**MODEL NO. : IE-G-1816AH05R24L-CB-1**

**ISSUED DATE: 2018-11-17**

**VERSION : Ver 1.0**

## REVISION RECORD

| Rev. NO. | Rev. Date | Description | Remarks |
|---|---|---|---|
| 1.0 | 2018-11-17 | First Release | |
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## 1. General Specifications

**IE-G-1816AH05R24L-CB-1 is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC, FPC， and a back light unit. The module display area contains 800x 480 pixels. This product accords with RoHS environmental criterion.**

| Item | Display Panel | Remark |
|---|---|---|
| Size | 7.0 inch | / |
| Display Mode | Normally White, Transmissive LCD | / |
| Viewing Direction | 6 O'Clock | / |
| Module area(W x H x T) | 180.0 x 109.0 x 7.42 | mm |
| TFT area(W x H x T) | 164.9 x 100.0 x 5.7 | mm |
| Active Area(W x H) | 154.08 x 85.92 | mm |
| Number of Dots | 800RGB x 480 | / |
| Pixel Pitch(W x H) | 0.1926 x 0.179 | mm |
| Surface treatment | Anti-Glare | / |
| Interface Type | TTL | / |
| Backlight Type | 27 LED(3 Serial*9) | / |
| Weight | TBD | / |

## 2. ABSOLUTE MAXIMUM RATINGS

| ITEM | Symbol | Min | Max | Uint | Note |
|---|---|---|---|---|---|
| Digital Supply Voltage | DVDD | -0.3 | 5 | V | |
| Analog Supply Voltage | AVDD | 6.5 | 13.5 | V | |
| Gate On Voltage | VGH | -0.3 | 40.0 | V | |
| Gate Off Voltage | VGL | -20 | 0.3 | V | |
| Gate On - Gate Off Voltage | VDDG-VEEG | - | 40 | V | |
| Operation Temperature | Top | -10 | 60 | ℃ | Note 1 |
| Storage Temperature | TSgt | -20 | 70 | ℃ | Note 1 |

## 3. ELECTRICAL CHARACTERISTICS

### 3.1 Operating Conditions

| ITEM | Symbol | Min | TYP | Max | Uint | Note |
|---|---|---|---|---|---|---|
| Digital Supply Voltage | DVDD | 3.0 | 3.3 | 3.6 | V | |
| Analog Supply Voltage | AVDD | 10.2 | 10.4 | 10.6 | V | |
| Gate On Voltage | VGH | 15.3 | 16.0 | 16.7 | V | |
| Gate Off Voltage | VGL | -7.7 | -7.0 | -6.3 | V | |
| Common Electrode Driving Signal | VCOM | 3.0 | 3.3 | 4.0 | V | |
| Input logic high voltage | VIH | 0.7DVDD | - | DVDD | V | |
| Input logic low voltage | VIL | 0 | - | 0.3DVDD | V | |

Note1：Please adjust VCOM to make the flicker level be minimum.

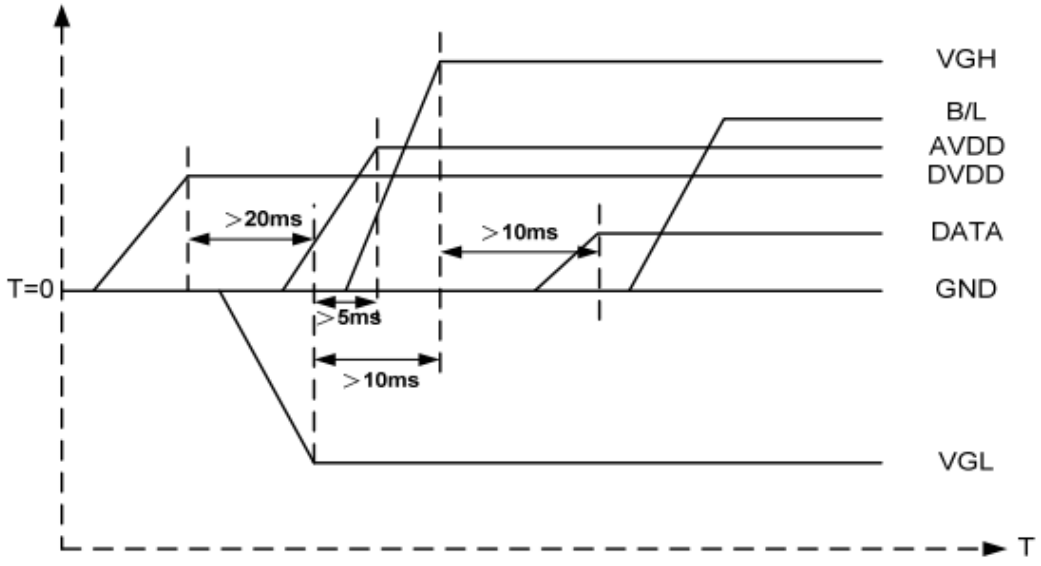
### 3.2 Current Consumption

| Item | Symbol | Values | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Current for Driver | $I_{GH}$ | - | 0.2 | 1.0 | mA | $V_{GH}$ =19.0V |
| | $I_{GL}$ | - | 0.2 | 1.0 | mA | $V_{GL}$=-6.0V |
| | $IDV_{DD}$ | - | 4.0 | 10 | mA | $DV_{DD}$ =3.3V |
| | $IAV_{DD}$ | - | 20 | 50 | mA | $AV_{DD}$ =9.6V |

## 3.3 Power Sequence

### 3.3.1 Power on:

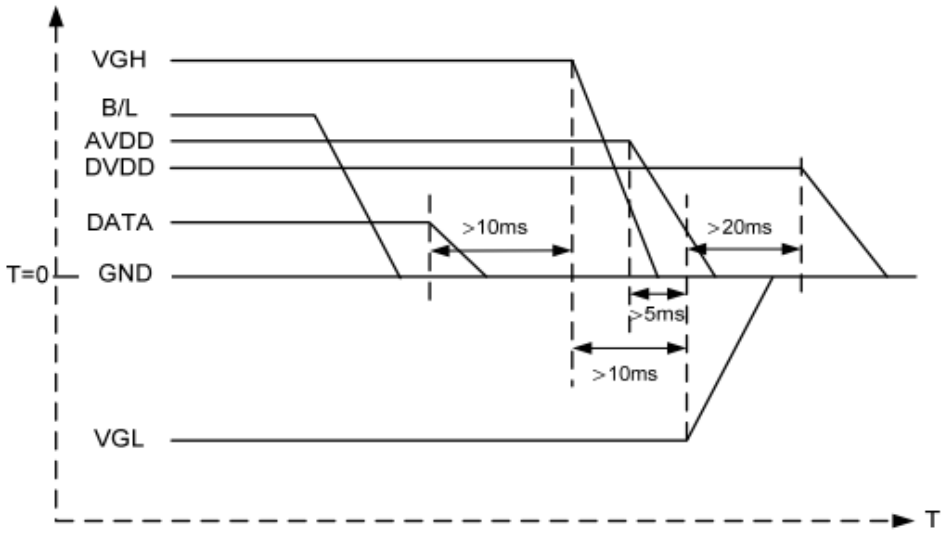
**a. Power on:**




$DV_{DD}$→VGL→AVDD→VGH→Data→B/L

### 3.3.2 Power off:

**b. Power off:**




B/L→Data→VGH→AVDD→VGL→$DV_{DD}$

Note: Data include R0~R7, B0~B7, GO~G7, U/D, L/R, DCLK, HS,VS,DE.

## 3.4 Timing characteristics

### 3.4.1 AC electrical characteristics

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| HS setup time | $T_{hst}$ | 8 | - | - | ns |
| HS hold time | $T_{hhd}$ | 8 | - | - | ns |
| VS setup time | $T_{vst}$ | 8 | - | - | ns |
| VS hold time | $T_{vhd}$ | 8 | - | - | ns |
| Data setup time | $T_{dsu}$ | 8 | - | - | ns |
| Data hold time | $T_{dhd}$ | 8 | - | - | ns |
| DE setup time | $T_{esu}$ | 8 | - | - | ns |
| DE hold time | $T_{ehd}$ | 8 | - | - | ns |
| VDD Power On Slew rate | $T_{POR}$ | - | - | 20 | ms |
| RSTB pulse width | $T_{Rst}$ | 10 | - | - | us |
| CLKIN cycle time | $T_{cph}$ | 20 | - | - | ns |
| CLKIN pulse duty | $T_{cwh}$ | 40 | 50 | 60 | % |
| Output stable time | $T_{sst}$ | - | - | 6 | us |

### 3.4.2 TTL mode data input format

- **Horizontal timing**

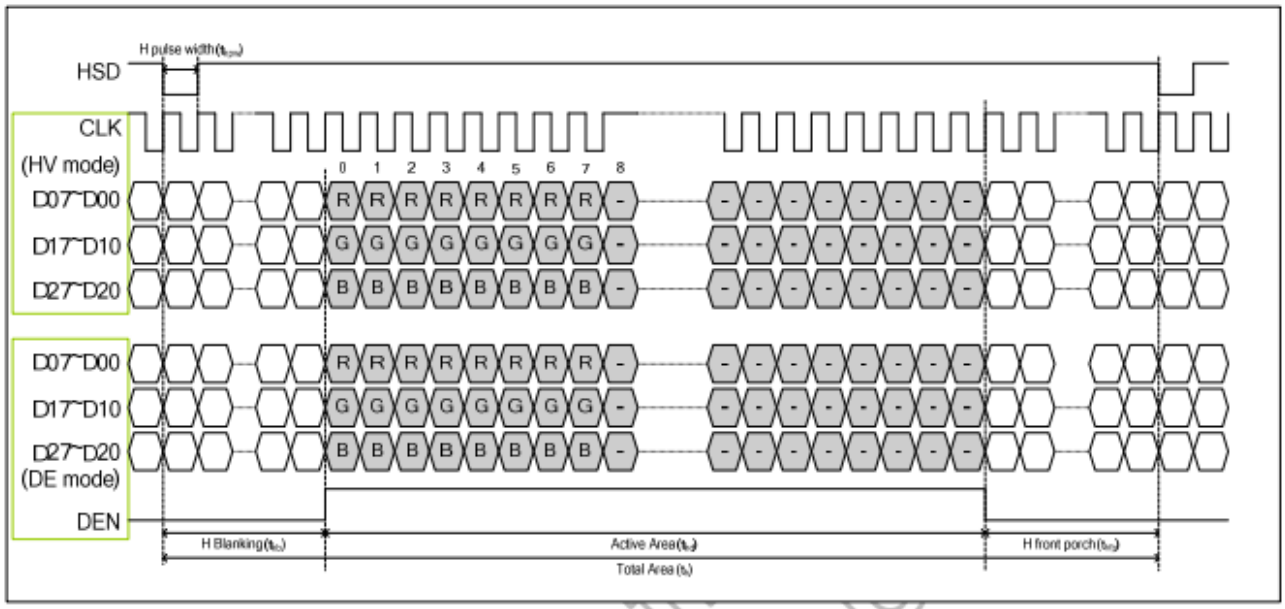



Figure 11. 1: Horizontal Input Timing Diagram

- **Vertical timing**

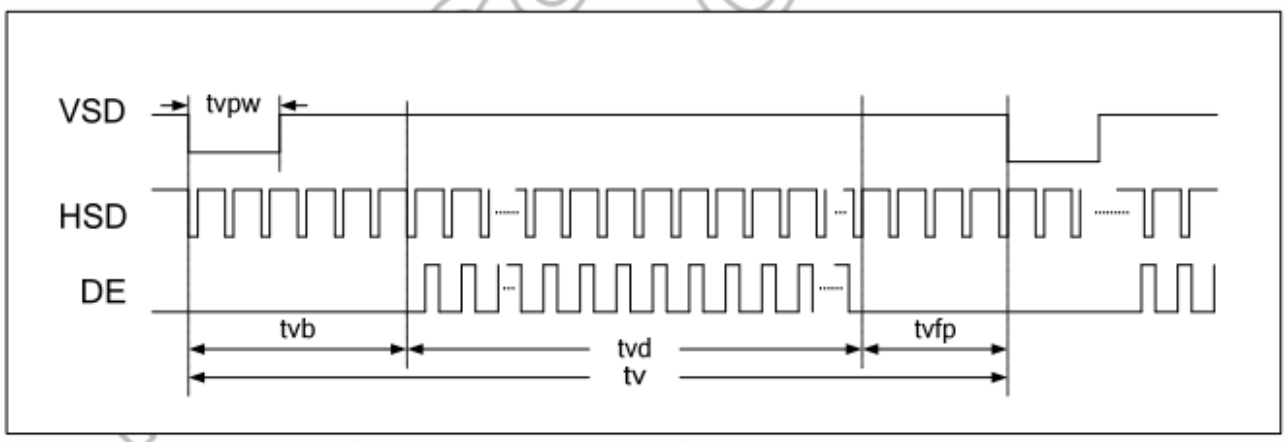



**Figure 11. 2: Vertical Input Timing Diagram**

### 3.4.3 Parallel RGB input timing

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Horizontal Display Area | thd | - | 800 | - | DCLK | |
| DCLK Frequency | fclk | 26.4 | 33.3 | 46.8 | MHz | |
| One Horizontal Line | th | 862 | 1056 | 1200 | DCLK | |
| HS pulse width | thpw | 1 | - | 40 | DCLK | |
| HS Blanking | thb | 46 | 46 | 46 | DCLK | |
| HS Front Porch | thfp | 16 | 210 | 354 | DCLK | |

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Vertical Display Area | tvd | - | 480 | - | TH | |
| VS period time | tv | 510 | 525 | 650 | TH | |
| VS pulse width | tvpw | 1 | - | 20 | TH | |
| VS Blanking | tvb | 23 | 23 | 23 | TH | |
| VS Front Porch | tvfp | 7 | 22 | 147 | TH | |

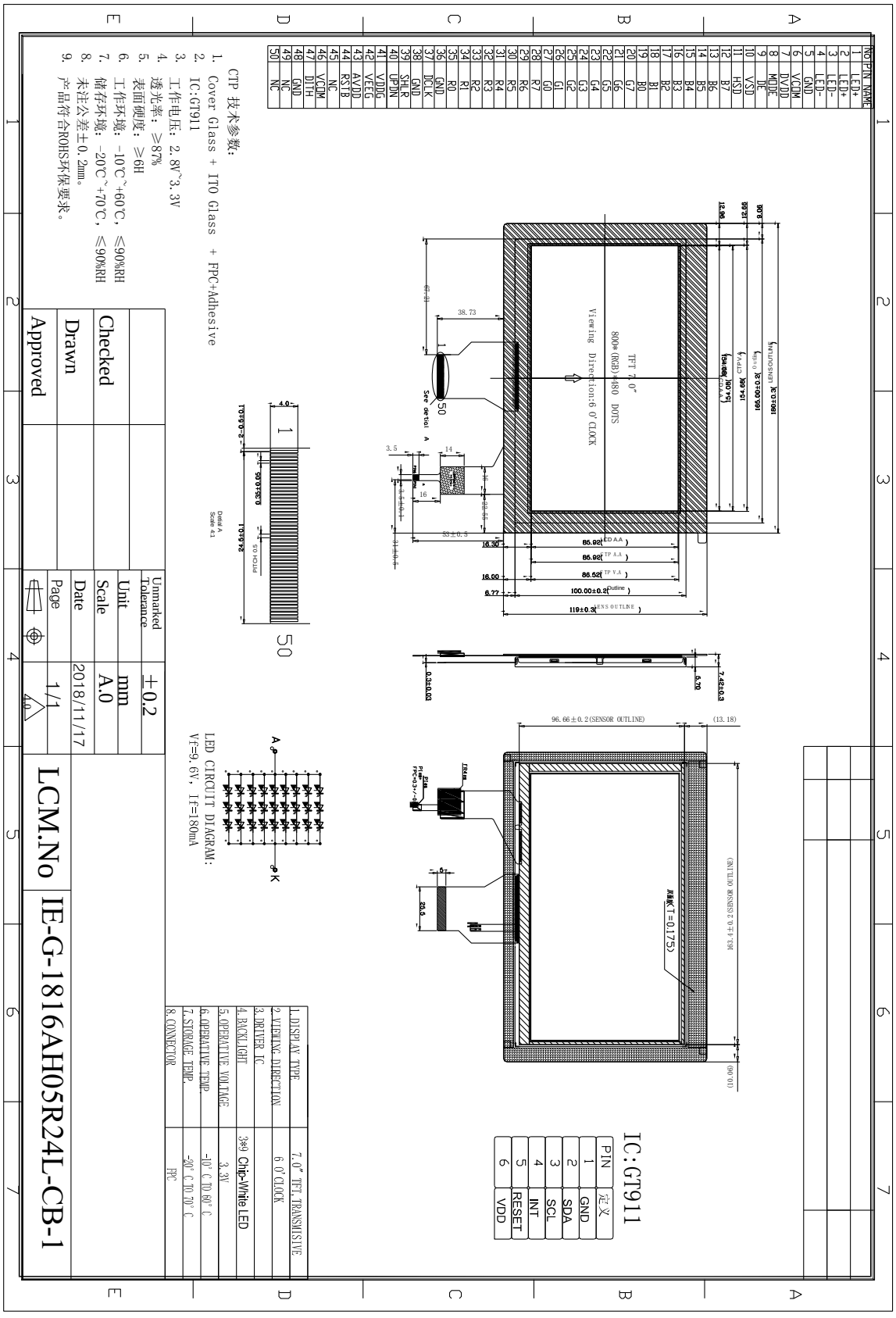
## 4. BACKLIGHT CHARACTERISTICS

| Item | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Forward Voltage | Vf | -- | 9.6 | -- | V | If=180mA |
| Forward Current | If | -- | 180 | - | mA | -- |
| Operating Life Time | -- | -- | 30000 | -- | Hrs | |

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃

Note 2: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data..

# 5. DIMENSIONAL DRAWING



# 6. INTERFACE PIN CONNECTIONS

| Pin No. | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | LED+ | - | LED+ | |
| 2 | LED+ | - | LED+ | |
| 3 | LED- | - | LED- | |
| 4 | LED- | - | LED- | |
| 5 | GND | P | Power ground | |
| 6 | VCOM | I | Common voltage | |
| 7 | DVDD | P | Power for Digital Circuit | |
| 8 | MODE | I | DE/SYNC mode select | NOTE 1 |
| 9 | DE | I | Data Input Enable | |
| 10 | VSD | I | Vertical Sync Input | |
| 11 | HSD | I | Horizontal Sync Input | |
| 12 | B7 | I | Blue data(MSB | NOTE 2 |
| 13 | B6 | I | Blue data | |
| 14 | B5 | I | Blue data | |
| 15 | B4 | I | Blue data | |
| 16 | B3 | I | Blue data | |
| 17 | B2 | I | Blue data | |
| 18 | B1 | I | Blue data | |
| 19 | B0 | I | Blue data(LSB) | NOTE 2 |
| 20 | G7 | I | Green data(MSB) | NOTE 2 |
| 21 | G6 | I | Green data | |
| 22 | G5 | I | Green data | |
| 23 | G4 | I | Green data | |
| 24 | G3 | I | Green data | |
| 25 | G2 | I | Green data | |
| 26 | G1 | I | Green data | |
| 27 | G0 | I | Green data(LSB) | NOTE 2 |
| 28 | R7 | I | Red data(MSB) | NOTE 2 |
| 29 | R6 | I | Red data | |
| 30 | R5 | I | Red data | |

| | | | | |
|---|---|---|---|---|
| 31 | R4 | I | Red data | |
| 32 | R3 | I | Red data | |
| 33 | R2 | I | Red data | |
| 34 | R1 | I | Red data | |
| 35 | R0 | I | Red data(LSB) | NOTE 2 |
| 36 | GND | P | Power Ground | |
| 37 | DCLK | I | Sample clock | NOTE 3 |
| 38 | GND | P | Power Ground | |
| 39 | SHLR | I | Left / right selection | NOTE 4,5 |
| 40 | UPDN | I | Up/down selection | NOTE 4,5 |
| 41 | VDDG | P | Gate ON Voltage | |
| 42 | VEEG | P | Gate OFF Voltage | |
| 43 | AVDD | P | Power for Analog Circuit | |
| 44 | RSTB | I | Global reset pin. | NOTE 6 |
| 45 | NC | - | No connection | |
| 46 | VCOM | I | Common Voltage | |
| 47 | DITH | I | Dithering function | NOTE 7 |
| 48 | GND | P | Power Ground | |
| 49 | NC | - | No connection | |
| 50 | NC | - | No connection | |

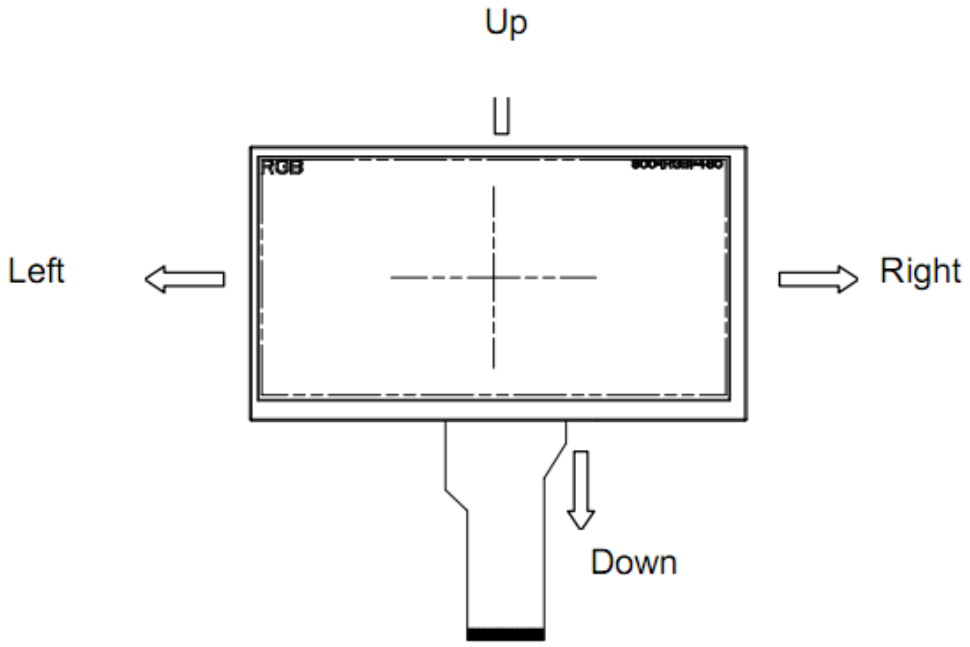
I: input, O: output, P: Power

Note 1: DE/SYNC mode select. Normally pull high.
When select DE mode, MODE="1", VS and HS must pull high.
When select SYNC mode, MODE= "0", DE must be grounded.
Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.
Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Selection of scanning mode

| Setting of scan control input | | Scanning direction |
|---|---|---|
| U/D | L/R | |
| GND | $DV_{DD}$ | Up to down, left to right |
| $DV_{DD}$ | GND | Down to up, right to left |
| GND | GND | Up to down, right to left |
| $DV_{DD}$ | $DV_{DD}$ | Down to up, left to right |

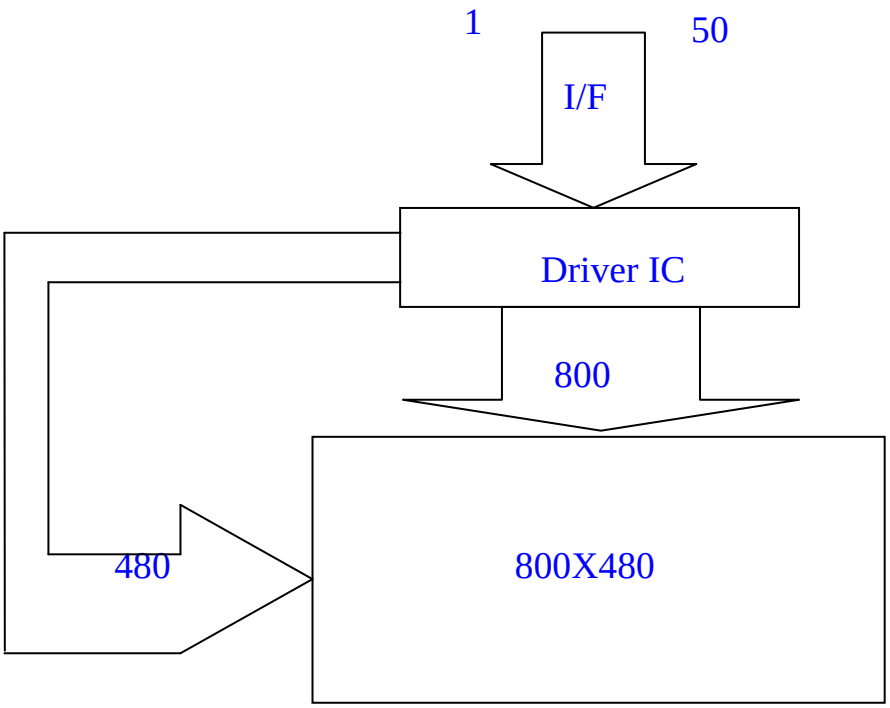
Note 5: Definition of scanning direction.
Refer to the figure as below:




Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.

Note 7: Dithering function enable control, normally pull high.
When DITHB="1",Disable internal dithering function,
When DITHB="0",Enable internal dithering function,

## 7. BLOCK DIAGRAM OF LCM



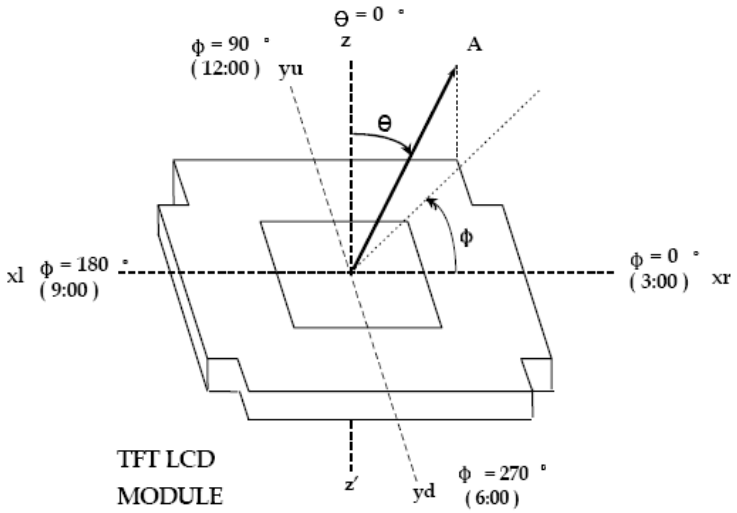
# 8. ELECTRO-OPTICAL CHARACTERISTICS

Optical characteristics are determined after the unit has been on and stable for approximately 30 minutes dark environment at 25℃.the value specified are at an approximate distance 500mm from the LCD surface at a viewing angle and θ equal to 0

## 8.1 LCD Optical Characteristics

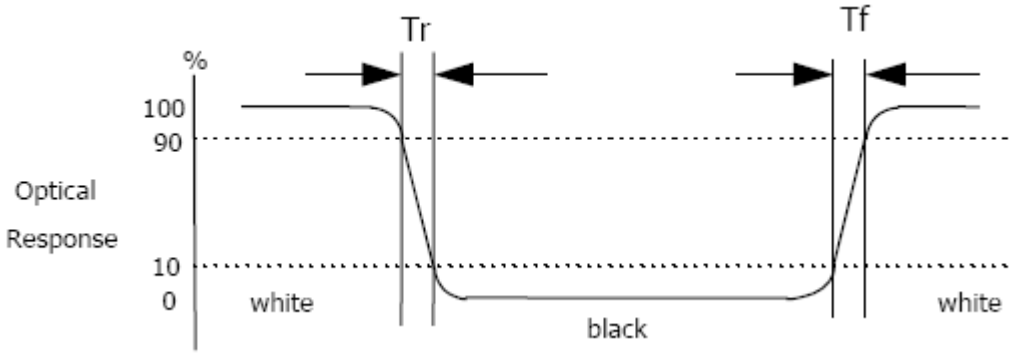
| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| **Viewing Angle** | Φ=3 O'clock | θ | Cr > 10 | 60 | 70 | - | deg | Note 1 |
| | Φ=9 O'clock | | | 60 | 70 | - | | |
| | Φ= 6 O'clock | | | 60 | 70 | - | | |
| | Φ=12 O'clock | | | 40 | 50 | - | | |
| **Response time** | | Tr+Tf | θ=0 Φ=0 | - | 25 | - | ms | Note 2 |
| **Contrast ratio** | | Cr | | 400 | 500 | - | | Note 3 |
| **CIE(x,y) chromaticity** | RED | X | θ=0 Φ=0 | - | - | - | - | Note 4 |
| | | Y | | - | - | - | | |
| | GREEN | X | | - | - | - | | |
| | | Y | | - | - | - | | |
| | BLUE | X | | - | - | - | | |
| | | Y | | - | - | - | | |
| | WHITE | X | | - | - | - | | |
| | | Y | | - | - | - | | |
| **Uniformity(%)** | | - | - | 80 | - | - | - | Note 5 |
| **Luminance** | | L | - | - | 400 | - | - | Note 6 |

**Note 1. LCD Viewing Angle**




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

**Note 2. Response time**




Response time is the time required for the display to transition from white to black (Rising time, Tr) and from black to white (Falling time, Tf).for additional information

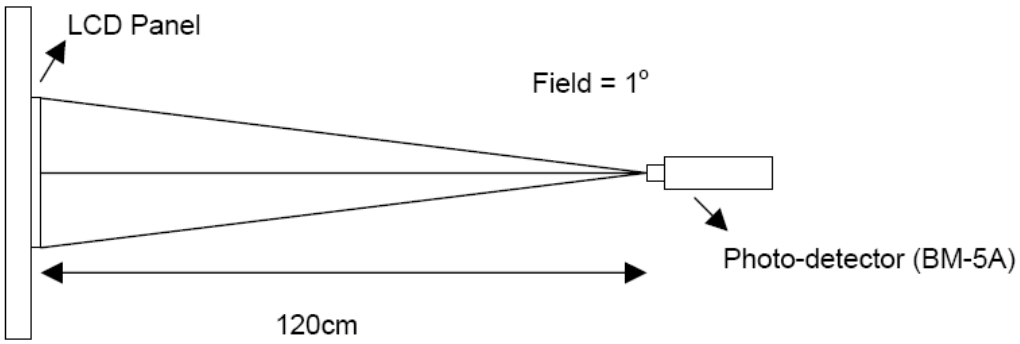
**Note 3. Contrast Ratio(CR)**

Contrast Ratio(CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Surface luminance is the center point across the lcd surface 500mm from the surface with all pixels displaying white.

**Note 4. Definition of optical measurement setup**

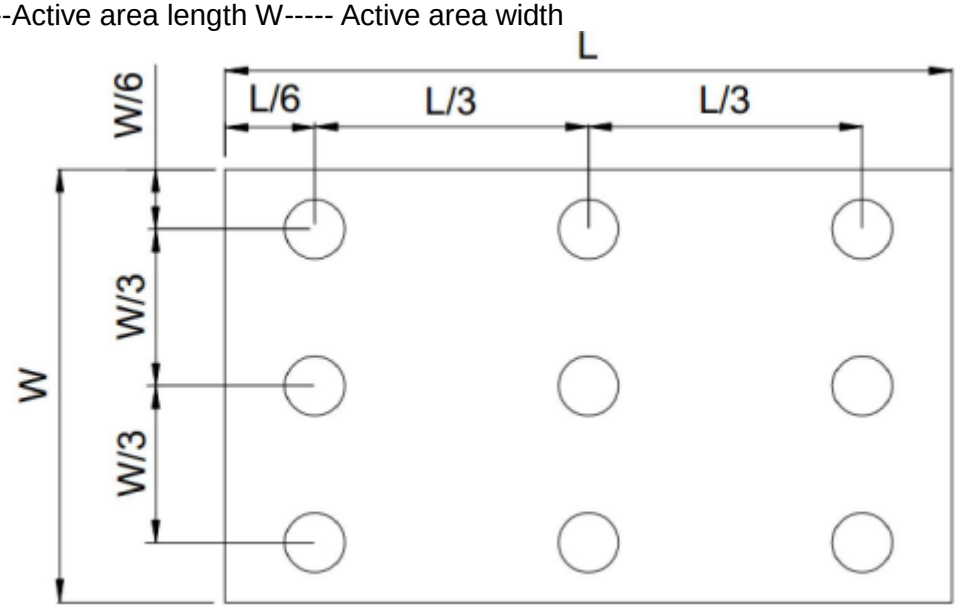



**Note 5. Definition of luminance uniformity**

Active area is divided into 9 measuring areas . Every measuring point is placed at the center of each measuring area.

Luminance Uniformity(U) = Lmin/ Lmax

L-------Active area length W----- Active area width




Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

**Note 6. Definition of luminance:**

Measure the luminance of white state at center point.

# 9.0 TOUCH PANEL SPECIFICATION

## 9.1 General Specification

| Item | Display Panel | Remark |
|---|---|---|
| Size | 7.0 inch | / |
| Outline Dimension | 180.0 x 119.0 x 1.7 | mm |
| View Area | 154.68 x 86.52 | mm |
| Sensor Area | 163.4 x 96.66 | mm |
| Touch Panel Structure | G+G | / |
| Surface Hardness | ≧6H | / |
| Transmittance | ≧87% | / |
| Controller IC | GT911 | / |
| Interface Type | I2C | / |
| Operating temperature &Humidity | -10℃～+60℃: 45%～90%RH | / |
| Storage temperature &Humidity | -20℃～+70℃: 45%～90%RH | / |

## 9.2 FPC PIN Assignment

| Pin.No | Symbol | Function |
|---|---|---|
| 1 | GND | Ground |
| 2 | SDA | IIC_SDA |
| 3 | SCL | IIC_SCL |
| 4 | INT | IIC_INT |
| 5 | RESET | IIC_RESET |
| 6 | VDD | Power supply3.3v |

# 10.0 INSPECTION CRITERIA

## 10.1 Inspection Conditions

### 10.1.1 Environmental conditions

The environmental conditions for inspection shall be as follows

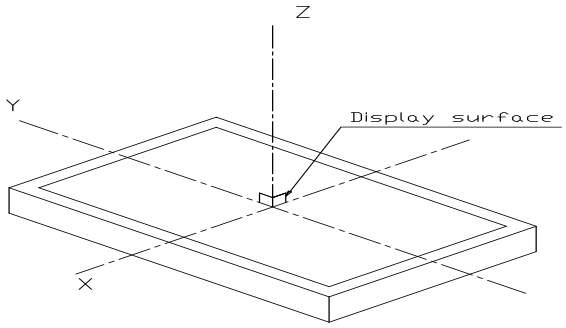
Room temperature: 20±3°C

Humidity: 65±20%RH

### 10.1.2 Environmental conditions

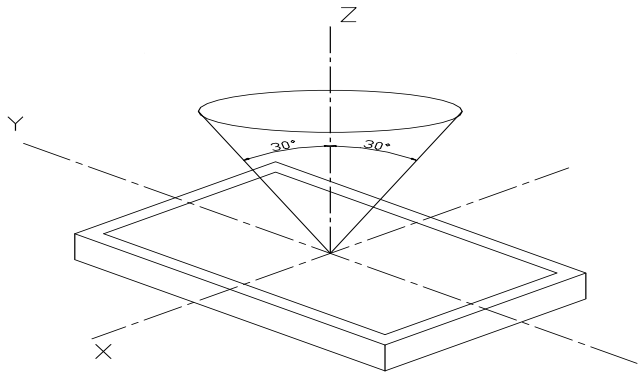
With a single 20-watt fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

## 10.2 Light Method




Fluorescent lamp perpendicular to the display surface

Inspection distance and angle




Inspection should be performed within angle φ (φ is usually 30°) from Z axis to each X and Y.

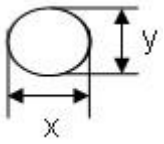
Inspection distance in any direction within φ must be kept 30±5cm from the display surface.

## 10.3 Classification of defects

### 10.3.1 Major defect

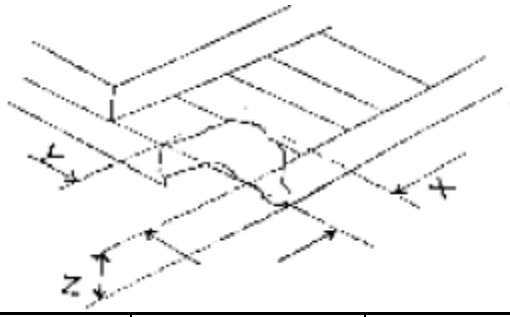
| No. | Item | Inspection Standard | Classification of defects |
|---|---|---|---|
| 1 | All functional defects | 1) No display<br>2) Display abnormally<br>3) Open or missing segment<br>4) Short circuit<br>5) Excess power consumption<br>6) Backlight no lighting, flickering and abnormal lighting | Major |
| 2 | Missing | Missing component | Major |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed | Major |

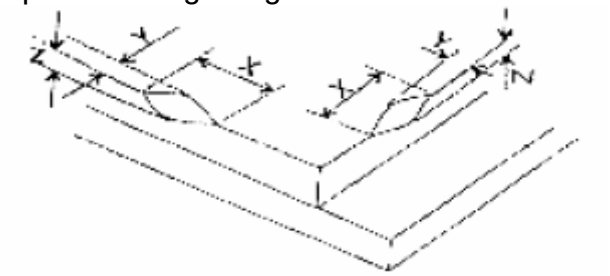
### 10.3.2 Cosmetic Defect

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">(spot defect)<br>Black and White spot pinhole</td><td>For dark/white spot, size Φ is defined as Φ=(x+y)/2</td><td> 
</td><td rowspan="2">Minor</td></tr>
<tr><td colspan="2"><table>
<tr><th>Size Φ (mm)</th><th>Acceptable Quantity</th></tr>
<tr><td>Φ≤0.10</td><td>Ignore</td></tr>
<tr><td>0.10<Φ≤0.20</td><td>2</td></tr>
<tr><td>0.20<Φ≤0.30</td><td>2</td></tr>
<tr><td>0.30<Φ</td><td>0</td></tr>
</table></td></tr>
<tr><td>2</td><td>(line defect)<br>Black and White line</td><td colspan="2">Define: 
</td><td>Minor</td></tr>
</table>

<table>
<tr><td></td><td>Polarizer scratch</td><td><table><tr><th>Width(mm)</th><th>Length(mm);Acceptable Qty</th></tr><tr><td>Φ≤0.03 L≤1.0</td><td>Ignore</td></tr><tr><td>0.03<W≤0.05</td><td>L≤3.0; N≤2</td></tr><tr><td>0.05<W or L>3.0</td><td>Define as spot defect</td></tr></table></td><td></td></tr>
<tr><td>3</td><td>Polarizer defect</td><td>Dent or bubble(between the polarizer and glass)<table><tr><th>Size Φ(mm)</th><th>Acceptable Qty</th></tr><tr><td>Φ≤0.10</td><td>Ignor</td></tr><tr><td>0.10<Φ≤0.2</td><td>2</td></tr><tr><td>0.20<Φ≤0.30</td><td>1</td></tr><tr><td>0.30<Φ</td><td>0</td></tr></table></td><td>Minor</td></tr>
</table>

**10.3.3 Cosmetic Defect**

<table>
<tr><th>No.</th><th>Item</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td>1</td><td>Glass defect</td><td>1) Chip on the corner<br>  <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0</td><td>≤S</td><td>≤T</td></tr></table>Remark: S=contact pad length;<br>T=the thickness of glass<br>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal. Acceptable Quantity N≤2.</td><td>Minor</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>2) Chip on the edge of glass<br>  <br>
<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>Ignore</td><td>≤0.5</td><td>≤T</td></tr>
</table>
Acceptable Quantity: N≤2</td>
<td>Minor</td>
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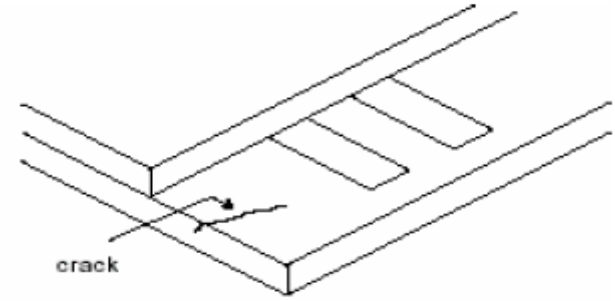
<tr>
<td></td>
<td></td>
<td>3) Creak<br>Creaks tend to break are not allowed.<br> 
</td>
<td>Minor</td>
</tr>
</table>

## 11.0 LIABILITY AND INSPECTION STANDARD

| NO. | Test Item | Test condition | Criterion |
|---|---|---|---|
| 1 | High Temperature Storage | 70℃±2℃ 96H<br>Restore 2H at 25℃<br>Power off | After testing, cosmetic and electrical defects should not happen. |
| 2 | Low Temperature Storage | -20℃±2℃ 96H<br>Restore 2H at 25℃<br>Power off | |
| 3 | High Temperature Operation | 60℃±2℃ 96H<br>Restore 2H at 25℃<br>Power on | |
| 4 | Low Temperature Operation | -10℃±2℃ 96H<br>Restore 2H at 25℃<br>Power on | |
| 5 | High Temperature & Humidity Storage | 60℃±2℃ 90%RH 96H<br>Power off | |
| 6 | Temperature Cycle | --20℃←→25℃←→70℃<br>30min 5min 30min<br>after 10cycle, Restore 2H at 25℃ Power off | |
| 7 | Vibration Test | 10Hz~150Hz, 100m/s2, 120min | |
| 8 | Shock Test | Half-sinewave,300m/s2,11ms | |
| 9 | Drop Test(package state) | 600mm, concrete floor,1corner, 3edges, 6 sides each time | 1.After testing, cosmetic and electrical defects should not happen.<br>2.The product should remain at initial place.<br>3.Product uncovered or package broken is not permitted. |

# 12 .0 PRECAUTIONS FOR USING LCD MODULE

## 12.1 Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile, it tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make

sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

### 12.2 Storage Precautions

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

### 12.3 Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.