

## Specification for TFT

### AFY240320A2-2.4INTH-C1

Revision P



|        |                                                                                         |
|--------|-----------------------------------------------------------------------------------------|
| A      | Orient Display                                                                          |
| FY     | TFT Type                                                                                |
| 240320 | Resolution 240 x 320                                                                    |
| A2     | Serial A2                                                                               |
| 2.4    | 2.4", Module Dimension 43.22 x 60.31 x 3.93 mm                                          |
| I      | IPS Display                                                                             |
| N      | Top: -20~+70°C; Tstr: -30~+80°C                                                         |
| T      | Transmissive                                                                            |
| H      | Hight Brightness, 800 cd/m2                                                             |
| C      | Capacitive Touch Panel                                                                  |
| /      | White Backlight                                                                         |
| /      | Controller <a href="#">ST7789VI</a> Or Compatible; CTP Controller ST1633I or Compatible |
| /      | RGB/MCU/SPI interface                                                                   |



## REVISION RECORD

| Rev No. | Rev date   | Contents                                                                                                                                               | Remarks               |
|---------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| O       | 2019-10-31 | First release                                                                                                                                          | Preliminary           |
| A       | 2019-12-18 | CHANGE CTP. IN PAGE OF 6 <sup>th</sup> .                                                                                                               |                       |
| B       | 2020-12-29 | CHANGE SHAPE OF LENS. IN PAGE OF 6 <sup>th</sup> .                                                                                                     |                       |
| C       | 2020-01-03 | CHANGE LENS IN PAGE OF 6 <sup>th</sup> .                                                                                                               |                       |
| D       | 2020-01-13 | CHANGE TP-FPC.IN PAGE OF 6 <sup>th</sup> .                                                                                                             |                       |
| E       | 2020-03-05 | CHANGE TP-IC.IN PAGE OF 6 <sup>th</sup> .                                                                                                              |                       |
| F       | 2020-03-30 | CHANGE CTP IC to ST1633                                                                                                                                |                       |
| G       | 2020-6-24  | Update drawing and add optical data                                                                                                                    | P5.P6                 |
| H       | 2020-07-17 | Update EXTERNAL DIMENSIONS<br>Change the pin4~pin5 definition                                                                                          | P5<br>P8              |
| I       | 2020-08-14 | Change Driver IC<br>Change Power supply input voltage<br>Update EXTERNAL DIMENSIONS                                                                    | P3<br>P4<br>P5        |
| J       | 2020-12-07 | Update Interface type;<br>Update CTP DC CHARACTERISTICS;<br>Update TOUCH PANEL CHARACTERISTICS;<br>Update AC CHARACTERISTICS;<br>Update POWER SEQUENCE | P3<br>P4<br>P9<br>P15 |
| K       | 2021-03-02 | Update CUSTOMER NO.;<br>Update TP IC;<br>Update EXTERNAL DIMENSIONS;                                                                                   | P3<br>P5              |
| L       | 2021-03-04 | Update Touch Count Max;                                                                                                                                | P4                    |
| M       | 2021-10-09 | Update<br>GENERAL INFORMATION<br>ELECTRICAL CHARACTERISTICS<br>EXTERNAL DIMENSIONS                                                                     | P3<br>P4<br>P5        |
| N       | 2022-4-1   | Update ABSOLUTE MAXIMUM RATINGS<br>Update ELECTRICAL CHARACTERISTICS                                                                                   | P4<br>P5              |
| P       | 2025-04-09 | Update CUSTOMER NO<br>Update ELECTRICAL CHARACTERISTICS                                                                                                | P5                    |
|         |            |                                                                                                                                                        |                       |
|         |            |                                                                                                                                                        |                       |
|         |            |                                                                                                                                                        |                       |
|         |            |                                                                                                                                                        |                       |
|         |            |                                                                                                                                                        |                       |

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## 1. GENERAL INFORMATION

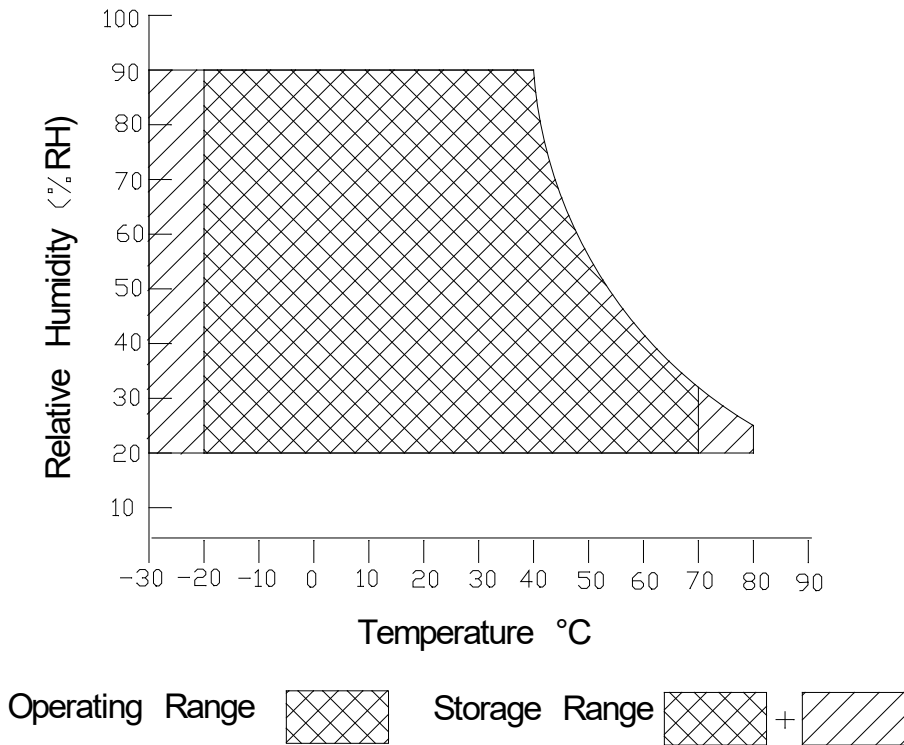
| No. | Item                           | Contents                               | Unit |
|-----|--------------------------------|----------------------------------------|------|
| 1   | LCD size                       | 2.4 inch (Diagonal)                    | /    |
| 2   | Display mode                   | Normally black/Transmissive/Anti-glare | /    |
| 3   | Viewing direction(eye)         | FREE                                   | /    |
| 4   | Gray scale inversion direction | -                                      | /    |
| 5   | Resolution(H*V)                | 240 *320 Pixels                        | /    |
| 6   | Module size (L*W*H)            | 43.22*60.31*3.93                       | mm   |
| 7   | Active area (L*W)              | 36.72*48.96                            | mm   |
| 8   | Pixel pitch (L*W)              | 0.153*0.153                            | mm   |
| 9   | Interface type                 | RGB/MCU/SPI interface                  | /    |
| 10  | Color Depth                    | 16.7M                                  | /    |
| 11  | Module power consumption       | 0.51(Appr)                             | W    |
| 12  | Back light type                | LED                                    | /    |
| 13  | Driver IC                      | ST7789VI or compatible<br>ST1633I(CTP) | /    |
| 14  | Weight                         | 20.1(Appr)                             | g    |

## 2. ABSOLUTE MAXIMUM RATINGS

| Item                               | Symbol | Min. | Max.          | Unit | Note  |
|------------------------------------|--------|------|---------------|------|-------|
| Power supply input voltage for TFT | VDD    | -0.3 | 4.6           | V    |       |
| Power supply input voltage for CTP | VDD    | -0.3 | 6             | V    |       |
| Backlight current (normal temp.)   | ILED   | -    | 100           | mA   |       |
| Operation temperature              | Top    | -20  | +70           | °C   | Note1 |
| Storage temperature                | Tst    | -30  | +80           | °C   | Note1 |
| Humidity                           | RH     | -    | 90%(Max60 °C) | /    | Note1 |

Note1 :

- 1).The relative humidity and temperature range are as below sketch,90%RH Max.
- 2).The maximum wet bulb temperature  $\leq 40^{\circ}\text{C}$  and without dewing.



### 3. ELECTRICAL CHARACTERISTICS

#### DC CHARACTERISTICS(at Ta=25°C)

| Item                       | Symbol | Min.   | Typ. | Max.   | Unit | Note |
|----------------------------|--------|--------|------|--------|------|------|
| Power supply input voltage | VCC    | 2.4    | 2.8  | 3.6    | V    |      |
| Input voltage 'H' level    | VIH    | 0.7VCC | -    | VCC    | V    |      |
| Input voltage 'L' level    | VIL    | VSS    | -    | 0.3VCC | V    |      |
| Power supply current       | IVCC   | -      | 9    | -      | mA   |      |

#### CTP DC CHARACTERISTICS(at Ta=25°C)

| Item                            | Symbol | Min.      | Typ. | Max.      | Unit | Note  |
|---------------------------------|--------|-----------|------|-----------|------|-------|
| Power supply input voltage      | VDD    | 3.1       | 3.3  | 3.5       | V    | Note2 |
| Input Power ripple              | Vpp    | -         | -    | 50        | mV   |       |
| I/O Signal Voltage              | VDDIO  | -         | VDD  | -         | V    | Note2 |
| Input voltage 'H' level         | VIH    | 0.85VDDIO | -    | VDDIO     | V    |       |
| Input voltage 'L' level         | VIL    | VSS       | -    | 0.15VDDIO | V    |       |
| Operating Current (Normal Mode) | IVDD   | -         | 16.1 | -         | mA   |       |
| Operating Current (Sleep mode)  | IVDD   | -         | -    | -         | uA   |       |

Note2 : If you need more information of CTP, please refer to our Spec of CTP.

### 4. BACKLIGHT CHARACTERISTICS

(at Ta=25°C, RH=60%)

| Item                  | Symbol | Min.       | Typ. | Max. | Unit | Note      |
|-----------------------|--------|------------|------|------|------|-----------|
| LED forward voltage   | VF     | 5.6        | 6.0  | 6.8  | V    |           |
| LED forward current   | IF     | -          | 80   | -    | mA   | IF=20*4mA |
| LED power consumption | PLED   | -          | 0.48 | -    | W    | Note1     |
| Number of LED         | -      |            | 4    |      | PCS  |           |
| Connection mode       | -      | 4 parallel |      |      | /    |           |
| LED life-time         | -      | 20000      | -    | -    | Hrs  | Note2     |

Note1 : Calculator value for reference : IF\*VF = PLED

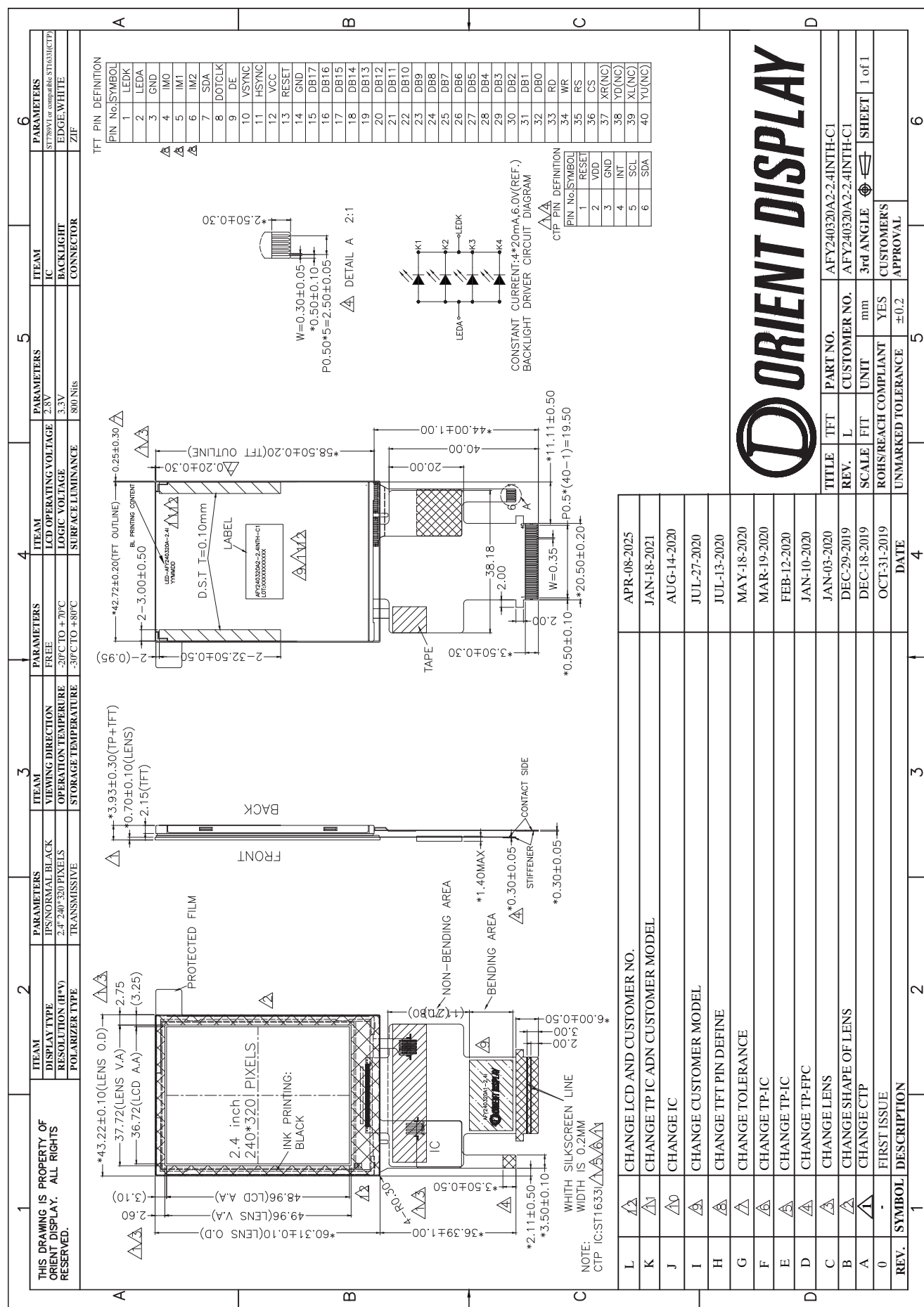
Note2 : The LED life-time define as the estimated time to 50% degradation of initial brightness at Ta=25°C and IF =80mA. The LED lifetime could be decreased if operating IF is larger than 80mA.

### 5. TOUCH PANEL CHARACTERISTICS

(at Ta=25°C)

| Item                  | Description                           | Remark                       |
|-----------------------|---------------------------------------|------------------------------|
| ProductStructure      | G+G                                   |                              |
| Surface Hardness      | ≤6H                                   | Pencil, Loading 500g, 45 deg |
| Ball-falling Test     | ≤60cm                                 | Steel ball weight 64g        |
| Touch Count Max       | Default 2 points, up to Max. 5 points |                              |
| I2C Slave Address*    | 0x70                                  |                              |
| Origin of Coordinate* | Top left corner                       |                              |

## 6. EXTERNAL DIMENSIONS



## 7. ELECTRO-OPTICAL CHARACTERISTICS

| Item                   | Symbol   | Condition                                                    | Min.         | Typ. | Max.         | Unit              | Remark           | Note   |
|------------------------|----------|--------------------------------------------------------------|--------------|------|--------------|-------------------|------------------|--------|
| Response time          | Tr+ Tf   | -                                                            | -            | 35   | 45           | ms                | FIG.1            | Note 1 |
| Contrast ratio         | Cr       |                                                              | 500          | 750  | -            | -                 | FIG.2            | Note 2 |
| Surface luminance      | Lv       | $\theta=0^\circ$                                             | 600          | 800  | -            | cd/m <sup>2</sup> | FIG.2            | Note 3 |
| Luminance uniformity   | Yu       | $\theta=0^\circ$                                             | 75           | 80   | -            | %                 | FIG.2            | Note 4 |
| NTSC                   | -        | $\theta=0^\circ$                                             | -            | 50   | -            | %                 | FIG.2            | Note 5 |
| Viewing angle          | $\theta$ | $\phi=90^\circ$                                              | 70           | 80   | -            | deg               | FIG.3            | Note 6 |
|                        |          | $\phi=270^\circ$                                             | 70           | 80   | -            | deg               | FIG.3            |        |
|                        |          | $\phi=0^\circ$                                               | 70           | 80   | -            | deg               | FIG.3            |        |
|                        |          | $\phi=180^\circ$                                             | 70           | 80   | -            | deg               | FIG.3            |        |
| CIE (x,y) chromaticity | Red x    | $\theta=0^\circ$<br>$\phi=0^\circ$<br>$T_a=25^\circ\text{C}$ | Typ<br>-0.04 | 0.64 | Typ<br>+0.04 | -                 | FIG.2<br>CIE1931 | Note 5 |
|                        | Red y    |                                                              |              | 0.34 |              | -                 |                  |        |
|                        | Green x  |                                                              |              | 0.33 |              | -                 |                  |        |
|                        | Green y  |                                                              |              | 0.61 |              | -                 |                  |        |
|                        | Blue x   |                                                              |              | 0.15 |              | -                 |                  |        |
|                        | Blue y   |                                                              |              | 0.06 |              | -                 |                  |        |
|                        | White x  |                                                              |              | 0.30 |              | -                 |                  |        |
|                        | White y  |                                                              |              | 0.33 |              | -                 |                  |        |

### Note1. Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.

For additional information see FIG1.

### Note2. Definition of contrast ratio

Contrast ratio(Cr) is defined mathematically by the following formula.

For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Measured at the center area of the LCD

### Note3. Definition of surface luminance

Surface luminance is the luminance with all pixels displaying white.

For more information see FIG.2.

$L_v$  = Average Surface Luminance with all white pixels( $P_1, P_2, P_3, \dots, P_n$ )

### Note4. Definition of luminance uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

$$Y_u = \frac{\text{Minimum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}{\text{Maximum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}$$

### Note5. Definition of color chromaticity (CIE1931)

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

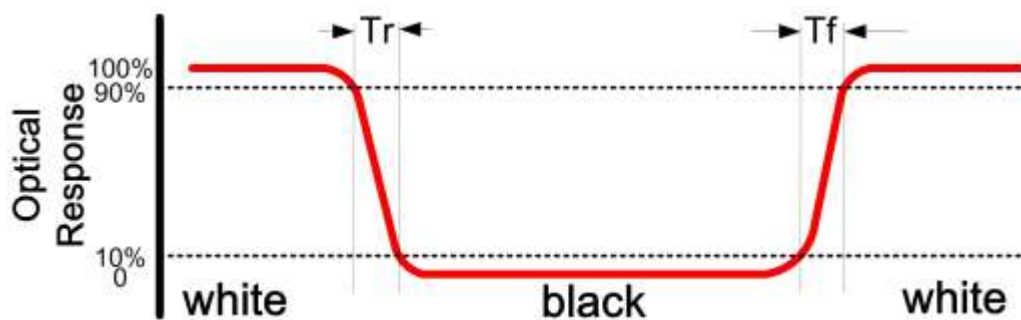
### Note6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 10. angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.

For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope or DMS series Instruments or compatible. For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is base on TOPCON's BM-5 or BM-7 photo detector or compatible.

**FIG.1. The definition of response Time**



**FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity**

H,V : Active area

Light spot size  $\varnothing=1.5\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCM surface to detector lens.

Test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible ,see Figure b.

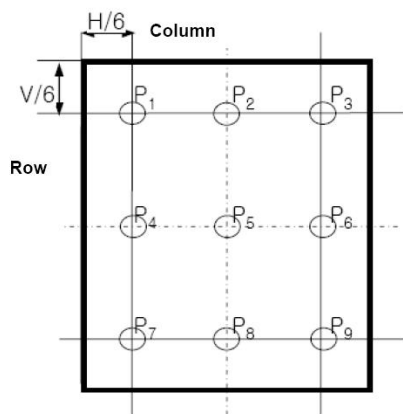


Figure a

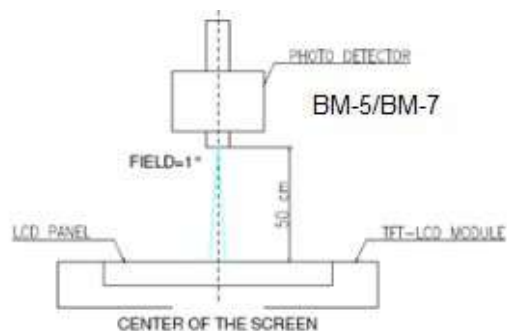
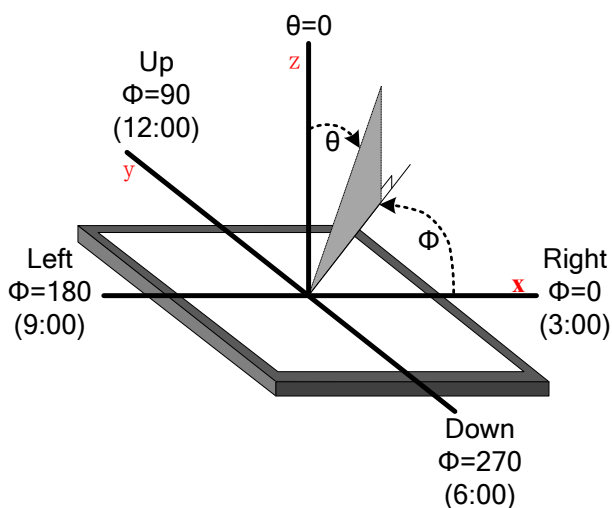


Figure b

**FIG.3. The definition of viewing angle**



## 8. INTERFACE DESCRIPTION

### Module Interface description

| Interface No. | Name | I/O or connect to | Description |
|---------------|------|-------------------|-------------|
|---------------|------|-------------------|-------------|

| 1     | LEDK      | P   | Power for LED backlight(Cathode).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
|-------|-----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--|--|--|------------------------|-------------|-----|--------------------|----------|---|---|---|----------------------|---------|---|---|---|-----------------------|----------|---|---|---|----------------------|---------|---|---|---|-----------------------|----------|---|---|---|------------------------|-------------|------------------------|------------------------|---|---|---|------------------------|-------------|
| 2     | LEDA      | P   | Power for LED backlight(Anode).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 3     | GND       | P   | Power Ground.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 4     | IM0       | I   | <table><tr><th>IM2</th><th>IM1</th><th>IM0</th><th>MPU Interface Mode</th><th>Data pin</th></tr><tr><td>0</td><td>0</td><td>0</td><td>80-8bit parallel I/F</td><td>DB[7:0]</td></tr><tr><td>0</td><td>0</td><td>1</td><td>80-16bit parallel I/F</td><td>DB[15:0]</td></tr><tr><td>0</td><td>1</td><td>0</td><td>80-9bit parallel I/F</td><td>DB[8:0]</td></tr><tr><td>0</td><td>1</td><td>1</td><td>80-18bit parallel I/F</td><td>DB[17:0]</td></tr><tr><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">1</td><td>3-line 9bit serial I/F</td><td>SDA: in/out</td></tr><tr><td>2 data lane serial I/F</td><td>SDA: in/out<br/>WRX: in</td></tr><tr><td>1</td><td>1</td><td>0</td><td>4-line 8bit serial I/F</td><td>SDA: in/out</td></tr></table> |                        |  |  |  | IM2                    | IM1         | IM0 | MPU Interface Mode | Data pin | 0 | 0 | 0 | 80-8bit parallel I/F | DB[7:0] | 0 | 0 | 1 | 80-16bit parallel I/F | DB[15:0] | 0 | 1 | 0 | 80-9bit parallel I/F | DB[8:0] | 0 | 1 | 1 | 80-18bit parallel I/F | DB[17:0] | 1 | 0 | 1 | 3-line 9bit serial I/F | SDA: in/out | 2 data lane serial I/F | SDA: in/out<br>WRX: in | 1 | 1 | 0 | 4-line 8bit serial I/F | SDA: in/out |
| IM2   | IM1       | IM0 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  | MPU Interface Mode     | Data pin    |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 0     | 0         | 0   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  | 80-8bit parallel I/F   | DB[7:0]     |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 0     | 0         | 1   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  | 80-16bit parallel I/F  | DB[15:0]    |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 0     | 1         | 0   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  | 80-9bit parallel I/F   | DB[8:0]     |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 0     | 1         | 1   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  | 80-18bit parallel I/F  | DB[17:0]    |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 1     | 0         | 1   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  | 3-line 9bit serial I/F | SDA: in/out |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
|       |           |     | 2 data lane serial I/F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SDA: in/out<br>WRX: in |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 1     | 1         | 0   | 4-line 8bit serial I/F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SDA: in/out            |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 5     | IM1       | I   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 6     | IM2       | I   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
|       |           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
|       |           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
|       |           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
|       |           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 7     | SDA       | I/O | SPI interface input pin.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 8     | DOTCLK    | I   | Dot clock.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 9     | DE        | I   | Data enable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 10    | VSYNC     | I   | Vertical sync input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 11    | HSYNC     | I   | Horizontal sync input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 12    | VCC       | I   | Power supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 13    | RESET     | I   | Reset signal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 14    | GND       | I   | Power Ground.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 15-32 | DB17--DB0 | I/O | Data bus (DB17--DB0).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 33    | RD        | I   | RGB Interface.please fix this pin at VDDI or DGND.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 34    | WR        | I   | RGB Interface.please fix this pin at VDDI or DGND.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 35    | RS(SCL)   | I   | RGB Interface. serial interface clock.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 36    | CS        | I   | Chip selection pin. Low enable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 37    | XR(NC)    | /   | X-Right                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 38    | YD(NC)    | /   | Y-Up                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 39    | XL(NC)    | /   | X-Left                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |
| 40    | YU(NC)    | /   | Y-Bottom                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |  |  |  |                        |             |     |                    |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                      |         |   |   |   |                       |          |   |   |   |                        |             |                        |                        |   |   |   |                        |             |

#### CTP Interface description

| Interface No. | Name  | I/O or connect to | Description            |
|---------------|-------|-------------------|------------------------|
| 1             | RESET | I                 | Reset low              |
| 2             | VDD   | P                 | Power Supply of CTP    |
| 3             | GND   | P                 | Ground                 |
| 4             | INT   | I                 | State change interrupt |
| 5             | SCL   | I                 | Serial interface clock |
| 6             | SDA   | I/O               | Serial interface data  |

## 9.AC CHARACTERISTICS

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

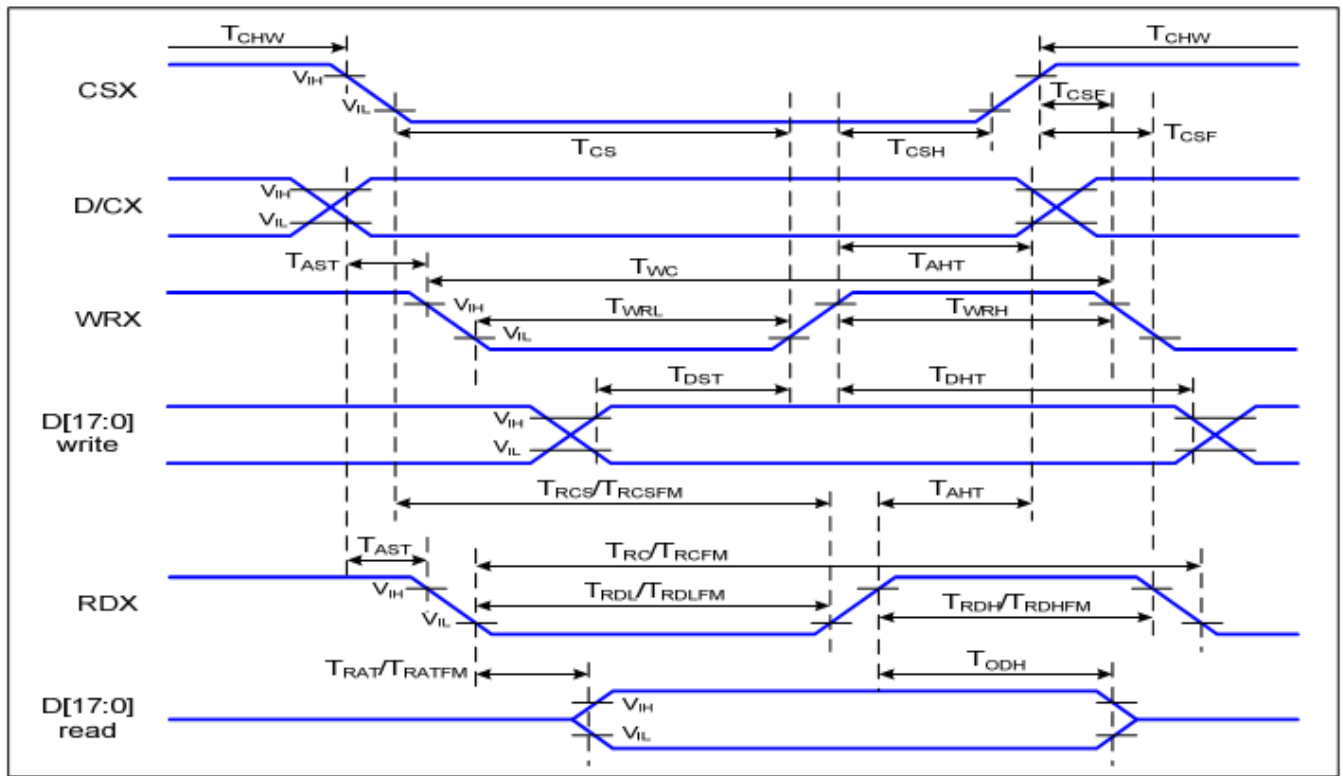


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

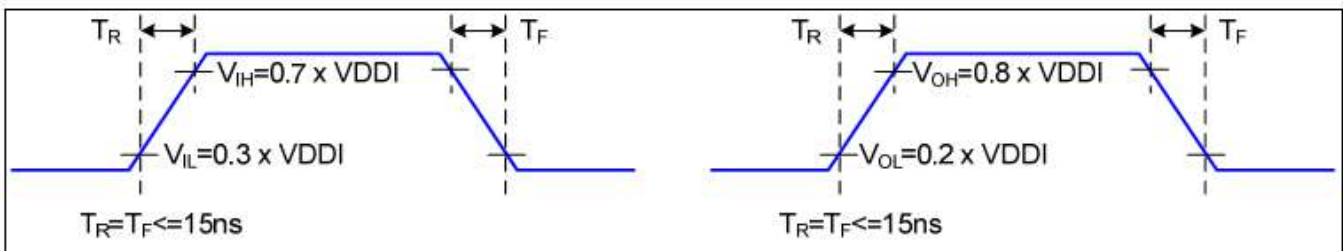


Figure 2 Rising and Falling Timing for I/O Signal

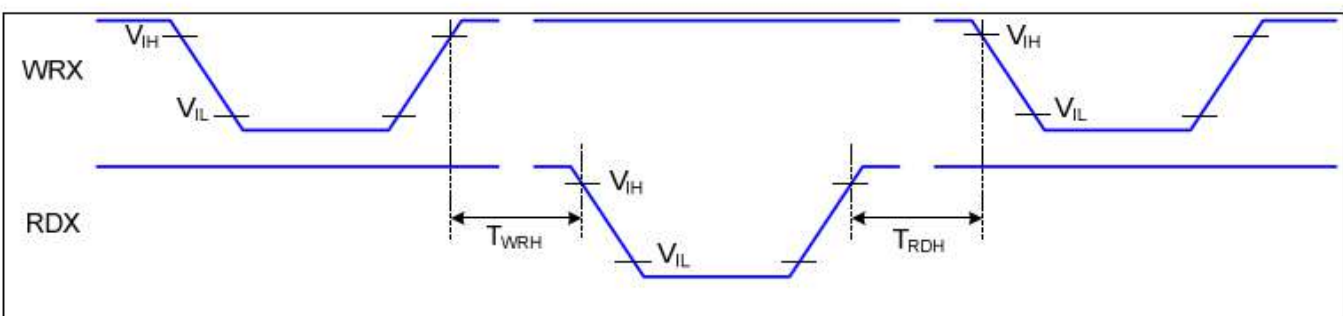
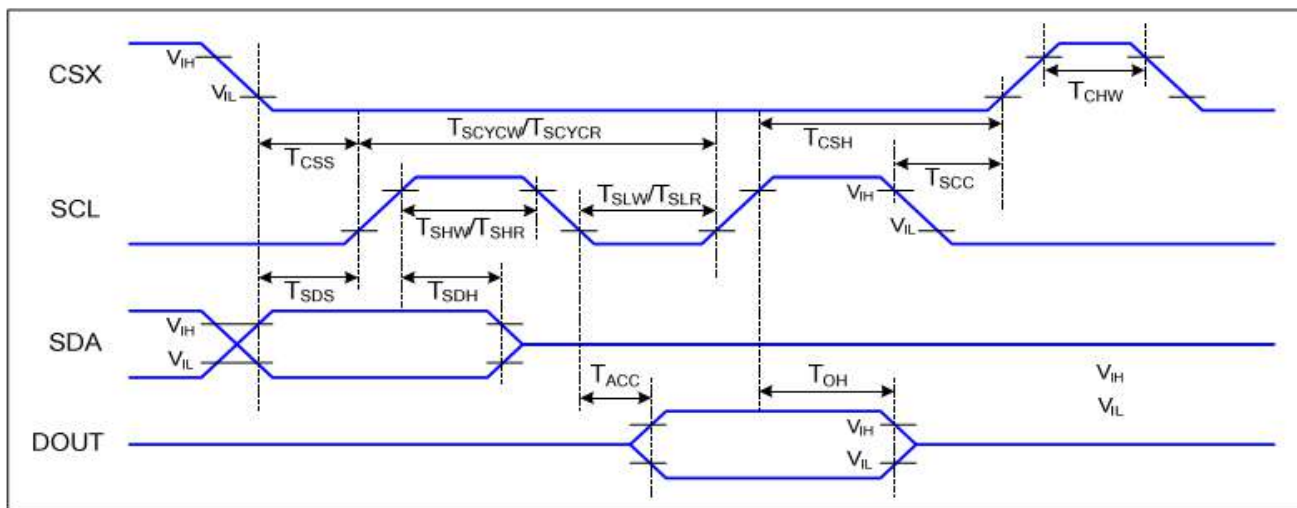


Figure 3 Write-to-Read and Read-to-Write Timing

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

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

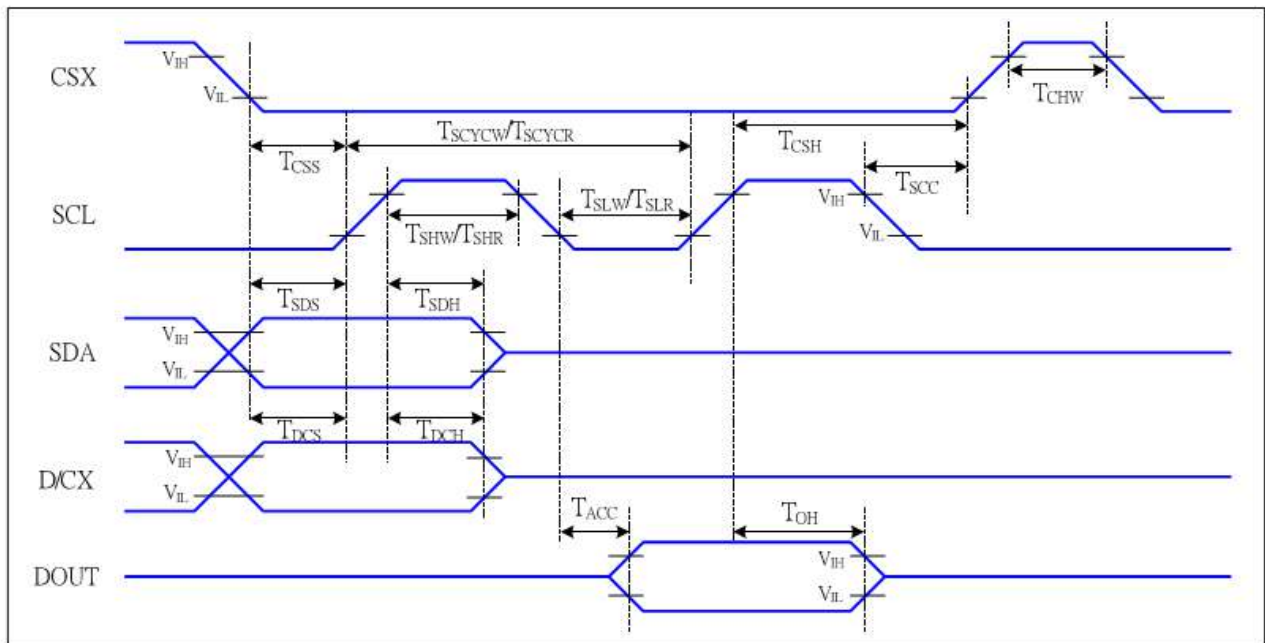


**Figure 4 3-line serial Interface Timing Characteristics**

$V_{DDI}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=-30$  to  $70\text{ }^{\circ}\text{C}$

| 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)     | 66  |     | ns   |                       |
|              | $T_{SHW}$   | SCL "H" pulse width (Write)    | 15  |     | ns   |                       |
|              | $T_{SLW}$   | SCL "L" pulse width (Write)    | 15  |     | 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<br>(DIN) | $T_{SDS}$   | Data setup time                | 10  |     | ns   |                       |
|              | $T_{SDH}$   | Data hold time                 | 10  |     | ns   |                       |
| DOUT         | $T_{ACC}$   | Access time                    | 10  | 50  | ns   | For maximum $CL=30pF$ |
|              | $T_{OH}$    | Output disable time            | 15  | 50  | ns   | For minimum $CL=8pF$  |

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

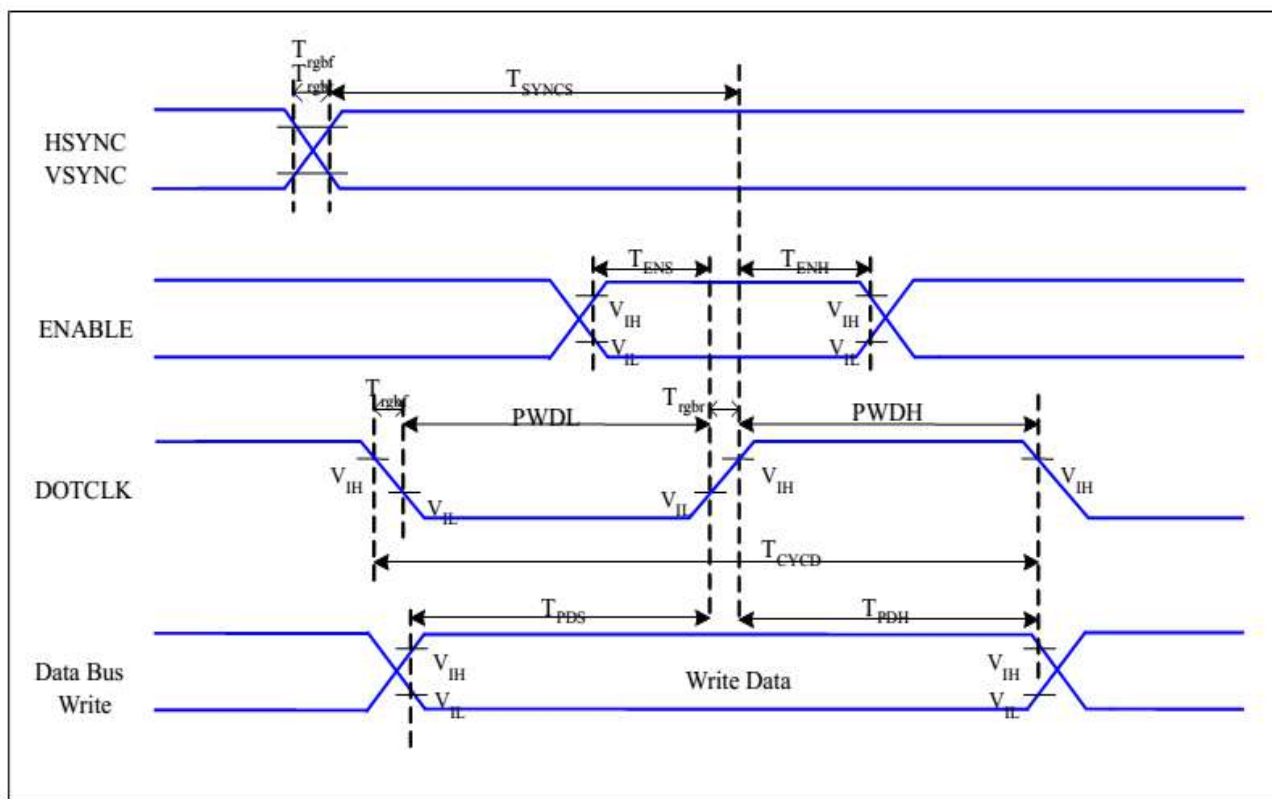


**Figure 5 4-line serial Interface Timing Characteristics**

$V_{DDI}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=-30$  to  $70\text{ }^{\circ}\text{C}$

| 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)     | 66  |     | ns   | -write command & data<br>ram |
|              | $T_{SHW}$   | SCL "H" pulse width (Write)    | 15  |     | ns   |                              |
|              | $T_{SLW}$   | SCL "L" pulse width (Write)    | 15  |     | ns   |                              |
|              | $T_{SCYCR}$ | Serial clock cycle (Read)      | 150 |     | ns   | -read command & data<br>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<br>(DIN) | $T_{SDS}$   | Data setup time                | 10  |     | ns   |                              |
|              | $T_{SDH}$   | Data hold time                 | 10  |     | ns   |                              |
| DOUT         | $T_{ACC}$   | Access time                    | 10  | 50  | ns   | For maximum $CL=30pF$        |
|              | $T_{OH}$    | Output disable time            | 15  | 50  | ns   | For minimum $CL=8pF$         |

## RGB Interface Characteristics



**Figure 6 RGB Interface Timing Characteristics**

$V_{DDI}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=-30 \sim 70 \text{ }^{\circ}\text{C}$

| Signal       | Symbol               | Parameter                     | MIN | MAX | Unit | Description |
|--------------|----------------------|-------------------------------|-----|-----|------|-------------|
| HSYNC, VSYNC | $T_{SYNCS}$          | VSYSNC, 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   |             |
|              | $T_{rghr}, T_{rghf}$ | DOTCLK Rise/Fall time         | -   | 20  | ns   |             |
| DB           | $T_{PDS}$            | PD Data Setup Time            | 50  | -   | ns   |             |
|              | $T_{PDH}$            | PD Data Hold Time             | 50  | -   | ns   |             |

## CTP AC CHARACTERISTICS

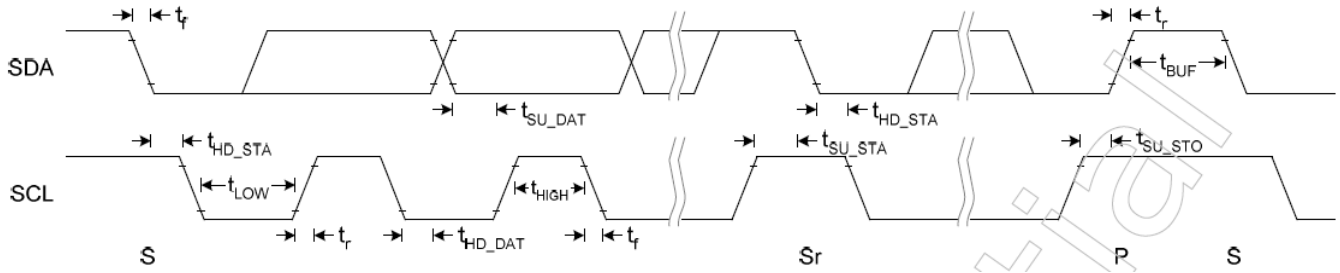


Figure 7 I2C Fast Mode Timing

Conditions: VDD = 3.3V, GND = 0V, T<sub>A</sub> = 25°C

| Symbol              | Parameter                                                                                   | Rating |      |      | Unit |
|---------------------|---------------------------------------------------------------------------------------------|--------|------|------|------|
|                     |                                                                                             | Min.   | Typ. | Max. |      |
| f <sub>SCL</sub>    | SCL clock frequency                                                                         | 0      | -    | 400  | kHz  |
| t <sub>LOW</sub>    | Low period of the SCL clock                                                                 | 1.3    | -    | -    | us   |
| t <sub>HIGH</sub>   | High period of the SCL clock                                                                | 0.6    | -    | -    | us   |
| t <sub>f</sub>      | Signal falling time                                                                         | -      | -    | 300  | ns   |
| t <sub>r</sub>      | Signal rising time                                                                          | -      | -    | 300  | ns   |
| t <sub>SU_STA</sub> | Set up time for a repeated START condition                                                  | 0.6    | -    | -    | us   |
| t <sub>HD_STA</sub> | Hold time (repeated) START condition. After this period, the first clock pulse is generated | 0.6    | -    | -    | us   |
| t <sub>SU_DAT</sub> | Data set up time                                                                            | 100    | -    | -    | ns   |
| t <sub>HD_DAT</sub> | Data hold time                                                                              | 0      | -    | 0.9  | us   |
| t <sub>SU_STO</sub> | Set up time for STOP condition                                                              | 0.6    | -    | -    | us   |
| t <sub>BUF</sub>    | Bus free time between a STOP and START condition                                            | 1.3    | -    | -    | us   |
| C <sub>b</sub>      | Capacitive load for each bus line                                                           | -      | -    | 400  | pF   |

## 10. POWER SEQUENCE

### 10.1 TFT Power On/Off Sequence

VDDI and VDD can be applied in any order.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

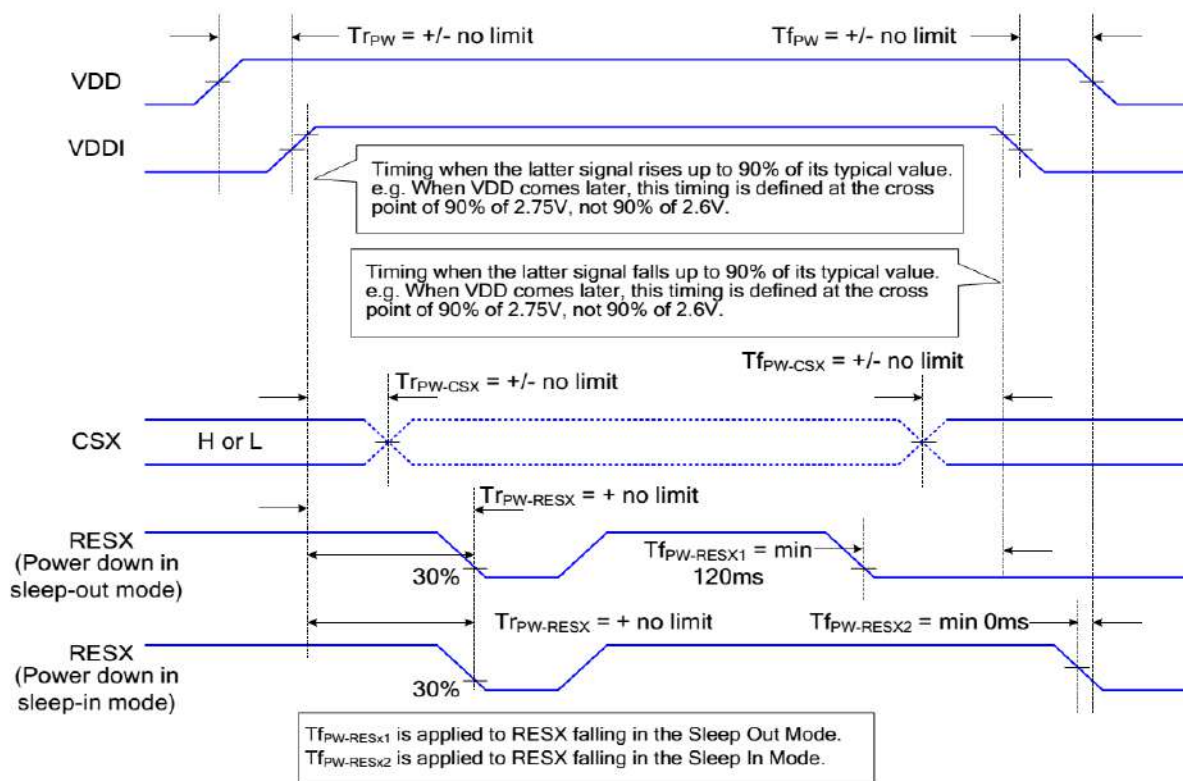
*Note 1: There will be no damage to the display module if the power sequences are not met.*

*Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.*

*Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.*

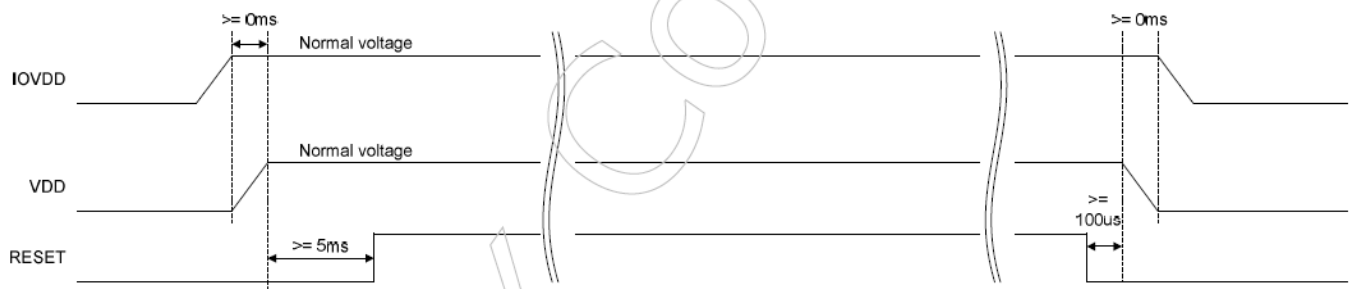
*Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.*

The power on/off sequence is illustrated below



### 10.2 CTP Power On/Off Sequence

RESET pin should be held low before power on and power off. During power on, after both VDD and IOVDD reach normal voltage, RESET pin needs to be held low for 5ms to ensure internal block stable.



## 11. RELIABILITY TEST CONDITIONS

| No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Test item                           | Test condition                                                   |                 | Inspection after test                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | High temperature storage test       | +80°C/240 hours                                                  |                 | Inspection after 2~4hours storage at room temperature, the sample shall be free from defects :<br>1.Current changing value before test and after test is 50% larger;<br>2. Function defect : Non-display,abnormal-d isplay,missing lines, Short lines,ITO corrosion;<br>3.Visual defect : Air bubble in the LCD,Seal leak,Glass crack. |
| 11.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Low temperature storage test        | -30°C/240 hours                                                  |                 |                                                                                                                                                                                                                                                                                                                                        |
| 11.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | High temperature operating test     | +70°C/120 hours                                                  |                 |                                                                                                                                                                                                                                                                                                                                        |
| 11.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Low temperature operating test      | -20°C/120 hours                                                  |                 |                                                                                                                                                                                                                                                                                                                                        |
| 11.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Temperature cycle storage test      | -30°C ~ 25°C ~ +80°C/10cycles (30min.) (10min.) (30min.)         |                 |                                                                                                                                                                                                                                                                                                                                        |
| 11.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | High temperature high humidity test | +50°C*90% RH/120 hours                                           |                 |                                                                                                                                                                                                                                                                                                                                        |
| 11.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Vibration test                      | Frequency : 250 r/min<br>Amplitude : 1 inch<br>Time: 45min       |                 |                                                                                                                                                                                                                                                                                                                                        |
| 11.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Drop test                           | Drop direction:<br>1 corner/3 edges/6 sides 10 times             |                 |                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                     | Packing weight(kg)                                               | Drop height(cm) |                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                     | <11                                                              | 80±1.6          |                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                     | 11≤G<21                                                          | 60±1.2          |                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                     | 21≤G<31                                                          | 50±1.0          |                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                     | 31≤G<40                                                          | 40±0.8          |                                                                                                                                                                                                                                                                                                                                        |
| 11.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ESD test                            | Air discharge: ±8KV, 10times<br>Contact discharge: ±4KV, 10times |                 |                                                                                                                                                                                                                                                                                                                                        |
| Remark :<br>1.The test samples should be applied to only one test item.<br>2.Sample size for each test item is 3~5pcs.<br>3.For High temperature high humidity test, Pure water(Resistance>10MΩ) should be used.<br>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.<br>5.B/L evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence B/L has.<br>6.Failure judgment criterion: Basic specification, Electrical characteristic, Mechanical characteristic, Optical characteristic.<br>7.After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification. |                                     |                                                                  |                 |                                                                                                                                                                                                                                                                                                                                        |

## 12. INSPECTION CRITERION

Refer to Inspection Criterion of back specification

## **13. HANDLING PRECAUTIONS**

### **13.1 Mounting method**

The LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

### **13.2 Caution of LCD handling and cleaning**

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly :

- .Isopropyl alcohol
- .Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent :

- .Water
- .Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated :

- .Soldering flux
- .Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

### **13.3 Caution against static charge**

The LCD module uses C-MOS LSI drivers, so we recommend that you :

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### **13.4 Packing**

Module employs LCD elements and must be treated as such.

- .Avoid intense shock and falls from a height.
- .To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

### **13.5 Caution for operation**

- .It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- .An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- .Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- .If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- .A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
- .Usage under the maximum operating temperature, 50%Rh or less is required.
- .When fixed patterns are displayed for a long time, remnant image is likely to occur.

### **13.6 Storage**

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- .Storing in an ambient temperature 10°C to 30°C, and in a relative humidity of 45% to 75%. Don't expose to sunlight or fluorescent light.
- .Storing in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- .Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- .Storing with no touch on polarizer surface by anything else.

It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

### **13.7 Safety**

- .It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- .When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well

with soap and water.

## **14. PRECAUTION FOR USE**

**14.1** A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

**14.2** On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- .When a question is arisen in this specification.
- .When a new problem is arisen which is not specified in this specifications.
- .When an inspection specifications change or operating condition change in customer is reported to ODNA, and some problem is arisen in this specification due to the change.
- .When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

## **15. PACKING SPECIFICATION**

Please consult our technical department for detail information.

## 16. INITIALIZATION CODE

Void Vendor X panelinitialcode(void)

```
{
LCD_RESET=1;
Delaysms(1);           //Delay 1ms
LCD_RESET=0;
Delaysms(10);          //Delay 10ms
LCD_RESET=1;
Delaysms(120);         //Delay 120ms
write_cmd(0x11); //SLPOUT (11h): Sleep Out
Delaysms(120);         //Delay 120ms
write_cmd(0x36); //MADCTL (36h): Memory Data Access Control - Default
write_dat(0x00);
write_cmd(0x3A); //COLMOD (3Ah): Interface Pixel Format
write_dat(0x05);
write_cmd(0xB2); //PORCTRL (B2h): Porch Setting - Default
write_dat(0x0C);
write_dat(0x0C);
write_dat(0x00);
write_dat(0x33);
write_dat(0x33);
write_cmd(0xB7); //GCTRL (B7h): Gate Control
write_dat(0x75);
write_cmd(0xBB); //VCOMS (BBh): VCOM Setting
write_dat(0x13);
write_cmd(0xC0); //LCMCTRL (C0h): LCM Control - Default
write_dat(0x2C);
write_cmd(0xC2); //VDVVRHEN (C2h): VDV and VRH Command Enable - Default
write_dat(0x01);
write_cmd(0xC3); //VRHS (C3h): VRH Set
write_dat(0x13);
write_cmd(0xC4); //VDVS (C4h): VDV Set - Default
write_dat(0x20);
write_cmd(0xC6); //FRCTRL2 (C6h): Frame Rate Control in Normal Mode - Default
write_dat(0x0F);
write_cmd(0xD0); //PWCTRL1 (D0h): Power Control 1 - Default
write_dat(0xA4);
write_dat(0xA1);
write_cmd(0xD6); //Undocumented
write_dat(0xA1);
write_cmd(0x21); //INVON (21h): Display Inversion On
write_cmd(0xE0); //PVGAMCTRL (E0h): Positive Voltage Gamma Control
write_dat(0xD0);
write_dat(0x08);
write_dat(0x10);
write_dat(0x0D);
write_dat(0x0C);
write_dat(0x07);
write_dat(0x37);
write_dat(0x53);
write_dat(0x4C);
write_dat(0x39);
write_dat(0x15);
write_dat(0x15);
write_dat(0x2A);
write_dat(0x2D);
write_cmd(0xE1); //NVGAMCTRL (E1h): Negative Voltage Gamma Control
write_dat(0xD0);
write_dat(0x0D);
write_dat(0x12);
write_dat(0x08);
write_dat(0x08);
}
```

```
write_dat(0x15);  
write_dat(0x34);  
write_dat(0x34);  
write_dat(0x4A);  
write_dat(0x36);  
write_dat(0x12);  
write_dat(0x13);  
write_dat(0x2B);  
write_dat(0x2F);  
write_cmd(0x29); //DISPON (29h): Display On  
}
```

## 17. HSF COMPLIANCE

- .This products complies with ROHS 2011/65/EU and 2015/863/EU、REACH 1907/2006/EC requirements, and the packaging complies with 94-62-EC.