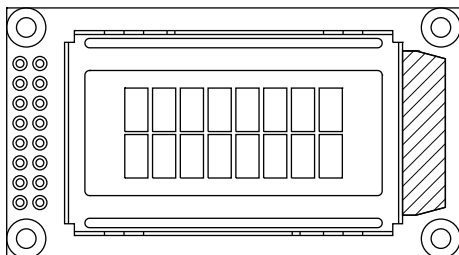


## 8 x 2 Character LCD



### FEATURES

- Type: Character
- Display format: 8 x 2 characters
- Built-in controller: ST 7066 or equivalent
- Duty cycle: 1/16
- 5 x 8 dots includes cursor
- + 5 V power supply
- LED can be driven by pin 1, pin 2, or A and K
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### MECHANICAL DATA

| ITEM             | STANDARD VALUE          | UNIT |
|------------------|-------------------------|------|
| Module Dimension | 58.0 x 32.0 x 13.2 max. | mm   |
| Viewing Area     | 38.0 x 16.0             |      |
| Dot Size         | 0.56 x 0.66             |      |
| Dot Pitch        | 0.60 x 0.70             |      |
| Mounting Hole    | 53.0 x 27.0             |      |
| Character Size   | 2.96 x 5.56             |      |

### ABSOLUTE MAXIMUM RATINGS

| ITEM          | SYMBOL               | STANDARD VALUE |      |          | UNIT |
|---------------|----------------------|----------------|------|----------|------|
|               |                      | MIN.           | TYP. | MAX.     |      |
| Power Supply  | $V_{DD}$ to $V_{SS}$ | - 0.3          | -    | 7.0      | V    |
| Input Voltage | $V_I$                | $V_{SS}$       | -    | $V_{DD}$ |      |

#### Note

- $V_{SS} = 0\text{ V}$ ,  $V_{DD} = 5.0\text{ V}$

### ELECTRICAL CHARACTERISTICS

| ITEM                                                                 | SYMBOL            | CONDITION                             | STANDARD VALUE |      |      | UNIT |
|----------------------------------------------------------------------|-------------------|---------------------------------------|----------------|------|------|------|
|                                                                      |                   |                                       | MIN.           | TYP. | MAX. |      |
| Input Voltage                                                        | $V_{DD}$          | $V_{DD} = +5\text{ V}$                | 4.7            | 5.0  | 5.3  | V    |
| Supply Current                                                       | $I_{DD}$          | $V_{DD} = +5\text{ V}$                | -              | 1.2  | -    | mA   |
| Recommended LC Driving Voltage for Normal Temperature Version Module | $V_{DD}$ to $V_0$ | - 20 °C                               | -              | -    | 5.5  | V    |
|                                                                      |                   | 0 °C                                  | -              | -    | -    |      |
|                                                                      |                   | 25 °C                                 | -              | 4.4  | -    |      |
|                                                                      |                   | 50 °C                                 | -              | -    | -    |      |
|                                                                      |                   | 70 °C                                 | 3.5            | -    | -    |      |
| LED Forward Voltage                                                  | $V_F$             | 25 °C                                 | -              | 4.2  | 4.6  | V    |
| LED Forward Current                                                  | $I_F$             | 25 °C                                 | -              | 70   | 140  | mA   |
| EL Power Supply Current                                              | $I_{EL}$          | $V_{EL} = 110\text{ V}_{AC}$ , 400 Hz | -              | -    | 5.0  | mA   |

### OPTIONS

| PROCESS COLOR |          |            |          |          |           | BACKLIGHT |     |    |      |
|---------------|----------|------------|----------|----------|-----------|-----------|-----|----|------|
| TN            | STN GRAY | STN YELLOW | STN BLUE | FSTN B&W | STN COLOR | NONE      | LED | EL | CCFL |
| x             | x        | x          | x        | x        | -         | x         | x   | x  | -    |

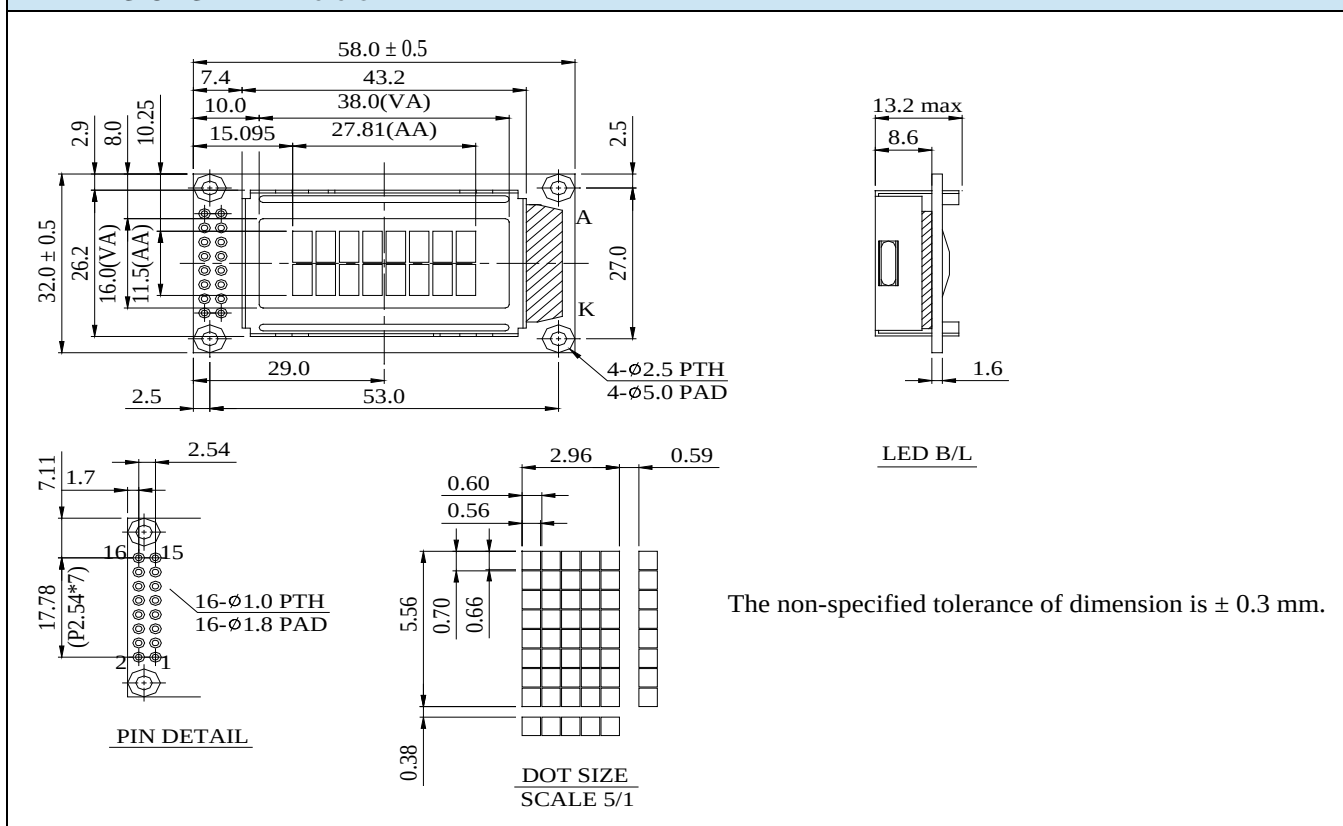
For detailed information, please see the "Product Numbering System" document.

### DISPLAY CHARACTER ADDRESS CODE

|                  |    |    |    |    |    |    |    |    |
|------------------|----|----|----|----|----|----|----|----|
| Display Position |    |    |    |    |    |    |    |    |
|                  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
| DD RAM Address   | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
| DD RAM Address   | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |

**INTERFACE PIN FUNCTIONS**

| PIN NO. | SYMBOL           | FUNCTION                                        |
|---------|------------------|-------------------------------------------------|
| 1       | V <sub>SS</sub>  | Ground                                          |
| 2       | V <sub>DD</sub>  | Supply voltage for logic + 5 V                  |
| 3       | V <sub>0</sub>   | Operating voltage for LCD (variable)            |
| 4       | RS               | H: Data, L: Instruction code                    |
| 5       | R $\overline{W}$ | H: Read (MPU → module), L: Write (MPU → module) |
| 6       | E                | Chip enable signal                              |
| 7       | DB0              | Data bus line                                   |
| 8       | DB1              | Data bus line                                   |
| 9       | DB2              | Data bus line                                   |
| 10      | DB3              | Data bus line                                   |
| 11      | DB4              | Data bus line                                   |
| 12      | DB5              | Data bus line                                   |
| 13      | DB6              | Data bus line                                   |
| 14      | DB7              | Data bus line                                   |
| 15      | A                | LED+                                            |
| 16      | K                | LED-                                            |

**DIMENSIONS** in millimeters




# 1. Module Classification Information

***LCD -008 N 002 A1 -T F H -ET***

①                      ②                      ③                      ④                      ⑤                      ⑥                      ⑦                      ⑧                      ⑨

1. Brand : Vishay Intertechnology, Inc.
2. Horizontal Format: 8 characters
3. Display Type : N→Character Type, H→Graphic Type
4. Vertical Format: 2 Lines
5. Model serials no.: A1
6. Backlight Type :
 

|                     |               |
|---------------------|---------------|
| N→Without backlight | T→LED, White  |
| B→EL, Blue green    | A→LED, Amber  |
| D→EL, Green         | R→LED, Red    |
| W→EL, White         | O→LED, Orange |
| F→CCFL, White       | G→LED, Green  |
| Y→LED, Yellow Green |               |
7. LCD Mode :
 

|                              |                 |
|------------------------------|-----------------|
| B→TN Positive, Gray          | T→FSTN Negative |
| N→TN Negative,               |                 |
| G→STN Positive, Gray         |                 |
| Y→STN Positive, Yellow Green |                 |
| M→STN Negative, Blue         |                 |
| F→FSTN Positive              |                 |
8. LCD Polarizer Type/ Temperature range/ View direction
 

|                            |                            |
|----------------------------|----------------------------|
| A→Reflective, N.T, 6:00    | H→Transflective, W.T,6:00  |
| D→Reflective, N.T, 12:00   | K→Transflective, W.T,12:00 |
| G→Reflective, W. T, 6:00   | C→Transmissive, N.T,6:00   |
| J→Reflective, W. T, 12:00  | F→Transmissive, N.T,12:00  |
| B→Transflective, N.T,6:00  | I→Transmissive, W. T, 6:00 |
| E→Transflective, N.T.12:00 | L→Transmissive, W.T,12:00  |
9. Special Code
 

|                                                     |
|-----------------------------------------------------|
| ET : English and European standard font             |
| Compliant with the ROHS Directions and regulations; |

## **2.Precautions in use of LCD Modules**

- (1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.
- (8) Supplier has the right to change the passive components, including R3,R6 & backlight adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- (9) Supplier has the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance...etc, under the premise of not affecting the electrical characteristics and external dimensions, Vishay has the right to modify the version.)

## **3.General Specification**

| Item                 | Dimension                                                                                                                                             | Unit |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Number of Characters | 8 characters x 2 Lines                                                                                                                                | —    |
| Module dimension     | 58.0 x 32.0 x 13.2(MAX)                                                                                                                               | mm   |
| View area            | 38.0 x 16.0                                                                                                                                           | mm   |
| Active area          | 27.81 x 11.5                                                                                                                                          | mm   |
| Dot size             | 0.56 x 0.66                                                                                                                                           | mm   |
| Dot pitch            | 0.60 x 0.70                                                                                                                                           | mm   |
| Character size       | 2.96 x 5.56                                                                                                                                           | mm   |
| Character pitch      | 3.55 x 5.94                                                                                                                                           | mm   |
| LCD type             | FSTN Positive Transflective,<br>(In LCD production, It will occur slightly color difference. We can only guarantee the same color in the same batch.) |      |
| Duty                 | 1/16                                                                                                                                                  |      |
| View direction       | 6 o'clock                                                                                                                                             |      |
| Backlight Type       | LED White                                                                                                                                             |      |

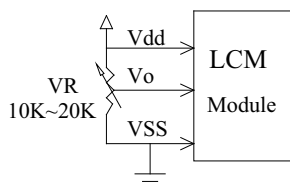
## 4. Absolute Maximum Ratings

| Item                     | Symbol          | Min      | Typ | Max      | Unit |
|--------------------------|-----------------|----------|-----|----------|------|
| Operating Temperature    | $T_{OP}$        | -20      | —   | +70      | °C   |
| Storage Temperature      | $T_{ST}$        | -30      | —   | +80      | °C   |
| Input Voltage            | $V_I$           | $V_{SS}$ | —   | $V_{DD}$ | V    |
| Supply Voltage For Logic | $V_{DD}-V_{SS}$ | -0.3     | —   | 7        | V    |
| Supply Voltage For LCD   | $V_{DD}-V_0$    | -0.3     | —   | 13       | V    |

## 5. Electrical Characteristics

| Item                            | Symbol          | Condition                 | Min          | Typ | Max      | Unit |
|---------------------------------|-----------------|---------------------------|--------------|-----|----------|------|
| Supply Voltage For Logic        | $V_{DD}-V_{SS}$ | —                         | 4.5          | 5.0 | 5.5      | V    |
| Supply Voltage For LCD<br>*Note | $V_{DD}-V_0$    | $T_a=-20^{\circ}\text{C}$ | —            | —   | 5.5      | V    |
|                                 |                 | $T_a=25^{\circ}\text{C}$  | —            | 4.4 | —        | V    |
|                                 |                 | $T_a=70^{\circ}\text{C}$  | 3.5          | —   | —        | V    |
| Input High Volt.                | $V_{IH}$        | —                         | $0.7 V_{DD}$ | —   | $V_{DD}$ | V    |
| Input Low Volt.                 | $V_{IL}$        | —                         | $V_{SS}$     | —   | 0.6      | V    |
| Output High Volt.               | $V_{OH}$        | —                         | 3.9          | —   | $V_{DD}$ | V    |
| Output Low Volt.                | $V_{OL}$        | —                         | —            | —   | 0.4      | V    |
| Supply Current                  | $I_{DD}$        | $V_{DD}=5V$               | —            | 1.2 | —        | mA   |

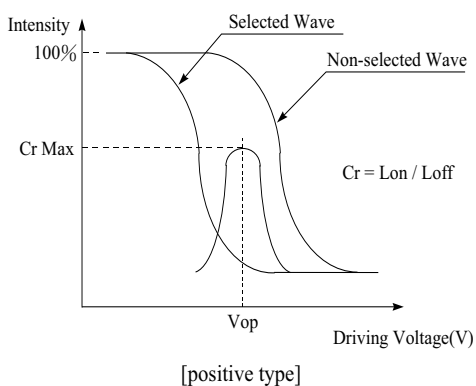
\* Note: Please design the VOP adjustment circuit on customer's main board



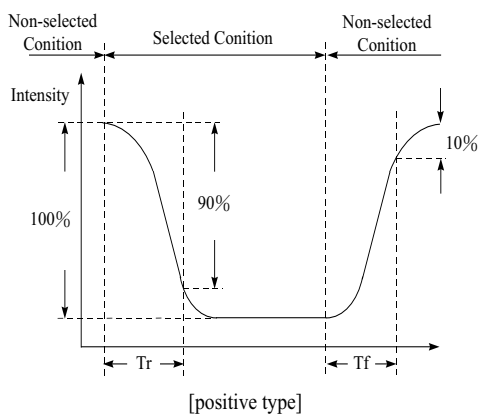
## 6. Optical Characteristics

| Item           | Symbol        | Condition   | Min | Typ | Max | Unit |
|----------------|---------------|-------------|-----|-----|-----|------|
| View Angle     | (V) $\theta$  | $CR \geq 2$ | 30  | —   | 60  | deg  |
|                | (H) $\varphi$ | $CR \geq 2$ | -45 | —   | 45  | deg  |
| Contrast Ratio | CR            | —           | —   | 5   | —   | —    |
| Response Time  | T rise        | —           | —   | 150 | 200 | ms   |
|                | T fall        | —           | —   | 150 | 200 | ms   |

### Definition of Operation Voltage ( $V_{op}$ )



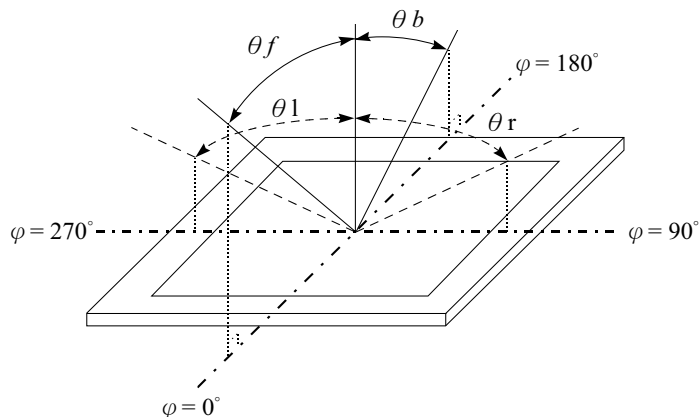
### Definition of Response Time ( $T_r$ , $T_f$ )



#### Conditions :

Operating Voltage :  $V_{op}$       Viewing Angle( $\theta$  ,  $\varphi$ ) :  $0^\circ$  ,  $0^\circ$   
Frame Frequency : 64 HZ      Driving Waveform : 1/N duty , 1/a bias

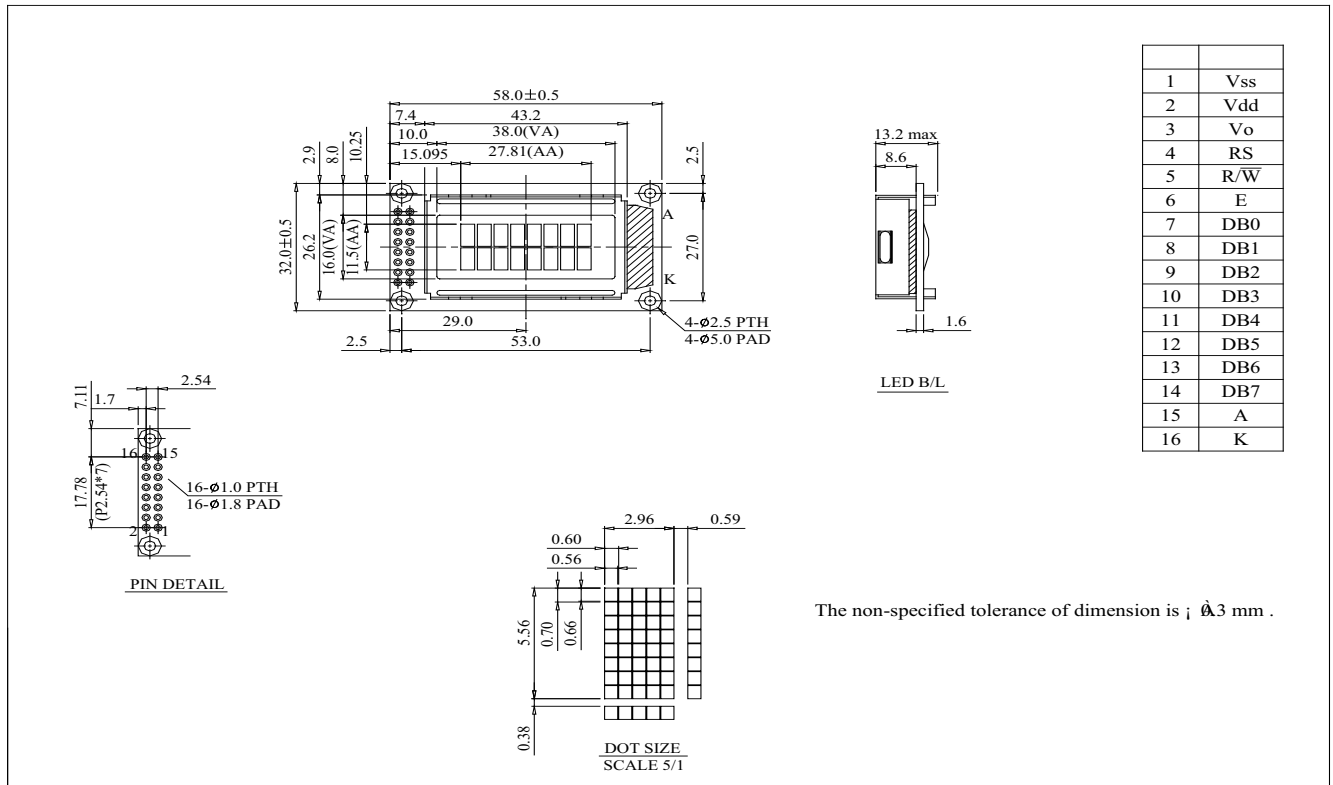
### Definition of viewing angle( $CR \geq 2$ )



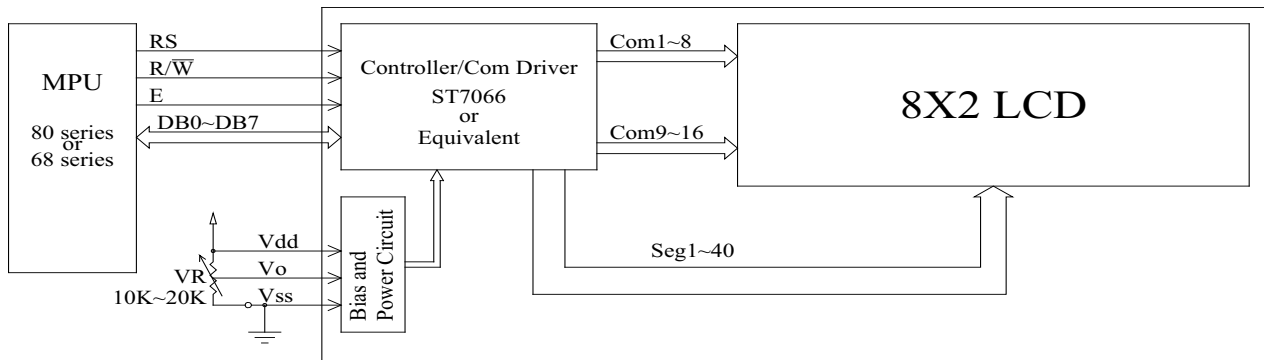
## 7. Interface Pin Function

| Pin No. | Symbol          | Level      | Description                              |
|---------|-----------------|------------|------------------------------------------|
| 1       | V <sub>SS</sub> | 0V         | Ground                                   |
| 2       | V <sub>DD</sub> | 5.0V       | Supply Voltage for logic                 |
| 3       | VO              | (Variable) | Operating voltage for LCD                |
| 4       | RS              | H/L        | H: DATA, L: Instruction code             |
| 5       | R/W             | H/L        | H: Read(MPU→Module) L: Write(MPU→Module) |
| 6       | E               | H,H→L      | Chip enable signal                       |
| 7       | DB0             | H/L        | Data bus line                            |
| 8       | DB1             | H/L        | Data bus line                            |
| 9       | DB2             | H/L        | Data bus line                            |
| 10      | DB3             | H/L        | Data bus line                            |
| 11      | DB4             | H/L        | Data bus line                            |
| 12      | DB5             | H/L        | Data bus line                            |
| 13      | DB6             | H/L        | Data bus line                            |
| 14      | DB7             | H/L        | Data bus line                            |
| 15      | A               |            | LED+                                     |
| 16      | K               |            | LED-                                     |

## 8. Contour Drawing & Block Diagram







External contrast adjustment.

|                   |    |    |    |    |    |    |    |    |
|-------------------|----|----|----|----|----|----|----|----|
| Character located | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
| DDRAM address     | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
| DDRAM address     | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |

## 9. Function Description

The LCD display Module is built in a LSI controller, the controller has two 8-bit registers, an instruction register (IR) and a data register (DR).

The IR stores instruction codes, such as display clear and cursor shift, and address information for display data RAM (DDRAM) and character generator (CGRAM). The IR can only be written from the MPU. The DR temporarily stores data to be written or read from DDRAM or CGRAM. When address information is written into the IR, then data is stored into the DR from DDRAM or CGRAM. By the register selector (RS) signal, these two registers can be selected.

| RS | R/W | Operation                                               |
|----|-----|---------------------------------------------------------|
| 0  | 0   | IR write as an internal operation (display clear, etc.) |
| 0  | 1   | Read busy flag (DB7) and address counter (DB0 to DB7)   |
| 1  | 0   | Write data to DDRAM or CGRAM (DR to DDRAM or CGRAM)     |
| 1  | 1   | Read data from DDRAM or CGRAM (DDRAM or CGRAM to DR)    |

### Busy Flag (BF)

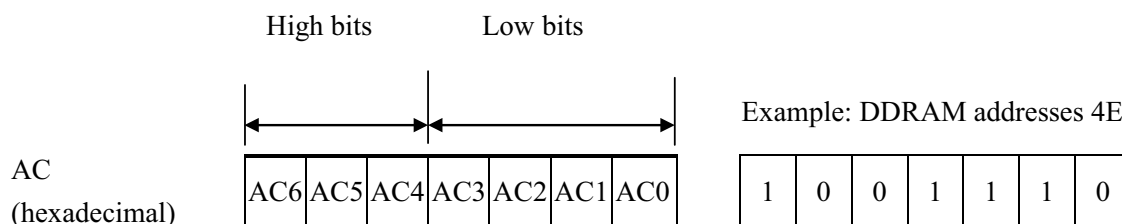
When the busy flag is 1, the controller LSI is in the internal operation mode, and the next instruction will not be accepted. When RS=0 and R/W=1, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

### Address Counter (AC)

The address counter (AC) assigns addresses to both DDRAM and CGRAM

### Display Data RAM (DDRAM)

This DDRAM is used to store the display data represented in 8-bit character codes. Its extended capacity is 80x8 bits or 80 characters. Below figure is the relationship between DDRAM addresses and positions on the liquid crystal display.





Display position DDRAM address

1 2 3 4 5 6 7 8

|    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |
|----|----|----|----|----|----|----|----|--|--|--|--|--|--|--|--|
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |  |  |  |  |  |  |  |  |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |  |  |  |  |  |  |  |  |

2-Line by 8-Character Display

### Character Generator ROM (CGROM)

The CGROM generate 5×8 dot or 5×10 dot character patterns from 8-bit character codes. See Table 2.

### Character Generator RAM (CGRAM)

In CGRAM, the user can rewrite character by program. For 5×8 dots, eight character patterns can be written, and for 5×10 dots, four character patterns can be written.

Write into DDRAM the character code at the addresses shown as the left column of table 1. To show the character patterns stored in CGRAM.

### Relationship between CGRAM Addresses, Character Codes (DDRAM) and Character patterns

**Table 1.**

For 5 \* 8 dot character patterns

| Character Codes ( DDRAM data ) |   |   |   |     |   |   |   | CGRAM Address |  |  |     |  |  | Character Patterns ( CGRAM data ) |       |  |   |     |  |   |  |  |   |  |  |
|--------------------------------|---|---|---|-----|---|---|---|---------------|--|--|-----|--|--|-----------------------------------|-------|--|---|-----|--|---|--|--|---|--|--|
| 7                              | 6 | 5 | 4 | 3   | 2 | 1 | 0 | 5             |  |  | 4   |  |  | 3                                 |       |  | 2 |     |  | 1 |  |  | 0 |  |  |
| High                           |   |   |   | Low |   |   |   | High          |  |  | Low |  |  | High                              |       |  |   | Low |  |   |  |  |   |  |  |
| 0 0 0 0 * 0 0 0 0              |   |   |   |     |   |   |   | 0 0 0         |  |  |     |  |  | 0 0 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 1 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 1 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 0 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 0 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 1 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 1 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
| 0 0 0 0 * 0 0 0 1              |   |   |   |     |   |   |   | 0 0 1         |  |  |     |  |  | 0 1 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 0 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 0 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 1 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 1 1 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 1 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 1 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 1 1                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 0                             | * * * |  |   |     |  |   |  |  |   |  |  |
|                                |   |   |   |     |   |   |   |               |  |  |     |  |  | 0 0 1                             | * * * |  |   |     |  |   |  |  |   |  |  |

Character pattern( 1 )

Cursor pattern

Character pattern( 2 )

Cursor pattern

|                   |  |  |  |  |  |  |  |       |  |  |  |  |  |       |   |   |   |
|-------------------|--|--|--|--|--|--|--|-------|--|--|--|--|--|-------|---|---|---|
| 0 0 0 0 * 1 1 1 1 |  |  |  |  |  |  |  | 1 1 1 |  |  |  |  |  | 1 0 0 |   |   |   |
|                   |  |  |  |  |  |  |  |       |  |  |  |  |  | 1 0 1 |   |   |   |
|                   |  |  |  |  |  |  |  |       |  |  |  |  |  | 1 1 0 |   |   |   |
|                   |  |  |  |  |  |  |  |       |  |  |  |  |  | 1 1 1 | * | * | * |

For 5 \* 10 dot character patterns

| 16 dot character patterns      |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|--------------------------------|---|---|---|-----|---|---|---|-----|--|-----------------------------------------------------------------------------------------------------------------------|---|---|---|-----|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|---|---|---|------------------------------------------------------------------|---|--|--|--|--|--|--|
| Character Codes ( DDRAM data ) |   |   |   |     |   |   |   |     |  | CGRAM Address                                                                                                         |   |   |   |     |   | Character Patterns ( CGRAM data )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
| 7                              | 6 | 5 | 4 | 3   | 2 | 1 | 0 |     |  | 5                                                                                                                     | 4 | 3 | 2 | 1   | 0 | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6 | 5    | 4 | 3 | 2 | 1                                                                | 0 |  |  |  |  |  |  |
| High                           |   |   |   | Low |   |   |   |     |  | High                                                                                                                  |   |   |   | Low |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   | High |   |   |   | Low                                                              |   |  |  |  |  |  |  |
| 0 0 0 0 * 0 0 0                |   |   |   |     |   |   |   | 0 0 |  | 0 0 0 0<br>0 0 0 1<br>0 0 1 0<br>0 0 1 1<br>0 1 0 0<br>0 1 0 1<br>0 1 1 0<br>0 1 1 1<br>1 0 0 0<br>1 0 0 1<br>1 0 1 0 |   |   |   |     |   | <div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div><div><div><div><div>*</div><div>*</div><div>*</div></div><div>0 0 0 0 0 0</div></div></div></div></div></div></div></div></div></div></div></div></div></div> |   |      |   |   |   | <div><div>Character pattern</div><div>Cursor pattern</div></div> |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  |                                                                                                                       |   |   |   |     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |   |   |   |                                                                  |   |  |  |  |  |  |  |
|                                |   |   |   |     |   |   |   |     |  | 1 1 1 1                                                                                                               |   |   |   |     |   | * * *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |      |   |   |   | * * * * *                                                        |   |  |  |  |  |  |  |

■ : " High "

# 10.Character Generator ROM Pattern

Table.2

| Upper<br>4 bit<br>Lower<br>4 bit | LLLL             | LLH                                                                                 | LLHL                                                                                | LLHH                                                                                | LHLL                                                                                | LHLH                                                                                | LHHL                                                                                | LHHH                                                                                | HLLL                                                                                | HLLH                                                                                | HLHL                                                                                | HLHH                                                                                  | HHLL                                                                                  | HHLH                                                                                  | HHHL                                                                                  | HHHH                                                                                  |
|----------------------------------|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| LLLL                             | CG<br>RAM<br>(1) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LLLH                             | CG<br>RAM<br>(2) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LLHL                             | CG<br>RAM<br>(3) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LLHH                             | CG<br>RAM<br>(4) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LHLL                             | CG<br>RAM<br>(5) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LHLH                             | CG<br>RAM<br>(6) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LHHL                             | CG<br>RAM<br>(7) |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| LHHH                             | CG<br>RAM<br>(8) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HLLL                             | CG<br>RAM<br>(1) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HLLH                             | CG<br>RAM<br>(2) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HLHL                             | CG<br>RAM<br>(3) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HLHH                             | CG<br>RAM<br>(4) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HHLL                             | CG<br>RAM<br>(5) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HHLH                             | CG<br>RAM<br>(6) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HHHL                             | CG<br>RAM<br>(7) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HHHH                             | CG<br>RAM<br>(8) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

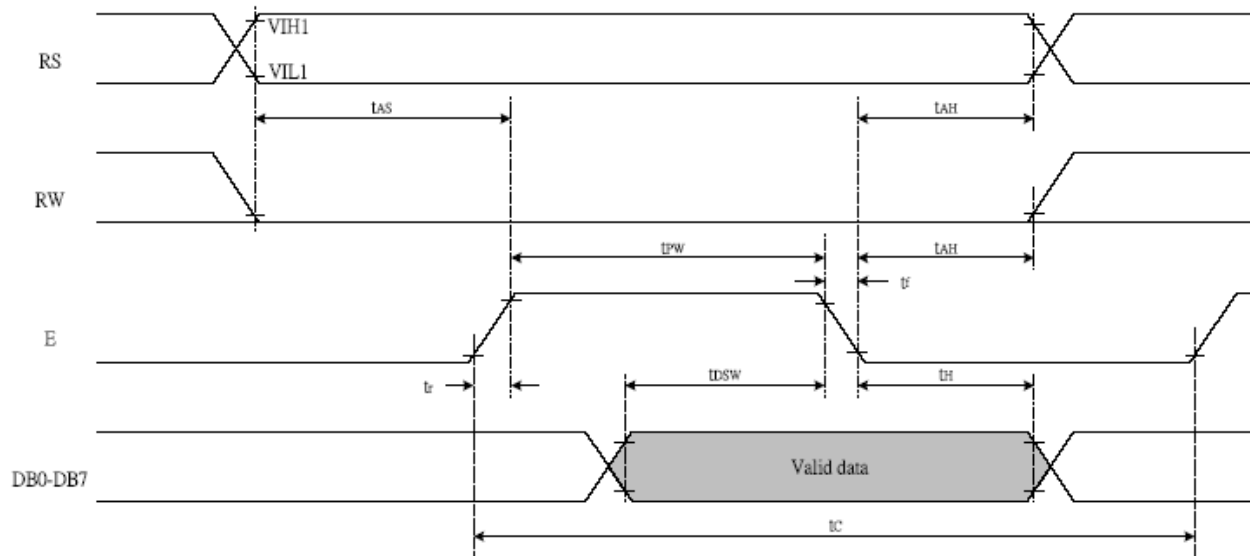
# 11. Instruction Table

| Instruction                | Instruction Code |     |     |     |     |     |     |     |     |     | Description                                                                                                                      | Execution time<br>(fosc=270Khz) |
|----------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|                            | RS               | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |                                                                                                                                  |                                 |
| Clear Display              | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | Write "20H" to DDRAM. and set DDRAM address to "00H" from AC                                                                     | 1.52ms                          |
| 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. | 1.52ms                          |
| Entry Mode Set             | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | SH  | Sets cursor move direction and specifies display shift. These operations are performed during data write and read.               | 37 $\mu$ s                      |
| Display ON/OFF Control     | 0                | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   | D=1:entire display on<br>C=1:cursor on<br>B=1:cursor position on                                                                 | 37 $\mu$ s                      |
| 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 DDRAM data.                                 | 37 $\mu$ s                      |
| Function Set               | 0                | 0   | 0   | 0   | 1   | DL  | N   | F   | —   | —   | DL:interface data is 8/4 bits<br>N:number of line is 2/1<br>F:font size is 5x11/5x8                                              | 37 $\mu$ s                      |
| Set CGRAM Address          | 0                | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter                                                                                             | 37 $\mu$ s                      |
| Set DDRAM Address          | 0                | 0   | 1   | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter                                                                                             | 37 $\mu$ s                      |
| Read Busy Flag and Address | 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.           | 0 $\mu$ s                       |
| Write Data to RAM          | 1                | 0   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Write data into internal RAM (DDRAM/CGRAM)                                                                                       | 37 $\mu$ s                      |
| Read Data from RAM         | 1                | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Read data from internal RAM (DDRAM/CGRAM)                                                                                        | 37 $\mu$ s                      |

\* "—" : don't care

# 12. Timing Characteristics

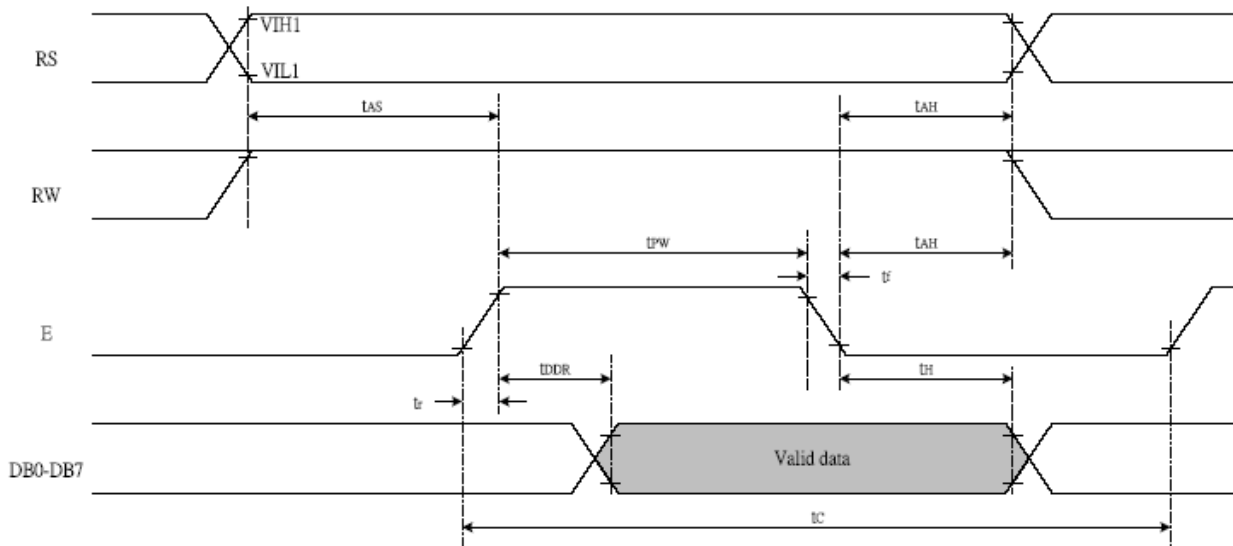
## 12.1 Writing data from MPU to ST7066U



$T_a = -30 \sim +85^{\circ}\text{C}$ ,  $V_{DD} = 5.0 \pm 0.5\text{V}$

|       |                       |                 |      |   |    |    |
|-------|-----------------------|-----------------|------|---|----|----|
| TC    | Enable Cycle Time     | Pin E           | 1200 | - | -  | ns |
| TPW   | Enable Pulse Width    | Pin E           | 140  | - | -  | ns |
| TR,TF | Enable Rise/Fall Time | Pin E           | -    | - | 25 | ns |
| TAS   | Address Setup Time    | Pins: RS,RW,E   | 0    | - | -  | ns |
| TAH   | Address Hold Time     | Pins: RS,RW,E   | 10   | - | -  | ns |
| TDSW  | Data Setup Time       | Pins: DB0 - DB7 | 40   | - | -  | ns |
| TH    | Data Hold Time        | Pins: DB0 - DB7 | 10   | - | -  | ns |

## 12.2 Reading data from ST7066U to MPU



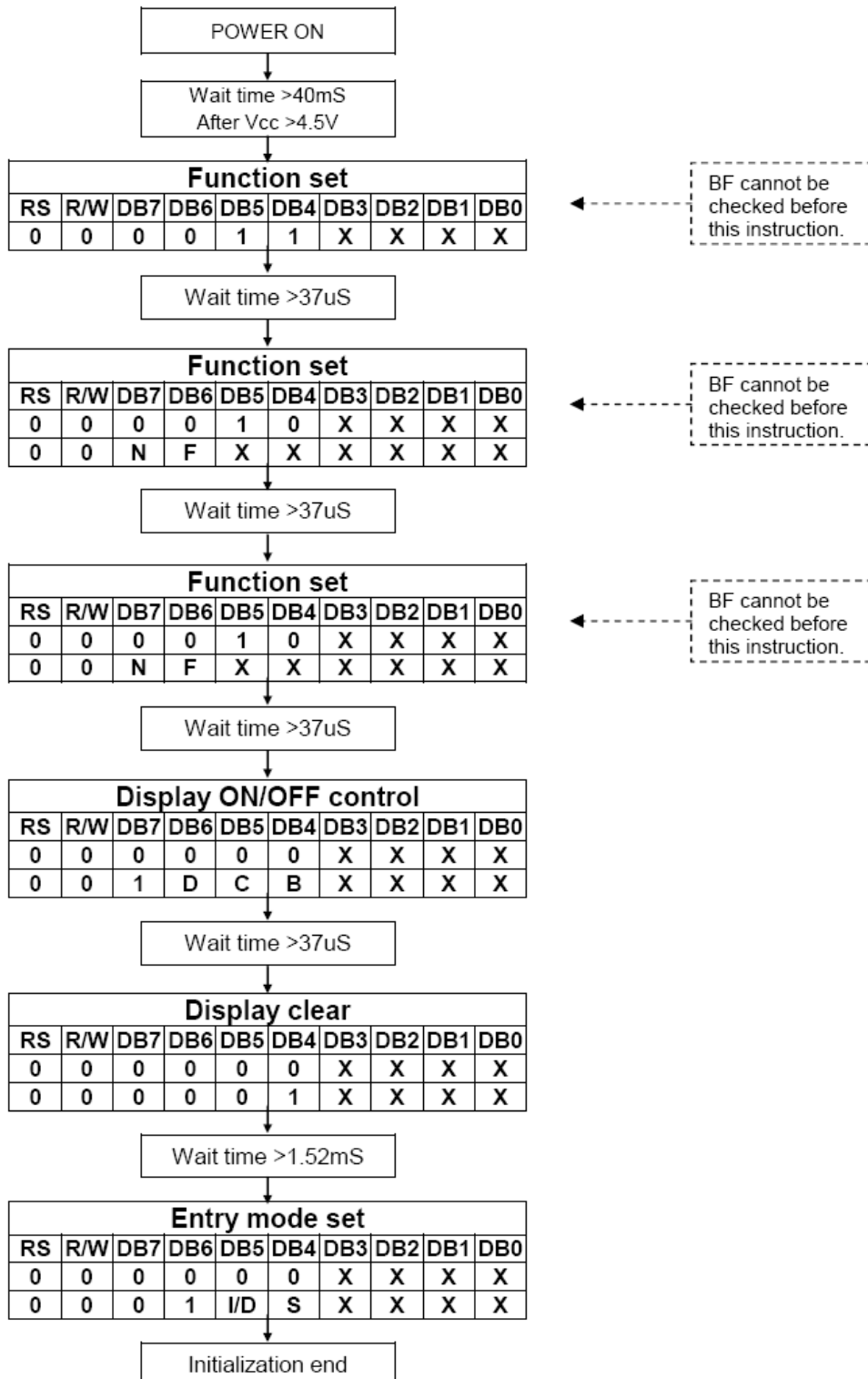
$T_a = -30 \sim +85^{\circ}\text{C}$ ,  $V_{DD} = 5.0 \pm 0.5\text{V}$

| Read Mode (Reading Data from ST7066U to MPU) |                       |                 |      |   |     |    |
|----------------------------------------------|-----------------------|-----------------|------|---|-----|----|
| TC                                           | Enable Cycle Time     | Pin E           | 1200 | - | -   | ns |
| TPW                                          | Enable Pulse Width    | Pin E           | 140  | - | -   | ns |
| TR,TF                                        | Enable Rise/Fall Time | Pin E           | -    | - | 25  | ns |
| TAS                                          | Address Setup Time    | Pins: RS,RW,E   | 0    | - | -   | ns |
| TAH                                          | Address Hold Time     | Pins: RS,RW,E   | 10   | - | -   | ns |
| TDDR                                         | Data Setup Time       | Pins: DB0 - DB7 | -    | - | 100 | ns |
| TH                                           | Data Hold Time        | Pins: DB0 - DB7 | 10   | - | -   | ns |

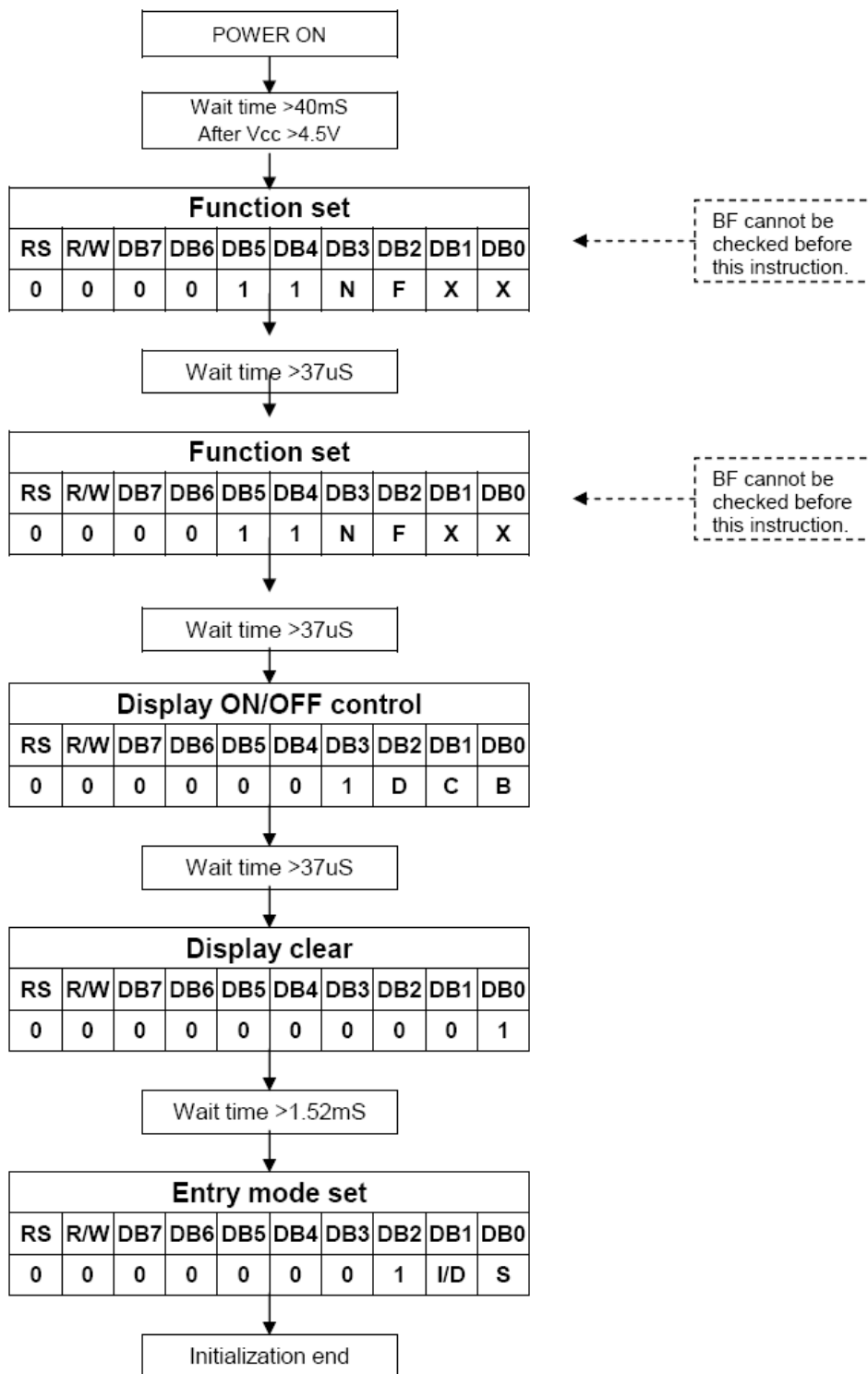


# 13. Initializing of LCM

- 4-bit Interface (fosc=270KHz)

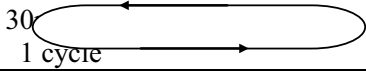


● 8-bit Interface (fosc=270KHz)



# 14. Reliability

Content of Reliability Test (wide temperature, -20°C~70°C)

| Environmental Test                      |                                                                                                                                                                                             |                                                                                                                                        |      |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------|
| Test Item                               | Content of Test                                                                                                                                                                             | Test Condition                                                                                                                         | Note |
| High Temperature storage                | Endurance test applying the high storage temperature for a long time.                                                                                                                       | 80°C<br>200hrs                                                                                                                         | 2    |
| Low Temperature storage                 | Endurance test applying the high storage temperature for a long time.                                                                                                                       | -30°C<br>200hrs                                                                                                                        | 1,2  |
| High Temperature Operation              | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.                                                                      | 70°C<br>200hrs                                                                                                                         | —    |
| Low Temperature Operation               | Endurance test applying the electric stress under low temperature for a long time.                                                                                                          | -20°C<br>200hrs                                                                                                                        | 1    |
| High Temperature/<br>Humidity Operation | The module should be allowed to stand at 60 °C, 90%RH max<br>For 96hrs under no-load condition excluding the polarizer,<br>Then taking it out and drying it at normal temperature.          | 60°C, 90%RH<br>96hrs                                                                                                                   | 1,2  |
| Thermal shock resistance                | The sample should be allowed stand the following 10 cycles of operation<br>-20°C    25°C    70°C<br><br> | -20°C/70°C<br>10 cycles                                                                                                                | —    |
| Vibration test                          | Endurance test applying the vibration during transportation and using.                                                                                                                      | Total fixed amplitude : 1.5mm<br>Vibration<br>Frequency : 10~55Hz<br>One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes | 3    |
| Static electricity test                 | Endurance test applying the electric stress to the terminal.                                                                                                                                | VS=800V, RS=1.5k Ω<br>CS=100pF<br>1 time                                                                                               | —    |

**Note1: No dew condensation to be observed.**

**Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.**

**Note3: Vibration test will be conducted to the product itself without putting it in a container.**

# 15.Backlight Information

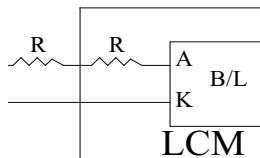
## Specification

| PARAMETER                             | SYMBOL           | MIN  | TYP   | MAX | UNIT              | TEST CONDITION                                       |
|---------------------------------------|------------------|------|-------|-----|-------------------|------------------------------------------------------|
| Supply Current                        | I <sub>LED</sub> | 14.6 | 16    | 25  | mA                | V=3.5V                                               |
| Supply Voltage                        | V                | 3.4  | 3.5   | 3.6 | V                 | —                                                    |
| Reverse Voltage                       | V <sub>R</sub>   | —    | —     | 5   | V                 | —                                                    |
| Luminous Intensity                    | I <sub>V</sub>   | 130  | 160   | —   | CD/M <sup>2</sup> | I <sub>LED</sub> =16mA                               |
| Chromaticity                          | x                | —    | 0.300 | —   | —                 | —                                                    |
|                                       | y                | —    | 0.310 | —   | —                 | —                                                    |
| LED Life Time<br>(For Reference only) | —                | —    | 50K   | —   | Hr.               | I <sub>LED</sub> ≤16mA<br>25°C,50-60%RH,<br>(Note 1) |
| Color                                 | White            |      |       |     |                   |                                                      |

**Note:** The LED of B/L is drive by current only, drive voltage is for reference only.  
drive voltage can make driving current under safety area (current between minimum and maximum).

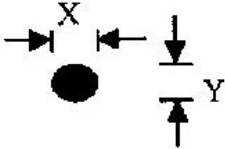
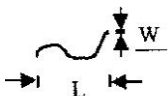
**Note 1:**50K hours is only an estimate for reference.

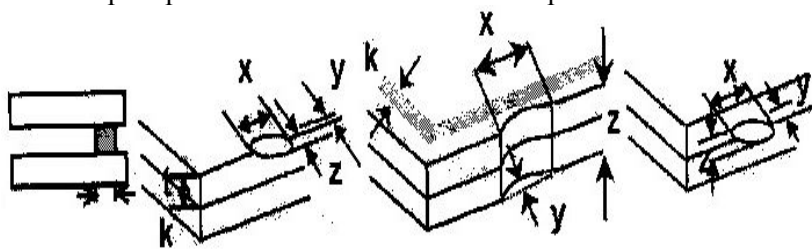
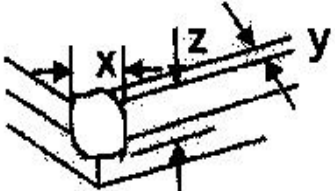
2.Drive from pin15,pin16

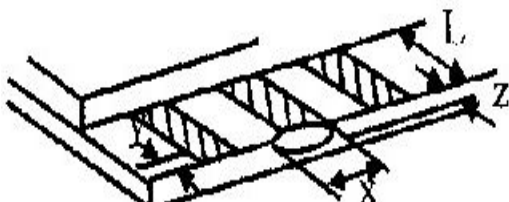
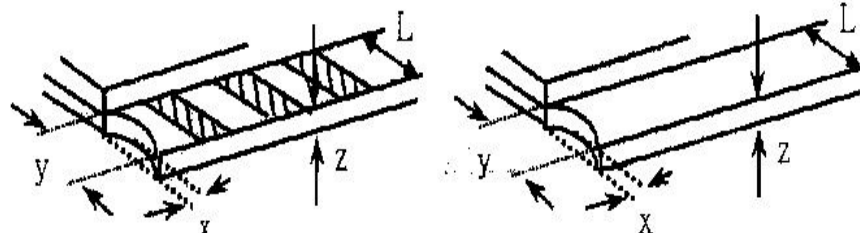
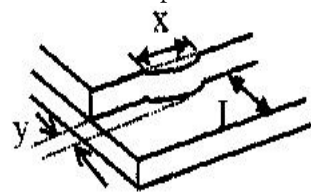


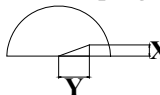
ill never get Vee output from pin15)

## 16. Inspection specification

| NO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Item                                                      | Criterion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | AQL             |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|------------------|-----------------|-------------------------|----------------------|-------------------------|--------------|----------------------|-----|------------|---------------|-----|
| 01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Electrical Testing                                        | 1.1 Missing vertical, horizontal segment, segment contrast defect.<br>1.2 Missing character , dot or icon.<br>1.3 Display malfunction.<br>1.4 No function or no display.<br>1.5 Current consumption exceeds product specifications.<br>1.6 LCD viewing angle defect.<br>1.7 Mixed product types.<br>1.8 Contrast defect.                                                                                                                                                                                                                                                    | 0.65            |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| 02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Black or white spots on LCD (display only)                | 2.1 White and black spots on display $\leq 0.25\text{mm}$ , no more than three white or black spots present.<br>2.2 Densely spaced: No more than two spots or lines within 3mm                                                                                                                                                                                                                                                                                                                                                                                              | 2.5             |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | LCD black spots, white spots, contamination (non-display) | 3.1 Round type : As following drawing<br>$\Phi=(x+y)/2$<br> <table border="1"> <thead> <tr> <th>SIZE</th> <th>Acceptable Q TY</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.10</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table>                                | SIZE            | Acceptable Q TY | $\Phi \leq 0.10$ | Accept no dense | $0.10 < \Phi \leq 0.20$ | 2                    | $0.20 < \Phi \leq 0.25$ | 1            | $0.25 < \Phi$        | 0   | 2.5        |               |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                           | SIZE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Acceptable Q TY |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $\Phi \leq 0.10$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Accept no dense                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $0.10 < \Phi \leq 0.20$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $0.20 < \Phi \leq 0.25$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $0.25 < \Phi$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| 3.2 Line type : (As following drawing)<br> <table border="1"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acceptable Q TY</th> </tr> </thead> <tbody> <tr> <td>---</td> <td><math>W \leq 0.02</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.02 &lt; W \leq 0.03</math></td> <td rowspan="2">2</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> </tr> <tr> <td>---</td> <td><math>0.05 &lt; W</math></td> <td>As round type</td> </tr> </tbody> </table> | Length                                                    | Width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Acceptable Q TY | ---             | $W \leq 0.02$    | Accept no dense | $L \leq 3.0$            | $0.02 < W \leq 0.03$ | 2                       | $L \leq 2.5$ | $0.03 < W \leq 0.05$ | --- | $0.05 < W$ | As round type | 2.5 |
| Length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Width                                                     | Acceptable Q TY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $W \leq 0.02$                                             | Accept no dense                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $L \leq 3.0$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $0.02 < W \leq 0.03$                                      | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $L \leq 2.5$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $0.03 < W \leq 0.05$                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| ---                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $0.05 < W$                                                | As round type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| 04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Polarizer bubbles                                         | If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction. <table border="1"> <thead> <tr> <th>Size <math>\Phi</math></th> <th>Acceptable Q TY</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.20</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.50</math></td> <td>3</td> </tr> <tr> <td><math>0.50 &lt; \Phi \leq 1.00</math></td> <td>2</td> </tr> <tr> <td><math>1.00 &lt; \Phi</math></td> <td>0</td> </tr> <tr> <td>Total Q TY</td> <td>3</td> </tr> </tbody> </table> | Size $\Phi$     | Acceptable Q TY | $\Phi \leq 0.20$ | Accept no dense | $0.20 < \Phi \leq 0.50$ | 3                    | $0.50 < \Phi \leq 1.00$ | 2            | $1.00 < \Phi$        | 0   | Total Q TY | 3             | 2.5 |
| Size $\Phi$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Acceptable Q TY                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $\Phi \leq 0.20$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Accept no dense                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $0.20 < \Phi \leq 0.50$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $0.50 < \Phi \leq 1.00$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| $1.00 < \Phi$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |
| Total Q TY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                 |                  |                 |                         |                      |                         |              |                      |     |            |               |     |

| NO                 | Item                  | Criterion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | AQL               |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
|--------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|----------------|---------------|-----------------------|---------------|--------------------|-----------------|---------------|-------------------|---------------|----------------|---------------|-----------------------|---------------|--------------------|-----------------|---------------|-----|
| 05                 | Scratches             | Follow NO.3 LCD black spots, white spots, contamination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| 06                 | Chipped glass         | <div> <div> <div>Symbols Define:</div> <div> <div>x: Chip length</div> <div>y: Chip width</div> <div>z: Chip thickness</div> <div>k: Seal width</div> <div>t: Glass thickness</div> <div>a: LCD side length</div> <div>L: Electrode pad length:</div> </div> </div> <div> <div>6.1 General glass chip :</div> <div>6.1.1 Chip on panel surface and crack between panels:</div> <div>  <table> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed 1/3k</td> <td><math>x \leq 1/8a</math></td> </tr> </table> <div> <div>⊙If there are 2 or more chips, x is total length of each chip.</div> <div>6.1.2 Corner crack:</div> <div>  <table> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed 1/3k</td> <td><math>x \leq 1/8a</math></td> </tr> </table> <div> <div>⊙If there are 2 or more chips, x is the total length of each chip.</div> </div> </div> </div> </div> </div></div> | z: Chip thickness | y: Chip width | x: Chip length | $Z \leq 1/2t$ | Not over viewing area | $x \leq 1/8a$ | $1/2t < z \leq 2t$ | Not exceed 1/3k | $x \leq 1/8a$ | z: Chip thickness | y: Chip width | x: Chip length | $Z \leq 1/2t$ | Not over viewing area | $x \leq 1/8a$ | $1/2t < z \leq 2t$ | Not exceed 1/3k | $x \leq 1/8a$ | 2.5 |
| z: Chip thickness  | y: Chip width         | x: Chip length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $Z \leq 1/2t$      | Not over viewing area | $x \leq 1/8a$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $1/2t < z \leq 2t$ | Not exceed 1/3k       | $x \leq 1/8a$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| z: Chip thickness  | y: Chip width         | x: Chip length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $Z \leq 1/2t$      | Not over viewing area | $x \leq 1/8a$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |
| $1/2t < z \leq 2t$ | Not exceed 1/3k       | $x \leq 1/8a$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |               |                |               |                       |               |                    |                 |               |                   |               |                |               |                       |               |                    |                 |               |     |

| NO            | Item          | Criterion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | AQL            |                   |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
|---------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------|-------------------|-----------------------|---------------|----------------|---------------|----------------|-------------------|------------|---------------|----------------|----------|-----------|---------------|------------|-----|
| 06            | Glass crack   | <p>Symbols :</p> <p>x: Chip length      y: Chip width      z: Chip thickness</p> <p>k: Seal width      t: Glass thickness      a: LCD side length</p> <p>L: Electrode pad length</p> <p>6.2 Protrusion over terminal :</p> <p>6.2.1 Chip on electrode pad :</p>  <table> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td><math>y \leq 0.5\text{mm}</math></td> <td><math>x \leq 1/8a</math></td> <td><math>0 &lt; z \leq t</math></td> </tr> </table> <p>6.2.2 Non-conductive portion:</p>  <table> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td><math>y \leq L</math></td> <td><math>x \leq 1/8a</math></td> <td><math>0 &lt; z \leq t</math></td> </tr> </table> <p>                     ⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.<br/>                     ⊙ If the product will be heat sealed by the customer, the alignment mark not be damaged.                 </p> <p>6.2.3 Substrate protuberance and internal crack.</p>  <table> <tr> <td>y: width</td> <td>x: length</td> </tr> <tr> <td><math>y \leq 1/3L</math></td> <td><math>x \leq a</math></td> </tr> </table> | y: Chip width  | x: Chip length    | z: Chip thickness | $y \leq 0.5\text{mm}$ | $x \leq 1/8a$ | $0 < z \leq t$ | y: Chip width | x: Chip length | z: Chip thickness | $y \leq L$ | $x \leq 1/8a$ | $0 < z \leq t$ | y: width | x: length | $y \leq 1/3L$ | $x \leq a$ | 2.5 |
|               |               | y: Chip width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | x: Chip length | z: Chip thickness |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
|               |               | $y \leq 0.5\text{mm}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $x \leq 1/8a$  | $0 < z \leq t$    |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
|               |               | y: Chip width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | x: Chip length | z: Chip thickness |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| $y \leq L$    | $x \leq 1/8a$ | $0 < z \leq t$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                   |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| y: width      | x: length     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                   |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |
| $y \leq 1/3L$ | $x \leq a$    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                   |                   |                       |               |                |               |                |                   |            |               |                |          |           |               |            |     |

| NO | Item               | Criterion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | AQL                                                            |
|----|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| 07 | Cracked glass      | The LCD with extensive crack is not acceptable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2.5                                                            |
| 08 | Backlight elements | 8.1 Illumination source flickers when lit.<br>8.2 Spots or scratched that appear when lit must be judged. Using LCD spot, lines and contamination standards.<br>8.3 Backlight doesn't light or color wrong.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.65<br>2.5<br>0.65                                            |
| 09 | Bezel              | 9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination.<br>9.2 Bezel must comply with job specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2.5<br>0.65                                                    |
| 10 | PCB、COB            | 10.1 COB seal may not have pinholes larger than 0.2mm or contamination.<br>10.2 COB seal surface may not have pinholes through to the IC.<br>10.3 The height of the COB should not exceed the height indicated in the assembly diagram.<br>10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places.<br>10.5 No oxidation or contamination PCB terminals.<br>10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts.<br>10.7 The jumper on the PCB should conform to the product characteristic chart.<br>10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down.<br>10.9 The Scraping testing standard for Copper Coating of PCB<br> $X * Y \leq 2\text{mm}^2$ | 2.5<br>2.5<br>0.65<br>2.5<br>2.5<br>0.65<br>0.65<br>2.5<br>2.5 |
| 11 | Soldering          | 11.1 No un-melted solder paste may be present on the PCB.<br>11.2 No cold solder joints, missing solder connections, oxidation or icicle.<br>11.3 No residue or solder balls on PCB.<br>11.4 No short circuits in components on PCB.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.5<br>2.5<br>2.5<br>0.65                                      |





| NO | Item               | Criterion                                                                                                                                | AQL  |
|----|--------------------|------------------------------------------------------------------------------------------------------------------------------------------|------|
| 12 | General appearance | 12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.                                                        | 2.5  |
|    |                    | 12.2 No cracks on interface pin (OLB) of TCP.                                                                                            | 0.65 |
|    |                    | 12.3 No contamination, solder residue or solder balls on product.                                                                        | 2.5  |
|    |                    | 12.4 The IC on the TCP may not be damaged, circuits.                                                                                     | 2.5  |
|    |                    | 12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it causes the interface pin to sever. | 2.5  |
|    |                    | 12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.                   | 2.5  |
|    |                    | 12.7 Sealant on top of the ITO circuit has not hardened.                                                                                 | 0.65 |
|    |                    | 12.8 Pin type must match type in specification sheet.                                                                                    | 0.65 |
|    |                    | 12.9 LCD pin loose or missing pins.                                                                                                      | 0.65 |
|    |                    | 12.10 Product packaging must the same as specified on packaging specification sheet.                                                     | 0.65 |
|    |                    | 12.11 Product dimension and structure must conform to product specification sheet.                                                       |      |

## **17. Material List of Components for RoHS**

1. Declaration that all of or part of products (with the mark “N” in code), including, but not limited to, the LCM, accessories or packages, manufactured and/or delivered to your company (including your subsidiaries and affiliated company) directly or indirectly by our company (including our subsidiaries or affiliated companies) do not intentionally contain any of the substances listed in all applicable EU directives and regulations, including the following substances.

Exhibit A : The Harmful Material List

| Material                                         | (Cd)    | (Pb)     | (Hg)     | (Cr6+)   | PBBs     | PBDEs    |
|--------------------------------------------------|---------|----------|----------|----------|----------|----------|
| Limited Value                                    | 100 ppm | 1000 ppm | 1000 ppm | 1000 ppm | 1000 ppm | 1000 ppm |
| Above limited value is set up according to RoHS. |         |          |          |          |          |          |

2.Process for RoHS requirement :

(1) Use the Sn/Ag/Cu soldering surface ; the surface of Pb-free solder is rougher than we used before.

(2) Heat-resistance temp. :

Reflow : 250C, 30 seconds Max. ;

Connector soldering wave or hand soldering : 320C, 10 seconds max.

(3) Temp. curve of reflow, max. Temp. : 235±5C ;

Recommended customer’s soldering temp. of connector : 280C, 3 seconds.

## **18. Recommendable Storage**

1. Place the panel or module in the temperature 25°C±5°C and the humidity below 65% RH
2. Do not place the module near organics solvents or corrosive gases.
3. Do not crush, shake, or jolt the module.



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