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-19201080QTZQW-00H |
| APPROVED BY | |
| DATE | |

☐ Preliminary Specification
☑ Formal Specification



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

This Specification is subject to change without notice.

# RECORD OF REVISION

| Revision Date | Page | Contents | Editor |
|---|---|---|---|
| 2023/12/21 | -- | New Release | Simon |

# 1.0 General Descriptions

## 1.1 Introduction

It's a 21.5 inch wide color TFT-LCD module, the display supports the Full HD-1920 X 1080 resolution and have 16.7M colors(RGB 8-bits).

## 1.2 Features

- Supported FHD Resolution
- LVDS (2ch) Interface for 1920 RGB x 1080 resolution
- Wide View Angle
- 16.7M colors (RGB 8 bits)
- Green Product (RoHS)

## 1.3 Product Summary

| Items | Specifications | Unit |
|---|---|---|
| Screen Diagonal | 21.5 | Inch |
| Active Area | 476.64 (H) ×268.11 (V) | mm |
| Pixel Format | 1920 (H) x RGB x 1080 (V) | - |
| Pixel Pitch | 0.2483 (H) X 0.2483 (V) | mm |
| Pixel Arrangement | R.G.B. Vertical Stripe | - |
| Display Mode | Normally Black | - |
| White Luminance | (1,500) (Typ.) | cd /m2 |
| Contrast Ratio | (1,500) (Typ.) | - |
| Input Voltage | +5.0 | V |
| Outline Dimensions | (495.6) (Typ.) x (292.2)(Typ.) x(20) (Typ) | mm |
| Support Color | 16.7M | - |
| Weight | 1760(MAX) | g |

### 1.4 Functional Block Diagram

Figure 1 shows the functional block diagram of the LCD module

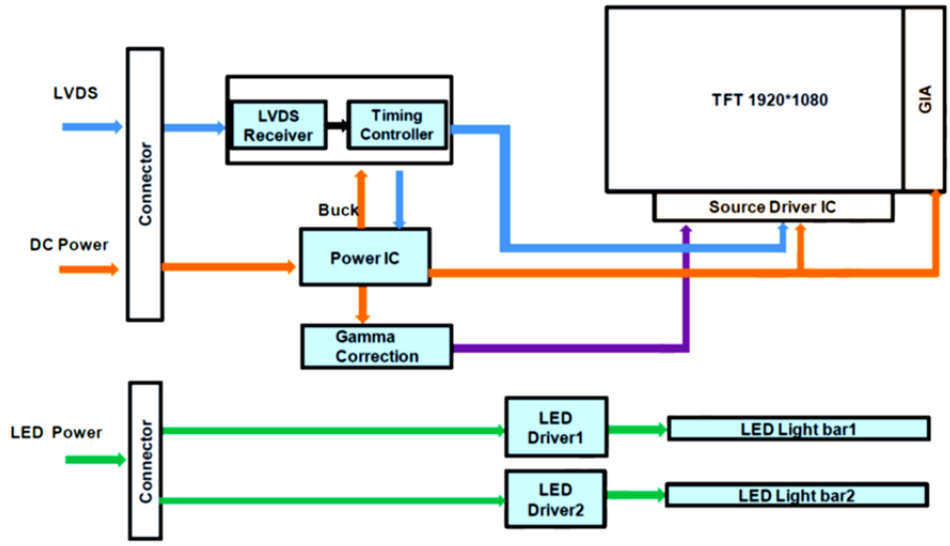



Figure 1 Block Diagram

### 1.5 Pixel Mapping

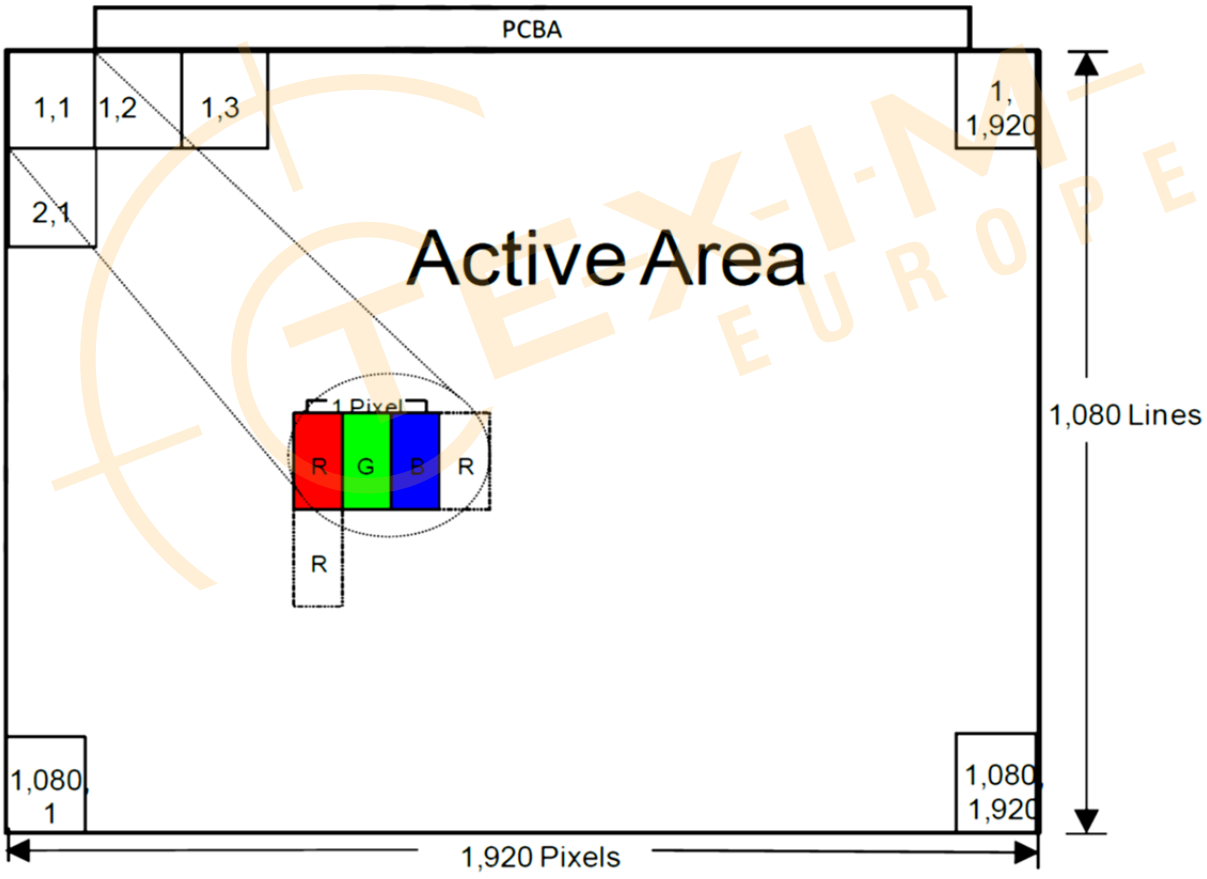



Figure2 Pixel Mapping

## 2.0 Absolute Maximum Ratings

| ITEM | SYMBOL | VALUES | | UNIT | REMARK |
|---|---|---|---|---|---|
| | | MIN | MAX | | |
| Logic / LCD Drive | VDD | -0.3 | 5.5 | V | |
| Operation Temperature | $T_{op}$ | -30 | 80 | ℃ | |
| Storage Temperature | $T_{st}$ | -30 | 85 | ℃ | |

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value.

Note (2) All the contents of electro-optical specifications and display fineness are guaranteed under Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH.

Note (3) Unpredictable results may occur when it was used in extreme conditions. $T_a$= Ambient Temperature, $T_{gs}$= Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be lower than 47℃, and no condensation of water. Besides, protect the module from static electricity.

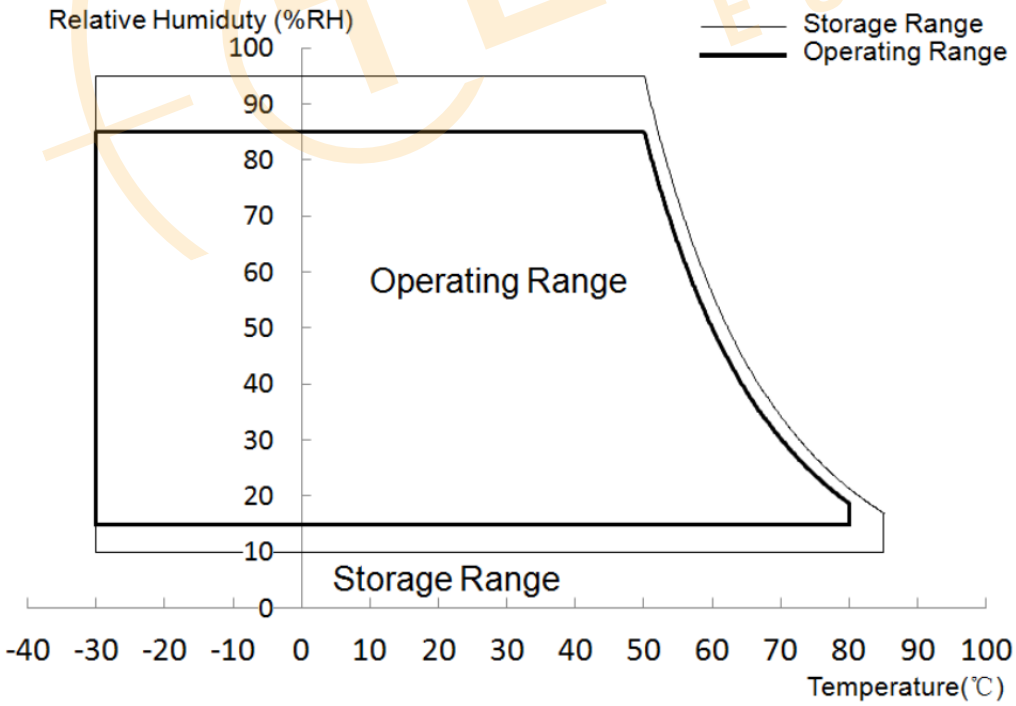



**Figure 3 Absolute Ratings of Environment of the LCD Module**

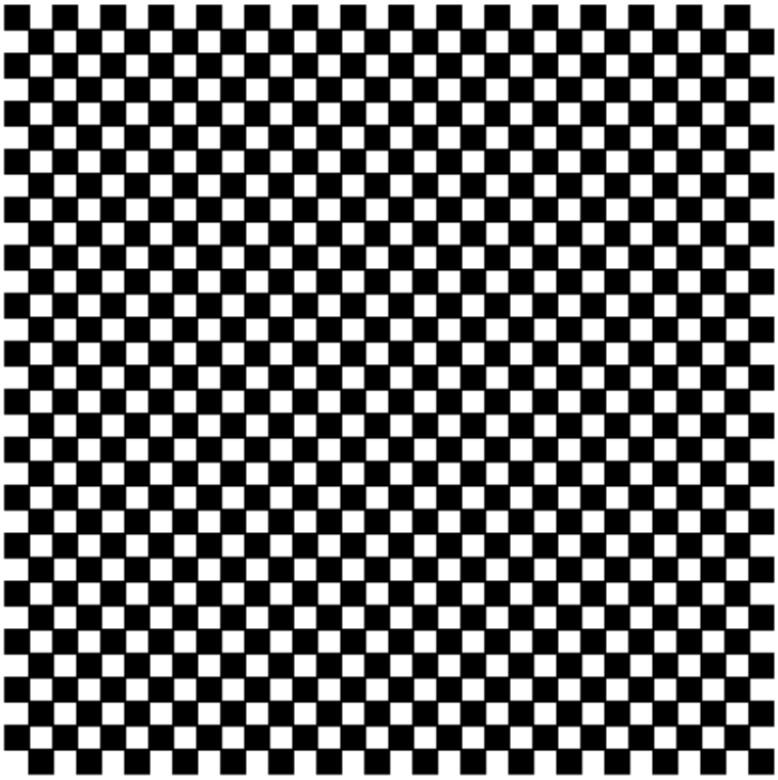
## 3.0 ELECTRICAL SPECIFICATIONS

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| *System Power Supply* | | | | | | | |
| LCD Drive Voltage (Logic) | | $V_{DD}$ | (4.5) | (5) | (5.5) | V | (1),(2) |
| VDD Current | Mosaic Pattern | $I_{DD}$ | - | - | (0.38) | A | (1),(3) |
| VDD Power Consumption | Mosaic Pattern | $P_{DD}$ | - | - | (1.9) | W | |
| LCD Self Test (BIST) | High level voltage | $V_{BIST}$ | (2.5) | - | (3.6) | V | (1) |
| | Low level voltage | | (0) | - | (0.5) | V | |
| Allowable Logic/LCD Drive Ripple Voltage | | $V_{VDD-RP}$ | - | - | (200) | mV | (1) |
| *LED Power Supply* | | | | | | | |
| LED Input Voltage | | $V_{LED}$ | (21.6) | (24) | (26.4) | V | (1),(2),(6) |
| LED Power Consumption | | $P_{LED}$ | - | - | (49.7) | W | (1),(6) |
| LED Forward Voltage | | $V_F$ | - | - | (3.3) | V | (1),(2) |
| LED Forward Current | | IF | | (80) | | mA | |
| PWM Signal Voltage | High | $V_{PWM}$ | (2.5) | - | (3.6) | V | |
| | Low | | - | - | (0.5) | V | |
| LED Enable Voltage | High | $V_{LED\_EN}$ | (2.5) | - | (3.6) | V | |
| | Low | | - | - | (0.5) | V | |
| Input PWM Frequency | | $F_{PWM}$ | (500) | | (5000) | Hz | (1),(2),(6) |
| Duty Ratio | | PWM | (5) | - | (100) | % | (1),(7) |
| LED Life Time | | LT | (50,000) | - | - | Hours | (1),(7) |

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified $V_{DD}$ current and power consumption are measured under the $V_{DD}$ = 5.0 V, FV= 60 Hz condition and Mosaic Pattern



Note (4) The figures below is the measuring condition of $V_{DD}$. Rush current can be measured when $T_{RUSH}$ is 0.5 ms.

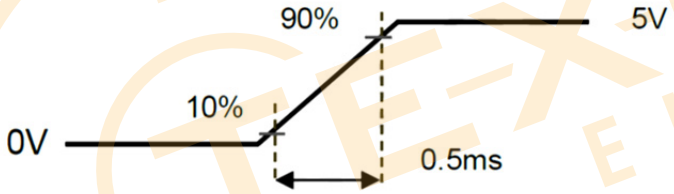



**Figure 11 $V_{DD}$ Rising Time**

Note (5) The power consumption of LED Driver are under the $V_{LED}$ = 24.0V, Dimming of Max luminance

Note (6) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note (7) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note (8) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 50% of the minimum value under normal operating condition.

### 3.1 Signal Electrical Characteristics

Signal Electrical Characteristics For LVDS Receiver

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

**Table 7 LVDS Receiver Electrical Characteristics**

| Symbol | Item | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| VTH | Differential Input High Threshold | - | - | +100 | mV | VCM=1.2V |
| VTL | Differential Input Low Threshold | -100 | - | - | mV | VCM=1.2V |
| \|VID\| | Input Differential Voltage | 150 | - | 600 | mV | |
| VICM | Differential Input Common mode Voltage | - | +1.2 | - | V | VTH/VTL=±100mV |

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

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

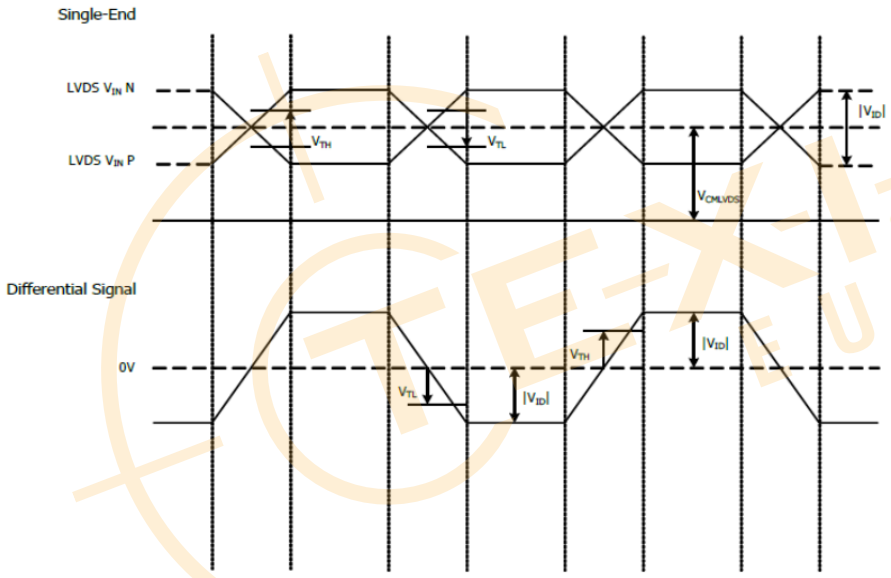



**Figure 8 Voltage Definitions**

**Table 8 LVDS AC Electrical Characteristics**

| | | MIN | Typ. | MAX. | Unit |
|---|---|---|---|---|---|
| **CLK Period** | TLVCP | - | (T) | (+100) | ms |
| **CLK High Time** | TLVCH | - | (4T/7) | - | ms |
| **CLK Low Time** | TLVCL | - | (3T/7) | - | ms |

Note: T=1/Fclk

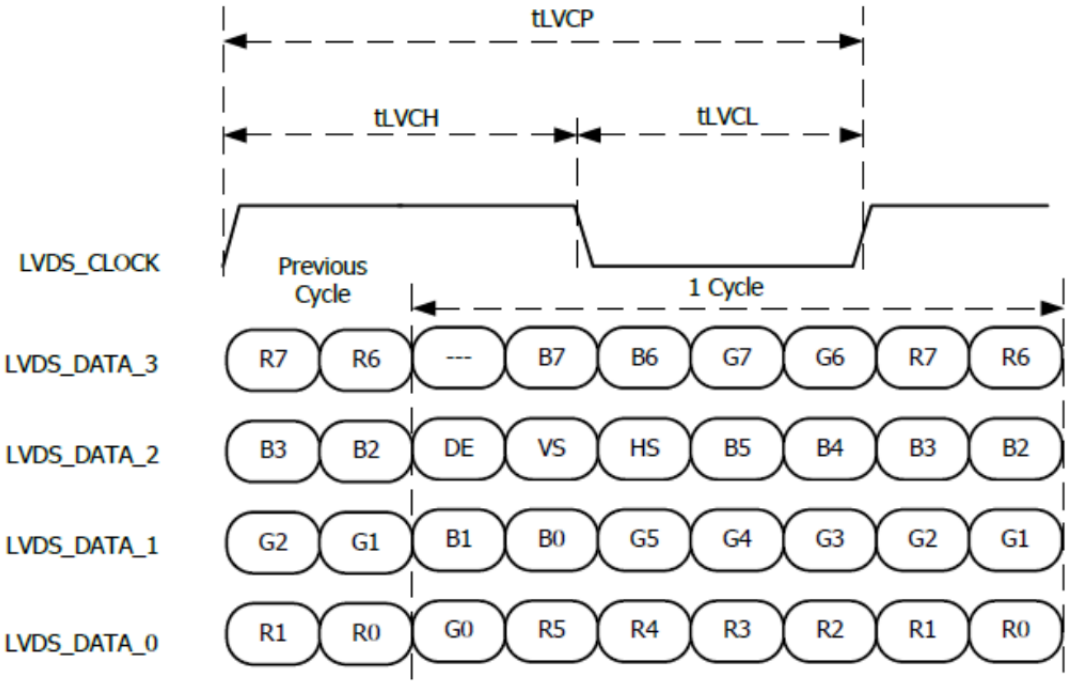



**Figure 9 Data Mapping**

LVDS Receiver Internal Circuit

Figure 10 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS lin

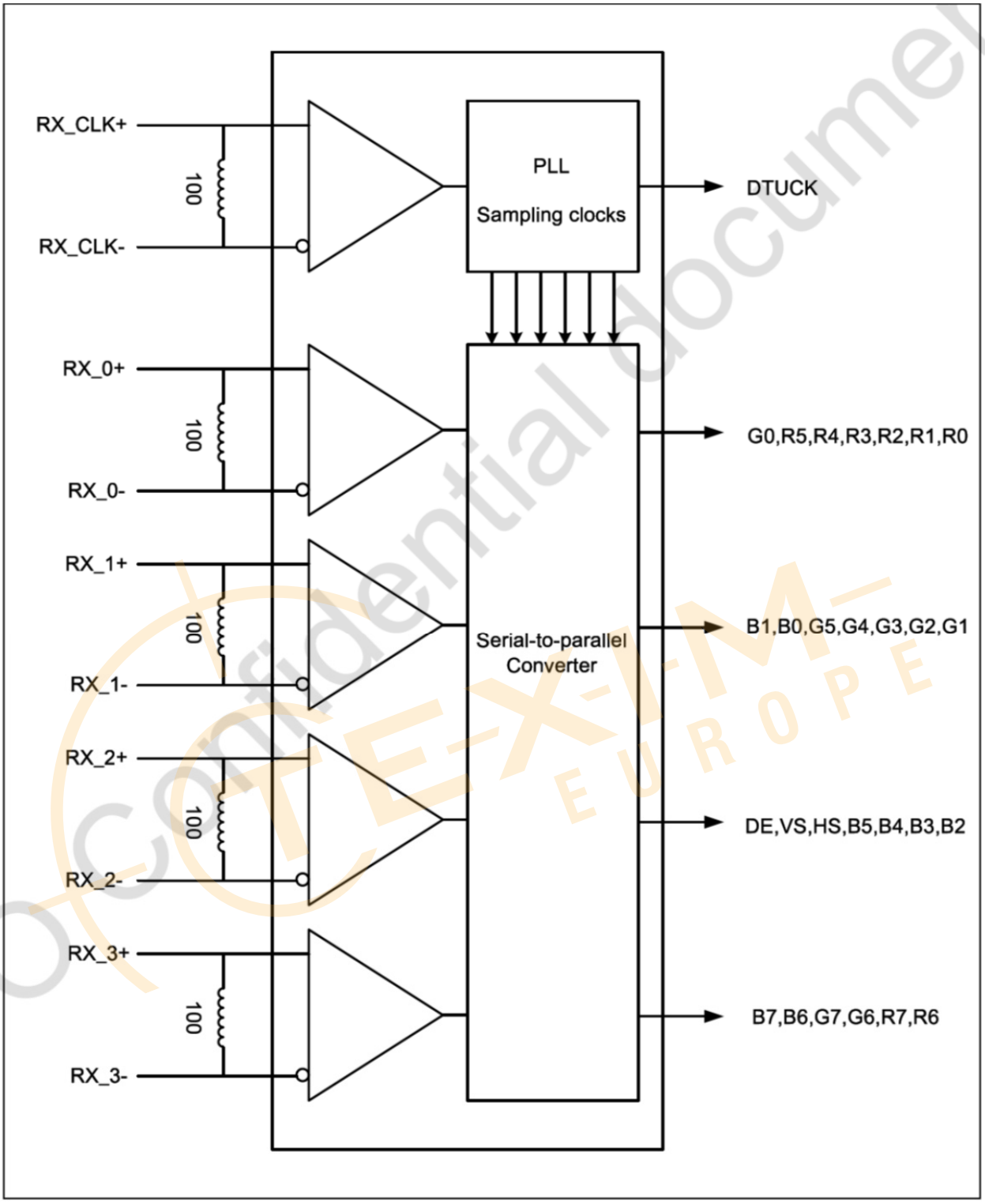



**Figure 10 LVDS Receiver Internal Circuit**

# 4. Interface Timings

## 4.1 Timing Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| LVDS Clock Frequency | Fclk | (59.3) | (72) | (89) | MHz |
| H Total Time | HT | (1004) | (1050) | (1100) | Clocks |
| H Active Time | HA | | 960 | | Clocks |
| V Total Time | VT | (1092) | (1130) | (1653) | Lines |
| V Active Time | VA | | 1080 | | Lines |
| Frame Rate | FV | (50) | (60) | (75) | Hz |

**Note 1:** **HT * VT *Frame Frequency≤89 MHz y.**

**Note 2:** **Synchronization Method: DE only**

## 4.3 POWER ON/OFF SEQUENCE

1.Interface signals are also shown in the chart. Signals from any system shall be Hi- resistance state or low level when VDD voltage is off.

2. When system first start up, should keep the VDD high time longer than 200ms, otherwise may cause image sticking when VDD drop off.

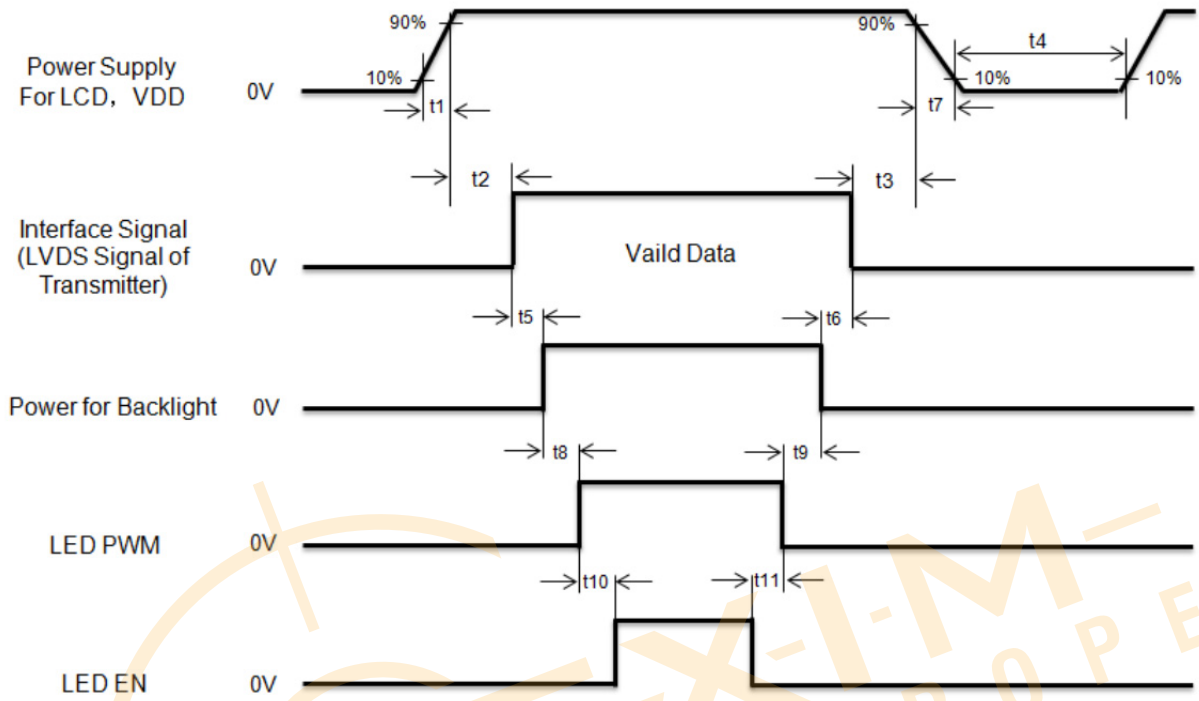



**Figure 12 Power Sequence**

**Table 11 Power Sequencing Requirements**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| VDD Rise Time | T1 | (0.5) | - | (10) | ms |
| VDD Good to Signal Valid | T2 | (0) | - | (50) | ms |
| Signal Disable to Power Down | T3 | (0) | - | (1,000) | ms |
| Power Off | T4 | (1,000) | - | - | ms |
| Signal Valid to VLED On | T5 | (300) | - | - | ms |
| VLED Off to Signal Disable | T6 | (200) | - | - | ms |
| VDD Fall Time | T7 | (0.5) | - | (10) | ms |
| VLED On to LED PWM On | T8 | (10) | - | - | ms |
| LED PWM Off to VLED Off | T9 | (10) | - | - | ms |
| LED PWM On LED EN On | T10 | (10) | - | - | ms |
| LED EN Off to LED PWM Off | T11 | (10) | - | - | ms |

## 5. Optical Specifications

The optical characteristics are measured under stable conditions as following notes

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity (CIE 1931) | Red | Rx | $\theta_x$=0°, $\theta_Y$ =0° CS-2000 R=G=B=255 Gray scale | Typ – 0.05 | 0.639 | Typ + 0.05 | - | (1)、(2) (3)、(8) |
| | | Ry | | | 0.334 | | | |
| | Green | Gx | | | 0.324 | | | |
| | | Gy | | | 0.613 | | | |
| | Blue | Bx | | | 0.153 | | | |
| | | By | | | 0.062 | | | |
| | White | Wx | | | 0.313 | | | |
| | | Wy | | | 0.329 | | | |
| Center Luminance of White | | $L_C$ | | 1200 | 1500 | - | cd/m$^2$ | (1)、(2) (6)、(8) |
| Contrast Ratio | | CR | | TBD | 1500 | - | - | (1)、(2) (4)、(8) |
| Response Time | | | Rising + Falling | - | TBD | 35 | ms | (1)、(2) (5)、(8)) |
| Color Gamut | | CG | | - | 72 | | % | (1)、(2) (3)、(8) |
| Uniformity | | | 9 points | 75 | 80 | | % | (1)、(2) (7)、(8) |
| Viewing Angle | Horizontal | $\theta_x$+ | CR ≧ 10 | 80 | 85 | --- | Deg. | (1)、(2) (3)、(4) (8) |
| | | $\theta_x$- | | 80 | 85 | | | |
| | Vertical | $\theta_Y$+ | | 80 | 85 | | | |
| | | $\theta_Y$- | | 80 | 85 | --- | | |

Note (1) Measurement Setup:

The LCD module should be stabilized at given ambient temperature (25℃) for 30 minutes to avoid abrupt temperature changing during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 30 minutes in the windless room.

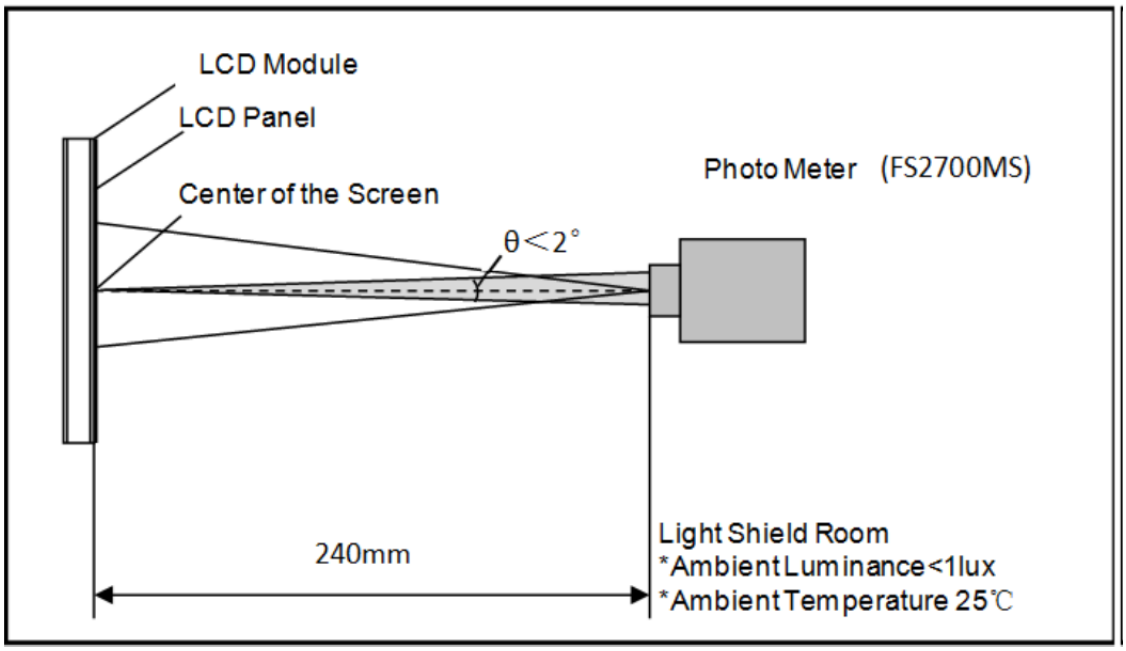



**Figure 4 Measurement Setup**

Note (2) The LED input parameter setting as:

$V_{LED}$: 24V

PWM_LED: Duty 100 %

Note (3) Definition of Viewing Angle

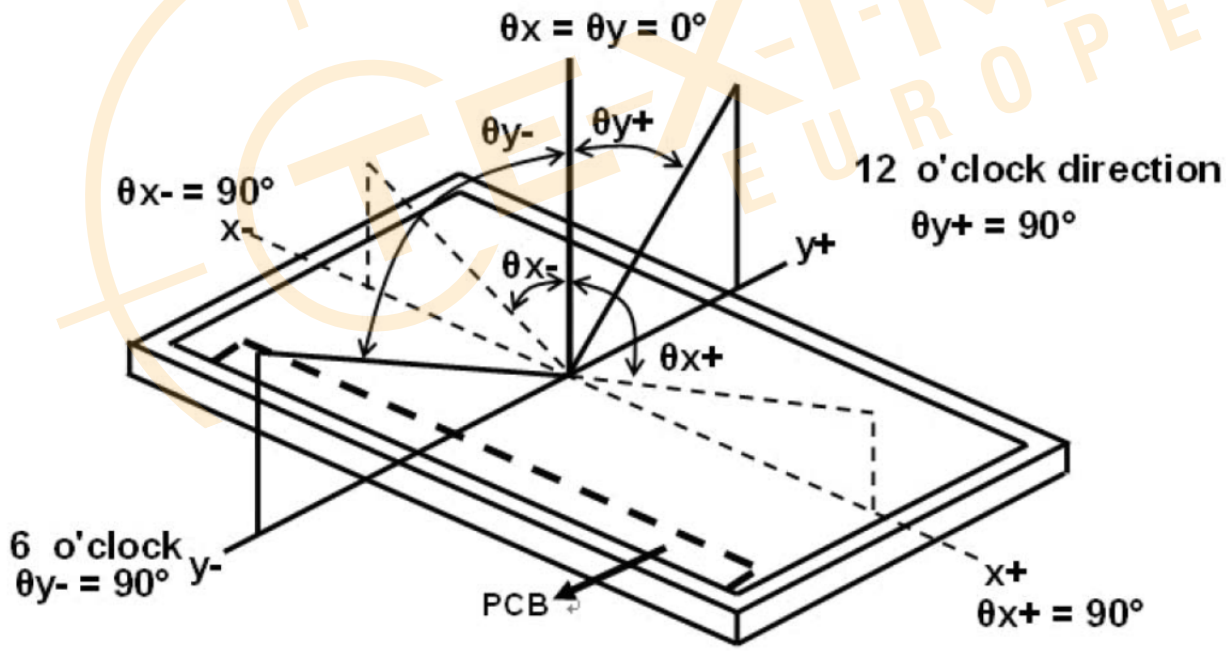



**Figure 5 Definition of Viewing Angle**

Note (4) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression:

Contrast Ratio (CR) = The luminance of White pattern/ The luminance of Black pattern

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

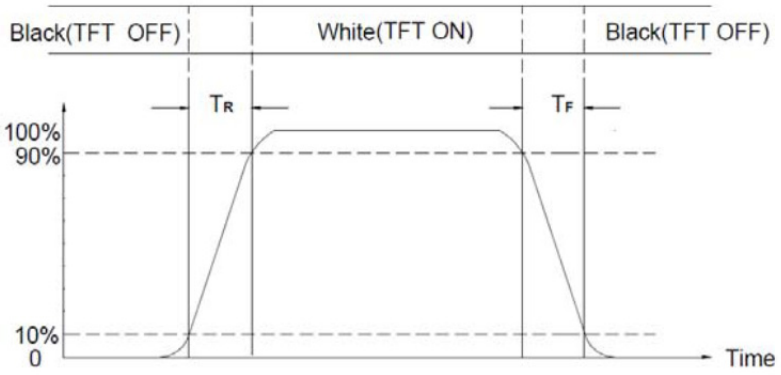



**Figure 6 Definition of Response Time**

Note (6) Definition of Luminance of White

Measure the luminance of White pattern (Ref.: Active Area)

Display Luminance=L1 ( center point )

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

Luminance Uniformity= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)；

H—Active Area Width, V—Active Area Height, L—Luminance

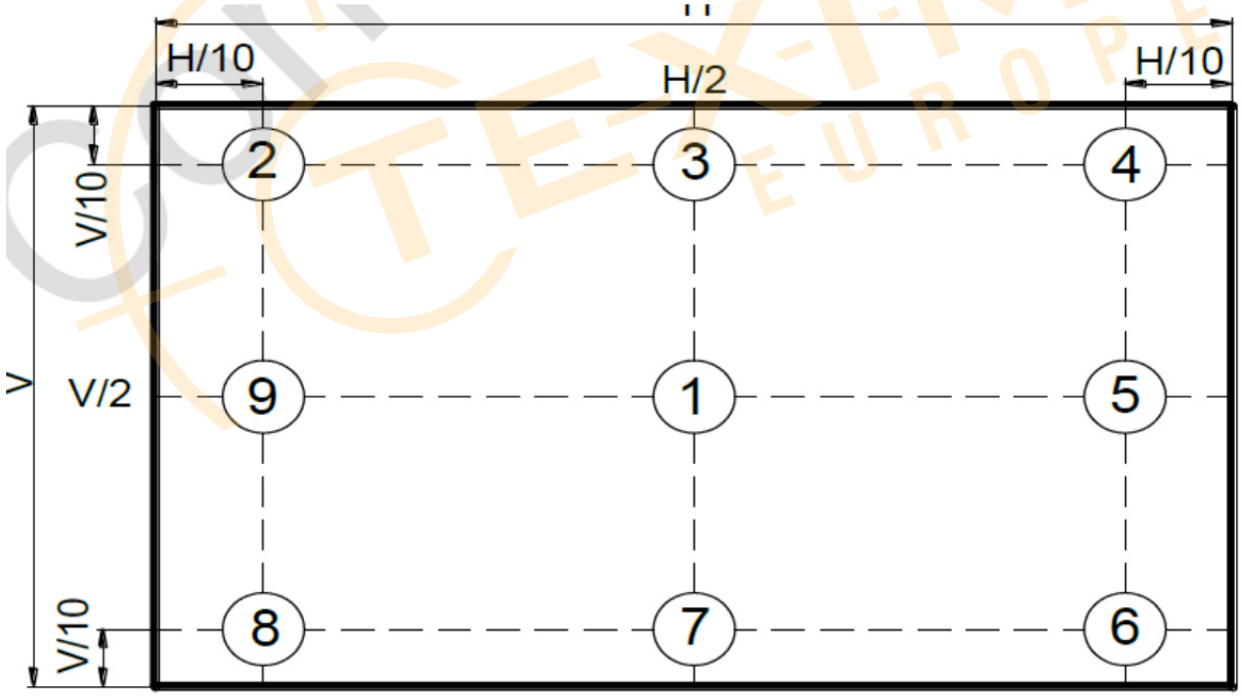



**Figure 7 Measurement Locations of 9 Points**

Note (8) All optical data are based on IVO given system & nominal parameter & testing machine in this document.

# 6. Interface Connections

## 6.1 LVDS

| Item | Description |
|---|---|
| Manufacturer / Type | STM/MSCKT2407P30HB |

| Pin | Name | Description |
|---|---|---|
| 1 | RXinO0- | Negative LVDS differential data input(Odd data) |
| 2 | RXinO0+ | Positive LVDS differential data input( Odd data) |
| 3 | RXinO1- | Negative LVDS differential data input(Odd data) |
| 4 | RXinO1+ | Positive LVDS differential data input( Odd data) |
| 5 | RXinO2- | Negative LVDS differential data input(Odd data,H-Sync, V-Sync, DSPTMG) |
| 6 | RXinO2+ | Positive LVDS differential data input( Odd data,H-Sync, V-Sync, DSPTMG) |
| 7 | GND | Power Ground |
| 8 | RXOCLKIN- | Negative LVDS differential data input(Odd clock) |
| 9 | RXOCLKIN+ | Positive LVDS differential data input( Odd clock) |
| 10 | RXinO3- | Negative LVDS differential data input(Odd data) |
| 11 | RXinO3+ | Positive LVDS differential data input( Odd data) |
| 12 | RXinE0- | Negative LVDS differential data input(Even data) |
| 13 | RXinE0+ | Positive LVDS differential data input(Even data) |
| 14 | GND | Power Ground |
| 15 | RXinE1- | Negative LVDS differential data input(Even data) |
| 16 | RXinE1+ | Positive LVDS differential data input(Even data) |
| 17 | GND | Power Ground |
| 18 | RXinE2- | Negative LVDS differential data input(Even data) |
| 19 | RXinE2+ | Positive LVDS differential data input(Even data) |
| 20 | RxECLKIN- | Negative LVDS differential data input(Even clock) |
| 21 | RxECLKIN+ | Positive LVDS differential data input(Even clock) |
| 22 | RXinE3- | Negative LVDS differential data input(Even data) |
| 23 | RXinE3+ | Positive LVDS differential data input(Even data) |
| 24 | GND | Power Ground |
| 25 | NC | No connect |
| 26 | Bist | For AMPIRE Test Only Bist=1，Panel into BIST Model Bist=0，Normal mode（Default） Suggest Connecting to GND if not used |
| 27 | NC | No connect |
| 28 | VDD | Power 5V |
| 29 | VDD | Power 5V |
| 30 | VDD | Power 5V |

### 6.2 LED

| Item | Description |
|---|---|
| Manufacturer / Type | STM /MS242614RHA |

| CN901 | | |
|---|---|---|
| Pin | Name | Description |
| 1 | VBL | Supply Voltage 24V |
| 2 | VBL | Supply Voltage 24V |
| 3 | VBL | Supply Voltage 24V |
| 4 | VBL | Supply Voltage 24V |
| 5 | VBL | Supply Voltage 24V |
| 6 | GND | Ground |
| 7 | GND | Ground |
| 8 | GND | Ground |
| 9 | GND | Ground |
| 10 | GND | Ground |
| 11 | DET | Ground |
| 12 | EN | BL ON/OFF Enable |
| 13 | NC | NC |
| 14 | PWM | 3.3V PWM Control |

## 7. Reliability Test

The reliability test items and its conditions are shown below.

| Test Item | Test Conditions | Note |
|---|---|---|
| High Temperature Operation | 80±3°C , t=240 hrs | |
| Low Temperature Operation | -10±3°C , t=240 hrs | |
| High Temperature Storage | 80±3°C , t=240 hrs | 1,2 |
| Low Temperature Storage | -20±3°C , t=240 hrs | 1,2 |
| Storage at High Temperature and Humidity | 50°C, 80% RH , 240 hrs | 1,2 |
| Thermal Shock Test | -20°C (30min) ~ 80°C (30min) , 100 cycles | 1,2 |
| Shock (Non-Operating) | Acceleration: 50 G<br>Wave: Half-sine<br>Active Time: 20 ms<br>Direction: ±X, ±Y, ±Z (one time for each Axis) | |
| Vibration (Non-Operating) | Acceleration: 1.5 Grms<br>Wave: Random<br>Frequency: 10 - 200 Hz<br>Duration: 30 Minutes each Axis (X, Y, Z) | |

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 more than one condition, and all the test conditions are independent.

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

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.

# 8 . GENERAL PRECAUTION

## 8.1 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.

## 8.2 Disassembling or Modification

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.

## 8.3 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.

## 8.4 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.

## 8.5 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.

**8.6 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.

**8.7 Mechanism**

Please mount LCD module by using mounting holes arranged in four corners tightly.

**8.8 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.

**8.9 Strong Light Exposure**

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

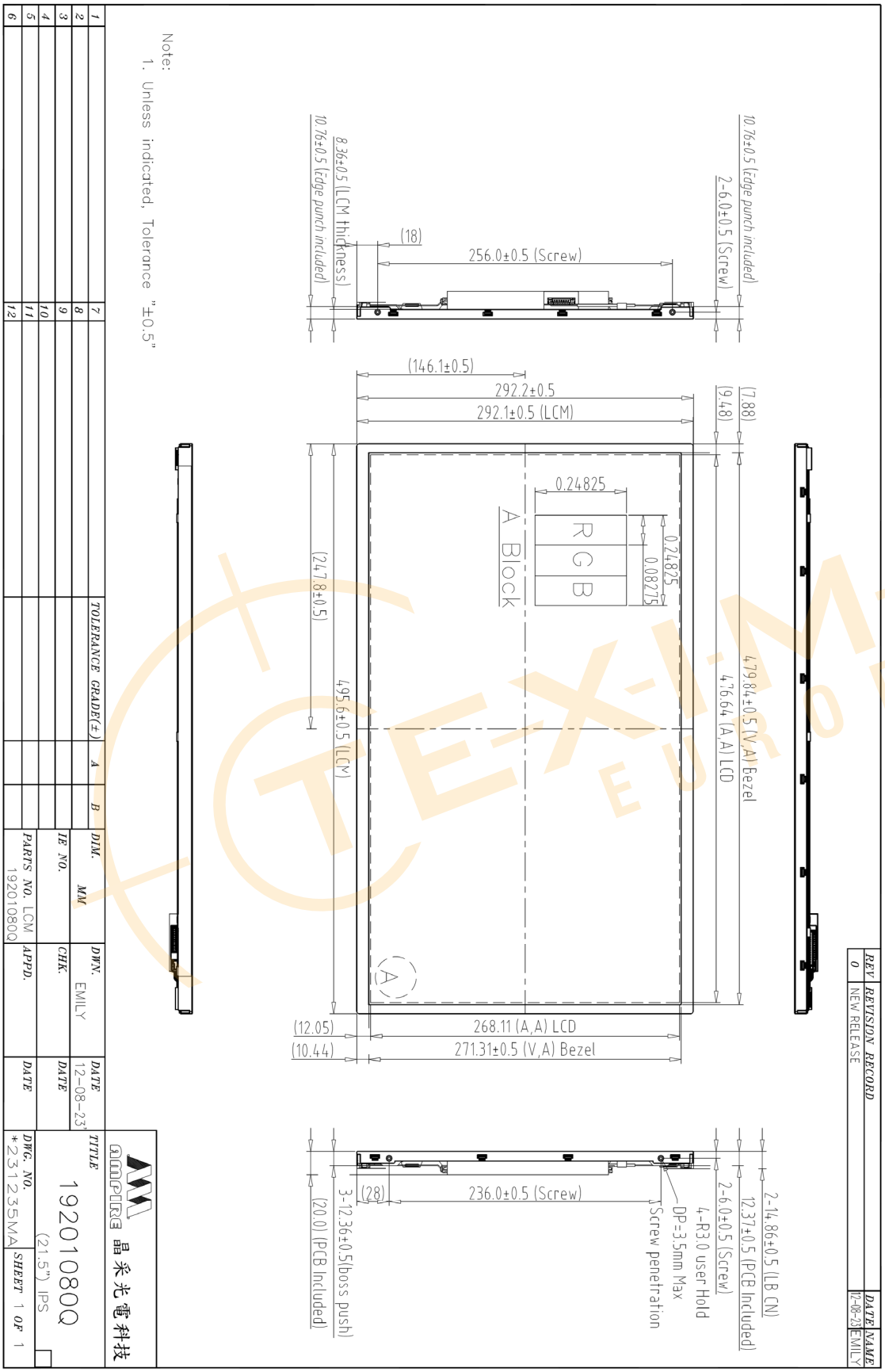
**8.10 Disposal**

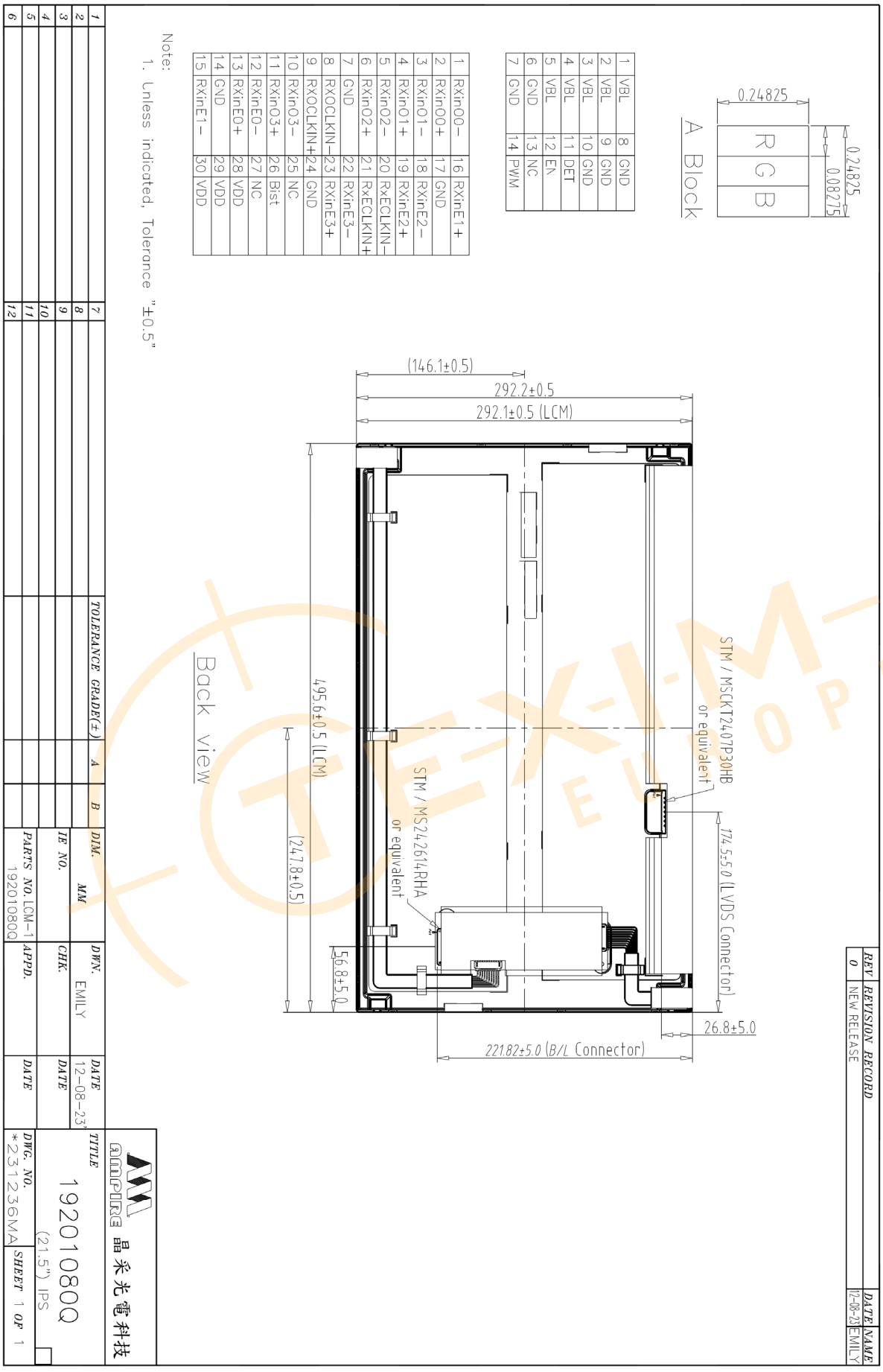
When disposing LCD module, obey the local environmental regulations.

**8.11 Others**

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.

## 9. Outline Dimension





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Please contact us if you have any questions about the contents of the datasheet.

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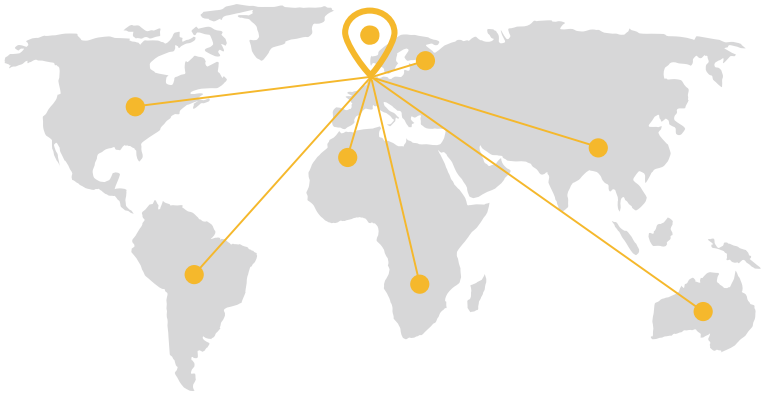
# Texim Europe - contact details



## Headquarters & Warehouse

Elektrostraat 17
NL-7483 PG Haaksbergen
The Netherlands

T: +31 (0)53 573 33 33
E: info@texim-europe.com
Homepage: www.texim-europe.com

### The Netherlands

Elektrostraat 17
NL-7483 PG Haaksbergen

T: +31 (0)53 573 33 33
E: nl@texim-europe.com

### Belgium

Zuiderlaan 14, box 10
B-1731 Zellik

T: +32 (0)2 462 01 00
E: belgium@texim-europe.com

### UK & Ireland

St Mary's House, Church Lane
Carlton Le Moorland
Lincoln LN5 9HS

T: +44 (0)1522 789 555
E: uk@texim-europe.com

### Germany

Bahnhofstrasse 92
D-25451 Quickborn

T: +49 (0)4106 627 07-0
E: germany@texim-europe.com

### Germany

Martin-Kollar-Strasse 9
D-81829 München

T: +49 (0)89 436 086-0
E: muenchen@texim-europe.com

### Austria

Warwitzstrasse 9
A-5020 Salzburg

T: +43 (0)662 216 026
E: austria@texim-europe.com

### Nordic

Stockholmsgade 45
2100 Copenhagen

T: +45 88 20 26 30
E: nordic@texim-europe.com

### Italy

Martin-Kollar-Strasse 9
D-81829 München

T: +49 (0)89 436 086-0
E: italy@texim-europe.com