

Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 240320D1 TTH-PW

2,4“ transfl. TFT

Product Specification

Version: 1

29.10.2024

Revision History

| Date | Rev. No. | Page | Summary |
|------------|----------|------|---------------------------------------|
| 18.10.2024 | 0 | ALL | FIRST ISSUE |
| 29.10.2024 | 1 | 4,6 | Updated views and structural drawings |
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*** Description**

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a transfective type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.4'TFT-LCD contains 240X320 pixels, and can display up to 262K colors.

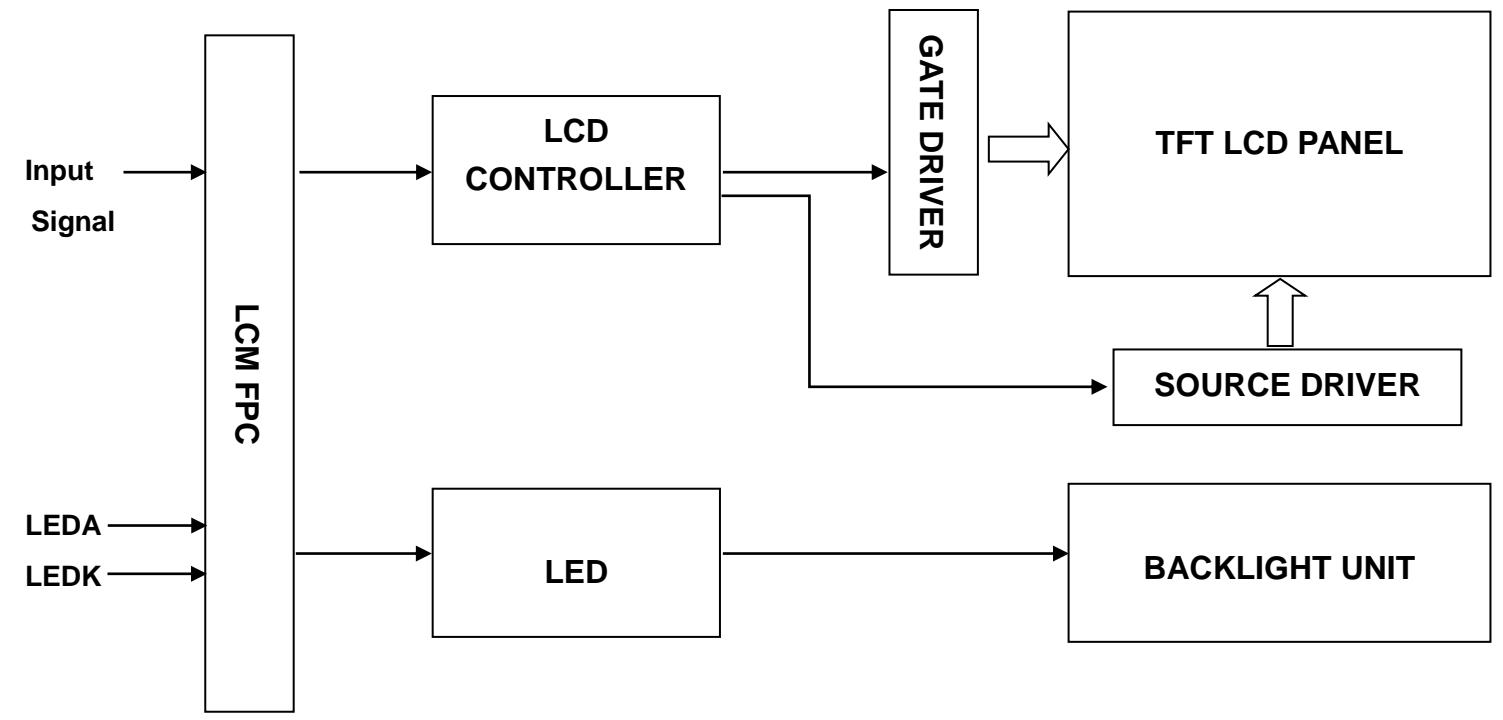
*** Features**

| General Information Items | Specification | Unit | Note |
|---------------------------|---|---------|------|
| | Main Panel | | |
| Display area(AA) | 36.72(H) *48.96(V) (2.4 inch) | mm | - |
| Driver element | TFT active matrix | - | - |
| Display colors | 262K | colors | - |
| Number of pixels | 240(RGB)*320 | dots | - |
| TFT Pixel arrangement | RGB vertical stripe | - | - |
| Pixel pitch | 0.153 (H) x 0.153 (V) | mm | - |
| Viewing angle | 6:00 | o'clock | - |
| TFT Controller IC | ST7789T3-G4-1 | - | - |
| LCM Interface | 8/9/16/18Bit MCU 3/4SPI+16/18Bit RGB 3-line/4-line Serial | - | - |
| Display mode | Transflective /Normally White | - | - |
| Operating temperature | -20~+70 | °C | - |
| Storage temperature | -30~+80 | °C | - |

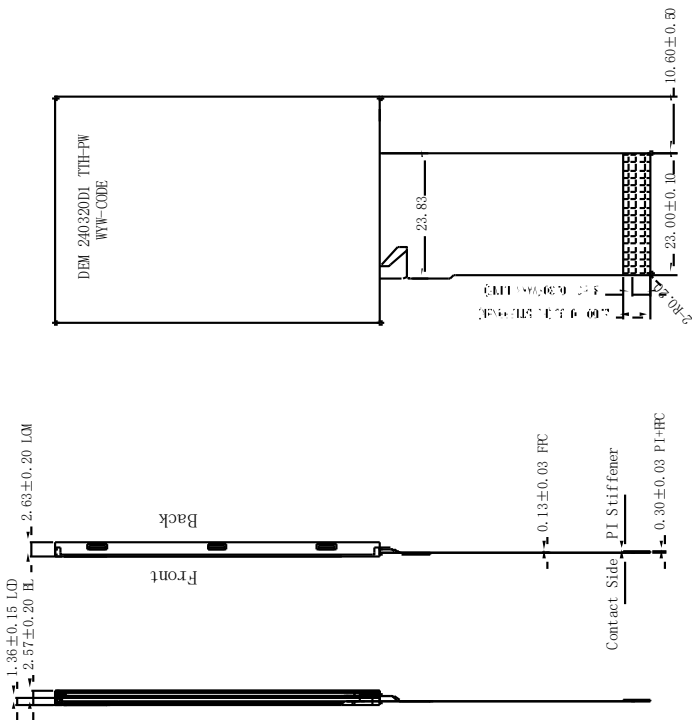
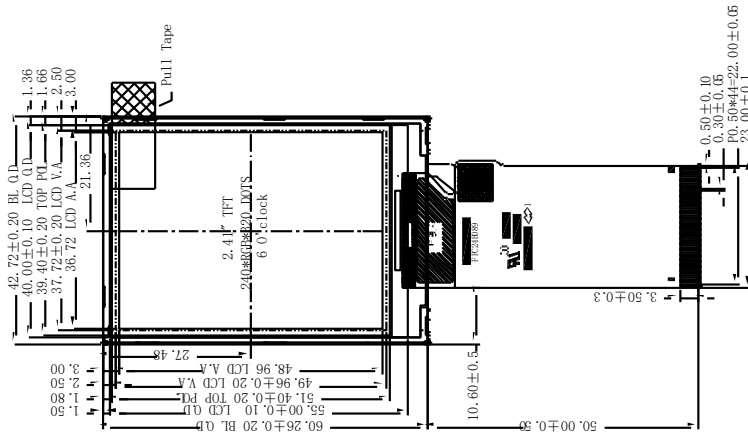
*** Mechanical Information**

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|---------------|------|-------|------|------|------|
| Module size | Horizontal(H) | | 42.72 | | mm | - |
| | Vertical(V) | | 60.26 | | mm | - |
| | Depth(D) | | 2.63 | | mm | - |
| Weight | | | 12 | | g | - |

1. Block Diagram



2. Outline dimension

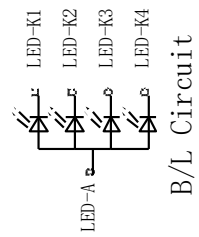


| NO. | FN | DIR |
|-----|---------|-----|
| 1 | NC | NC |
| 2 | NC | NC |
| 3 | NC | NC |
| 4 | NC | NC |
| 5 | NC | NC |
| 6 | GND | NC |
| 7 | GND | NC |
| 8 | VCC | NC |
| 9 | IOVCC | NC |
| 10 | SDD | NC |
| 11 | DB17 | NC |
| 12 | DB16 | NC |
| 13 | DB15 | NC |
| 14 | DB14 | NC |
| 15 | DB13 | NC |
| 16 | DB12 | NC |
| 17 | DB11 | NC |
| 18 | DB10 | NC |
| 19 | DB9 | NC |
| 20 | DB8 | NC |
| 21 | DB7 | NC |
| 22 | DB6 | NC |
| 23 | DB5 | NC |
| 24 | DB4 | NC |
| 25 | DB3 | NC |
| 26 | DB2 | NC |
| 27 | DB1 | NC |
| 28 | DB0 | NC |
| 29 | DINTEN | NC |
| 30 | CLK | NC |
| 31 | DE | NC |
| 32 | HSTXNC | NC |
| 33 | VSTXNC | NC |
| 34 | RD | NC |
| 35 | WRESFRC | NC |
| 36 | RESFRC | NC |
| 37 | CS | NC |
| 38 | RESER | NC |
| 39 | IMT | NC |
| 40 | IMT | NC |
| 41 | IMT | NC |
| 42 | NC | NC |
| 43 | LEDA | NC |
| 44 | NC | NC |
| 45 | LEDB | NC |

NOTE: MCU interface SET for IM PINS.

| IM2 | IM1 | IM0 | Interface Type | IM Pin in use |
|-----|-----|-----|---------------------------|--------------------|
| 0 | 0 | 0 | IM1 Typ. 16-bit interface | IM17-IM10, IM8-IM1 |
| 0 | 0 | 1 | IM1 Typ. 8-bit interface | IM17-IM10 |
| 0 | 1 | 0 | IM1 Typ. 18-bit interface | IM17-IM9 |
| 0 | 1 | 1 | IM1 Typ. 9-bit interface | IM17-IM9 |
| 1 | 0 | 1 | IM1 Typ. 16-bit interface | SIM, SCL, CS |
| 1 | 1 | 0 | IM1 Typ. 8-bit interface | SIM, SCL, CS, IS |

NOTE:
 1. If not use PIN, fix to the GND, IOVCC or NC.
 2. If use RGB mode must select serial interface.



- NOTE:
1. DISPLAY TYPE: 2.41", TFT-LCD, 262K COLORS
 2. DISPLAY MODE: NORMALLY WHITE, TN, TRANSPARENT
 3. VIEWING DIRECTION: 6 O'Clock
 4. LCM DRIVER IC: ST7789T3-G4-1 (COG)
 LCM Interface: 8/9/16/18BIT MCU
 3/4SPI+16/18BIT RGB
 5. VDD: 3.3V (TYP.), IOVCC: 1.8-3.3V
 6. OPERATING TEMP: -20° C TO 70° C
 STORAGE TEMP: -30° C TO 80° C
 7. BACK LIGHT: LED WHITE, 4 LED, 80mA, 2.7~3.3V
 8. RoHS COMPLIANT.

3. Input terminal Pin Assignment

| NO. | SYMBOL | DISCRIPTION | I/O |
|-------|-------------|--|-----|
| 1 | NC | -- | -- |
| 2 | NC | -- | -- |
| 3 | NC | -- | -- |
| 4 | NC | -- | -- |
| 5 | GND | Ground. | P |
| 6 | GND | Ground. | P |
| 7 | VCC | Supply voltage(3.3V). | I |
| 8 | VCC | Supply voltage(3.3V). | I |
| 9 | IOVCC | Power Supply for I/O System. | I |
| 10 | SDO | SPI interface output pin. -The data is output on the falling edge of the SCL signal. -If not used, let this pin open. | O |
| 11-28 | DB17-DB0 | 18-bit parallel bi-directional data bus for MCU system and RGB i nterface mode. Fix to GND level when not in use | I/O |
| 29 | DIN(SDA) | Serial input signal. The data is latched on the rising edge of the SCL signal. fix this pin at IOVCC or GND when not in use. | I/O |
| 30 | PCLK | Dot clock signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use. | I |
| 31 | DE | Data enable signal for RGB interface operation. fix this pin at IOVCC or GND when not in use. | I |
| 32 | HSYNC | Line synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use. | I |
| 33 | VSYNC | Frame synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use. | I |
| 34 | RD | Read enable in 8080 MCU parallel interface. -If not used, please fix this pin at IOVCC or DGND. | I |
| 35 | WR(SPI-RS) | -Write enable in MCU parallel interface. - Display data/command selection pin in 4-line serial interface. - Second Data lane in 2 data lane serial interface. -If not used, please fix this pin at IOVCC or DGND. | I |
| 36 | RS(SPI-SCL) | -Display data/command selection pin in parallel interface. | I |

| | | | |
|----|-------|---|----|
| | | -This pin is used to be serial interface clock. RS='1': display data or parameter. RS='0': command data. -If not used, please fix this pin at IOVCC or DGND. | |
| 37 | CS | Chip select input pin ("Low" enable). fix this pin at IOVCC or GND when not in use. | I |
| 38 | RESET | This signal will reset the device and must be applied to properly initialize the chip. | I |
| 39 | IM0 | 18-bit parallel bi-directional data bus for MCU system and RGB interface mode. Fix to GND level when not in use | I |
| 40 | IM1 | | |
| 41 | IM2 | | |
| 42 | NC | -- | -- |
| 43 | LEDA | Anode pin of backlight | P |
| 44 | NC | -- | -- |
| 45 | LEDK | Cathode pin OF backlight | P |

4. LCD Optical Characteristics

4.1 Optical specification (Reflective)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit. | Note |
|---------------------------------------|--------------------|--------------------------------|------------------------------|-------|------|-------|--------|
| White Reflectance (with Polarizer) | R _w (%) | Θ=0 Normal viewing angle | -- | 17.54 | -- | % | |
| Contrast Ratio | CR | | -- | 15 | -- | | (1)(2) |
| Response time | Rising | | T _{R+T_F} | -- | 5 | 7 | msec |
| | Falling | -- | | | | | |
| Color Gamut | S(%) | | -- | 13.79 | -- | % | |
| Color Filter Chromaticity | White | W _X | -- | 0.336 | -- | | (1)(4) |
| | | W _Y | -- | 0.342 | -- | | CA-310 |
| Viewing angle | Hor. | Θ _L | -- | 55 | -- | -- | (1)(4) |
| | | Θ _R | -- | 55 | -- | | |
| | Ver. | Θ _U | -- | 60 | -- | | |
| | | Θ _D | -- | 60 | -- | | |

4.2 Optical specification (Transmittance)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit. | Note |
|---|--------------------|--------------------------------|------------------------------|-------|-------|-------|------------------|
| White Transmittance (with Polarizer) | R _w (%) | Θ=0 Normal viewing angle | -- | 2.19 | | % | |
| Contrast Ratio | CR | | 60 | 80 | -- | | (1)(2) |
| Response time | Rising | | T _{R+T_F} | -- | 6 | 8 | msec |
| | Falling | -- | | | | | |
| Color Gamut | S(%) | | 20 | 24.5 | -- | % | |
| Color Filter Chromaticity | White | W _X | -0.04 | 0.327 | +0.04 | | (1)(4) CA-310 |
| | | W _Y | | 0.341 | | | |
| | Red | R _X | | 0.488 | | | |
| | | R _Y | | 0.298 | | | |
| | Green | G _X | | 0.329 | | | |
| | | G _Y | | 0.461 | | | |
| | Blue | B _X | | 0.173 | | | |
| | | B _Y | | 0.134 | | | |
| Viewing angle | Hor. | Θ _L | -- | 60 | -- | | (1)(4) |
| | | Θ _R | -- | 60 | -- | | |
| | Ver. | Θ _U | -- | 60 | -- | | |
| | | Θ _D | -- | 60 | -- | | |
| Option View Direction | 3 O'clock | | | | | | |

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark rooms

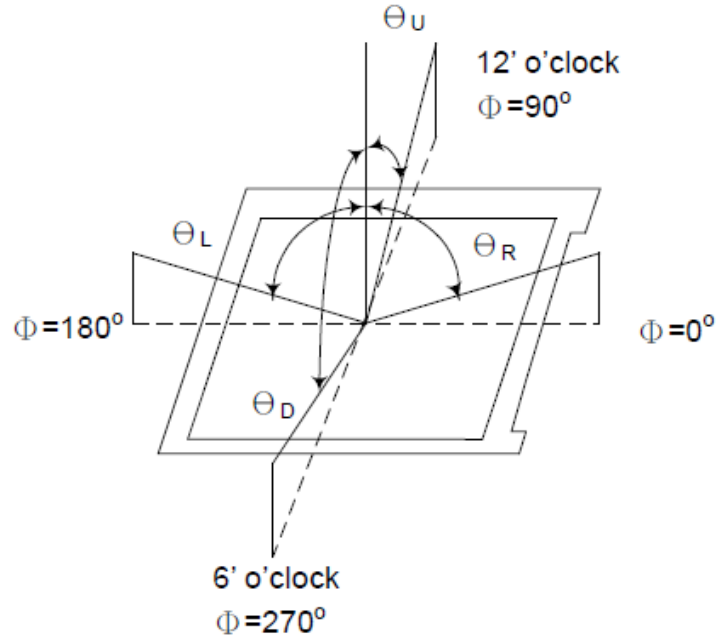
Ambient temperature : 25±2°C

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

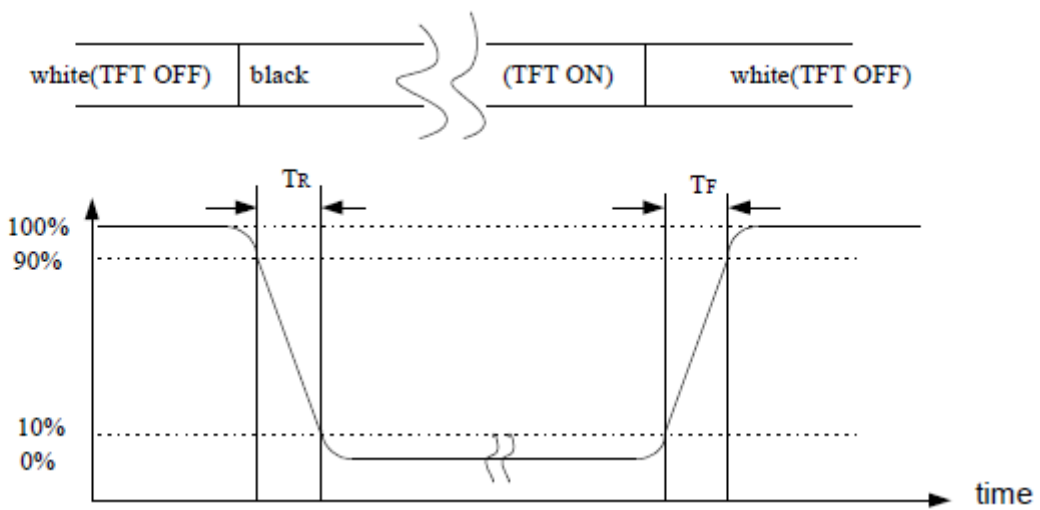
Note (1): Definition of Viewing Angle :



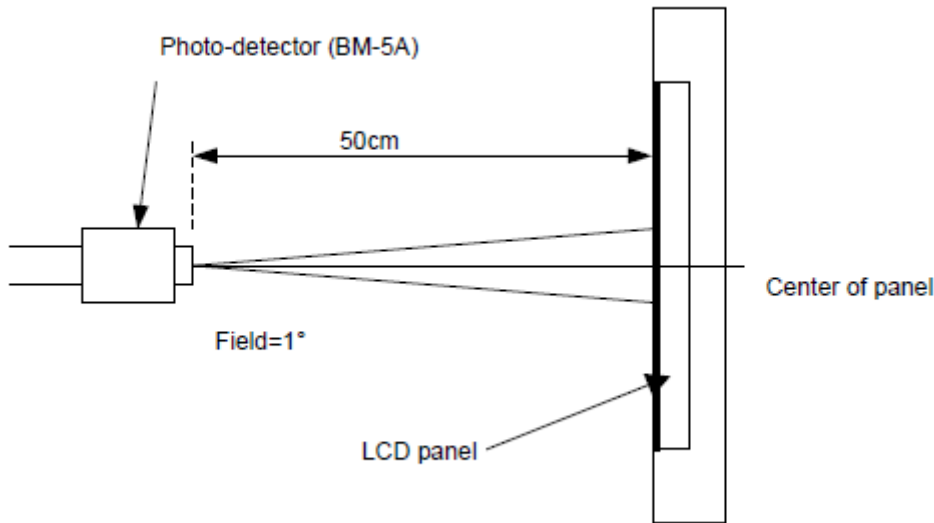
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

| Characteristics | Symbol | Min. | Max. | Unit |
|------------------------|-----------------|------|------|------|
| Digital Supply Voltage | VCC | -0.3 | 4.6 | V |
| Supply Voltage (Logic) | IOVCC | -0.3 | 4.6 | |
| Operating temperature | T _{OP} | -20 | +70 | °C |
| Storage temperature | T _{ST} | -30 | +80 | °C |

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|---------------------------------|-----------------|-----------|------|-----------|------|------|
| Digital Supply Voltage | VCC | 2.4 | 3.3 | 3.6 | V | |
| Supply Voltage (Logic) | IOVCC | 1.65 | 1.8 | 3.3 | | |
| Normal mode Current consumption | IDD | -- | 5 | 10 | mA | |
| Level input voltage | V _{IH} | 0.7 Iovcc | | Iovcc | V | |
| | V _{IL} | GND | | 0.3Iovcc | V | |
| Level output voltage | V _{OH} | 0.8 Iovcc | | Iovcc | V | |
| | V _{OL} | GND | | 0.2 Iovcc | V | |

5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 4 chips White LED

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|----------------|-------|------|------|-------------------|------------------|
| Forward Current | I _F | -- | 80 | -- | mA | Constant current |
| Forward Voltage | V _F | 2.7 | 3.1 | 3.3 | V | |
| LCM Luminance (I _F =80mA) | L _v | 200 | 250 | -- | cd/m ² | Note3 |
| LED life time | Hr | 50000 | -- | -- | Hour | Note1,2 |
| Uniformity | AVg | 80 | -- | -- | % | Note3 |

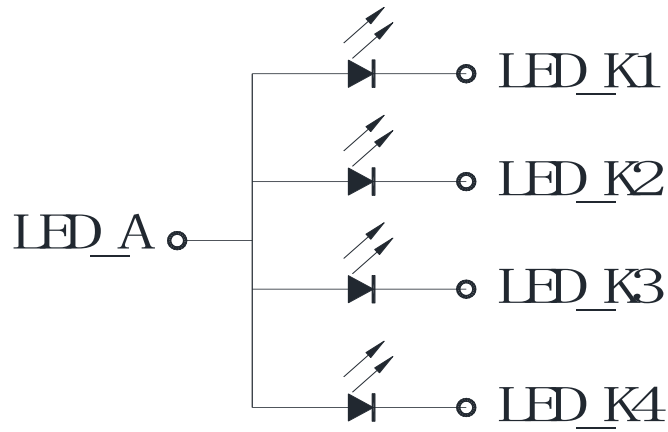
Note 1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

T_a=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at

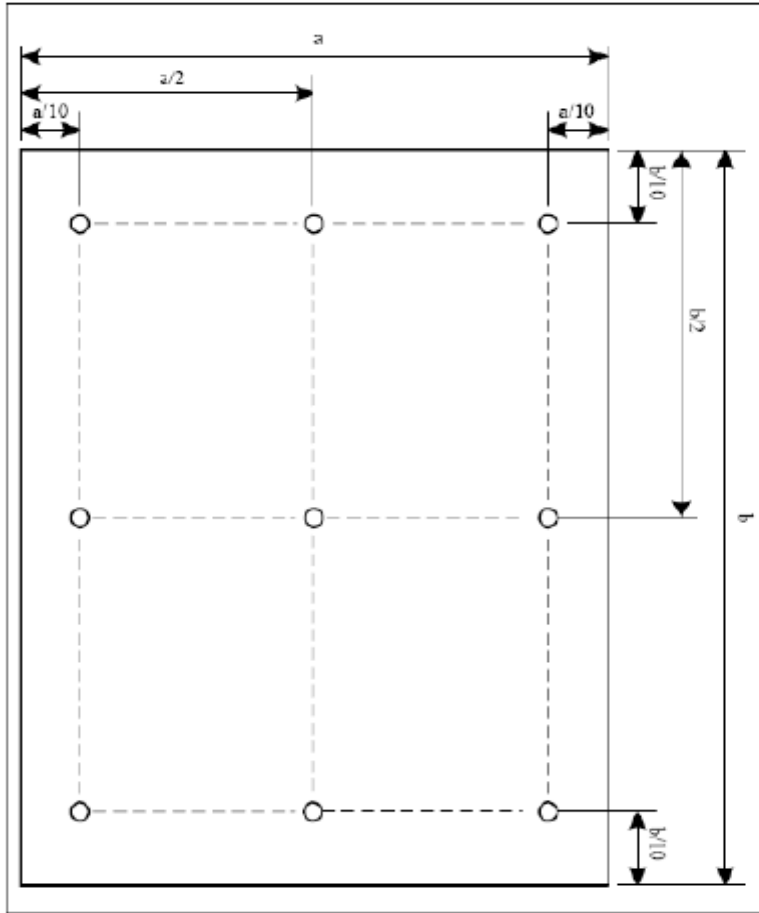
T_a=25°C and I_L=80mA. The LED lifetime could be decreased if operating I_L is larger than 20mA. The

constant current driving method is suggested.



LED(B/L) CIRCUIT

NOTE 3: Luminance Uniformity of these 9 points is defined as below:

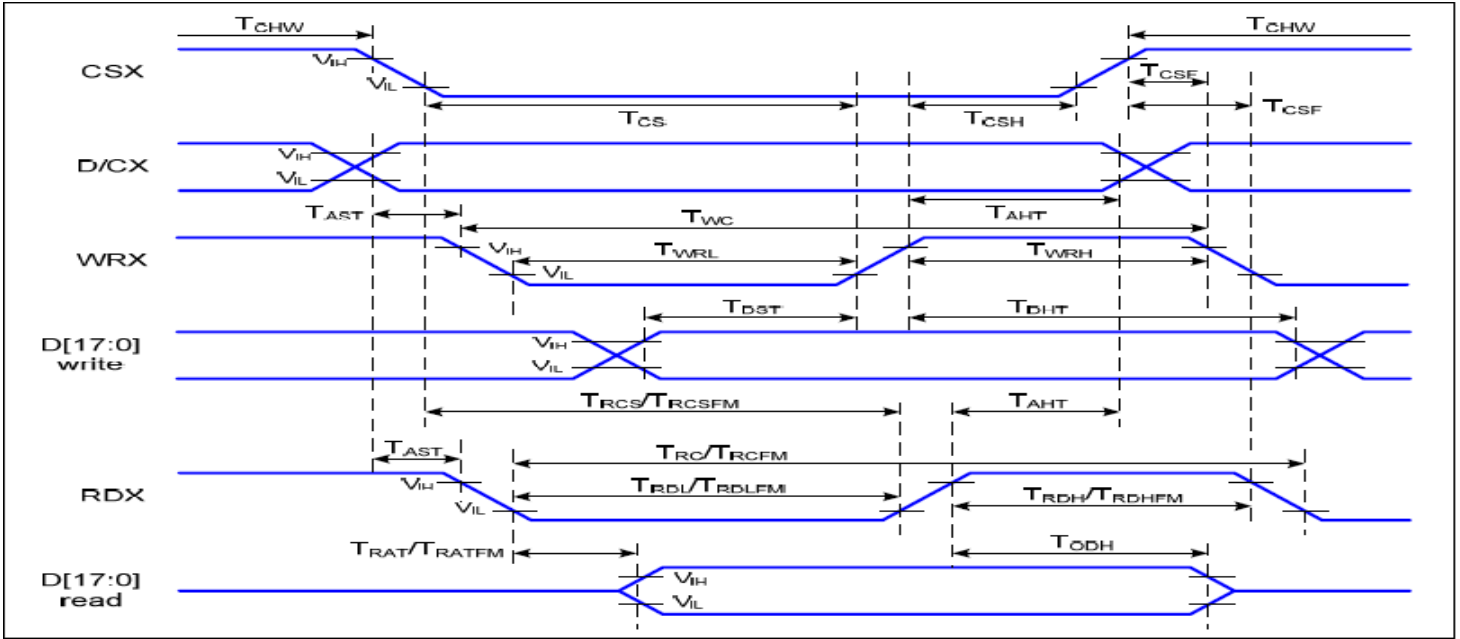


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. AC Characteristic

6.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

| 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 4 8080 Parallel Interface Characteristics

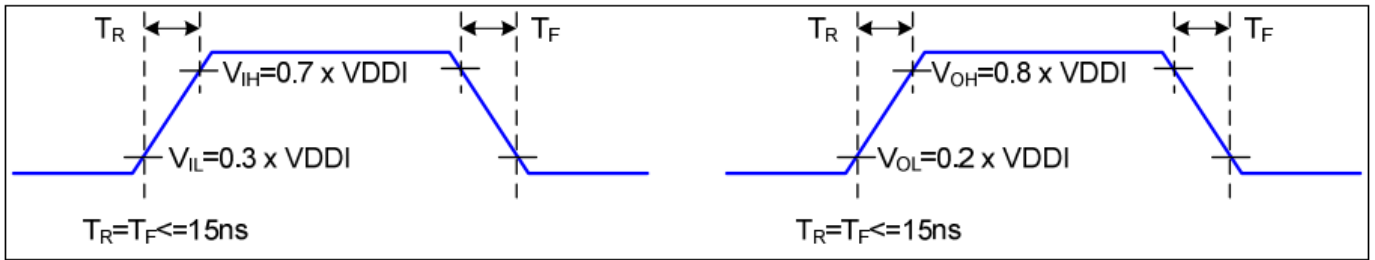


Figure 2 Rising and Falling Timing for I/O Signal

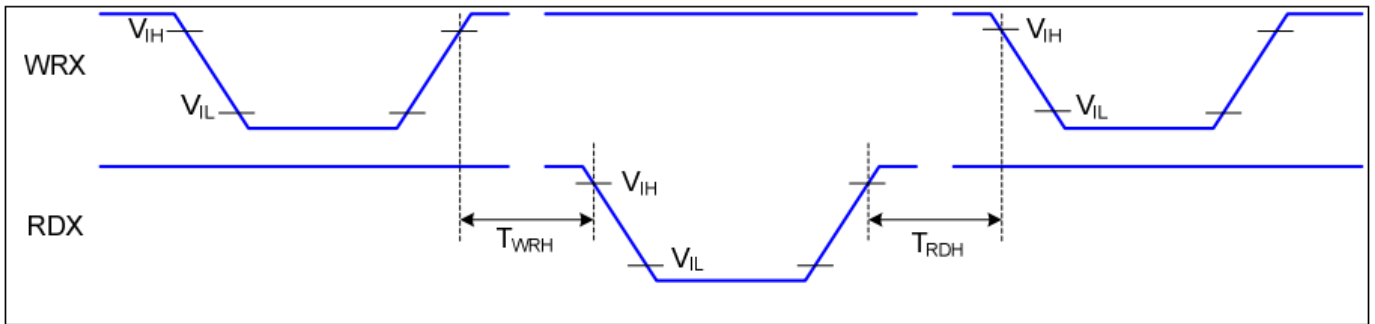


Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (T_r , T_f) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

6.2 Serial Interface Characteristics (3-line serial)

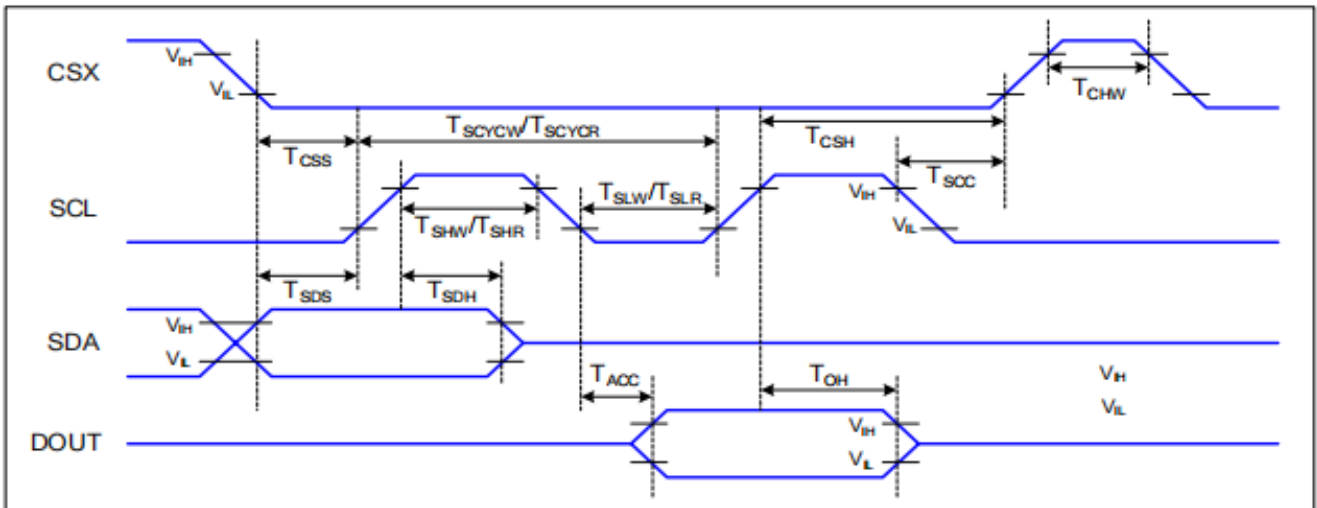


Figure 4 3-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

| 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 | |
| | 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 | |
| | T _{SHR} | SCL "H" pulse width (Read) | 60 | | ns | |
| | T _{SLR} | SCL "L" pulse width (Read) | 60 | | 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 5 3-line serial Interface Characteristics

Note 1 : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals

Note2: In the read sequence of serial interface, the 500nsec delay time is needed between read command and first read clock..

6.3 Serial Interface Characteristics (4-line serial)

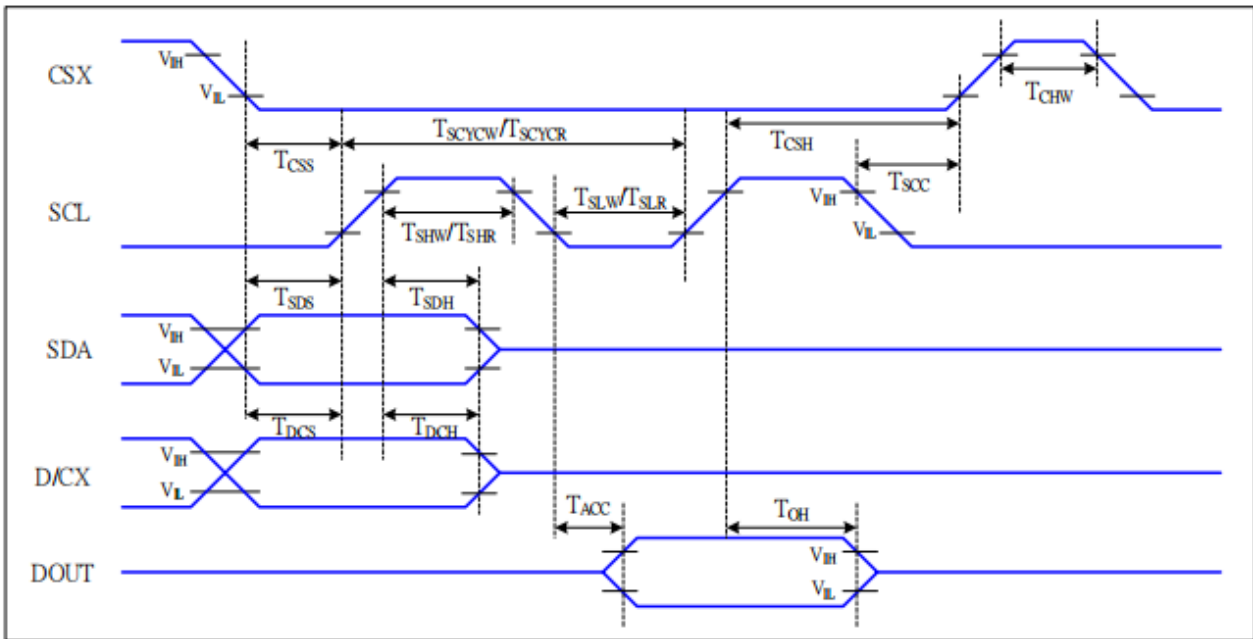


Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

| 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 _{scyw} | 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 _{scy} | 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 _{sd} | 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 6 4-line serial Interface Characteristics

Note1 : The rising time and falling time (T_r , T_f) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals

Note2: In the read sequence of serial interface, the 500nsec delay time is needed between read command and first read clock..

6.4 RGB Interface Characteristics

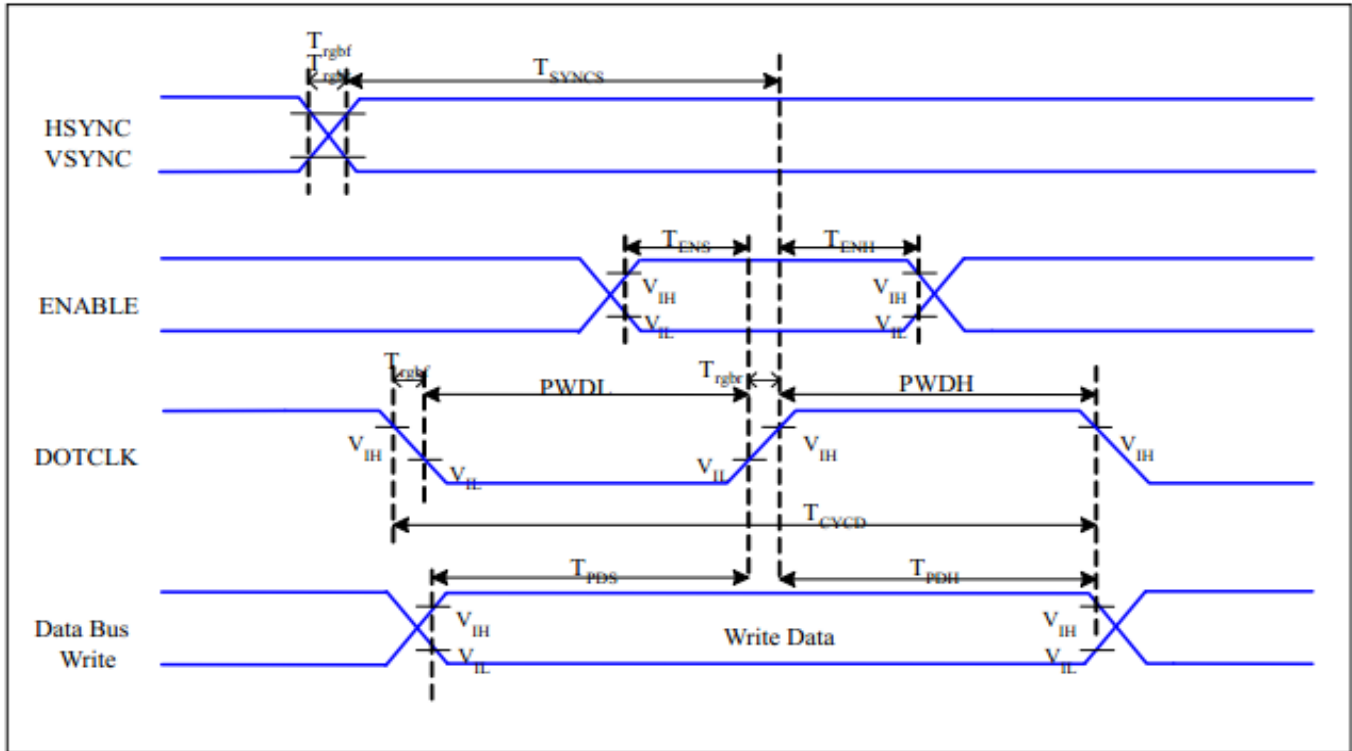


Figure 6 RGB Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25 °C

| 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 7 18/16 Bits RGB Interface Timing Characteristics

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|--------------|-------------|-------------------------|-----|-----|------|-------------|
| HSYNC, VSYNC | T_{SYNCS} | VSYNC, HSYNC Setup Time | 35 | - | ns | |
| ENABLE | T_{ENS} | Enable Setup Time | 35 | - | ns | |

| | | | | | | |
|--------|--------------|-------------------------------|----|----|----|--|
| | T_{ENH} | Enable Hold Time | 35 | - | ns | |
| DOTCLK | PWDH | DOTCLK High-level Pulse Width | 35 | - | ns | |
| | PWDL | DOTCLK Low-level Pulse Width | 35 | - | ns | |
| | T_{CYCD} | DOTCLK Cycle Time | 80 | - | ns | |
| | Trghr, Trghf | DOTCLK Rise/Fall time | - | 10 | ns | |
| DB | T_{PDS} | PD Data Setup Time | 35 | - | ns | |
| | T_{PDH} | PD Data Hold Time | 35 | - | ns | |

Table 8 6 Bits RGB Interface Timing Characteristics

6.5 Reset Timing Characteristics

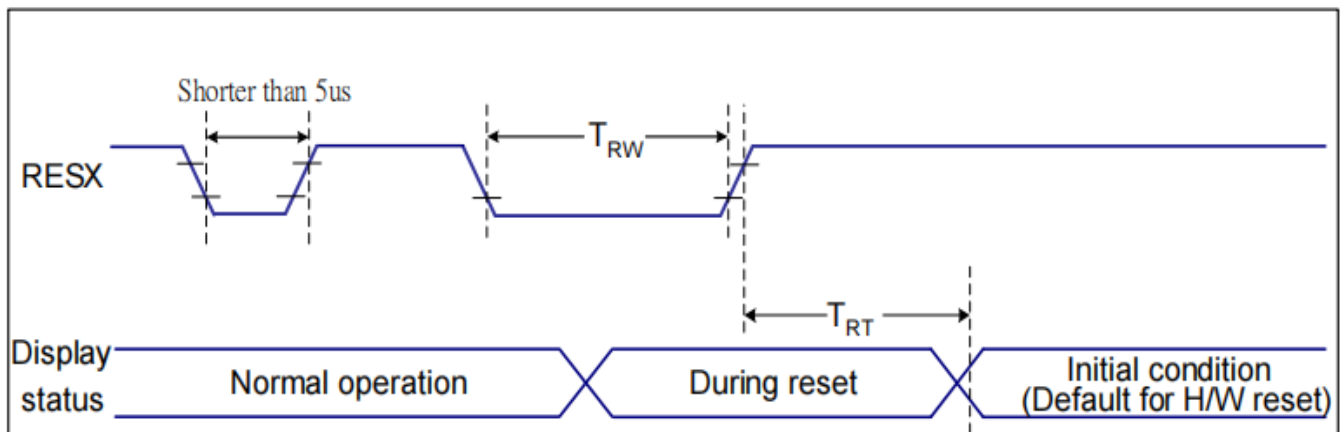


Figure 7 Reset Timing

$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=25^{\circ}C$

| 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 9 Reset Timing

Notes:

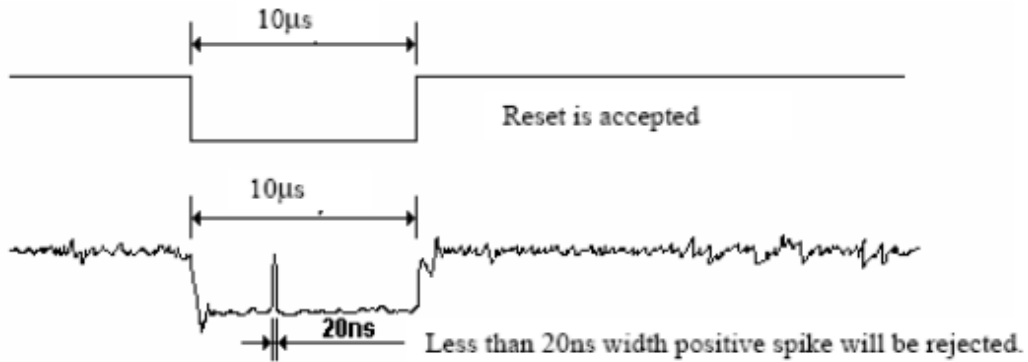
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

| RESX Pulse | Action |
|---------------------|----------------|
| Shorter than 5us | Reset Rejected |
| Longer than 9us | Reset |
| Between 5us and 9us | Reset starts |

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

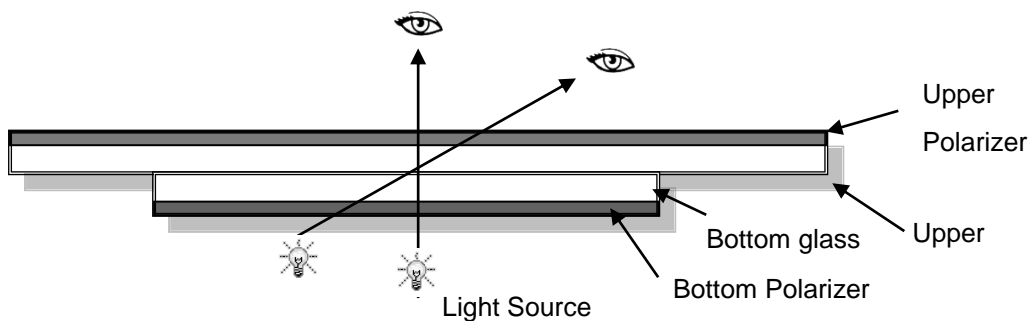
Temperature : $25 \pm 5^\circ\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

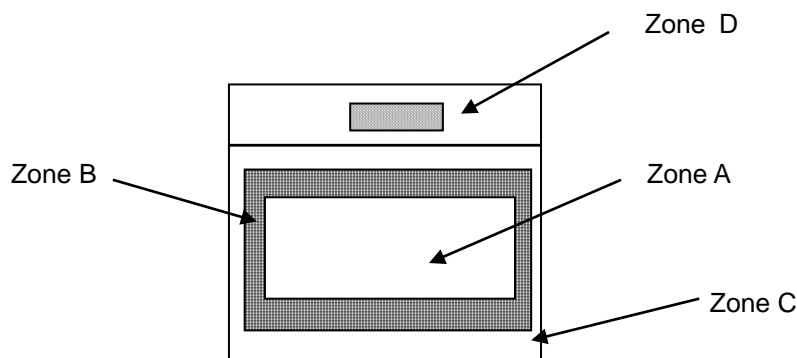
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2012 ; , normal inspection, Class II

AQL:

| Major defect | Minor defect |
|--------------|--------------|
| 0.65 | 1.5 |

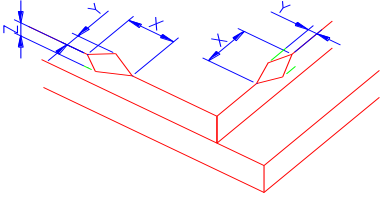
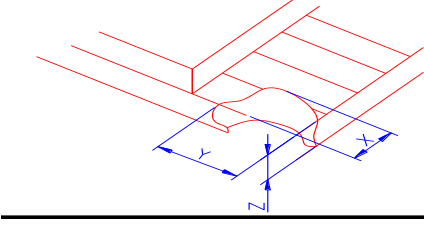
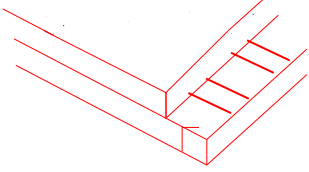
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module,

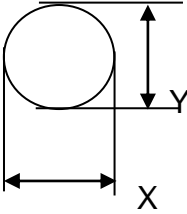
| No | Items to be inspected | Criteria | Classification of defects |
|----|-----------------------|--|---------------------------|
| 1 | Functional defects | 1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc... | Major |
| 2 | Missing | Missing components and etc... | |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed, deformation and etc... | |
| 4 | Color tone | Color unevenness, refer to limited sample | Minor |
| 5 | Spot/Line defect | Light dot, Dim spot, (Note1) Polarizer Air Bubble, Polarizer accidented spot and etc. | |
| 6 | Soldering appearance | Good soldering , Peeling off is not allowed and etc. | |
| 7 | LCD/Polarizer | Black/White spot/line, scratch, crack, etc. | |




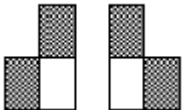
Note1: a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.


b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

| Number | Items | Criteria(mm) | | | | | | |
|---|---|---|----|---|--------|--------|--------------------------------|----|
| 1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD | (1) The edge of LCD broken |  <table border="1" data-bbox="756 613 1455 761"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td><Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table> | X | Y | Z | ≤3.0mm | <Inner border line of the seal | ≤T |
| | X | Y | Z | | | | | |
| | ≤3.0mm | <Inner border line of the seal | ≤T | | | | | |
| (2) LCD corner broken |  <table border="1" data-bbox="836 1070 1375 1169"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table> | X | Y | Z | ≤3.0mm | ≤L | ≤T | |
| X | Y | Z | | | | | | |
| ≤3.0mm | ≤L | ≤T | | | | | | |
| (3) LCD crack |  <p style="text-align: center;">Crack Not allowed</p> | | | | | | | |

| 2.0 | Spot defect | <p>① light dot (black/white spot , pinhole, stain, etc.)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.25$</td> <td colspan="3" style="text-align: center;">3(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$0.25 < \Phi \leq 0.4$</td> <td colspan="3" style="text-align: center;">2(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>② Dim spot (light leakage, dent, dark spot, etc)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.25$</td> <td colspan="3" style="text-align: center;">3(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$0.25 < \Phi \leq 0.4$</td> <td colspan="3" style="text-align: center;">2(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>③ Polarizer accidented spot</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.2$</td> <td colspan="2" style="text-align: center;">Ignore</td> <td rowspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi \leq 0.5$</td> <td colspan="2" style="text-align: center;">2(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.5$</td> <td colspan="2" style="text-align: center;">0</td> </tr> </tbody> </table> <p>④ Polarizer Bubble</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.2$</td> <td colspan="2" style="text-align: center;">Ignore</td> <td rowspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi \leq 0.4$</td> <td colspan="2" style="text-align: center;">3(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="2" style="text-align: center;">0</td> </tr> </tbody> </table> | | | Zone Size (mm) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.15$ | Ignore | | | $0.15 < \Phi \leq 0.25$ | 3(distance ≥ 6 mm) | | | $0.25 < \Phi \leq 0.4$ | 2(distance ≥ 6 mm) | | | $\Phi > 0.4$ | 0 | | | Zone Size (mm) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.15$ | Ignore | | | $0.15 < \Phi \leq 0.25$ | 3(distance ≥ 6 mm) | | | $0.25 < \Phi \leq 0.4$ | 2(distance ≥ 6 mm) | | | $\Phi > 0.4$ | 0 | | | Zone Size (mm) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.2$ | Ignore | | Ignore | $0.2 < \Phi \leq 0.5$ | 2(distance ≥ 6 mm) | | $\Phi > 0.5$ | 0 | | Zone Size (mm) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.2$ | Ignore | | Ignore | $0.2 < \Phi \leq 0.4$ | 3(distance ≥ 6 mm) | | $\Phi > 0.4$ | 0 | |
|--|--------------------------|--|--------|--|-------------------|----------------|---|--|---|---|---|------------------|--------|--|--|-------------------------|-------------------------|--|--|------------------------|-------------------------|--|--|--------------|---|--|--|-------------------|----------------|--|--|---|---|---|------------------|--------|--|--|-------------------------|--------------------------|--|--|------------------------|--------------------------|--|--|--------------|---|--|--|-------------------|----------------|--|--|---|---|---|-----------------|--------|--|--------|-----------------------|--------------------------|--|--------------|---|--|-------------------|----------------|--|--|---|---|---|-----------------|--------|--|--------|-----------------------|-------------------------|--|--------------|---|--|
| | Zone Size (mm) | | | | | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | $\Phi \leq 0.15$ | | | | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.15 < \Phi \leq 0.25$ | 3(distance ≥ 6 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.25 < \Phi \leq 0.4$ | 2(distance ≥ 6 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.15$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.15 < \Phi \leq 0.25$ | 3(distance ≥ 6 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.25 < \Phi \leq 0.4$ | 2(distance ≥ 6 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.2$ | Ignore | | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < \Phi \leq 0.5$ | 2(distance ≥ 6 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.5$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.2$ | Ignore | | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < \Phi \leq 0.4$ | 3(distance ≥ 6 mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  <p style="text-align: center;">$\Phi = (X+Y)/2$</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 3.0 | LCD Pixel defect | <p>Pixel bad points</p> <table border="1" data-bbox="539 250 1497 999"> <thead> <tr> <th data-bbox="539 250 730 304">Item</th> <th data-bbox="730 250 1241 304">Zone A</th> <th data-bbox="1241 250 1497 304">Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="539 304 730 465" rowspan="3">Bright dot</td> <td data-bbox="730 304 1241 358">Random</td> <td data-bbox="1241 304 1497 358">N≤2</td> </tr> <tr> <td data-bbox="730 358 1241 412">2 dots adjacent</td> <td data-bbox="1241 358 1497 412">N≤0</td> </tr> <tr> <td data-bbox="730 412 1241 465">3 dots adjacent</td> <td data-bbox="1241 412 1497 465">N≤0</td> </tr> <tr> <td data-bbox="539 465 730 627" rowspan="3">Dark dot</td> <td data-bbox="730 465 1241 519">Random</td> <td data-bbox="1241 465 1497 519">N≤2</td> </tr> <tr> <td data-bbox="730 519 1241 573">2 dots adjacent</td> <td data-bbox="1241 519 1497 573">N≤0</td> </tr> <tr> <td data-bbox="730 573 1241 627">3 dots adjacent</td> <td data-bbox="1241 573 1497 627">N≤0</td> </tr> <tr> <td data-bbox="539 627 730 940">Distance</td> <td data-bbox="730 627 1241 940"> 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. </td> <td data-bbox="1241 627 1497 940">5mm</td> </tr> <tr> <td colspan="2" data-bbox="539 940 1241 999">Total bright and dark dot</td> <td data-bbox="1241 940 1497 999">N≤4</td> </tr> </tbody> </table> <p data-bbox="539 1008 619 1039">Note:</p> <p data-bbox="539 1061 1481 1151">A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p data-bbox="539 1169 1439 1258">B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p data-bbox="539 1317 1031 1348">C) 2 dot adjacent = 1 pair = 2 dots</p> <p data-bbox="539 1366 651 1397">Picture:</p> <div data-bbox="667 1451 743 1509" style="display: inline-block; text-align: center;">  </div> <p data-bbox="584 1554 791 1585">2 dot adjacent</p> <div data-bbox="1075 1451 1187 1509" style="display: inline-block; text-align: center;">  </div> <p data-bbox="1027 1554 1235 1585">2 dot adjacent</p> <div data-bbox="676 1621 718 1729" style="display: inline-block; text-align: center;">  </div> <p data-bbox="539 1751 874 1783">2 dot adjacent (vertical)</p> <div data-bbox="1082 1621 1264 1729" style="display: inline-block; text-align: center;">  </div> <p data-bbox="1018 1751 1321 1783">2 dot adjacent (slant)</p> | Item | Zone A | Acceptable Qty | Bright dot | Random | N≤2 | 2 dots adjacent | N≤0 | 3 dots adjacent | N≤0 | Dark dot | Random | N≤2 | 2 dots adjacent | N≤0 | 3 dots adjacent | N≤0 | Distance | 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. | 5mm | Total bright and dark dot | | N≤4 |
|---------------------------|---|--|------|--------|----------------|------------|--------|-----|-----------------|-----|-----------------|-----|----------|--------|-----|-----------------|-----|-----------------|-----|----------|---|-----|---------------------------|--|-----|
| Item | Zone A | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | |
| Bright dot | Random | N≤2 | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| Dark dot | Random | N≤2 | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| Distance | 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. | 5mm | | | | | | | | | | | | | | | | | | | | | | | |
| Total bright and dark dot | | N≤4 | | | | | | | | | | | | | | | | | | | | | | | |

| 4.0 | Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N : Count | <table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> <td colspan="2">Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.04$</td> <td>$L \leq 3.0$</td> <td colspan="2">$N \leq 2$</td> </tr> <tr> <td>$0.04 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td colspan="2">$N \leq 1$</td> </tr> <tr> <td>$W > 0.05$</td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table> | Width(mm) | Length(m m) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.03$ | Ignore | Ignore | | Ignore | $0.03 < W \leq 0.04$ | $L \leq 3.0$ | $N \leq 2$ | | $0.04 < W \leq 0.05$ | $L \leq 2.0$ | $N \leq 1$ | | $W > 0.05$ | Define as spot defect | | | |
|----------------------|---|--|--------------|-------------|----------------|----------------|--|---|---|---|------------------|--------|--------|--|--------|----------------------|--------------|------------|--|----------------------|--------------|------------|--|------------|-----------------------|--|--|--|
| | | Width(mm) | | | Length(m m) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | |
| | | | A | B | | C | | | | | | | | | | | | | | | | | | | | | | |
| | | $\Phi \leq 0.03$ | Ignore | Ignore | | Ignore | | | | | | | | | | | | | | | | | | | | | | |
| | | $0.03 < W \leq 0.04$ | $L \leq 3.0$ | $N \leq 2$ | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.04 < W \leq 0.05$ | $L \leq 2.0$ | $N \leq 1$ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $W > 0.05$ | Define as spot defect | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | Electronic Components SMT. | Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.0 | Display color& Brightness. | 1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.0 | LCD Mura/Waving/ Hot spot | Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary. | | | | | | | | | | | | | | | | | | | | | | | | | | |

Criteria (functional items)

| Number | Items | Criteria (mm) |
|--------|-----------------------|---------------|
| 1 | No display | Not allowed |
| 2 | Missing segment | Not allowed |
| 3 | Short | Not allowed |
| 4 | Backlight no lighting | Not allowed |

8. Reliability Test Result

| Item | Condition | Inspection after test |
|--|--|--|
| High Temperature Operating | 70°C,96H | Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value. |
| Low Temperature Operating | -20°C, 96HRS | |
| High Temperature Storage | 80°C, 96HR | |
| Low Temperature Storage | -30°C, 96HR | |
| High Temperature & High Humidity Operating | +60°C, 90% RH ,96 hours. | |
| Thermal Shock (Non-operation) | -10°C,30 min ↔ +60°C,30 min, Change time:5min 20CYC. | |
| ESD test | C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%). | |
| Vibration (Non-operation) | Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition). | |
| Box Drop Test | 1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX) | |

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

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

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.