FANNAL ELECTRONICS



# FN0240D008A

# Product Specification Rev.V2

| | |
|---|---|
| BUYER | |
| SUPPLIER | FANNAL Electronics CO., LTD |
| FG-Code | FN0240D008A |

☐ Preliminary Specification
■ Approval Specification

| ITEM | BUYER SIGNATURE | DATE |
|---|---|---|
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| ITEM | SUPPLIER SIGNATURE | DATE |
|---|---|---|
| Prepared | DONG | 2022-12-30 |
| Reviewed | XIONG | 2022-12-30 |
| Approved | JACK | 2022-12-30 |

# REVISION HISTORY

| REV. | Page. | DESCRIPTION OF CHANGES | DATE | PREPARED |
|---|---|---|---|---|
| V0 | | Initial Release | 2022-10-18 | JACK |
| V1 | | Change to IPS Panel | 2022-11-17 | JACK |
| V2 | | Based on sample test data, change the brightness of 350 to 550nits and the Uniformity of 75% to 80%, update Color Coordinate data, Improve specification information | 2022-12-30 | JACK |
| | | | | |
| | | | | |

# Contents

# 1.0 General Description /一般说明

## 1.1 Application /应用

■ Industrial

☐ Automotive

☐ Medical

☐ Outdoor highlight

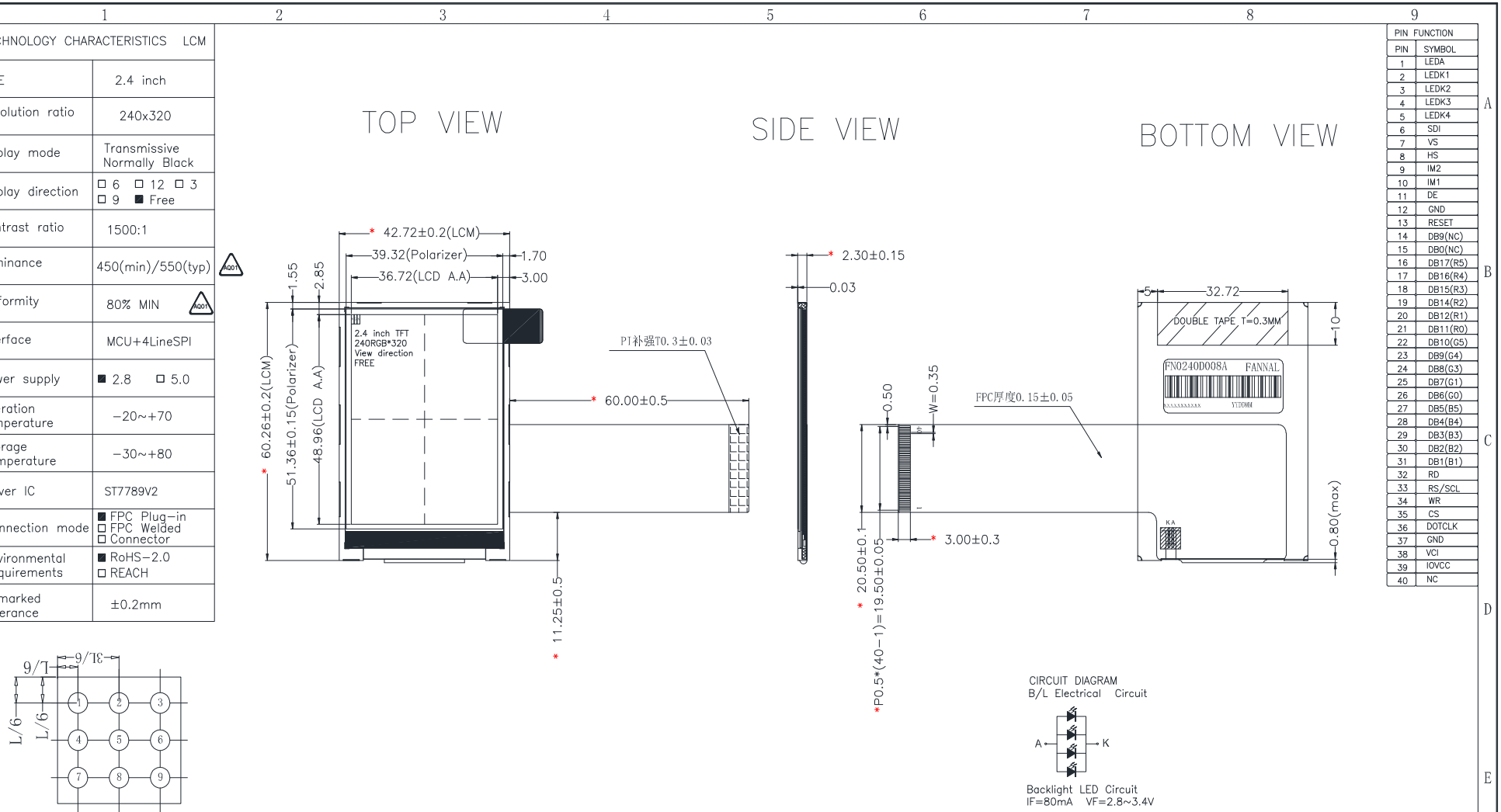
## 1.2 General Specification /通用技术条件

The followings are general specifications at the FN0240D008A.

| Parameter | Specification | Unit |
|---|---|---|
| LCD size | 2.4 (Diagonal) | inch |
| Number Of Pixels | 240(H)×320(V) | pixels |
| Pixel Pitch | 0.051(H)×RGBx0.153(V) | mm |
| Active Area | 36.72(H)×48.96(V) | mm |
| Module Size | 42.72(W)×60.26(H)×2.3(D) | mm |
| Display Mode | Normally Black | - |
| Interface | MCU&4-line SPI | - |
| Color Depth | 65K | - |
| Surface treatment | Anti-Glare | - |
| View Direction | ALL | - |
| Power Consumption | 0.5 | W |
| Weight | 12 | g |
| Luminance | 550 (TYP.) | cd/m² |
| Driver IC | ST7789V2 | - |

# 2.0 Mechanical Drawing /机械制图

| TECHNOLOGY CHARACTERISTICS | LCM |
|---|---|
| SIZE | 2.4 inch |
| Resolution ratio | 240x320 |
| Display mode | Transmissive Normally Black |
| Display direction | □ 6 □ 12 □ 3 □ 9 ■ Free |
| Contrast ratio | 1500:1 |
| Luminance | 450(min)/550(typ) |
| Uniformity | 80% MIN |
| Interface | MCU+4LineSPI |
| Power supply | ■ 2.8 □ 5.0 |
| Operation Temperature | −20~+70 |
| Storage Temperature | −30~+80 |
| Driver IC | ST7789V2 |
| Connection mode | ■ FPC Plug−in □ FPC Welded □ Connector |
| Environmental Requirements | ■ RoHS−2.0 □ REACH |
| Unmarked Tolerance | ±0.2mm |




| PIN | SYMBOL |
|---|---|
| 1 | LEDA |
| 2 | LEDK1 |
| 3 | LEDK2 |
| 4 | LEDK3 |
| 5 | LEDK4 |
| 6 | SDI |
| 7 | VS |
| 8 | HS |
| 9 | IM2 |
| 10 | IM1 |
| 11 | DE |
| 12 | GND |
| 13 | RESET |
| 14 | DB9(NC) |
| 15 | DB0(NC) |
| 16 | DB17(R5) |
| 17 | DB16(R4) |
| 18 | DB15(R3) |
| 19 | DB14(R2) |
| 20 | DB12(R1) |
| 21 | DB11(R0) |
| 22 | DB10(G5) |
| 23 | DB9(G4) |
| 24 | DB8(G3) |
| 25 | DB7(G1) |
| 26 | DB6(G0) |
| 27 | DB5(B5) |
| 28 | DB4(B4) |
| 29 | DB3(B3) |
| 30 | DB2(B2) |
| 31 | DB1(B1) |
| 32 | RD |
| 33 | RS/SCL |
| 34 | WR |
| 35 | CS |
| 36 | DOTCLK |
| 37 | GND |
| 38 | VCI |
| 39 | IOVCC |
| 40 | NC |

| VER. | SYMBOL | AMENDMENT | SIGN | DATE |
|---|---|---|---|---|
| AQ01 | AQ01 | Based on sample test data, change the brightness of 350 to 550nits, change the Uniformity of 75% to 80% | JACK | 20221230 |
| A0 | | First issue | LAI | 20221117 |

| | |
|---|---|
| DRAWN | LAI |
| CHECKED | LCF |
| APPROVED | JACK |
| CSR APPROVED | |
| Customer No: | |
| SHEET 1 OF 1 | |

TITLE: MODULE SPEC.

Drawing NO: FN0240D008A

Project No: TPM30360

FANNAL ELECTRONICS CO., LTD

## 3.0 ABSOLUTE MAXIMUM RATINGS /绝对最大额定值

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

| Parameter | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Supply voltage for logic | VDD | -0.3 | 3.3 | V | |
| Input voltage | VIN | -0.3 | 3.3 | V | |
| Operating Temperature | $T_{OP}$ | -20 | +70 | ℃ | |
| Storage Temperature | $T_{ST}$ | -30 | +80 | ℃ | |
| Humidity | RH | | 90%(Max 60℃) | RH | |

# 4.0 ELECTRICAL SPECIFICATIONS/电气规范

## 4.1 TFT LCM Module

[Ta =25±2 ℃]

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Supply voltage for logic | VDD | 2.5 | 2.8 | 3.3 | V |
| Input current | IDD | | 8.8 | | mA |
| Input voltage "H" level | VIH | 0.7VDD | - | VDD | V |
| Input voltage "L" level | VIL | VSS | - | 0.3VDD | V |
| Output voltage "H" level | VOH | 0.8VDD | - | VDD | mA |
| Output voltage "L" level | VOL | VSS | - | 0.2VDD | V |

## 4.2 Backlight Driving Conditions /背光驱动条件

[Ta =25±2 ℃]

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Forward Current Voltage | $V_F$ | 2.9 | 3.2 | 3.4 | V | Note 1 |
| Forward Current | If | - | 80 | 100 | mA | |
| Backlight Power Consumption | Wbl | - | 0.256 | 0.34 | W | |
| LED Life Time | - | - | 30000 | - | Hrs | Note 2 |

Note1: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note2: Optical performance should be evaluated at Ta=25℃. if LED is driven by high current, high ambient temperature & Humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

## 5.0 Interface Description/接口说明

| Connector Name/Designation | Interface Connector/Interface Card |
|---|---|
| Type Part Number | FPC 0.5Pitch 40P |
| Mating Housing Part Number | FH12s-40S-0.5H |

### 5.1 Pin assignment for LCM module /模组引脚分配

| Pin No. | Symbol | I/O | Description |
|---|---|---|---|
| 1 | LEDA | P | LED power anode |
| 2-5 | LEDK1-4 | P | LED power cathode |
| 6 | SDI | I | SPI interface Input pin. |
| 7 | VS | I | Frame synchronizing signal |
| 8 | HS | I | Line synchronizing signal |
| 9 | IM2 | I | Select the interface mode（NC） |
| 10 | IM1 | I | Select the interface mode（NC） |
| 11 | DE | I | Data enable signal for RGB interface operation. |
| 12 | GND | I | System ground |
| 13 | RESET | I | This signal will reset the device and must be applied to properly initialize the chip. Signal is active low. |
| 14 | DB9 | - | No connection |
| 15 | DB0 | - | No connection |
| 16 | DB17(R5) | I | MCU system and RGB interface mode. |
| 17 | DB16(R4) | I | MCU system and RGB interface mode. |
| 18 | DB15(R3) | I | MCU system and RGB interface mode. |
| 19 | DB14(R2) | I | MCU system and RGB interface mode. |
| 20 | DB13(R1) | I | MCU system and RGB interface mode. |
| 21 | DB12(R0) | I | MCU system and RGB interface mode. |
| 22 | DB11(G5) | I | MCU system and RGB interface mode. |
| 23 | DB10(G4) | I | MCU system and RGB interface mode. |
| 24 | DB8(G2) | I | MCU system and RGB interface mode. |
| 25 | DB7(G1) | I | MCU system and RGB interface mode. |
| 26 | DB6(G0) | I | MCU system and RGB interface mode. |
| 27 | DB5(B5) | I | MCU system and RGB interface mode. |
| 28 | DB4(B4) | I | MCU system and RGB interface mode. |
| 29 | DB3(B3) | I | MCU system and RGB interface mode. |
| 30 | DB2(B2) | I | MCU system and RGB interface mode. |

| Pin No. | Symbol | I/O | Description |
|---|---|---|---|
| 31 | DB1(B1) | I | MCU system and RGB interface mode. |
| 32 | RD | I | 8080-/8080Ⅰ-Ⅱ system(RDX)：Serves as a read signal and MCU read data at the rising edge. |
| 33 | RS/SCL | I | (D/CX)：This pin is used to select “Data or command” in the parallel interface<br>(SCL)：This pin is used as the serial interface clock in 3-line 9 bit/4-line 8bit serial data interface |
| 34 | WR | I | (WRX)-8080-/8080Ⅰ-Ⅱsystem：Serves as a write signal and writes data at the rising edge.<br>(D/CX)-4-line system：Serves as the selector of command or parameter |
| 35 | CS | I | Chip select input pin. |
| 36 | DOTCLK | I | Dot clock signal for RGB interface operation. |
| 37 | GND | P | System ground |
| 38 | VCI | P | Analog supply voltage range VCI to AVSS: 2.8V/3.3V |
| 39 | IOVCC | P | Power supply for I/O block: 1.8V/2.8V/3.3V |
| 40 | NC | - | No connection |

**5.2 Interface Logic Pins**

| IM3 | IM2 | IM1 | IM0 | MPU Interface Mode | Data Pin |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 80-8bit parallel I/F | DB(7:0) |
| 0 | 0 | 0 | 1 | 80-16bit parallel I/F | DB(15:0) |
| 0 | 0 | 1 | 0 | 80-9bit parallel I/F | DB(8:0) |
| 0 | 0 | 1 | 1 | 80-18bit parallel I/F | DB(17:0) |
| 0 | 1 | 0 | 1 | 3-line 9bit serial I/F | SDA：in/out |
| | | | | 2 data lane serial I/F | SDA：in/out<br>WRX：in |
| 0 | 1 | 1 | 0 | 4-line 8bit serial I/F | SDA：in/out |
| 1 | 0 | 0 | 0 | 80-16bit parallel I/F Ⅱ | DB(17:10)<br>DB(8:1) |
| 1 | 0 | 0 | 1 | 80-8bit parallel I/F Ⅱ | DB(17:10) |
| 1 | 0 | 1 | 0 | 80-18bit parallel I/F Ⅱ | DB(17:0) |
| 1 | 0 | 1 | 1 | 80-9bit parallel I/F Ⅱ | DB(17:9) |
| 1 | 1 | 0 | 1 | 3-line 9bit serial I/F Ⅱ | SDA：in<br>SDO：out |
| 1 | 1 | 1 | 0 | 4-line89bit serial I/F Ⅱ | SDA：in<br>SDO：out |

## 5.3 AC Characteristics

### 5.3.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8bit Bus

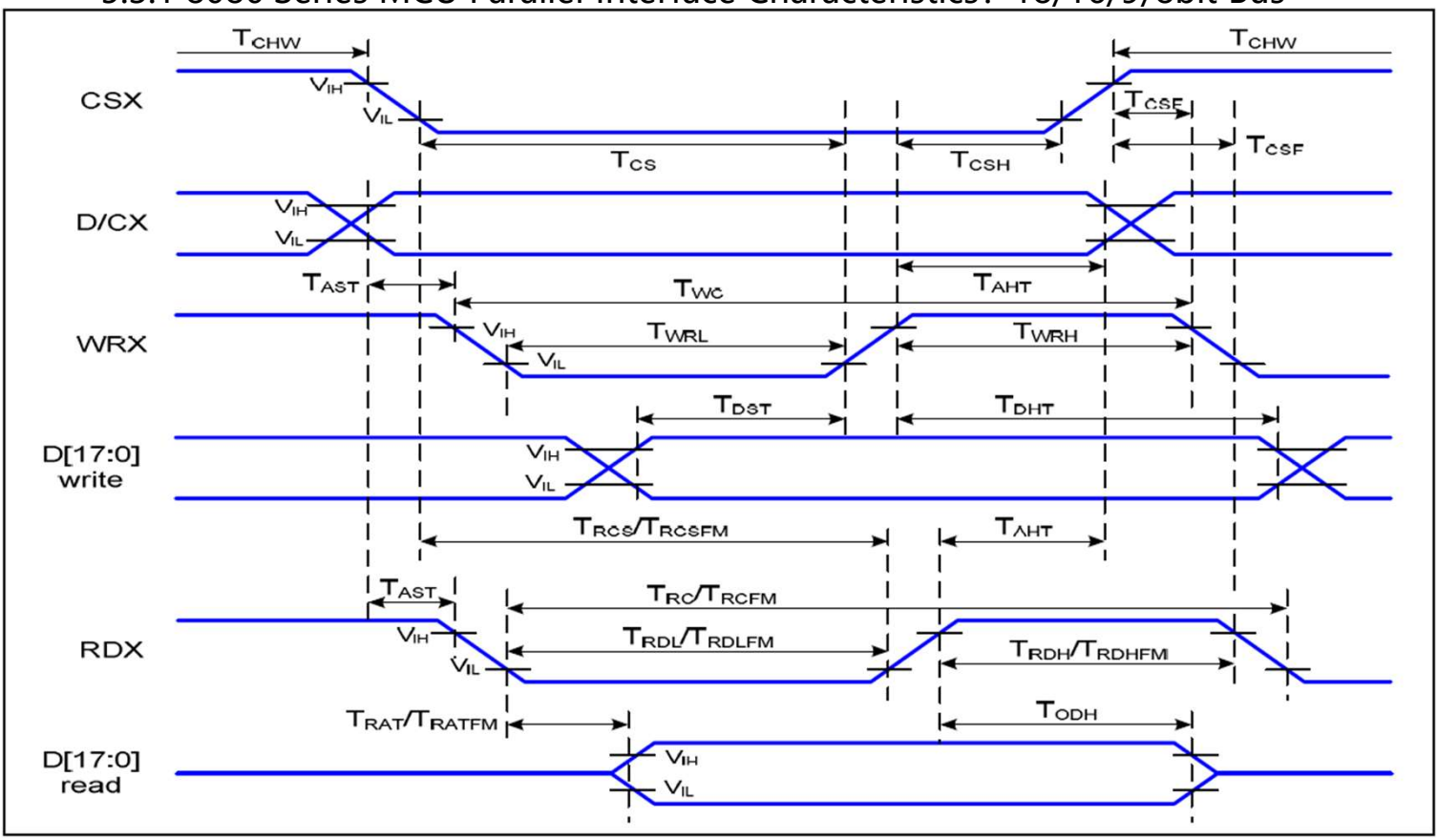



**Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)**

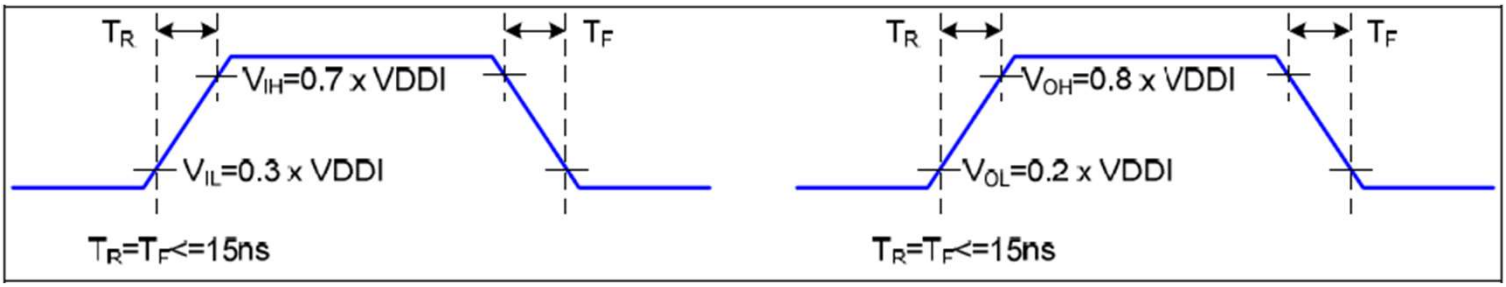



**Figure 2 Rising and Falling Timing for I/O Signal**

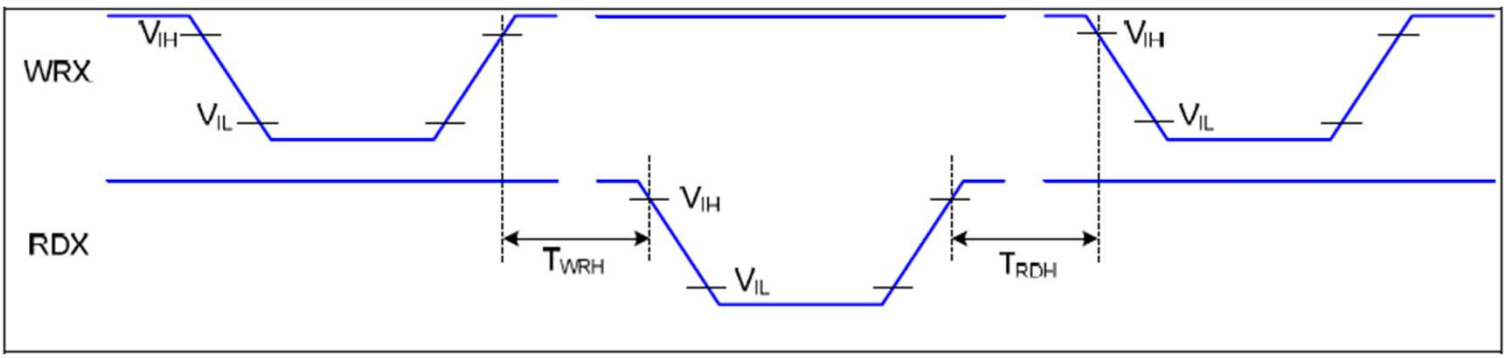



**Figure 3 Write-to-Read and Read-to-Write Timing**

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|---|---|---|---|---|---|---|
| D/CX | $T_{AST}$ | Address setup time | 0 | | ns | - |
| | $T_{AHT}$ | Address hold time (Write/Read) | 10 | | ns | |
| CSX | $T_{CHW}$ | Chip select "H" pulse width | 0 | | ns | - |
| | $T_{CS}$ | Chip select setup time (Write) | 15 | | ns | |
| | $T_{RCS}$ | Chip select setup time (Read ID) | 45 | | ns | |
| | $T_{RCSFM}$ | Chip select setup time (Read FM) | 355 | | ns | |
| | $T_{CSF}$ | Chip select wait time (Write/Read) | 10 | | ns | |
| | $T_{CSH}$ | Chip select hold time | 10 | | ns | |
| WRX | $T_{WC}$ | Write cycle | 66 | | ns | |
| | $T_{WRH}$ | Control pulse "H" duration | 15 | | ns | |
| | $T_{WRL}$ | Control pulse "L" duration | 15 | | ns | |
| RDX (ID) | $T_{RC}$ | Read cycle (ID) | 160 | | ns | When read ID data |
| | $T_{RDH}$ | Control pulse "H" duration (ID) | 90 | | ns | |
| | $T_{RDL}$ | Control pulse "L" duration (ID) | 45 | | ns | |
| RDX (FM) | $T_{RCFM}$ | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | $T_{RDHFM}$ | Control pulse "H" duration (FM) | 90 | | ns | |
| | $T_{RDLFM}$ | Control pulse "L" duration (FM) | 355 | | ns | |
| D[17:0] | $T_{DST}$ | Data setup time | 10 | | ns | For CL=30pF |
| | $T_{DHT}$ | Data hold time | 10 | | ns | |
| | $T_{RAT}$ | Read access time (ID) | | 40 | ns | |
| | $T_{RATFM}$ | Read access time (FM) | | 340 | ns | |
| | $T_{ODH}$ | Output disable time | 20 | 80 | ns | |

**Table 1 8080 Parallel Interface Characteristics**

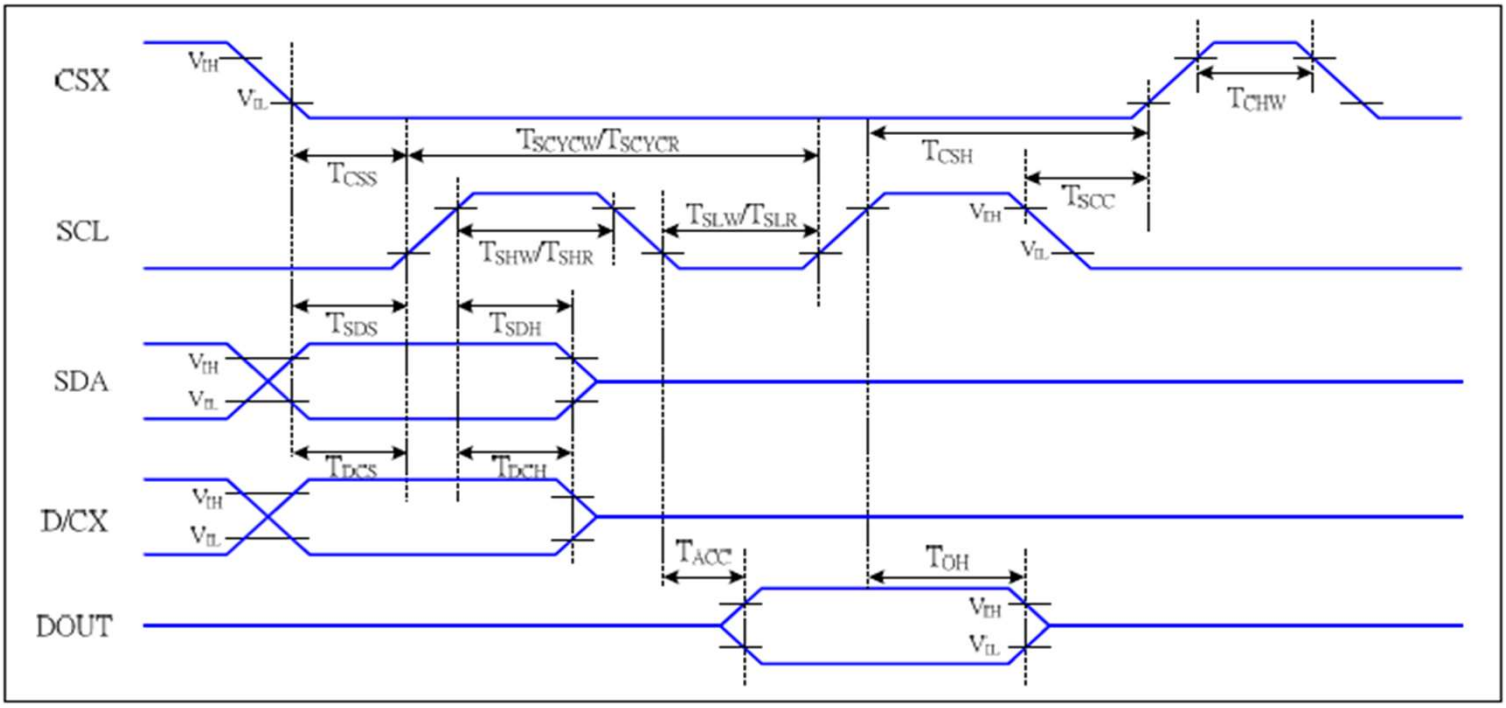



**Figure 4 4-line serial Interface Timing Characteristics**

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $T_{CSS}$ | Chip select setup time (write) | 15 | | ns | |
| | $T_{CSH}$ | Chip select hold time (write) | 15 | | ns | |
| | $T_{CSS}$ | Chip select setup time (read) | 60 | | ns | |
| | $T_{SCC}$ | Chip select hold time (read) | 65 | | ns | |
| | $T_{CHW}$ | Chip select "H" pulse width | 40 | | ns | |
| SCL | $T_{SCYCW}$ | Serial clock cycle (Write) | 16 | | ns | -write command & data ram |
| | $T_{SHW}$ | SCL "H" pulse width (Write) | 7 | | ns | |
| | $T_{SLW}$ | SCL "L" pulse width (Write) | 7 | | ns | |
| | $T_{SCYCR}$ | Serial clock cycle (Read) | 150 | | ns | -read command & data ram |
| | $T_{SHR}$ | SCL "H" pulse width (Read) | 60 | | ns | |
| | $T_{SLR}$ | SCL "L" pulse width (Read) | 60 | | ns | |
| D/CX | $T_{DCS}$ | D/CX setup time | 10 | | ns | |
| | $T_{DCH}$ | D/CX hold time | 10 | | ns | |
| SDA (DIN) | $T_{SDS}$ | Data setup time | 7 | | ns | |
| | $T_{SDH}$ | Data hold time | 7 | | ns | |
| DOUT | $T_{ACC}$ | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | $T_{OH}$ | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

**Table 2 4-line serial Interface Characteristics**

## 5.4 RGB Interface Characteristics:

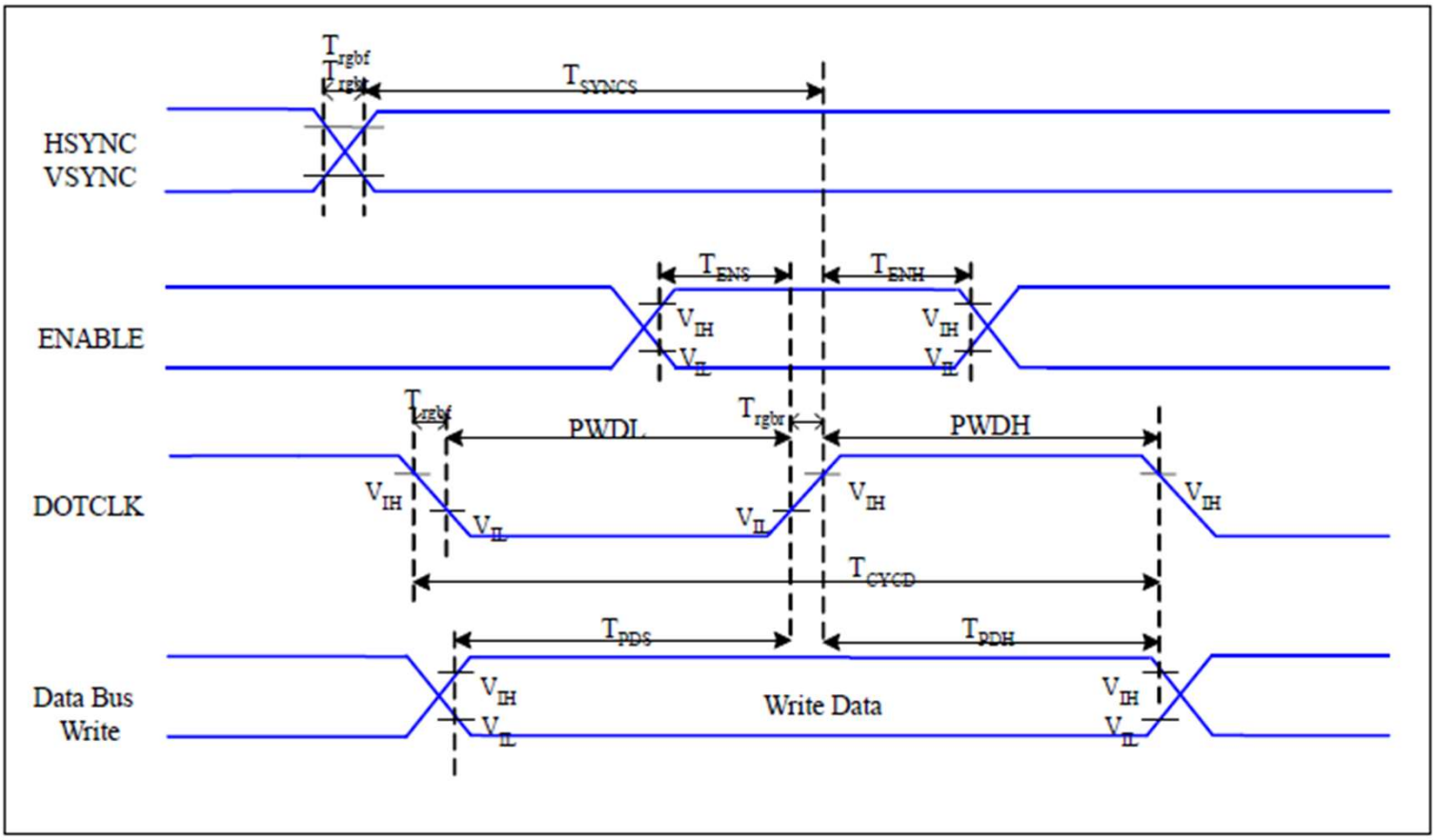



**Figure 5 RGB Interface Timing Characteristics**

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| HSYNC, VSYNC | $T_{SYNCS}$ | VSYNC, HSYNC Setup Time | 30 | - | ns | |
| ENABLE | $T_{ENS}$ | Enable Setup Time | 25 | - | ns | |
| | $T_{ENH}$ | Enable Hold Time | 25 | - | ns | |
| DOTCLK | PWDH | DOTCLK High-level Pulse Width | 60 | - | ns | |
| | PWDL | DOTCLK Low-level Pulse Width | 60 | - | ns | |
| | $T_{CYCD}$ | DOTCLK Cycle Time | 120 | - | ns | |
| | Trghr, Trghf | DOTCLK Rise/Fall time | - | 20 | ns | |
| DB | $T_{PDS}$ | PD Data Setup Time | 50 | - | ns | |
| | $T_{PDH}$ | PD Data Hold Time | 50 | - | ns | |

**Table 3 18/16 Bits RGB Interface Timing Characteristics**

## 5.5 Reset Timing:

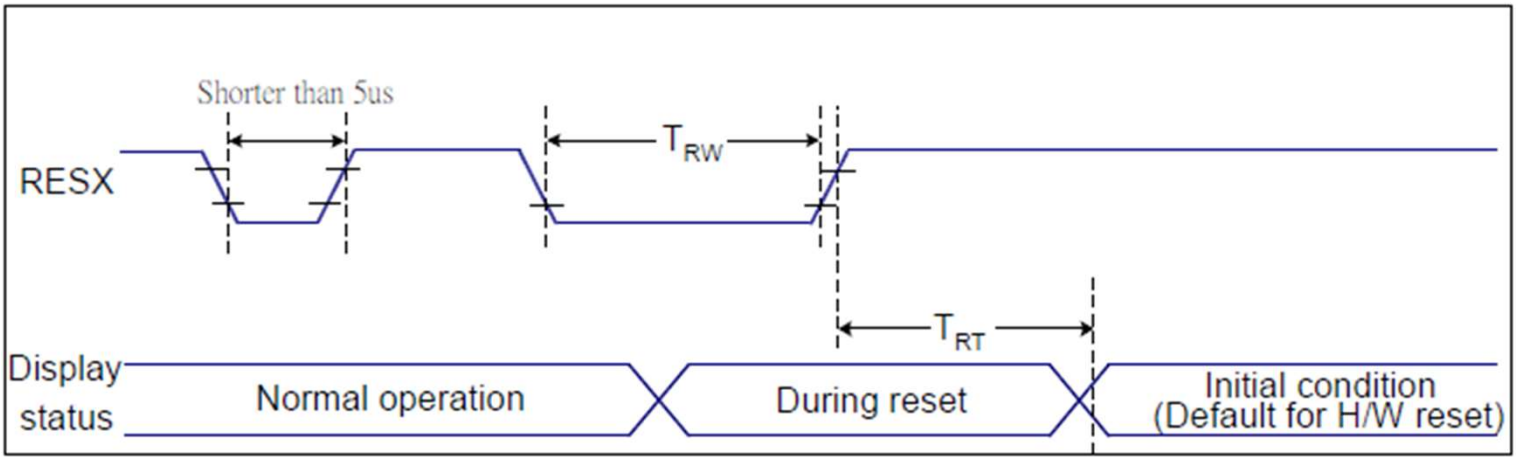



**Figure 6 Reset Timing**

| Related Pins | Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|---|
| RESX | TRW | Reset pulse duration | 10 | - | us |
| | TRT | Reset cancel | - | 5 (Note 1, 5) | ms |
| | | | | 120 (Note 1, 6, 7) | ms |

**Table 3 Reset Timing**

# 6.0 OPTICAL SPECIFICATIONS /光学规格

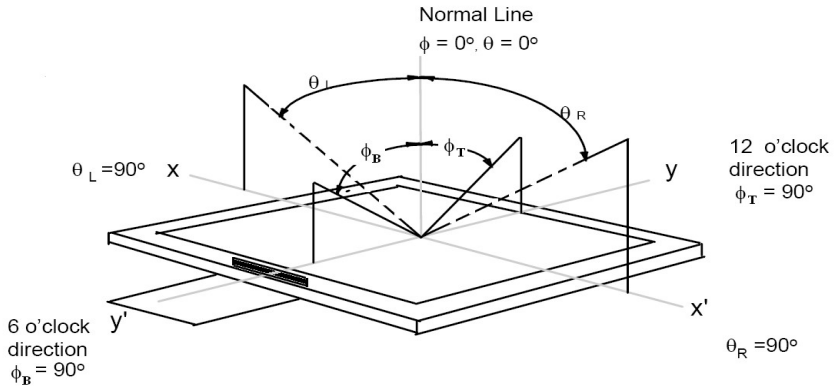
## 6.1 Overview /概述

The test of optical specifications shall be measured in a dark room (ambient luminance ≤1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) 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 θ and/or Ø, the center of the measuring spot on the display surface shall stay fixed.

## 6.2 Optical Specifications /光学规格

| Item | Symbol | Condition | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Viewing Angle | θL | Cr≥10 | 70 | 80 | - | deg | Note 1 |
| | $\theta_R$ | | 70 | 80 | - | | |
| | $\psi_T$ | | 70 | 80 | - | | |
| | $\psi_B$ | | 70 | 80 | - | | |
| Contrast Ratio | Cr | θ=0° FF=0° | 1000 | 1500 | - | - | Note 2 |
| Response Time | Tr+Tf | | - | 35 | 45 | ms | Note 3 |
| Color Coordinate of CIE1931 | Wx | θ=0° | 0.259 | 0.289 | 0.319 | - | Note 4 |
| | Wy | | 0.281 | 0.311 | 0.341 | | |
| | Rx | | 0.611 | 0.641 | 0.671 | | |
| | Ry | | 0.310 | 0.340 | 0.370 | | |
| | Gx | | 0.294 | 0.324 | 0.354 | | |
| | Gy | | 0.578 | 0.608 | 0.638 | | |
| | Bx | | 0.124 | 0.154 | 0.184 | | |
| | By | | 0.021 | 0.051 | 0.081 | | |
| Uniformity | U | | 80 | -- | -- | % | Note 5 |
| Color Gamut | | | 65 | 70 | -- | % | |
| Luminance | L | | 450 | 550 | -- | cd/m² | Note 6 |

**Note 1**:**The definition of Viewing Angle**
Refer to the graph below marked by $\theta$ and $\Phi$.




**Note2**:**ThedefinitionofContrastRatio**

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

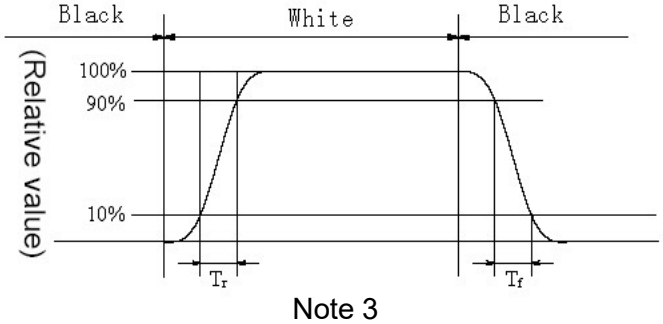
(Contrast Ratio is measured in optimum common electrode voltage)

**Note3**:**DefinitionofResponse time.**(Test LCD using RD80S or similar equipments):
The output sign also photo detector are measured when the input sign also are changed from "black " to "white" (Voltage falling time)and from "white" to "black" (Voltage rising time), respectively . The response time is defined as the time interval between the 10% and 90% of amplitudes . Refer to fi gures below.

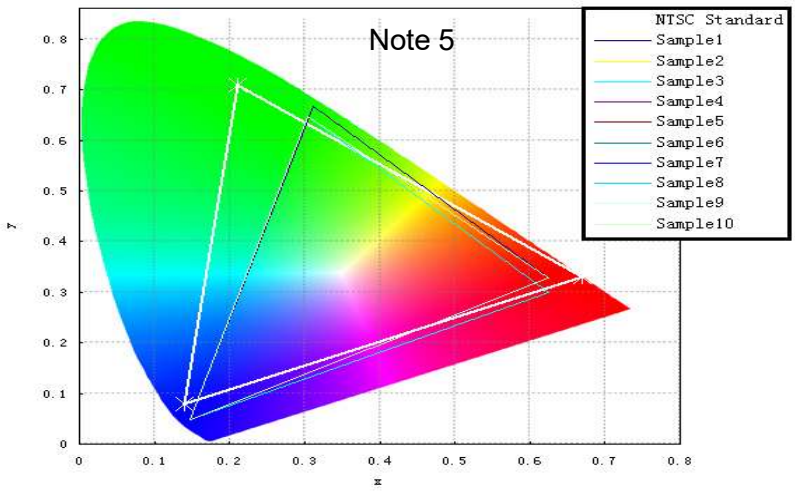
**Note 4: Color Coordinates of CIE 1931**
The test condition is at ILED=20mA and measured on the surface of LCD module at 25℃.
Measurement equipment:CS2000 or similar equipments
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

**Note 5: Definition of Color of CIE Coordinate and NTSC Ratio.**

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$




Note 3



## 7.0 RELIABLITY TEST /可靠性测试

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

| No | Test Items | Conditions | Testing standard |
|---|---|---|---|
| 1 | High temperature storage test | 80℃ 240hrs | IEC60068-2-1:2007<br>GB2423.2-2008 |
| 2 | Low temperature storage test | -30℃ 240hrs | |
| 3 | Low temperature operation test | -20℃ 240hrs | |
| 4 | High temperature operation test | 70℃ 240hrs | |
| 5 | High temperature & humidity (storage test) | 60℃ 90%RH 240hrs | IEC60068-2-78:2001<br>GB/T2423.3-2006 |
| 6 | Thermal Shock Test | -30℃~80℃ 1hr/cycle 50cycle | Start with cold temperature<br>End with high temperature<br>IEC60068-2-14:1984,<br>GB2423.22-2002 |
| 7 | Vibration Test | 10Hz-55Hz 100m/s² 120min | IEC60068-2-32:1990<br>GB/T2423.8-1995 |
| 8 | Mechanical shock | 100G ±X, ±Y, ±Z, 3times for each direction | |
| 9 | Dropping test | Height: 60 cm, 1 corner, 3 edges, 6 surfaces | |
| 10 | ESD test | C=150pF, R=330 Ω, 5 points/panel<br>Air:±8KV, 5 times; Contact: ±4KV, 5 times; | IEC61000-4-2:2001<br>GB/T17626.2-2006<br>Class C |

## • 8.0 Precautions /注意事项

• Please pay attention to the followings when you use this TFT LCD Panel.

### • 8.1 Mounting Precautions /安装注意事项

• (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

• (2) You must mount a module using specified mounting holes (Details refer to the drawings).

• (3) Please make sure to avoid external forces applied to the Source PCB or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.

• (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.

• (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel.

• Do not pull or fold the LED wire.

• (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water.

• Do not strong polar solvent because they cause chemical damage to the polarizer.

• (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

• (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

• (9) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it f alls from a high place or receives a strong shock, the glass may be broken.

• (10) Do not disassemble the module.

• (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.

• (12) If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.

• (13)Do not drop water or any chemicals onto the LCD’s surface.

## 8.2 Operating Precautions /操作注意事项

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) For the Q/Single/OC Product, If the LED designed side view, LED bar should be putted in the L ong/short side；Otherwise, its reliability and function may not be guaranteed.

注:
①(1)涉及到Pol相关条目适用于OC/MDL出货产品，
②(6)(7)涉及到connector相关适用于OC/MDL出货产品
③ (12) 涉及到客户进行BLU设计，LED Bar位置需要避开GOA位置；

## 8.3 Electrostatic Discharge Control /静电放电控制

- (1) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don’t touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

## 8.4 Precautions for Strong Light Exposure /强光照射注意事项

It is not allowed to store or run directly in strong light or in high temperature and humidity for a long ti me; Strong light exposure causes degradation of polarizer and color filter.

## 8.5 Storage Precautions /存储注意事项

When storing modules as spares for a long time, the following precautions are necessary.

•(1) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
Temperature : 5 ~ 40 ℃

•(2) Humidity : 35 ~ 75 %RH

•(3) Period : 6 months

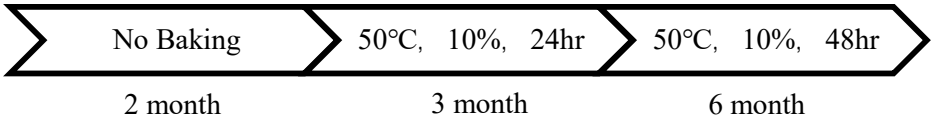
•(4) Control of ventilation and temperature is necessary.

•(5) Please make sure to protect the product from strong light exposure, water or moisture.
Be careful for condensation.

•(6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.

•(7)Do not store the LCD near organic solvents or corrosive gasses.

•(8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.




## 8.6 Precautions for Protection Film /保护膜注意事项

• (1) Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and th e humidity of working room should be kept over 50%RH to reduce the risk of static charge.

• (2) In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

## 8.7 Appropriate Condition for Display /适当的显示条件

•(1) Normal operating condition
- Temperature: 0 ~ 40℃
- Operating Ambient Humidity : 10 ~ 90 %
- Display pattern: dynamic pattern (Real display)
- Suitable operating time: under 12 hours a day.

•(2) Special operating condition

If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7*24hrs operation time etc.., It is strongly recommended to contact us for Application engineering advi ce. Otherwise, its reliability and function may not be guaranteed.

•(3)Black image or moving image is strongly recommended as a screen save.

- (4) Lifetime in this spec. is guaranteed only when commercial display is used according to operating usages.
- (5) Please contact us in advance when you display the same pattern for a long time.
- (6) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" or "turn off" to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (7) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (8) Dew drop atmosphere should be avoided.
- (9) The storage room should be equipped with a good ventilation facility and avoid to expose to corrosive gas , which has a temperature controlling system.
- (10) The LCD should be avoided to expose to corrosive gas for long time, ,the LCD may be affected by the gas as SO2 ,H2S etc.
- (11) When expose to drastic fluctuation of temperature (hot to cold or cold to hot） ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- (12) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation

## 8.8 Others /其他

### A. LC Leak /液晶泄露

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

### B. Rework /返工

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

**C.** In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line (适用于Q/Single/OC出货产品)

## 9.0 PACKING INFORMATION(产品形态： LCM )

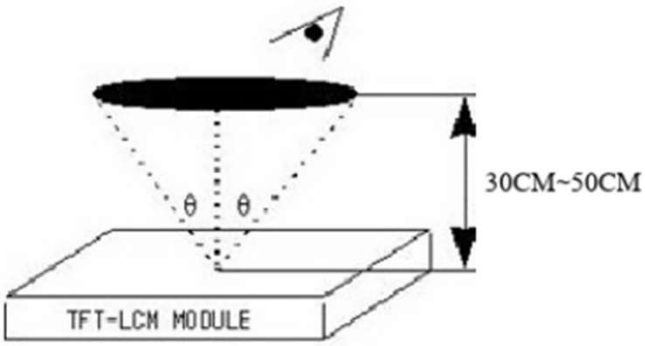
| LCM MODEL | LCM Qty. in the Box | Carton Size(mm) | LCM Qty. in the Pallet |
|---|---|---|---|
| FN0240D008A | | | |

# 10.0 VISUAL INSPECTION CRITERIA FOR ALL CUSTMERS /所有客户的目视检查标准

## 10.1 Sampling Method /抽样方法

Unless otherwise agreed upon in writing, the sampling insepction shall be applied to t he Customers incoming inspection.

10.1.1 Lot size：1 pallet per same model
10.1.2 Sampling type：Random sampling
10.1.3 Inspection level：II
10.1.4 Sampling table：MIL-STD-105E




## 10.2 Inspection Environment /检验环境

10.2.1 Ambient conditions
a. Ambient Temperature:25±3℃
b. Relative Humidity:65±20%RH
c. Ambient Illumination:300-700LUX(Normal:500LUX)

10.2.2 Viewing Distance
The distance between the LCM and the inspector's eyes shall be at least 30cm-50cm

10.2.3 Viewing Angle
performing in front of the panel
[Vertical]：±25degree
[Horizontal]：±40degree

10.2.4 Inspection Area:
Display Area(Active Area)

## 10.3 Definitions /定义

10.3.1 Dark / Bright Spots
Points on display which appear dark/bright and usually result form the contamination.
These defects do not vary in size or intensity(contrast)when contrast is varied.
10.3.2 Dark / Bright Lines
Lines on display which appear dark/bright and usually result from the contamination.
10.3.3 Polarizer Scratch
Lines on display which are seen across a darker background and do not vary in size.
10.3.4 Polarizer Dent
White spots on display which appear againse a darker backgound and do not vary in size.
103.5 Bright Dot Defects
Dots(sub-pixels)on display which appear bright in the display area and visible throug h the 5%ND filter at Black Pattern.

10.3.6 Dark Dot Defects

Dots(sub-pixels)on display which appear dark in the display area at R.G.B Color Pattern.

10.3.7 Line Defects

All line defects on display which appear brigh/dark such as vertical,horizontal,or cross lines.

10.3.8 Mura

Mura on display which appears darker/brighter against background birghtness on parts of display area.

10.3.9 BM Defects

Bright(white)Points on display which are off BM(Black Matrix).

10.3.10 Visual Inspection

Inspection for LCM when the unit turns on.

10.3.11 Appearance Inspection

External inspection for LCM when the unit turns off.

10.3.12 Other

Defects which cannot be classified into the above defect definitions.

Note 1: Bright& Dark dots are not smaller than a sub-pixel(Dots smaller than a sub-pixel are not counted as defect dots)

**10.4 Inspectin Criteria /检验标准**

Refer to 《TFT LCM general inspection standard》

**10.5 Verification /验证**

The supplier can verify the defective LCMs to segregate the responsibilities at customer's facility or can request the Customer to ship the defective LCMs to assigned place for verification

This verificatin result shall be agreed mutually buy the Customer and Supplier. This result can be corrected/changed after detail failure analysis at Supplier's facilities.

**10.6 Supplier Induced Defects /供应商引起的缺陷**

All of the Supplier induced defective LCMs shall be returned to the Supplier for repair or replacement.

Bfore return the defective LCMs, the Customer needs Supplier's confirmatin with RMA Number.

All of the returned LCMs shall be returned to the Customer within agreed time period.

**10.7 Customer Induced Defects /顾客引起的缺陷**

The Customer can return the custmoer induced defective LCMs to the Supplier for repair.

The repair cost for Customer induced defective LCMs shall be agreed with both parties, Customer and Supplier.

**10.8 Warranty Period /质量保证期**

In-warranty period is Eighteen(18)Months from manufacturing month of LCM

Note：

a. Eighteen months are composed of twelfth months in-warranty period and sixth months distribution period

b. The manufacturing Month is on the LCMs as Supplier's serial No.

**10.9 Repair Warranty /维修保证书**

Repair warranty is Twelve(12)Months from repaired month for repaired LCMs

Note：a. The Label for repair will be added after repairing.

**10.10 Warranty avoidance /避免担保**

The warranty will be avoided in cases of below:

a. When the warranty period is expired.

b. The Customer induced defective LCMs.

c. When the LCMs were repaired by 3rd party without Suppolier's approval.

d.When the LCMs were treated like Disassemble and Rework by the Customer and/or Customer's representatives without Supplier's approval.

**10.11 Others /其他**

If any problems arise with the LCMs supplied by supplier, the customer and supplier will coopeate and make ettorts to solve it with mutual contidence and respect