


# TFT Module Specification

MODEL: 13-057VMTB00A1-S

- < ◇ > PRELIMINARY SPECIFICATION
- < ◆ > APPROVAL SPECIFICATION

|             |
|-------------|
| CUSTOMER    |
|             |
| APPROVED BY |
|             |
| DATE:       |

| DESIGNED | CHECKED | APPROVED   |
|----------|---------|--|
|          |         |  <p>PM<br/>2014.08.22<br/>呂家祥</p> |

## RECORD OF REVISION

| Version | Revised Date | Page | Content  |
|---------|--------------|------|--|
| V1.0    | 2013/11/28   | --   | First Issued                                       |
| V1.1    | 2014/08/22   | 16   | Modify Brightness Min. 800 → 720 cd/m <sup>2</sup> |
|         |              |      |  |
|         |              |      |  |
|         |              |      |  |

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## 1. GENERAL DESCRIPTION

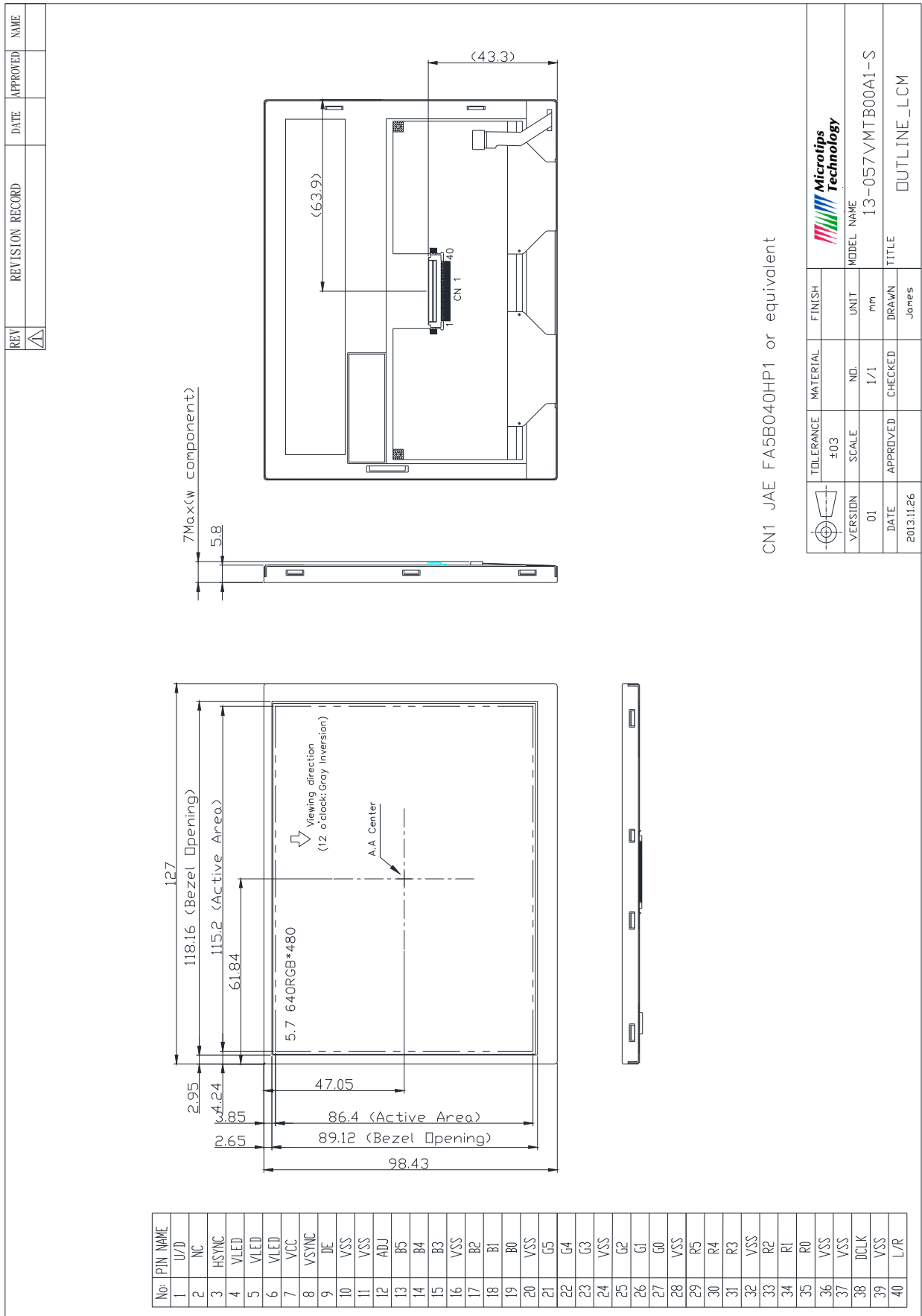
### 1.1 Description

The specifications is model 13-057VMTB00A1-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 back light system. This TFT LCD has a 5.7 inch diagonally measured active display area with WVGA (640 horizontal by 480 vertical pixels) resolution.

### 1.2 Features:

| No. | Item                           | Specification                      | Unit              |
|-----|--------------------------------|------------------------------------|-------------------|
| 1   | Panel Size                     | 5.7"                               | Inch              |
| 2   | Number of Pixels               | 640 (W) x RGB x 480 (H)            | Pixels            |
| 3   | Active Area                    | 115.2 (W) × 86.4 (H)               | mm                |
| 4   | Pixel Pitch                    | 0.18 (W) x 0.18 (H)                | mm                |
| 5   | Outline Dimension              | 127 (W) × 98.43 (H) × 7 (T)        | mm                |
| 6   | Number of Colors               | 262K                               | - -               |
| 7   | Display Mode                   | TN / Normally White / Transmissive | - -               |
| 8   | View Direction                 | 12 o'clock(Gray Inversion)         |                   |
| 9   | Display Format                 | RGB vertical stripe                | - -               |
| 10  | Surface Treatment              | Clear                              | - -               |
| 11  | Contrast Ratio                 | 300 (Typ.)                         | - -               |
| 12  | Luminance (cd/m <sup>2</sup> ) | 900 (Typ.)                         | cd/m <sup>2</sup> |
| 13  | Interface                      | RGB 18bit Interface                | - -               |
| 14  | Backlight                      | White LED                          | - -               |
| 15  | Operation Temperature          | -20 ~ 70                           | °C                |
| 16  | Storage Temperature            | -30 ~ 80                           | °C                |
| 17  | Weight                         | 110                                | g                 |

## 2. MECHANICAL SPECIFICATION



### 3. PIN DESCRIPTION

#### 3.1 TFT LCD Module

| Pin No. | Symbol | I/O | Function                       | Remark |
|---------|--------|-----|--------------------------------|--------|
| 1       | U/D    | I   | Up or Down Display Control     |        |
| 2       | NC     | -   | No connection                  |        |
| 3       | HSYNC  | I   | Horizontal SYNC Signal         |        |
| 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       | VSYNC  | I   | Vertical SYNC Signal           |        |
| 9       | DE     | I   | Data Enable Signal             |        |
| 10      | VSS    | P   | Ground                         |        |
| 11      | VSS    | P   | Ground                         |        |
| 12      | ADJ    | I   | Brightness control for LED B/L |        |
| 13      | B5     | I   | Blue data signal (MSB)         |        |
| 14      | B4     | I   | Blue data signal               |        |
| 15      | B3     | I   | Blue data signal               |        |
| 16      | VSS    | P   | Ground                         |        |
| 17      | B2     | I   | Blue data signal               |        |
| 18      | B1     | I   | Blue data signal               |        |
| 19      | B0     | I   | Blue data signal (LSB)         |        |
| 20      | VSS    | P   | Ground                         |        |
| 21      | G5     | I   | Green data signal (MSB)        |        |
| 22      | G4     | I   | Green data signal              |        |
| 23      | G3     | I   | Green data signal              |        |
| 24      | VSS    | P   | Ground                         |        |
| 25      | G2     | I   | Green data signal              |        |
| 26      | G1     | I   | Green data signal              |        |
| 27      | G0     | I   | Green data signal (LSB)        |        |
| 28      | VSS    | P   | Ground                         |        |
| 29      | R5     | I   | Red data signal (MSB)          |        |
| 30      | R4     | I   | Red data signal                |        |
| 31      | R3     | I   | Red data signal                |        |
| 32      | VSS    | P   | Ground                         |        |
| 33      | R2     | I   | Red data signal                |        |

|    |      |   |  |  |
|----|------|---|--|--|
| 34 | R1   | I | Red data signal                                |  |
| 35 | R0   | I | Red data signal (LSB)                          |  |
| 36 | VSS  | P | Ground   |  |
| 37 | VSS  | P | Ground   |  |
| 38 | DCLK | I | Clock Signals ; Latch Data at the Falling Edge |  |
| 39 | VSS  | P | Ground   |  |
| 40 | L/R  | I | Left or Right Display Control                  |  |

Note:

- (1) VSS PIN must be grounding, cannot be floating.
- (2) U/D and L/R control Function

| L/R | U/D | Function                                       |
|-----|-----|--|
| 1   | 0   | Normally display                               |
| 0   | 0   | Left and Right opposite                        |
| 1   | 1   | Up and Down opposite                           |
| 0   | 1   | Left and Right opposite · Up and Down opposite |

- (3) If DE signal is fixed low, SYNC mode is used. Otherwise, DE mode is used.

#### 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   | 5.0  | V    |      |
|                      | VLED   | 0      | 5.5  | V    |      |

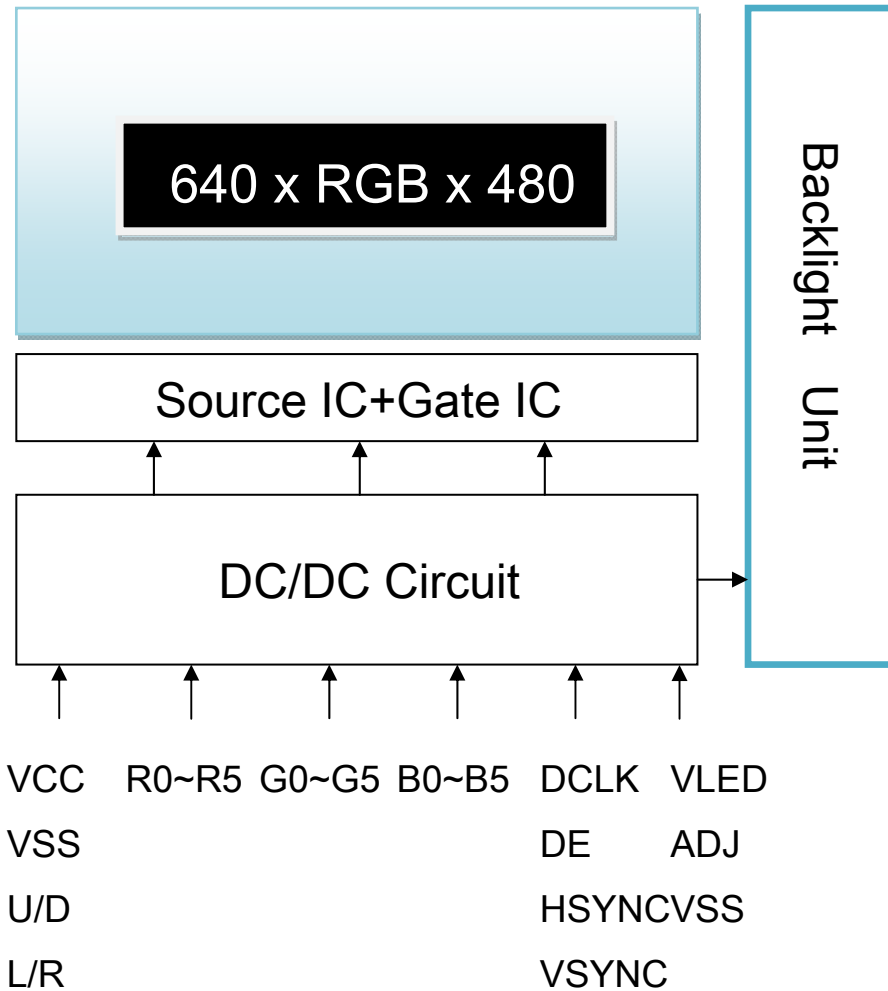
##### 4.1.2 Environment Absolute Rating

| Item                  | Symbol | Values |     |      | Unit | Note                   |
|-----------------------|--------|--------|-----|------|------|------------------------|
|                       |        | Min    | Typ | Max. |      |                        |
| Operating Temperature | Topa   | -20    |     | 70   | °C   | Ambient<br>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  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
| 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  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
| 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        | 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

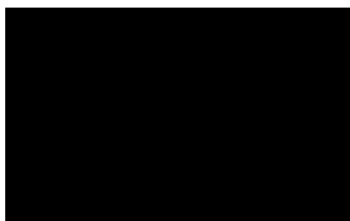
Each basic color can be displayed in 64 gray scales from 6 bit data signals. With the combination of total 18 bit data signals, the 262K-color display can be achieved on the screen.

## 7. ELECTRICAL CHARACTERISTICS

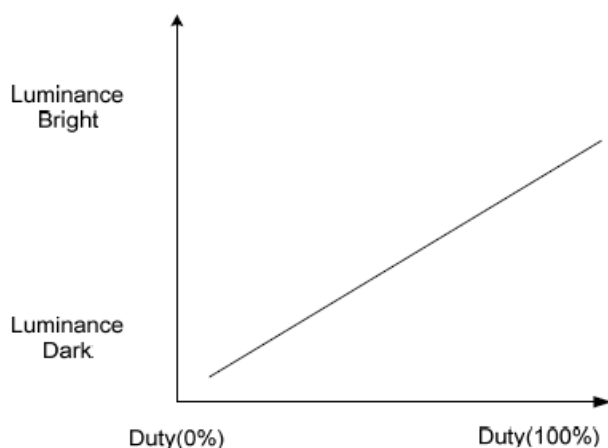
### 7.1 TFT LCD Module

| 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 | $0.7 \times VCC$ | -    | VCC              | V    |         |
|                         | L Level | 0                | -    | $0.3 \times VCC$ | V    |         |
| PWM frequency           | ADJ     | 19K              | 20K  | 21K              | Hz   | Note2   |
| Digital Current         | ICC     | -                | 111  | 140              | mA   | Note1   |
|                         | ILED    | -                | 333  | 400              | mA   | VLED=5V |
| 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.

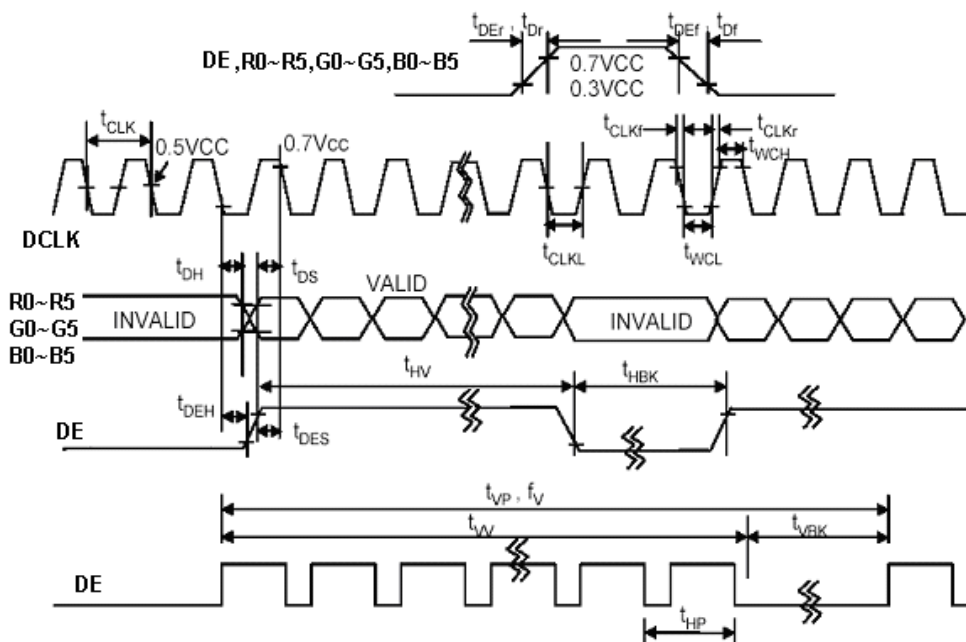
## 7.2 INTERFACE SPECIFICATIONS

### 7.2.1 DE Mode Input Timing Table

| Signal        | Parameter        | Symbol      | Min. | Typ. | Max. | Unit. | Note |
|---------------|------------------|-------------|------|------|------|-------|------|
| DCLK          | CLK frequency    | fCLK        | 23   | 25   | 30   | MHz   |      |
|               | CLK period       | tCLK        | 33   | 40   | 43   | ns    |      |
|               | CLK pulse duty   | -           | 45   | 50   | 55   | %     |      |
|               | Low Level Width  | tWCL        | 6    | -    | -    | ns    |      |
|               | High Level Width | tWCH        | 6    | -    | -    | ns    |      |
|               | Rise, Fall Time  | tCLKr,tCLKf | -    | -    | 3    | ns    |      |
| DE            | Setup Time       | tDES        | 5    | -    | -    | ns    |      |
|               | Hold Time        | tDEH        | 10   | -    | -    | ns    |      |
|               | Rise, Fall Time  | tDEr,tDEf   | -    | -    | 16   | ns    |      |
|               | Horizontal Line  | tHP         | 750  | 800  | 900  | tCLK  |      |
|               | HS Display Area  | tHV         | 640  | 640  | 640  | tCLK  |      |
|               | HS Blank         | tHBK        | 110  | 160  | 260  | tCLK  |      |
|               | VS Display Area  | tVP         | 515  | 525  | 560  | tHP   |      |
|               | VS Period Time   | tVV         | 480  | 480  | 480  | tHP   |      |
|               | VS Blank         | tVBK        | 35   | 45   | 80   | tHP   |      |
| VS Frequency  | fV               | 55          | 60   | 65   | Hz   |       |      |
| Data<br>R,G,B | Setup Time       | tDS         | 5    | -    | -    | ns    |      |
|               | Hold Time        | tDH         | 10   | -    | -    | ns    |      |
|               | Rise, Fall Time  | tDr,tDf     | -    | -    | 3    | ns    |      |

Note: (1) tCLKL / tCLK.

### 7.2.2 DE mode timing waveform



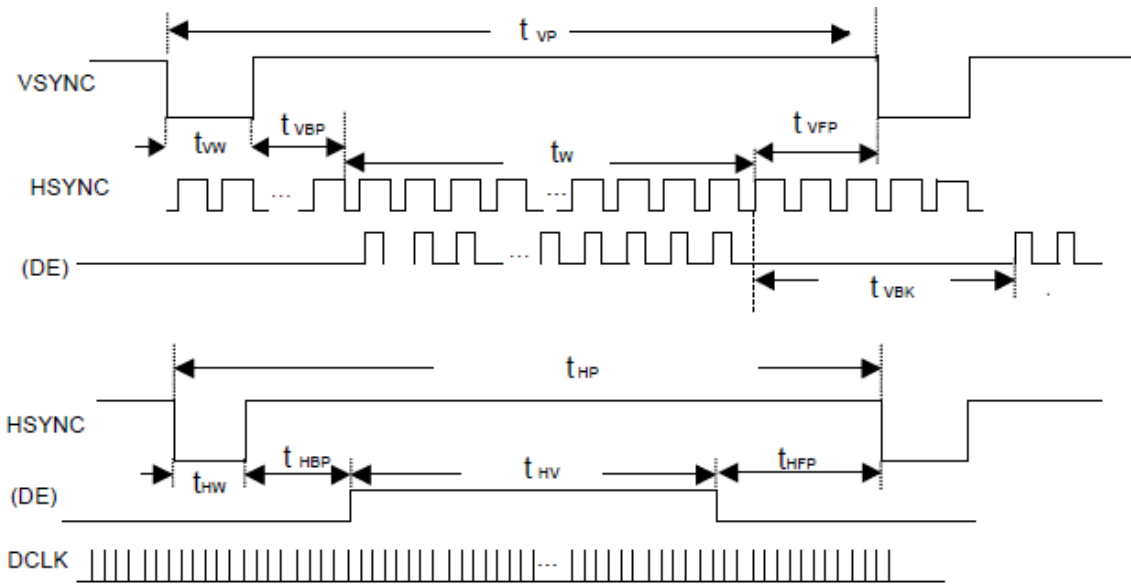
### 7.2.3 SYNC mode Input signal characteristics

| Signal | Parameter            | Symbol       | Min. | Typ. | Max. | Unit. | Note |
|--------|----------------------|--------------|------|------|------|-------|------|
| DCLK   | CLK frequency        | fCLK         | 23   | 25   | 30   | MHz   |      |
|        | CLK period           | tCLK         | 33   | 40   | 43   | ns    |      |
|        | Low Level Width      | tWCL         | 6    | -    | -    | ns    |      |
|        | High Level Width     | tWCH         | 6    | -    | -    | ns    |      |
|        | Rise, Fall Time      | tCLKr, tCLKf | -    | -    | 3    | ns    |      |
| HSYNC  | Horizontal Line      | tHP          | 750  | 800  | 900  | tCLK  |      |
|        | HS Display Area      | tHV          | 640  | 640  | 640  | tCLK  |      |
|        | HS Pulse Width       | tHW          | 5    | 30   | -    | tCLK  |      |
|        | HS Back Porch        | tHBP         | 1    | 114  | 139  | tCLK  |      |
|        | HS Front Porch       | tHFP         | 1    | 16   | 116  | tCLK  |      |
|        | HS Blanking          | tHBK         | 1    | 160  | 260  | tCLK  |      |
|        | HS Width+ Back Porch | tHW+tHBP     | 144  | 144  | 144  | tCLK  |      |
| VSYNC  | VS Period Time       | tVP          | 515  | 525  | 560  | tHP   |      |
|        | VS Display Area      | tVV          | 480  | 480  | 480  | tHP   |      |
|        | VS Pulse Width       | tVW          | 1    | 3    | 5    | tHP   |      |
|        | VS Back Porch        | tVBP         | 30   | 32   | 34   | tHP   |      |
|        | VS Front Porch       | tVFP         | 1    | 10   | 45   | tHP   |      |
|        | VS Width+ Back Porch | tVW+tVBP     | 35   | 35   | 35   | tHP   |      |
|        | VS Blanking          | tVBK         | 35   | 45   | 80   | tHP   |      |
| DATA   | Setup Time           | tDS          | 5    | -    | -    | ns    |      |
|        | Hold Time            | tDH          | 10   | -    | -    | ns    |      |

Note: (1) tHBK = tHFP + tHW + tHBP.

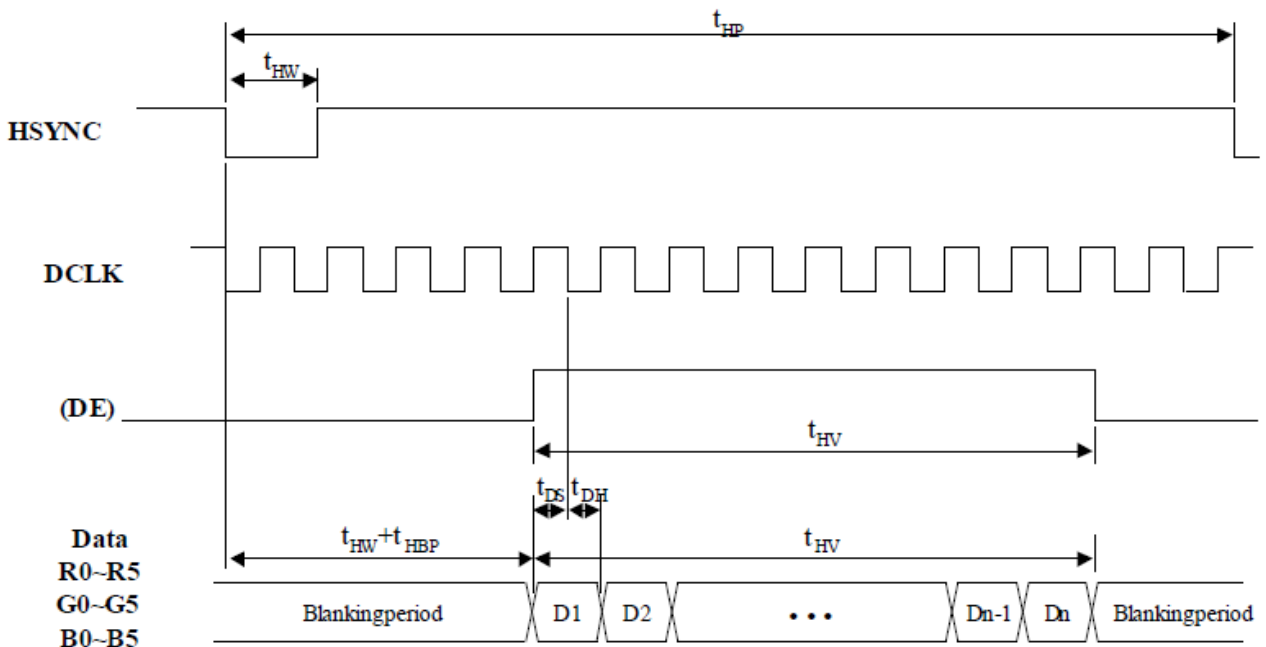
## 7.2.4 SYNC mode timing waveform

Input vertical timing:



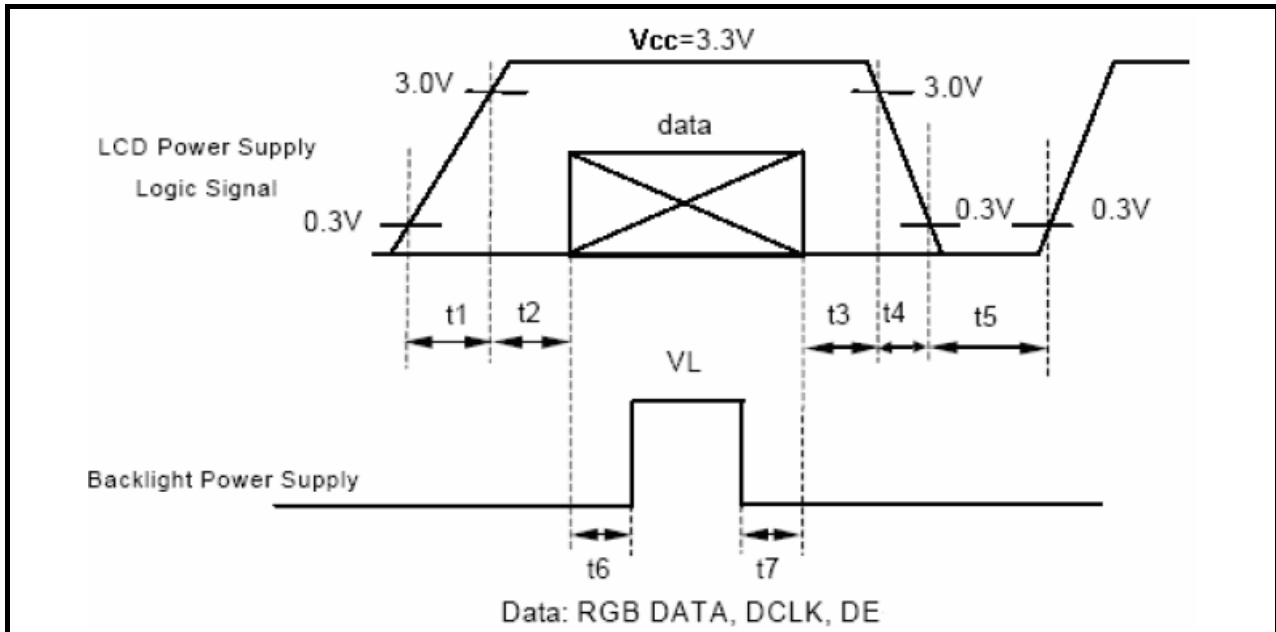
Note: If SYNC mode is used, please fix DE signal to low, DE timing waveform is for reference only.

Input horizontal timing:



Note: If SYNC mode is used, please fix DE signal to low, DE timing waveform is for reference only

### 7.3 Power On / Off Sequence



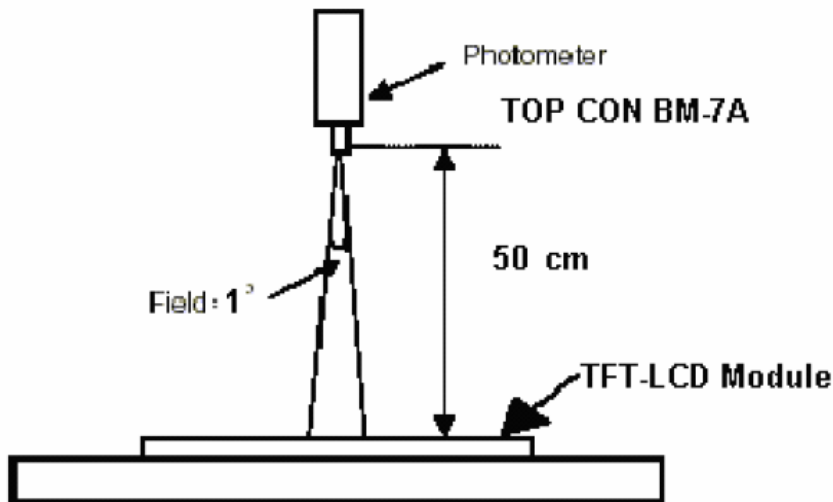
$t_1 \leq 10\text{ms} : 1 \text{ sec} \leq t_5$   
 $50\text{ms} \leq t_2 : 200\text{ms} \leq t_6$   
 $0 < t_3 \leq 50\text{ms} : 200\text{ms} \leq t_7$   
 $0 < t_4 \leq 10\text{ms}$

## 8. OPTICAL CHARACTERISTICS

| Item               | Symbol     | Condition  | Min.  | Typ.  | Max.  | Unit              |
|--------------------|------------|--|-------|-------|-------|-------------------|
| Brightness         | --         | Note1,<br>Note 3,<br>( $\theta = 0^\circ$ ;<br>Normal<br>Viewing<br>Angle) | 720   | 900   | --    | cd/m <sup>2</sup> |
| Uniformity         | B-uni      |  | 70    | 80    | -     | %                 |
| Contrast Ratio     | CR         |  | 200   | 300   | --    | --                |
| Response Time      | Tr         |  | --    | 15    | --    | ms                |
|                    | Tf         |  | --    | 35    | --    | ms                |
| Color Chromaticity | White      | Wx   | 0.259 | 0.309 | 0.359 | --                |
|                    |            | Wy   | 0.270 | 0.320 | 0.370 | --                |
| View angle         | Horizontal | $\theta x+$  | 60    | 70    | --    |                   |
|                    |            | $\theta x-$  | 60    | 70    | --    |                   |
|                    | Vertical   | $\theta Y+$  | 50    | 60    | --    |                   |
|                    |            | $\theta Y-$  | 30    | 40    | --    |                   |
| Image sticking     | tis        | 2 hours  | --    | --    | 2     | Sec               |

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:



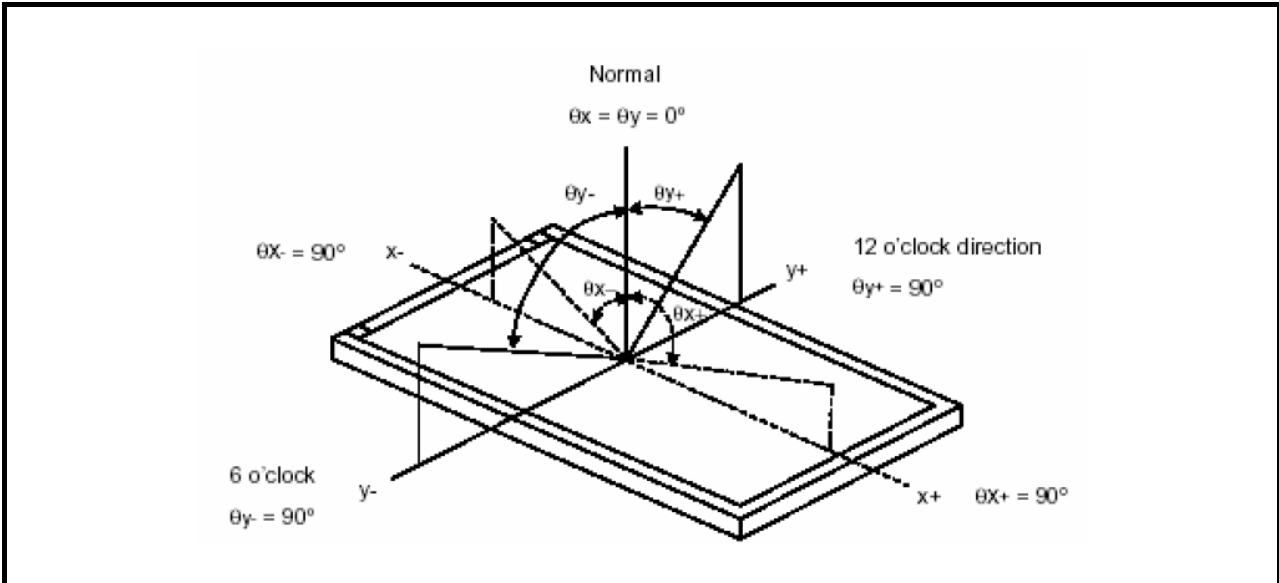
Note2: Measured at the center area of the panel and at the viewing angle of the  $\theta x = \theta y = 0^\circ$

Note3: Definition of Contrast Ratio (CR):

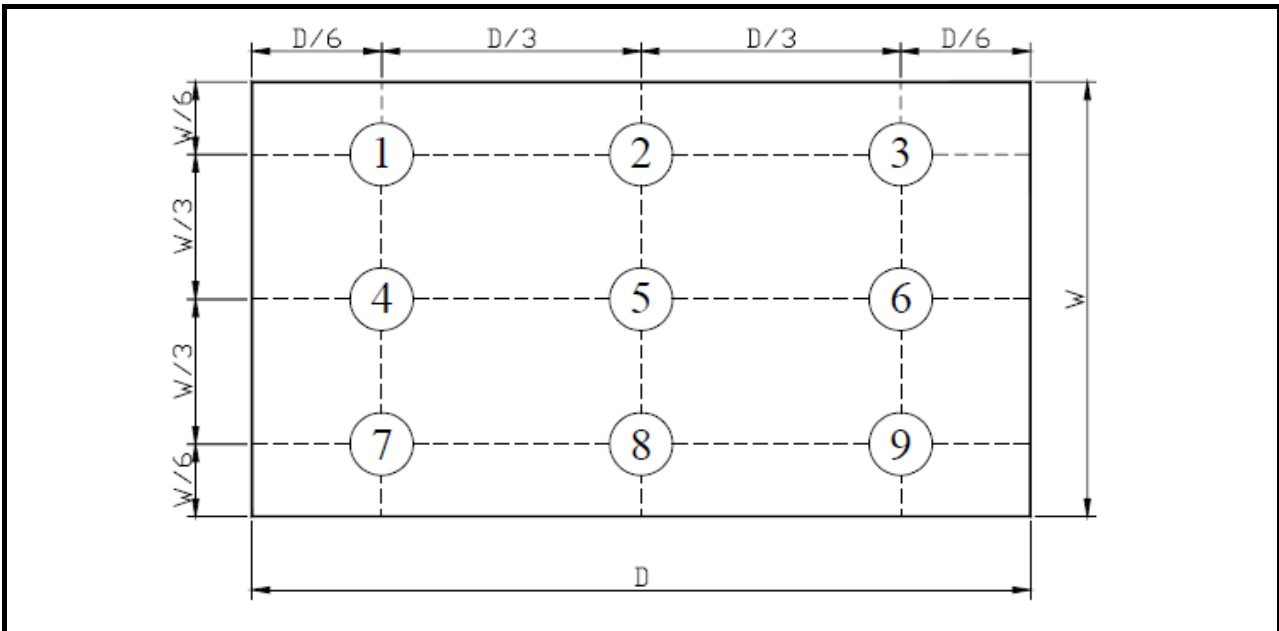
CR = Luminance with all pixels in white state  $\div$  Luminance with all pixels in Black state



Note4: Definition of Viewing Angle:



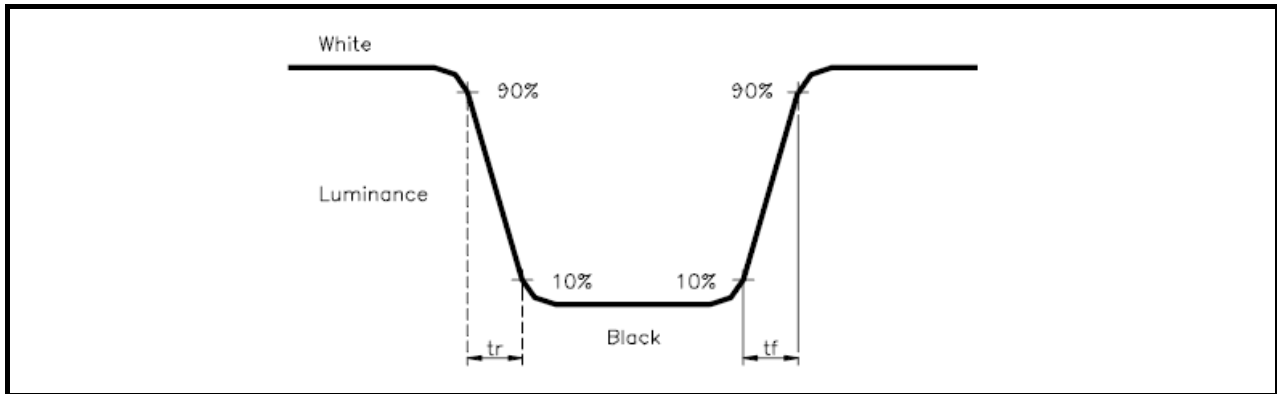
Note 5: Definition of Brightness Uniformity (B-uni):



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

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



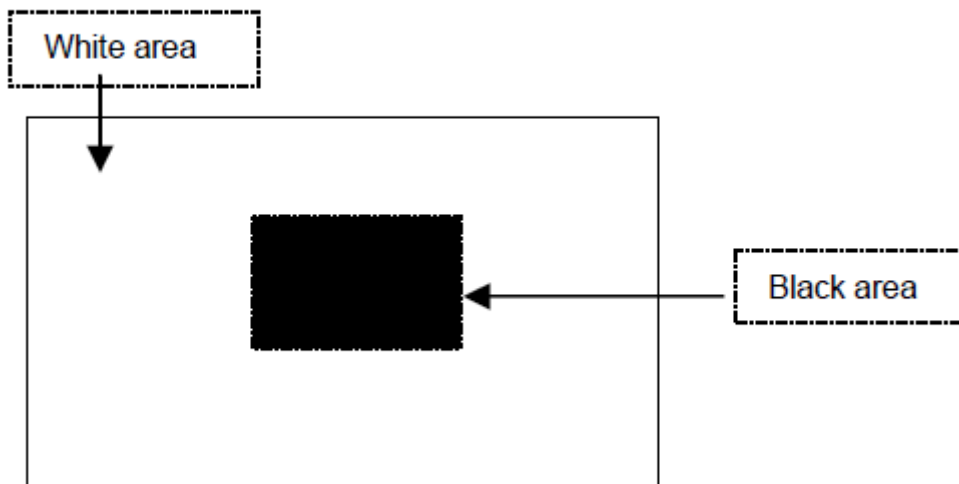
Note 7: Definition of Chromaticity:

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.

Note 8: Definition of Image sticking ( $t_{is}$ ):

Continuously display the test pattern shown in the figure below for 2 hours. Then display a completely white screen. The previous image shall not persist more than 2 sec at 25 °C

### Image sticking pattern



## 9. RELIABILITY

### 9.1 Test Condition

#### 9.1.1 Temperature and Humidity(Ambient Temperature)

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

Humidity :  $65 \pm 5\%$

#### 9.1.2 Operation

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

#### 9.1.3 Container

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

#### 9.1.4 Test Frequency

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

### 9.2 TESTS

| No. | ITEM                                    | CONDITION CRITERION  |
|-----|---|--|
| 1   | High Temperature Storage                | 80°C, 240 hrs  |
| 2   | Low Temperature Storage                 | -30°C, 240 hrs   |
| 3   | High Temperature Operating              | 70°C, 240 hrs  |
| 4   | Low Temperature Operating               | -20°C, 240 hrs   |
| 5   | High Temperature/Humidity Non-Operating | 60°C, 90%RH, 240 hrs   |
| 6   | Temperature Shock Non-Operating         | -30°C ←+25°C → 80°C<br>(0.5hr each), 200 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:± 12KV;Contact: ±6KV<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.

### 9.3 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.

#### 9.4 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 border="1"> <thead> <tr> <th rowspan="2">Item</th> <th>Acceptable number</th> <th rowspan="2">Total</th> </tr> <tr> <th>Active Area</th> </tr> </thead> <tbody> <tr> <td>Bright</td> <td>2</td> <td rowspan="2">5</td> </tr> <tr> <td>Dark</td> <td>4</td> </tr> </tbody> </table>   | Item                   | Acceptable number | Total             | Active Area | Bright                               | 2 | 5                          | Dark | 4            |     |       |     |
| Item  | Acceptable number                      | Total   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
|   | Active Area                            |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| Bright  | 2                                      | 5   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| Dark  | 4                                      |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| 2   | External Inspection<br>(non-operating) | Non-uniformity: Visible through 5%ND filter. (Minor)  |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
|   |  | Foreign material in Black or White spots shape ( $W > 1/4L$ )   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
|   |  | <table border="1"> <thead> <tr> <th>Zone<br/>Dimension</th> <th>Acceptable number</th> <th rowspan="3">Class Of Defects</th> <th rowspan="3">AQL Level</th> </tr> </thead> <tbody> <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> <td>Minor</td> <td>1.5</td> </tr> </tbody> </table> <p><math>D = (\text{Long} + \text{Short}) / 2</math> * : Disregard</p> | Zone<br>Dimension      | Acceptable number | Class Of Defects  | AQL Level   | $D > 0.5$                            | 0 | $0.3 < D \leq 0.5$         | 5    | $D \leq 0.3$ | *   | Minor | 1.5 |
|   |  | Zone<br>Dimension   | Acceptable number      | Class Of Defects  |                   |             | AQL Level                            |   |                            |      |              |     |       |     |
|   |  | $D > 0.5$   | 0                      |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| $0.3 < D \leq 0.5$  | 5                                      |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| $D \leq 0.3$  | *                                      | Minor   | 1.5                    |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| Foreign Material in Line or spiral shape ( $W \leq 1/4L$ ) (Note: 4)  |  |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| <table border="1"> <thead> <tr> <th>Zone<br/>L (mm) \ W(mm)</th> <th>Acceptable number</th> <th rowspan="3">Class Of Defects</th> <th rowspan="3">AQL Level</th> </tr> </thead> <tbody> <tr> <td><math>L &gt; 5</math>    <math>W &gt; 0.1</math></td> <td>0</td> </tr> <tr> <td><math>0.5 &lt; L \leq 5</math>    <math>0.03 &lt; W \leq 0.1</math></td> <td>5</td> </tr> <tr> <td><math>L \leq 0.5</math>    <math>W \leq 0.03</math></td> <td>*</td> <td>Minor</td> <td>1.5</td> </tr> </tbody> </table> <p>L : Length    W : Width    * : Disregard</p> | Zone<br>L (mm) \ 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 | $L \leq 0.5$ $W \leq 0.03$ | *    | Minor        | 1.5 |       |     |
| Zone<br>L (mm) \ 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                                      |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| $L \leq 0.5$ $W \leq 0.03$  | *                                      | Minor   | 1.5                    |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| 2   | External Inspection<br>(non-operating) | Dimension: Outline (Major)  |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
|   |  | Bezel appearance: uneven (Minor)  |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
|   |  | Scratch on the polarize: (Note:2)   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
|   |  | <table border="1"> <thead> <tr> <th>Zone<br/>L (mm) \ W(mm)</th> <th>Acceptable number</th> <th rowspan="3">Class Of Defects</th> <th rowspan="3">AQL Level</th> </tr> </thead> <tbody> <tr> <td>--    <math>W &gt; 0.1</math></td> <td>0</td> </tr> <tr> <td><math>L \leq 3</math>    <math>W \leq 0.1</math></td> <td>3</td> </tr> </tbody> </table> <p>L : Length    W : Width    * : Disregard</p>  | Zone<br>L (mm) \ W(mm) | Acceptable number | Class Of Defects  | AQL Level   | -- $W > 0.1$                         | 0 | $L \leq 3$ $W \leq 0.1$    | 3    |              |     |       |     |
|   |  | Zone<br>L (mm) \ W(mm)  | Acceptable number      | Class Of Defects  |                   |             | AQL Level                            |   |                            |      |              |     |       |     |
| -- $W > 0.1$  | 0                                      |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| $L \leq 3$ $W \leq 0.1$   | 3                                      |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| Dent or bubble on the polarize (Note:2)   |  |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |
| <table border="1"> <thead> <tr> <th>Zone<br/>Dimension</th> <th>Acceptable number</th> <th rowspan="3">Class Of Defects</th> <th rowspan="3">AQL Level</th> </tr> </thead> <tbody> <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> </tbody> </table> <p><math>D = (\text{Long} + \text{Short}) / 2</math> * : Disregard</p>   | 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                                      |   |                        |                   |                   |             |                                      |   |                            |      |              |     |       |     |

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

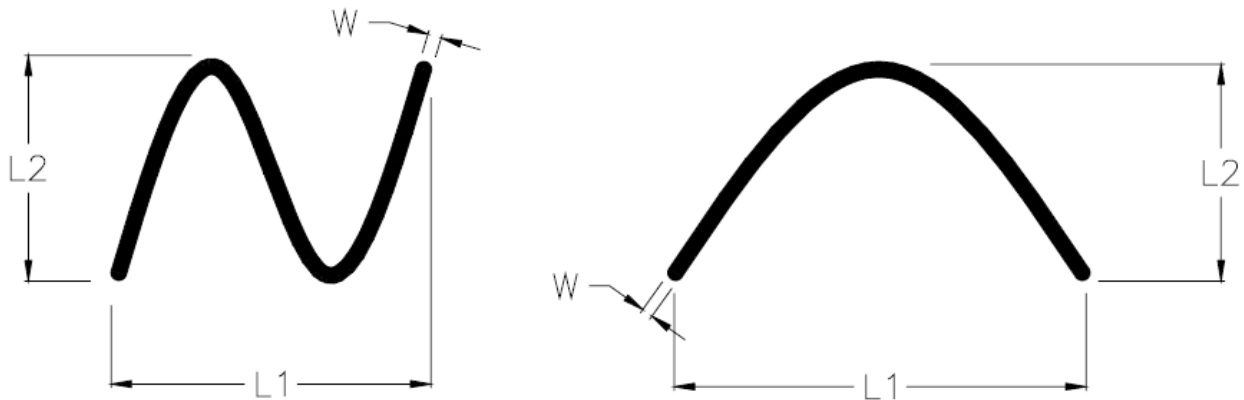
**Note1:**

- (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.



### 9.5 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

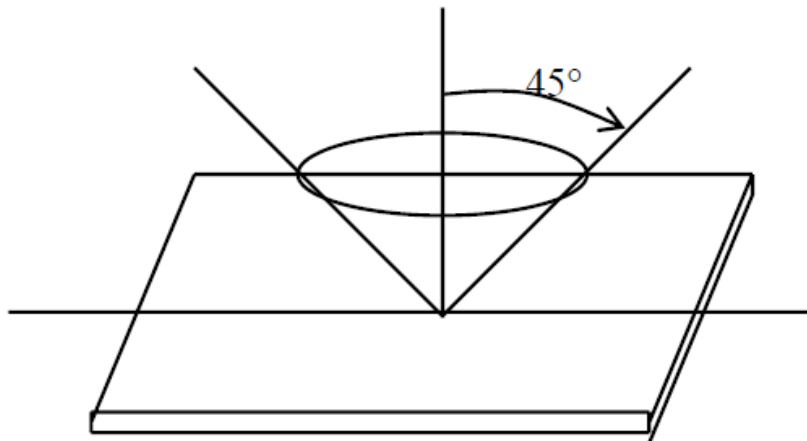
Inspection level: Level II

### 9.6 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



## 10. PRECAUTION RELATING PRODUCT HANDLING

### 10.1 SAFETY

10.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.

10.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

### 10.2 HANDLING

10.2.1 Avoid any strong mechanical shock which can break the glass.

10.2.2 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.

10.2.3 Do not remove the panel or frame from the module.

10.2.4 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.)

10.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

10.2.6 Do not touch the display area with bare hands , this will stain the display area.

10.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

10.2.8 To control temperature and time of soldering is  $280 \pm 10^{\circ}\text{C}$  and 3-5 sec.

10.2.9 To avoid liquid (include organic solvent) stained on LCM.

### 10.3 STORAGE

10.3.1 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.

10.3.2 Do not place the module near organics solvents or corrosive gases.

10.3.3 Do not crush, shake, or jolt the module.



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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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