# ZTM156HXXE5415

# Final Product Specification

# Rev. 0

## REVISION HISTORY

| Revision No. | Page | Description of Changes | Date | Prepared |
|---|---|---|---|---|
| P0 | 32 | Release | 2023.04.26 | |
| | | | | |
| | | | | |

# Contents

# 1.0 GENERAL DESCRIPTION

## 1.1 Introduction

ZTM156HXXE5415 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 15.6 inch diagonally measured active area with Full-HD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.2M(6bit+FRC) colors and color gamut 45%. The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for Notebook PC. The LED driver for back-light driving is built in this model.
All input signals are eDP1.2 interface compatible.

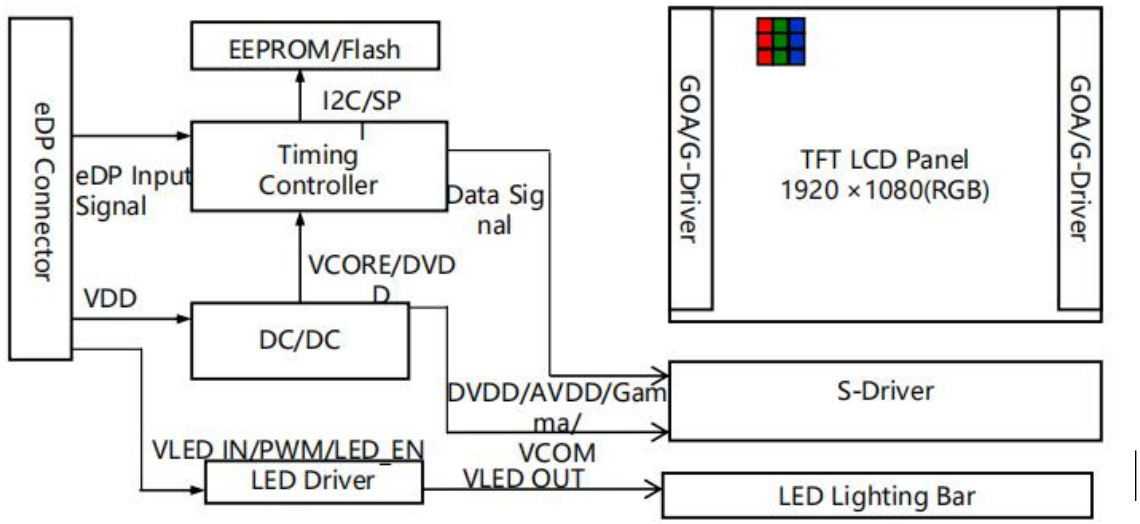



Figure 1. Drive Architecture

## 1.2 Features

- 2 lane eDP interface with 2.7Gbps link rates
- Thin and light weight
- 16.2M(6 bit+FRC) color depth, color gamut 45%
- Single LED lighting bar (Bottom side/Horizontal Direction)
- Data enable signal mode
- Green product (RoHS & Halogen free product)
- On board LED driving circuit
- Low driving voltage and low power consumption
- On board EDID chip

### 1.3 Application

- Notebook PC (Wide type)

### 1.4 General Specification

The followings are general specifications at the model ZTM156HXXE5415(listed in Table 1)

<Table 1. General Specifications>

| Parameter | Specification | Unit | Remarks |
|---|---|---|---|
| Active area | 344.16(H)x193.59(V) | mm | |
| Number of pixels | 1920 (H) xRGB(3)x1080 (V) | pixels | |
| Pixel pitch | 179.25(H)x179.25(V) | um | |
| Pixel arrangement | RGB Vertical stripe | | |
| Display colors | 16.2M(6bit+FRC) | | |
| Color gamut | 45% | | |
| Display mode | Normally Black | | |
| Dimensional outline | 350.66(H)*214.16(V) (PCB)*2.75(D)<br>350.66(H)*205.23(V) (W/PCB)*2.75(D) | mm | |
| Weight | -(max) | g | |
| Surface treatment | Anti-Glare | | |
| Power consumption | $P_D$ : 0.75(Max) | W | @Mosaic |
| | $P_{BL}$ :3.456(Max) | W | |
| | $P_{Total}$ : 4.2(Max) | W | @Mosaic |

## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

Ta=25+/-2°C

| Parameter | Symbol | Min. | Max. | Unit | Remarks |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | -0.3 | 4.0 | V | Note 1 |
| BLU Power Supply Voltage | $V_{BL}$ | -0.3 | 26 | V | |
| Operating Temperature | $T_{OP}$ | 0 | +50 | °C | Note 2 |
| Storage Temperature | $T_{ST}$ | -20 | +60 | °C | |

Notes :
1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.
2. Temperature and relative humidity range are shown in the figure below.
90 % RH Max. ( 40 °C ≥ Ta) Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C )
No condensation.

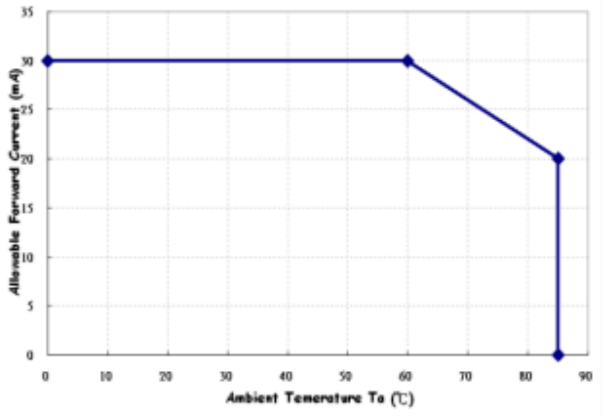



Figure 2. forward current vs ambient temperature

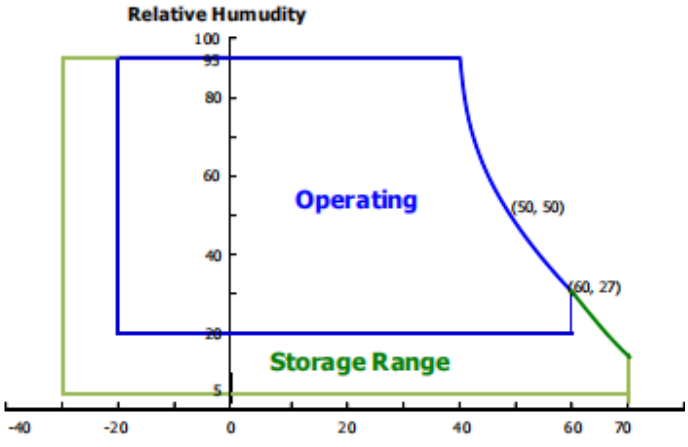



Figure 3. Operation temperature vs Humudity

# 3.0 ELECTRICAL SPECIFICATIONS

## 3.1 Electrical Specifications

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | VCCS | 3.0 | 3.3 | 3.6 | V | (1) |
| BIST Control Level | | BIST on | 2.4 | 3.3 | 3.6 | V | (1) |
| | | BIST off | 0 | - | 0.4 | V | (1) |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mV | (1) |
| Inrush Current | | $I_{RUSH}$ | - | - | 1.5 | A | (1)(2) |
| Power Supply Current | Mosaic | - | - | 180 | 228 | mA | (3) |

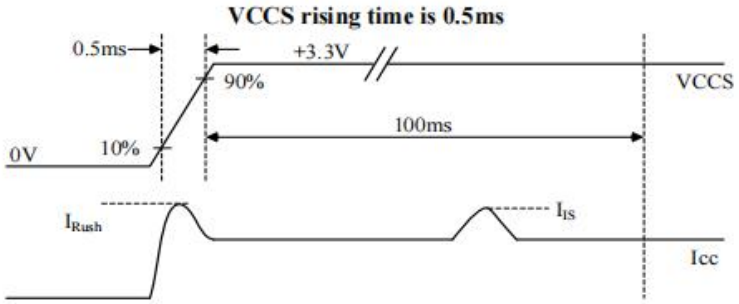
Note (1) The ambient temperature is Ta = 25 ± 2 °C.

Note (2) $I_{RUSH}$: the maximum current when VCCS is rising

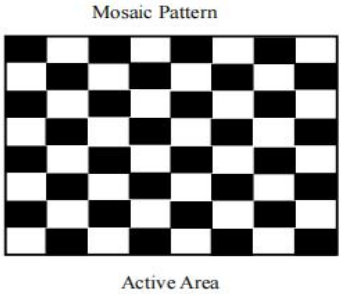
$I_{IS}$: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure.

Test pattern: Mosaic




Note (3) The specified power supply current is under the conditions at VCCS = 3.3 V, Ta = 25 ± 2 °C, DC Current and $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.



### 3.2 Backlight Unit

< Table 4. LED Driving Guideline Specifications > Ta=25+/-2°C

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Converter Input power supply voltage | | LED_Vccs | 5.0 | 12.0 | 21.0 | V | |
| Converter Inrush Current | | $ILED_{RUSH}$ | - | - | 1.5 | A | (1) |
| EN Control Level | Backlight On | | 1.5 | - | 3.6 | V | |
| | Backlight Off | | 0 | - | 0.5 | V | |
| PWM Control Level | PWM High Level | | 1.5 | - | 3.6 | V | |
| | PWM Low Level | | 0 | - | 0.5 | V | |
| PWM Control Duty Ratio | | | 1 | - | 100 | % | |
| PWM Control Permissive Ripple Voltage | | $V_{PWM\_pp}$ | - | - | 100 | mV | |
| PWM Control Frequency | | $f_{PWM}$ | 200 | - | 2000 | Hz | |
| LED Power consumption | | $P_L$ | - | - | 3.3 | W | (2) |
| LED Power Current | LED_VCCS =Typ. | ILED | - | - | 275 | mA | (3) |

Note (1) $ILED_{RUSH}$: the maximum current when LED_VCCS is rising,

$ILED_{IS}$: the maximum current of the first 100ms after power-on,

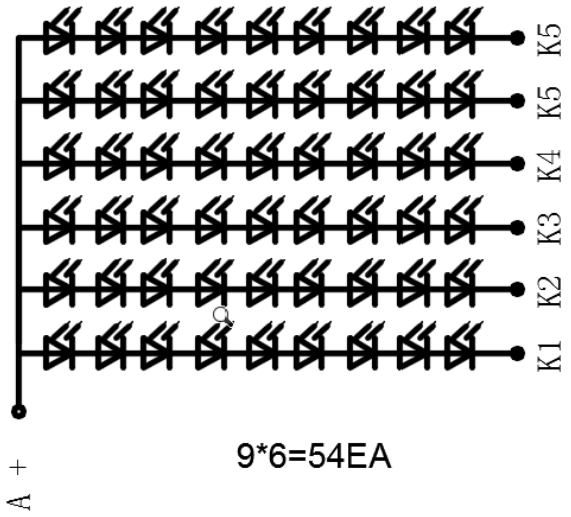
Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 °C, $f_{PWM}$ = 200 Hz, Duty=100%.

**VLED rising time is 0.5ms**

Notes :

1. $ILED_{RUSH}$:the maximum current when LED_VCCS is rising.
2. $P_L=I_L$ x $V_L$(With LED converter transfer efficiency)
3. The specified LED power supply current is under the conditions at"LED_VCCS=Typ",Ta=25±2℃, fPWM=200Hz, Duty=100%.

**3.3 LED Structure**




LED CIRCUIT DIAGRAM:9*6=54EA

Figure 6. LED Structure

# 4.0 OPTICAL SPECIFICATION

## 4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance □ 1 lux and temperature = 25□2℃) with the equipment of luminance meter system (CA310) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0□ We refer to θØ=0 (=θ3 ) as the 3 o'clock direction (the "right"), θØ=90 (= θ12 ) as the 12 o'clock direction ("upward"), θØ=180 (= θ9 ) as the 9 o'clock direction ("left") and θØ=270(= θ6 ) as the 6 o'clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.3+/- 0.3V at 25□C. Optimum viewing angle direction is 6 'clock.

## 4.2 Optical Specifications

<Table 5. Optical Specifications>

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle Range | Horizontal | $\Theta_3$ | CR > 10 | 80 | 85 | - | Deg. | Note 1 |
| | | $\Theta_9$ | | 80 | 85 | - | Deg. | |
| | Vertical | $\Theta_{12}$ | | 80 | 85 | - | Deg. | |
| | | $\Theta_6$ | | 80 | 85 | - | Deg. | |
| Luminance Contrast Ratio | | CR | Θ = 0□ | 800 | 1000 | - | | Note 2 |
| Luminance of White | 5 Points | $Y_w$ | Θ = 0□ $I_{LED}$ = 20mA | 260 | 300 | - | cd/m² | Note 3 |
| White Luminance Uniformity | 5 Points | ΔY5 | | 75 | - | - | % | Note 4 |
| | 13 Points | ΔY13 | | 60.5 | - | - | % | |
| White Chromaticity | | $W_x$ | Θ = 0□ | 0.283 | 0.313 | 0.343 | - | Note 5 |
| | | $W_y$ | | 0.299 | 0.329 | 0.359 | - | |
| Reproduction of Color | Red | $R_x$ | Θ = 0□ | Typ.-0.03 | 0.603 | Typ.+0.03 | - | - |
| | | $R_y$ | | | 0.351 | | - | - |
| | Green | $G_x$ | | | 0.368 | | - | - |
| | | $G_y$ | | | 0.551 | | - | - |
| | Blue | $B_x$ | | | 0.144 | | - | - |
| | | $B_y$ | | | 0.126 | | - | - |
| Color Gamut | | - | - | 42 | 45 | - | % | - |
| Response Time (Rising + Falling) | | $T_{RT}$ | Ta= 25℃ Θ = 0□ | - | 20 | 25 | ms | Note 6 |
| Cross Talk | | CT | Θ = 0□ | - | - | 2 | % | Note 7 |

Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 7).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see Figure 7) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as luminance values of 5 point average across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in Figure 8 for a total of the measurements per display.

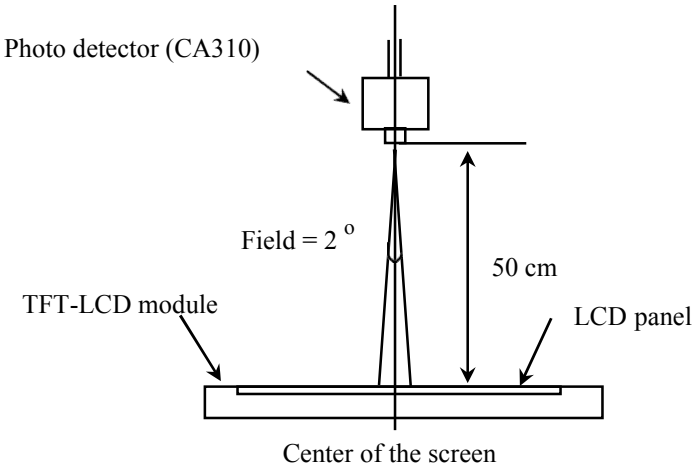
4. The White luminance uniformity on LCD surface is then expressed as : ΔY =Minimum Luminance of 5(or 13) points / Maximum Luminance of 5(or 13) points.(see Figure 8 and Figure 9).

5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The electro-optical response time measurements shall be made as Figure 10 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is $T_f$, and 90% to 10% is $T_r$.

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 10±1mm diameter area, with all display pixels set to gray 127(of 0 to 255), to the luminance (YB) of that same area when any adjacent area is driven dark.The luminance ratio shall not exceed 1:1.05 (See Figure 11).

**4.3 Optical Measurements**




Optical characteristics measurement setup

Figure 7. Measurement Set Up

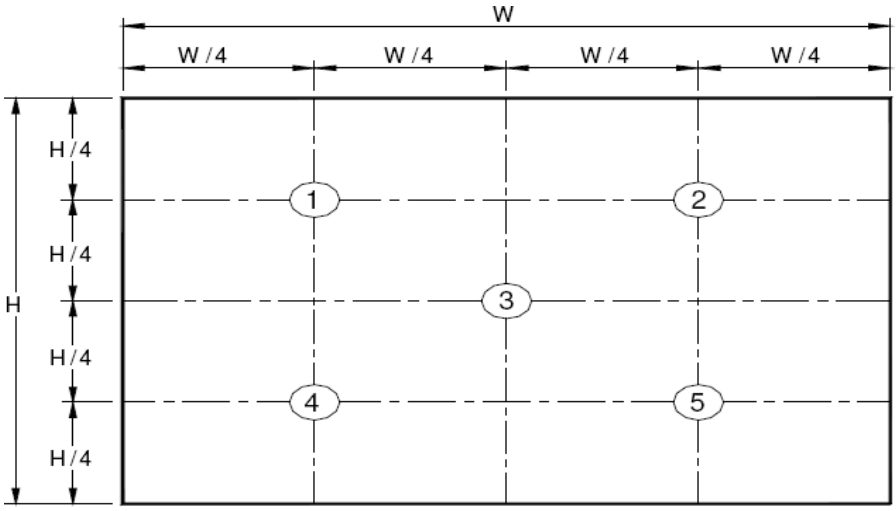



Figure 8. White Luminance and Uniformity Measurement Locations (5 points)

Center Luminance of white is defined as luminance values of center 5 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in Figure 7 for a total of the measurements per display.

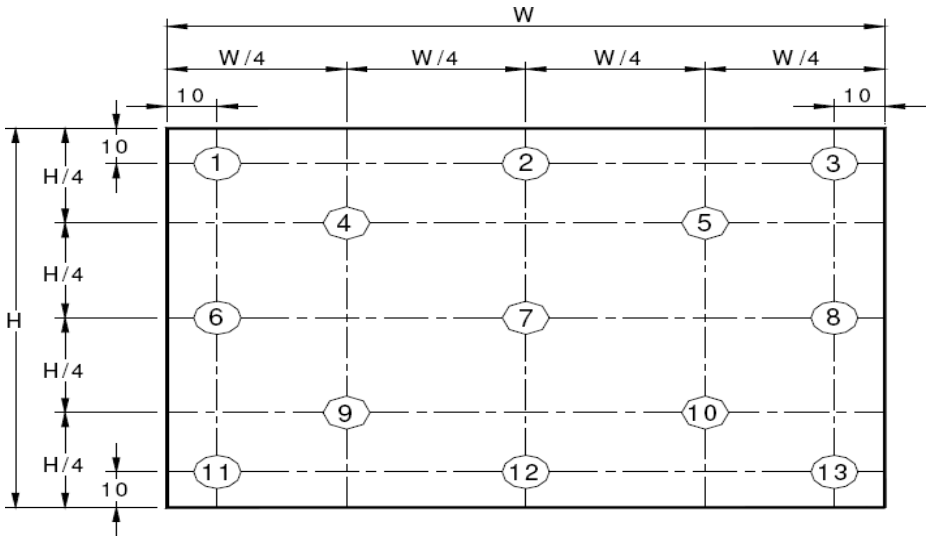



Figure 9. Uniformity Measurement Locations (13 points)

The White luminance uniformity on LCD surface is then expressed as : ΔY5 = Minimum Luminance of five points / Maximum Luminance of five points (see Figure 8) , ΔY13 = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see Figure 9).

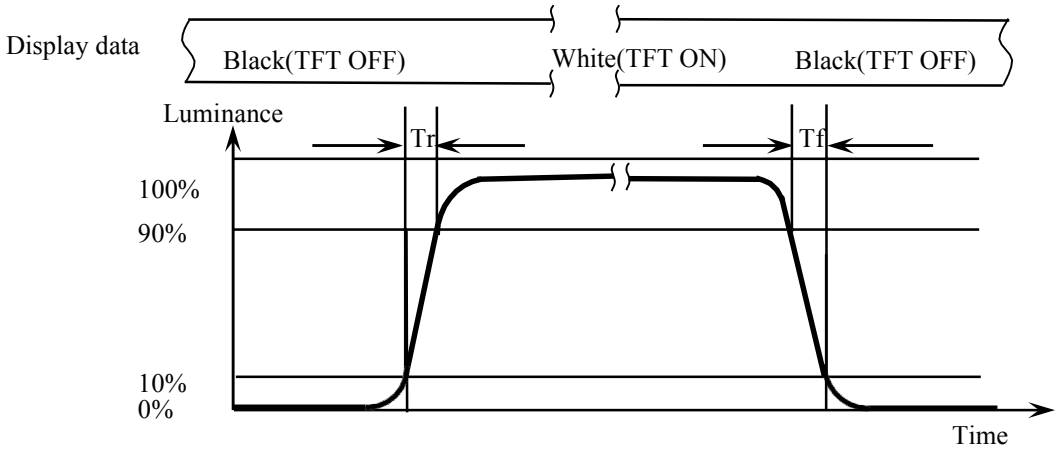
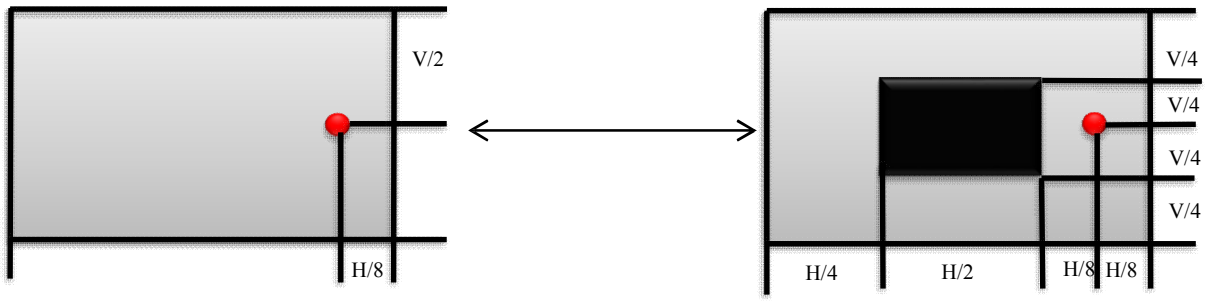



Figure 10. Response Time Testing

The electro-optical response time measurements shall be made as shown in Figure 10 by switching the “data” input signal ON and OFF. Tr: The luminance to change from 10% to 90% ,Tf: The luminance to change from 90% to 10% .

The test system : CA310




$$\text{Cross Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_B} \right| \times 100$$

Figure 11. Cross Talk Modulation Test Description

Where:

$Y_A$ = Initial luminance of measured area (cd/m$^2$)

$Y_B$ = Subsequent luminance of measured area (cd/m$^2$)

The location measured will be exactly the same in both patterns. The test background gray is L127.

Cross Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 10±1mm diameter area, with all display pixels set to a gray level 127, to the luminance (YB) of that same area when any adjacent area is driven dark.(Refer to Figure 11)
The test system: CA310

# 5.0 INTERFACE CONNECTION

## 5.1 Electrical Interface Connection

The electronics interface connector is STM MSAK24025P30.
The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

| Terminal | Symbol | Functions |
|---|---|---|
| Pin No. | Symbol | Description |
| 1 | NC | No Connection |
| 2 | H_GND | Ground |
| 3 | LANE1_N | eDP RX Channel 1 Negative |
| 4 | LANE1_P | eDP RX Channel 1 Positive |
| 5 | H_GND | Ground |
| 6 | LANE0_N | eDP RX Channel 0 Negative |
| 7 | LANE0_P | eDP RX Channel 0 Positive |
| 8 | H_GND | Ground |
| 9 | AUX_CH_P | eDP AUX CH Positive |
| 10 | AUX_CH_N | eDP AUX CH Negative |
| 11 | H_GND | Ground |
| 12 | LCD_VCC | Power Supply, 3.3V (typ.) |
| 13 | LCD_VCC | Power Supply, 3.3V (typ.) |
| 14 | BIST | Built-In Self Test（active high） |
| 15 | H_GND | Ground |
| 16 | H_GND | Ground |
| 17 | HPD | Hot Plug Detect Output |
| 18 | BL_GND | LED Ground |
| 19 | BL_GND | LED Ground |
| 20 | BL_GND | LED Ground |
| 21 | BL_GND | LED Ground |
| 22 | BL_ENABLE | LED Enable Pin(+3.3V Input) |
| 23 | BL_PWM | System PWM Signal Input |
| 24 | NC | No Connection |
| 25 | NC | No Connection |
| 26 | BL_POWER | LED Power Supply 5V-21V |
| 27 | BL_POWER | LED Power Supply 5V-21V |
| 28 | BL_POWER | LED Power Supply 5V-21V |
| 29 | BL_POWER | LED Power Supply 5V-21V |
| 30 | NC | No Connection |

**5.2 eDP Interface**

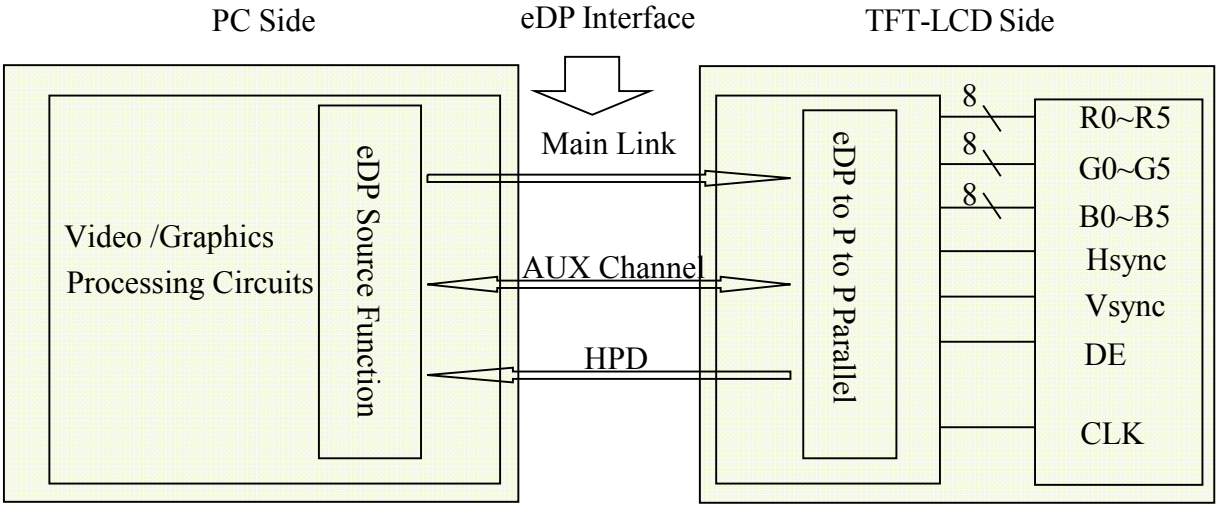



Figure 12. eDP Interface Architecture

Note:
Transmitter :
Transmitter is not contained in module.

### 5.3 Data Input Format

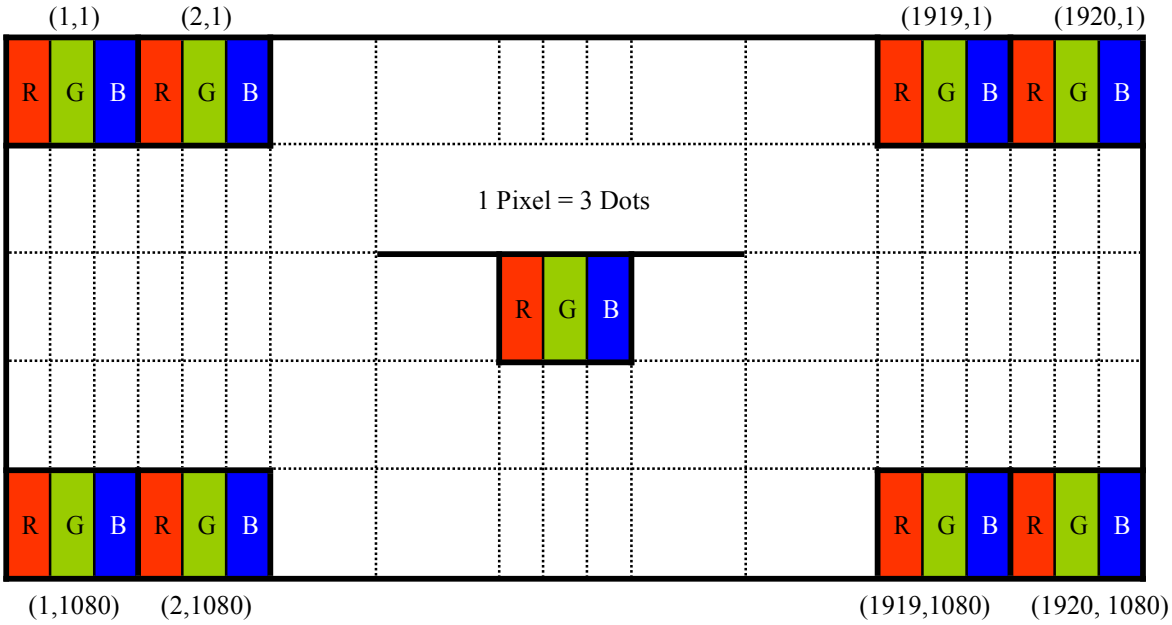
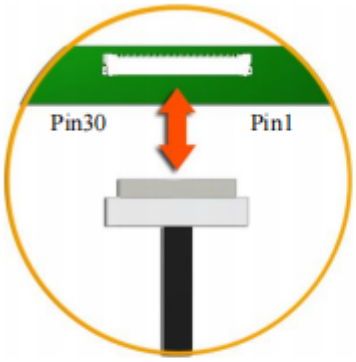



Figure 13. Display Position of Input Data (V-H)

### 5.4 Back-light & LCM Interface Connection

BLU Interface Connector:




Please refer Appendix Outline Drawing for detail design.

Connector Part No.: 300E30-1010RC-G3(Starconn)

<Table 7. Pin Assignments for the BLU Connector>

# 6.0 SIGNAL TIMING SPECIFICATION

## 6.1 The ZTM156HXXE5415 Is Operated

< Table 8. Signal Timing Specification >

The input signal timing specification is showed as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| DCLK | Frequency | 1/Tc | - | 138.5 | - | MHz | - |
| DE | Vertical Total Time | TV | - | 1111 | - | TH | - |
| | Vertical Active Display Period | TVD | 1080 | 1080 | 1080 | TH | - |
| | Vertical Active Blanking Period | TVB | - | 31 | - | TH | - |
| | Horizontal Total Time | TH | - | 2080 | - | Tc | - |
| | Horizontal Active Display Period | THD | 1920 | 1920 | 1920 | Tc | - |
| | Horizontal Active Blanking Period | THB | - | 160 | - | Tc | - |

Note : The above is as optimized setting.

### 6.2 eDP Rx Interface Timing Parameter

The specification of the eDP Rx interface timing parameter is shown in Table 9.

<Table 9. eDP Main-Link RX TP4 Package Pin Parameters>

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Spread spectrum clock (Link clock down-spreading) | ssc | 0 | - | 0.5 | % | |
| Differential peak-to-peak input voltage at package pins | $V_{RX-DIFFp-p}$ | 100 | - | 1320 | mV | |
| Rx input DC common mode voltage | $V_{RX\_DC\_CM}$ | 0 | - | 2 | V | |
| Differential termination resistance | $R_{RX-DIFF}$ | 80 | - | 120 | Ω | |
| Single-ended termination resistance | $R_{RX-SE}$ | 40 | - | 60 | Ω | |
| Rx short circuit current limit | $I_{RX\_SHORT}$ | - | - | 50 | mA | |
| Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR | $L_{RX\_SKEW\_INTRA\_PAIR}$ | - | - | 60 | ps | |

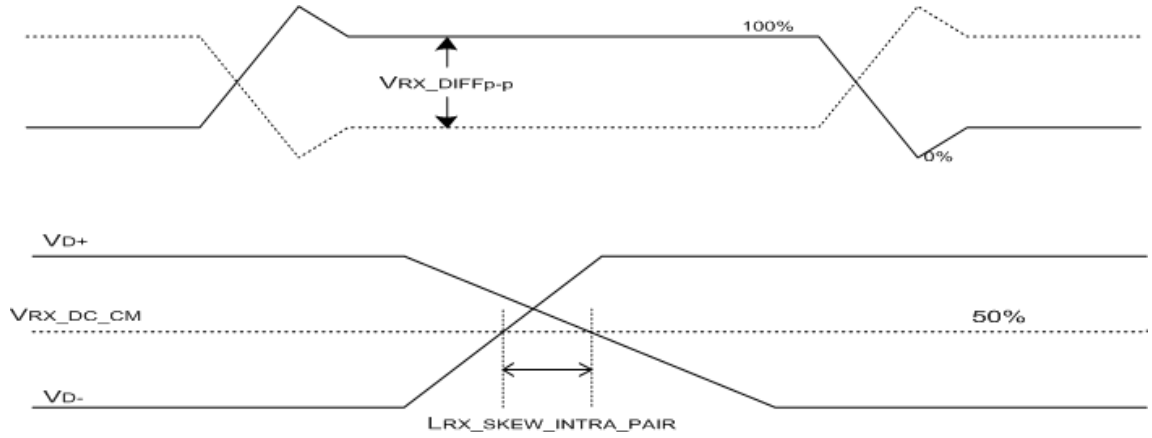



Figure 14. $V_{RX-DIFFp-p}$ & $L_{RX\_SKEW\_INTRA\_PAIR}$

# 7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

<Table 10. Input Signal & Basic Display Colors & Gray Scale of Colors >

| | Colors & Grayscale | Data signal | | |
|---|---|---|---|---|
| | | R0 R1 R2 R3 R4 R5 | G0 G1 G2 G3 G4 G5 | B0 B1 B2 B3 B4 B5 |
| Basic colors | Black | 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 | 1 1 1 1 1 1 |
| | Green | 0 0 0 0 0 0 | 1 1 1 1 1 1 | 0 0 0 0 0 0 |
| | Light Blue | 0 0 0 0 0 0 | 1 1 1 1 1 1 | 1 1 1 1 1 1 |
| | Red | 1 1 1 1 1 1 | 0 0 0 0 0 0 | 0 0 0 0 0 0 |
| | Purple | 1 1 1 1 1 1 | 0 0 0 0 0 0 | 1 1 1 1 1 1 |
| | Yellow | 1 1 1 1 1 1 | 1 1 1 1 1 1 | 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 |
| Gray scale of Red | Black | 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 0 |
| | Darker | 0 1 0 0 0 0 | 0 0 0 0 0 0 | 0 0 0 0 0 0 |
| | △ ▽ | ↑ ↓ | ↑ ↓ | ↑ ↓ |
| | Brighter | 1 0 1 1 1 1 | 0 0 0 0 0 0 | 0 0 0 0 0 0 |
| | ▽ | 0 1 1 1 1 1 | 0 0 0 0 0 0 | 0 0 0 0 0 0 |
| | Red | 1 1 1 1 1 1 | 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 | 1 0 0 0 0 0 | 0 0 0 0 0 0 |
| | Darker | 0 0 0 0 0 0 | 0 1 0 0 0 0 | 0 0 0 0 0 0 |
| | △ ▽ | ↑ ↓ | ↑ ↓ | ↑ ↓ |
| | Brighter | 0 0 0 0 0 0 | 1 0 1 1 1 1 | 0 0 0 0 0 0 |
| | ▽ | 0 0 0 0 0 0 | 0 1 1 1 1 1 | 0 0 0 0 0 0 |
| | Green | 0 0 0 0 0 0 | 1 1 1 1 1 1 | 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 | 1 0 0 0 0 0 |
| | Darker | 0 0 0 0 0 0 | 0 0 0 0 0 0 | 0 1 0 0 0 0 |
| | △ ▽ | ↑ ↓ | ↓ ↓ | ↑ ↓ |
| | Brighter | 0 0 0 0 0 0 | 0 0 0 0 0 0 | 1 0 1 1 1 1 |
| | ▽ | 0 0 0 0 0 0 | 0 0 0 0 0 0 | 0 1 1 1 1 1 |
| | Blue | 0 0 0 0 0 0 | 0 0 0 0 0 0 | 1 1 1 1 1 1 |
| Gray scale of White & Black | Black | 0 0 0 0 0 0 | 0 0 0 0 0 0 | 0 0 0 0 0 0 |
| | △ | 1 0 0 0 0 0 | 1 0 0 0 0 0 | 1 0 0 0 0 0 |
| | Darker | 0 1 0 0 0 0 | 0 1 0 0 0 0 | 0 1 0 0 0 0 |
| | △ ▽ | ↑ ↓ | ↑ ↓ | ↑ ↓ |
| | Brighter | 1 0 1 1 1 1 | 1 0 1 1 1 1 | 1 0 1 1 1 1 |
| | ▽ | 0 1 1 1 1 1 | 0 1 1 1 1 1 | 0 1 1 1 1 1 |
| | White | 1 1 1 1 1 1 | 1 1 1 1 1 1 | 1 1 1 1 1 1 |

## 8.0 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.

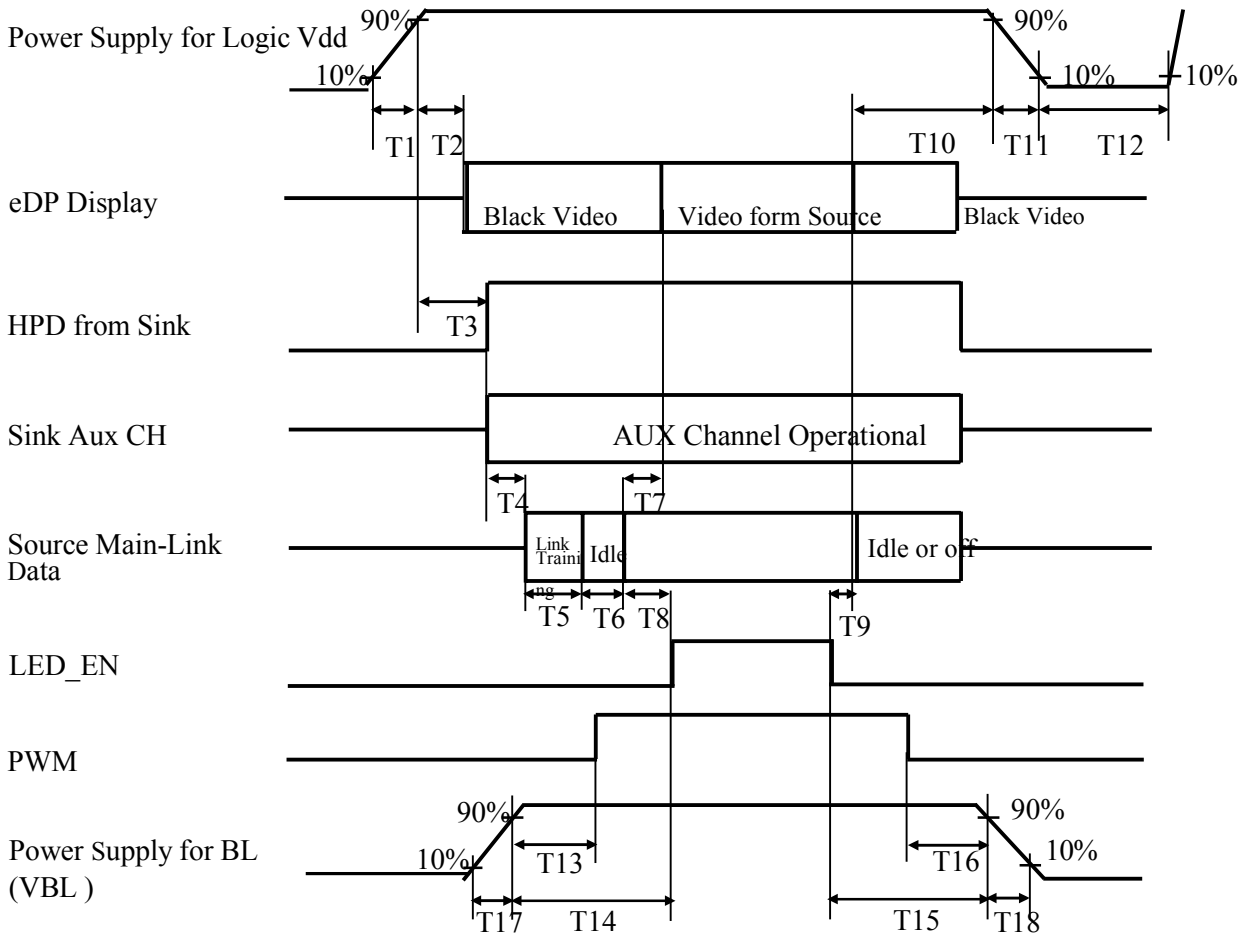



Figure 15. Power Sequence

- 0.5ms □ T1 □ 10 ms
- 0ms < T2 □ 200 ms
- 0ms < T3 □ 200 ms
- 0ms < T13
- 0ms < T7 □ 50ms
- 80ms < T8
- 0ms < T9
- 0ms < T10 < 500 ms
- 0.5ms □ T11 □ 10 ms
- 500ms □ T12
- 0ms < T14
- 1ms < T15
- 1ms < T16
- 0ms □ T17
- 0ms □ T18

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. Back Light must be turn on after power for logic and interface signal are valid.

# 9.0 Connector Description

Physical interface is described as for the connector on LCM.
These connectors are capable of accommodating the following signals and will be following components.

## 9.1 TFT LCD Module

< Table 11. Signal Connector >

| Connector Name /Description | For Signal Connector |
|---|---|
| Manufacturer | - |
| Type/ Part Number | - |
| Mating Housing/ Part Number | - |

# 10.0 MECHANICAL CHARACTERISTICS

## 10.1 Dimensional Requirements

Figure 23 shows mechanical outlines for the model ZTM156HXXE5415.
Other parameters are shown in Table 12.

<Table 12. Dimensional Parameters>

| Parameter | Specification | Unit |
|---|---|---|
| Active Area | 344.16 (H) ×193.59 (V) | mm |
| Number of pixels | 1920 (H) X 1080 (V) (1 pixel = R + G + B dots) | pixels |
| Pixel pitch | 179.25 X 179.25 | um |
| Pixel arrangement | RGB Vertical stripe | |
| Display colors | 16.2M(6bit+FRC) | |
| Display mode | Normally black | |
| Dimensional outline | - | mm |
| Weight | -(Max) | g |

## 10.2 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an Anti-Glare coating to minimize reflection and to reduce scratching.
The polarizer hardness is 3H.

## 10.3 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

## 11.0 RELIABILITY TEST

The reliability test items and its conditions are shown in below.

<Table 13. Reliability Test>

| Test Item | Test Condition | Remark |
|---|---|---|
| High Temperature Storage | Ta=60℃; 120hrs | IEC60068-2-1：2007<br>GB2423.2-2008 |
| Low Temperature Storage | Ta=-20℃;120hrs | IEC60068-2-1：2007<br>GB2423.1-2008 |
| High Temperature Operation | Ta=50℃，120Hrs | IEC60068-2-1：2007<br>GB2423.2-2008 |
| Low Temperature Operation | Ta=-0℃; 120hrs | IEC60068-2-1：2007<br>GB2423.1-2008 |
| High Temperature High Humidity Operation | Ta=40℃，90%RH，120Hrs(no condensation) | IEC60068-2-78：2001<br>GB/T2423.3-2006 |
| Thermal Shock | -20℃(0.5h) ~ 60℃ (0.5h) / 96 cycles | Start with cold temperature，<br>End with high temperature，<br>IEC60068-2-14:1984,GB2423.22-2002 |
| Image Sticking | 25℃；0.5hrs | Note1 |

## 12.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module

 Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module

 As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.

 As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.

 As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.

 Do not pull the interface connector in or out while the LCD module is operating.

 Put the module display side down on a flat horizontal plane.

 Handle connectors and cables with care.

(3) Cautions for the operation

 When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.

 Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(4) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics

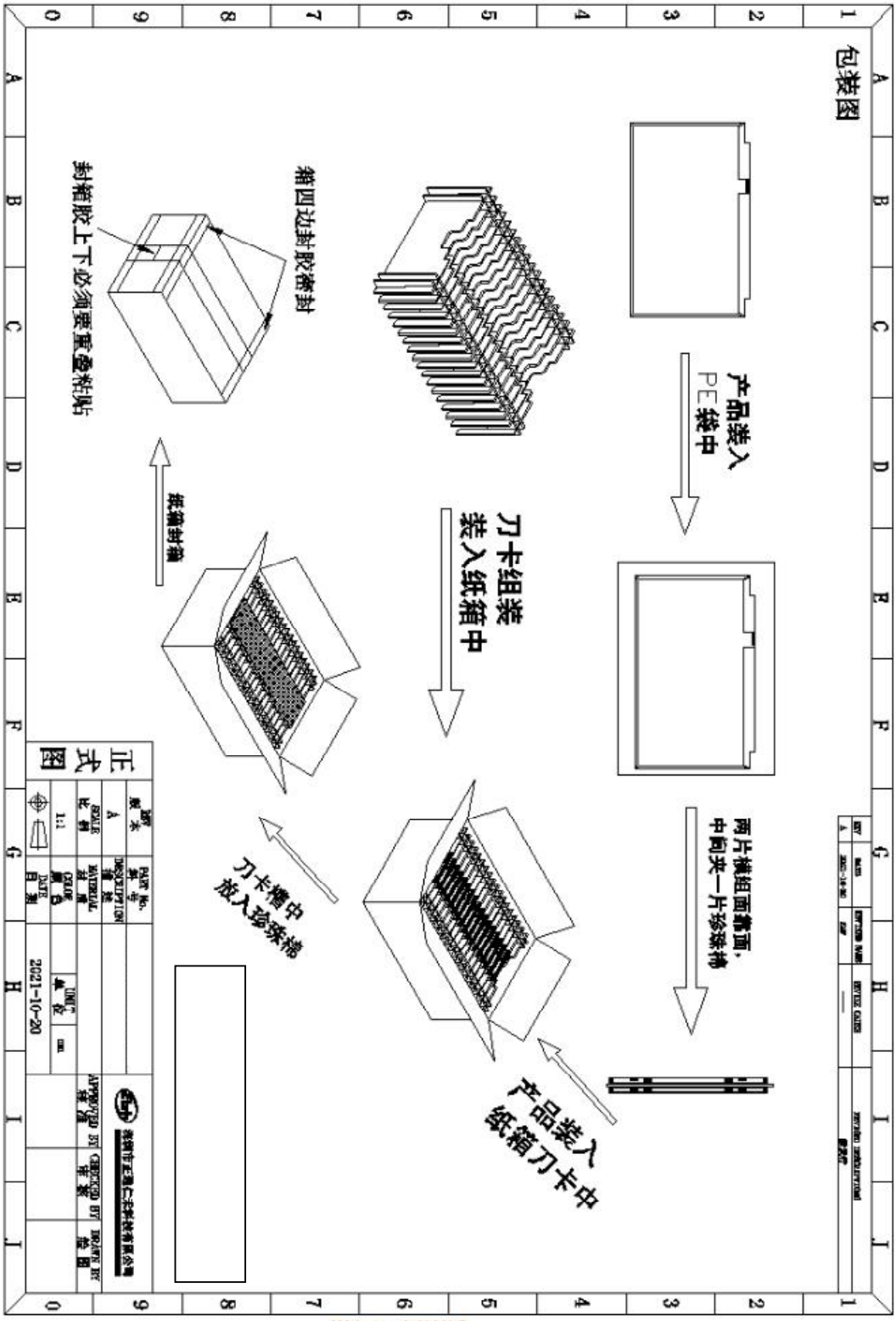
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions

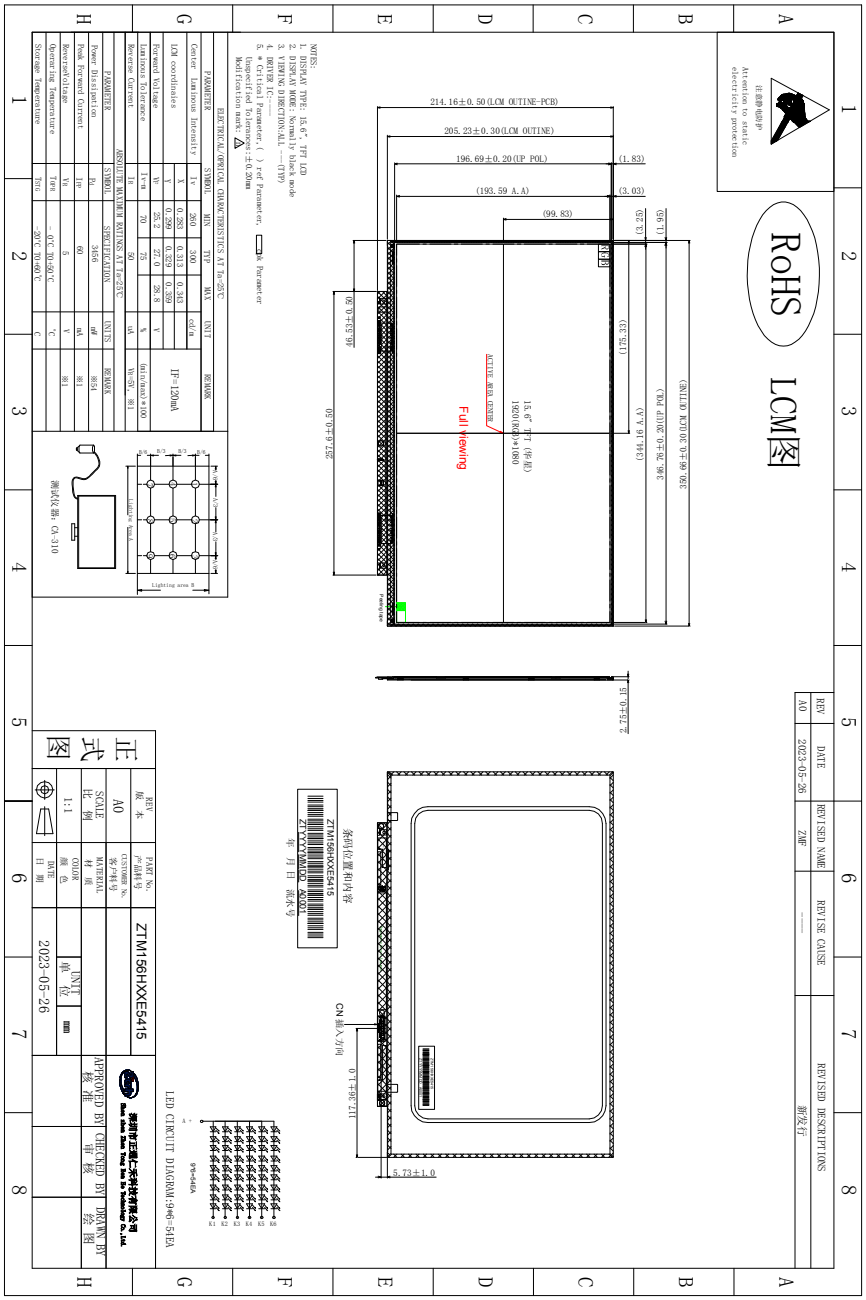
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc. Please pack the module not to be broken. We recommend to use the original shipping packages.

# 13.0 PACKING INGORMATION

## 13.1 Packing Order



# 14.0 MECHANICAL OUTLINE DIMENSION




| SPEC. NUMBER | SPEC. TITLE | PAGE |
|---|---|---|
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## 15.0 EDID Table

| Address (DEC) | Address (HEX) | Field Name & Comments | Set Value (HEX) | Set Value (BIN) | Set Value (DEC) |
|---|---|---|---|---|---|
| 0 | 0 | Header | 00 | 00000000 | 0 |
| 1 | 1 | Header | FF | 11111111 | 255 |
| 2 | 2 | Header | FF | 11111111 | 255 |
| 3 | 3 | Header | FF | 11111111 | 255 |
| 4 | 4 | Header | FF | 11111111 | 255 |
| 5 | 5 | Header | FF | 11111111 | 255 |
| 6 | 6 | Header | FF | 11111111 | 255 |
| 7 | 7 | Header | 00 | 00000000 | 0 |
| 8 | 8 | EISA Manuf. Code LSB | 0E | 00001110 | 14 |
| 9 | 9 | Compressed ASCII | 6F | 01101111 | 111 |
| 10 | 0A | Product Code | 0B | 00001011 | 11 |
| 11 | 0B | hex, LSB first | 15 | 00010101 | 21 |
| 12 | 0C | 32-bit ser # | 00 | 00000000 | 0 |
| 13 | 0D | ID S/N - option | 00 | 00000000 | 0 |
| 14 | 0E | ID S/N - option | 00 | 00000000 | 0 |
| 15 | 0F | ID S/N - option | 00 | 00000000 | 0 |
| 16 | 10 | Week of manufacture | 03 | 00000011 | 3 |
| 17 | 11 | Year of manufacture | 21 | 00100001 | 33 |
| 18 | 12 | EDID Structure Ver | 01 | 00000001 | 1 |
| 19 | 13 | EDID revision # | 04 | 00000100 | 4 |
| 20 | 14 | Video input def. | A5 | 10100101 | 165 |
| 21 | 15 | Max H image size | 22 | 00100010 | 34 |

| | | | | | |
|---|---|---|---|---|---|
| 22 | 16 | Max V image size | 13 | 00010011 | 19 |
| 23 | 17 | Display Gamma | 78 | 01111000 | 120 |
| 24 | 18 | Feature support ( no DPMS, Active off, RGB, timing BLK 1) | 03 | 00000011 | 3 |
| 25 | 19 | Red/Green Low bits (RxRy/GxGy) | 2C | 00101100 | 44 |
| 26 | 1A | Blue/White Low bits (BxBy/WxWy) | C5 | 11000101 | 197 |
| 27 | 1B | Red X Rx | 94 | 10010100 | 148 |
| 28 | 1C | Red Y Ry | 5C | 01011100 | 92 |
| 29 | 1D | Green X Gx | 59 | 01011001 | 89 |
| 30 | 1E | Green Y Gy | 95 | 10010101 | 149 |
| 31 | 1F | Blue X Bx | 29 | 00101001 | 41 |
| 32 | 20 | Blue Y By | 1E | 00011110 | 30 |
| 33 | 21 | White X Wx | 50 | 01010000 | 80 |
| 34 | 22 | White Y Wy | 54 | 01010100 | 84 |
| 35 | 23 | Established timings 1 | 00 | 00000000 | 0 |
| 36 | 24 | Established timing 2 | 00 | 00000000 | 0 |
| 37 | 25 | Established timing 3 | 00 | 00000000 | 0 |
| 38 | 26 | Standard timing #1 | 01 | 00000001 | 1 |
| 39 | 27 | Standard timing #1 | 01 | 00000001 | 1 |
| 40 | 28 | Standard timing #2 | 01 | 00000001 | 1 |
| 41 | 29 | Standard timing #2 | 01 | 00000001 | 1 |
| 42 | 2A | Standard timing #3 | 01 | 00000001 | 1 |
| 43 | 2B | Standard timing #3 | 01 | 00000001 | 1 |
| 44 | 2C | Standard timing #4 | 01 | 00000001 | 1 |
| 45 | 2D | Standard timing #4 | 01 | 00000001 | 1 |
| 46 | 2E | Standard timing #5 | 01 | 00000001 | 1 |
| 47 | 2F | Standard timing #5 | 01 | 00000001 | 1 |
| 48 | 30 | Standard timing #6 | 01 | 00000001 | 1 |
| 49 | 31 | Standard timing #6 | 01 | 00000001 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 50 | 32 | Standard timing #7 | 01 | 00000001 | 1 |
| 51 | 33 | Standard timing #7 | 01 | 00000001 | 1 |
| 52 | 34 | Standard timing #8 | 01 | 00000001 | 1 |
| 53 | 35 | Standard timing #8 | 01 | 00000001 | 1 |
| 54 | 36 | Pixel Clock LSB | 1A | 00011010 | 26 |
| 55 | 37 | Pixel Clock HSB | 36 | 00110110 | 54 |
| 56 | 38 | Horizontal Active (lower 8 bits) | 80 | 10000000 | 128 |
| 57 | 39 | Hor blanking (lower 8 bits) | A0 | 10100000 | 160 |
| 58 | 3A | Horizontal Active/Horizontal blanking (upper4:4 bits) | 70 | 01110000 | 112 |
| 59 | 3B | Vertcal active(lower 8 bits) | 38 | 00111000 | 56 |
| 60 | 3C | Vertical blanking(lower 8 bits) | 1F | 00011111 | 31 |
| 61 | 3D | Vertical Active : Vertical Blanking (upper4:4 bits) | 40 | 01000000 | 64 |
| 62 | 3E | Horizontal Sync Offset | 30 | 00110000 | 48 |
| 63 | 3F | Horizontal Sync Pulse Width | 20 | 00100000 | 32 |
| 64 | 40 | Vertical Sync Offset , Sync Width | 35 | 00110101 | 53 |
| 65 | 41 | Horizontal Vertical Sync Offset/Width upper 2 bits | 00 | 00000000 | 0 |
| 66 | 42 | Horizontal Image Size | 58 | 01011000 | 88 |
| 67 | 43 | Vertical image Size | C1 | 11000001 | 193 |
| 68 | 44 | Horizontal Image Size / Vertical image size | 10 | 00010000 | 16 |
| 69 | 45 | Horizontal Border = (0 for Notebook LCD) | 00 | 00000000 | 0 |
| 70 | 46 | Vertical Border = (0 for Notebook LCD) | 00 | 00000000 | 0 |
| 71 | 47 | Signal (non-intr, norm, no stero, sep sync, neg pol) | 1A | 00011010 | 26 |
| 72 | 48 | Pixel Clock LSB | 00 | 00000000 | 0 |
| 73 | 49 | Pixel Clock HSB | 00 | 00000000 | 0 |
| 74 | 4A | Horizontal Active (lower 8 bits) | 00 | 00000000 | 0 |
| 75 | 4B | Hor blanking (lower 8 bits) | FD | 11111101 | 253 |
| 76 | 4C | Horizontal Active/Horizontal blanking (upper4:4 bits) | 00 | 00000000 | 0 |
| 77 | 4D | Vertcal active(lower 8 bits) | 28 | 00101000 | 40 |

| | | | | | |
|---|---|---|---|---|---|
| 78 | 4E | Vertical blanking(lower 8 bits) | 3C | 00111100 | 60 |
| 79 | 4F | Vertical Active : Vertical Blanking (upper4:4 bits) | 43 | 01000011 | 67 |
| 80 | 50 | Horizontal Sync Offset | 43 | 01000011 | 67 |
| 81 | 51 | Horizontal Sync Pulse Width | 0E | 00001110 | 14 |
| 82 | 52 | Vertical Sync Offset , Sync Width | 00 | 00000000 | 0 |
| 83 | 53 | Horizontal Vertical Sync Offset/Width upper 2 bits | 0A | 00001010 | 10 |
| 84 | 54 | Horizontal Image Size | 20 | 00100000 | 32 |
| 85 | 55 | Vertical image Size | 20 | 00100000 | 32 |
| 86 | 56 | Horizontal Image Size / Vertical image size | 20 | 00100000 | 32 |
| 87 | 57 | Horizontal Border = (0 for Notebook LCD) | 20 | 00100000 | 32 |
| 88 | 58 | Vertical Border = (0 for Notebook LCD) | 20 | 00100000 | 32 |
| 89 | 59 | Signal (non-intr, norm, no stero, sep sync, neg pol) | 20 | 00100000 | 32 |
| 90 | 5A | descriptor#3 | 00 | 00000000 | 0 |
| 91 | 5B | Reserved for definition | 00 | 00000000 | 0 |
| 92 | 5C | Reserved for definition | 00 | 00000000 | 0 |
| 93 | 5D | ASCII String | FE | 11111110 | 254 |
| 94 | 5E | Reserved for definition | 00 | 00000000 | 0 |
| 95 | 5F | Manufacture | 43 | 01000011 | 67 |
| 96 | 60 | Manufacture | 53 | 01010011 | 83 |
| 97 | 61 | Manufacture | 4F | 01001111 | 79 |
| 98 | 62 | Manufacture | 54 | 01010100 | 84 |
| 99 | 63 | Manufacture | 20 | 00100000 | 32 |
| 100 | 64 | Manufacture | 54 | 01010100 | 84 |
| 101 | 65 | Manufacture | 39 | 00111001 | 57 |
| 102 | 66 | Reserved for definition | 0A | 00001010 | 10 |
| 103 | 67 | Reserved for definition | 20 | 00100000 | 32 |
| 104 | 68 | Reserved for definition | 20 | 00100000 | 32 |
| 105 | 69 | Reserved for definition | 20 | 00100000 | 32 |