



# Microtips

---

## TECHNOLOGY

Model No: 13-070WMTB4RA1-S

| Approved By |  |
|-------------|--|
|             |  |

Tel: 1 (888) 499-8477

Fax: (407) 273-0771

E-mail: [mtusainfo@microtipsusa.com](mailto:mtusainfo@microtipsusa.com)

Web: [www.microtipsusa.com](http://www.microtipsusa.com)

## RECORD OF REVISION

| Version | Revised Date | Page | Content                               |
|---------|--------------|------|---------------------------------------|
| V1.0    | 2013/11/27   | --   | First Issued                          |
| V1.1    | 2018/07/26   | 11   | Update LED Life time 30000 → 50000Hr. |
|         |              |      |                                       |
|         |              |      |                                       |
|         |              |      |                                       |

## TABLE OF CONTENTS

| No. | Content                                              | Page |
|-----|------------------------------------------------------|------|
|     | TFT Module Specification .....                       | 1    |
|     | TABLE OF CONTENTS .....                              | 3    |
| 1.  | GENERAL DESCRIPTION .....                            | 4    |
| 2.  | MECHANICAL SPECIFICATION .....                       | 5    |
| 3.  | PIN DESCRIPTION .....                                | 6    |
| 4.  | ABSOLUTE MAXIMUM RATINGS .....                       | 8    |
| 5.  | BLOCK DIAGRAM .....                                  | 9    |
| 6.  | RELATIONSHIP BETWEEN DISPLAYED COLOR AND INPUT ..... | 10   |
| 7.  | ELECTRICAL CHARACTERISTICS .....                     | 11   |
| 8.  | TOUCH SCREEN PANEL SPECIFICATIONS .....              | 15   |
| 9.  | OPTICAL CHARACTERISTICS .....                        | 16   |
| 10. | RELIABILITY.....                                     | 19   |
| 11. | PRECAUTION RELATING PRODUCT HANDLING .....           | 24   |

## 1. GENERAL DESCRIPTION

### 1.1 Description

The specification is model 13-070WMTB4RA1-S is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit, a backlight system and Touch panel. This TFT LCD has a 7.0 (16:9) inch diagonally measured active display area with WVGA (800 horizontal by 480 vertical pixels) resolution.

### 1.2 Features:

| No. | Item                           | Specification                      | Unit   |
|-----|--------------------------------|------------------------------------|--------|
| 1   | Panel Size                     | 7.0"                               | Inch   |
| 2   | Number of Pixels               | 800 (W) x RGB x 480 (H)            | Pixels |
| 3   | Active Area                    | 153.6 (W) x 86.64 (H)              | mm     |
| 4   | Pixel Pitch                    | 0.192 (W) x 0.1805(H)              | mm     |
| 5   | Outline Dimension              | 165 (W) x 104 (H) x 4.6 (T)        | mm     |
| 6   | Number of Colors               | 262K                               | - -    |
| 7   | Display Mode                   | TN / Normally White / Transmissive | - -    |
| 8   | View Direction                 | 6 o'clock (Gray Inversion)         |        |
| 9   | Display Format                 | RGB vertical stripe                | - -    |
| 10  | Surface Treatment              | Anti-Glare                         | - -    |
| 11  | Contrast Ratio                 | 500 (Typ.)                         | - -    |
| 12  | Luminance (cd/m <sup>2</sup> ) | 800 (Typ.)                         | cd/m2  |
| 13  | Interface                      | RGB 18bit Interface                | - -    |
| 14  | Backlight                      | White LED                          | - -    |
| 15  | Operation Temperature          | -20 ~ 70                           | °C     |
| 16  | Storage Temperature            | -30 ~ 80                           | °C     |
| 17  | Weight                         | (TBD)                              | g      |



### 3. PIN DESCRIPTION

#### 3.1 TFT LCD Module

| Pin No. | Symbol | I/O | Function                       | Remark |
|---------|--------|-----|--------------------------------|--------|
| 1       | GND    | P   | Ground                         |        |
| 2       | GND    | P   | Ground                         |        |
| 3       | ADJ    | I   | Brightness control for LED B/L |        |
| 4       | VLED   | P   | Power Supply for LED Driver    |        |
| 5       | VLED   | P   | Power Supply for LED Driver    |        |
| 6       | VLED   | P   | Power Supply for LED Driver    |        |
| 7       | VCC    | P   | Power Supply for system        |        |
| 8       | VCC    | P   | Power Supply for system        |        |
| 9       | DE     | I   | Data Enable Timing Signal      |        |
| 10      | GND    | P   | Ground                         |        |
| 11      | GND    | P   | Ground                         |        |
| 12      | GND    | P   | Ground                         |        |
| 13      | B5     | I   | Blue data signal (MSB)         |        |
| 14      | B4     | I   | Blue data signal               |        |
| 15      | B3     | I   | Blue data signal               |        |
| 16      | GND    | P   | Ground                         |        |
| 17      | B2     | I   | Blue data signal               |        |
| 18      | B1     | I   | Blue data signal               |        |
| 19      | B0     | I   | Blue data signal (LSB)         |        |
| 20      | GND    | P   | Ground                         |        |
| 21      | G5     | I   | Green data signal (MSB)        |        |
| 22      | G4     | I   | Green data signal              |        |
| 23      | G3     | I   | Green data signal              |        |
| 24      | GND    | P   | Ground                         |        |
| 25      | G2     | I   | Green data signal              |        |
| 26      | G1     | I   | Green data signal              |        |
| 27      | G0     | I   | Green data signal (LSB)        |        |
| 28      | GND    | P   | Ground                         |        |
| 29      | R5     | I   | Red data signal (MSB)          |        |
| 30      | R4     | I   | Red data signal                |        |
| 31      | R3     | I   | Red data signal                |        |
| 32      | GND    | P   | Ground                         |        |
| 33      | R2     | I   | Red data signal                |        |

|    |      |   |                       |  |
|----|------|---|-----------------------|--|
| 34 | R1   | I | Red data signal       |  |
| 35 | R0   | I | Red data signal (LSB) |  |
| 36 | GND  | P | Ground                |  |
| 37 | GND  | P | Ground                |  |
| 38 | DCLK | I | Data Clock            |  |
| 39 | GND  | P | Ground                |  |
| 40 | GND  | P | Ground                |  |

#### 4. ABSOLUTE MAXIMUM RATINGS

##### 4.1 Electrical Absolute Rating

##### 4.1.1 TFT LCD Module

| Item                 | Symbol | Values |      | Unit | Note |
|----------------------|--------|--------|------|------|------|
|                      |        | Min    | Max. |      |      |
| Power supply voltage | VCC    | -0.3   | 4.0  | V    |      |
|                      | VLED   | 0      | 6.0  | V    |      |

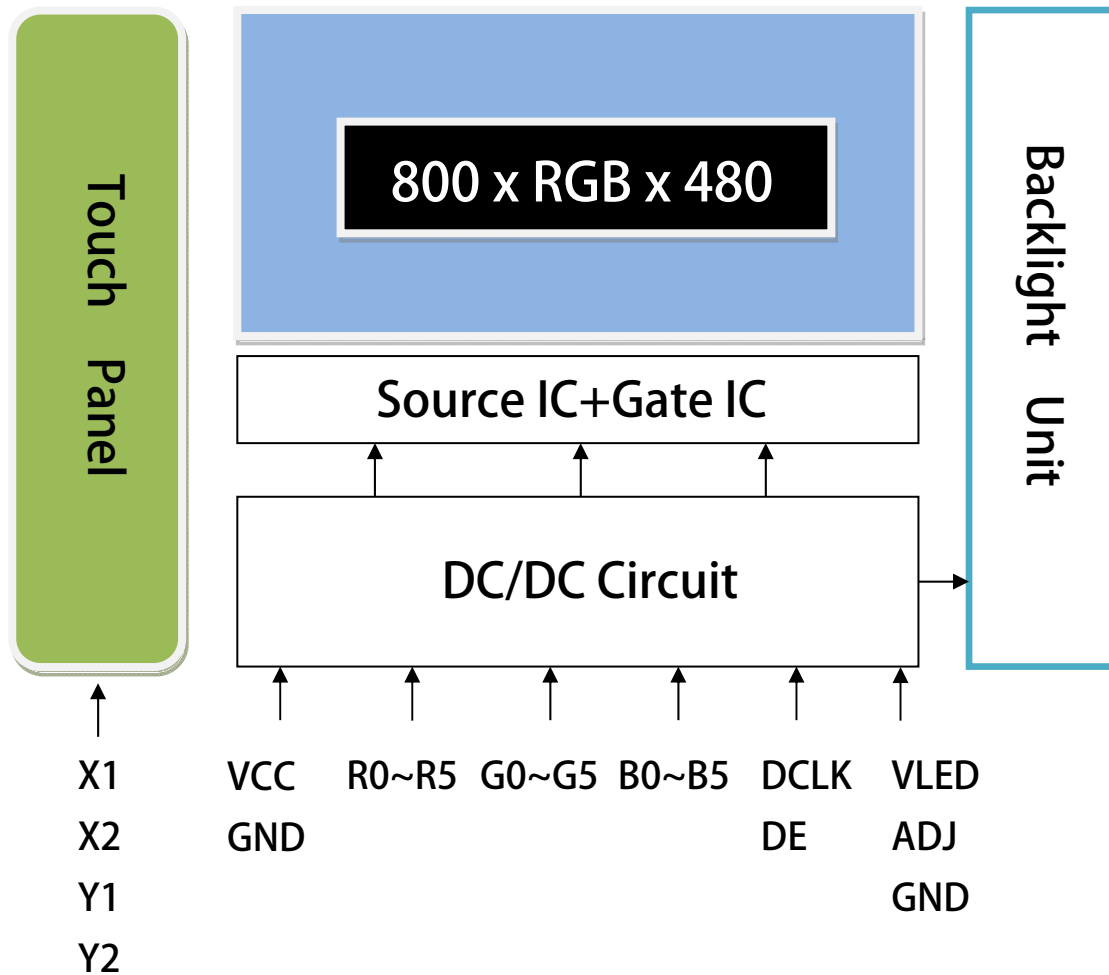
##### 4.1.2 Environment Absolute Rating

| Item                  | Symbol | Values |     |      | Unit | Note                |
|-----------------------|--------|--------|-----|------|------|---------------------|
|                       |        | Min    | Typ | Max. |      |                     |
| Operating Temperature | Topa   | -20    |     | 70   | °C   | Ambient temperature |
| Storage Temperature   | Tstg   | -30    |     | 80   | °C   |                     |



## 5. BLOCK DIAGRAM

### 5.1 TFT LCD Module



## 6. Relationship Between Displayed Color and Input

### 6.1 6 bit

|             | Color & Gray Scale | Data Signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|             |                    | R5          | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red                | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green              | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Blue               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Cyan               | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Magenta            | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Yellow             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | White              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Red         | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red(1)             | 0           | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red(2)             | 0           | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Red(31)            | 0           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Red(62)            | 1           | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Red(63)            | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Green       | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green(1)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green(2)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Green(31)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Green(62)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Green(63)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| Blue        | Black              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Blue(1)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|             | Blue(2)            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Blue(31)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Blue(62)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  |
|             | Blue(63)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |

0 : Low level voltage, 1 :High level voltage

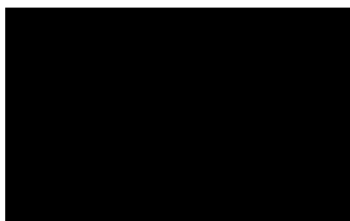
Each basic color can be displayed in 64 gray scales from 6 bit data signals. With the combination of total 18 bit data signals, the 262K-color display can be achieved on the screen.

## 7. ELECTRICAL CHARACTERISTICS

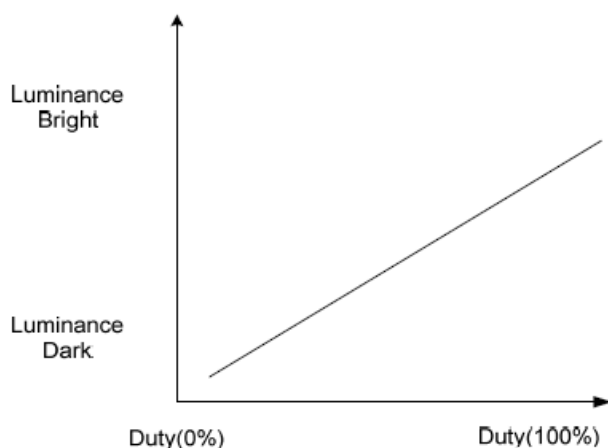
### 7.1 TFT LCD Module

| Item                    |         | Symbol | Value   |       |         | Unit | Note  |
|-------------------------|---------|--------|---------|-------|---------|------|-------|
|                         |         |        | Min.    | Typ.  | Max.    |      |       |
| Power supply voltage    |         | VCC    | 3.0     | 3.3   | 3.6     | V    |       |
|                         |         | VLED   | 4.5     | 5     | 5.5     | V    |       |
| Input Voltage for logic | H Level | VIH    | 0.7xVCC | -     | VCC     | V    |       |
|                         | L Level | VIL    | 0       | -     | 0.3xVCC | V    |       |
| PWM frequency           |         | ADJ    | 19K     | 20K   | 21K     | Hz   | Note2 |
| Digital Current         |         | ICC    | -       | (120) | (150)   | mA   | Note1 |
|                         |         | ILED   | -       | (450) | (550)   | mA   |       |
| LED Life Time (25°C)    |         | -      | (50000) | -     | -       | hr   | Note3 |

Note 1: frame =60Hz, Ta=25°C, Display pattern: Black pattern



Note 2: ADJ signal is 0~3.3V. Operation frequency is 20KHz

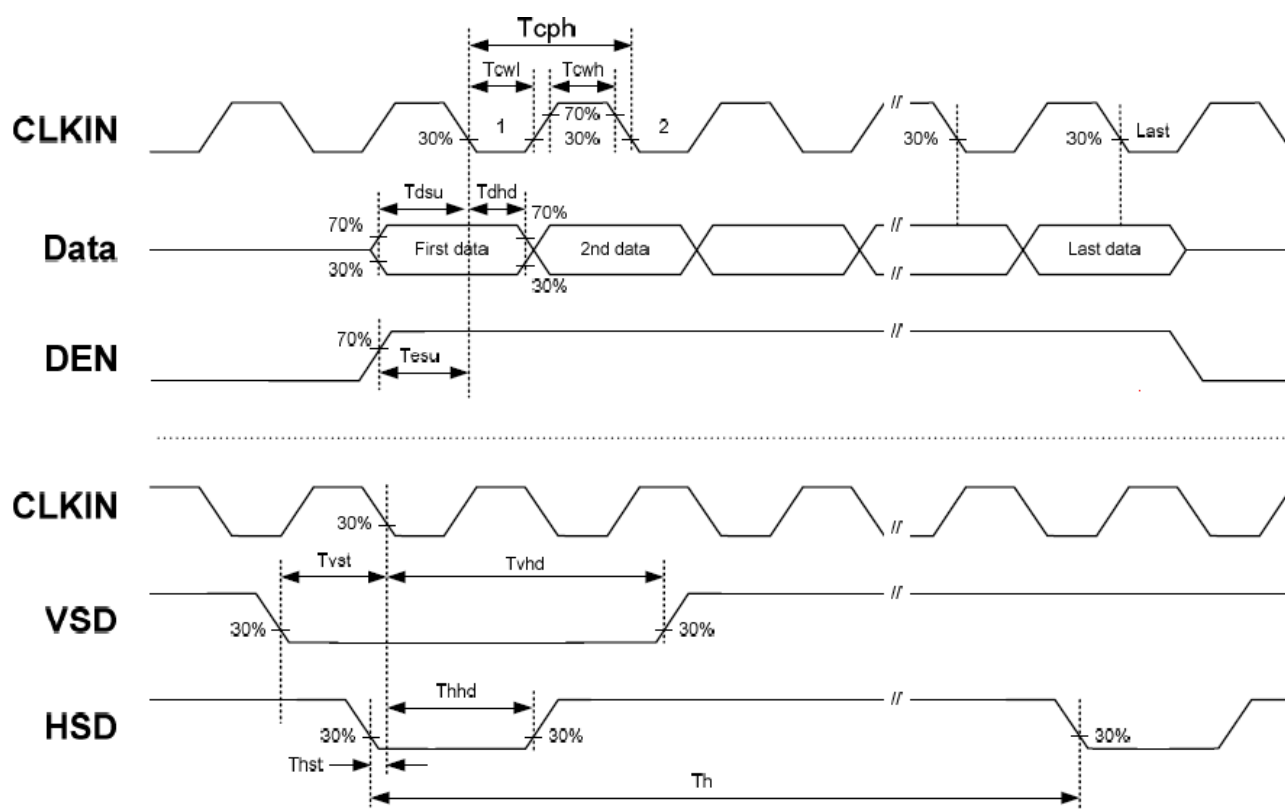


Note 3: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C 60% RH.

## 7.2 INTERFACE SPECIFICATIONS

### 7.2.1 AC Timing characteristics

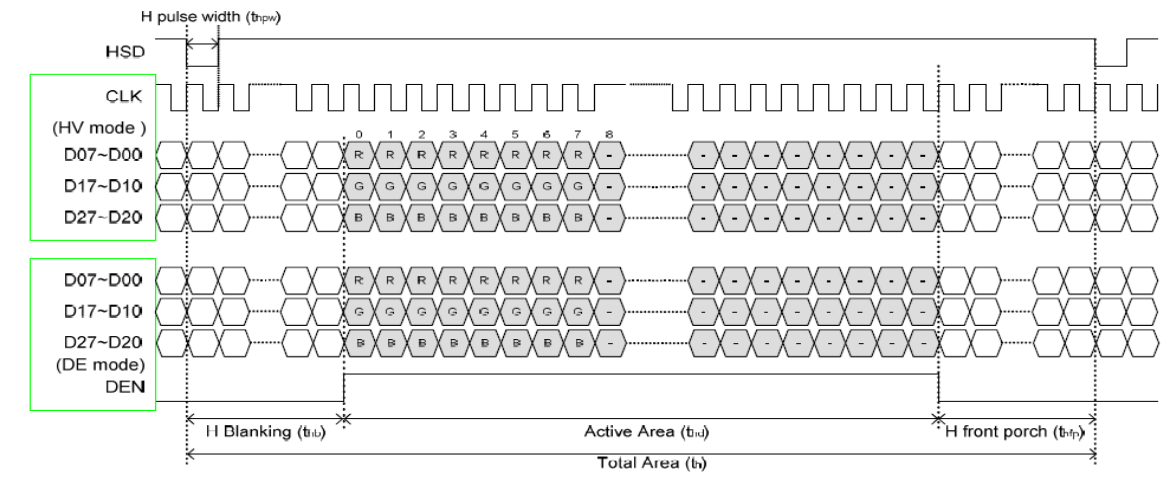
| Signal | Parameter       | Symbol | Min. | Typ. | Max. | Unit. | Remark |
|--------|-----------------|--------|------|------|------|-------|--------|
| HSYNC  | HS setup time   | Thst   | 8    | -    | -    | ns    |        |
|        | HS hold time    | Thhd   | 8    | -    | -    | ns    |        |
| VSYNC  | VS setup time   | Tvst   | 8    | -    | -    | ns    |        |
|        | VS hold time    | Tvhd   | 8    | -    | -    | ns    |        |
| Data   | Data setup time | Tdsu   | 8    | -    | -    | ns    |        |
|        | Data hold time  | Tdhd   | 8    | -    | -    | ns    |        |
| DE     | DEN setup time  | Tvpw   | 8    | -    | -    | ns    |        |
|        | DEN hold time   | Tvb    | 8    | -    | -    | ns    |        |



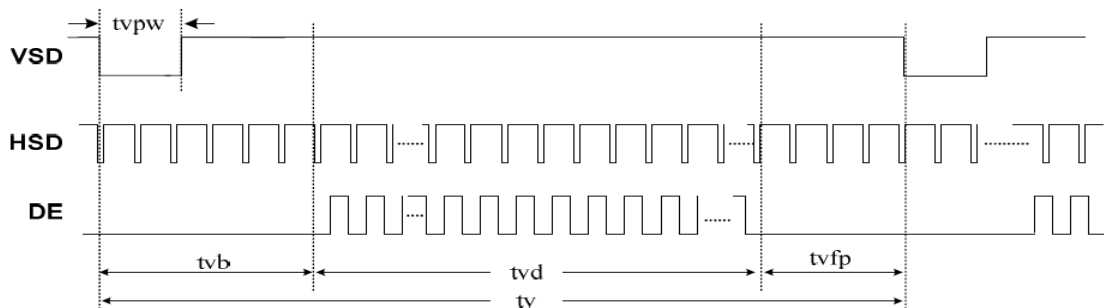
## 7.2.2 DE Mode Input Timing Table

| Signal | Parameter        | Symbol | Min. | Typ. | Max. | Unit. | Remark |
|--------|------------------|--------|------|------|------|-------|--------|
| DCLK   | CLK frequency    | Fclk   | -    | 30   | 50   | MHz   |        |
|        | CLK period       | Tcph   | 20   | -    | -    | ns    |        |
|        | CLK pulse duty   | Tcwh   | 40   | 50   | 60   | %     |        |
| HSYNC  | Horizontal Line  | Th     | 862  | 1056 | 1200 | CLK   |        |
|        | HS Display Area  | Thd    | -    | 800  | -    | CLK   |        |
|        | HS Pulse Width   | Thpw   | 1    | -    | 40   | CLK   |        |
|        | HS Back Porch    | Thb    | -    | 46   | -    | CLK   |        |
|        | HS Front Porch   | Thfp   | 16   | 210  | 354  | CLK   |        |
| DE     | DE Mode Blanking | Th-Thd | 85   | 256  | 400  | CLK   |        |
| VSYNC  | VS Display Area  | Tvd    | -    | 480  | -    | th    |        |
|        | VS Period Time   | Tv     | 513  | 525  | 650  | th    |        |
|        | VS Pulse Width   | Tvpw   | 3    | -    | 20   | th    |        |
|        | VS Back Porch    | Tvb    | -    | 23   | -    | th    |        |
|        | VS Front Porch   | Tvfp   | 1    | 12   | 77   | th    |        |
| DE     | DE Mode Blanking | Tv-Tvd | 30   | 45   | 170  | th    |        |

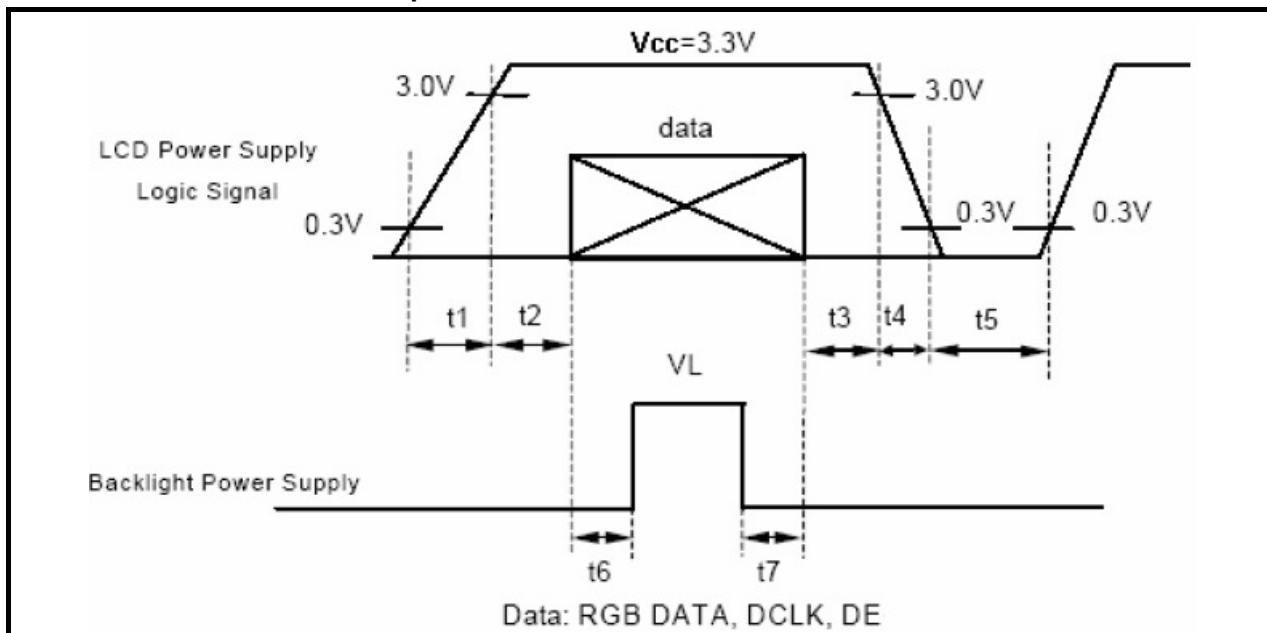
### Horizontal input timing



### Vertical input timing



### 7.3 Power On / Off Sequence



$t_1 \leq 10ms : 1 \text{ sec} \leq t_5$   
 $50ms \leq t_2 : 200ms \leq t_6$   
 $0 < t_3 \leq 50ms : 200ms \leq t_7$   
 $0 < t_4 \leq 10ms$

## 8. Touch Screen Panel Specifications

### 8.1 Main Feature

| Item                  | Min.    | Typ. | Max. | Unit       | Note                                                           |
|-----------------------|---------|------|------|------------|----------------------------------------------------------------|
| Linearity             | -1.5    | -    | 1.5  | %          | Initial data                                                   |
|                       | -3.0    | -    | +3.0 | %          | After environmental & life test, Refer Note2                   |
| Terminal resistance   | 200     | -    | 400  | $\Omega$   | Y1~Y2                                                          |
|                       | 200     | -    | 800  | $\Omega$   | X1~X2                                                          |
| Insulation resistance | 20      | -    | -    | M $\Omega$ | DC 25V                                                         |
| Voltage               | 3       | -    | 15   | V          | DC                                                             |
| Response time         | -       | -    | 10   | ms         |                                                                |
| Haze                  | -       | 3    | -    | %          | JIS K-7105                                                     |
| FPC peeling strength  | 5       | -    | -    | N          | Peeling upward by 90°                                          |
| Minimum Input force   | 60      | -    | 100  | gf         | Test Area is 3mm inside of active area, but not on Dot-Spacer. |
| Notes life            | 100000  |      |      | words      |                                                                |
| Input life            | 1000000 |      |      | times      |                                                                |

### 8.2 Pin Assignments and Definitions

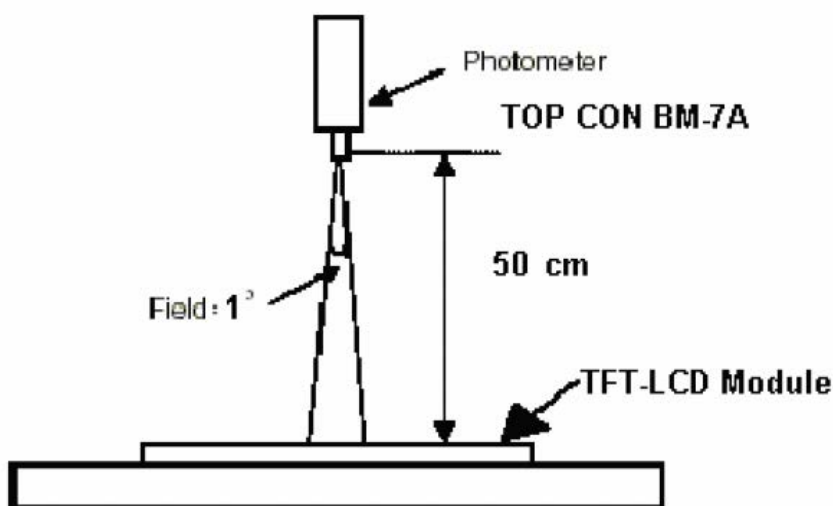
| Item | Name | I/O | Unit              |
|------|------|-----|-------------------|
| 1    | Y2   | O   | Touch Panel Up    |
| 2    | X2   | O   | Touch Panel Right |
| 3    | Y1   | O   | Touch Panel Down  |
| 4    | X1   | O   | Touch Panel Left  |

## 9. OPTICAL CHARACTERISTICS

| Item               | Symbol     | Condition                                                                  | Min.  | Typ.  | Max.  | Unit              |
|--------------------|------------|----------------------------------------------------------------------------|-------|-------|-------|-------------------|
| Brightness         | --         | Note1,<br>Note 3,<br>( $\theta = 0^\circ$ ;<br>Normal<br>Viewing<br>Angle) | 640   | 800   | --    | cd/m <sup>2</sup> |
| Uniformity         | B-uni      |                                                                            | 70    | 75    | -     | %                 |
| Contrast Ratio     | CR         |                                                                            | 400   | 500   | --    | --                |
| Response Time      | Tr         |                                                                            | --    | 10    | --    | ms                |
|                    | Tf         |                                                                            | --    | 15    | --    | ms                |
| Color Chromaticity | White      | Wx                                                                         | 0.260 | 0.310 | 0.360 | --                |
|                    |            | Wy                                                                         | 0.280 | 0.330 | 0.380 | --                |
| View angle         | Horizontal | $\theta x+$                                                                | 50    | 60    | --    |                   |
|                    |            | $\theta x-$                                                                | 50    | 60    | --    |                   |
|                    | Vertical   | $\theta Y+$                                                                | 40    | 50    | --    |                   |
|                    |            | $\theta Y-$                                                                | 50    | 60    | --    |                   |

Note : The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance  $\leq 1$  lux, and at room temperature). The operation temperature is  $25^\circ\text{C} \pm 2^\circ\text{C}$ . The measurement method is shown in Note1.

Note1: The method of optical measurement:



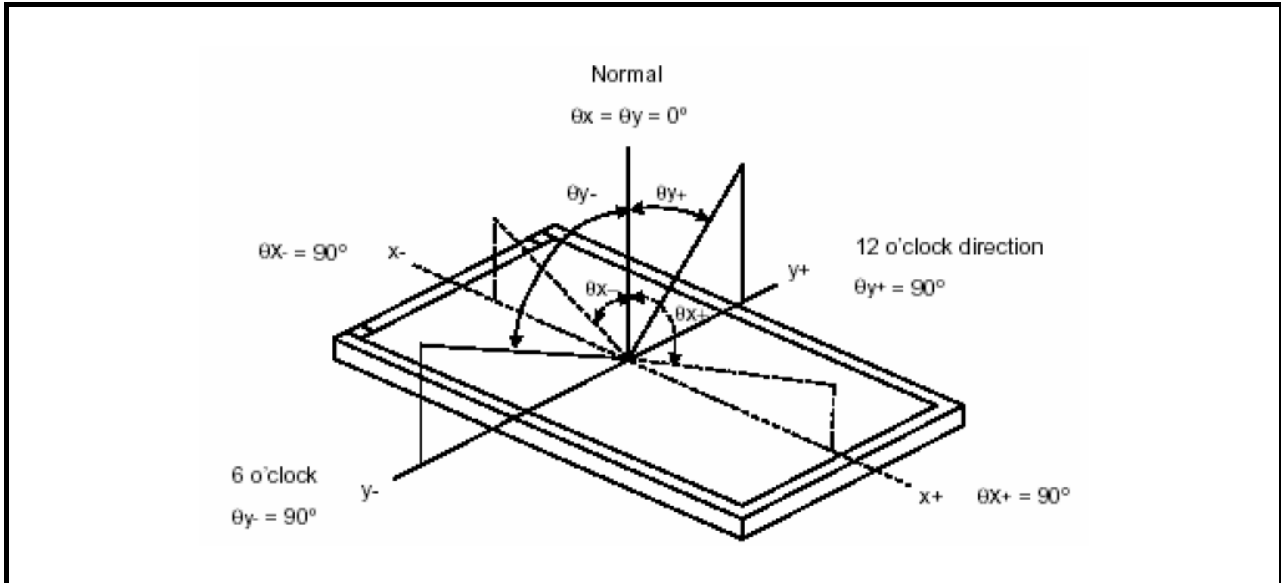
Note2: Measured at the center area of the panel and at the viewing angle of the  $\theta x = \theta y = 0^\circ$

Note3: Definition of Contrast Ratio (CR):

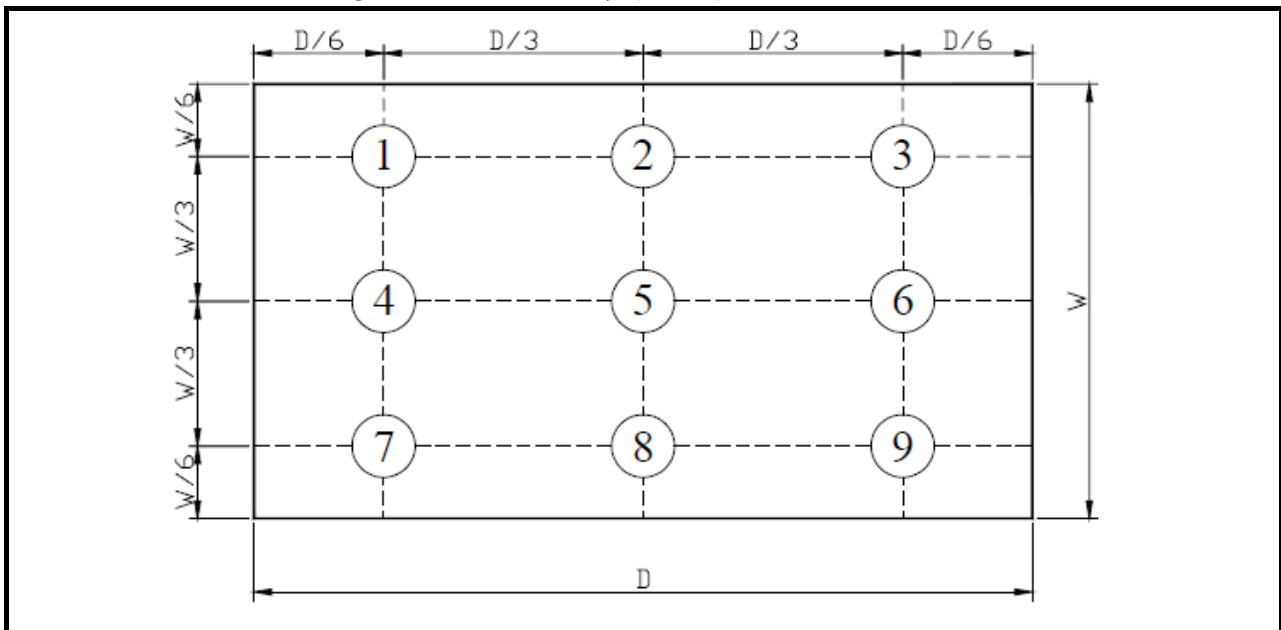
CR = Luminance with all pixels in white state  $\div$  Luminance with all pixels in Black state



Note4: Definition of Viewing Angle:



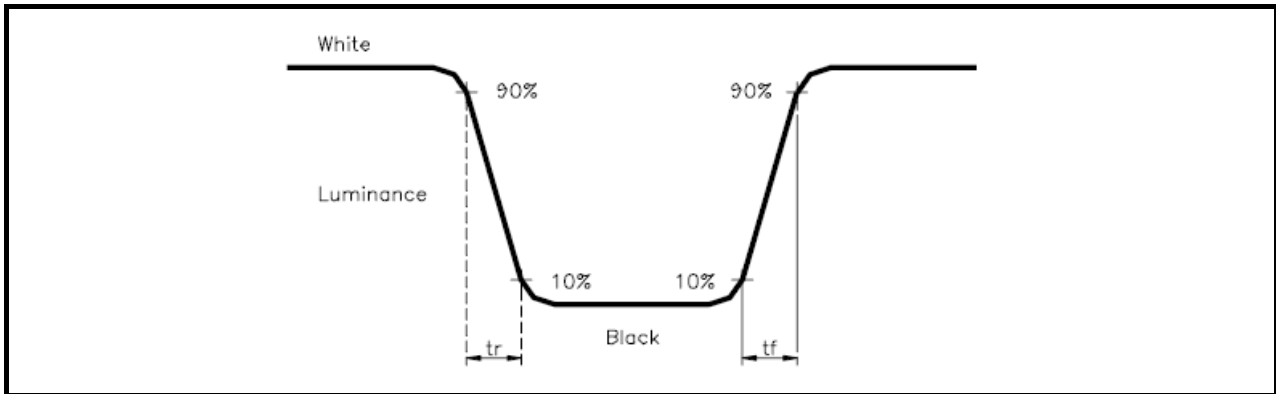
Note 5: Definition of Brightness Uniformity (B-uni):



B-uni = (Minimum luminance of 9 points ÷ Maximum luminance of 9 points) X 100%

**Note6: Definition of Response Time:**

The Response Time is set initially by defining the “Rising Time ( $T_r$ )” and the “Falling Time ( $T_f$ )” respectively.  $T_r$  and  $T_f$  are defined as following figure



**Note 7: Definition of Chromaticity:**

The color coordinates ( $W_x, W_y$ ), ( $R_x, R_y$ ), ( $G_x, G_y$ ), and ( $B_x, B_y$ ) are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

## 10. RELIABILITY

### 10.1 Test Condition

#### 10.1.1 Temperature and Humidity(Ambient Temperature)

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

Humidity :  $65 \pm 5\%$

#### 10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

#### 10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

#### 10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

### 10.2 TESTS

| No. | ITEM                                    | CONDITION CRITERION                                                                                          |
|-----|-----------------------------------------|--------------------------------------------------------------------------------------------------------------|
| 1   | High Temperature Storage                | 80°C, 120 hrs                                                                                                |
| 2   | Low Temperature Storage                 | -30°C, 120 hrs                                                                                               |
| 3   | High Temperature Operating              | 70°C, 120 hrs                                                                                                |
| 4   | Low Temperature Operating               | -20°C, 120 hrs                                                                                               |
| 5   | High Temperature/Humidity Non-Operating | 60°C, 90%RH, 120 hrs                                                                                         |
| 6   | Temperature Shock Non-Operating         | -30°C $\longleftrightarrow$ 80°C<br>(0.5hr each), 25 cycles                                                  |
| 7   | Vibration Test Non-Operating            | Frequency:0 ~ 55 Hz Amplitude:1.5 mm<br>Sweep Time:11min<br>Test Period:6 Cycles for each Direction of X,Y,Z |
| 8   | Electro-static Discharge Non-Operating  | 150pF,330Ω<br>Air:± 8KV;Contact: ±4KV<br>10 times/point;4 points/panel face                                  |

Note1: The test sample have recovery time for 24 hours at room temperature before the function check. In the standard conditions, there is no any touch panel function NG issue occurred.

### **10.3 JUDGMENT STANDARD**

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

## 10.4 INCOMING INSPECTION STANDARDS

| No.                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Parameter                           | Criteria                                                                                                                                                                                                                                                                                                                             |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|-------------------|------------------|--------------|-----|--------------------|------|------------------|---------------------|------------|--------------|---------------|---|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Operating                           | Display function: No Display malfunction (Major)                                                                                                                                                                                                                                                                                     |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Contrast ratio (Black, White):<br>Does not meet specified range in the spec. (Major) (Note:3)                                                                                                                                                                                                                                        |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)                                                                                                                                                                                                                            |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Point Defect : Active area $\leq 5$ dots (Minor) (Note:1)                                                                                                                                                                                                                                                                            |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | <table><tr><th rowspan="2">Item</th><th>Acceptable number</th><th rowspan="2">Total</th></tr><tr><th>Active Area</th></tr><tr><td>Bright</td><td>2</td><td rowspan="2">5</td></tr><tr><td>Dark</td><td>4</td></tr></table>                                                                                                           | Item              | Acceptable number | Total             | Active Area      | Bright       | 2   | 5                  | Dark | 4                |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Item                                                                                                                                                                                                                                                                                                                                 |                   | Acceptable number |                   | Total            |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     |                                                                                                                                                                                                                                                                                                                                      | Active Area       |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Bright                                                                                                                                                                                                                                                                                                                               | 2                 | 5                 |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Dark                                                                                                                                                                                                                                                                                                                                 | 4                 |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Non-uniformity: Visible through 5%ND filter. (Minor)                                                                                                                                                                                                                                                                                 |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| Foreign material in Black or White spots shape ( $W>1/4L$ )                                                                                                                                                                                                                                                                                                                                                                                                    |                                     |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| <table><tr><th>Zone<br/>Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr><tr><td><math>D&gt;0.5</math></td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr><tr><td><math>0.3 &lt; D \leq 0.5</math></td><td>5</td></tr><tr><td><math>D \leq 0.3</math></td><td>*</td></tr></table>                                                                                                                     | Zone<br>Dimension                   | Acceptable number                                                                                                                                                                                                                                                                                                                    | Class Of Defects  | AQL Level         | $D>0.5$           | 0                | Minor        | 1.5 | $0.3 < D \leq 0.5$ | 5    | $D \leq 0.3$     | *                   |            |              |               |   |
| Zone<br>Dimension                                                                                                                                                                                                                                                                                                                                                                                                                                              | Acceptable number                   | Class Of Defects                                                                                                                                                                                                                                                                                                                     | AQL Level         |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $D>0.5$                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0                                   | Minor                                                                                                                                                                                                                                                                                                                                | 1.5               |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $0.3 < D \leq 0.5$                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5                                   |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $D \leq 0.3$                                                                                                                                                                                                                                                                                                                                                                                                                                                   | *                                   |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $D = (\text{Long} + \text{Short}) / 2$ * : Disregard                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| Foreign Material in Line or spiral shape ( $W \leq 1/4L$ ) (Note: 4)                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| <table><tr><th>L (mm)</th><th>Zone<br/>W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr><tr><td><math>L &gt; 5</math></td><td><math>W &gt; 0.1</math></td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr><tr><td><math>0.5 &lt; L \leq 5</math></td><td><math>0.03 &lt; W \leq 0.1</math></td><td>5</td></tr><tr><td><math>L \leq 0.5</math></td><td><math>W \leq 0.03</math></td><td>*</td></tr></table> | L (mm)                              | Zone<br>W(mm)                                                                                                                                                                                                                                                                                                                        | Acceptable number | Class Of Defects  | AQL Level         | $L > 5$          | $W > 0.1$    | 0   | Minor              | 1.5  | $0.5 < L \leq 5$ | $0.03 < W \leq 0.1$ | 5          | $L \leq 0.5$ | $W \leq 0.03$ | * |
| L (mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Zone<br>W(mm)                       | Acceptable number                                                                                                                                                                                                                                                                                                                    | Class Of Defects  | AQL Level         |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $L > 5$                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $W > 0.1$                           | 0                                                                                                                                                                                                                                                                                                                                    | Minor             | 1.5               |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $0.5 < L \leq 5$                                                                                                                                                                                                                                                                                                                                                                                                                                               | $0.03 < W \leq 0.1$                 | 5                                                                                                                                                                                                                                                                                                                                    |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $L \leq 0.5$                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $W \leq 0.03$                       | *                                                                                                                                                                                                                                                                                                                                    |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $L$ : Length $W$ : Width    * : Disregard                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                              | External Inspection (non-operating) | Dimension: Outline (Major)                                                                                                                                                                                                                                                                                                           |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Bezel appearance: uneven (Minor)                                                                                                                                                                                                                                                                                                     |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Scratch on the polarize: (Note:2)                                                                                                                                                                                                                                                                                                    |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | <table><tr><th>L (mm)</th><th>Zone<br/>W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr><tr><td>--</td><td><math>W &gt; 0.1</math></td><td>0</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr><tr><td><math>L \leq 3</math></td><td><math>W \leq 0.1</math></td><td>3</td></tr></table> | L (mm)            | Zone<br>W(mm)     | Acceptable number | Class Of Defects | AQL Level    | --  | $W > 0.1$          | 0    | Minor            | 1.5                 | $L \leq 3$ | $W \leq 0.1$ | 3             |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | L (mm)                                                                                                                                                                                                                                                                                                                               | Zone<br>W(mm)     | Acceptable number | Class Of Defects  | AQL Level        |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | --                                                                                                                                                                                                                                                                                                                                   | $W > 0.1$         | 0                 | Minor             | 1.5              |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | $L \leq 3$                                                                                                                                                                                                                                                                                                                           | $W \leq 0.1$      | 3                 |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | $L$ : Length $W$ : Width    * : Disregard                                                                                                                                                                                                                                                                                            |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | Dent or bubble on the polarize (Note:2)                                                                                                                                                                                                                                                                                              |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     | <table><tr><th>Zone<br/>Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr><tr><td><math>D \leq 0.3</math></td><td>*</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr><tr><td><math>D \leq 0.5</math></td><td>3</td></tr></table>                                                     | Zone<br>Dimension | Acceptable number | Class Of Defects  | AQL Level        | $D \leq 0.3$ | *   | Minor              | 1.5  | $D \leq 0.5$     | 3                   |            |              |               |   |
| Zone<br>Dimension                                                                                                                                                                                                                                                                                                                                                                                                                                              | Acceptable number                   | Class Of Defects                                                                                                                                                                                                                                                                                                                     | AQL Level         |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $D \leq 0.3$                                                                                                                                                                                                                                                                                                                                                                                                                                                   | *                                   | Minor                                                                                                                                                                                                                                                                                                                                | 1.5               |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $D \leq 0.5$                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                   |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |
| $D = (\text{Long} + \text{Short}) / 2$ * : Disregard                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                                                                                                                                                                                                                      |                   |                   |                   |                  |              |     |                    |      |                  |                     |            |              |               |   |

| Class of defects | Major | AQL 0.65% | Definition                                                                            |
|------------------|-------|-----------|---------------------------------------------------------------------------------------|
|                  | Minor | AQL 1.5%  | It is a defect that will not result in functioning problem with deviation classified. |

Note1:

(a) Bright point defect is defined as point defect of R,G,B with area  $>1/2$  pixel respectively

(b) Dark point defect is defined as visible in full white pattern.

(c) Definition of distribution of point defect is as follows:

- minimum separation between dark point defects should be larger than 5mm.
- minimum separation between bright point defects should be larger than 5mm.

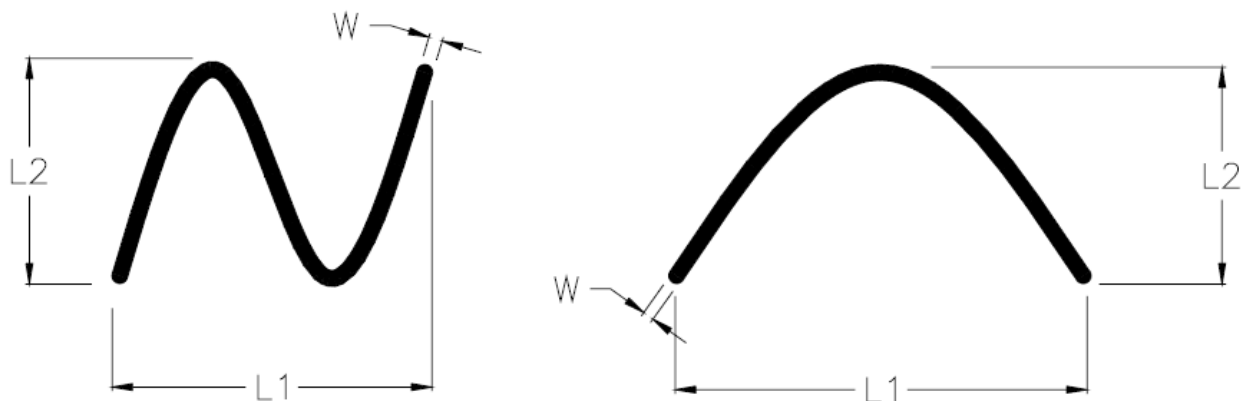
(d) Definition of joined bright point defect and joined dark point defect are as follows:

- Two or more joined bright point defects must be nil.
- Three joined dark point defects must be nil.
- Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 1 pair maximum.
- Two Joined dark point is counted as two dark points with 2 pair maximum.

Note2: The external inspection should be conducted at the distance  $30 \pm 5$  cm between the eyes of inspector and the panel.

Note3: Luminance measurement for contrast ratio is at the distance  $50 \pm 5$  cm between the detective head and the panel with ambient luminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note4: W-Width in mm , L-length of Max.(L1,L2) in mm.



### 10.5 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

Sampling table: MIL-STD-105E

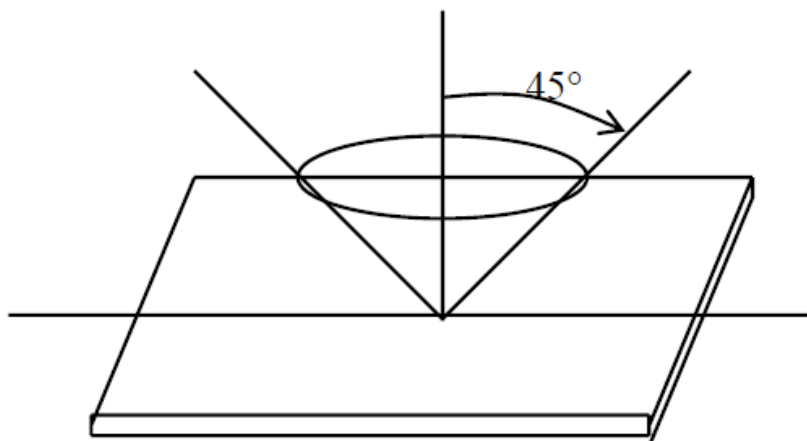
Inspection level: Level II

### 10.6 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.

$\theta \leq 45^\circ$  inspection under non-operating condition.

$\theta \leq 5^\circ$  inspection under operating condition



## **11. PRECAUTION RELATING PRODUCT HANDLING**

### **11.1 SAFETY**

- 11.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.**
- 11.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.**

### **11.2 HANDLING**

- 11.2.1 Avoid any strong mechanical shock which can break the glass.**
- 11.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module, be sure to ground your body and any electrical equipment you may be using.**
- 11.2.3 Do not remove the panel or frame from the module.**
- 11.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, Do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)**
- 11.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.**
- 11.2.6 Do not touch the display area with bare hands , this will stain the display area.**
- 11.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.**
- 11.2.8 To control temperature and time of soldering is  $280 \pm 10^{\circ}\text{C}$  and 3-5 sec.**
- 11.2.9 To avoid liquid (include organic solvent) stained on LCM.**

### **11.3 STORAGE**

- 11.3.1 Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the humidity is below 65% RH.**
- 11.3.2 Do not place the module near organics solvents or corrosive gases.**
- 11.3.3 Do not crush, shake, or jolt the module.**