



Model No: 13-043YISB4GA0-S

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

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## RECORD OF REVISION

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## 1. GENERAL DESCRIPTION

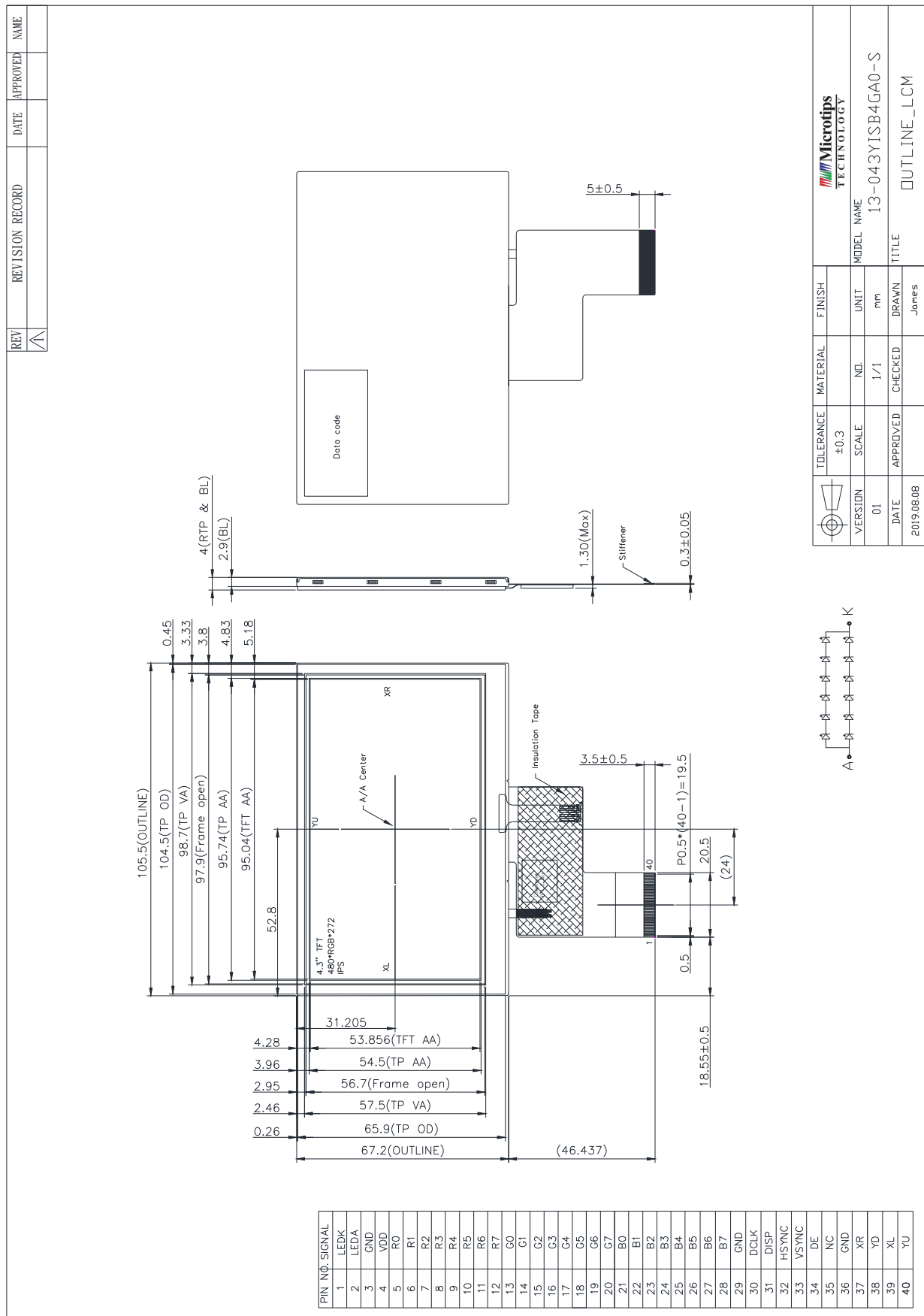
### 1.1 Description

The specification is model 13-043YISB4GA0-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 4-wire touch panel. This TFT LCD has a 4.3 (16:9) inch diagonally measured active display area with WQVGA (480 horizontal by 272 vertical pixels) resolution.

### 1.2 Features:

| No. | Item                           | Specification                       | Unit   |
|-----|--------------------------------|-------------------------------------|--------|
| 1   | Panel Size                     | 4.3"                                | Inch   |
| 2   | Number of Pixels               | 480 (W) x RGB x 272 (H)             | Pixels |
| 3   | Active Area                    | 95.04 (W) x 53.856 (H)              | mm     |
| 4   | Pixel Pitch                    | 0.198 (W) x 0.198(H)                | mm     |
| 5   | Outline Dimension              | 105.5 (W) x 67.2 (H) x 4 (T)        | mm     |
| 6   | Number of Colors               | 16.7M                               | - -    |
| 7   | Display Mode                   | IPS / Normally Black / Transmissive | - -    |
| 8   | View Direction                 | Free direction                      |        |
| 9   | Display Format                 | RGB vertical stripe                 | - -    |
| 10  | Surface Treatment              | Anti-Glare (3H)                     | - -    |
| 11  | Contrast Ratio                 | 800 (Typ.)                          | - -    |
| 12  | Luminance (cd/m <sup>2</sup> ) | 400 (Typ.)                          | cd/m2  |
| 13  | Interface                      | RGB 24bit Interface                 | - -    |
| 14  | Backlight                      | White LED                           | - -    |
| 15  | Driver IC                      | SC7283                              | - -    |
| 16  | Operation Temperature          | -20 ~ 70                            | °C     |
| 17  | Storage Temperature            | -30 ~ 80                            | °C     |
| 18  | Weight                         | TBD                                 | g      |

## 2. MECHANICAL SPECIFICATION



### 3. PIN DESCRIPTION

| Pin No. | Symbol | I/O | Function                        | Note |
|---------|--------|-----|---------------------------------|------|
| 1       | VLED-  | P   | Power for LED backlight cathode |      |
| 2       | VLED+  | P   | Power for LED backlight anode   |      |
| 3       | GND    | P   | Power Ground                    |      |
| 4       | VDD    | P   | Power Supply                    |      |
| 5       | R0     | I   | Red data signal (LSB)           |      |
| 6       | R1     | I   | Red data signal                 |      |
| 7       | R2     | I   | Red data signal                 |      |
| 8       | R3     | I   | Red data signal                 |      |
| 9       | R4     | I   | Red data signal                 |      |
| 10      | R5     | I   | Red data signal                 |      |
| 11      | R6     | I   | Red data signal                 |      |
| 12      | R7     | I   | Red data signal (MSB)           |      |
| 13      | G0     | I   | Green data signal (LSB)         |      |
| 14      | G1     | I   | Green data signal               |      |
| 15      | G2     | I   | Green data signal               |      |
| 16      | G3     | I   | Green data signal               |      |
| 17      | G4     | I   | Green data signal               |      |
| 18      | G5     | I   | Green data signal               |      |
| 19      | G6     | I   | Green data signal               |      |
| 20      | G7     | I   | Green data signal (MSB)         |      |
| 21      | B0     | I   | Blue data signal (LSB)          |      |
| 22      | B1     | I   | Blue data signal                |      |
| 23      | B2     | I   | Blue data signal                |      |
| 24      | B3     | I   | Blue data signal                |      |
| 25      | B4     | I   | Blue data signal                |      |
| 26      | B5     | I   | Blue data signal                |      |
| 27      | B6     | I   | Blue data signal                |      |
| 28      | B7     | I   | Blue data signal (MSB)          |      |
| 29      | DGND   | P   | Digital ground                  |      |
| 30      | DCLK   | I   | Pixel clock                     |      |
| 31      | DISP   | I   | Display on/ off                 |      |
| 32      | HSYNC  | I   | Horizontal sync signal          |      |
| 33      | VSYNC  | I   | Vertical sync signal            |      |
| 34      | DE     | I   | Data Enable signal              |      |

|    |     |   |                   |  |
|----|-----|---|-------------------|--|
| 35 | NC  | - | No Connect        |  |
| 36 | GND | P | Power Ground      |  |
| 37 | XR  | O | Touch panel Right |  |
| 38 | YD  | O | Touch panel Down  |  |
| 39 | XL  | O | Touch panel Left  |  |
| 40 | YU  | O | Touch panel Up    |  |

#### 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 | VDD    | -0.3   | 4.0  | V    |      |

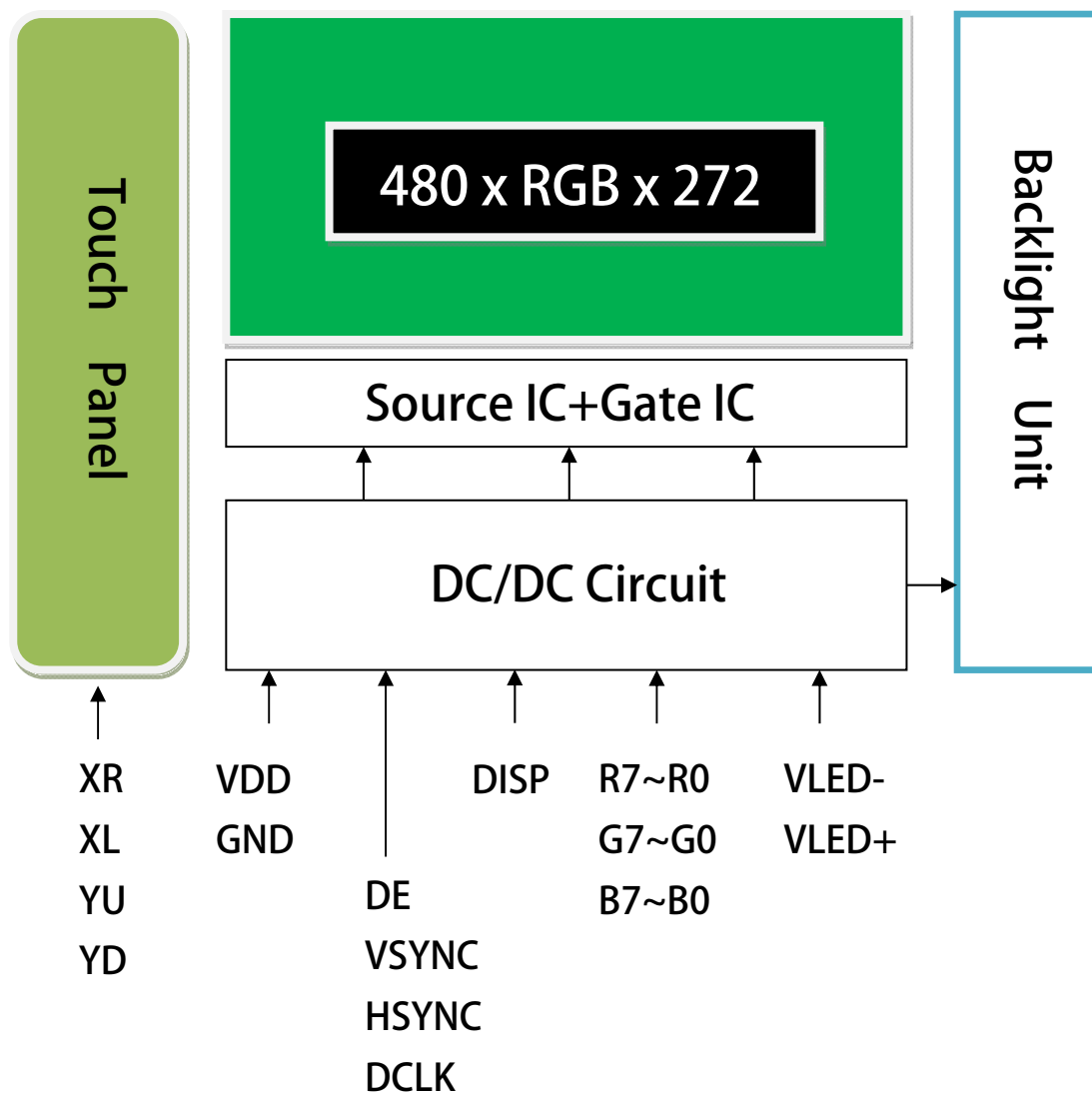
##### 4.1.2 Environment Absolute Rating

| 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 8 bit

|             |                                                                                     | Color & Gray Scale | Data Signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------|-------------------------------------------------------------------------------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|             |                                                                                     |                    | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | Red                | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | Green              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | Blue               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             |    | Cyan               | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             |    | Magenta            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             |    | Yellow             | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 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  | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | Red(1)             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | Red(2)             | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             |    | Red(127)           | 0           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |    | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             |  | Red(254)           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |  | Red(255)           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 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  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |  | Green(1)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |  | Green(2)           | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |  | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             |  | Green(127)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |  | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             |  | Green(254)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             |  | Green(255)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 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  | 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  | 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  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|             |  | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             |  | Blue(127)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             |  | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             |  | Blue(254)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|             |  | Blue(255)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16,777,216-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    | VDD     | 3.0   | 3.3     | 3.6  | V       |       |
| Input Voltage for logic | H Level | VIH   | 0.7xVDD | -    | VDD     | V     |
|                         | L Level | VIL   | 0       | -    | 0.3xVDD | V     |
| Digital Current         | IDD     | -     | 23      | 30   | mA      | Note1 |

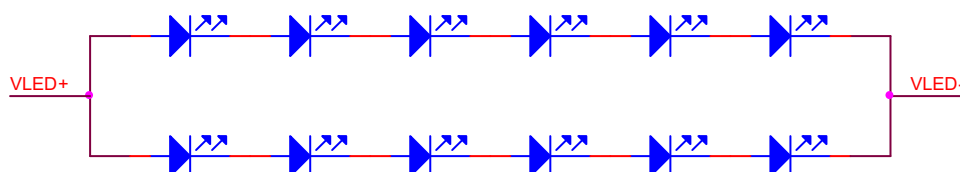
Note 1: frame =60Hz, Ta=25°C, Display pattern: white pattern



### 7.2 Backlight Unit

| Item                 | Symbol | Value   |        |        | Unit | Condition |
|----------------------|--------|---------|--------|--------|------|-----------|
|                      |        | Min.    | Typ.   | Max.   |      |           |
| LED Voltage          | VL     | (18)    | (19.2) | (20.4) | V    |           |
| LED Current          | If     | -       | 40     | -      | mA   | 6S2P      |
| Power Consumption    | PBL    | -       | 768    | -      | mW   |           |
| LED Life Time (25°C) | -      | (50000) | -      | -      | hr   | (1)       |

Note (1): The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C 60% RH.



## 7.3 INTERFACE SPECIFICATIONS

### 7.3.1 Input Timing Table

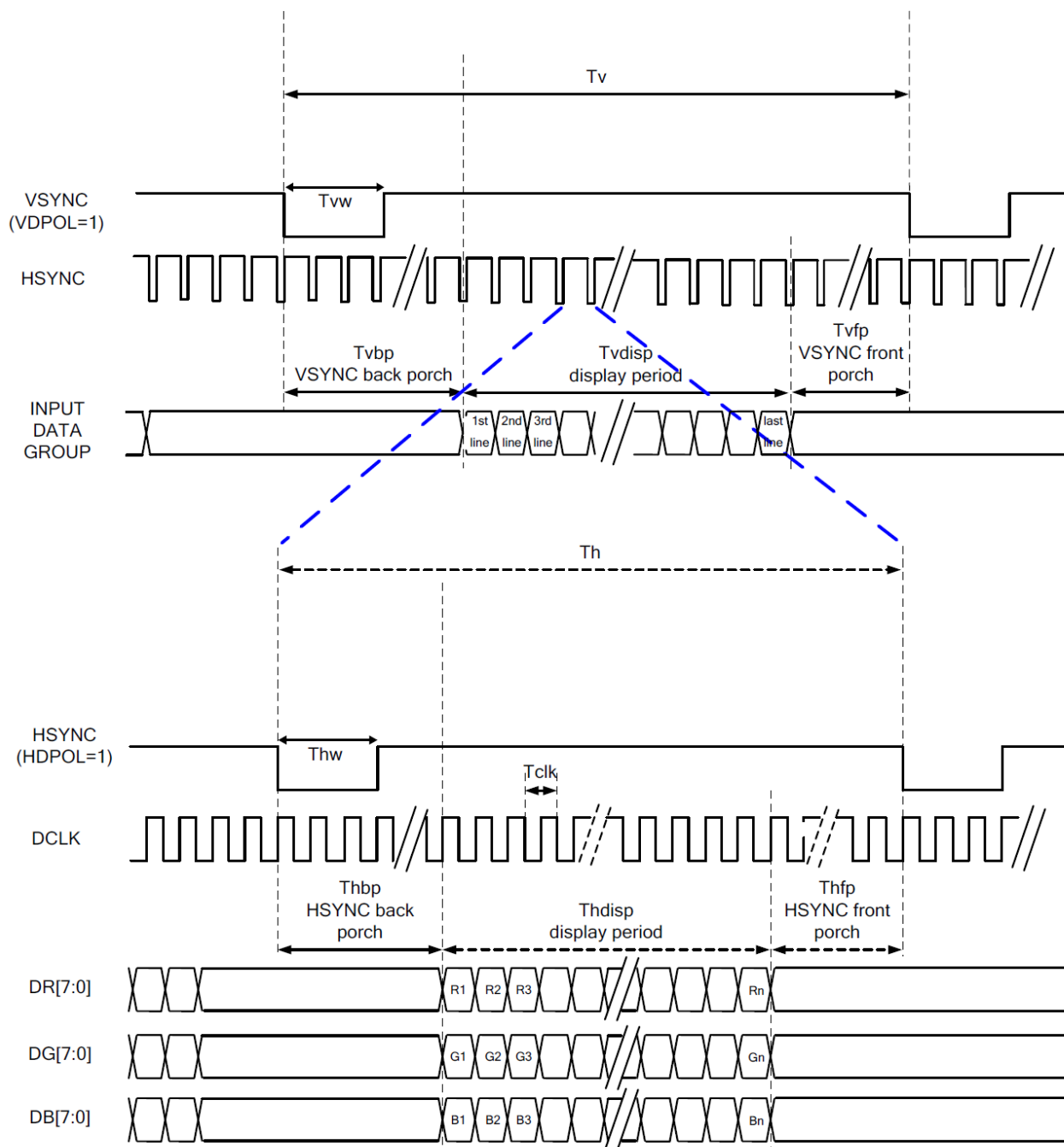
| Item                    | Symbol | Min. | Typ. | Max. | Unit  |
|-------------------------|--------|------|------|------|-------|
| DOTCLK Frequency        | Fclk   | 8    | 9    | 12   | MHz   |
| DOTCLK Period           | Tclk   | 83   | 111  | 125  | ns    |
| Horizontal Back Porch   | Thbp   | 3    | 43   | 43   | DCLK  |
| Horizontal Front Porch  | Thfp   | 2    | 8    | 75   | DCLK  |
| Horizontal Pulse width  | Thw    | 2    | 4    | 43   | DCLK  |
| Horizontal Display Area | Thdisp | -    | 480  | -    | DCLK  |
| Horizontal Period       | Th     | 485  | 531  | 598  | DCLK  |
| Vertical Back Porch     | Tvbp   | 2    | 12   | 12   | HSYNC |
| Vertical Front Porch    | Tvfp   | 2    | 8    | 37   | HSYNC |
| Vertical Pulse width    | Tvw    | 2    | 4    | 12   | HSYNC |
| Vertical Display        | Tvdisp | -    | 272  | -    | HSYNC |
| Vertical Cycle          | Tv     | 276  | 292  | 321  | HSYNC |

Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

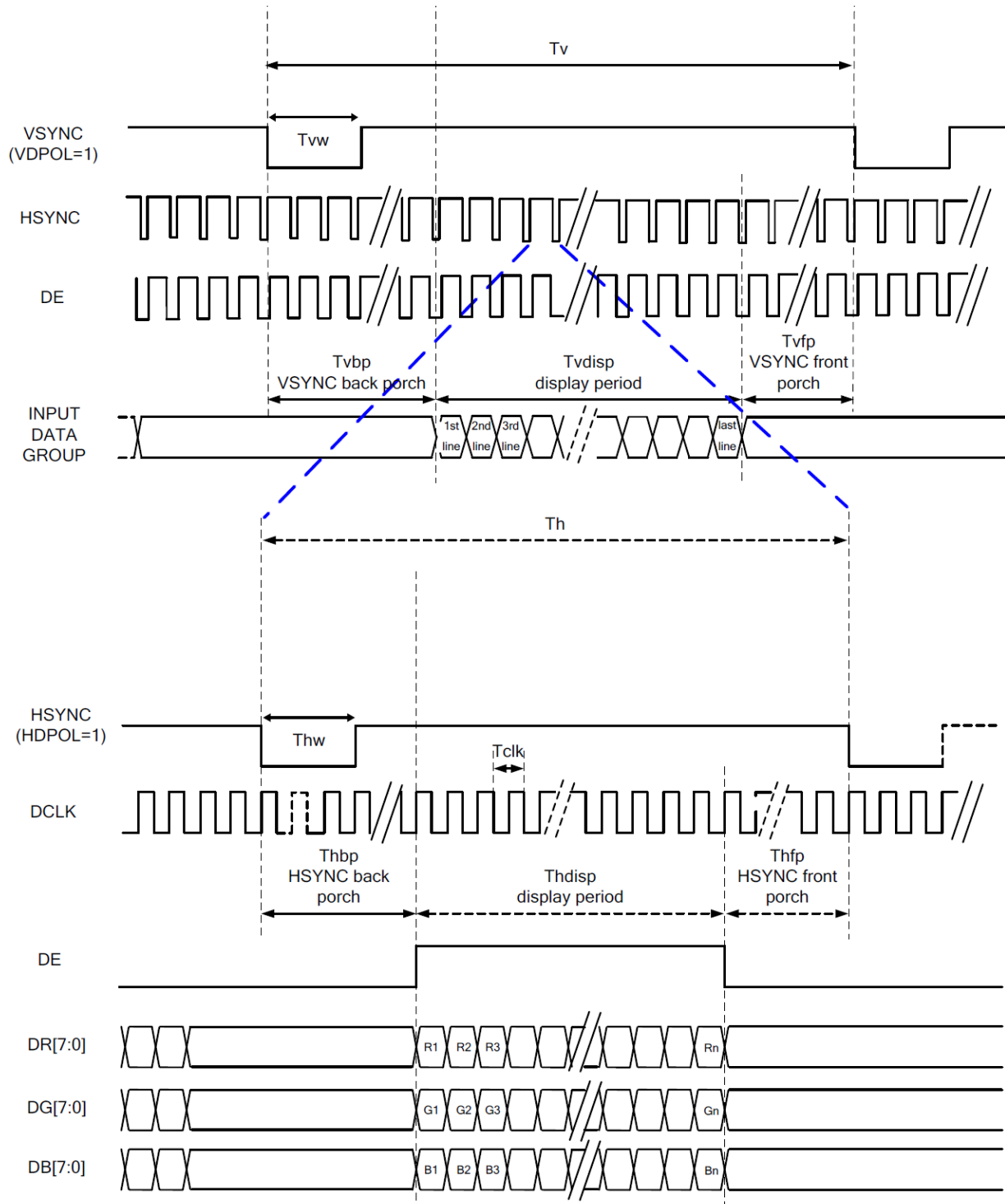
| RGB Mode Selection Table | DCLK  | HSYNC | VSYNC | DE    |
|--------------------------|-------|-------|-------|-------|
| SYNC - DE Mode           | Input | Input | Input | Input |
| SYNC Mode                | Input | Input | Input | GND   |
| DE Mode                  | Input | GND   | GND   | Input |

Note: "Input" means these signals are driven by host side.

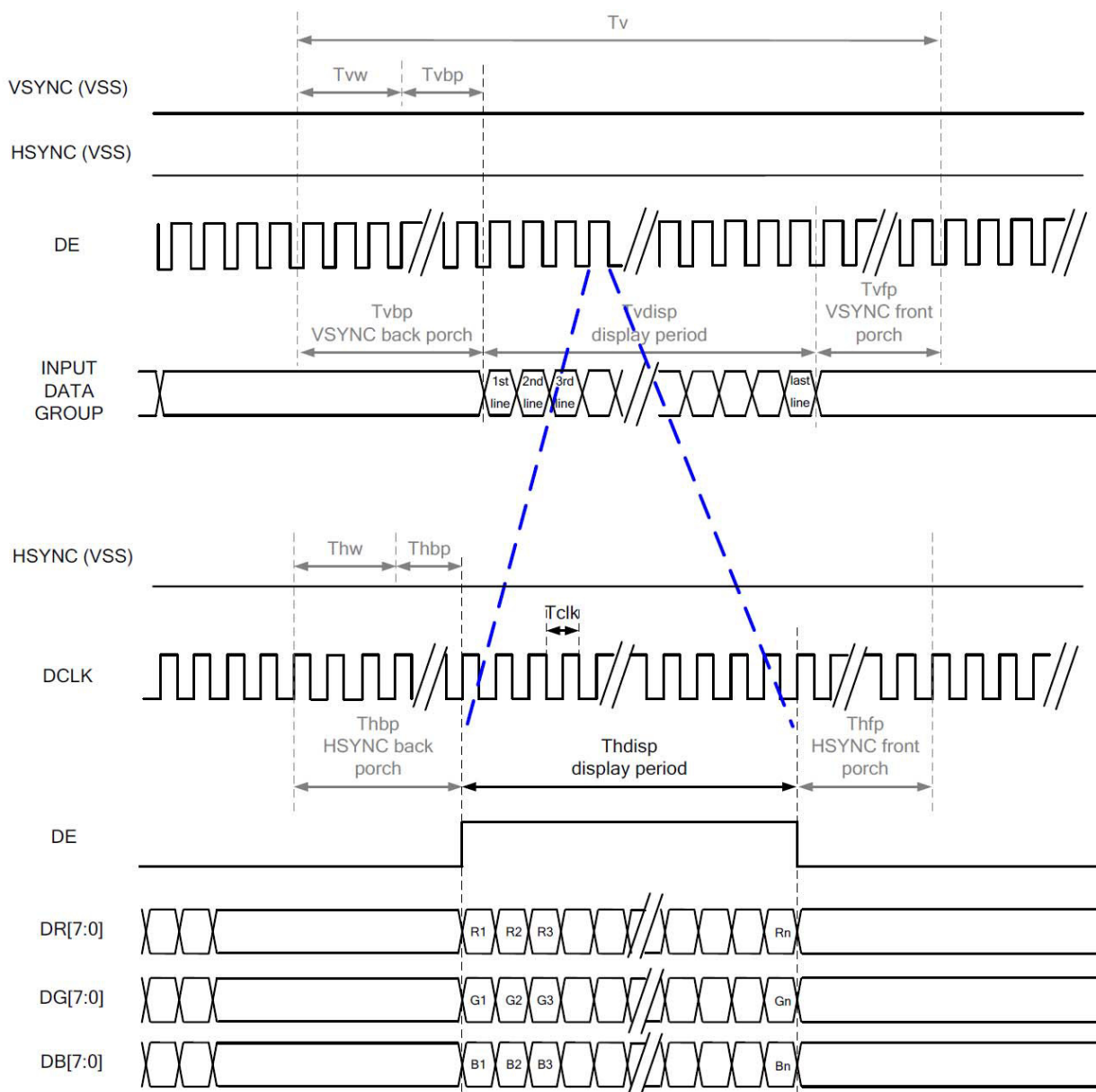
### 7.3.2 SYNC Mode



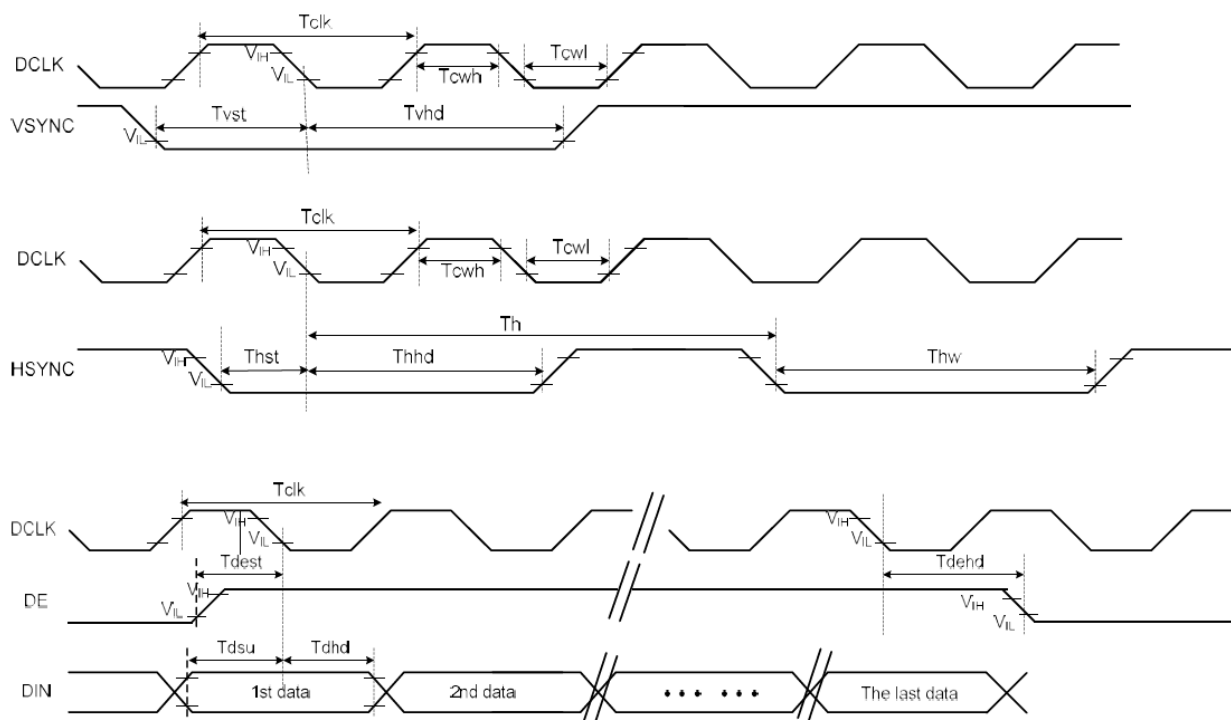
### 7.3.3 SYNC-DE Mode



### 7.3.4 DE Mode



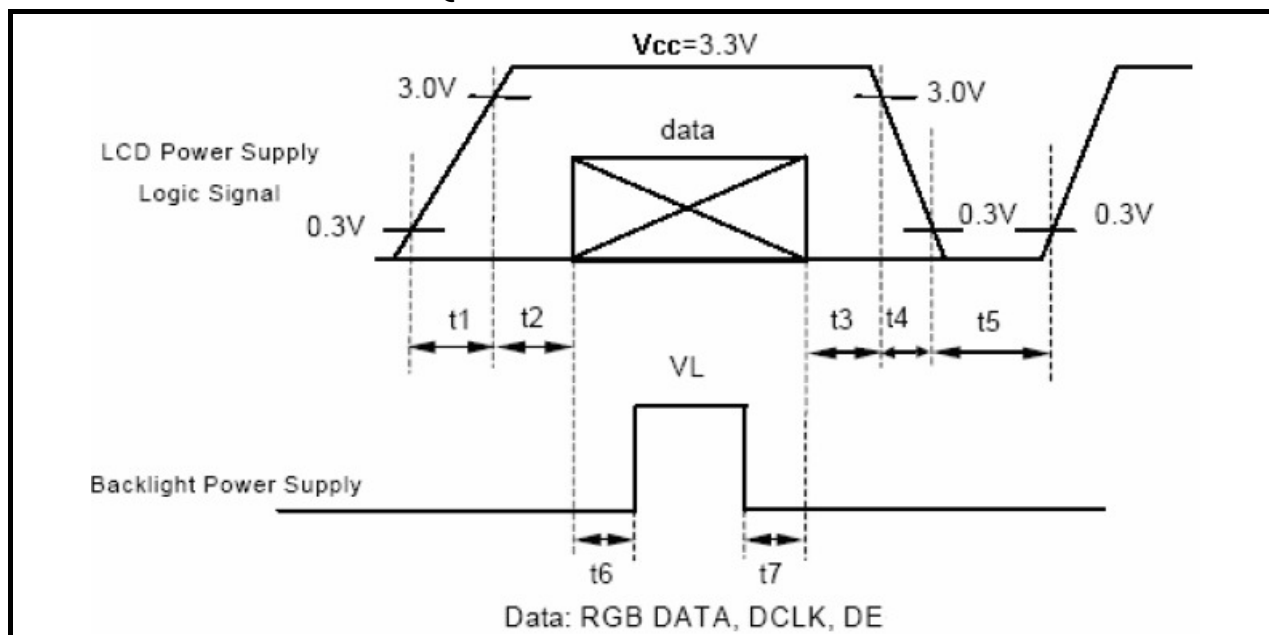
## 7.4 SYSTEM BUS TIMING FOR RGB INTERFACE



| Item             | Symbol     | Min. | Typ. | Max. | Unit | Conditions |
|------------------|------------|------|------|------|------|------------|
| CLK Pulse Duty   | $T_{cwl}$  | 40   | 50   | 60   | %    |            |
| HSYNC Width      | $T_{hw}$   | 2    | -    | -    | DCLK |            |
| HSYNC Period     | $T_h$      | 55   | 60   | 65   | us   |            |
| VSYNC Setup Time | $T_{vst}$  | 12   | -    | -    | ns   |            |
| VSYNC Hold Time  | $T_{vhd}$  | 12   | -    | -    | ns   |            |
| HSYNC Setup Time | $T_{hst}$  | 12   | -    | -    | ns   |            |
| HSYNC Hold Time  | $T_{hhd}$  | 12   | -    | -    | ns   |            |
| Data Setup Time  | $T_{dsu}$  | 12   | -    | -    | ns   |            |
| Data Hold Time   | $T_{dhhd}$ | 12   | -    | -    | ns   |            |
| DE Setup Time    | $T_{dest}$ | 12   | -    | -    | ns   |            |
| DE Hold Time     | $T_{dehd}$ | 12   | -    | -    | ns   |            |



## 7.5 POWER ON / OFF SEQUENCE



$$\begin{aligned}
 t_1 &\leq 10\text{ms} : 1 \text{ sec} \leq t_5 \\
 20\text{ms} &\leq t_2 : 250\text{ms} \leq t_6 \\
 80\text{ms} &< t_3 : 200\text{ms} \leq t_7 \\
 0 &< t_4 \leq 10\text{ms}
 \end{aligned}$$

## 8. TOUCH SCREEN PANEL SPECIFICATION

### 8.1 Main Feature

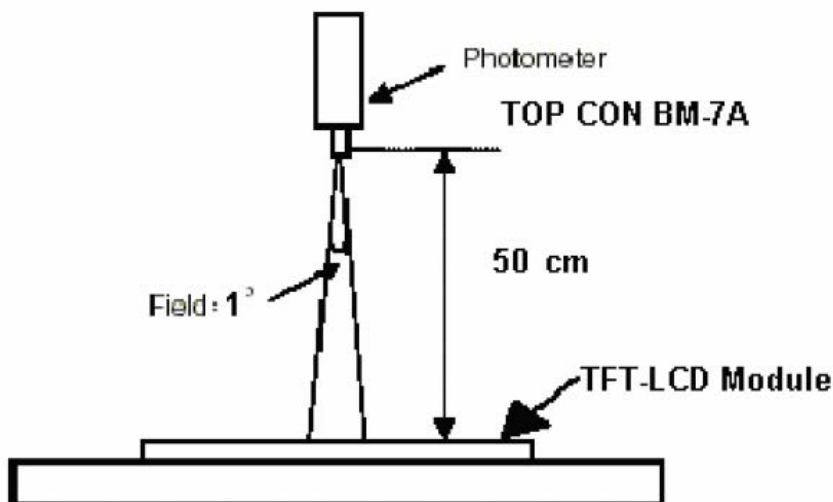
| Item                  | Min.    | Typ. | Max. | Unit       | Note         |
|-----------------------|---------|------|------|------------|--------------|
| Linearity             | -1.5    | -    | 1.5  | %          | Initial data |
| Terminal resistance   | 500     | -    | 1300 | $\Omega$   | X            |
|                       | 100     | -    | 540  | $\Omega$   | Y            |
| Insulation resistance | 10      | -    | -    | M $\Omega$ | DC 25V       |
| Voltage               | 3       | -    | 15   | V          | 1mA          |
| Response time         | -       | -    | 10   | ms         |              |
| Minimum Input force   | 60      | -    | 100  | gf         |              |
| Notes life            | 100000  |      |      | words      |              |
| Input life            | 1000000 |      |      | times      |              |

## 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) | 320   | 400   | --    | cd/m <sup>2</sup> |
| Uniformity         |            | B-uni       |                                                                            | 70    | 75    | -     | %                 |
| Contrast Ratio     |            | CR          |                                                                            | 600   | 800   | --    | --                |
| Response Time      |            | Tr+Tf       |                                                                            | --    | 30    | 40    | ms                |
| Color Chromaticity | White      | Wx          |                                                                            | 0.260 | 0.310 | 0.360 | --                |
|                    |            | Wy          |                                                                            | 0.280 | 0.330 | 0.380 | --                |
| View angle         | Horizontal | $\theta x+$ | Center<br>CR $\geq$ 10                                                     | 70    | 80    | --    |                   |
|                    |            | $\theta x-$ |                                                                            | 70    | 80    | --    |                   |
|                    | Vertical   | $\theta Y+$ |                                                                            | 70    | 80    | --    |                   |
|                    |            | $\theta Y-$ |                                                                            | 70    | 80    | --    |                   |

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:

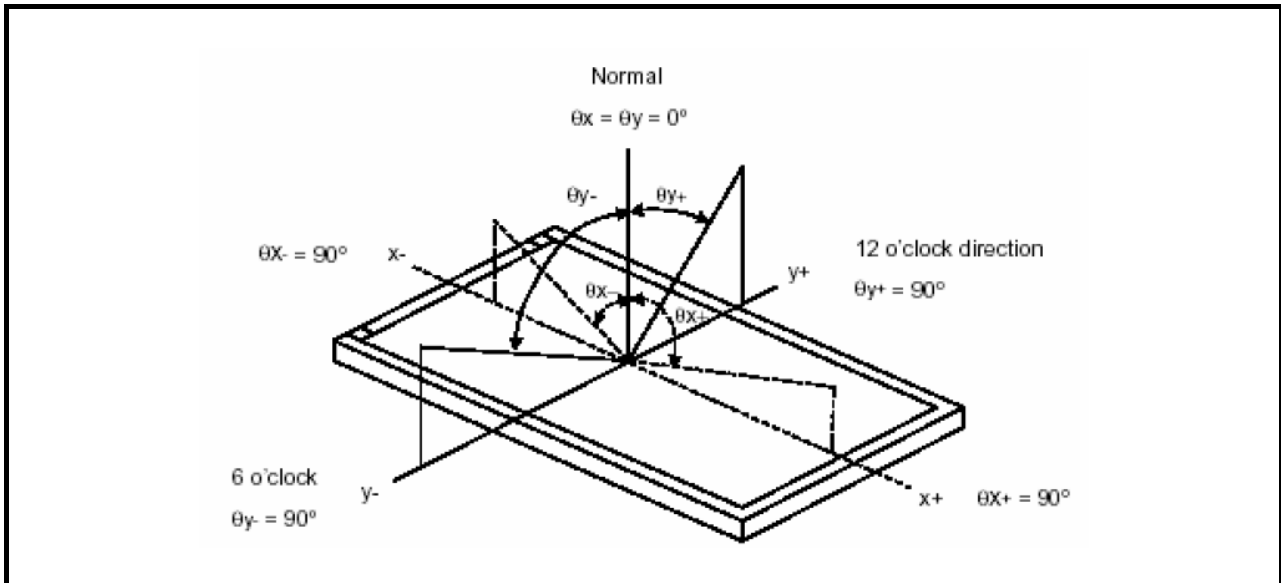


Note2: Measured at the center area of the panel and at the viewing angle of the  $\theta x = \theta y = 0^\circ$

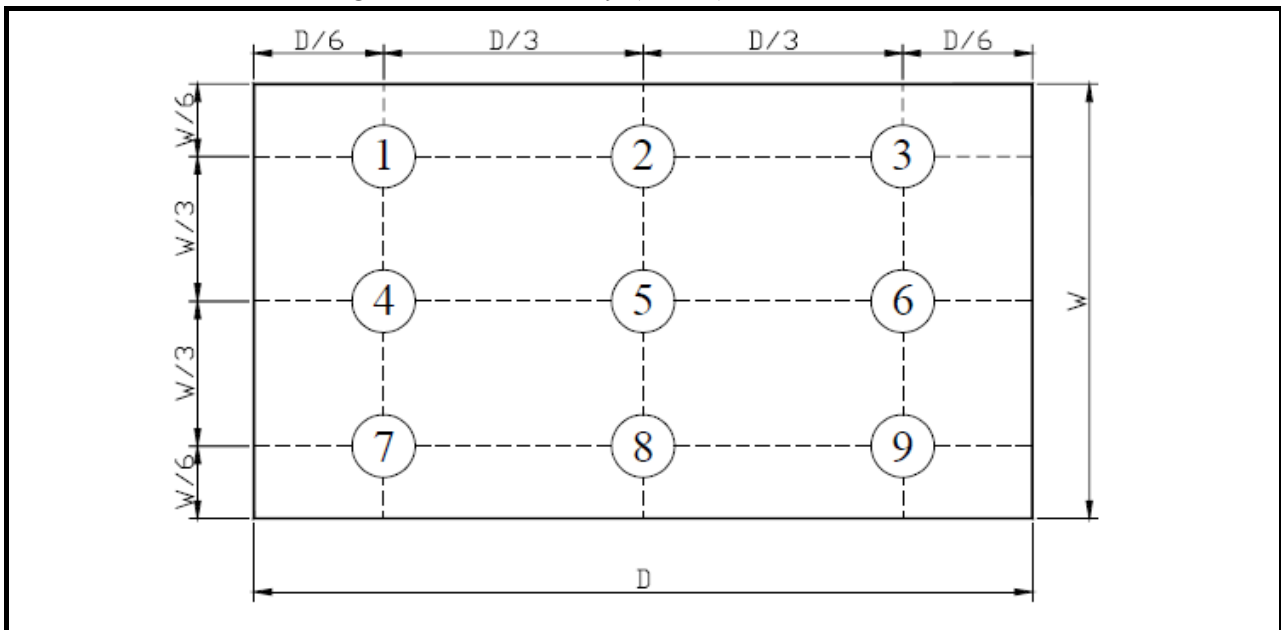
Note3: Definition of Contrast Ratio (CR):

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

**Note 4: Definition of Viewing Angle:**



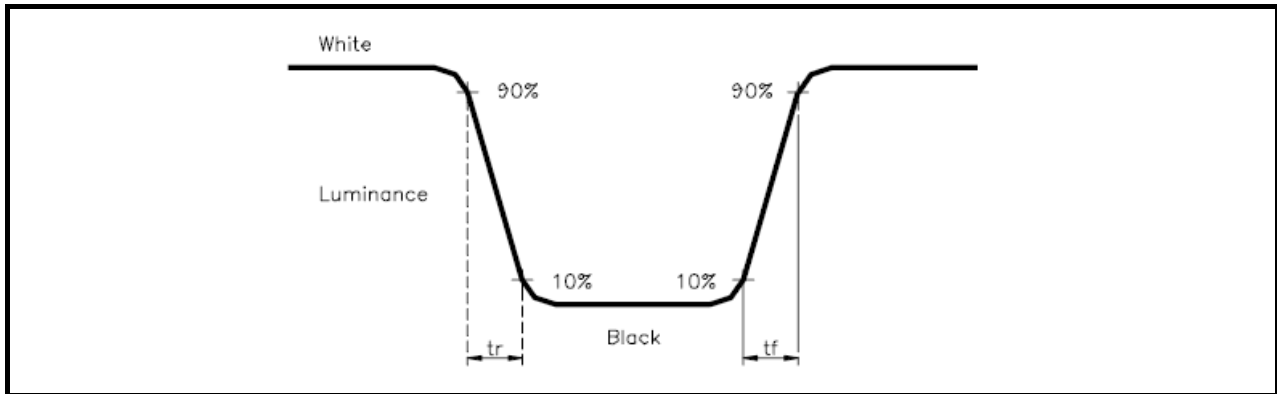
**Note 5: Definition of Brightness Uniformity (B-uni):**



$$B\text{-uni} = (\text{Minimum luminance of 9 points} \div \text{Maximum luminance of 9 points}) \times 100\%$$

**Note 6: 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 rowspan="4">Class Of Defects</th><th rowspan="4">AQL Level</th></tr><tr><td><math>D&gt;0.5</math></td><td>0</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                | $0.3 < D \leq 0.5$ | 5         | $D \leq 0.3$     | *                   |            |              |               |   |
| Zone<br>Dimension                                                                                                                                                                                                                                                                                                                                                                                                                    | Acceptable number                   | Class Of Defects                                                                                                                                                                                                                                                                                           |                   |                   | AQL Level         |                  |                    |           |                  |                     |            |              |               |   |
| $D>0.5$                                                                                                                                                                                                                                                                                                                                                                                                                              | 0                                   |                                                                                                                                                                                                                                                                                                            |                   |                   |                   |                  |                    |           |                  |                     |            |              |               |   |
| $0.3 < D \leq 0.5$                                                                                                                                                                                                                                                                                                                                                                                                                   | 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 rowspan="4">Class Of Defects</th><th rowspan="4">AQL Level</th></tr><tr><td><math>L &gt; 5</math></td><td><math>W &gt; 0.1</math></td><td>0</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         | $0.5 < L \leq 5$ | $0.03 < W \leq 0.1$ | 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                                                                                                                                                                                                                                                                                                          |                   |                   |                   |                  |                    |           |                  |                     |            |              |               |   |
| $0.5 < L \leq 5$                                                                                                                                                                                                                                                                                                                                                                                                                     | $0.03 < W \leq 0.1$                 | 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 rowspan="3">Class Of Defects</th><th rowspan="3">AQL Level</th></tr><tr><td>--</td><td><math>W &gt; 0.1</math></td><td>0</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                   | $L \leq 3$ | $W \leq 0.1$ | 3             |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     | L (mm)                                                                                                                                                                                                                                                                                                     | Zone<br>W(mm)     | Acceptable number | Class Of Defects  |                  |                    | AQL Level |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     | --                                                                                                                                                                                                                                                                                                         | $W > 0.1$         | 0                 |                   |                  |                    |           |                  |                     |            |              |               |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     | $L \leq 3$                                                                                                                                                                                                                                                                                                 | $W \leq 0.1$      | 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 rowspan="3">Class Of Defects</th><th rowspan="3">AQL Level</th></tr><tr><td><math>D \leq 0.3</math></td><td>*</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        | $D \leq 0.3$       | *         | $D \leq 0.5$     | 3                   |            |              |               |   |
| Zone<br>Dimension                                                                                                                                                                                                                                                                                                                                                                                                                    | Acceptable number                   | Class Of Defects                                                                                                                                                                                                                                                                                           | AQL Level         |                   |                   |                  |                    |           |                  |                     |            |              |               |   |
| $D \leq 0.3$                                                                                                                                                                                                                                                                                                                                                                                                                         | *                                   |                                                                                                                                                                                                                                                                                                            |                   |                   |                   |                  |                    |           |                  |                     |            |              |               |   |
| $D \leq 0.5$                                                                                                                                                                                                                                                                                                                                                                                                                         | 3                                   |                                                                                                                                                                                                                                                                                                            |                   |                   |                   |                  |                    |           |                  |                     |            |              |               |   |
| $D = (\text{Long} + \text{Short}) / 2$ * : Disregard                                                                                                                                                                                                                                                                                                                                                                                 |                                     |                                                                                                                                                                                                                                                                                                            |                   |                   |                   |                  |                    |           |                  |                     |            |              |               |   |



| Class of defects | Major | AQL 0.65% | Definition                                                                                                                         |
|------------------|-------|-----------|------------------------------------------------------------------------------------------------------------------------------------|
|                  | Minor | AQL 1.5%  | Definition                                                                                                                         |
|                  |       |           | It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function. |
|                  |       |           | It is a defect that will not result in functioning problem with deviation classified.                                              |

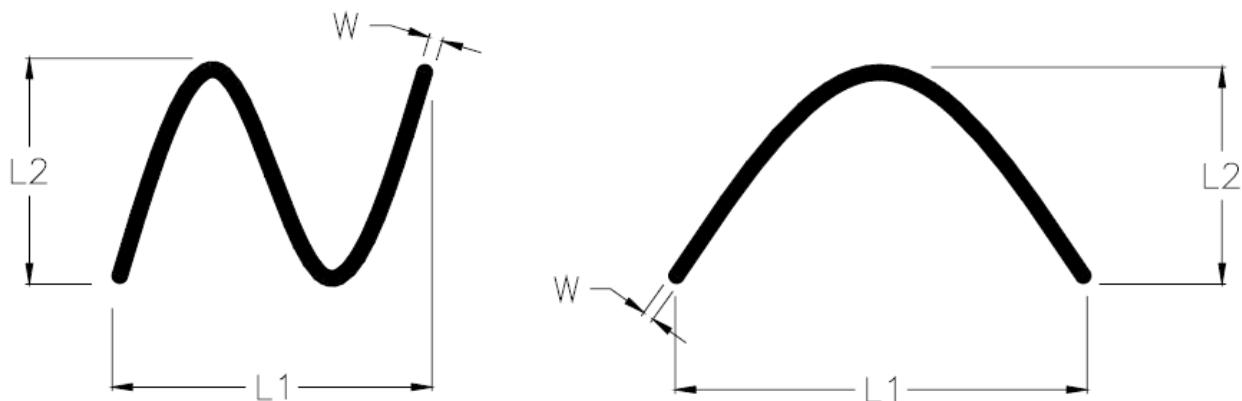
**Note1:**

- (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

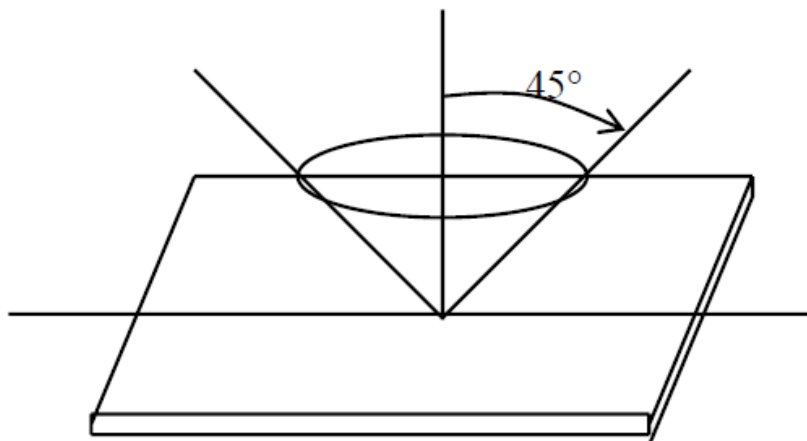
Inspection level: Level II

### 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.**