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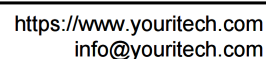
# SPECIFICATION FOR LCM+CTP Module

|            |              |
|------------|--------------|
| MODULE No: | ET020TR01-KT |
| CUSTOMER:  |              |

|             |         |      |
|-------------|---------|------|
| YOURITECH   | INITIAL | DATE |
| PREPARED BY |         |      |
| CHECKED BY  |         |      |
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|             |         |      |
|-------------|---------|------|
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[illegible]

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# 1.Basic Specifications

## \* 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, capacitance touch panel, back-light unit. The resolution of a 2.0 " TFT-LCD contains 320 x240 pixels, and can display up to 65K/262K colors.

## 1.1 TFT Features

| General Information Items | Specification                                                             | Unit    | Note |
|---------------------------|---------------------------------------------------------------------------|---------|------|
|                           | Main Panel                                                                |         |      |
| Display area(AA)          | 40.80(H)*30.60(V) (2.0 inch)                                              | mm      |      |
| Driver element            | TFT active matrix                                                         | -       |      |
| Display colors            | 65K/262K                                                                  | colors  |      |
| Number of pixels          | 320(RGB)*240                                                              | dots    |      |
| Pixel arrangement         | RGB vertical stripe                                                       | -       |      |
| Pixel pitch               | 0.1275(H)*0.1275(V)                                                       | mm      |      |
| Viewing angle             | Wide angle                                                                | o'clock |      |
| Controller IC             | ILI9342C                                                                  | -       |      |
| LCM Interface             | 8/9/16/18Bit MCU<br>3/4SPI+16/18Bit RGB Interface<br>3-line/4-line Serial | -       |      |
| Display mode              | Transflective /Normally Black                                             | -       |      |
| Operating temperature     | -20~+70                                                                   | °C      |      |
| Storage temperature       | -30~+80                                                                   | °C      |      |
| Module bonding technology | Use Tape bonding between LCM and CTP                                      | -       |      |

## 1.2 CTP Features

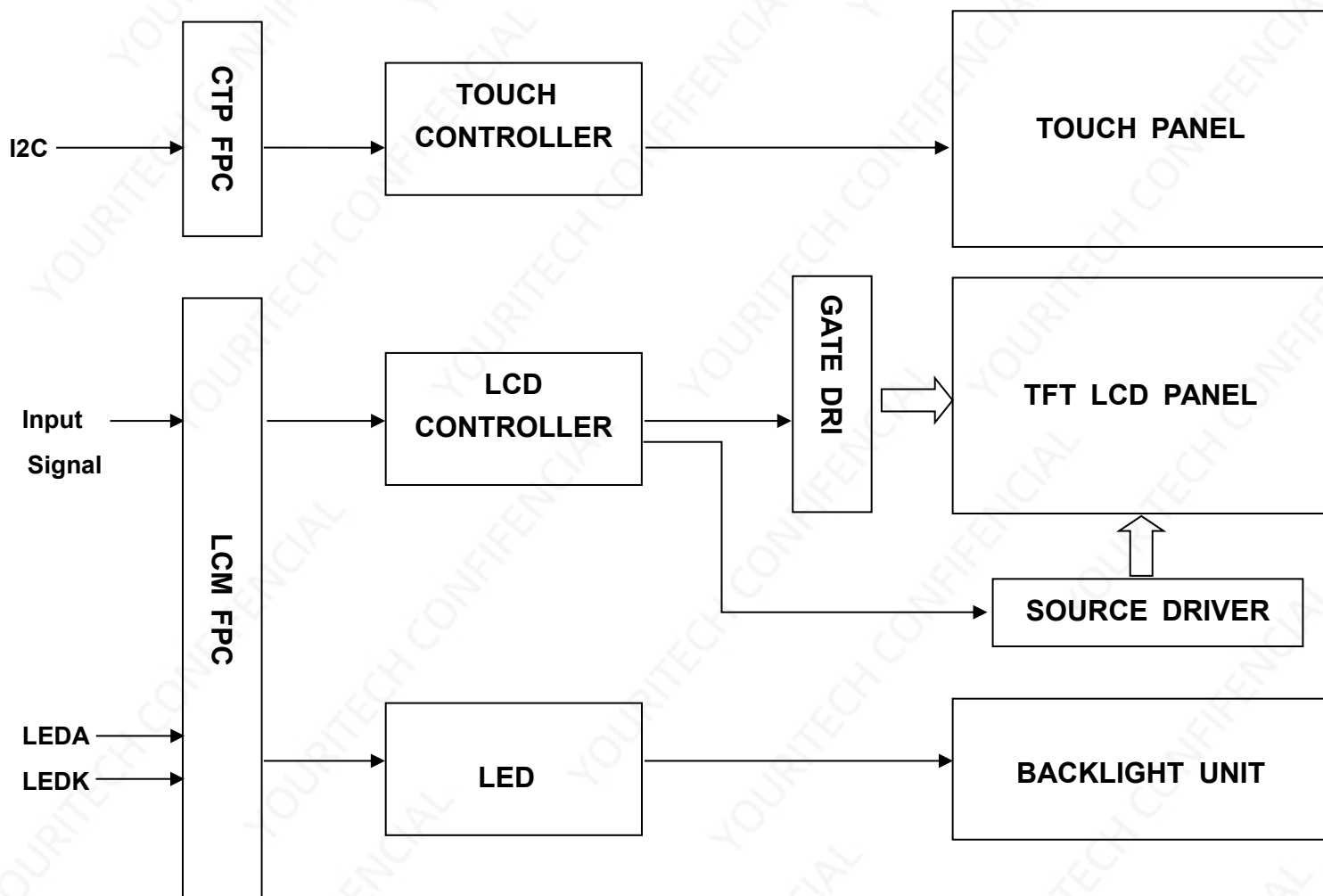
| General Information Items | Specification                          | Unit | Note |
|---------------------------|----------------------------------------|------|------|
|                           | Main Panel                             |      |      |
| Resolution                | 320(H)*240(V)                          | -    |      |
| Structure                 | G+G                                    | -    |      |
| Controller IC             | FT5436DQQ                              | -    |      |
| Interface                 | I2C                                    | -    |      |
| Slave Address             | 0x38(7bit)/8bit:0x70(Write) 0x71(Read) | -    |      |
| Touch mode                | Five points and Gestures               | -    | -    |



### 1.3 Mechanical Information

| Item        |               | Min. | Typ.  | Max. | Unit | Note |
|-------------|---------------|------|-------|------|------|------|
| Module size | Horizontal(H) | -    | 54.50 | -    | mm   |      |
|             | Vertical(V)   | -    | 47.56 | -    | mm   |      |
|             | Depth(D)      | -    | 4.35  | -    | mm   |      |
| Weight      |               | -    | TBD   | -    | g    |      |

### 2. Block Diagram





## 4. Input terminal Pin Assignment

### 4.1 TFT PIN Define

| NO. | SYMBOL      | DISCRIPTION                                                                                                                                                                    |   |   |                                     |               | I/O |
|-----|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------------------------------------|---------------|-----|
| 1   | GND         | Ground.                                                                                                                                                                        |   |   |                                     |               | P   |
| 2   | GND         | Ground.                                                                                                                                                                        |   |   |                                     |               | P   |
| 3   | IOVCC       | Supply voltage(1.65-3.3V)                                                                                                                                                      |   |   |                                     |               | P   |
| 4   | VCI         | Supply voltage(3.3V).                                                                                                                                                          |   |   |                                     |               | P   |
| 5   | IM3         | Interface Selection                                                                                                                                                            |   |   |                                     |               | I   |
| 6   | IM2         |                                                                                                                                                                                |   |   |                                     |               | IM3 |
| 7   | IM0         | 0                                                                                                                                                                              | 0 | 0 | DBI Tyb_ 8-bit interface            | DB7-DB0       | I   |
|     |             | 0                                                                                                                                                                              | 1 | 0 | DBI Tyb_ 16-bit interface           | DB15-DB0      |     |
|     |             | 0                                                                                                                                                                              | 0 | 1 | DBI Tyb_ 9-bit interface            | DB8-DB0       |     |
|     |             | 0                                                                                                                                                                              | 1 | 1 | DBI Tyb_ 18-bit interface           | DB17-DB0      |     |
|     |             | 1                                                                                                                                                                              | 0 | 1 | 3-Wire 9 BIT data serial interface. | SDA SCL CS    |     |
|     |             | 1                                                                                                                                                                              | 1 | 1 | 4-Wire 8 BIT data serial interface  | SDA SCL CS RS |     |
| 8   | SDA         | Serial input signal.The data is applied on the rising edge of the SCL signal.<br>If not used, fix this pin at IOVCC or GND.                                                    |   |   |                                     |               | I   |
| 9   | VSYNC       | Frame synchronizing signal for RGB interface operation.<br>fix this pin at IOVCC or GND when not in use.                                                                       |   |   |                                     |               | I   |
| 10  | HSYNC       | Line synchronizing signal for RGB interface operation.<br>fix this pin at IOVCC or GND when not in use                                                                         |   |   |                                     |               | I   |
| 11  | DOTCLK      | Dot clock signal for RGB interface operation<br>Fix this pin at IOVCC or GND when not in use.                                                                                  |   |   |                                     |               | I   |
| 12  | ENABLE      | Data enable signal for RGB interface operation.<br>fix this pin at IOVCC or GND when not in use.                                                                               |   |   |                                     |               | I   |
| 13  | RD          | Serves as a read signal and MCU read data at the rising edge.<br>fix this pin at IOVCC or GND when not in use.                                                                 |   |   |                                     |               | I   |
| 14  | WR(SPI-RS)  | (WR): Serves as a write signal and writes data at the rising edge.<br>4-line system (RS): Serves as command or parameter select.<br>Fix to IOVCC or GND level when not in use. |   |   |                                     |               | I   |
| 15  | RS(SPI-SCL) | This pin is used to select “Data or Command” in the parallel interface.                                                                                                        |   |   |                                     |               | I   |



|       |          |                                                                                                                                                                                                                                                                                               |     |
|-------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|       |          | <p>When RS = '1', data is selected.</p> <p>When RS = '0', command is selected.</p> <p>This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface.</p> <p>If not used, this pin should be connected to IOVCC or GND.</p> <p>RS_SCL1 is equal to RS(SCL).</p> |     |
| 16    | CS       | <p>Chip select input pin ("Low" enable).</p> <p>This pin can be permanently fixed "Low" in MPU interface mode only.</p> <p>CSX1 is equal to CSX.</p>                                                                                                                                          | I   |
| 17    | RESET    | <p>This signal will reset the device and must be applied to properly initialize the chip.</p> <p>Signal is active low. RESX1 is equal to RESX.</p>                                                                                                                                            | I   |
| 18-35 | DB17-DB0 | <p>18-bit parallel bi-directional data bus for MCU system and RGB interface mode</p> <p>Fix to GND level when not in use</p>                                                                                                                                                                  | I/O |
| 36    | NC       | --                                                                                                                                                                                                                                                                                            | --  |
| 37    | NC       | --                                                                                                                                                                                                                                                                                            | --  |
| 38    | LEDK     | Cathode pin OF backlight                                                                                                                                                                                                                                                                      | P   |
| 39    | NC       | --                                                                                                                                                                                                                                                                                            | --  |
| 40    | LEDA     | Anode pin of backlight                                                                                                                                                                                                                                                                        | P   |
| 41    | XR       | No connected.                                                                                                                                                                                                                                                                                 |     |
| 42    | YU       | No connected.                                                                                                                                                                                                                                                                                 |     |
| 43    | XL       | No connected.                                                                                                                                                                                                                                                                                 |     |
| 44    | YD       | No connected.                                                                                                                                                                                                                                                                                 |     |
| 45    | GND      | Ground.                                                                                                                                                                                                                                                                                       | P   |



## 4.2 CTP PIN Define

| NO. | SYMBOL | DISCRIPTION                     | I/O |
|-----|--------|---------------------------------|-----|
| 1   | GND    | Ground.                         | P   |
| 2   | VDDIO  | I/O power supply voltage.       | P   |
| 3   | VDD    | Supply voltage.                 | P   |
| 4   | SCL    | I2C clock input.                | I   |
| 5   | SDA    | I2C data input and output       | I/O |
| 6   | INT    | External interrupt to the host. | I   |
| 7   | RST    | External Reset, Low is active.  | I   |
| 8   | GND    | Ground.                         | P   |



## 5 LCD Optical Characteristics

### 5.1 Optical specification

| Item                                 |         | Symbol                         | Condition                   | Min.   | Typ.   | Max.   | Unit. | Note             |
|--------------------------------------|---------|--------------------------------|-----------------------------|--------|--------|--------|-------|------------------|
| Contrast Ratio                       |         | CR                             | Θ=0<br>Normal viewing angle | 120    | 170    | --     |       | (1)(2)           |
| Reflection Ratio<br>(With Polarizer) |         | R                              |                             | 5      | 7      | --     | %     |                  |
| Reflective Contrast Ratio            |         | Cr                             |                             | --     | 5      | --     | %     |                  |
| Response time                        | Rising  | T <sub>R</sub> +T <sub>F</sub> |                             | --     | 30     | 50     | msec  |                  |
|                                      | Falling |                                | (1)(3)                      |        |        |        |       |                  |
| Color Gamut                          |         | S(%)                           |                             | 37     | 42     | --     | %     |                  |
| Color Filter Chromaticity            | White   | W <sub>X</sub>                 |                             | 0.2517 | 0.2917 | 0.3317 |       | (1)(4)<br>CA-310 |
|                                      |         | W <sub>Y</sub>                 |                             | 0.2626 | 0.3026 | 0.3426 |       |                  |
|                                      | Red     | R <sub>X</sub>                 |                             | 0.5101 | 0.5501 | 0.5901 |       |                  |
|                                      |         | R <sub>Y</sub>                 |                             | 0.3079 | 0.3479 | 0.3879 |       |                  |
|                                      | Green   | G <sub>X</sub>                 |                             | 0.2931 | 0.3331 | 0.3731 |       |                  |
|                                      |         | G <sub>Y</sub>                 |                             | 0.4998 | 0.5398 | 0.5798 |       |                  |
|                                      | Blue    | B <sub>X</sub>                 |                             | 0.1181 | 0.1581 | 0.1981 |       |                  |
|                                      |         | B <sub>Y</sub>                 |                             | 0.0441 | 0.0841 | 0.1241 |       |                  |
| Viewing angle                        | Hor.    | Θ <sub>L</sub>                 | CR>10                       | 60     | 80     | --     |       | (1)(4)           |
|                                      |         | Θ <sub>R</sub>                 |                             | 60     | 80     | --     |       |                  |
|                                      | Ver.    | Θ <sub>U</sub>                 |                             | 60     | 80     | --     |       |                  |
|                                      |         | Θ <sub>D</sub>                 |                             | 60     | 80     | --     |       |                  |
| Option View Direction                |         | Wide angle                     |                             |        |        |        |       |                  |

\*The data comes from the LCD specification.

### Measuring Condition

Measuring surrounding : dark rooms

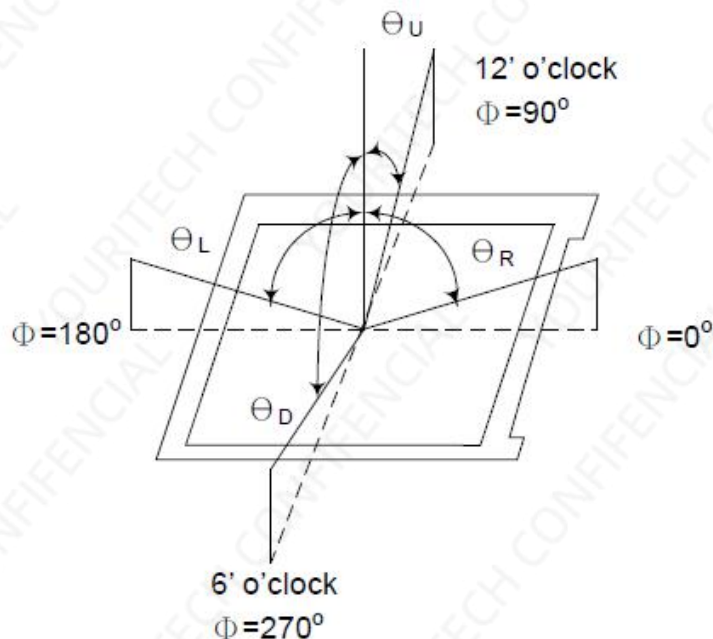
Ambient temperature :  $25\pm 2^\circ\text{C}$

15min. warm-up time.



FPM520 , which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

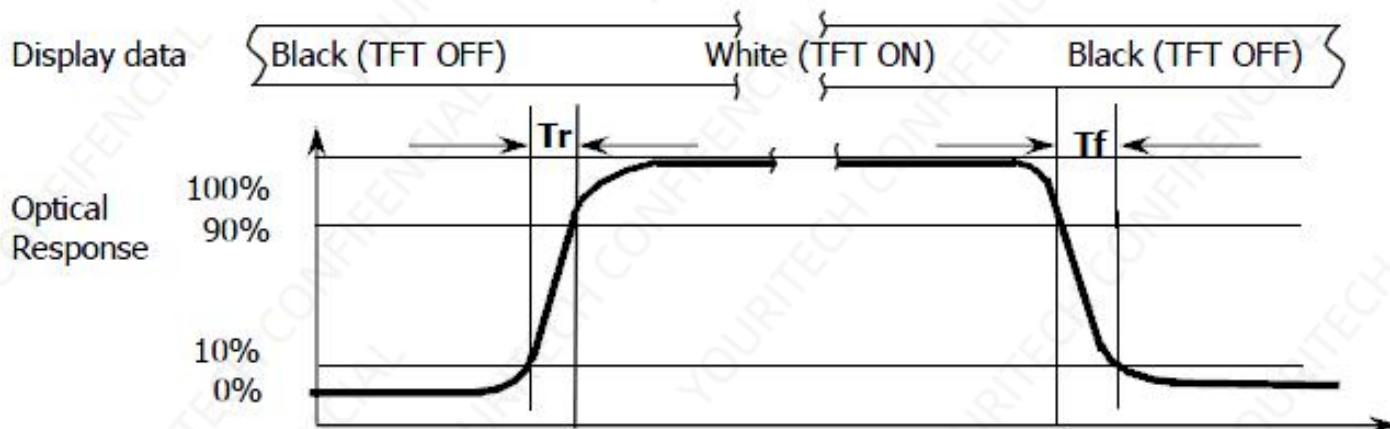
**Note (1):** Definition of Viewing Angle :



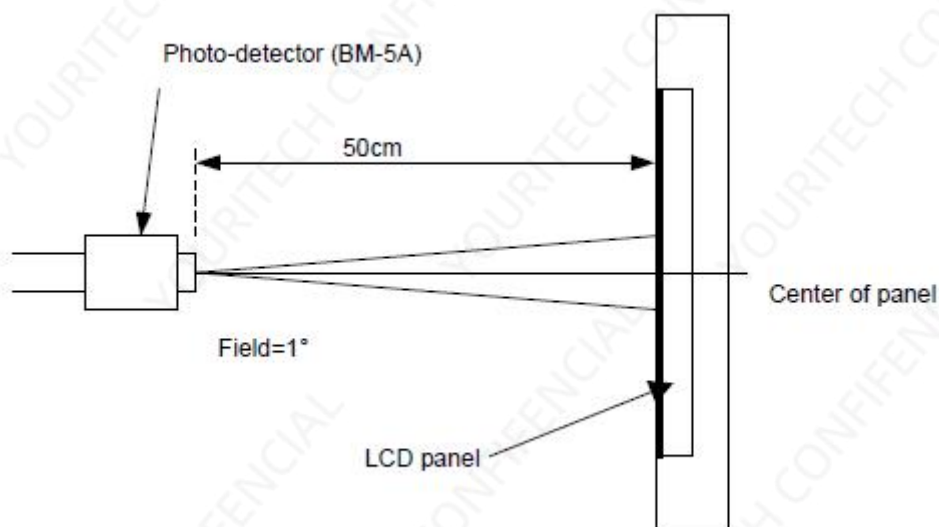
**Note (2):** Definition of Contrast Ratio(CR) :measured at the center point of panel

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

**Note (3): Response Time**



**Note (4): Definition of optical measurement setup**



## 6. Electrical Characteristics

### 6.1 Absolute Maximum Rating

| Characteristics                  | Symbol          | Min. | Max. | Unit | Note  |
|----------------------------------|-----------------|------|------|------|-------|
| Digital Supply Voltage           | V <sub>CI</sub> | -0.3 | 4.2  | V    | Note1 |
| Digital interface supply Voltage | IOVCC           | -0.3 | 3.3  | V    | Note1 |
| Operating temperature            | T <sub>OP</sub> | -20  | +70  | °C   |       |
| Storage temperature              | T <sub>ST</sub> | -30  | +80  | °C   |       |

NOTE1: 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.

### 6.2 DC Electrical Characteristics

| Characteristics                  | Symbol          | Min.      | Typ.    | Max.      | Unit | Note |
|----------------------------------|-----------------|-----------|---------|-----------|------|------|
| Digital Supply Voltage           | V <sub>CI</sub> | 2.5       | 2.8/3.3 | 3.6       | V    |      |
| Digital interface supply Voltage | IOVCC           | 1.65      | 1.8     | 3.3       | V    |      |
| Normal mode Current              | I <sub>DD</sub> | --        | 5       | --        | mA   |      |
| Level input voltage              | V <sub>IH</sub> | 0.7*IOVCC | --      | IOVCC     | V    |      |
|                                  | V <sub>IL</sub> | GND       | --      | 0.3*IOVCC | V    |      |
| Level output voltage             | V <sub>OH</sub> | 0.8*IOVCC | --      | IOVCC     | V    |      |
|                                  | V <sub>OL</sub> | GND       | --      | 0.2*IOVCC | V    |      |



### 6.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 8 chips LED

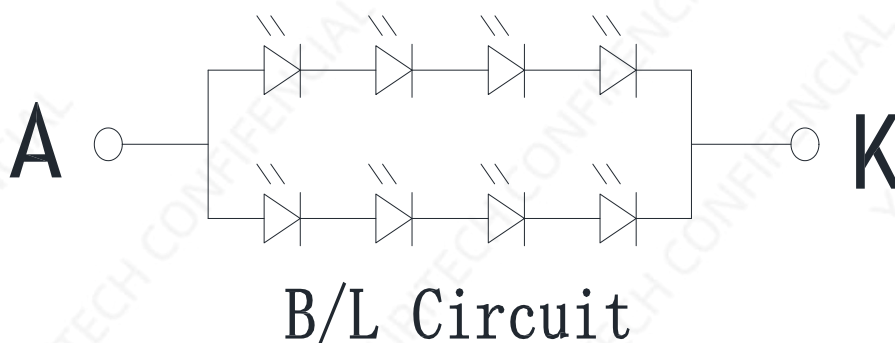
| Item            | Symbol | Min.  | Typ. | Max. | Unit              | Note    |
|-----------------|--------|-------|------|------|-------------------|---------|
| Forward Current | $I_F$  | 30    | 40   | --   | mA                |         |
| Forward Voltage | $V_F$  | --    | 12   | --   | V                 |         |
| LCM Luminance   | LV     | 250   | 300  | --   | cd/m <sup>2</sup> | Note3   |
| LED life time   | Hr     | 50000 | --   | --   | Hour              | Note1,2 |
| Uniformity      | Avg    | 80    | --   | --   | %                 | Note3   |

Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

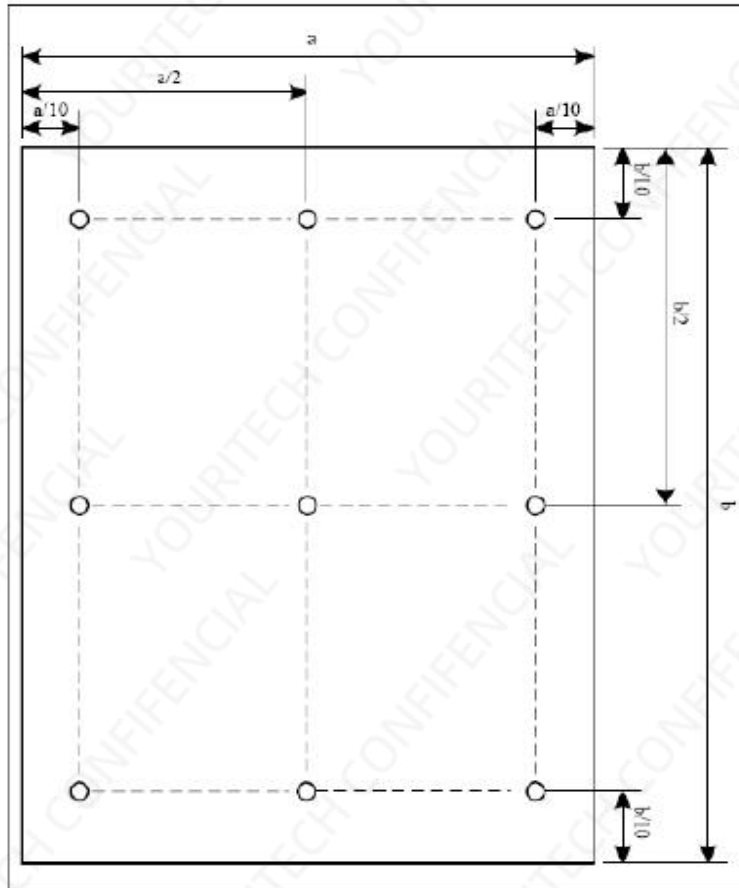
$T_a = 25 \pm 3$  °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

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

$T_a = 25$ °C and  $I_L = 40$ mA. The LED lifetime could be decreased if operating  $I_L$  is larger than 40mA. The constant current driving method is suggested.



Note (3) Luminance Uniformity of these 9 points is defined as below:sss



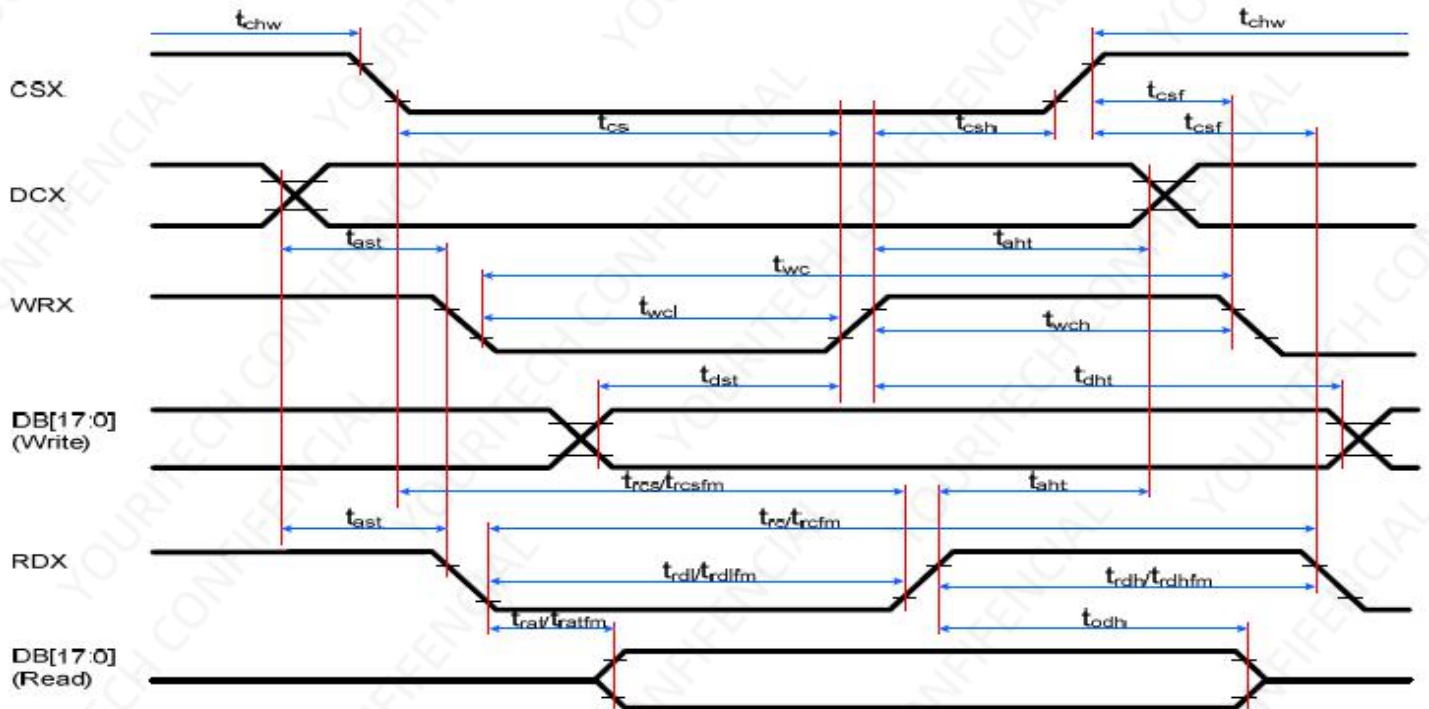
$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

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



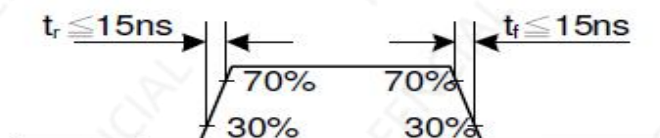
## 7. AC Characteristics

### 7.1 Display Parallel 8/9/16/18-bit Interface Timing Characteristics (8080 system)

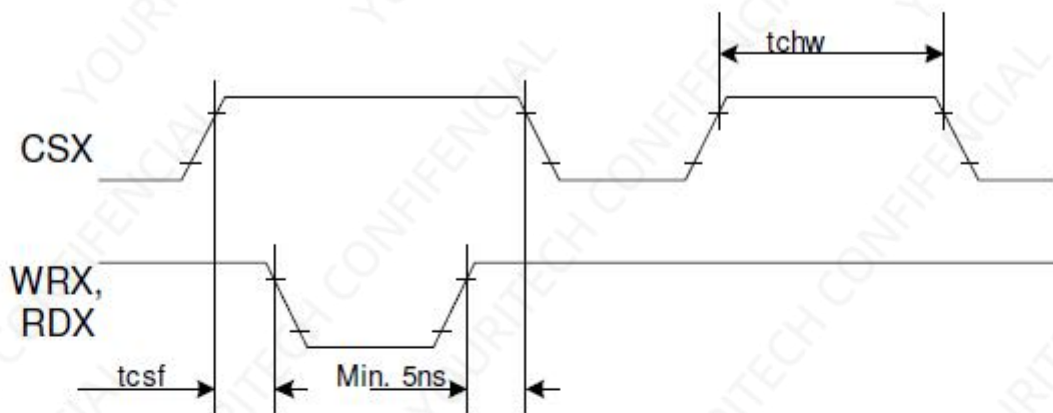


| Signal                                               | Symbol              | Parameter                          | min | max | Unit | Description                               |
|------------------------------------------------------|---------------------|------------------------------------|-----|-----|------|-------------------------------------------|
| DCX                                                  | t <sub>ast</sub>    | Address setup time                 | 0   | -   | ns   |                                           |
|                                                      | t <sub>ahh</sub>    | Address hold time (Write/Read)     | 10  | -   | ns   |                                           |
| CSX                                                  | t <sub>chw</sub>    | CSX "H" pulse width                | 0   | -   | ns   |                                           |
|                                                      | t <sub>cs</sub>     | Chip Select setup time (Write)     | 15  | -   | ns   |                                           |
|                                                      | t <sub>rcs</sub>    | Chip Select setup time (Read ID)   | 45  | -   | ns   |                                           |
|                                                      | t <sub>trcsfm</sub> | Chip Select setup time (Read FM)   | 355 | -   | ns   |                                           |
|                                                      | t <sub>csf</sub>    | Chip Select Wait time (Write/Read) | 10  | -   | ns   |                                           |
| WRX                                                  | t <sub>wc</sub>     | Write cycle                        | 66  | -   | ns   |                                           |
|                                                      | t <sub>wrh</sub>    | Write Control pulse H duration     | 15  | -   | ns   |                                           |
|                                                      | t <sub>wrl</sub>    | Write Control pulse L duration     | 15  | -   | ns   |                                           |
| RDX (FM)                                             | t <sub>trcfm</sub>  | Read Cycle (FM)                    | 450 | -   | ns   |                                           |
|                                                      | t <sub>trdhfm</sub> | Read Control H duration (FM)       | 90  | -   | ns   |                                           |
|                                                      | t <sub>trdlfm</sub> | Read Control L duration (FM)       | 355 | -   | ns   |                                           |
| RDX (ID)                                             | t <sub>trc</sub>    | Read cycle (ID)                    | 160 | -   | ns   |                                           |
|                                                      | t <sub>trdh</sub>   | Read Control pulse H duration      | 90  | -   | ns   |                                           |
|                                                      | t <sub>trdl</sub>   | Read Control pulse L duration      | 45  | -   | ns   |                                           |
| D[17:0],<br>D[17:10]&D[8:1],<br>D[17:10],<br>D[17:9] | t <sub>dst</sub>    | Write data setup time              | 10  | -   | ns   | For maximum CL=30pF<br>For minimum CL=8pF |
|                                                      | t <sub>dht</sub>    | Write data hold time               | 10  | -   | ns   |                                           |
|                                                      | t <sub>rat</sub>    | Read access time                   | -   | 40  | ns   |                                           |
|                                                      | t <sub>ratfm</sub>  | Read access time                   | -   | 340 | ns   |                                           |
|                                                      | t <sub>trod</sub>   | Read output disable time           | 20  | 80  | ns   |                                           |

Note: Ta = -30 to 70 °C, IOVCC=1.65V to 2.8V, VCI=2.6V to 3.3V, GND=0V.

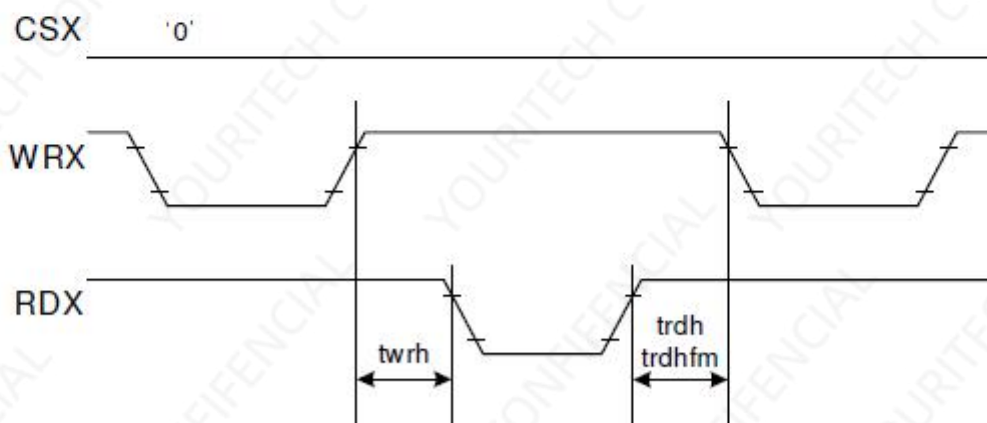


CSX timings :



Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

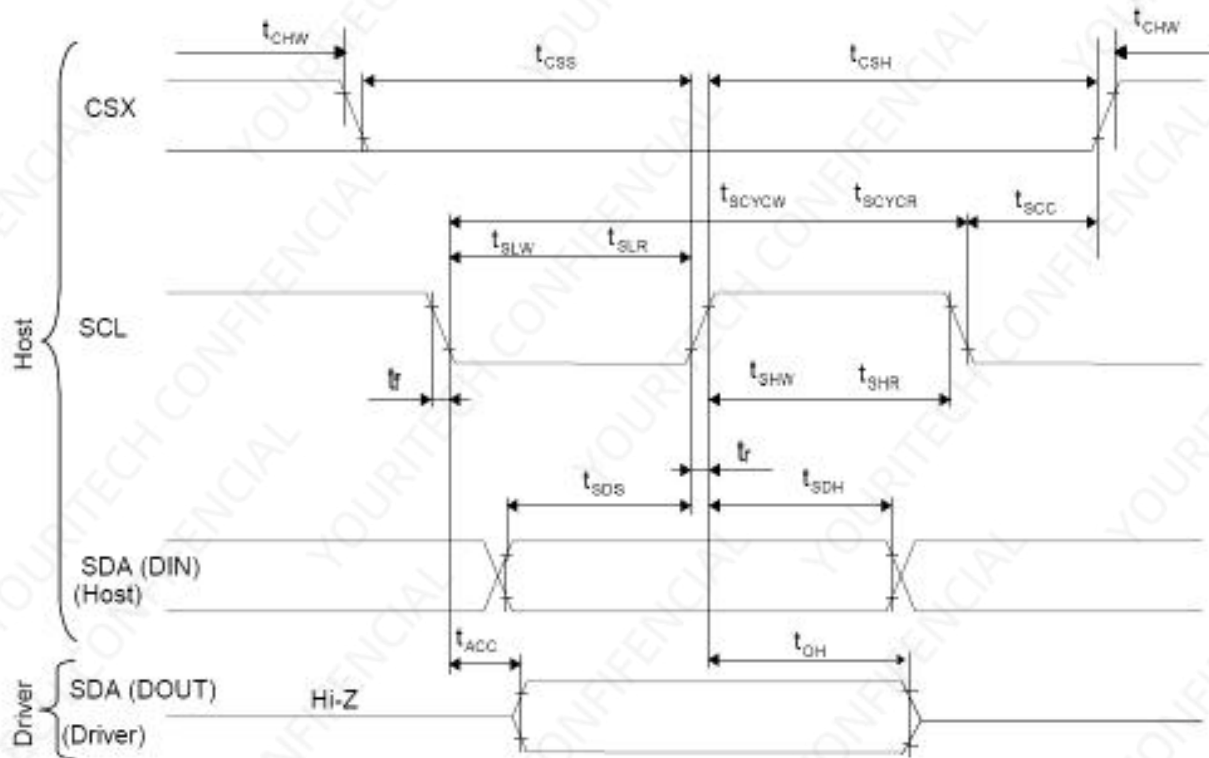
Write to read or read to write timings:



Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

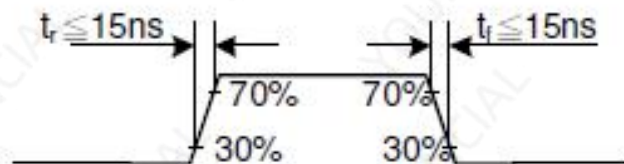


## 7.2 Display Serial Interface Timing Characteristics (3-line SPI system)

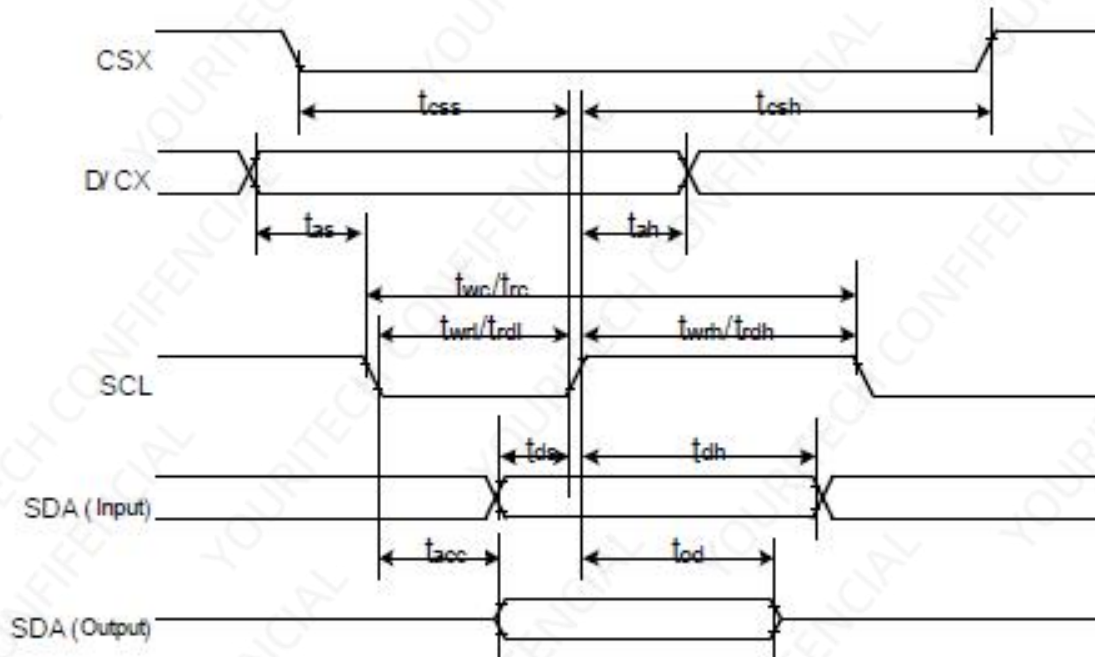


| Signal       | Symbol | Parameter                   | min | max | Unit | Description |
|--------------|--------|-----------------------------|-----|-----|------|-------------|
| SCL          | tscycw | Serial Clock Cycle (Write)  | 100 | -   | ns   |             |
|              | tshw   | SCL "H" Pulse Width (Write) | 35  | -   | ns   |             |
|              | tslw   | SCL "L" Pulse Width (Write) | 35  | -   | ns   |             |
|              | tscycr | Serial Clock Cycle (Read)   | 150 | -   | ns   |             |
|              | tshr   | SCL "H" Pulse Width (Read)  | 60  | -   | ns   |             |
|              | tslr   | SCL "L" Pulse Width (Read)  | 60  | -   | ns   |             |
| SDA (Input)  | tsds   | Data setup time (Write)     | 30  | -   | ns   |             |
|              | tsdh   | Data hold time (Write)      | 30  | -   | ns   |             |
| SDA (Output) | tacc   | Access time (Read)          | 10  | -   | ns   |             |
|              | toh    | Output disable time (Read)  | 15  | 50  | ns   |             |
| CSX          | tsc    | SCL-CSX                     | 20  | -   | ns   |             |
|              | tchw   | CSX "H" Pulse Width         | 40  | -   | ns   |             |
|              | tcsw   | CSX-SCL Time(write)         | 30  | -   | ns   |             |
|              | tch    |                             | 30  | -   | ns   |             |

Note:  $T_a = 25^\circ\text{C}$ ,  $\text{IOVCC}=1.65\text{V to }2.8\text{V}$ ,  $\text{VCI}=2.6\text{V to }3.3\text{V}$ ,  $\text{AGND}=\text{GND}=0\text{V}$

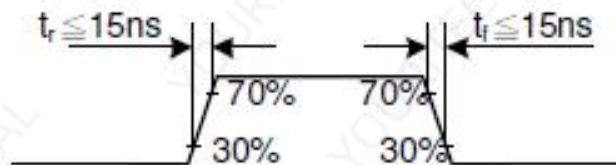


### 7.3 Display Serial Interface Timing Characteristics (4-line SPI system)

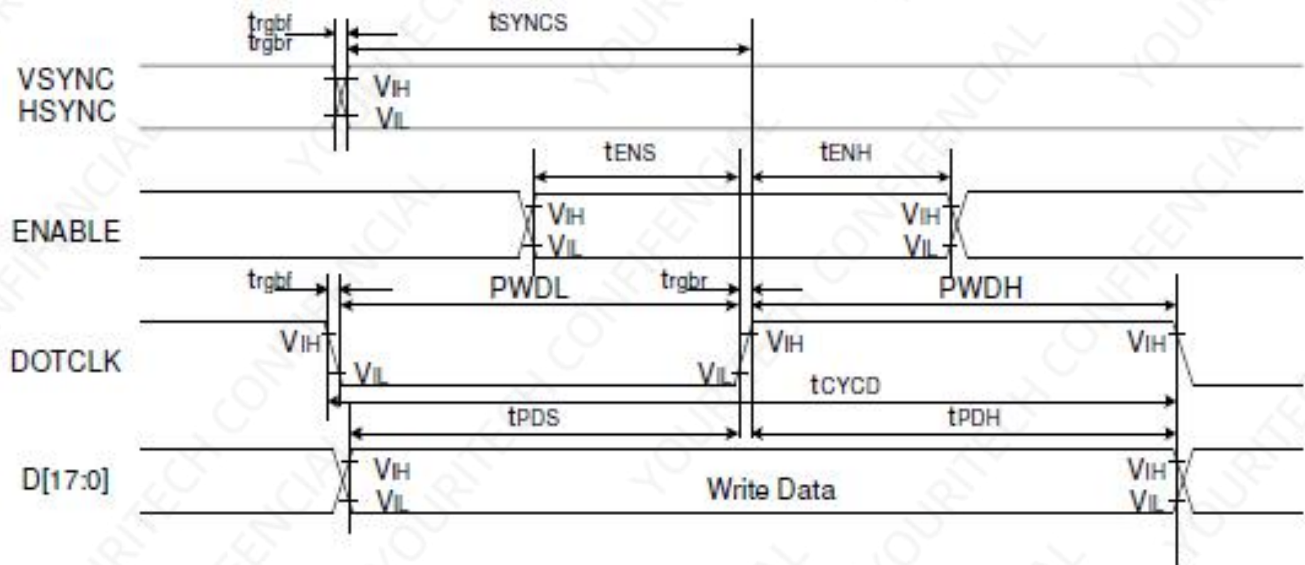


| Signal       | Symbol    | Parameter                     | min | max | Unit | Description         |
|--------------|-----------|-------------------------------|-----|-----|------|---------------------|
| CSX          | $t_{css}$ | Chip select time (Write)      | 30  | -   | ns   |                     |
|              | $t_{csh}$ | Chip select hold time (write) | 30  | -   | ns   |                     |
| SCL          | $t_{wc}$  | Serial clock cycle (Write)    | 100 | -   | ns   |                     |
|              | $t_{wrh}$ | SCL "H" pulse width (Write)   | 35  | -   | ns   |                     |
|              | $t_{wrl}$ | SCL "L" pulse width (Write)   | 35  | -   | ns   |                     |
|              | $t_{rc}$  | Serial clock cycle (Read)     | 150 | -   | ns   |                     |
|              | $t_{rdh}$ | SCL "H" pulse width (Read)    | 60  | -   | ns   |                     |
|              | $t_{rdl}$ | SCL "L" pulse width (Read)    | 60  | -   | ns   |                     |
| D/CX         | $t_{as}$  | D/CX setup time               | 10  | -   |      |                     |
|              | $t_{ah}$  | D/CX hold time (Write / Read) | 10  | -   |      |                     |
| SDA (Input)  | $t_{ds}$  | Data setup time (Write)       | 30  | -   | ns   |                     |
|              | $t_{dh}$  | Data hold time (Write)        | 30  | -   | ns   |                     |
| SDA (Output) | $t_{acc}$ | Access time (Read)            | -   | 50  | ns   | For maximum CL=30pF |
|              | $t_{od}$  | Output disable time (Read)    | 15  | 50  | ns   | For minimum CL=8pF  |

Note:  $T_a = 25^\circ\text{C}$ ,  $IOVCC=1.65\text{V to }2.8\text{V}$ ,  $VCI=2.6\text{V to }3.3\text{V}$ ,  $AGND=GND=0\text{V}$

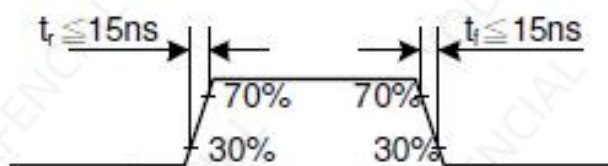


## 7.4 Parallel 16/18BIT RGB Interface Timing Characteristics



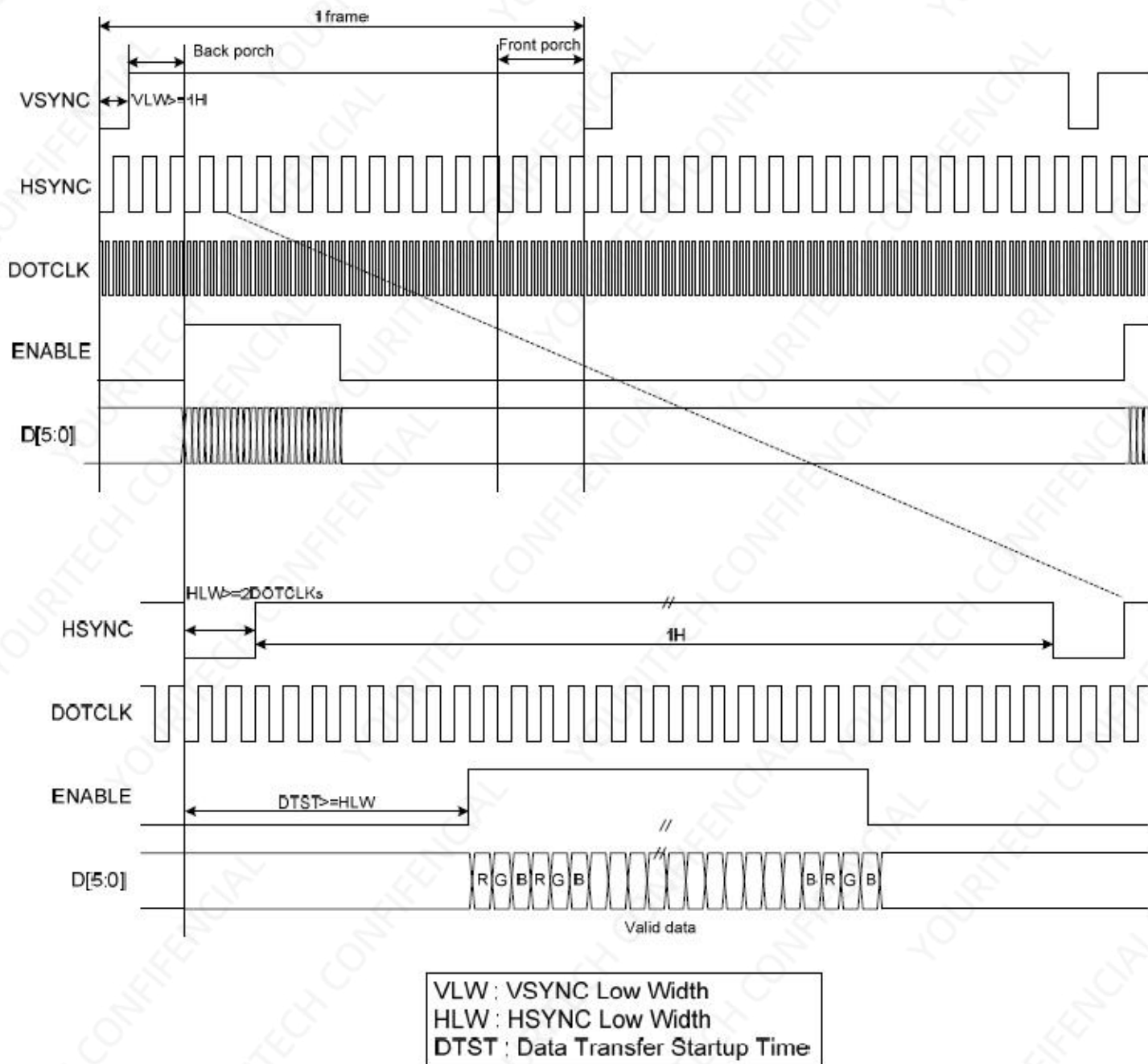
| Signal        | Symbol               | Parameter                         | min | max | Unit | Description                      |
|---------------|----------------------|-----------------------------------|-----|-----|------|----------------------------------|
| VSYNC / HSYNC | $t_{SYNCS}$          | VSYNC/HSYNC setup time            | 15  | -   | ns   | 18/16-bit bus RGB interface mode |
|               | $t_{SYNCH}$          | VSYNC/HSYNC hold time             | 15  | -   | ns   |                                  |
| DE            | $t_{ENS}$            | DE setup time                     | 15  | -   | ns   |                                  |
|               | $t_{ENH}$            | DE hold time                      | 15  | -   | ns   |                                  |
| D[17:0]       | $t_{POS}$            | Data setup time                   | 15  | -   | ns   |                                  |
|               | $t_{PDH}$            | Data hold time                    | 15  | -   | ns   |                                  |
| DOTCLK        | PWDH                 | DOTCLK high-level period          | 33  | -   | ns   |                                  |
|               | PWDL                 | DOTCLK low-level period           | 33  | -   | ns   |                                  |
|               | $t_{CYCD}$           | DOTCLK cycle time(18 bit)         | 100 | -   | ns   |                                  |
|               | $t_{RGBF}, t_{RGBF}$ | DOTCLK,HSYNC,VSYNC rise/fall time | -   | 15  | ns   |                                  |
| VSYNC / HSYNC | $t_{SYNCS}$          | VSYNC/HSYNC setup time            | 15  | -   | ns   | 6-bit bus RGB interface mode     |
|               | $t_{SYNCH}$          | VSYNC/HSYNC hold time             | 15  | -   | ns   |                                  |
| DE            | $t_{ENS}$            | DE setup time                     | 15  | -   | ns   |                                  |
|               | $t_{ENH}$            | DE hold time                      | 15  | -   | ns   |                                  |
| D[17:0]       | $t_{POS}$            | Data setup time                   | 15  | -   | ns   |                                  |
|               | $t_{PDH}$            | Data hold time                    | 15  | -   | ns   |                                  |
| DOTCLK        | PWDH                 | DOTCLK high-level pulse period    | 25  | -   | ns   |                                  |
|               | PWDL                 | DOTCLK low-level pulse period     | 25  | -   | ns   |                                  |
|               | $t_{CYCD}$           | DOTCLK cycle time                 | 50  | -   | ns   |                                  |
|               | $t_{RGBF}, t_{RGBF}$ | DOTCLK,HSYNC,VSYNC rise/fall time | -   | 15  | ns   |                                  |

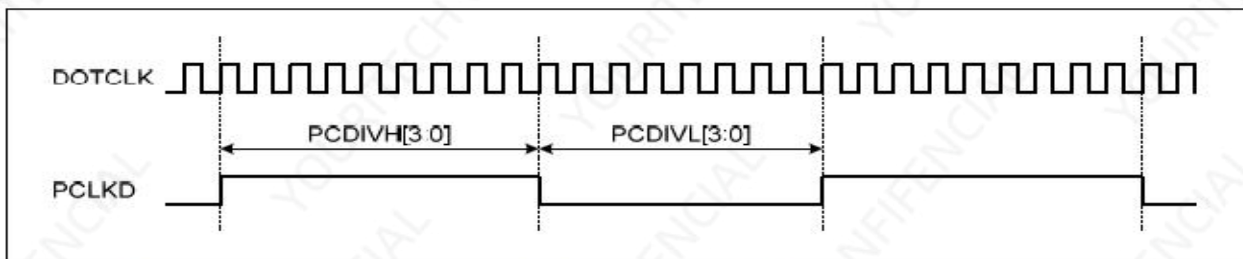
Note:  $T_a = -30$  to  $70^\circ\text{C}$ ,  $IOVCC=1.65\text{V}$  to  $2.8\text{V}$ ,  $VCI=2.6\text{V}$  to  $3.3\text{V}$ ,  $AGND=GND=0\text{V}$



## 7.5 RGB Interface Timing

The timing chart of 18-/16-bit RGB interface mode is shown as below.



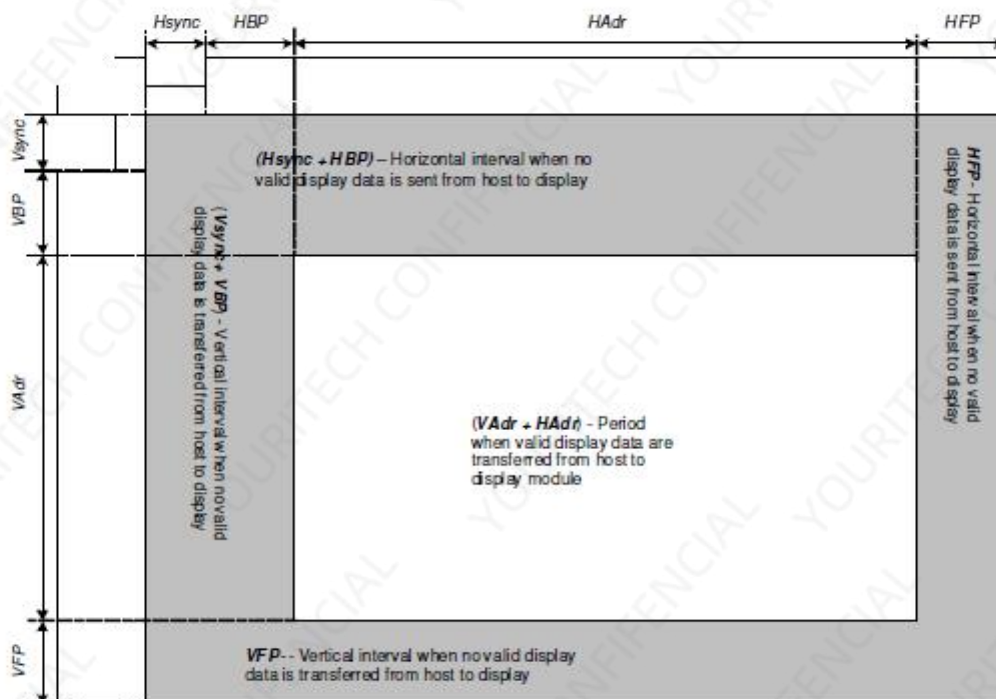


Note 1: The DE signal is not needed when RGB interface SYNC mode is selected.

Note 2: VSPL='0', HSPL='0', DPL='0' and EPL='1' of "Interface Mode Control (B0h)" command.

Note 3: In 6-bit RGB interface mode, each dot of one pixel (R, G and B) is transferred in synchronization with DOTCLK.

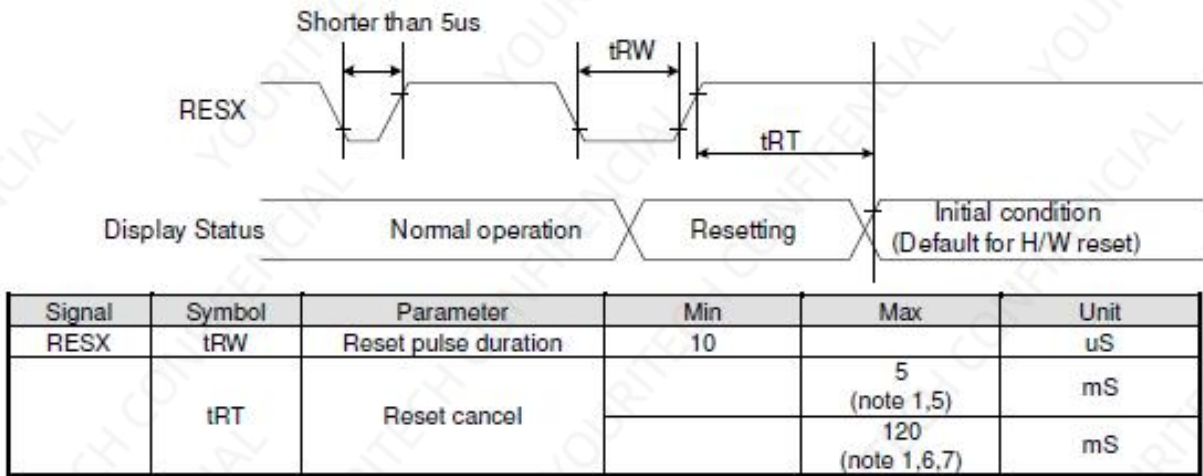
Note 4: In 6-bit RGB interface mode, set the cycles of VSYNC, HSYNC and DE to 3 multiples of DOTCLK.



| Parameters                           | Symbols | Condition | Min. | Typ. | Max. | Units  |
|--------------------------------------|---------|-----------|------|------|------|--------|
| Horizontal Synchronization           | Hsync   |           | 2    | 10   | 16   | DOTCLK |
| Horizontal Back Porch                | HBP     |           | 2    | 20   | 24   | DOTCLK |
| Horizontal Back Porch(By pass mode)* | HBP(BP) |           | 58   | 68   | 200  | DOTCLK |
| Horizontal Address                   | HAdr    |           | -    | 320  | -    | DOTCLK |
| Horizontal Front Porch               | HFP     |           | 2    | 10   | 16   | DOTCLK |
| Vertical Synchronization             | Vsync   |           | 1    | 2    | 4    | Line   |
| Vertical Back Porch                  | VBP     |           | 1    | 2    | -    | Line   |
| Vertical Address                     | VAdr    |           | -    | 240  | -    | Line   |
| Vertical Front Porch                 | VFP     |           | 3    | 4    | -    | Line   |



## 7.6 Reset Timing Characteristics



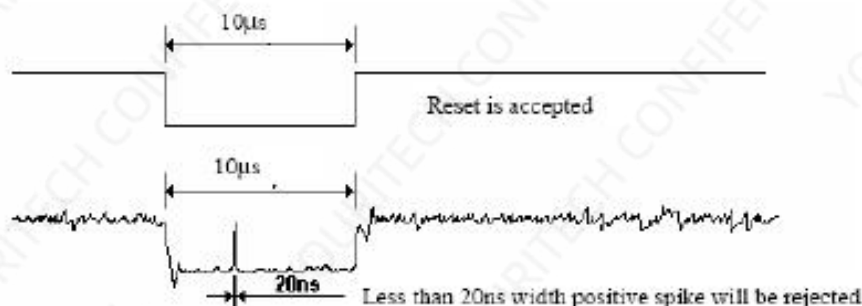
**Note 1:** The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

**Note 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 10us     | Reset          |
| Between 5us and 10us | Reset starts   |

**Note 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.

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



**Note 5:** When Reset applied during Sleep In Mode.

**Note 6:** When Reset applied during Sleep Out Mode.

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



## 8. CTP Specification

### 8.1 Electrical Characteristics

#### 8.1.1 Absolute Maximum Rating

| Item                  | Symbol          | Min. | Max. | Unit | Note |
|-----------------------|-----------------|------|------|------|------|
| Power Supply Voltage  | VDD             | 2.7  | 3.6  | V    | 1    |
| I/O Digital Voltage   | VDDIO           | 1.8  | 3.6  | V    | 1    |
| Operating temperature | T <sub>OP</sub> | -20  | +70  | °C   |      |
| Storage temperature   | T <sub>ST</sub> | -30  | +80  | °C   |      |

#### NOTES:

- If used beyond the absolute maximum ratings, FT5436 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

#### 8.1.2 DC Electrical Characteristics (Ta=25°C)

| Item                            | Min.      | Typ. | Max.      | Unit | Note |
|---------------------------------|-----------|------|-----------|------|------|
| Power Supply Voltage/VDD        | 2.7       | 3.3  | 3.47      | V    |      |
| I/O Digital supply voltage      | 1.8       | 3.3  | 3.6       | V    |      |
| Normal mode operating current   | --        | 11   | --        | mA   |      |
| Sleep mode operating current    | --        | 42   | --        | uA   |      |
| Monitor mode operating current  | --        | 0.43 | --        | mA   |      |
| Digital Input low voltage/VIL   | -0.3      | --   | 0.3*VDDIO | V    |      |
| Digital Input high voltage/VIH  | 0.7*VDDIO | --   | VDDIO     | V    |      |
| Digital Output low voltage/VOL  | --        | --   | 0.3*VDDIO | V    |      |
| Digital Output high voltage/VOH | 0.7*VDD   | --   | --        | V    |      |



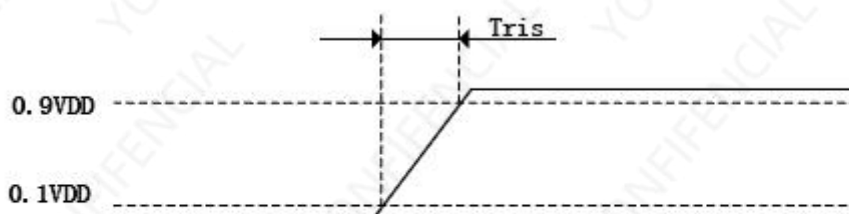
### 8.1.3 AC Characteristics

**AC Characteristics of Oscillators**

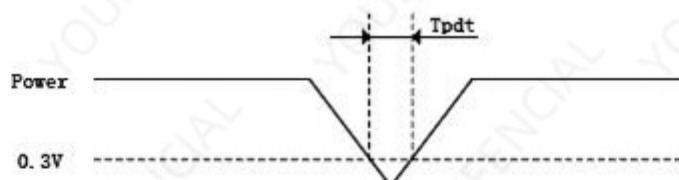
| Item        | Symbol | Unit | Test Condition       | Min. | Typ. | Max. | Note |
|-------------|--------|------|----------------------|------|------|------|------|
| OSC clock 1 | fosc1  | MHz  | VDD3 = 2.8V; Ta=25°C | 49   | 50   | 51   |      |

## 8.2 POWER ON/Reset Sequence

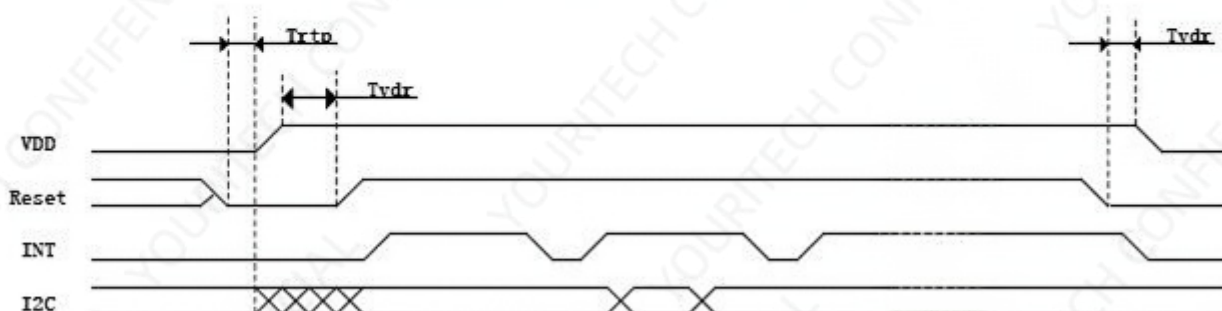
Reset should be pulled down to be low before powering on and powering down. I2C shouldn't be used by other devices during Reset time after VDD powering on (Trtp). INT signal will be sent to the host after initial-izing all parameters and then start to report points to the host. If Power is down, the voltage of supply must be below 0.3V and Tpdtr is more than 1ms.



**Figure 3-3 Power on time**



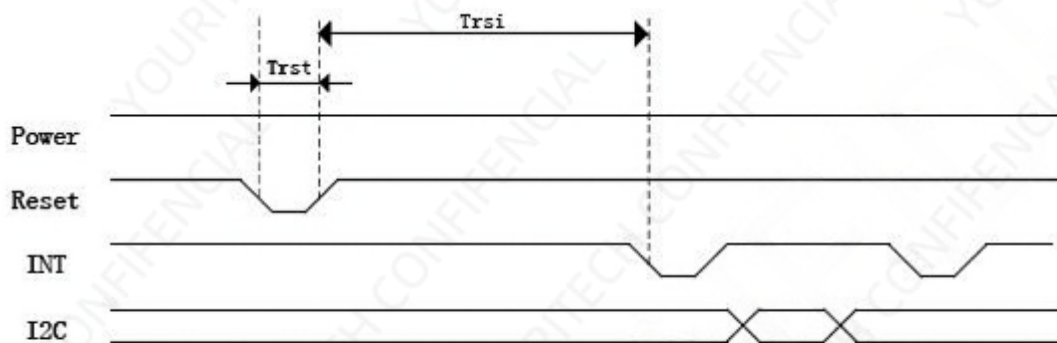
**Figure 3-4 Power Cycle requirement**



**Figure 3-5 Power on Sequence**



Reset time must be enough to guarantee reliable reset, the time of starting to report point after resetting approach to the time of starting to report point after powering on.



**Figure 3-6 Reset Sequence**

**Table 3-5 Power on/Reset Sequence Parameters**

| Parameter | Description                                      | Min | Max | Units |
|-----------|--------------------------------------------------|-----|-----|-------|
| Tris      | Rise time from 0.1VDD to 0.9VDD                  | —   | 5   | ms    |
| Tpdt      | Time of the voltage of supply being below 0.3V   | 5   | —   | ms    |
| Trtp      | Time of resetting to be low before powering on   | 100 | —   | μs    |
| Tvdr      | Reset time after VDD powering on                 | 1   | —   | ms    |
| Trsi      | Time of starting to report point after resetting | —   | 200 | ms    |
| Trst      | Reset time                                       | 1   | —   | ms    |



### 8.3 I2C Timing

FT5436 supports the I2C interfaces, which can be used by a host processor or other devices.

The I2C is always configured in the Slave mode. The data transfer format is shown in **Figure 2-4**.

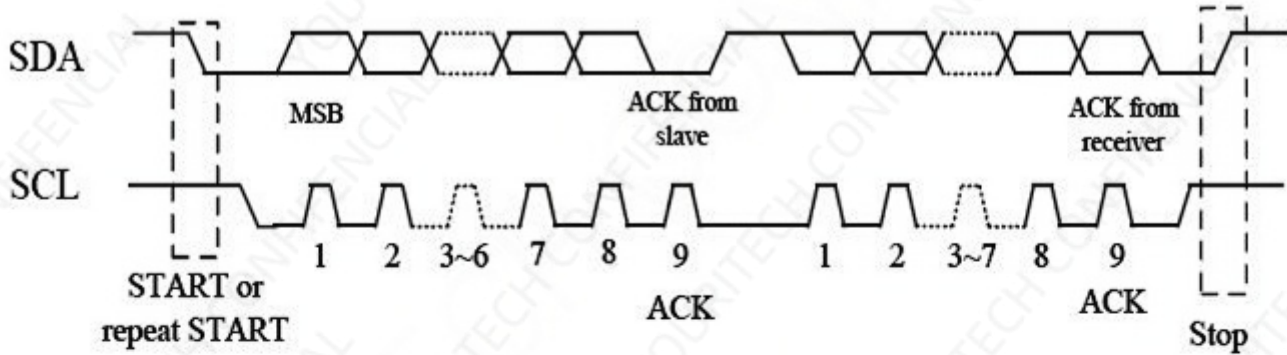


Figure 2-4 I2C Serial Data Transfer Format

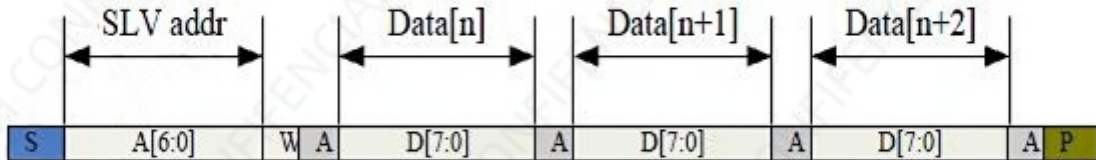


Figure 2-5 I2C master write, slave read

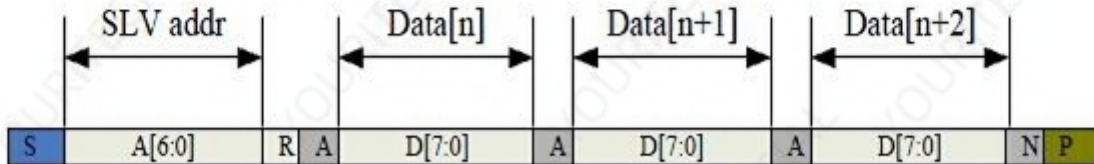


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the mnemonics used in the above figures.

**Table 2-1 Mnemonics Description**



| Mnemonics | Description                                                                                                                                              |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| S         | I2C Start or I2C Restart                                                                                                                                 |
| A[6:0]    | Slave address                                                                                                                                            |
| R/ W      | READ/WRITE bit, '1' for read, '0'for write                                                                                                               |
| A(N)      | ACK(NACK) bit                                                                                                                                            |
| P         | STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet) |

I2C Interface Timing Characteristics is shown in Table 2-2.

**Table 2-2 I2C Timing Characteristics**

| Parameter                                        | Min | Max | Unit |
|--------------------------------------------------|-----|-----|------|
| SCL frequency                                    | 0   | 400 | KHz  |
| Bus free time between a STOP and START condition | 1.3 |     | us   |
| Hold time (repeated) START condition             | 0.6 |     | us   |
| Data setup time                                  | 100 |     | ns   |
| Setup time for a repeated START condition        | 0.6 |     | us   |
| Setup Time for STOP condition                    | 0.6 |     | us   |



## 9. LCD Module Out-Going Quality Level

### 9.1 VISUAL & FUNCTION INSPECTION STANDARD

#### 9.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

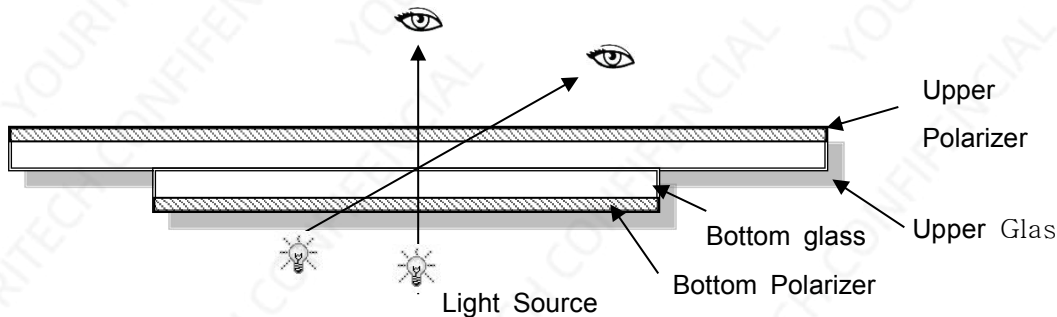
Temperature :  $25\pm 5^{\circ}\text{C}$

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

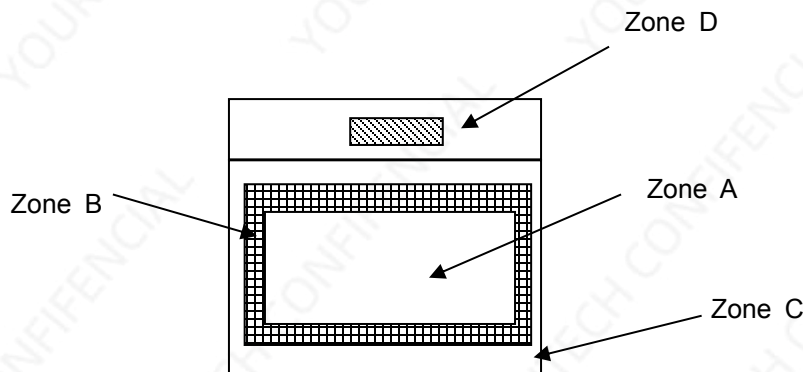
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



#### 9.1.2 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



### 9.1.3 Sampling Plan

According to GB/T 2828.1-2003 ; , normal inspection, Class II

AQL:

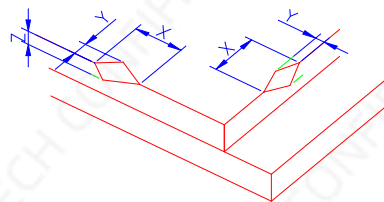
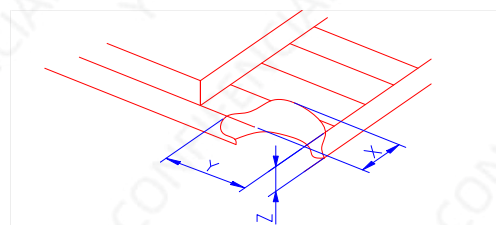
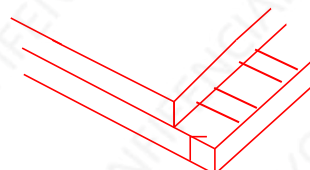
| Major defect | Minor defect |
|--------------|--------------|
| 0.65         | 1.5          |

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

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



### 9.1.4 Criteria (Visual)

| Number                                                                                                              | Items                                                                                                                                                                                               | Criteria(mm)                                                                                                                                                                                                                      |    |   |        |        |                                |    |
|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|--------|--------|--------------------------------|----|
| 1.0 LCD<br>Crack/Broken<br>NOTE:<br>X: Length<br>Y: Width<br>Z: Height<br>L: Length of IT<br>O,<br>T: Height of LCD | (1) The edge of LCD broken                                                                                                                                                                          | <div></div> <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>&lt;Inner border line of the seal</td><td>≤T</td></tr></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                                                                                                | <div></div> <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table> | X                                                                                                                                                                                                                                 | Y  | Z | ≤3.0mm | ≤L     | ≤T                             |    |
| X                                                                                                                   | Y                                                                                                                                                                                                   | Z                                                                                                                                                                                                                                 |    |   |        |        |                                |    |
| ≤3.0mm                                                                                                              | ≤L                                                                                                                                                                                                  | ≤T                                                                                                                                                                                                                                |    |   |        |        |                                |    |
| (3) LCD crack                                                                                                       | <div></div> <div>Crack<br/>Not allowed</div>                                                                    |                                                                                                                                                                                                                                   |    |   |        |        |                                |    |



Spot defect

2.0

Y

X

Φ=(X+Y)/2

① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)

| Zone<br>Size (mm) | Acceptable Qty      |   |   |
|-------------------|---------------------|---|---|
|                   | A                   | B | C |
| Φ≤0.10            | Ignore              |   |   |
| 0.10<Φ≤0.20       | 3( distance ≥ 10mm) |   |   |
| 0.20<Φ≤0.25       | 2                   |   |   |
| Φ>0.3             | 0                   |   |   |

②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)

| Zone<br>Size (mm) | Acceptable Qty      |   |   |
|-------------------|---------------------|---|---|
|                   | A                   | B | C |
| Φ≤0.1             | Ignore              |   |   |
| 0.10<Φ≤0.20       | 3( distance ≥ 10mm) |   |   |
| 0.20<Φ≤0.25       | 2                   |   |   |
| Φ>0.3             | 0                   |   |   |

③ Polarizer accidented spot

| Zone<br>Size (mm) | Acceptable Qty      |   |   |
|-------------------|---------------------|---|---|
|                   | A                   | B | C |
| Φ≤0.2             | Ignore              |   |   |
| 0.3<Φ≤0.5         | 2( distance ≥ 10mm) |   |   |
| Φ>0.5             | 0                   |   |   |

④Pixel bad points (light dot, Dim dot, color dot)

| Zone<br>Size (mm) | Acceptable Qty      |   |   |
|-------------------|---------------------|---|---|
|                   | A                   | B | C |
| Φ≤0.1             | Ignore              |   |   |
| 0.15<Φ≤0.2        | 2( distance ≥ 10mm) |   |   |
| Φ>0.2             | 0                   |   |   |

⑤ Polarizer Bubble

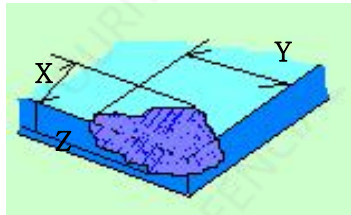
| Zone<br>Size (mm) | Acceptable Qty  |   |   |
|-------------------|-----------------|---|---|
|                   | A               | B | C |
| Φ≤0.2             | Ignore          |   |   |
| 0.3<Φ≤0.4         | 3(distance ≥ 10 |   |   |
| 0.4<Φ≤0.5         | 2               |   |   |
| Φ>0.5             | 0               |   |   |



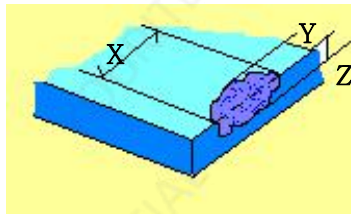
|            |                                                                               |                                                                                                                                                                                                                                        |              |                |   |        |
|------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------|---|--------|
| 3.0        | Line defect (LCD/TP<br>/Polarizer backlight black/white line, scratch, stain) | Width(mm)                                                                                                                                                                                                                              | Length(m)    | Acceptable Qty |   |        |
|            |                                                                               |                                                                                                                                                                                                                                        |              | A              | B | C      |
|            |                                                                               | $\Phi \leq 0.03$                                                                                                                                                                                                                       | Ignore       | Ignore         |   | Ignore |
|            |                                                                               | $0.03 < W \leq 0.04$                                                                                                                                                                                                                   | $L \leq 3.0$ | $N \leq 2$     |   |        |
|            |                                                                               | $0.04 < W \leq 0.05$                                                                                                                                                                                                                   | $L \leq 2.0$ | $N \leq 1$     |   |        |
| $0.05 < W$ |                                                                               | Define as spot defect                                                                                                                                                                                                                  |              |                |   |        |
| 4.0        | Electronic Components SMT                                                     | Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite                                                                                                               |              |                |   |        |
| 5.0        | Display color& Brightness                                                     | 1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples.<br>2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples. |              |                |   |        |
| 6.0        | LCD Mura                                                                      | By 5% ND filter invisible.                                                                                                                                                                                                             |              |                |   |        |

|     |                |                                                              |                         |                           |   |        |
|-----|----------------|--------------------------------------------------------------|-------------------------|---------------------------|---|--------|
| 7.0 | CTP<br>Related | CTP Cover<br>sensor acc<br>identified<br>black/white<br>spot |                         |                           |   |        |
|     |                |                                                              | Size $\Phi$ (mm)        | Acceptable Qty            |   |        |
|     |                |                                                              |                         | A                         | B | C      |
|     |                |                                                              | $\Phi \leq 0.1$         | Ignore                    |   | Ignore |
|     |                |                                                              | $0.1 < \Phi \leq 0.2$   | 3 (distance $\geq 10$ mm) |   |        |
|     |                |                                                              | $0.20 < \Phi \leq 0.25$ | 2                         |   |        |
|     |                |                                                              | $\Phi > 0.3$            | 0                         |   |        |



|                                                              |                                                                                                                                                                                                      |                                 |                |   |   |   |                       |                       |                              |                                                                                       |  |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------|---|---|---|-----------------------|-----------------------|------------------------------|---------------------------------------------------------------------------------------|--|
| CTP Cover<br><br>scratch                                     | Width(mm)                                                                                                                                                                                            | Ignore<br>(mm)                  | Acceptable Qty |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              |                                                                                                                                                                                                      |                                 | A              | B | C |   |                       |                       |                              |                                                                                       |  |
|                                                              | $\Phi \leq 0.03$                                                                                                                                                                                     | Ignore                          | Ignore         |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.03 < W \leq 0.04$                                                                                                                                                                                 | $L \leq 3.0$                    | $N \leq 2$     |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.04 < W \leq 0.05$                                                                                                                                                                                 | $L \leq 2.0$                    | $N \leq 1$     |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.05 < W$                                                                                                                                                                                           | Define as spot defect           |                |   |   |   |                       |                       |                              |                                                                                       |  |
| CTP Cover<br>Pinhole/ Lack of ink                            | <div>Zone<br/>Size (mm)</div>                                                                                                                                                                        |                                 | Acceptable Qty |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              |                                                                                                                                                                                                      |                                 | C              |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $\Phi \leq 0.1$                                                                                                                                                                                      | Ignore                          |                |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.1 < \Phi \leq 0.2$                                                                                                                                                                                | 3(distance $\geq 10\text{mm}$ ) |                |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.2 < \Phi \leq 0.25$                                                                                                                                                                               | 2                               |                |   |   |   |                       |                       |                              |                                                                                       |  |
| $\Phi > 0.3$                                                 | 0                                                                                                                                                                                                    |                                 |                |   |   |   |                       |                       |                              |                                                                                       |  |
| CTP Bondi<br>ng bubble/<br>accident<br>ed spot               | Size $\Phi(\text{mm})$                                                                                                                                                                               |                                 | Acceptable Qty |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              |                                                                                                                                                                                                      |                                 | A              | B |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $\Phi \leq 0.1$                                                                                                                                                                                      | Ignore                          |                |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.1 < \Phi \leq 0.15$                                                                                                                                                                               | 2(distance $\geq 10\text{mm}$ ) |                |   |   |   |                       |                       |                              |                                                                                       |  |
|                                                              | $0.15 < \Phi \leq 0.2$                                                                                                                                                                               | 1                               |                |   |   |   |                       |                       |                              |                                                                                       |  |
| $\Phi > 0.2$                                                 | 0                                                                                                                                                                                                    |                                 |                |   |   |   |                       |                       |                              |                                                                                       |  |
| Assembly<br>deflection                                       | beyond the edge of backlight $\leq 0.2\text{mm}$                                                                                                                                                     |                                 |                |   |   |   |                       |                       |                              |                                                                                       |  |
| TP cover b<br>roken<br>X : length<br>Y : width<br>Z : height | <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td><math>X \leq 0.5\text{mm}</math></td><td><math>Y \leq 0.5\text{mm}</math></td><td><math>Z &lt; \text{cover thickness}</math></td></tr></table> |                                 |                | X | Y | Z | $X \leq 0.5\text{mm}$ | $Y \leq 0.5\text{mm}$ | $Z < \text{cover thickness}$ |  |  |
|                                                              | X                                                                                                                                                                                                    | Y                               | Z              |   |   |   |                       |                       |                              |                                                                                       |  |
| $X \leq 0.5\text{mm}$                                        | $Y \leq 0.5\text{mm}$                                                                                                                                                                                | $Z < \text{cover thickness}$    |                |   |   |   |                       |                       |                              |                                                                                       |  |
| Circuitry broken is not allowed.                             |                                                                                                                                                                                                      |                                 |                |   |   |   |                       |                       |                              |                                                                                       |  |



|  |  |                                       |                                    |                       |                            |                                                                                     |
|--|--|---------------------------------------|------------------------------------|-----------------------|----------------------------|-------------------------------------------------------------------------------------|
|  |  |                                       | X                                  | Y                     | Z                          |  |
|  |  | TP cover broken                       | $X \leq 0.3\text{mm}$              | $Y \leq 0.3\text{mm}$ | $Z < \text{LCD thickness}$ |                                                                                     |
|  |  | X : length<br>Y : width<br>Z : height | * Circuitry broken is not allowed. |                       |                            |                                                                                     |

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   |
| 5      | TP no function        | Not allowed   |



## 10. Reliability Test Result

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



## 11. Cautions and Handling Precautions

### 11.1 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.

### 11.2 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.