AGTechnologies
LCD Displays

SPECIFICATION

# AGM 4004B-207

Atualizado em 18/04/19.

# Revision Status

| Version | Revise Date | Page | Content | Modified By |
|---|---|---|---|---|
| VER 1.0 | 2010/07/30 | | First Issued | |
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# Table of Contents

## No. Contents Page

# 1. Features

The features of LCD are showed as follows

* Display mode : STN/Yellow-Green/Transflective/Positive/anit-UV
* Controller IC : SPLC780D1-001(English-Japanese)
* Display format : 40X4Characters
* Interface Input Data : 8 bit or 4bit MPU
* Driving Method : 1/16Duty, 1/5Bias
* Viewing Direction : 6 O'clock
* Backlight : LED Unit /Yellow-Green/Bottom
* Sample NO. : AGM 4004B-207

# 2. MECHANICAL SPECIFICATIONS

| Item | Specification | Unit |
|---|---|---|
| Module Size | 190(W) x54(H) x14MAX(D) | mm |
| Viewing Area | 149(H) x 30(V) | mm |
| Activity Display Area | 140.45(H)x23.16(V) | mm |
| Character Font | 5x8 Dots | - |
| Character Size | 2.78(H)x4.89(V) | mm |
| Character Pitch | 3.53(H)x6.09(V) | mm |
| Dot Size | 0.50(H)x0.55(V) | mm |

# 3. ELECTRICAL SPECIFICATIONS

3-1 ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

| Item | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage For Logic | $V_{DD}$ | 0.3 | 7.0 | V |
| Supply Voltage For LCD Drive | $V_{LCD}$ | VDD-10 | VDD+0.3 | V |
| Input Voltage | Vin | -0.3 | VDD+0.3 | V |
| Operating Temp. | Top | -20 | +70 | °C |
| Storage Temp. | Tst | -30 | +80 | °C |

*****. NOTE: The response time will be extremely slow when the operating temperature is around -10℃ and the back ground will become darker at high temperature operating.

3-2 ELECTICAL CHARACTERISTICS

| Item | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Logic supply Voltage | | $V_{DD} - V_{SS}$ | Ta = 25 °C | 4.5 | 5.0 | 5.5 | V |
| LCD Drive | | $V_{OP}=V_{DD}-V_0$ | | 4.27 | 4.57 | 4.87 | V |
| Input Voltage | "H" Level | $V_{IH}$ | $V_{DD}$=5V±5% | 0.7VDD | - | $V_{DD}$ | V |
| | "L" Level | $V_{IL}$ | | -0.3 | - | 0.55 | V |
| Frame Frequency | | $f_{FLM}$ | | - | 78.1 | | Hz |
| Current Consumption | | $I_{DD}$ | | - | 2.6 | - | mA |

3-3.BACKLIGHT

3-3-1.Absolute Maximum Ratings

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Current | IF | Ta = 25 °C | - | - | 500 | mA |
| Reverse Voltage | VR | | - | - | 10 | V |
| Power Dissipation | PD | | - | 5000 | - | mW |

3-3-2.Electrical-optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage | VF | Ta = 25 °C If=500mA | 4.0 | 4.2 | 4.4 | V |
| Peak wavelength | λ | | 568 | 572 | 575 | nm |

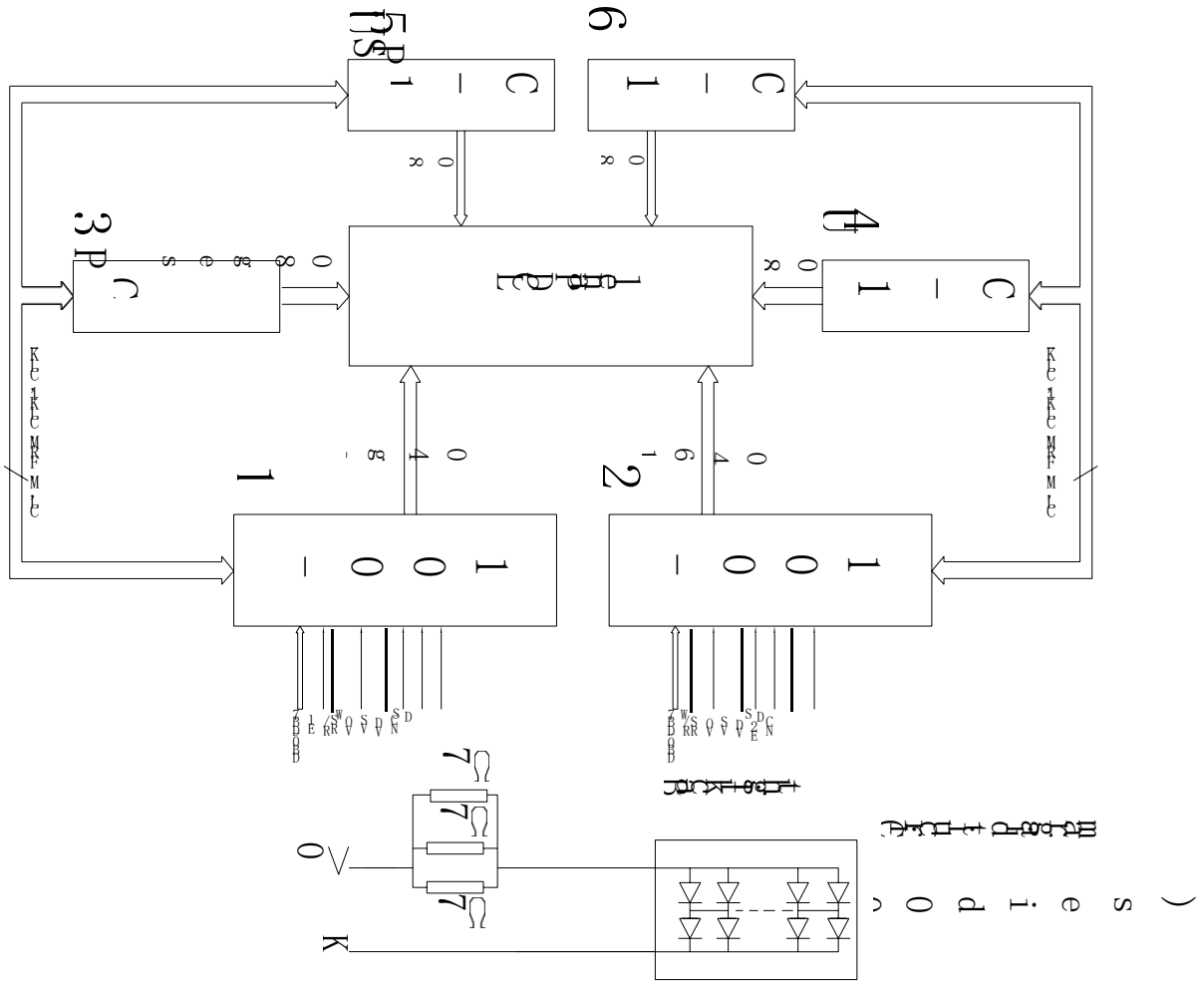
The brightness is measured without LCD panel

# 4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

## 4-1 INTERFACE PIN FUNCTION DESCRIPTION

| PIN NO. | SYMBOL | FUNCIONS |
|---|---|---|
| 1-8 | DB7~DB0 | 8 Bit Data Bus |
| 9 | E1 | Chip selection signal |
| 10 | R/W | A signal for selecting read or write actions.1: Read, 0: Write. |
| 11 | RS | A signal for selecting registers.<br>1: Data Register (for read and write)<br>0: Instruction Register (for write) |
| 12 | V0 | Supply voltage for LCD driving |
| 13 | VSS | Ground |
| 14 | VDD | Supply voltage for logical circuit |
| 15 | E2 | Chip selection signal |
| 16 | N/C | Not Connect |
| 17 | LEDA | Backlight (+5.0) |
| 18 | LEDK | Backlight(-) |

**4-2 BLOCK DIAGRAM**

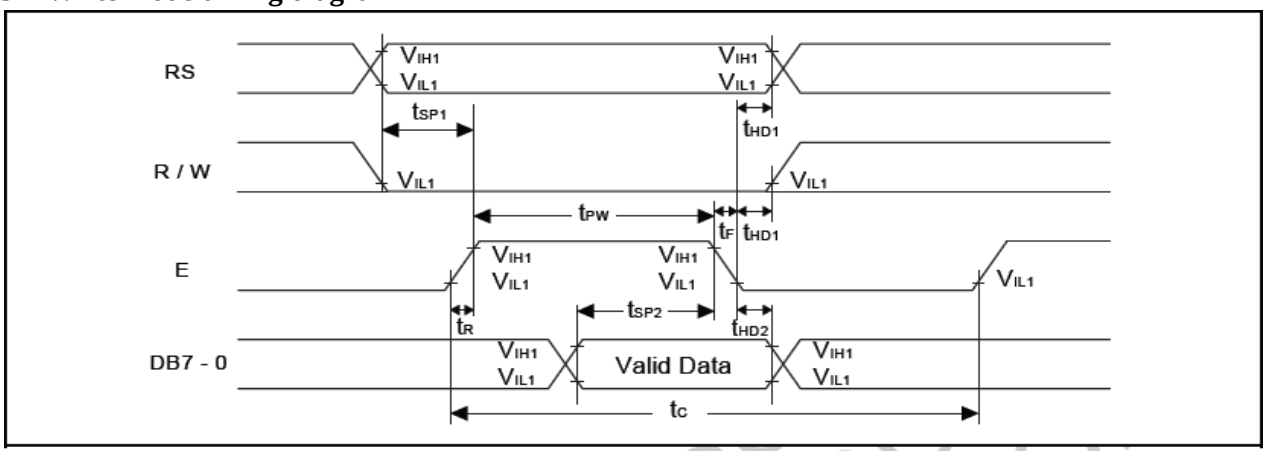


# 5. TIMING CHARACTERISTICS

## 5 - 1 Write mode

| Characteristics | Symbol | Limit | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| E Cycle Time | $t_C$ | 400 | - | - | ns | Pin E |
| E Pulse Width | $t_{PW}$ | 150 | - | - | ns | Pin E |
| E Rise/Fall Time | $t_R$, $t_F$ | - | - | 25 | ns | Pin E |
| Address Setup Time | $t_{SP1}$ | 30 | - | - | ns | Pins: RS, R/W, E |
| Address Hold Time | $t_{HD1}$ | 10 | - | - | ns | Pins: RS, R/W, E |
| Data Setup Time | $t_{SP2}$ | 40 | - | - | ns | Pins: DB0 - DB7 |
| Data Hold Time | $t_{HD2}$ | 10 | - | - | ns | Pins: DB0 - DB7 |

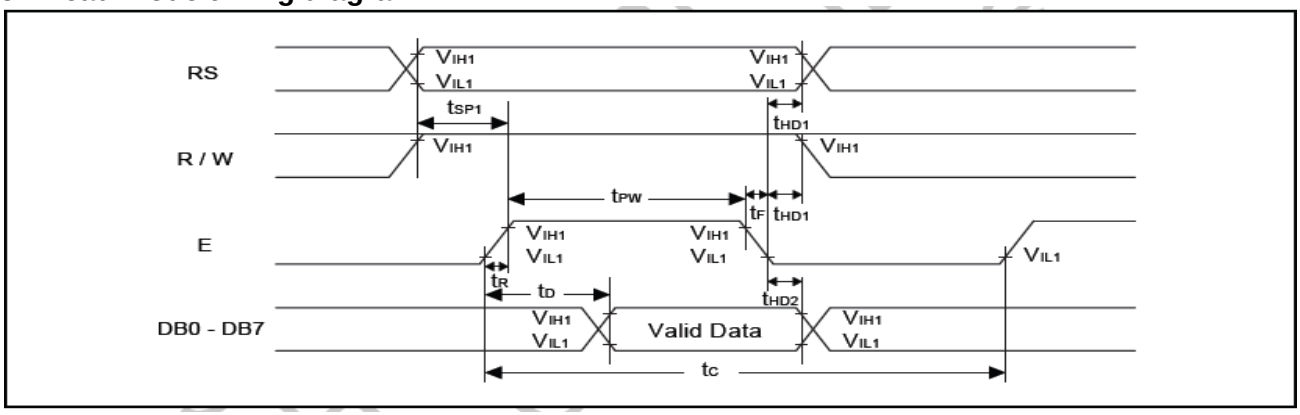
## 5-2 Write mode timing diagram




## 5.3 Read mode

| Characteristics | Symbol | Limit | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| E Cycle Time | $t_C$ | 400 | - | - | ns | Pin E |
| E Pulse Width | $t_W$ | 150 | - | - | ns | Pin E |
| E Rise/Fall Time | $t_R$, $t_F$ | - | - | 25 | ns | Pin E |
| Address Setup Time | $t_{SP1}$ | 30 | - | - | ns | Pins: RS, R/W, E |
| Address Hold Time | $t_{HD1}$ | 10 | - | - | ns | Pins: RS, R/W, E |
| Data Output Delay Time | $t_D$ | - | - | 100 | ns | Pins: DB0 - DB7 |
| Data hold time | $t_{HD2}$ | 5.0 | - | - | ns | Pin DB0 - DB7 |

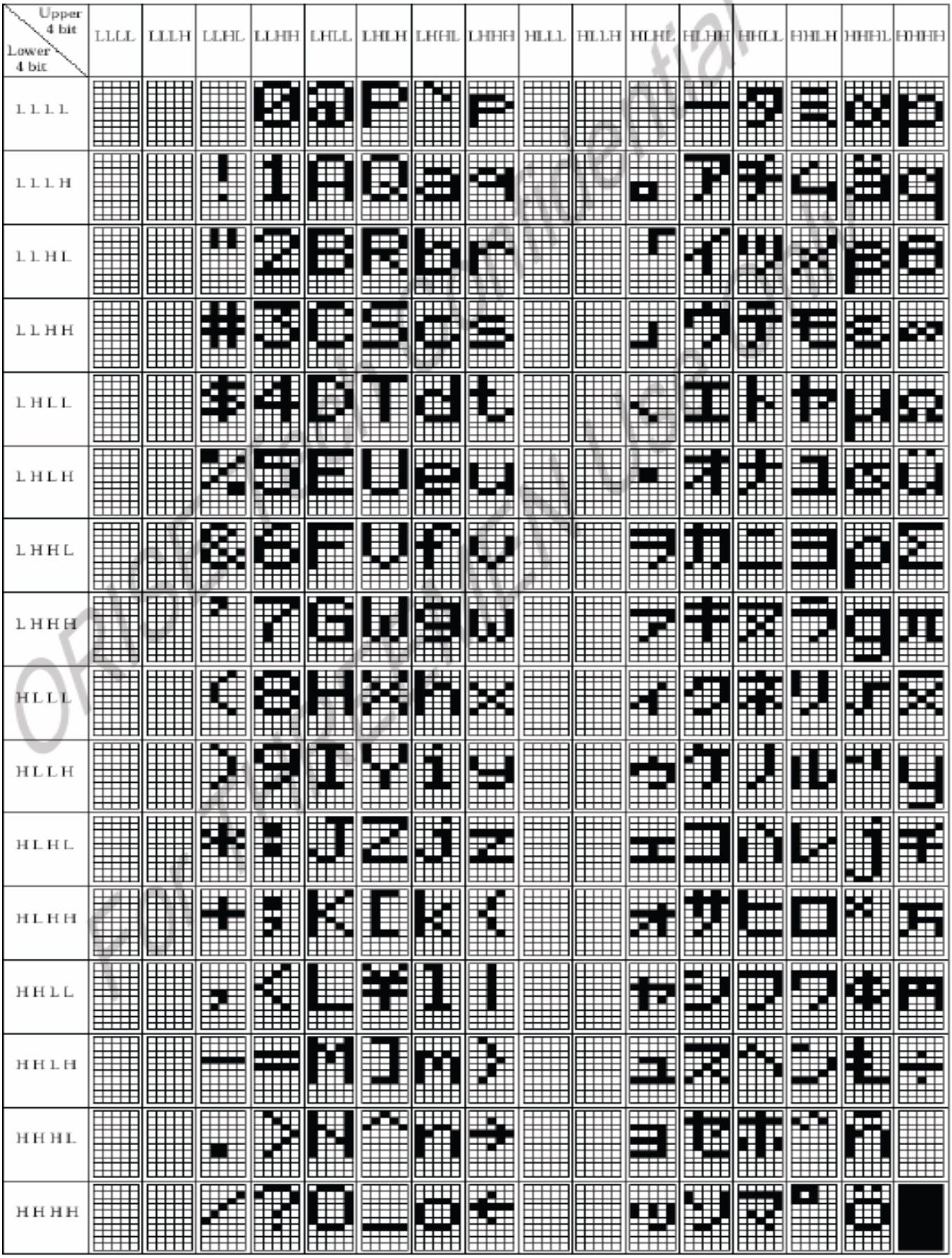
## 5-4Read mode timing diagram



# 6. COMMAND LIST

| Instruction | Instruction Code | | | | | | | | | | Description | Execution time (Temp = 25℃) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RS | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | Fosc= 190KHz | Fosc= 270KHz | Fosc= 350KHz |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write "20H" to DDRAM and set DDRAM address to "00H" from AC | 2.16ms | 1.52ms | 1.18ms |
| Return Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | - | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 2.16ms | 1.52ms | 1.18ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Assign cursor moving direction and enable the shift of entire display | 53μs | 38μs | 29μs |
| Display ON/ OFF Control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Set display (D), cursor(C), and blinking of cursor(B) on/off control bit. | 53μs | 38μs | 29μs |
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | - | - | Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data. | 53μs | 38μs | 29μs |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | - | - | Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots) | 53μs | 38μs | 29μs |
| Set CGRAM Address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter. | 53μs | 38μs | 29μs |
| Set DDRAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter | 53μs | 38μs | 29μs |
| Read Busy Flag and Address Counter | 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read. | | | |
| Write Data to RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM). | 53μs | 38μs | 29μs |
| Read Data from RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM). | 53μs | 38μs | 29μs |

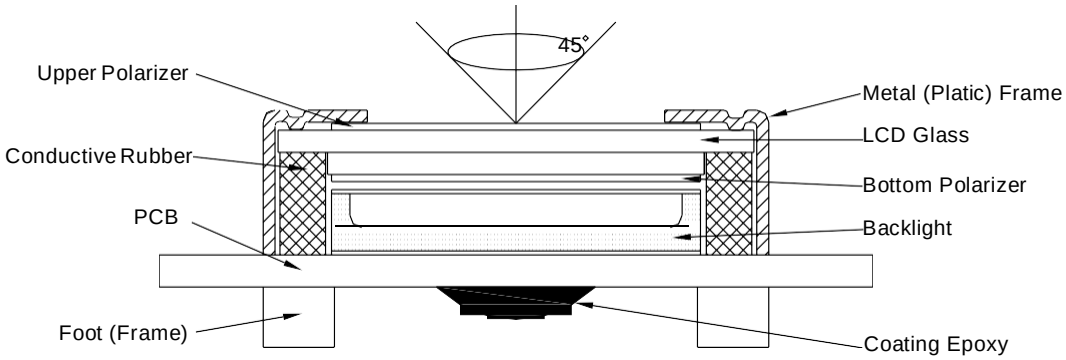
# 7. CHARACTER GENERATOR ROM



# 8. QUALITY SPECIFICATIONS

## 8 - 1. LCM Appearance and Electric inspection Condition

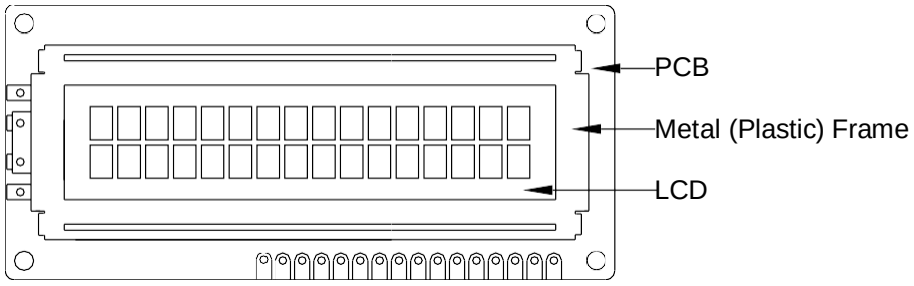
1. **Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.**



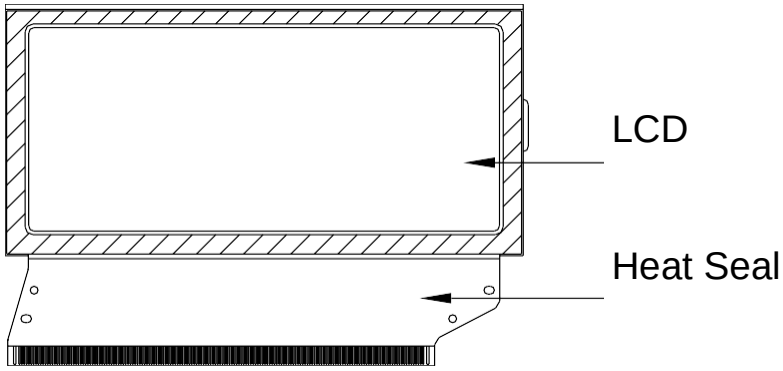

2. **View Angle: with in 45˚around perpendicular line.**

## 8- 2. Definition

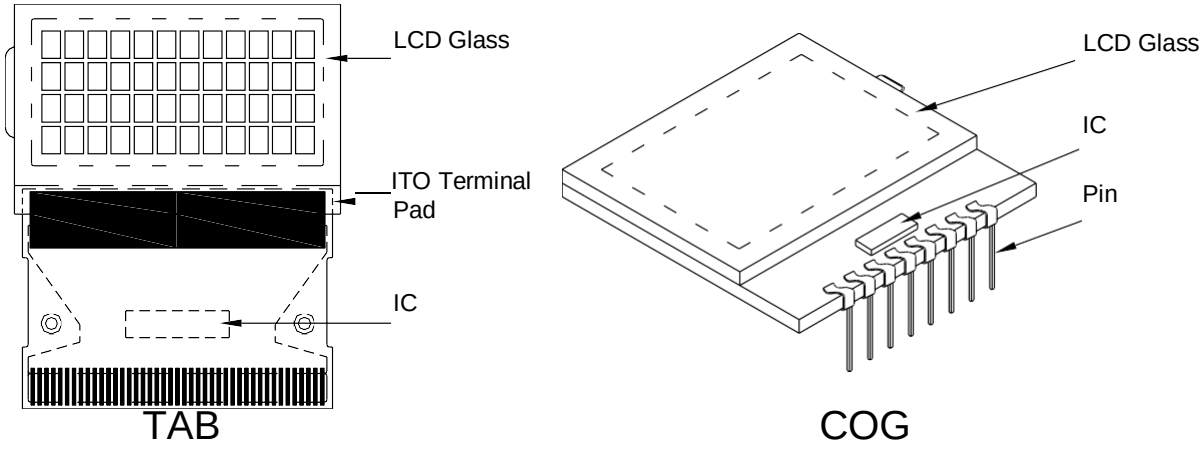
1. **COB**




2. **Heat Seal**




3. **TAB and COG**



## 8-3. Sampling Plan and Acceptance

1.Sampling Plan

MIL - STD - 105E ( || ) ordinary single inspection is used.

2.Acceptance

Major defect: AQL = 0.25%

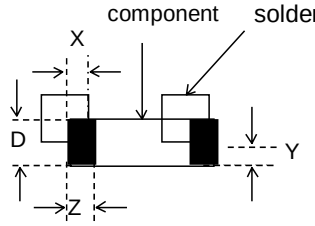
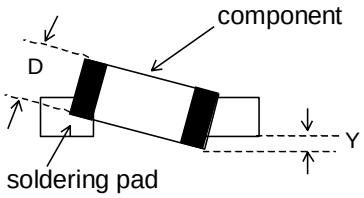
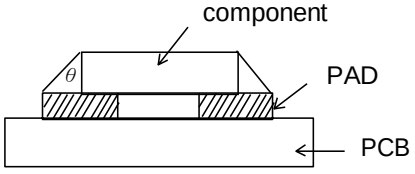
Minor defect: AQL = 0.65%

## 8-4. Criteria

### 1. COB

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Major | PCB copper flakes peeling off | Any copper flake in viewing Area should be greater than 1.0mm$^2$ | Reject |
| Major | Height of coating epoxy | Exceed the dimension of drawing | Reject |
| Major | Void or hole of coating epoxy | Expose bonding wire or IC | Reject |
| Major | PCB cutting defect | Exceed the dimension of drawing | Reject |

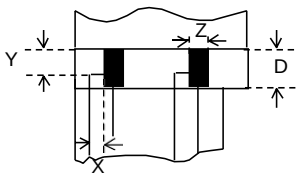
### 2. SMT

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Minor | Component marking not readable | | Reject |
| Minor | Component height | Exceed the dimension Of drawing | Reject |
| Major | Component solder defect (missing , extra, wrong component or wrong orientation | | Reject |
| Minor | Component position shift   | X < 3/4Z<br>Y > 1/3D | Reject |
| Minor | Component tilt   | Y > 1/3D | Reject |
| Minor | Insufficient solder   | $\theta \leq 20^\circ$ | Reject |

**3. Metal (Plastic) Frame**

| Defect | Inspection Item | Inspection Standards | | |
|---|---|---|---|---|
| Major | Crack / breakage | Anywhere | | Reject |
| Minor | Frame Scratch | W | L | Acceptable of Scratch |
| | | w<0.1mm | Any | Ignore |
| | | 0.1≤w<0.2mm | L≤5.0mm | 2 |
| | | 0.2<w<0.3mm | L<3.0mm | 1 |
| | | w>0.3mm | Any | 0 |
| | | Note: 1. Above criteria applicable to scratch lines with distance greater than 5mm.<br>2. Scratch on the back side of frame (not visible) can be ignored. | | |
| Minor | Frame Dent , Prick<br>$\Phi = \frac{L + W}{2}$ | | | Acceptable of Dents / Pricks |
| | | $\Phi \leq 1.0$mm | | 2 |
| | | $1.0 < \Phi \leq 1.5$mm | | 1 |
| | | $1.5\text{mm} < \Phi$ | | 0 |
| | | Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm<br>2. Dent / prick on the back side of frame (not visible) can be ignored | | |
| Minor | Frame Deformation | Exceed the dimension of drawing | | |
| Minor | Metal Frame Oxidation | Any rust | | |

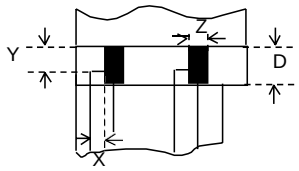
**4. Flexible Film Connector (FFC)**

| Defect | Inspection Item | | Inspection Standards | |
|---|---|---|---|---|
| Minor | Tilted soldering | | Within the angle +5° | Acceptable |
| Minor | Uneven solder joint /bump | | | Reject |
| Minor | Hole | $\Phi = \frac{L + W}{2}$ | Expose the conductive line | Reject |
| | | | $\Phi$ > 1.0mm | Reject |
| Minor | Position shift   | | Y > 1/3D | Reject |
| | | | X > 1/2Z | Reject |

**5. Screw**

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Major | Screw missing/loosen | | Reject |
| Minor | Screw oxidation | Any rust | Reject |
| Minor | Screw deformation | Difficult to accept screw driver | Reject |

**6. Heatseal 、TCP 、FPC**

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Major | Scratch expose conductive layer | | Reject |
| Minor | HS Hole $\Phi = \frac{L + W}{2}$ | $\Phi$> 0.5mm | Reject |
| Major | Adhesion strength | Less than the specification | Reject |
| Minor | Position shift   | Y > 1/3D | Reject |
| | | X > 1/2Z | Reject |
| Major | Conductive line break | | Reject |

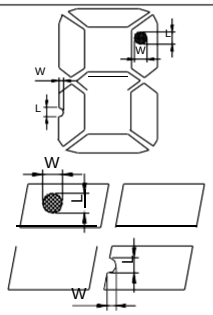
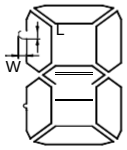
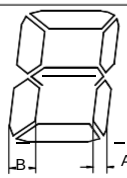
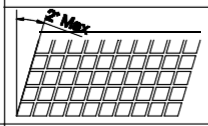
**7. LED Backing Protective Film and Others**

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Minor | LED dirty, prick | Acceptable number of units | |
| | | $\Phi \leq$0.10mm | ignore |
| | | 0.10< $\Phi \leq$0.15mm | 2 |
| | | 0.15< $\Phi \leq$0.2mm | 1 |
| | | $\Phi$>0.2mm | 0 |
| | | The distance between any two spots should be $\geq$5mm<br>Any spot/dot/void outside of viewing area is acceptable | |
| Minor | Protective film tilt | Not fully cover LCD | Reject |
| Major | COG coating | Not fully cover ITO circuit | Reject |

**8. Electric Inspection**

| Defect | Inspection Item | Inspection Standards | |
|---|---|---|---|
| Major | Short | | Reject |
| Major | Open | | Reject |

## 9. Inspection Specification of LCD

<table>
<tr><th>Defect</th><th colspan="2">Inspect Item</th><th colspan="5">Inspection Standards</th></tr>
<tr><td rowspan="4">Minor</td><td rowspan="4">Linear Defect</td><td rowspan="4">∗ Glass Scratch<br>∗ Polarizer Scratch<br>∗ Fiber and Linear material</td><td>W</td><td colspan="2">W<0.03</td><td colspan="2">0.03<W<0.05</td><td>W>0.05</td></tr>
<tr><td>L</td><td colspan="2">L<5</td><td colspan="2">L<3</td><td>Any</td></tr>
<tr><td>ACC. NO.</td><td colspan="2">1</td><td colspan="2">1</td><td>Reject</td></tr>
<tr><td>Note</td><td colspan="5">L is the length and W is the width of the defect</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Black Spot and Polarizer Pricked</td><td rowspan="3">∗ Foreign material between glass and polarizer or glass and glass<br>∗ Polarizer hole or protuberance by external force</td><td>Φ</td><td>Φ≤0.1</td><td>0.1<Φ≤0.15</td><td>0.15<Φ≤0.2</td><td>Φ>0.2</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm²</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="4">Φ is the average diameter of the defect.<br>Distance between two defects > 10mm.</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">White Spot and Bubble in polarizer</td><td rowspan="3">∗ Unobvious transparent foreign material between glass and glass or glass and polarizer<br>∗ Air protuberance between polarizer and glass</td><td>Φ</td><td>Φ≤0.3</td><td>0.3<Φ≤0.5</td><td>0.5<Φ</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm²</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="3">Φ is the average diameter of the defect.<br>Distance between two defects > 10mm.</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Segment Defect</td><td rowspan="3">  </td><td>Φ</td><td>Φ≤0.10</td><td>0.10<Φ≤0.20</td><td>0.20<Φ≤0.25</td><td>Φ>0.25</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm²</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Note</td><td colspan="3">W is more than 1/2 segment width</td><td>Reject</td></tr>
<tr><td rowspan="3">Minor</td><td rowspan="3">Protuberant Segment</td><td rowspan="3">  <br>Φ = ( L + W ) / 2</td><td>Φ</td><td>Φ≤0.10</td><td>0.10<Φ≤0.20</td><td>0.20<Φ≤0.25</td><td>Φ>0.25</td></tr>
<tr><td>W</td><td>Glue</td><td>W≤1/2 Seg<br>W<0.2</td><td>W≤1/2 Seg<br>W<0.2</td><td>Ignore</td></tr>
<tr><td>ACC. NO.</td><td>3EA / 100mm²</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="4">Minor</td><td rowspan="4">Assembly Mis-alignment</td><td rowspan="2">  </td><td colspan="5">1. Segment</td></tr>
<tr><td>B</td><td>B≤0.4mm</td><td>0.4<B≤1.0mm</td><td>B>1.0mm</td></tr>
<tr><td>B-A Judge</td><td>B-A<1/2B Acceptable</td><td>B-A<0.2 Acceptable</td><td>B-A<0.25 Acceptable</td></tr>
<tr><td rowspan="2">  </td><td colspan="5">2. Dot Matrix</td></tr>
<tr><td colspan="4">Deformation>2°</td><td>Reject</td></tr>
<tr><td>Minor</td><td>Stain on LCD Panel Surface</td><td></td><td colspan="5">Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: “Black spot” and “White Spot”</td></tr>
</table>

# 9. RELIABILITY

| NO. | Item | Condition | Criterion |
|---|---|---|---|
| 1 | High Temperature Operating | 70℃, 96Hrs | No defect in cosmetic and operational function allowable.<br>Total current Consumption should be below double of initial value. |
| 2 | Low Temperature Operating | -20℃, 96Hrs | |
| 3 | High Humidity | 60℃, 90%RH, 96Hrs | |
| 4 | High Temperature Storage | 80℃, 96Hrs | |
| 5 | Low Temperature Storage | -30℃, 96Hrs | |
| 6 | Vibration | Random wave<br>10 ~ 100Hz<br>Acceleration: 2g<br>2 Hrs per direction(X,Y,Z) | |
| 7 | Thermal Shock | -20℃ to 25℃ to 70℃<br>(60Min) (5Min) (60Min)<br>16Cycles | |
| 8 | ESD Testing | Contract Discharge Voltage:<br>+1 ~ 5kV and –1 ~ –5kV | There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV. |
| | | Air Discharge Voltage:<br>+1 ~ 8kV and –1 ~ -8kV | |

Note: 1) Above conditions are suitable for standard products.
2) For restrict products, the test conditions listed as above must be revised.

# 10. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers, which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Tricolor trifler thane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Kenton
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's .which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time, (For years) for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.

When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

# 11. OUTLINE DIMENSION