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# RGB 3.5"



This datasheet gives detailed information about the Riverdi 3.5" TFT displays with an RGB interface. The displays come in different versions: with **capacitive, resistive, or no touchscreen**, as well as with or without a **metal mounting frame**

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| ITEM                           |                 | CONTENTS                        | UNIT     |
|--------------------------------|-----------------|---------------------------------|----------|
| LCD Type                       |                 | TFT/Transmissive/Normally white | /        |
| Size                           |                 | 3.5                             | Inch     |
| Viewing Direction              |                 | 12:00 (without image inversion) | O' Clock |
| Gray Scale Inversion Direction |                 | 6:00                            | O' Clock |
| Number of Dots                 |                 | 320 x (RGB) × 240               | /        |
| Driver IC                      |                 | NV3035C                         | /        |
| Interface Type                 |                 | 24bit RGB                       | /        |
| Brightness                     | no touch module | 540                             | cd/m2    |
|                                | CTP module      | 480                             |          |
|                                | RTP module      | 450                             |          |
| Color Depth                    |                 | 16.7M                           | /        |
| Pixel Arrangement              |                 | RGB Vertical Stripe             | /        |
| Surface Treatment              |                 | Anti-glare / Clear (for CTP)    | /        |
| Input Voltage                  |                 | 3.3                             | V        |

**Note 1:** RoHS, REACH SVHC compliant

**Note 2:** LCM weight tolerance: ± 5%.

## Revision Record

| REV NO. | REVDATE    | CONTENTS        | REMARKS |
|---------|------------|-----------------|---------|
| 1.0     | 2019-06-07 | Initial Release |         |

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# 1. Module classification information

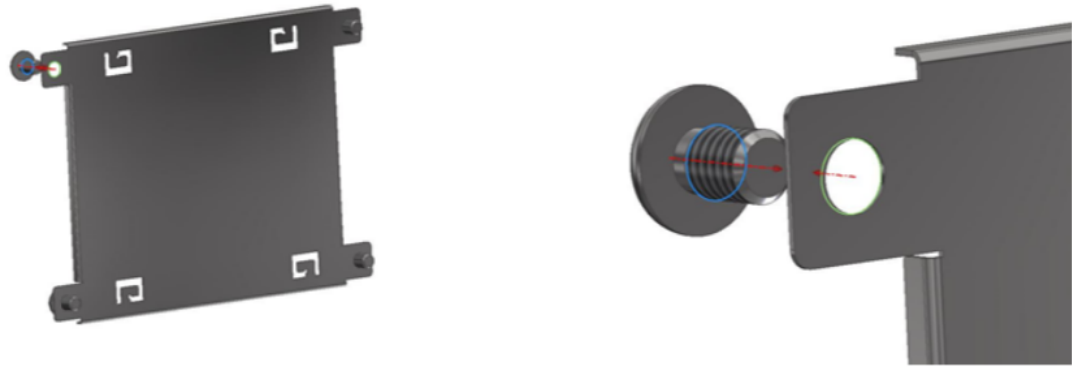
| RV | T  | 3.5 | A  | 320240 | T  | X  | W  | x  | 0x  |
|----|----|-----|----|--------|----|----|----|----|-----|
| 1. | 2. | 3.  | 4. | 5.     | 6. | 7. | 8. | 9. | 10. |

|     |                  |                                                                               |
|-----|------------------|-------------------------------------------------------------------------------|
| 1.  | BRAND            | RV – Riverdi                                                                  |
| 2.  | PRODUCT TYPE     | T – TFT Standard                                                              |
| 3.  | DISPLAY SIZE     | 35 – 3.5”                                                                     |
| 4.  | MODEL SERIAL NO. | A (A-Z)                                                                       |
| 5.  | RESOLUTION       | 320240– 320×240 px                                                            |
| 6.  | INTERFACE        | T – RGB interface                                                             |
| 7.  | FRAME            | N – No Frame<br>F – Mounting Frame                                            |
| 8.  | BACKLIGHT TYPE   | W – LED White                                                                 |
| 9.  | TOUCH PANEL      | N – No Touch Panel<br>R – Resistive Touch Panel<br>C – Capacitive Touch Panel |
| 10. | VERSION          | 0x (00-99)                                                                    |

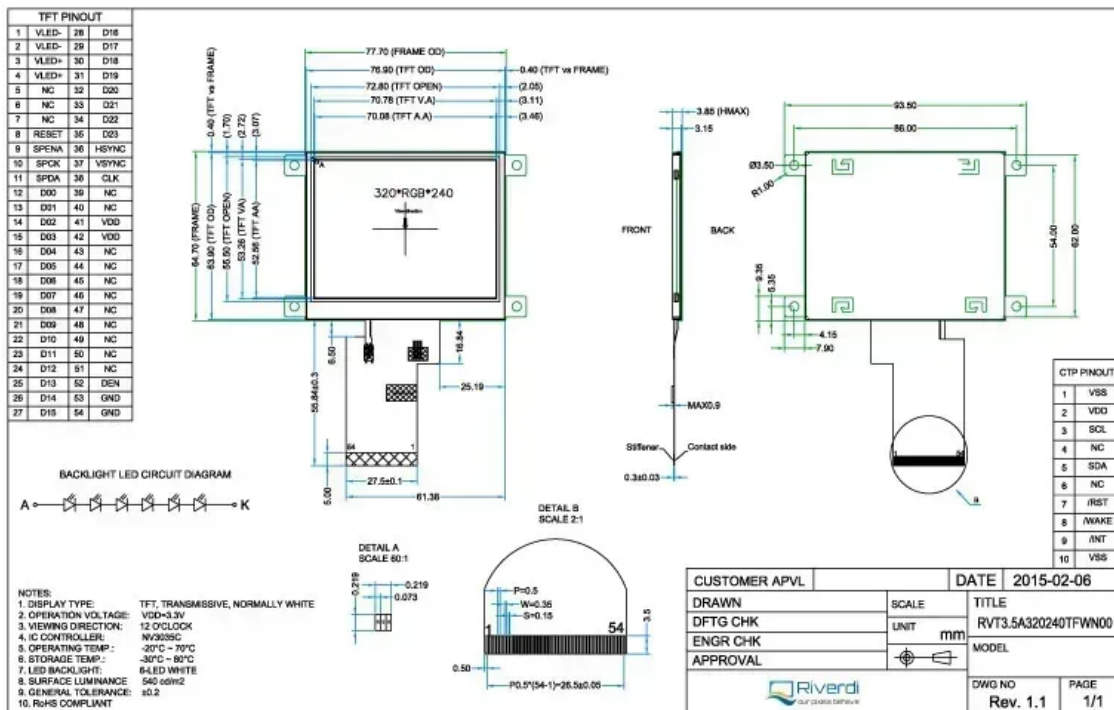
## 2. Mounting frame

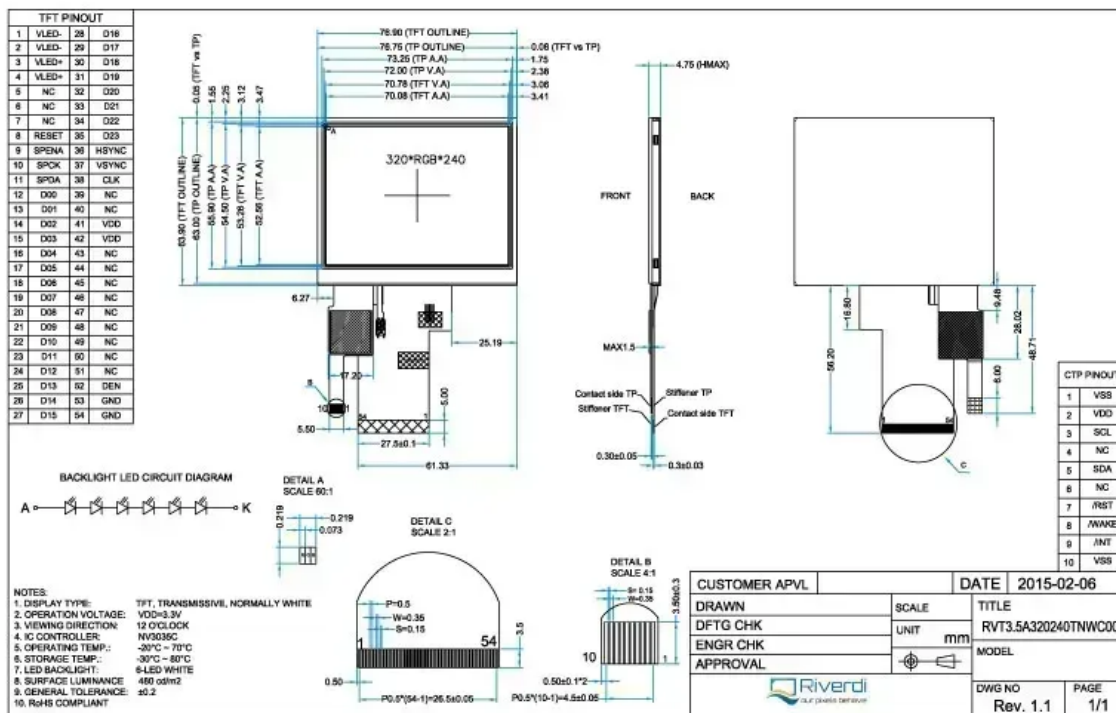
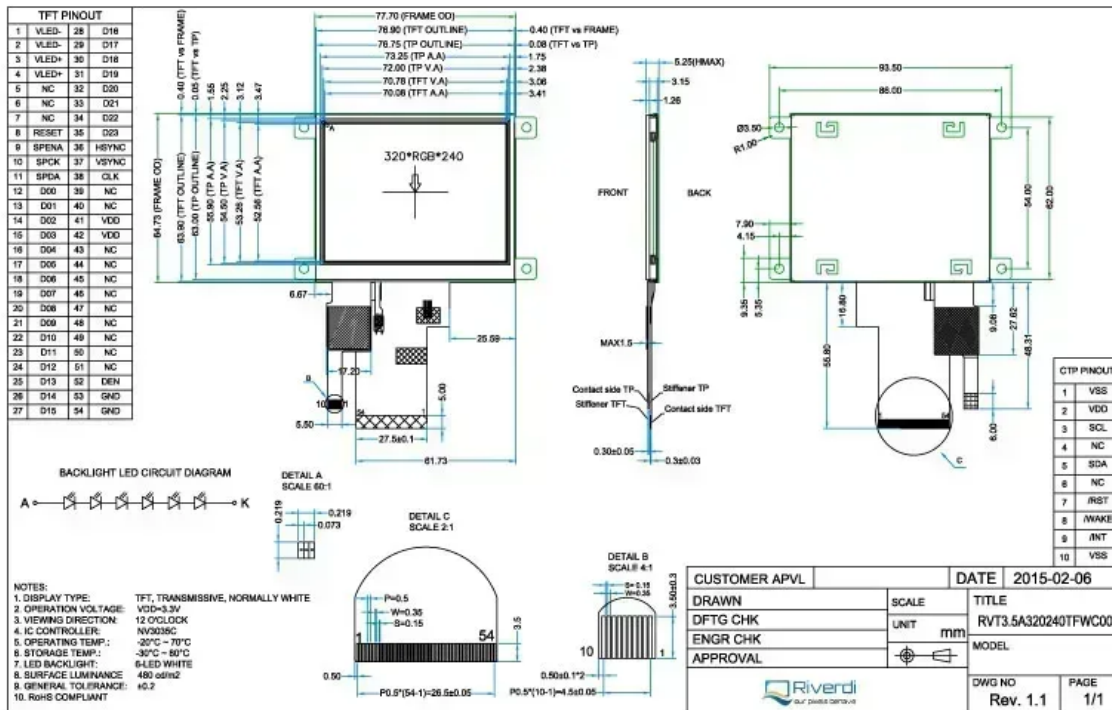
Thanks to the four catches attached to the side, frame provides strong assembly to the surface by mounting element (like the screw, see Figure 1). The frames are specially designed to fit Riverdi products perfectly. The diameter of the mounting hole is 3.5mm.

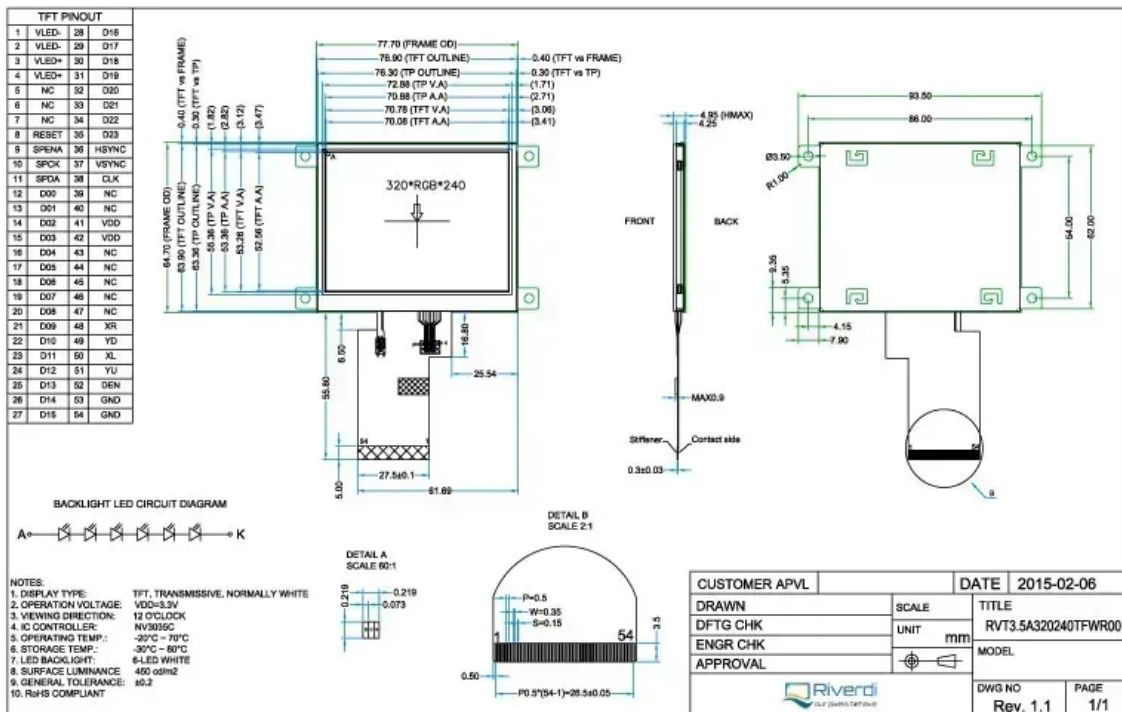
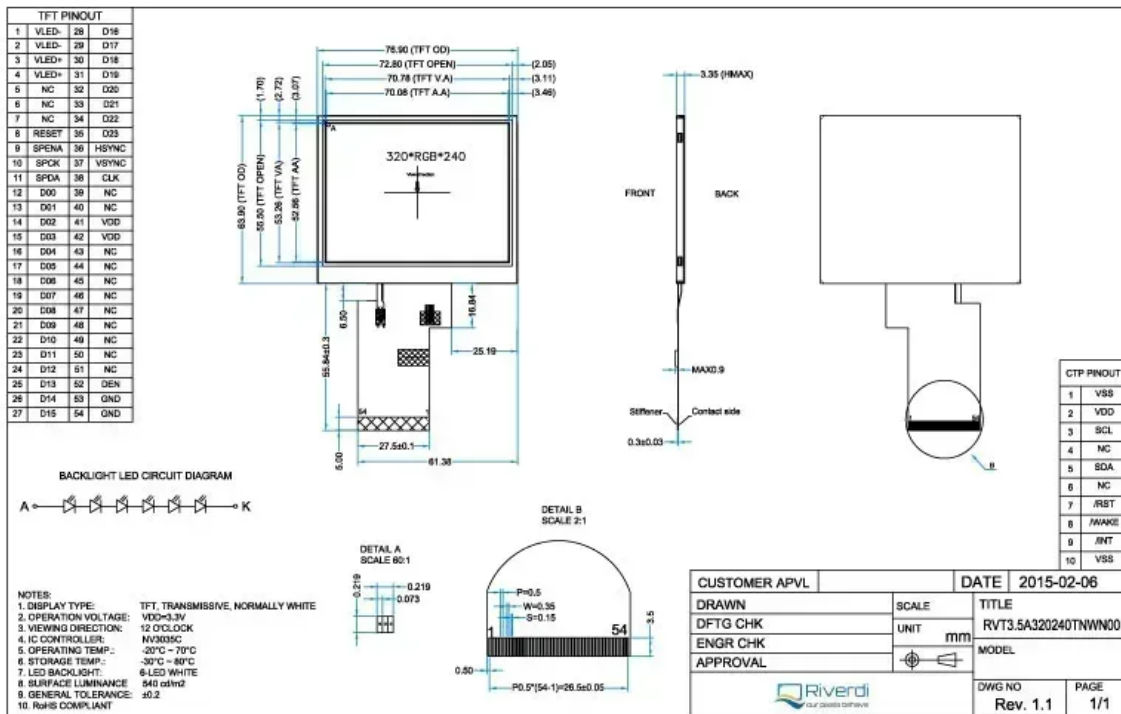
Figure 1. Mounting frame

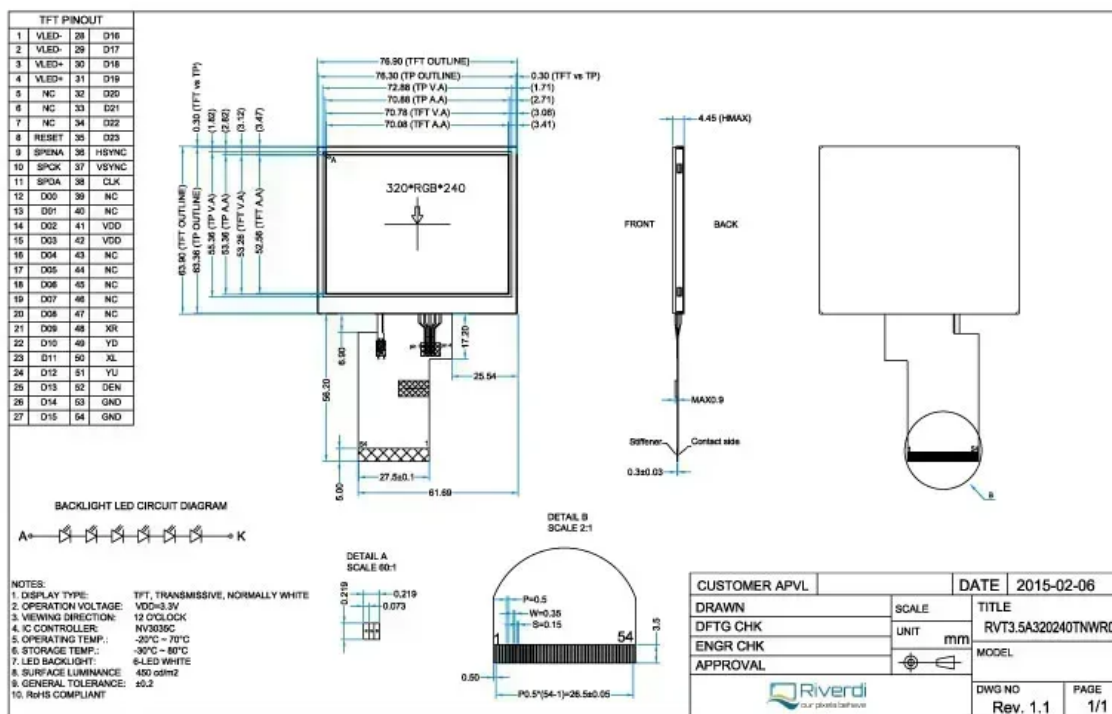


### 3. Drawings









## 4. Absolute maximum ratings

| PARAMETER                      | SYMBOL          | MIN     | MAX            | UNIT |
|--------------------------------|-----------------|---------|----------------|------|
| Supply Voltage For LCM Logic   | VDD             | -0.3    | 5              | V    |
| Supply Voltage For CTP Logic   | VDD-VSS         | -0.3    | 3.6            | V    |
| Input Voltage For Logic        | VIN             | VSS-0.5 | VDD            | V    |
| LED forward voltage (each LED) | IF              | —       | 25             | mA   |
| Operating Temperature          | T <sub>OP</sub> | -20     | 70             | °C   |
| Storage Temperature            | T <sub>ST</sub> | -30     | 80             | °C   |
| Humidity                       | RH              | —       | 90% (Max 60°C) | RH   |

## 5. Electrical characteristics

| PARAMETER                 | SYMBOL | MIN | TYP | MAX | UNIT |
|---------------------------|--------|-----|-----|-----|------|
| Supply Voltage For Module | VDD    | 3.0 | 3.3 | 3.6 | V    |

|                           |      |        |       |        |     |
|---------------------------|------|--------|-------|--------|-----|
| Input Current             | IVDD | –      | 10    | –      | mA  |
| Input Voltage ‘H’ level   | Vih  | 0.8VDD | –     | VDD    | V   |
| Input Voltage ‘L’ level   | Vil  | 0      | –     | 0.2VDD | V   |
| Voltage for LED backlight | Vi   | 18.0   | 19.2  | 20.4   | V   |
| Current for LED backlight | Ii   | –      | 20    | 25     | mA  |
| LED Life Time             | –    | 40000  | 50000 | –      | Hrs |

**Note 1:** The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C.

## 6. Electro-optical characteristics

| ITEM                    |         | SYMBOL         | CONDITION                                                | MIN   | TYP   | MAX   | UNIT     | REMARK   | NOTE |
|-------------------------|---------|----------------|----------------------------------------------------------|-------|-------|-------|----------|----------|------|
| Response Time           |         | Tr+Tf          | $\theta=0^{\circ}$<br>$\varnothing=0^{\circ}$<br>Ta=25°C | —     | 25    | 30    | ms       | Figure 1 | 4    |
| Contrast Ratio          |         | Cr             |                                                          | —     | 350   | —     | —        | Figure 2 | 1    |
| Luminance Uniformity    |         | $\delta$ WHITE |                                                          | 75    | 80    | —     | %        | Figure 2 | 3    |
| Surface Luminance       | TFT     | Lv             |                                                          | —     | 540   | —     | cd/m2    | Figure 2 | 2    |
|                         | TFT+CTP |                |                                                          | —     | 480   | —     |          |          |      |
|                         | TFT+RTP |                |                                                          | —     | 450   | —     |          |          |      |
| Viewing Angle Range     |         | $\theta$       | $\varnothing = 90^{\circ}$                               | 30    | 40    | —     | deg      | Figure 3 | 6    |
|                         |         |                | $\varnothing = 270^{\circ}$                              | 50    | 60    | —     | deg      | Figure 3 |      |
|                         |         |                | $\varnothing = 0^{\circ}$                                | 50    | 60    | —     | deg      | Figure 3 |      |
|                         |         |                | $\varnothing = 180^{\circ}$                              | 50    | 60    | —     | deg      | Figure 3 |      |
| CIE (x, y) Chromaticity | Red     | x              | $\theta=0^{\circ}$<br>$\varnothing=0^{\circ}$<br>Ta=25°C | 0.574 | 0.624 | 0.674 | Figure 2 | 5        |      |
|                         |         | y              |                                                          | 0.318 | 0.368 | 0.418 |          |          |      |
|                         | Green   | x              |                                                          | 0.3   | 0.35  | 0.4   |          |          |      |
|                         |         | y              |                                                          | 0.5   | 0.55  | 0.6   |          |          |      |
|                         | Blue    | x              |                                                          | 0.093 | 0.143 | 0.193 |          |          |      |
|                         |         | y              |                                                          | 0.069 | 0.119 | 0.169 |          |          |      |
|                         | White   | x              |                                                          | 0.26  | 0.31  | 0.36  |          |          |      |
|                         |         | y              |                                                          | 0.283 | 0.333 | 0.383 |          |          |      |
| NTSC                    | —       | —              | —                                                        | —     | 50    | —     | %        | —        |      |

**Note 1.** Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 3.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

**Note 2.** Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information, see Figure 3.

**L<sub>v</sub> = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)**

**Note 3.** The uniformity in surface luminance  $\delta$  WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information, see Figure 3 .

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

**Note 4.** Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope series.

**Note 5.** CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

**Note 6.** Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The 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 Figure 4.

**Note 7.** For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCON's BM-5 photo detector.

**Note 8.** For TFT module, Gray scale reverse occurs in the direction of panel viewing angle.

Figure 2. The definition of response time

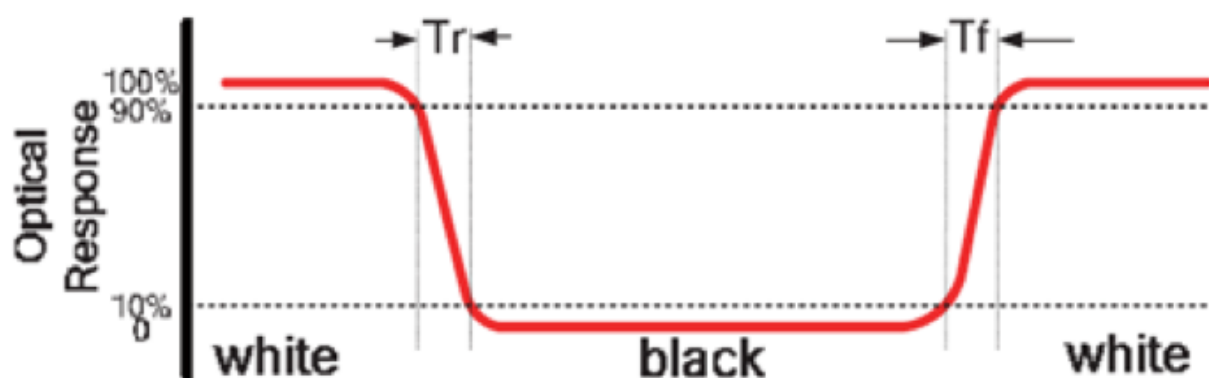


Figure 3. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

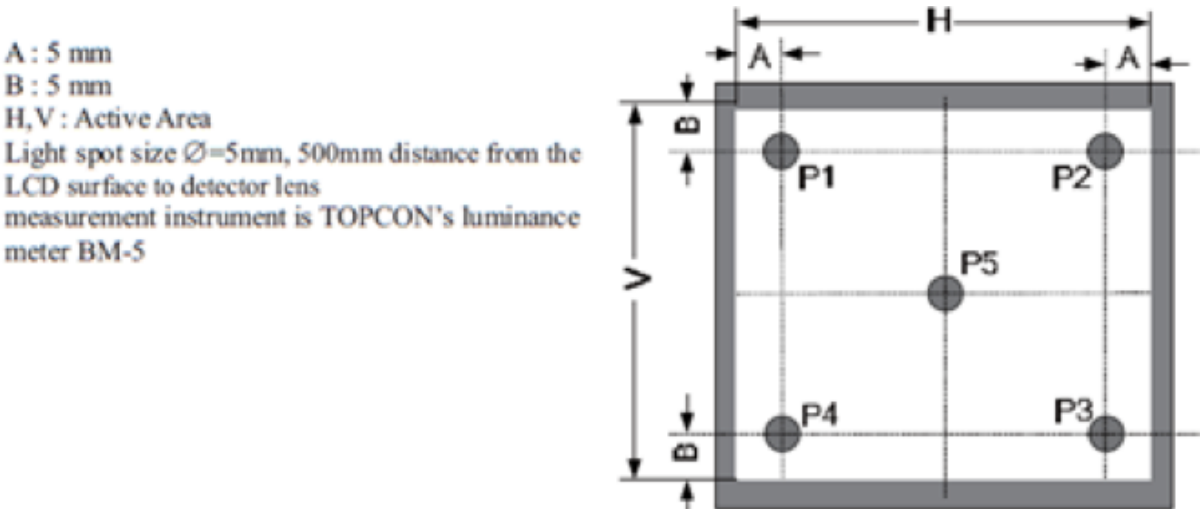
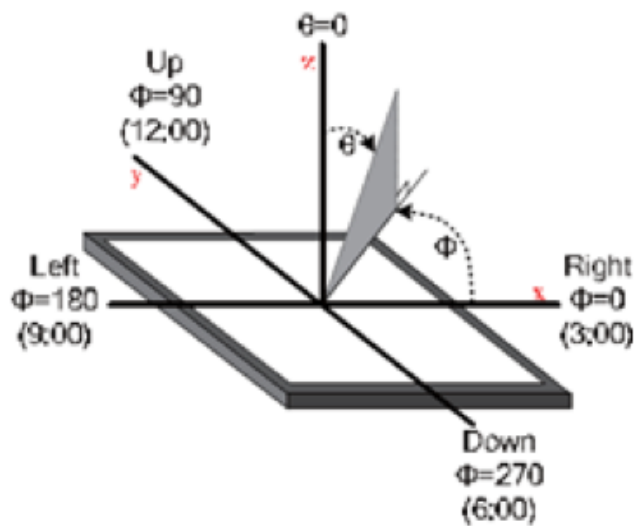


Figure 4.The definition of viewing angle



7. Interface description

| PIN NO. | SYMBOL | DESCRIPTION              | REMARK |
|---------|--------|--------------------------|--------|
| 1       | VLED-  | Cathode Of LED Backlight |        |
| 2       | VLED-  | Cathode Of LED Backlight |        |
| 3       | VLED+  | Anode Of LED Backlight   |        |
| 4       | VLED+  | Anode Of LED Backlight   |        |
| 5       | NC     | No Connect               |        |

|       |                       |                                |        |
|-------|-----------------------|--------------------------------|--------|
| 6     | NC                    | No Connect                     |        |
| 7     | NC                    | No Connect                     |        |
| 8     | RESET                 | Reset                          |        |
| 9     | SPENA                 | Serial Port Data Enable Signal |        |
| 10    | SPCK                  | SPI Serial Clock               |        |
| 11    | SPDA                  | SPI Serial Data Input/Output   |        |
| 12-35 | D00-D23               | Data 00 – Data 23              | Note 1 |
| 36    | HSYNC                 | Horizontal Synchronous Signal  |        |
| 37    | VSYNC                 | Vertical Synchronous Signal    |        |
| 38    | CLK                   | Data Clock                     |        |
| 39    | NC                    | No Connect                     |        |
| 40    | NC                    | No Connect                     |        |
| 41    | VDD                   | Power Supply (3.3V)            |        |
| 42    | VDD                   | Power Supply (3.3V)            |        |
| 43    | NC                    | No Connect                     |        |
| 44    | NC                    | No Connect                     |        |
| 45    | NC                    | No Connect                     |        |
| 46    | NC                    | No Connect                     |        |
| 47    | NC                    | No Connect                     |        |
| 48    | NC(CTP and no touch)  | No Connect                     |        |
|       | XR (RTP)              | Touch Right Electrode          |        |
| 49    | NC (CTP and no touch) | No Connect                     |        |
|       | YD (RTP)              | Touch Down Electrode           |        |
| 50    | NC(CTP and no touch)  | No Connect                     |        |
|       | XL (RTP)              | Touch Left Electrode           |        |
| 51    | NC(CTP and no touch)  | No Connect                     |        |
|       | YU (RTP)              | Touch Up Electrode             |        |
| 52    | DEN                   | Data Enabling Signal           |        |
| 53    | GND                   | Ground                         |        |
| 54    | GND                   | Ground                         |        |

**Note1:** D00-D23 (pins 12-35)

| MODE         | D(23:16) | D(15:08) | D(07:00) | HSYNC | VSYNC |
|--------------|----------|----------|----------|-------|-------|
| ITU-R BT 656 | D(23:16) | GND      | GND      | NC    | NC    |
| ITU-R BT 601 | D(23:16) | GND      | GND      | HSYNC | VSYNC |
| 8 Bit RGB    | D(23:16) | GND      | GND      | HSYNC | VSYNC |
| 24 Bit RGB   | R(7:0)   | G(7:0)   | B(7:0)   | HSYNC | VSYNC |

## 7.1. CTP interface description

| PIN NO.  | SYMBOL | DESCRIPTION   | REMARK |
|----------|--------|---------------|--------|
| <b>1</b> | VSS    | Power Ground  |        |
| <b>2</b> | VDD    | Power For CTP |        |
| <b>3</b> | SCL    | I2C SCL       |        |

|           |      |                           |  |
|-----------|------|---------------------------|--|
| <b>4</b>  | NC   | –                         |  |
| <b>5</b>  | SDA  | I2C SDA                   |  |
| <b>6</b>  | NC   | –                         |  |
| <b>7</b>  | /RST | Reset pin                 |  |
| <b>8</b>  | /NC  | No connection             |  |
| <b>9</b>  | /INT | Interrupt signal from CTP |  |
| <b>10</b> | VSS  | Power Ground              |  |

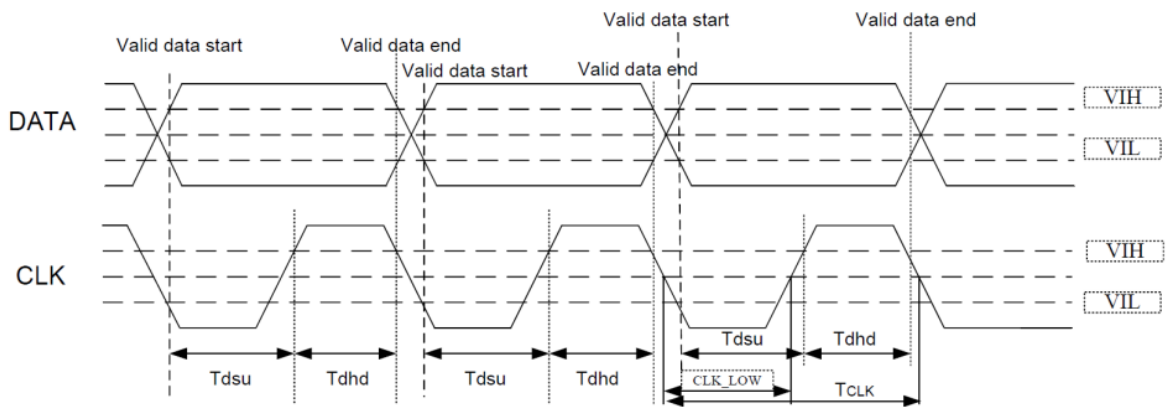
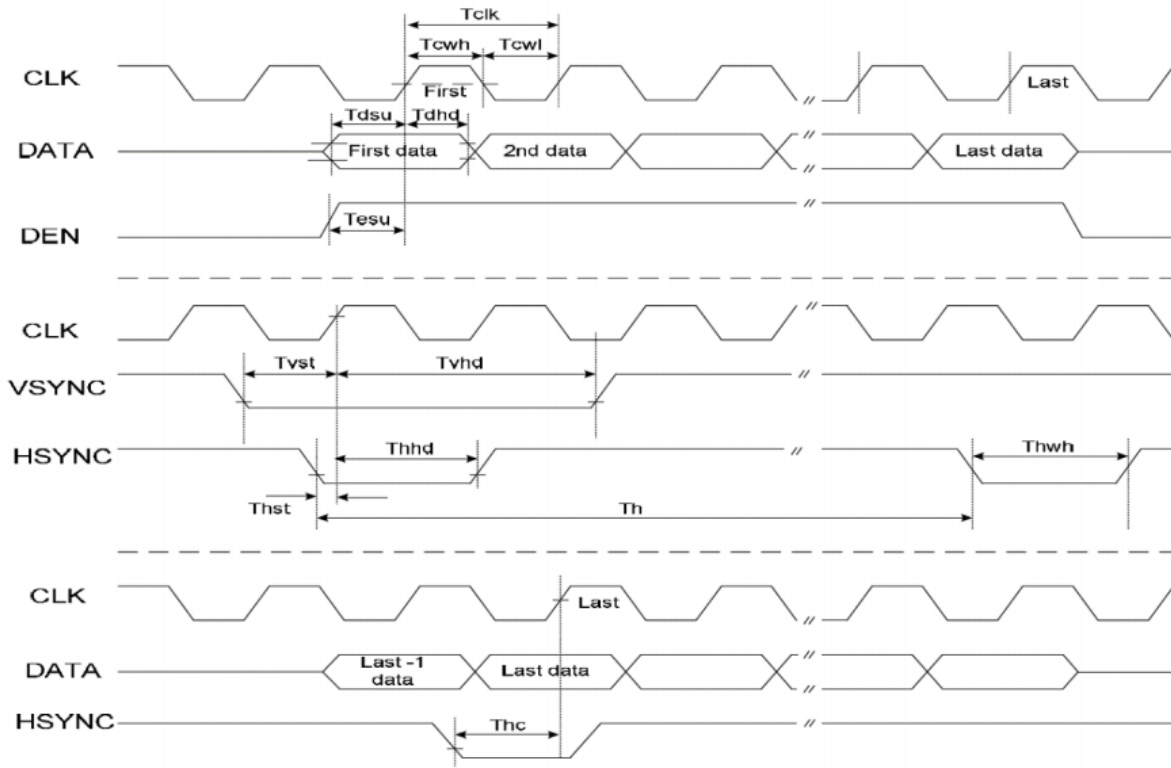
## 8. LCD timing characteristics

### 8.1. Timing Chart

Timing parameter (VDD=3.3V, GND=0V, Ta=25 °C)

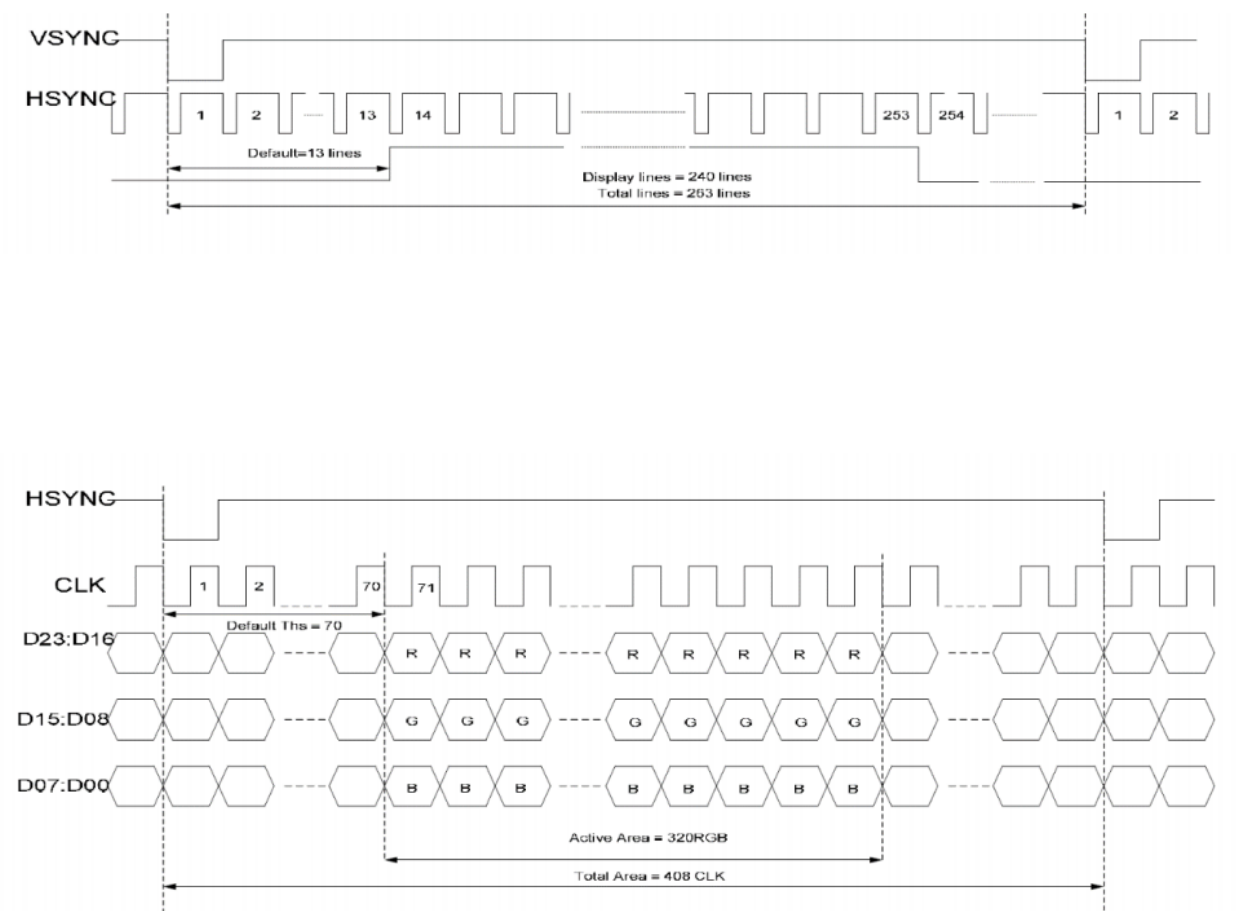
| PARAMETER         | SYMBOL | MIN         | TYP   | MAX         | UNIT | CONDITION      |
|-------------------|--------|-------------|-------|-------------|------|----------------|
| CLK Clock Time    | Tclk   | 1/Max(FCLK) | –     | 1/Min(FCLK) | ns   | –              |
| CLK Pulse Duty    | Tchw   | 40          | 50    | 60          | %    | TCLK           |
| HSYNC to CLK      | Thc    | –           | –     | 1           | CLK  | –              |
| HSYNC Width       | Thwh   | 1           | –     | –           | CLK  | –              |
| VSYNC Width       | Tvwh   | 1           | –     | –           | ns   | –              |
| HSYNC Period Time | Th     | 60          | 63.56 | 67          | ns   | –              |
| VSYNC Set-up Time | Tvst   | 12          | –     | –           | ns   | –              |
| VSYNC Hold Time   | Tvhd   | 12          | –     | –           | ns   | –              |
| HSYNC Setup Time  | Thst   | 12          | –     | –           | ns   | –              |
| HSYNC Hold Time   | Thhd   | 12          | –     | –           | ns   | –              |
| Data Set-up Time  | Tdsu   | 12          | –     | –           | ns   | D00~D23 to CLK |
| Data Hold Time    | Tdhd   | 12          | –     | –           | ns   | D00~D23 to CLK |
| DEN Set-up Time   | Tesu   | 12          | –     | –           | ns   | DEN to CLK     |

Note: Each CLK Frequency of 24 Bit RGB Mode, 8 Bit RGB Mode, CCIR601 and CCIR656 are different.



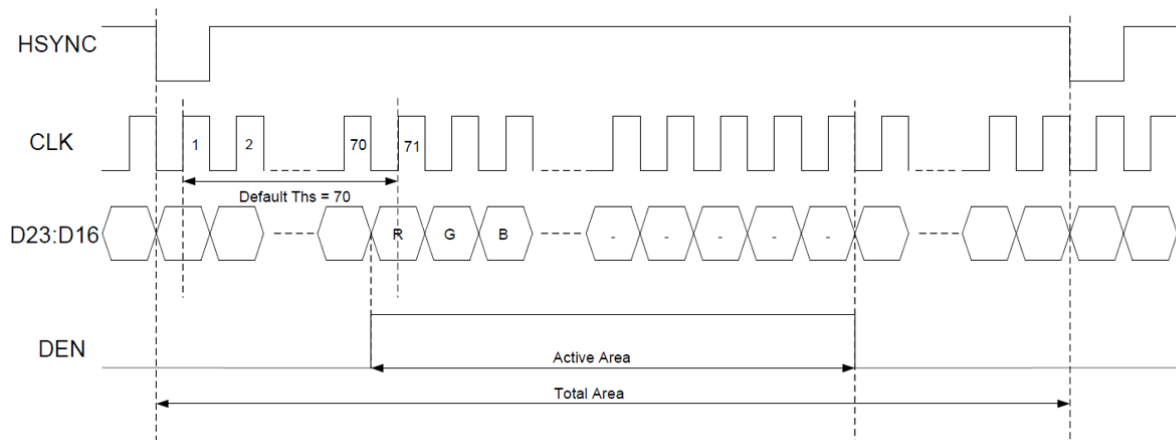
## 8.2. 24 Bit RGB Mode for 320xRGBx240

| PARAMETER                                | SYMBOL | MIN | TYP | MAX | UNIT | CONDITION                  |
|------------------------------------------|--------|-----|-----|-----|------|----------------------------|
| CLK Frequency                            | Fclk   | 6.1 | 6.4 | 8.0 | MHz  | VDD=3.0V~3.6V              |
| CLK Cycle Time                           | Tclk   | 125 | 156 | 164 | ns   | –                          |
| CLK Pulse Duty                           | Tcwh   | 40  | 50  | 60  | %    | –                          |
| Time that HSYNC to 1st Data Input (NTSC) | Ths    | 40  | 70  | 255 | CLK  | DDLY=70<br>Offset=0(fixed) |



### 8.3. 8 Bit RGB Mode for 320xRGBx240

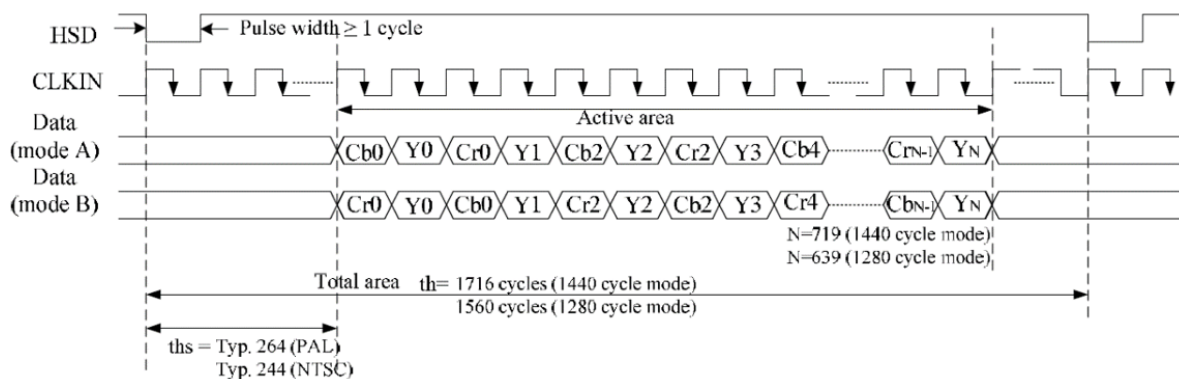
| PARAMETER                                | SYMBOL    | MIN | TYP | MAX | UNIT | CONDITION                  |
|------------------------------------------|-----------|-----|-----|-----|------|----------------------------|
| CLK Frequency                            | $F_{clk}$ | –   | 27  | 30  | MHz  | VDD=3.0V~3.6V              |
| CLK Cycle Time                           | $T_{clk}$ | –   | 37  | –   | ns   | –                          |
| Time that HSYNC to 1st Data Input (NTSC) | $T_{hs}$  | 35  | 70  | 255 | CLK  | DDLY=70<br>Offset=0(fixed) |



## 8.4. CCIR601

| PARAMETER                                | SYMBOL | MIN | TYP      | MAX | UNIT | CONDITION                     |
|------------------------------------------|--------|-----|----------|-----|------|-------------------------------|
| CLK Frequency                            | Fclk   | –   | 24.54/27 | 30  | MHz  | VDD=3.0V~3.6V                 |
| CLK Cycle Time                           | Tclk   | –   | 40/37    | –   | ns   | –                             |
| Time From HSYNC to 1st Data Input (PAL)  | Ths    | 128 | 264      | –   | CLK  | DDLY=136<br>Offset=128(fixed) |
| Time From HSYNC to 1st Data Input (NTSC) | Ths    | 128 | 244      | –   | CLK  | DDLY=116<br>Offset=128(fixed) |

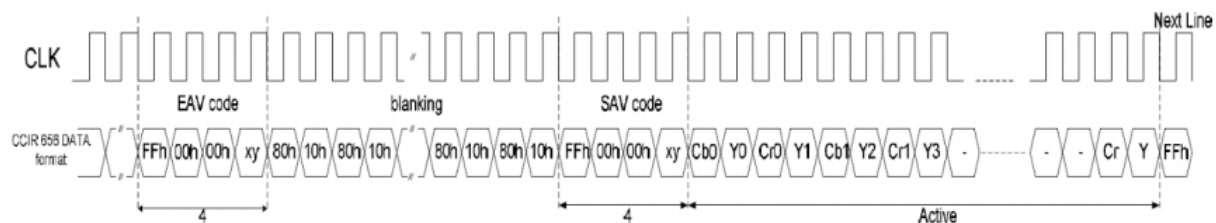
CLKIN frequency:  
 24.54MHz for 1280-cycle mode  
 27MHz for 1440-cycle mode



## 8.5. CCIR656

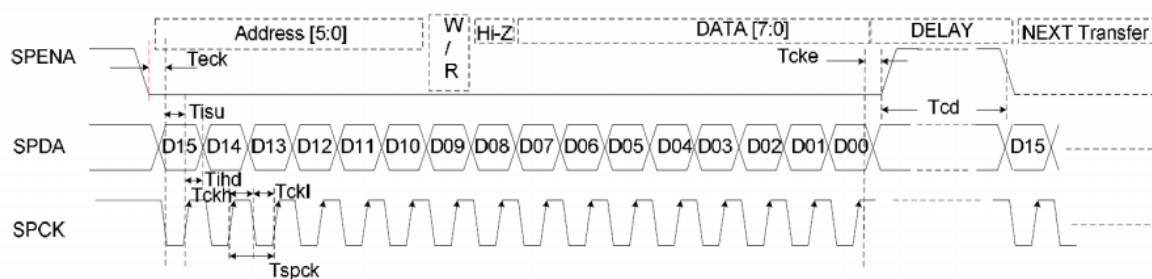
| PARAMETER     | SYMBOL | MIN | TYP | MAX | UNIT | CONDITION     |
|---------------|--------|-----|-----|-----|------|---------------|
| CLK Frequency | Fclk   | –   | 27  | 30  | MHz  | VDD=3.0V~3.6V |

|                                        |      |     |     |   |     |                               |
|----------------------------------------|------|-----|-----|---|-----|-------------------------------|
| CLK Cycle Time                         | Tclk | –   | 37  | – | ns  | –                             |
| Time From EVA to 1st Data Input (PAL)  | Ths  | 128 | 288 | – | CLK | DDLY=152<br>Offset=128(fixed) |
| Time From EVA to 1st Data Input (NTSC) | Ths  | 128 | 276 | – | CLK | DDLY=140<br>Offset=128(fixed) |



## 8.6. 3-Wire serial communication AC timing

| PARAMETER               | SYMBOL | MIN | TYP | MAX | UNIT |
|-------------------------|--------|-----|-----|-----|------|
| Serial Clock            | TSPCK  | 320 | –   | –   | ns   |
| SPCK Pulse Duty         | Tscdut | 40  | 50  | 60  | %    |
| Serial Data Setup Time  | Tisu   | 120 | –   | –   | ns   |
| Serial Data Hold Time   | Tihd   | 120 | –   | –   | ns   |
| Serial Clock High/Low   | Tssw   | 120 | –   | –   | ns   |
| Chip Select Distinguish | Tcd    | 1   | –   | –   | ns   |



**Note:** DDLY Description (Ths=DDLY+Offset)

**R04:** Source Timing Delay Control Register

| BIT      | NAME      | INITIAL | DESCRIPTION                                                                                                                                                                     |
|----------|-----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit[7:0] | DDLY[7:0] | 46h     | Select the HSD signal to 1st input data delay timing<br><br>Under CCIR601 mode, Ths=DDLY[7:0] + 128, (Unit=CLKIN)<br><br>Under CCIR656 mode, Ths=DDLY[7:0] +136, (Unit = CLKIN) |

|  |  |  |                                                                                                                                                               |
|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>The register value will be update to the different mode, such as 24RGB, 8RGB, CCIR mode</p> <p>Read the section of “24RGB, 8RGB, CCIR mode” for detail</p> |
|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 8.7. 3-wire control register list

| 3-WIRE REGISTERS |      | REGISTER DESCRIPTION |     |                                      |
|------------------|------|----------------------|-----|--------------------------------------|
| D[15:10]         | Name | Init                 | R/W | Function Description                 |
| 000000b          | R01  | 03h                  | R/W | System Control Register              |
| 000001b          | R02  | 00h                  | R/W | Timing Controller Function Register  |
| 000010b          | R03  | 03h                  | R/W | Operation Control Register           |
| 000011b          | R04  | CCh                  | R/W | Input Data Format Control Register   |
| 000100b          | R05  | 46h                  | R/W | Source Timing Delay Control Register |
| 000101b          | R06  | 0Dh                  | R/W | Gate Timing Delay Control Register   |
| 000111b          | R07  | 00h                  | R/W | Internal Function Control Register   |
| 001000b          | R08  | 08h                  | R/W | RGB Contrast Control Register        |
| 001001b          | R09  | 40h                  | R/W | RGB Brightness Control Register      |
| 001011b          | R0B  | 88h                  | R/W | R/B Sub-Contrast Control Register    |
| 001100b          | R0C  | 20h                  | R/W | R Sub-Brightness Control Register    |
| 001101b          | R0D  | 20h                  | R/W | B Sub-Brightness Control Register    |
| 001110b          | R0E  | 2Bh                  | R/W | VCOMDC Level Control Register        |
| 001111b          | R0F  | A6h                  | R/W | VCOMAC Level Control Register        |
| 010000b          | R10  | 04h                  | R/W | VGAM2 Level Control Register         |
| 010001b          | R11  | 24h                  | R/W | VGAM3/4 Level Control Register       |
| 010010b          | R12  | 24h                  | R/W | VGAM5/6 Level Control Register       |
| 011101b          | R1D  | 00h                  | R/W | OTP Operation Control Register       |
| 011110b          | R1E  | 00h                  | R/W | OTP Operation Control Register       |
| 011111b          | R1F  | 00h                  | R/W | OTP Operation Control Register       |

### Note :

R03: C4h:CCIR656 Mode

C2h:CCIR601 Mode

C8h:8 bit RGB Mode(HV Mode)

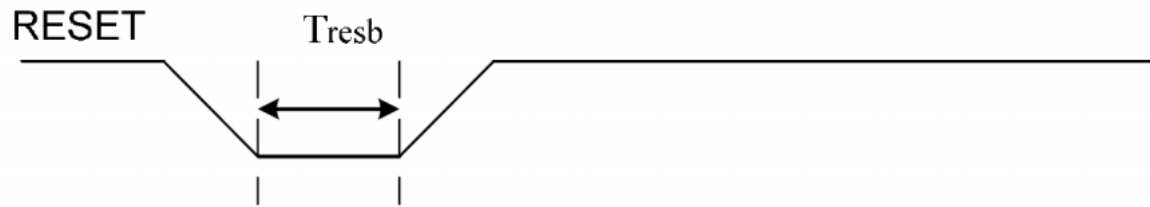
C9h:8 bit RGB Mode(DEN Mode)

CCh(default):24 bit RGB Mode (HV mode)

CDh:24 bit RGB Mode (DEN mode)

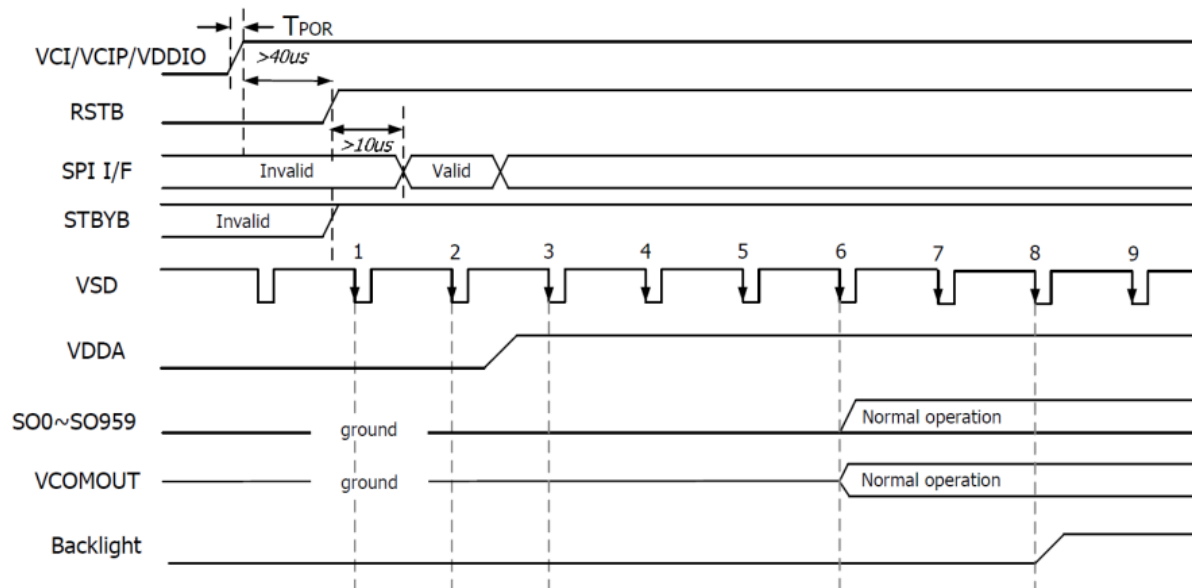
R0F: A4h(default):VGH=15V,VGL=-10V. 24h(recommend): VGH=15V,VGL=-7V.

## 8.8. Reset timing

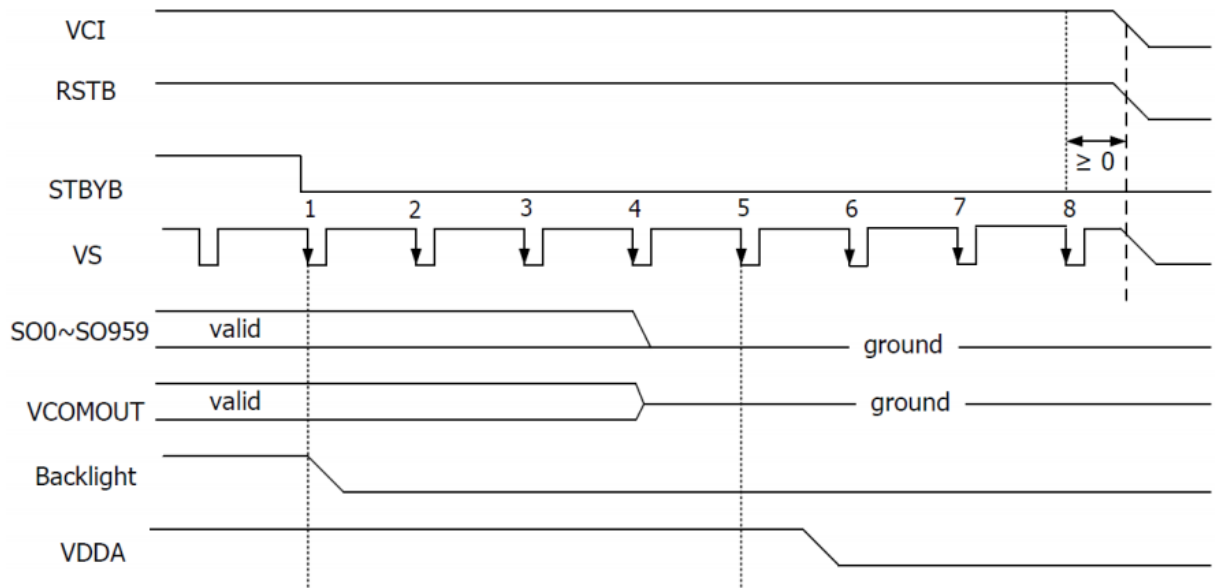


| PARAMETER  | MIN | TYP | MAX | UNIT | CONDITIONS |
|------------|-----|-----|-----|------|------------|
| $T_{resb}$ | 40  | –   | –   | us   | VDD=3.3V   |

## 8.9. Power on sequence



## 8.10. Power off sequence



## 9. Capacitive touch panel interface timing characteristics

| PARAMETER                                        | MIN | MAX | UNIT    |
|--------------------------------------------------|-----|-----|---------|
| SCL Frequency                                    | 0   | 400 | kHz     |
| Bus Free Time Between a STOP and START Condition | 4.7 | /   | $\mu$ s |
| Hold Time (repeated) START Condition             | 4.0 | /   | $\mu$ s |
| Data Setup Time                                  | 250 | /   | ns      |
| Setup Time for Repeated START Condition          | 4.7 | /   | $\mu$ s |
| Setup Time for STOP Condition                    | 4.0 | /   | $\mu$ s |

### 9.1 I2C Read/Write Interface description

Figure 5. Write N bytes to I2C slave

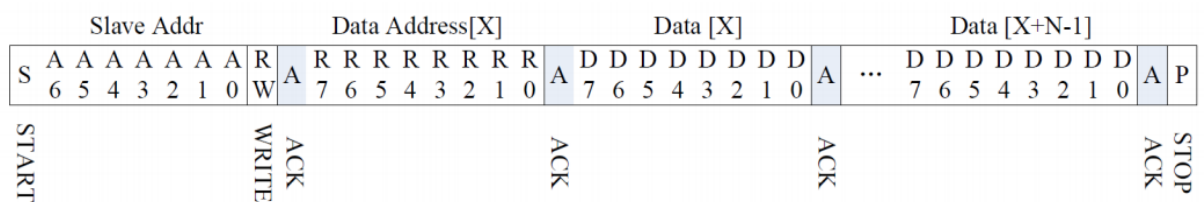


Figure 6. Set Data Address

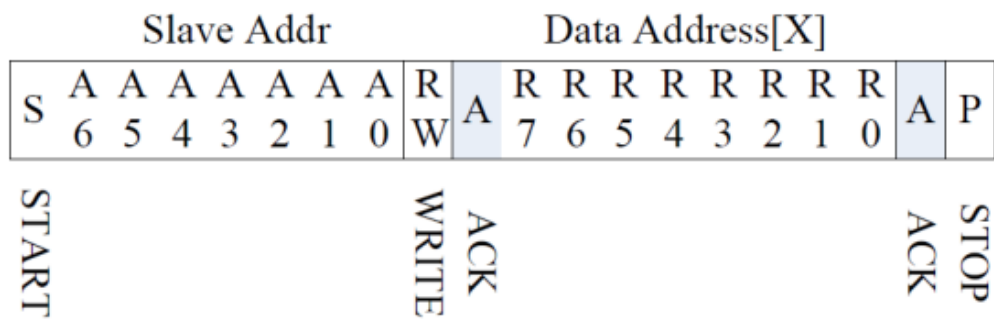
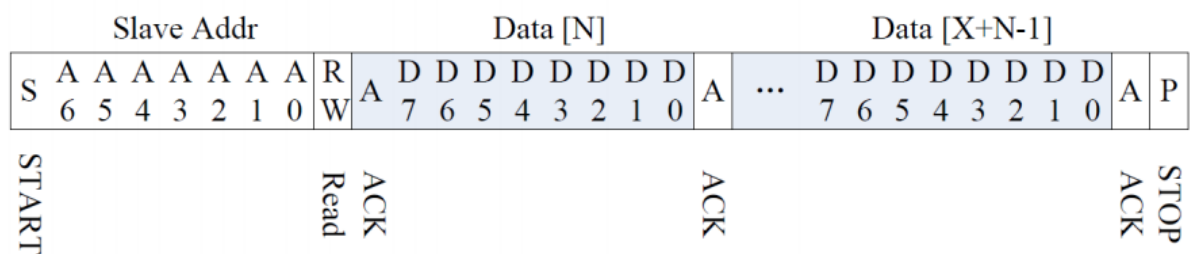
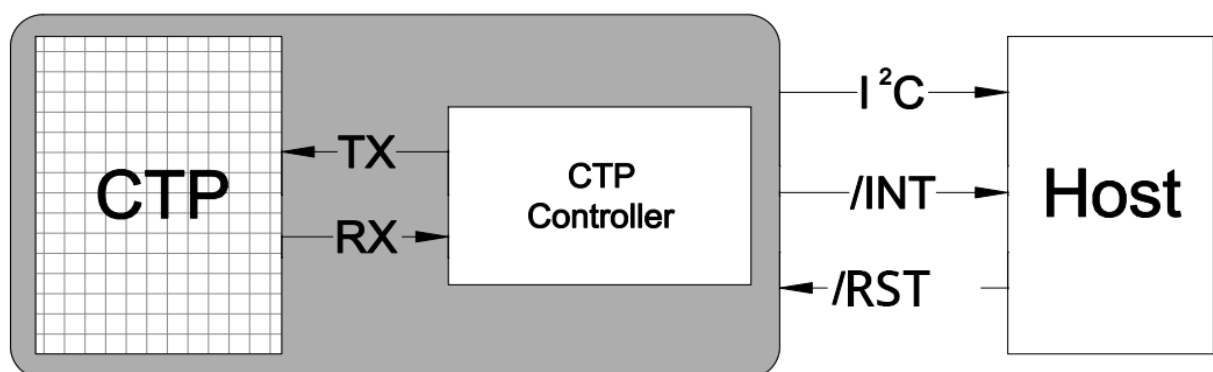


Figure 7. Read X bytes from I2C Slave



## 9.2 Communication of the I2C interface with Host

Figure 8. Communication of the I2C interface with Host



## 9.3 Touch data read protocol

| ADDRESS | NAME | BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 | HOST |
|---------|------|------|------|------|------|------|------|------|------|------|
|---------|------|------|------|------|------|------|------|------|------|------|

|     |             |                           |                  |  |                            |                             |  |  |   | ACCESS |
|-----|-------------|---------------------------|------------------|--|----------------------------|-----------------------------|--|--|---|--------|
| 00h | DEVIDE_MODE |                           | Device Mode[2:0] |  |                            |                             |  |  |   | RW     |
| 01h | GEST_ID     | Gesture ID[7:0]           |                  |  |                            |                             |  |  |   | R      |
| 02h | TD_STATUS   |                           |                  |  |                            | Number of touch points[3:0] |  |  |   | R      |
| 03h | TOUCH1_XH   | 1st Event Flag            |                  |  | 1st Touch X Position[11:8] |                             |  |  | R |        |
| 04h | TOUCH1_XL   | 1st Touch X Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 05h | TOUCH1_YH   | 1st Touch ID[3:0]         |                  |  | 1st Touch X Position[11:8] |                             |  |  |   | R      |
| 06h | TOUCH1_YL   | 1st Touch Y Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 07h |             |                           |                  |  |                            |                             |  |  | R |        |
| 08h |             |                           |                  |  |                            |                             |  |  | R |        |
| 09h | TOUCH2_XH   | 2nd Event Flag            |                  |  | 2nd Touch X Position[11:8] |                             |  |  | R |        |
| 0Ah | TOUCH2_XL   | 2nd Touch X Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 0Bh | TOUCH2_YH   | 2nd Touch ID[3:0]         |                  |  | 2nd Touch X Position[11:8] |                             |  |  |   | R      |
| 0Ch | TOUCH2_YL   | 2nd Touch Y Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 0Dh |             |                           |                  |  |                            |                             |  |  | R |        |
| 0Eh |             |                           |                  |  |                            |                             |  |  | R |        |
| 0Fh | TOUCH3_XH   | 3rd Event Flag            |                  |  | 3rd Touch X Position[11:8] |                             |  |  | R |        |
| 10h | TOUCH3_XL   | 3rd Touch X Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 11h | TOUCH3_YH   | 3rd Touch ID[3:0]         |                  |  | 3rd Touch X Position[11:8] |                             |  |  |   | R      |
| 12h | TOUCH3_YL   | 3rd Touch Y Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 13h |             |                           |                  |  |                            |                             |  |  | R |        |
| 14h |             |                           |                  |  |                            |                             |  |  | R |        |
| 15h | TOUCH4_XH   | 4th Event Flag            |                  |  | 4th Touch X Position[11:8] |                             |  |  | R |        |
| 16h | TOUCH4_XL   | 4th Touch X Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 17h | TOUCH4_YH   | 4th Touch ID[3:0]         |                  |  | 4th Touch X Position[11:8] |                             |  |  |   | R      |
| 18h | TOUCH4_YL   | 4th Touch Y Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 19h |             |                           |                  |  |                            |                             |  |  | R |        |
| 1Ah |             |                           |                  |  |                            |                             |  |  | R |        |
| 1Bh | TOUCH5_XH   | 5th Event Flag            |                  |  | 5th Touch X Position[11:8] |                             |  |  | R |        |
| 1Ch | TOUCH5_XL   | 5th Touch X Position[7:0] |                  |  |                            |                             |  |  |   | R      |
| 1Dh | TOUCH5_YH   | 5th Touch ID[3:0]         |                  |  | 5th Touch X Position[11:8] |                             |  |  |   | R      |
| 1Eh | TOUCH5_YL   | 5th Touch Y Position[7:0] |                  |  |                            |                             |  |  |   | R      |

## 9.4 Data description

### DEVICE\_MODE

This register is the device mode register, configure it to determine the current mode of the chip.

| ADRESS | BIT ADDRESS | REGISTER NAME     | DESCRIPTION    |
|--------|-------------|-------------------|----------------|
| 00h    | 6:4         | Device Mode [2:0] | 000b Work Mode |

|  |  |  |                                   |
|--|--|--|-----------------------------------|
|  |  |  | 100b Factory Mode – Read Raw Data |
|--|--|--|-----------------------------------|

### GEST\_ID

This register describes the gesture of a valid touch.

| ADDRESS | BIT ADDRESS | REGISTER NAME    | DESCRIPTION                                                                                                         |
|---------|-------------|------------------|---------------------------------------------------------------------------------------------------------------------|
| 01h     | 7:0         | Gesture ID [7:0] | Gesture ID<br>0x10 Move Up<br>0x14 Move Down<br>0x18 Move Right<br>0x48 Zoom In<br>0x49 Zoom Out<br>0x00 No Gesture |

### TD\_STATUS

This register is the Touch Data status register.

| ADDRESS | BIT ADDRESS | REGISTER NAME                | DESCRIPTION                              |
|---------|-------------|------------------------------|------------------------------------------|
| 02h     | 3:0         | Number of Touch Points [2:0] | How Many Points Detected<br>1-5 is Valid |
|         | 7:4         |                              |                                          |

### TOUCHn\_XH(n:1-10)

This register describes MSB of the X coordinate of the nth touch point and the corresponding event flag.

| ADDRESS         | BIT ADDRESS | REGISTER NAME           | DESCRIPTION                                                   |
|-----------------|-------------|-------------------------|---------------------------------------------------------------|
| 03h<br>~<br>39h | 7:6         | Event Flag              | 00b: Put Down<br>01b: Put Up<br>10b: Contact<br>11b: Reserved |
|                 | 5:4         |                         | Reserved                                                      |
|                 | 3:0         | Touch X Position [11:8] | MSB of Touch X Position in Pixels                             |

### TOUCHn\_XL(n:1-10)

This register describes LSB of the X coordinate of the nth touch point.

| ADDRESS  | BIT ADDRESS | REGISTER NAME          | DESCRIPTION                           |
|----------|-------------|------------------------|---------------------------------------|
| 04h<br>~ | 7:0         | Touch X Position [7:0] | LSB of the Touch X Position in Pixels |

|     |  |  |  |
|-----|--|--|--|
| 3Ah |  |  |  |
|-----|--|--|--|

### TOUCHn\_YH(n:1-10)

This register describes MSB of the Y coordinate of the nth touch point and corresponding touch ID.

| ADRESS | BIT ADRESS | REGISTER NAME           | DESCRIPTION                       |
|--------|------------|-------------------------|-----------------------------------|
| 05h    | 7:4        | Touch ID[3:0]           | Touch ID of Touch Point           |
| ~      |            |                         |                                   |
| 3Bh    | 3:0        | Touch X Position [11:8] | MSB of Touch Y Position in Pixels |

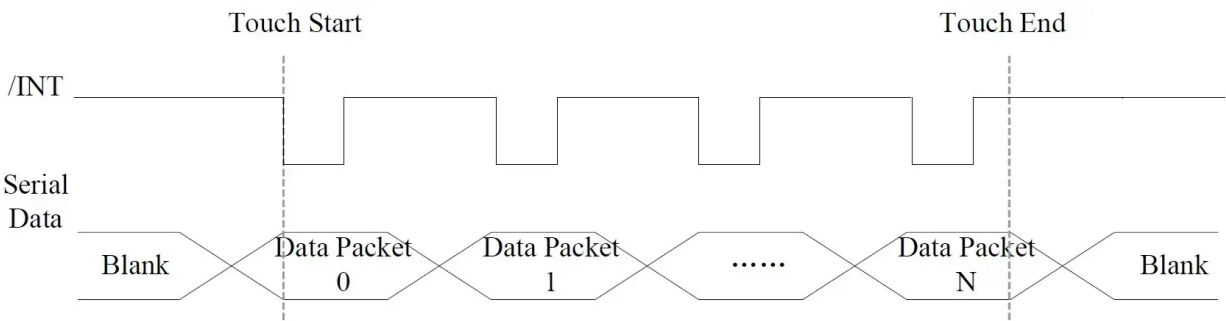
### TOUCHn\_YL(n:1-10)

This register describes LSB of the Y coordinate of the nth touch point.

| ADRESS | BIT ADRESS | REGISTER NAME          | DESCRIPTION                           |
|--------|------------|------------------------|---------------------------------------|
| 05h    | 7:0        | Touch X Position [7:0] | LSB of the Touch Y Position in Pixels |
| ~      |            |                        |                                       |
| 3Bh    |            |                        |                                       |

## 9.5 Interrupt Trigger Mode

Figure 9. Interrupt trigger mode timing



## 10. Touch screen panel specification

### 10.1. Electrical characteristics

#### 10.1.1. Capacitive touch panel

| DESCRIPTION             |             | SPECIFICATION        |
|-------------------------|-------------|----------------------|
| Operating Voltage       |             | DC 2.8~3.6V          |
| Power Consumption (IDD) | Active Mode | 10~18mA              |
|                         | Sleep Mode  | 30~50μA              |
| Interface               |             | I2C                  |
| Linearity               |             | <1.5%                |
| Controller              |             | FT5346               |
| I2C address             |             | 0x38 (7 bit address) |
| Resolution              |             | 896*640              |

10.1.2. Resistive touch panel

| ITEM                  | VALUE |      |      | UNIT | REMARK                    |
|-----------------------|-------|------|------|------|---------------------------|
|                       | Min.  | Typ. | Max. |      |                           |
| Linearity             | –     | –    | 1.5  | %    | Analog X and Y directions |
| Terminal Resistance   | 200   | –    | 900  | Ω    | X                         |
|                       | 100   | –    | 600  | Ω    | Y                         |
| Insulation Resistance | 20    | –    | –    | MΩ   | DC 25V                    |
| Voltage               | –     | –    | 10   | V    | DC                        |
| Chattering            | –     | –    | 10   | ms   | 100kΩ pull-up             |
| Transparency          | 78    | –    | –    | %    |                           |

**Note:** Avoid operating with hard or sharp material such as a ball point pen or a mechanical pencil except a polyacetal pen (tip R0.8mm or less) or a finger

10.2. Mechanical characteristic

10.2.1. Capacitive touch panel

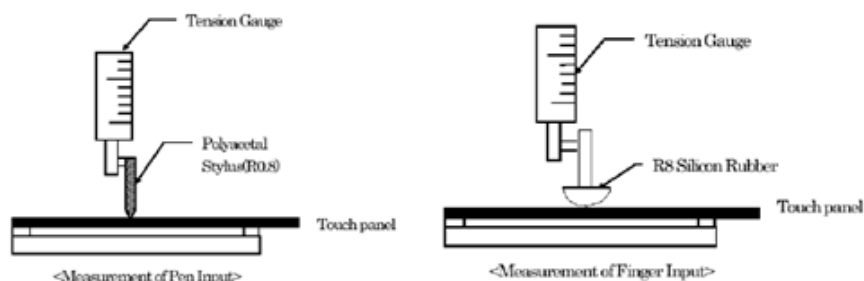
| DESCRIPTION            | INL SPECIFICATION  | REMARK             |
|------------------------|--------------------|--------------------|
| Touch Panel Size       | 3.5 inch           |                    |
| Outline Dimension (OD) | 76.75 mm x 63.00mm | Cover Lens Outline |
| Product Thickness      | 1.26mm             |                    |
| Glass Thickness        | 0.7 mm             |                    |
| Ink View Area          | 72.00mm x 54.50mm  |                    |
| Sensor Active Area     | 73.25mm x 55.90mm  |                    |
| Input Method           | 5 Finger           |                    |
| Activation Force       | Touch              |                    |
| Surface Hardness       | ≥7H                |                    |

10.2.2. Resistive touch panel

| ITEM | VALUE |      |      | UNIT | REMARK |
|------|-------|------|------|------|--------|
|      | Min.  | Typ. | Max. |      |        |

|                                 |               |   |     |            |           |
|---------------------------------|---------------|---|-----|------------|-----------|
| Activation Force                | 20            | – | 100 | gf         | Note 1    |
| Durability – Surface Scratching | Write 100,000 | – | –   | characters | Note 2    |
| Durability-Surface Pitting      | 1,000,000     | – | –   | touches    | Note 3    |
| Surface Hardness                | 3             | – | –   | H          | JIS K5400 |

**Note 1: Force test condition,** Input DC 5V on X direction, Drop off Polyacetal Stylus (R0.8), until output voltage stabilize, then get the R8.0mm Silicon rubber and do finger Activation force test. Next step, 9 points.



**Note 2: Measurement surface area conditions,** Scratch 100,000 times straight line on the film with a stylus change every 20,000 times with Force: 250gf, Speed: 60mm/sec by R0.8 polaceteal stylus.

**Note 3: Pitting test,** Pit 1, 000, 000 times on the film with R0.8 silicon rubber with Force: 250gf and Speed: 2 times/sec.

## 11. Inspection

Standard acceptance/rejection criteria for TFT module.

### 11.1. Inspection condition

Ambient conditions:

- Temperature: 25±°C
- Humidity: (60±10) %RH
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

Viewing distance:

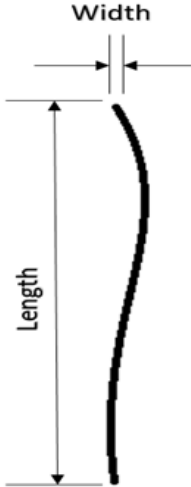
35±5cm between inspector bare eye and LCD.

Viewing Angle:

U/D: 45°/45°, L/R 45°/45°



**LCD black spots,  
white spots, light  
leakage (line Type)**



| Size < 5"         |                 |               |
|-------------------|-----------------|---------------|
| Length            | Width           | Qualified Qty |
| –                 | W < 0.02        | Ignored       |
| <b>L &lt; 3.0</b> | 0.02 < W < 0.05 | 2             |
| <b>L &lt; 2.5</b> | 0.05 < W < 0.08 |               |
| –                 | 0.08 < W        | 0             |

| Size >= 5"        |                 |               |
|-------------------|-----------------|---------------|
| Length            | Width           | Qualified Qty |
| –                 | W < 0.02        | Ignored       |
| <b>L &lt; 3.0</b> | 0.02 < W < 0.05 | 4             |
| <b>L &lt; 2.5</b> | 0.05 < W < 0.08 |               |
| –                 | 0.08 < W        | 0             |

| Item                  | Criterion                                                                                                                                                                                                                                                                                                                                             |               |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--|------------------|---------------|------------|---------|---------------------|---|---------------------|---|------------|---|------------|---|
| Clear spots           | <table><tr><th colspan="2">Size &lt; 5"</th></tr><tr><th>Average Diameter</th><th>Qualified Qty</th></tr><tr><td>D &lt; 0.2 mm</td><td>Ignored</td></tr><tr><td>0.2 mm &lt; D &lt; 0.3 mm</td><td>3</td></tr><tr><td>0.3 mm &lt; D &lt; 0.5 mm</td><td>2</td></tr><tr><td>0.5 mm &lt; D</td><td>0</td></tr></table>                                   | Size < 5"     |  | Average Diameter | Qualified Qty | D < 0.2 mm | Ignored | 0.2 mm < D < 0.3 mm | 3 | 0.3 mm < D < 0.5 mm | 2 | 0.5 mm < D | 0 |            |   |
|                       | Size < 5"                                                                                                                                                                                                                                                                                                                                             |               |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | Average Diameter                                                                                                                                                                                                                                                                                                                                      | Qualified Qty |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | D < 0.2 mm                                                                                                                                                                                                                                                                                                                                            | Ignored       |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.2 mm < D < 0.3 mm                                                                                                                                                                                                                                                                                                                                   | 3             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.3 mm < D < 0.5 mm                                                                                                                                                                                                                                                                                                                                   | 2             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.5 mm < D                                                                                                                                                                                                                                                                                                                                            | 0             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | <table><tr><th colspan="2">Size &gt;= 5"</th></tr><tr><th>Average Diameter</th><th>Qualified Qty</th></tr><tr><td>D&lt;0.2 mm</td><td>Ignored</td></tr><tr><td>0.2 mm &lt; D &lt; 0.3 mm</td><td>4</td></tr><tr><td>0.3 mm &lt; D &lt; 0.5 mm</td><td>2</td></tr><tr><td>0.5 mm &lt; D</td><td>0</td></tr></table>                                    | Size >= 5"    |  | Average Diameter | Qualified Qty | D<0.2 mm   | Ignored | 0.2 mm < D < 0.3 mm | 4 | 0.3 mm < D < 0.5 mm | 2 | 0.5 mm < D | 0 |            |   |
|                       | Size >= 5"                                                                                                                                                                                                                                                                                                                                            |               |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | Average Diameter                                                                                                                                                                                                                                                                                                                                      | Qualified Qty |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | D<0.2 mm                                                                                                                                                                                                                                                                                                                                              | Ignored       |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.2 mm < D < 0.3 mm                                                                                                                                                                                                                                                                                                                                   | 4             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.3 mm < D < 0.5 mm                                                                                                                                                                                                                                                                                                                                   | 2             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.5 mm < D                                                                                                                                                                                                                                                                                                                                            | 0             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
| *Spots density: 10 mm |                                                                                                                                                                                                                                                                                                                                                       |               |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
| Polarizer bubbles     | <table><tr><th colspan="2">Size &lt; 5"</th></tr><tr><th>Average Diameter</th><th>Qualified Qty</th></tr><tr><td>D &lt; 0.2 mm</td><td>Ignored</td></tr><tr><td>0.2 mm &lt; D &lt; 0.5 mm</td><td>3</td></tr><tr><td>0.5 mm &lt; D &lt; 1 mm</td><td>2</td></tr><tr><td>1 mm &lt; D</td><td>0</td></tr><tr><td>Total Q'ty</td><td>3</td></tr></table> | Size < 5"     |  | Average Diameter | Qualified Qty | D < 0.2 mm | Ignored | 0.2 mm < D < 0.5 mm | 3 | 0.5 mm < D < 1 mm   | 2 | 1 mm < D   | 0 | Total Q'ty | 3 |
|                       | Size < 5"                                                                                                                                                                                                                                                                                                                                             |               |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | Average Diameter                                                                                                                                                                                                                                                                                                                                      | Qualified Qty |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | D < 0.2 mm                                                                                                                                                                                                                                                                                                                                            | Ignored       |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.2 mm < D < 0.5 mm                                                                                                                                                                                                                                                                                                                                   | 3             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 0.5 mm < D < 1 mm                                                                                                                                                                                                                                                                                                                                     | 2             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | 1 mm < D                                                                                                                                                                                                                                                                                                                                              | 0             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | Total Q'ty                                                                                                                                                                                                                                                                                                                                            | 3             |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | <table><tr><th colspan="2">Size &gt;= 5"</th></tr><tr><th>Average Diameter</th><th>Qualified Qty</th></tr></table>                                                                                                                                                                                                                                    | Size >= 5"    |  | Average Diameter | Qualified Qty |            |         |                     |   |                     |   |            |   |            |   |
|                       | Size >= 5"                                                                                                                                                                                                                                                                                                                                            |               |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |
|                       | Average Diameter                                                                                                                                                                                                                                                                                                                                      | Qualified Qty |  |                  |               |            |         |                     |   |                     |   |            |   |            |   |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|---------|----------------------|-----------|---------------|-----------------|------------------|-------|-------------------|------------|---------|-----------|---------------------|----------------|------------|---------------------|----------------|------|------------|---------------|-----------------|------------|---|-------------------|------------------|---------------|---------------|-----------|---------|---------|----------------------|---|---|------------|---|---|
|                                | <table><tr><td colspan="2">D&lt;0.25 mm</td><td>Ignored</td></tr><tr><td colspan="2">0.25 mm &lt; D &lt; 0.5 mm</td><td>3</td></tr><tr><td colspan="2">0.5 mm &lt; D</td><td>0</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | D<0.25 mm     |           | Ignored | 0.25 mm < D < 0.5 mm |           | 3             | 0.5 mm < D      |                  | 0     |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| D<0.25 mm                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Ignored       |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.25 mm < D < 0.5 mm           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.5 mm < D                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Electrical Dot Defect          | <table><tr><td colspan="3">Size &lt; 5"</td></tr><tr><td colspan="2">item</td><td>Qualified Qty</td></tr><tr><td colspan="2">Black do defect</td><td>4</td></tr><tr><td colspan="2">Bright dot defect</td><td>2</td></tr><tr><td colspan="2">Total Dot</td><td>5</td></tr></table><br><table><tr><td colspan="3">Size &gt;= 5"</td></tr><tr><td colspan="2">item</td><td>Qualified Qty</td></tr><tr><td colspan="2">Black do defect</td><td>5</td></tr><tr><td colspan="2">Bright dot defect</td><td>2</td></tr><tr><td colspan="2">Total Dot</td><td>5</td></tr></table>                                                                                                                          | Size < 5"     |           |         | item                 |           | Qualified Qty | Black do defect |                  | 4     | Bright dot defect |            | 2       | Total Dot |                     | 5              | Size >= 5" |                     |                | item |            | Qualified Qty | Black do defect |            | 5 | Bright dot defect |                  | 2             | Total Dot     |           | 5       |         |                      |   |   |            |   |   |
| Size < 5"                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| item                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Qualified Qty |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Black do defect                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Bright dot defect              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Total Dot                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Size >= 5"                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| item                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Qualified Qty |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Black do defect                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Bright dot defect              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Total Dot                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Item                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               | Criterion |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Touch panel spot               | <table><tr><td colspan="3">Size &lt; 5"</td></tr><tr><td colspan="2">Average Diameter</td><td>Qualified Qty</td></tr><tr><td colspan="2">D &lt; 0.2 mm</td><td>Ignored</td></tr><tr><td colspan="2">0.2 mm &lt; D &lt; 0.4 mm</td><td>5</td></tr><tr><td colspan="2">0.4 mm &lt; D &lt; 0.5 mm</td><td>2</td></tr><tr><td colspan="2">0.5 mm &lt; D</td><td>0</td></tr></table><br><table><tr><td colspan="3">Size &gt;= 5"</td></tr><tr><td colspan="2">Average Diameter</td><td>Qualified Qty</td></tr><tr><td colspan="2">D&lt;0.25 mm</td><td>Ignored</td></tr><tr><td colspan="2">0.25 mm &lt; D &lt; 0.5 mm</td><td>4</td></tr><tr><td colspan="2">0.5 mm &lt; D</td><td>0</td></tr></table> |               |           |         |                      | Size < 5" |               |                 | Average Diameter |       | Qualified Qty     | D < 0.2 mm |         | Ignored   | 0.2 mm < D < 0.4 mm |                | 5          | 0.4 mm < D < 0.5 mm |                | 2    | 0.5 mm < D |               | 0               | Size >= 5" |   |                   | Average Diameter |               | Qualified Qty | D<0.25 mm |         | Ignored | 0.25 mm < D < 0.5 mm |   | 4 | 0.5 mm < D |   | 0 |
| Size < 5"                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Average Diameter               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Qualified Qty |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| D < 0.2 mm                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Ignored       |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.2 mm < D < 0.4 mm            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.4 mm < D < 0.5 mm            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.5 mm < D                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Size >= 5"                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Average Diameter               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Qualified Qty |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| D<0.25 mm                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Ignored       |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.25 mm < D < 0.5 mm           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| 0.5 mm < D                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Touch panel White Line Scratch | <table><tr><td colspan="3">Size &lt; 5"</td></tr><tr><td>Length</td><td>Width</td><td>Qualified Qty</td></tr><tr><td>–</td><td>W&lt; 0.02</td><td>Ignored</td></tr><tr><td>L &lt; 3.0</td><td>0.02 &lt; W &lt;0.05</td><td rowspan="2">2</td></tr><tr><td>L &lt; 2.5</td><td>0.05 &lt; W &lt;0.08</td></tr><tr><td>–</td><td>0.08 &lt; W</td><td>0</td></tr></table><br><table><tr><td colspan="3">Size &gt;= 5"</td></tr><tr><td>Length</td><td>Width</td><td>Qualified Qty</td></tr><tr><td>–</td><td>W&lt; 0.03</td><td>Ignored</td></tr><tr><td>L &lt; 5.0</td><td>0.03 &lt; W &lt;0.05</td><td>2</td></tr><tr><td>–</td><td>0.05 &lt; W</td><td>0</td></tr></table>                           |               |           |         |                      | Size < 5" |               |                 | Length           | Width | Qualified Qty     | –          | W< 0.02 | Ignored   | L < 3.0             | 0.02 < W <0.05 | 2          | L < 2.5             | 0.05 < W <0.08 | –    | 0.08 < W   | 0             | Size >= 5"      |            |   | Length            | Width            | Qualified Qty | –             | W< 0.03   | Ignored | L < 5.0 | 0.03 < W <0.05       | 2 | – | 0.05 < W   | 0 |   |
| Size < 5"                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Length                         | Width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Qualified Qty |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| –                              | W< 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Ignored       |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| L < 3.0                        | 0.02 < W <0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| L < 2.5                        | 0.05 < W <0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| –                              | 0.08 < W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Size >= 5"                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| Length                         | Width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Qualified Qty |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| –                              | W< 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Ignored       |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| L < 5.0                        | 0.03 < W <0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |
| –                              | 0.05 < W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0             |           |         |                      |           |               |                 |                  |       |                   |            |         |           |                     |                |            |                     |                |      |            |               |                 |            |   |                   |                  |               |               |           |         |         |                      |   |   |            |   |   |

## 12. Reliability test

| NO. | TEST ITEM                  | TEST CONDITION                                                                                                                                          | INSPECTION AFTER TEST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | High Temperature Storage   | 80±2°C/240 hours                                                                                                                                        | <p>Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects:</p> <ol style="list-style-type: none"> <li>1. Air bubble in the LCD</li> <li>2. Seal leak</li> <li>3. Non-display</li> <li>4. Missing segments</li> <li>5. Glass crack</li> <li>6. Current Idd is twice higher than initial value</li> <li>7. The surface shall be free from damage</li> <li>8. Linearity must be no more than 1.5% by the linearity tester</li> <li>9. The Electric characteristics requirements shall be satisfied</li> </ol> |
| 2   | Low Temperature Storage    | -30±2°C/240 hours                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3   | High Temperature Operating | 70±2°C/240 hours                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 4   | Low Temperature Operating  | -20±2°C/240 hours                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 5   | Temperature Cycle          | -30±2°C~25~70±2°C × 30 cycles                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 6   | Damp Proof Test            | 60°C ±5°C × 90%RH/160 hours                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 7   | Vibration Test             | Frequency 10Hz~55Hz<br>Stroke: 1.5mm<br>Sweep: 10Hz~55Hz~10Hz 2 hours<br>For each direction of X, Y, Z<br>(6 hours for total)                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 8   | Mechanical Shock           | 60G 6ms, ± X, ± Y, ± Z 3 times for each direction                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 9   | Packing Drop Test          | Height: 80 cm<br>1 corner, 3 edges, 6 surfaces                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10  | Package Vibration Test     | Random vibration:<br>0.015G <sup>2</sup> /Hz from 5-200Hz<br>-6dB/Octave from 200-500Hz<br>2 hours for each direction of X, Y, Z<br>(6 hours for total) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 11  | Electrostatic Discharge    | Air: ±8KV 150pF/330Ω 5 times<br>Contact: ±4KV 150pF/330Ω 5 times                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Hitting Test                | <p>1,000,000 times in the same point</p> <p>Hitting pad: tip R3.75mm, Silicone rubber, Hardness: 40deg.</p> <p>Load: 2.45N</p> <p>Hitting speed: Twice/sec</p> <p>Electric load: none</p> <p>Test area should be at 1.8mm inside of insulation.</p> |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pen Sliding Durability Test | <p>100,000 times minimum</p> <p>Hitting pad: tip R0.8mm plastic pen</p> <p>Load: 1.47N</p> <p>Sliding speed: 60 mm/sec</p> <p>Electric load: none</p> <p>Test area should be at 1.8mm inside of insulation.</p>                                     |
| <p>Remark:</p> <p>1. The test samples should be applied to only one test item.</p> <p>2. Sample size for each test item is 5~10pcs.</p> <p>3. For Damp Proof Test, Pure water (Resistance 10M<math>\Omega</math>) should be used.</p> <p>4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.</p> <p>5. EL 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 EL has.</p> <p>6. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.</p> |                             |                                                                                                                                                                                                                                                     |



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*Updated on May 20, 2021*

RGB 4.3" →

Was this article helpful to you

Yes

No