | VSS    | Ground  |
| 4     | REV    | Reverse Scan selection<br>{High:2.5(min), 3.3(typ),3.6(max); Low: 0.5(max)} |
| 5     | Rin1-  | -LVDS differential data input (R0-R5,G0)                                    |
| 6     | Rin1+  | +LVDS differential data input (R0-R5,G0)                                    |
| 7     | VSS    | Ground  |
| 8     | Rin2-  | -LVDS differential data input (G1-G5,B0-B1)                                 |
| 9     | Rin2+  | +LVDS differential data input (G1-G5,B0-B1)                                 |
| 10    | VSS    | Ground  |
| 11    | Rin3-  | -LVDS differential data input (B2-B5,HS,VS,DE)                              |
| 12    | Rin3+  | +LVDS differential data input (B2-B5,HS,VS,DE)                              |
| 13    | VSS    | Ground  |
| 14    | CIKIN- | -LVDS differential clock input  |
| 15    | CIKIN+ | +LVDS differential clock input  |
| 16    | GND    | Ground  |
| 17    | Rin4-  | -LVDS differential data input (R6-R7,G6-G7,B6-B7)                           |
| 18    | Rin4+  | +LVDS differential data input (R6-R7,G6-G7,B6-B7)                           |
| 19    | SEL68  | 6/8 bits LVDS data input selection(H:8bit L/NC:6bit)                        |
| 20    | Bist   | Internal use  |

Note(1) : All input signals shall be low or Hi-resistance state when VDD is off.

Note (2) REV = LOW/NC



Note (3) REV = High



## 6.2 LVDS Receiver

### 6.2.1 Signal Electrical Characteristics For LVDS Receiver

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644 ) standard.

**Table 8 LVDS Receiver Electrical Characteristics**

|                                      |                 |      |   |      |    |                |
|--------------------------------------|-----------------|------|---|------|----|----------------|
| Differential Input High Threshold    | $V_{th}$        | -    | - | +100 | mV | $V_{CM}=+1.2V$ |
| Differential Input Low Threshold     | $V_{tl}$        | -100 | - | -    | mV | $V_{CM}=+1.2V$ |
| Magnitude Differential Input Voltage | $ V_{ID} $      | 100  | - | 600  | mV | -              |
| Common Mode Voltage                  | $V_{CM}$        | 0.7  | - | 1.6  | V  | -              |
| Common Mode Voltage Offset           | $\Delta V_{CM}$ | -    | - | 50   | mV | $V_{CM}=+1.2V$ |

Note: (1) Input signals shall be low or Hi- resistance state when VDD is off.

(2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

**Figure 9 Voltage Definitions**

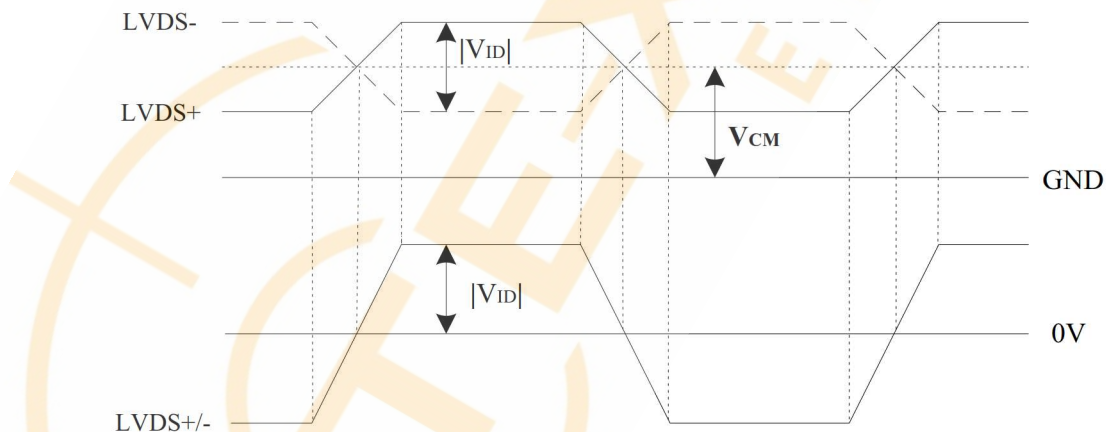


Figure10 Measurement System

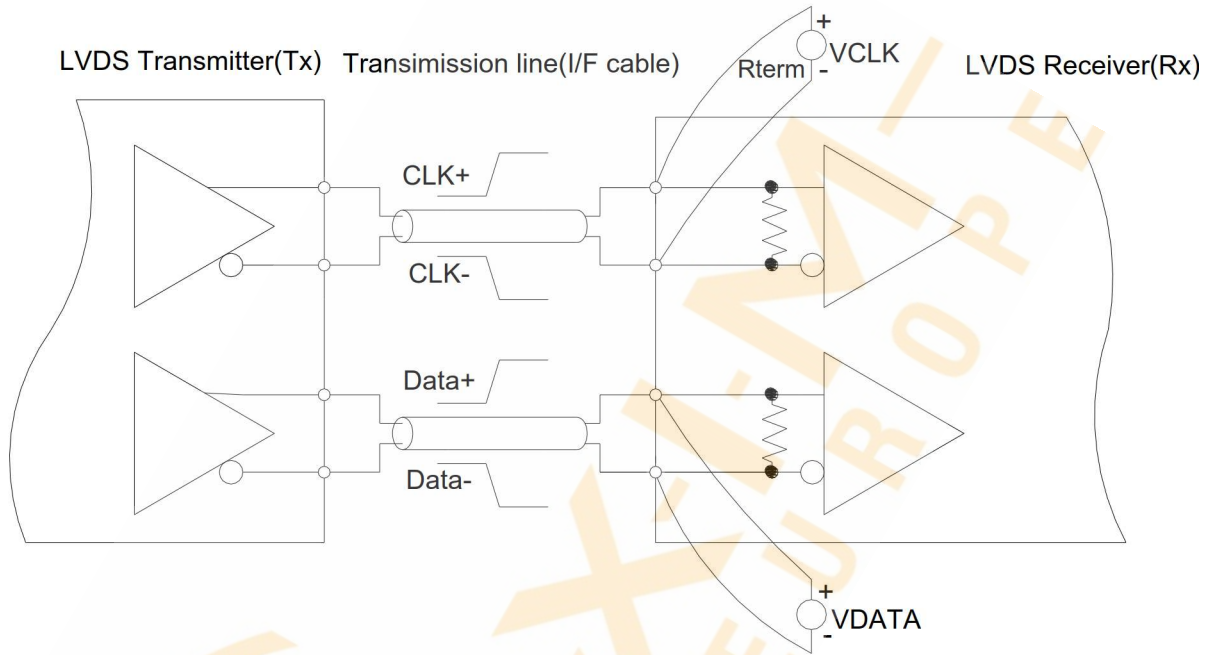


Figure 11 Date Mapping(8 Bit)

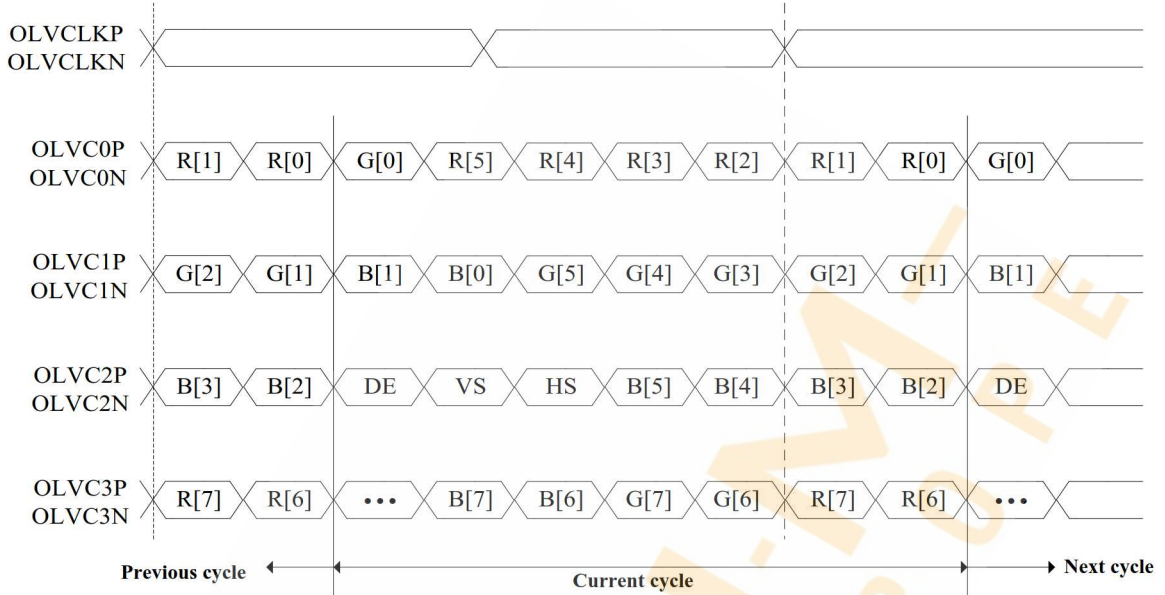
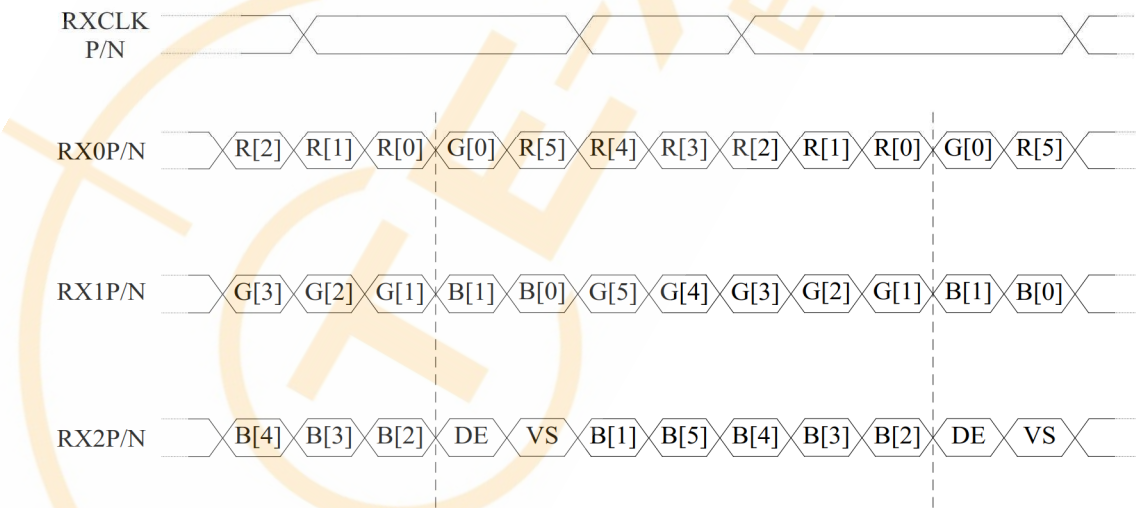


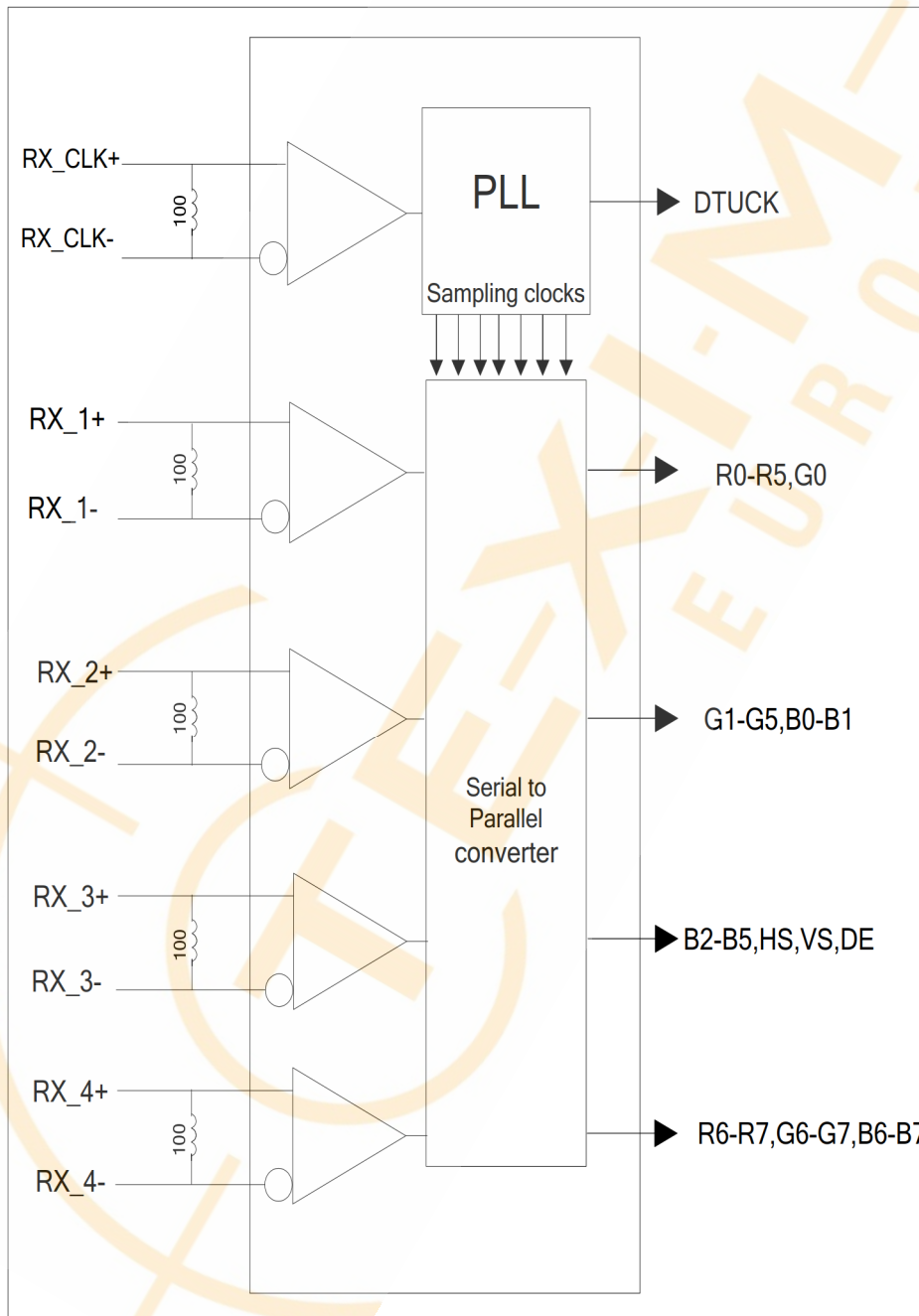
Figure 12 Data Mapping(6 Bit)



8.2.2 LVDS Receiver Internal Circuit

Figure 13 LVDS Receiver Internal Circuit shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.

Figure 13 LVDS Receiver Internal Circuit



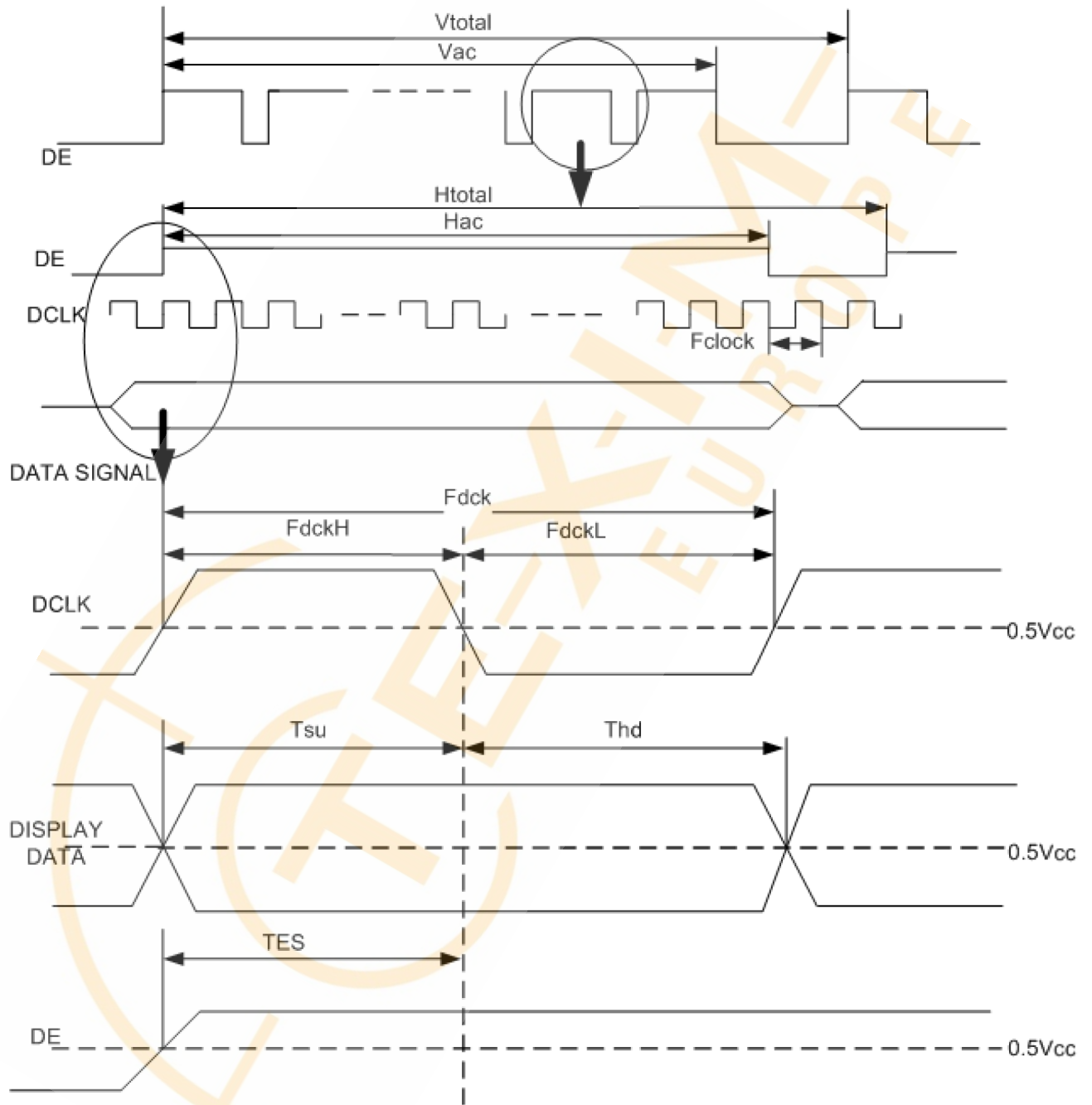
## 9.0 Interface Timings

**Table 9 Interface Timings**

| Parameter            | Symbol | Unit   | Min. | Typ. | Max. |
|----------------------|--------|--------|------|------|------|
| LVDS Clock Frequency | Fclk   | MHz    | 50   | 65   | 80   |
| H Total Time         | HT     | Clocks | 1100 | 1344 | 1400 |
| H Active Time        | HA     | Clocks | 1024 | 1024 | 1024 |
| H Blanking Time      | HBL    | Clocks | 76   | 320  | 1023 |
| V Total Time         | VT     | Lines  | 776  | 806  | 820  |
| V Active Time        | VA     | Lines  | 768  | 768  | 768  |
| V Blanking Time      | VBL    | Lines  | 8    | 38   | 255  |
| Frame Rate           | Vsync  | Hz     | 55   | 60   | 65   |

Note: H Blanking Time and V Blanking Time can not be changed at every frame.

Figure 14 Timing Characteristics





## 10.0 Power Consumption

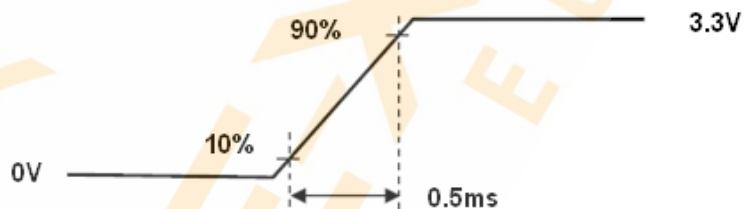
Input power voltage specifications are as follows.

**Table 10 Power Voltage**

| Item                                     | Symbol        | Min. | Typ. | Max. | Units | Note        |             |
|--|---------------|------|------|------|-------|-------------|-------------|
| LCD Drive Voltage (Logic)                | VDD           | 3.0  | 3.3  | 3.6  | V     | (2), (4)    |             |
| VDD Current                              | Black Pattern | IDD  | -    | -    | 250   | mA          | (3),(4),(6) |
| VDD Power Consumption                    | Black Pattern | PDD  | -    | -    | 0.825 | W           |             |
| Rush Current                             | Irush         | -    | -    | 3    | A     | (1),(4),(5) |             |
| Allowable Logic/LCD Drive Ripple Voltage | VDDrp         | -    | -    | 200  | mV    | (4)         |             |

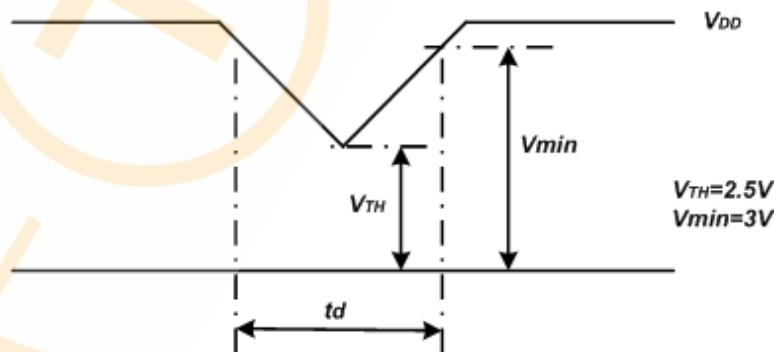
Note (1) Measure Condition

**Figure 15 VDD Rising Time**



Note (2) VDD Power Dip Condition

If  $V_{TH} < VDD \leq V_{min}$ , then  $t_d \leq 10ms$ ; When the voltage returns to normal our panel must revive automatically.



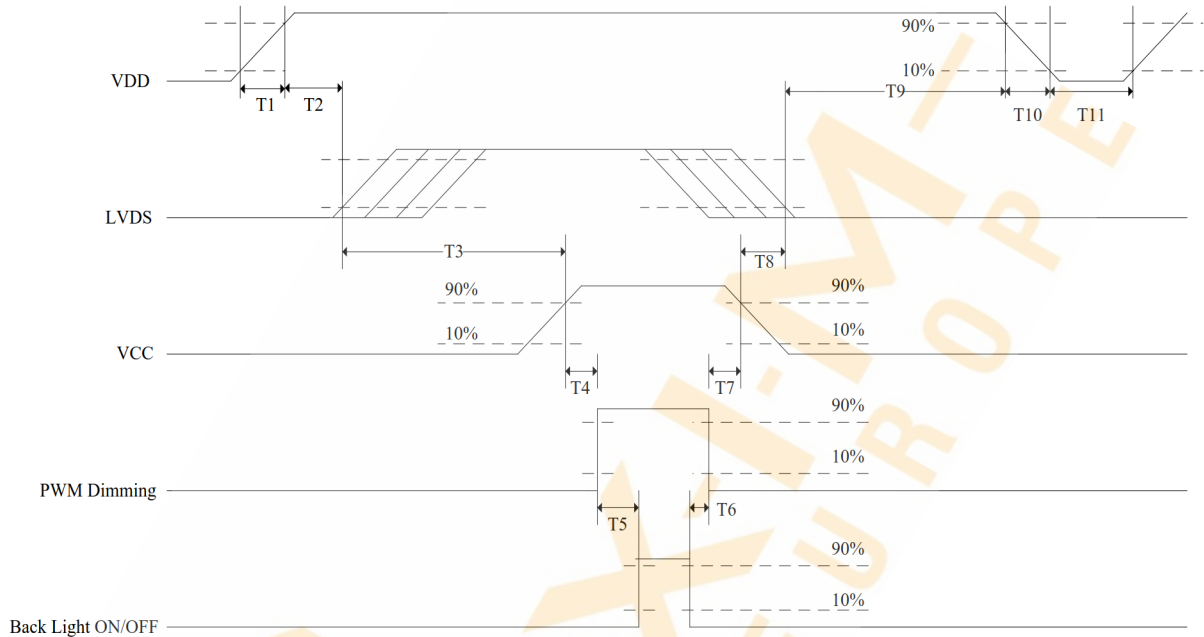
Note (3) Frame Rate=60Hz, VDD=3.3V,DC Current.

Note (4) Operating temperature 25°C, humidity 55%RH.

### 11.0 Power ON/OFF Sequence

Power on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-resistance state or low level when VDD is off.

**Figure 17 Power Sequence**



**Table 11 Power Sequencing Requirements**

| Parameter | Unit | min  | typ | max |
|-----------|------|------|-----|-----|
| T1        | ms   | 0.5  | -   | 10  |
| T2        | ms   | 30   | 40  | 50  |
| T3        | ms   | 200  | -   | -   |
| T4        | ms   | 10   | -   | -   |
| T5        | ms   | 10   | -   | -   |
| T6        | ms   | 0    | -   | -   |
| T7        | ms   | 10   | -   | -   |
| T8        | ms   | 100  | -   | -   |
| T9        | ms   | 0    | 16  | 50  |
| T10       | ms   | -    | -   | 10  |
| T11       | ms   | 1000 | -   | -   |

Note (1) Power On Sequence: VCC-> AVDD -> VGL -> VGH -> Data -> B/L

(2) Power Off Sequence: B/L-> Data -> VGH -> VGL -> AVDD -> VCC

**12.0 Reliability Conditions**

| Item                                   | Package | Test Conditions   | Note        |
|--|---------|-------------------|-------------|
| High Temperature Operation Test        | Module  | 70°C, 300hrs      | 1,2,3,4,5,6 |
| Low Temperature Operating Test         | Module  | -20°C, 300hrs     | 1,2,3,4,5,6 |
| High Temperature Storage Test          | Module  | 80°C, 300hrs      | 1,3,4,5,6   |
| Low Temperature Storage Test           | Module  | -30°C, 300hrs     | 1,3,4,5,6   |
| High Temp High Humidity Operating Test | Module  | 50°C, 85%, 300hrs | 1,2,3,4,5,6 |

Note:

1. There is no function defect and occurrence of any new defective shall not be allowed.
2. In Operating test, the B/L voltage and current must be in spec.
3. All the judgments are under normal temperature and the sample need to be static more than 2 hours in the normal temperature before judge.
4. During measurement, the condensation water or remains shall not be allowed.
5. The minimum sample quantity of test is 3pcs.
6. There is no display function fail issue occurred, all the cosmetic specification is judged before the reliability stress.

## **13.0 General Precaution**

### **13.1 Use Restriction**

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.

### **13.2 Handling Precaution**

- (1) Please mount LCD module by using mounting holes arranged in four corners tightly.
- (2) Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. CHEFREE does not warrant the module, if customers disassemble or modify the module.
- (3) 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. If liquid crystal contacts mouth or eyes, rinse out with water immediately. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and Rinse thoroughly with water.
- (4) Disconnect power supply before handling LCD module
- (5) Refrain from strong mechanical shock and /or any force to the module.
- (6) 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. It's recommended employing protection circuit for power supply.
- (7) Do not touch, push or rub the polarizer with anything harder than HB pencil lead. Use fingerstalls of soft gloves in order to keep clean display quality, when Persons handle the LCD module for incoming inspection or assembly.
- (8) When the surface is dusty, please wipe gently with absorbent cotton or other soft Material. When cleaning the adhesives, please use absorbent cotton wetted with a little Petroleum benzene or other adequate solvent.
- (9) Wipe off saliva or water drops as soon as possible. If saliva or water drops Contact with polarizer for a long time, they may causes deformation or color Fading.
- (10) Protection film must remove very slowly from the surface of LCD module to Prevent from electrostatic occurrence.
- (11) Because LCD module uses 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.
- (12) Do not adjust the variable resistor located on the module.

### **13.3 Storage Precaution**

- (1) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- (2) The module shall not be exposed under strong light such as direct sunlight. Otherwise, Display characteristics may be changed.
- (3) The module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storage.

### **13.4 Operation Precaution**

- (1) Do not connect or disconnect the module in the "Power On" condition.
- (2) Power supply should always be turned on/off by "Power on/off sequence"
- (3) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding

methods may be important to minimize the interference.

- (4) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentarily. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

### 13.5 Others

- (1) Ultra-violet ray filter is necessary for outdoor operation.
- (2) Avoid condensation of water which may result in improper operation or disconnection of electrode.
- (3) If the module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
- (4) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

### 13.6 Disposal

When disposing LCD module, obey the local environmental regulations.

