# 19.0” 1920 x 360 Stretched
# High brightness color TFT-LCD module

**Model: VM19S1 V1**

**Date: Jul. 6th, 2020**

**Note: This specification is subject to change without notice**

| |
|---|
| **Customer：** _____<br><br>**Date：** _____ |

| **Approved** | **Prepared** |
|---|---|
| **Date:** | **Date:** |

# Contents

# RECORD OF REVISION

| Version and Date | Page | Old description | New description | Remark |
|---|---|---|---|---|
| 0.1 2020/03/31 | All | First Edition for customer | | |
| 0.2 2020/07/06 | 5 | LED power：15.8W | LED power 10.14W | |
| | 11 | LED voltage：37.7V | LED voltage：39V | |
| | | LED current：420mA | LED current：260mA | |

# 1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7) Do not open or modify the Module Assembly.
8) Do not press the reflector sheet at the back of the module to any directions.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
10) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. 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.

# 2. General Description

## 2.1 Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support 1920(H) x 360(V) screen and 16.7M colors.

## 2.2 Features

- High brightness display, 1000nits by LED backlight.
- Long operation lifetime BLU design
- Wide operation temperature.
- 1920 x 360 pixel resolution.
- RoHS Compliance

## 2.3 Application

Industrial applications.

2.4 Display specifications

| Items | Unit | Specification |
|---|---|---|
| Screen Diagonal | mm | 19.0 |
| Active Area | mm | 476.64 (H) X 89.37 (V) |
| Pixels H x V | pixels | 1920 x3(RGB) x 360 |
| Pixels Pitch | um | 248.25 (per one triad) x 248.25 |
| Pixel Arrangement | | RGB Vertical stripe |
| Display mode | | Normally Black |
| White luminance (center) | $Cd/m^2$ | 1000 (Typ) |
| Contrast ratio | | 1200:1 (Typ.) |
| Optical Response Time | msec | 30 ms (Typ. On/off) |
| Normal Input Voltage VDD | Volt | 5.0 |
| Power Consumption<br>(Vcc Line + LED backlight) | Watt | 13.14W<br>(VDD line=3.0 W; LED lines= 10.14 W) |
| Weight | Grams | 780 |
| Physical size | mm | 491.5 (W)×109.4 (H)×8.4 (D) |
| Electrical Interface | | 2-ch LVDS |
| Support colors | | 16.7M colors |
| Surface Treatment | | Anti-glare and hard-coating 3H |
| Temperature range<br>Operating<br>Storage | <br>$^0C$<br>$^0C$ | <br>-20 ~ 70 (TFT surface)<br>-20 ~ 70 |
| RoHS Compliance | | RoHS Compliance |

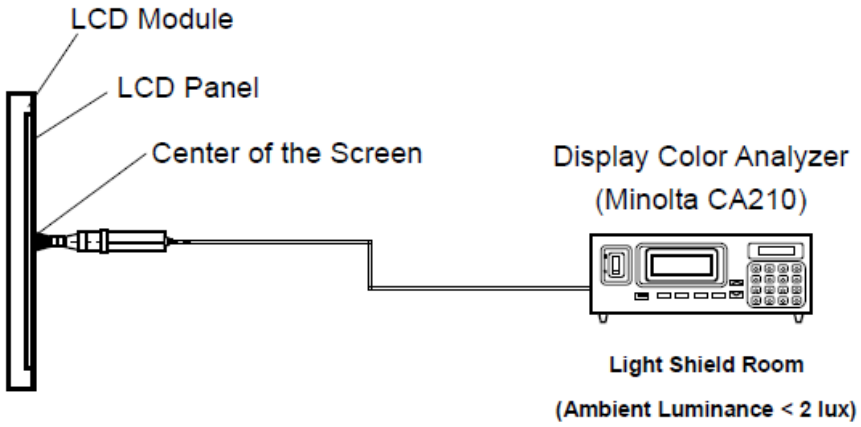
## 2.5 Optical characteristics

The following optical characteristics are measured under stable condition at 25 $^0$C

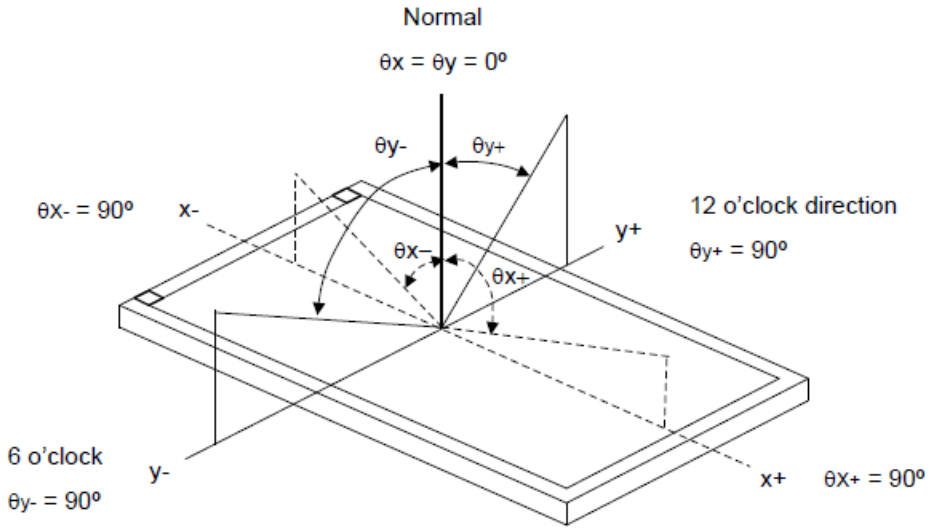
| Items | Unit | Conditions | Min. | Typ. | Max. | Note |
|---|---|---|---|---|---|---|
| Viewing angle | Deg. | Horizontal (Right) | 85 | 89 | | 2 |
| | | CR=10 (Left) | 85 | 89 | | |
| | | Vertical (Up) | 85 | 89 | | |
| | | CR=10 (Down) | 85 | 89 | | |
| Contrast Ratio | | Normal Direction | 900 | 1200 | | 3 |
| Response Time | msec | Raising + Falling | | 30 | 35 | 4 |
| Color / Chromaticity Coordinates (CIE) | | Red x | -0.05 | 0.655 | +0.05 | 5 |
| | | Red y | | 0.328 | | |
| | | Green x | | 0.303 | | |
| | | Green y | | 0.607 | | |
| | | Blue x | | 0.140 | | |
| | | Blue y | | 0.088 | | |
| Color coordinates (CIE) White | | White x | | 0.311 | | |
| | | White y | | 0.326 | | |
| Center Luminance | Cd/m$^2$ | | | 1000 | | 6 |
| Luminance Uniformity | % | | 70 | 75 | | 7 |
| Crosstalk (in 60 Hz) | % | | | | 1.5 | |
| Flicker | dB | | | | -20 | |

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



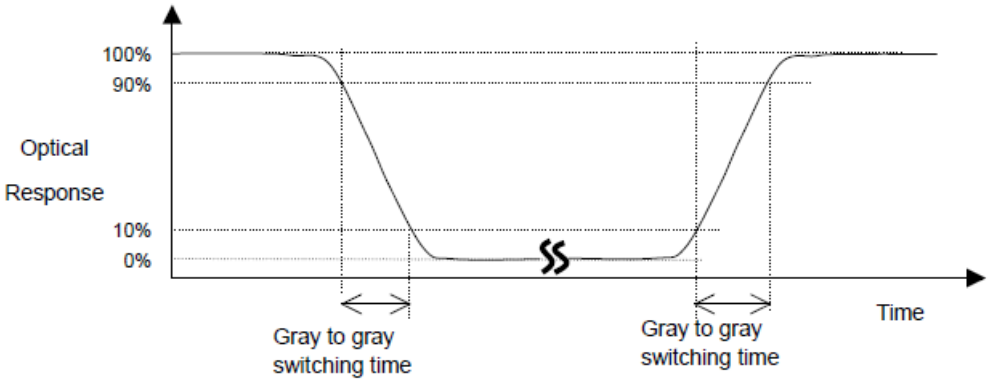

Note 2: Definition of viewing angle




Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

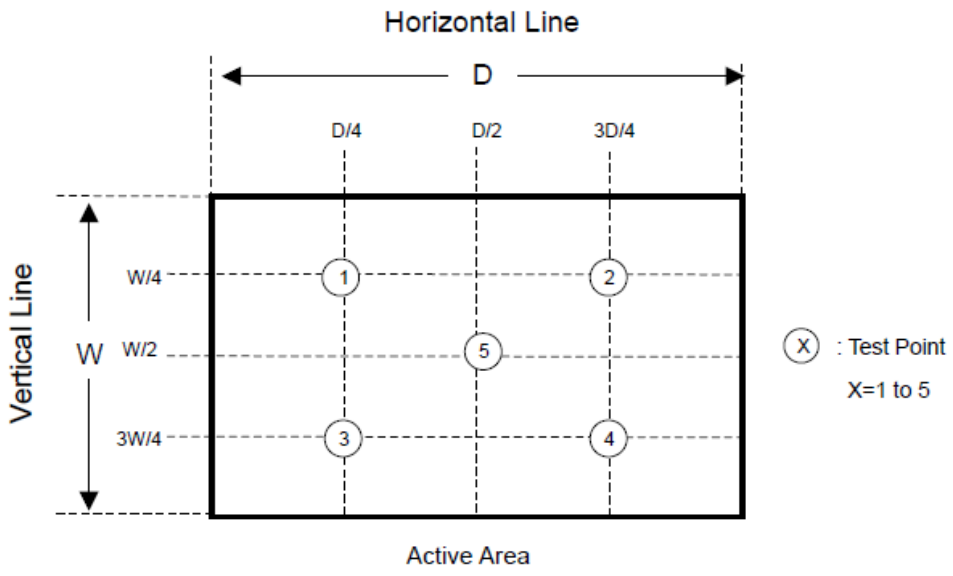
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.




Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA210

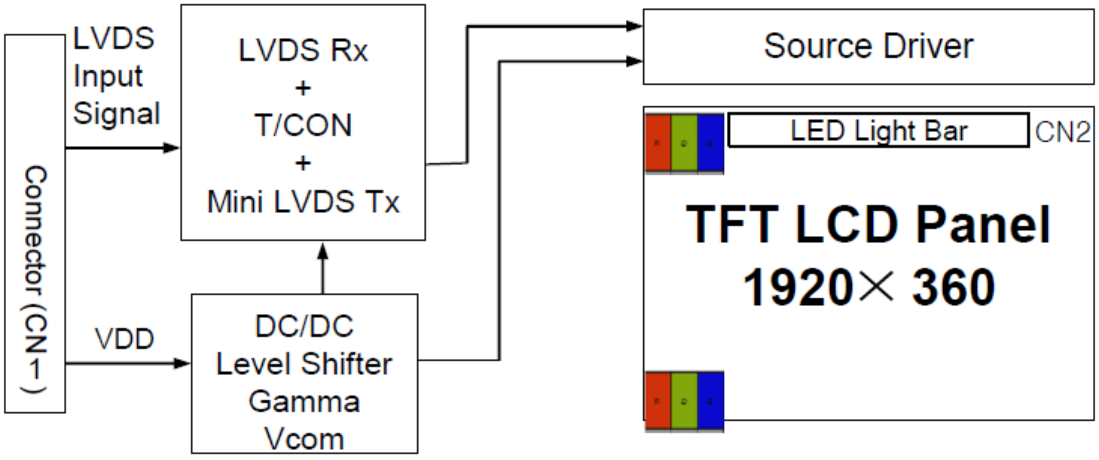
Note 6: Center luminance is measured by Minolta CA210

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210




Uniformity = (Min. Luminance of 5 points) / (Max. Luminance of 5 points)

## 3. Function block diagram



## 4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

### 4.1 TFT LCD module

| Items | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| Power supply voltage | $V_{DD}$ | -0.3 | 7.0 | Volt | Note 1, 2 |
| Logic supply voltage | $V_{IN}$ | $V_{SS}$-0.3 | $V_{DD}$+0.3 | Volt | |

### 4.2 Backlight unit

| Items | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| LED bar input current | | | 840 | mA | |

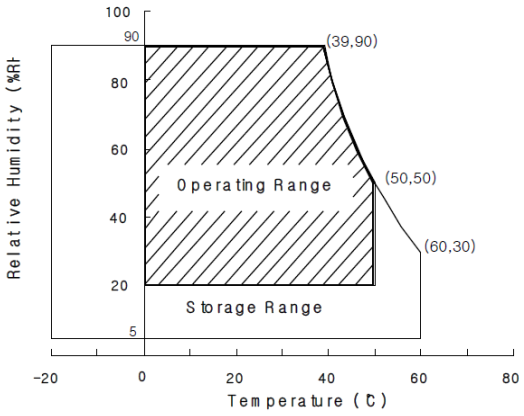
### 4.3 Environment

| Items | Symbol | Values | | | Unit | Conditions |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Operation temperature | $T_{OS}$ | -20 | - | 70 | $^0$C | Note 3 |
| Operation Humidity | $H_{OP}$ | 10 | | 85 | % | |
| Storage temperature | $T_{ST}$ | -20 | | 70 | $^0$C | |
| Storage Humidity | $H_{ST}$ | 5 | | 90 | % | |

Note 1: With in Ta= 25℃

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).



# 5. Electrical characteristics

## 5.1 LCD electronics specification

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[Ta =25±2 ℃]

| Parameter | | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | 4.5 | 5.0 | 5.5 | V | Note1 |
| Power Supply Current | $I_{DD}$ | - | 600 | 800 | mA | |
| In-Rush Current | $I_{RUSH}$ | - | 2 | 3 | A | Note 2 |
| Permissible Input Ripple Voltage | $V_{RF}$ | - | - | 300 | mV | Note1,3 |
| High Level Differential Input Threshold Voltage | $V_{IH}$ | - | - | +100 | mV | |
| Low Level Differential Input Threshold Voltage | $V_{IL}$ | -100 | - | - | mV | |
| Differential input voltage | $\|V_{ID}\|$ | 200 | - | 600 | mV | |
| Differential input common mode voltage | Vcm | 1.0 | 1.2 | 1.5 | | $V_{IH}$=100mV, $V_{IL}$=-100mV |
| Power Consumption | $P_D$ | - | 3.0 | 4.0 | W | @60Hz |

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDD=5.0V, Frame rate=60Hz and Clock frequency = 75.4MHz. Test Pattern of power supply current
a) Typ: Color Test
b) Max: Skip Sub Pixel

a )

b )

2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %
3. Ripple Voltage should be covered by Input voltage Spec.

## 5.2 Backlight unit

| Parameter | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|
| LED voltage (VL) | | 39 | | [V] | 2 |
| LED current (IL) | | 260 | | [mA] | 2, |
| LED Power (PL) | | 10.14 | | [W] | |
| LED Life Time(LTLED) | | 100,000 | | [Hour] | 1 |

Note 1: The “LED lift time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 260 mA

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL = PLED)

## 5.3 Interface connector

### 5.3.1 TFT connector(CN1)

● CN1 Module Side Connector : UJU IS100-30O-C23 or Equivalent
User Side Connector : JAE FI-X30H or Equivalent

| Pin No | Symbol | Function | Remark |
|---|---|---|---|
| 1 | RXO0- | Negative Transmission data of Pixel 0 (ODD) | |
| 2 | RXO0+ | Positive Transmission data of Pixel 0 (ODD) | |
| 3 | RXO1- | Negative Transmission data of Pixel 1 (ODD) | |
| 4 | RXO1+ | Positive Transmission data of Pixel 1 (ODD) | |
| 5 | RXO2- | Negative Transmission data of Pixel 2 (ODD) | |
| 6 | RXO2+ | Positive Transmission data of Pixel 2 (ODD) | |
| 7 | GND | Power Ground | |
| 8 | RXOC- | Negative Transmission Clock (ODD) | |
| 9 | RXOC+ | Positive Transmission Clock (ODD) | |
| 10 | RXO3- | Negative Transmission data of Pixel 3 (ODD) | |
| 11 | RXO3+ | PositiveTransmission data of Pixel 3 (ODD) | |
| 12 | RXE0- | Negative Transmission data of Pixel 0 (EVEN) | |
| 13 | RXE0+ | Positive Transmission data of Pixel 0 (EVEN) | |
| 14 | GND | Power Ground | |
| 15 | RXE1- | Negative Transmission data of Pixel 1 (EVEN) | |
| 16 | RXE1+ | Positive Transmission data of Pixel 1 (EVEN) | |
| 17 | GND | Power Ground | |
| 18 | RXE2- | Negative Transmission data of Pixel 2 (EVEN) | |
| 19 | RXE2+ | Positive Transmission data of Pixel 2 (EVEN) | |
| 20 | RXEC- | Negative Transmission Clock (EVEN) | |
| 21 | RXEC+ | Positive Transmission Clock (EVEN) | |
| 22 | RXE3- | Negative Transmission data of Pixel 3 (EVEN) | |
| 23 | RXE3+ | Positive Transmission data of Pixel 3 (EVEN) | |
| 24 | GND | Power Ground | |
| 25 | CTL | CTL_DVR for LCD manufacturer | |
| 26 | CE | CE_DVR for LCD manufacturer | |
| 27 | NC | Not connection | |
| 28 | VDD1 | Power Supply:+5V | |
| 29 | VDD2 | | |
| 30 | VDD3 | | |

### 5.3.2 Backlight connector(CN2)

Recommended connector : JOIN TEK JT1025-1021 (BHSR-02VS-1 manufactured by JST)

| Pin no | Symbol | I/O | Description | Remark |
|---|---|---|---|---|
| 1 | VLED+ | P | Backlight LED anode | |
| 2 | VLED- | P | Backlight LED cathode | |

# 6. LVDS interface

## 6.1 LVDS interface

| | Input Signal | Transmitter | | Interface | | (CN11) | Remark |
|---|---|---|---|---|---|---|---|
| | | Pin No. | Pin No. | System (Tx) | TFT-LCD (Rx) | Pin No. | |
| EVEN LVDS | ER0 | 51 | 48<br>47 | OUT0-<br>OUT0+ | RXE0-<br>RXE0+ | 12<br>13 | |
| | ER1 | 52 | | | | | |
| | ER2 | 54 | | | | | |
| | ER3 | 55 | | | | | |
| | ER4 | 56 | | | | | |
| | ER5 | 3 | | | | | |
| | EG0 | 4 | | | | | |
| | EG1 | 6 | 46<br>45 | OUT1-<br>OUT1+ | RXE1-<br>RXE1+ | 15<br>16 | |
| | EG2 | 7 | | | | | |
| | EG3 | 11 | | | | | |
| | EG4 | 12 | | | | | |
| | EG5 | 14 | | | | | |
| | EB0 | 15 | | | | | |
| | EB1 | 19 | | | | | |
| | EB2 | 20 | 42<br>41 | OUT2-<br>OUT2+ | RXE2-<br>RXE2+ | 18<br>19 | |
| | EB3 | 22 | | | | | |
| | EB4 | 23 | | | | | |
| | EB5 | 24 | | | | | |
| | Hsync | 27 | | | | | |
| | Vsync | 28 | | | | | |
| | DE | 30 | | | | | |
| | MCLK | 31 | 40<br>39 | CLK OUT-<br>CLK OUT+ | RXE CLK-<br>RXE CLK+ | 20<br>21 | |
| | ER6 | 50 | 38<br>37 | OUT3-<br>OUT3+ | RXE3-<br>RXE3+ | 22<br>23 | |
| | ER7 | 2 | | | | | |
| | EG6 | 8 | | | | | |
| | EG7 | 10 | | | | | |
| | EB6 | 16 | | | | | |
| | EB7 | 18 | | | | | |
| | RSVD | 25 | | | | | |

## 7. Signal timing specification

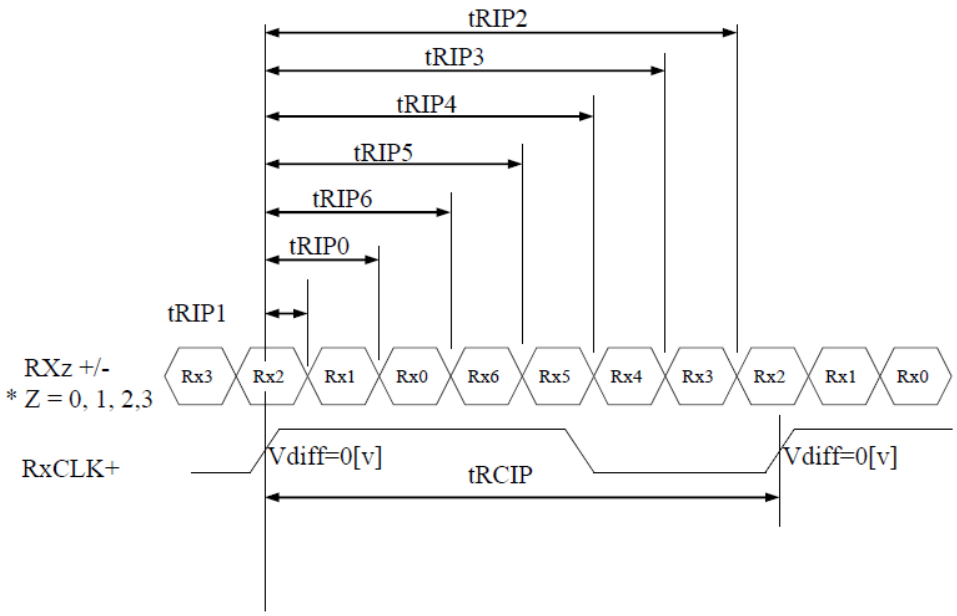
7.1 DE mode

| Item | | Symbols | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | 61.93 | 74.32 | 92.90 | MHz |
| | High Time | Tch | - | 4/7 Tc | - | |
| | Low Time | Tcl | - | 3/7 Tc | - | |
| Frame Period | | Tv | 1091 | 1125 | 1149 | lines |
| | | | 50 | 60 | 75 | Hz |
| | | | 20 | 16.67 | 13.33 | ms |
| Vertical Display Period | | Tvd | - | 1080 | - | lines |
| One line Scanning Period | | Th | 1060 | 1100 | 1200 | clocks |
| Horizontal Display Period | | Thd | - | 960 | - | clocks |
| Modulating frequency of input clock during SSC | | $F_{LVMOD}$(F=85MHz,$V_{IC}$=1.2V,$V_{ID}$=±200mV) | 10 | - | 300 | KHz |
| Maximum deviation of input clock during SSC | | $F_{LVDEV}$(F=85MHz,$V_{IC}$=1.2V,$V_{ID}$=±200mV) | -3 | - | +3 | % |

## 7.2 LVDS Rx interface timing parameter

The specification of the LVDS Rx interface timing parameter is shown as below.

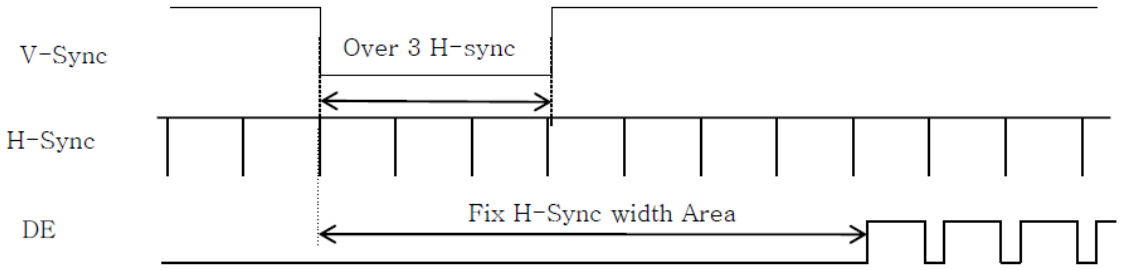
| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| CLKIN Period | tRCIP | 10.60 | 13.25 | 20.00 | nsec | |
| Input Data 0 | tRIP1 | -0.4 | 0.0 | +0.4 | nsec | |
| Input Data 1 | tRIP0 | tRCIP/7-0.4 | tRCIP/7 | tRCIP/7+0.4 | nsec | |
| Input Data 2 | tRIP6 | 2 ×tRCIP/7-0.4 | 2 ×tRCIP/7 | 2 ×tRCIP/7+0.4 | nsec | |
| Input Data 3 | tRIP5 | 3 ×tRCIP/7-0.4 | 3 ×tRCIP/7 | 3 ×tRCIP/7+0.4 | nsec | |
| Input Data 4 | tRIP4 | 4 ×tRCIP/7-0.4 | 4 ×tRCIP/7 | 4 ×tRCIP/7+0.4 | nsec | |
| Input Data 5 | tRIP3 | 5 ×tRCIP/7-0.4 | 5 ×tRCIP/7 | 5 ×tRCIP/7+0.4 | nsec | |
| Input Data 6 | tRIP2 | 6 ×tRCIP/7-0.4 | 6 ×tRCIP/7 | 6 ×tRCIP/7+0.4 | nsec | |




* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

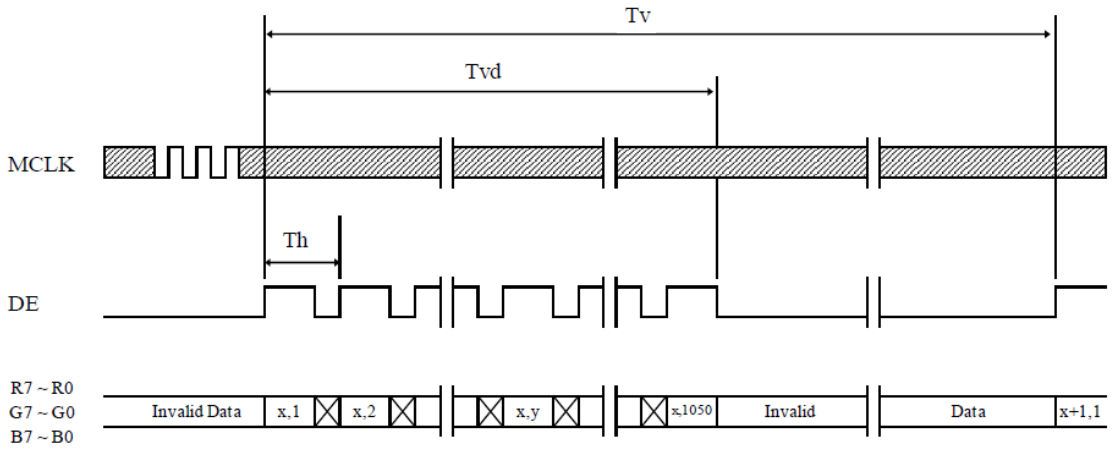
# 8. Signal timing waveforms of interface signal

## 8.1 Sync timing waveforms

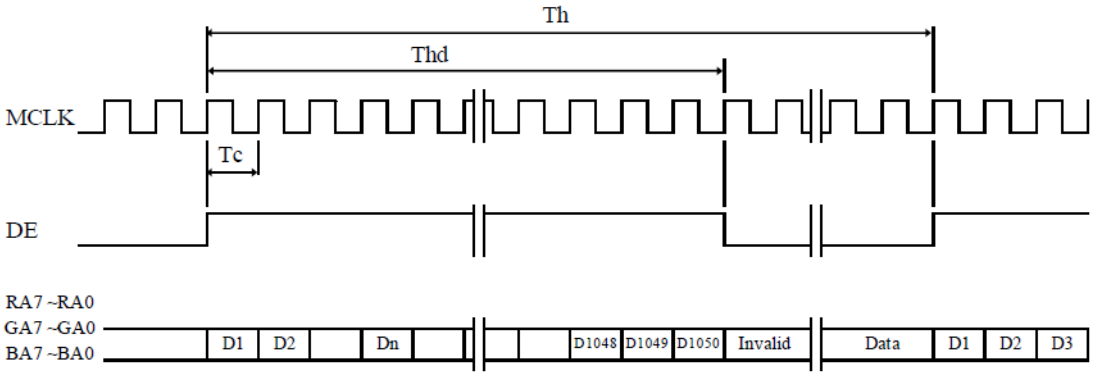


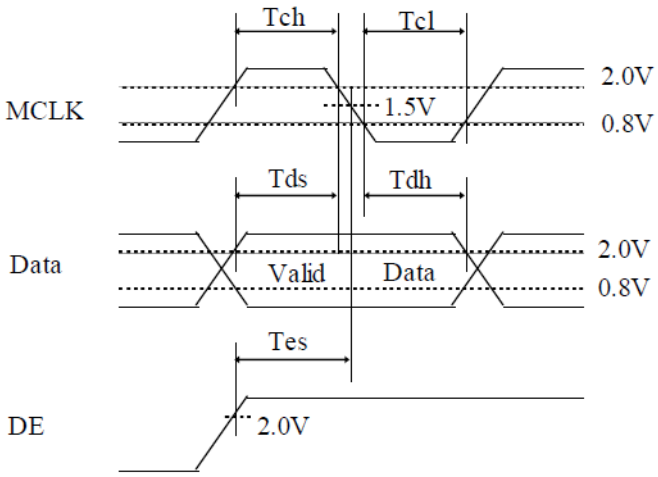

1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

## 8.2 Vertical timing waveforms



## 8.3 Horizontal timing waveforms



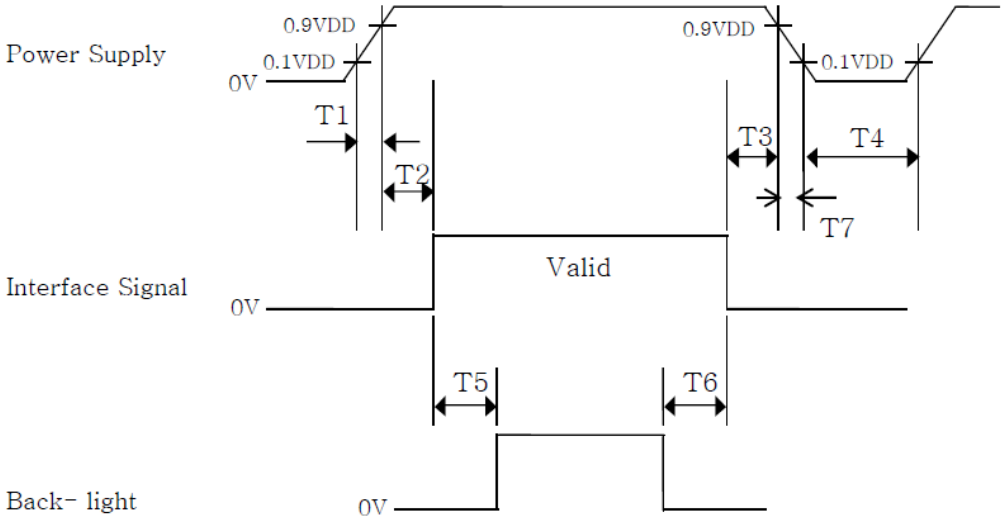



## 9. Input signal basic display colors & gray scale of colors

| Color & Gray Scale | | RED DATA | | | | | | | | GREEN DATA | | | | | | | | BLUE DATA | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale of RED | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | ↑ | | | | | | | | ↑ | | | | | | | | ↑ | | | | | | | |
| | ▽ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | Brighter | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ▽ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of GREEN | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | ↑ | | | | | | | | ↑ | | | | | | | | ↑ | | | | | | | |
| | ▽ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ▽ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of BLUE | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | △ | ↑ | | | | | | | | ↑ | | | | | | | | ↑ | | | | | | | |
| | ▽ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | ▽ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale of WHITE | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | △ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | △ | ↑ | | | | | | | | ↑ | | | | | | | | ↑ | | | | | | | |
| | ▽ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | |
| | Brighter | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | ▽ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## 10. Power sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below




- 0.5 ms ≤ T1 ≤ 10 ms
- 0 ≤ T2 ≤ 50 ms
- 0 ≤ T3 ≤ 50 ms
- 1 sec ≤ T4
- 200 ms ≤ T5
- 200 ms ≤ T6

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.

## 11. Reliability Test

Environment test conditions are listed as following table.

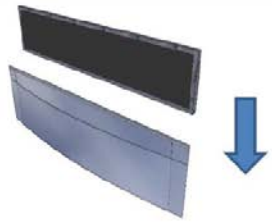
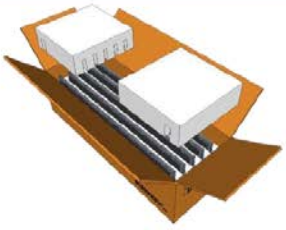
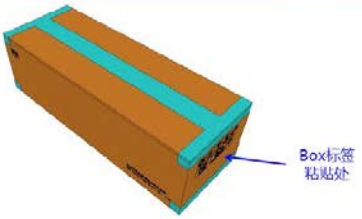
| Items | Required Condition | Note |
|---|---|---|
| Temperature Humidity Bias (THB) | Ta=40℃, 80%RH, 240hours | |
| High Temperature Operation (HTO) | Ts= 70℃, 240hours | 3 |
| Low Temperature Operation (LTO) | Ta= -20℃, 240hours | |
| High Temperature Storage (HTS) | Ta= 70℃, 240hours | |
| Low Temperature Storage (LTS) | Ta= -20℃, 240hours | |
| Thermal Shock Test (TST) | -20℃/30min, 60℃/30min, 100 cycles | |
| On/Off Test | On/10sec, Off/10sec, 30,000 cycles | |
| ESD (ElectroStatic Discharge) | Contact Discharge: ± 8KV, 150pF(330Ω ) 1sec, 9 points, 25 times/ point. | |
| | Air Discharge: ± 15KV, 150pF(330Ω ) 1sec 9 points, 25 times/ point. | |

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -10℃ to 50℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

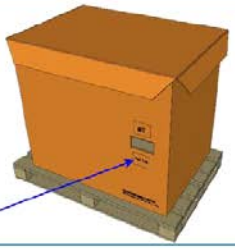
Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3: TFT surface.

## 12. Shipping package

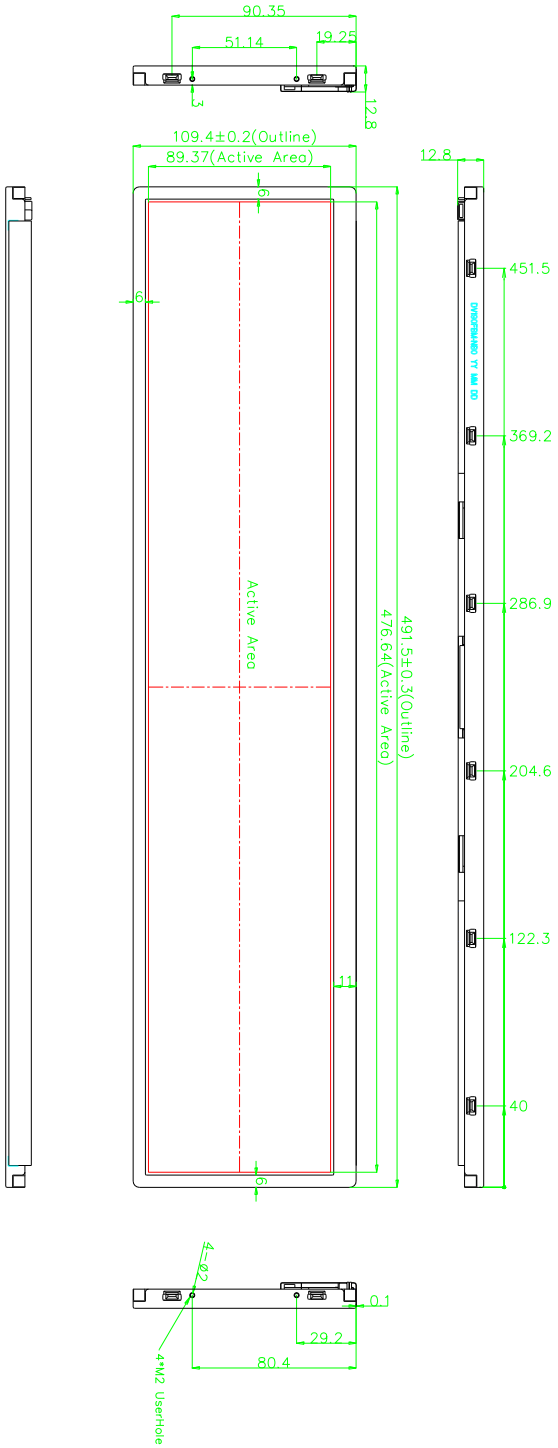
| | |
|---|---|
| 将MDL放入防尘袋内，并用防尘袋自带双面胶封口。**产品PCB侧朝下，封口胶带置于产品金属背板侧。**<br>1 MDL/ Bag | 将Bottom缓冲材放置于箱底，**放置方式详见Cushion Instructions。** |
|  <br>Step 1 |  <br>Step 2 |
| 降装好防尘袋的产品竖直插入缓冲Bottom内。**产品PCB侧朝上。**<br>5 MDL/Inner Box | 加盖缓冲Cover。 |
|  <br>Step 3 |  <br>Step 4 |
| 采用“H”形封箱方式，对Box进行封箱，并在Box的Mark处粘贴相应标签。<br>5 MDL/Inner Box | 按如下图片所示对Inner Box进行码拍。<br>24 Inner Box/Pallet |
|  <br>Step 5 |  <br>Step 6 |

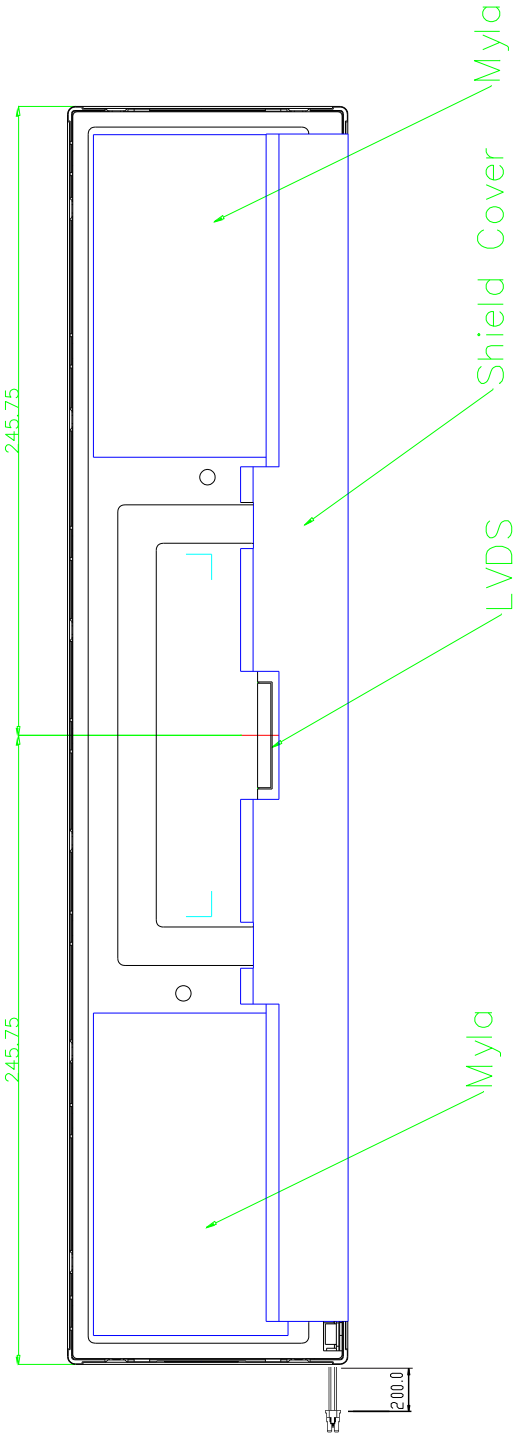
套上Outer Box和Top Cover，用打包带打包，并粘贴相应标签。
120 MDL/Pallet




Step 7

## 13. Mechanical Characteristics




Myla
Shield Cover
LVDS
Myla
245.75
245.75
200.0