

## 16 x 2 Character LCD



### FEATURES

- Type: Character
- Display format: 16 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
- N.V. optional for + 3 V power supply
- Optional: Smaller character size (2.95 mm x 4.35 mm)
- 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 | 80.0 x 36.0 x 13.2 (max.) | mm   |
| Viewing Area     | 66.0 x 16.0               |      |
| Dot Size         | 0.55 x 0.65               |      |
| Dot Pitch        | 0.60 x 0.70               |      |
| Mounting Hole    | 75.0 x 31.0               |      |
| Character Size   | 2.95 x 5.55               |      |

| ABSOLUTE MAXIMUM RATINGS |                      |                |      |          |      |
|--------------------------|----------------------|----------------|------|----------|------|
| ITEM                     | SYMBOL               | STANDARD VALUE |      |          | UNIT |
|                          |                      | MIN.           | TYP. | MAX.     |      |
| Power Supply             | $V_{DD}$ to $V_{SS}$ | - 0.3          | -    | 13       | V    |
| Input Voltage            | $V_I$                | $V_{SS}$       | -    | $V_{DD}$ |      |

#### Note

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

| ELECTRICAL CHARACTERISTICS                                           |                   |                                         |                |      |      |      |
|----------------------------------------------------------------------|-------------------|-----------------------------------------|----------------|------|------|------|
| ITEM                                                                 | SYMBOL            | CONDITION                               | STANDARD VALUE |      |      | UNIT |
|                                                                      |                   |                                         | MIN.           | TYP. | MAX. |      |
| Input Voltage                                                        | $V_{DD}$          | $V_{DD} = + 5$ V                        | 4.5            | 5.0  | 5.5  | V    |
| Supply Current                                                       | $I_{DD}$          | $V_{DD} = + 5$ V                        | 1.0            | 1.2  | 1.5  | mA   |
| Recommended LC Driving Voltage for Normal Temperature Version Module | $V_{DD}$ to $V_0$ | - 20 °C                                 | -              | -    | 5.2  | V    |
|                                                                      |                   | 0 °C                                    | -              | -    | -    |      |
|                                                                      |                   | 25 °C                                   | -              | 3.7  | -    |      |
|                                                                      |                   | 50 °C                                   | -              | -    | -    |      |
|                                                                      |                   | 70 °C                                   | 3.1            | -    | -    |      |
| LED Forward Voltage                                                  | $V_F$             | 25 °C                                   | -              | 4.2  | 4.6  | V    |
| LED Forward Current - Array                                          | $I_F$             | 25 °C                                   | -              | 100  | -    | mA   |
| LED Forward Current - Edge                                           |                   |                                         | -              | 20   | 40   |      |
| EL Power Supply Current                                              | $I_{EL}$          | $V_{EL} = 110$ V <sub>AC</sub> , 400 Hz | -              | -    | 5.0  | mA   |

| DISPLAY CHARACTER ADDRESS CODE |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Display Position               |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                                | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| DD RAM Address                 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| DD RAM Address                 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

**INTERFACE PIN FUNCTION**

| PIN NO. | SYMBOL           | FUNCTION                                       |
|---------|------------------|------------------------------------------------|
| 1       | $V_{SS}$         | Ground                                         |
| 2       | $V_{DD}$         | Supply voltage for logic                       |
| 3       | $V_0$            | Operating voltage for LCD                      |
| 4       | RS               | H: Data/L: Instruction code                    |
| 5       | $R/\overline{W}$ | H: Read (MPU → Module)/L: Write (MPU → Module) |
| 6       | E                | H → L 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                | Supply power for LED+                          |
| 16      | R                | Supply power for Red-                          |
| 17      | G                | Supply power for Green-                        |
| 18      | B                | Supply power for Blue-                         |

**DIMENSIONS** in millimeters




## 1. Module Classification Information

***LCD -016 N 002 B -C F H -ET***

①                      ②                      ③                      ④                      ⑤                      ⑥                      ⑦                      ⑧                      ⑨

1. Brand : Vishay Intertechnology, Inc.
2. Horizontal Format: 16 characters
3. Display Type : N→Character Type, H→Graphic Type
4. Vertical Format: 2 Lines
5. Model serials no.: B
6. Backlight Type :
 

|                     |                  |
|---------------------|------------------|
| N→Without backlight | A→LED, Amber     |
| B→EL, Blue green    | R→LED, Red       |
| D→EL, Green         | O→LED, Orange    |
| W→EL, White         | G→LED, Green     |
| F→CCFL, White       | T→LED, White     |
| Y→LED, Yellow Green | C→LED, RGB color |
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 Polarize 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.

## **3.General Specification**

| Item                 | Dimension                    | Unit |
|----------------------|------------------------------|------|
| Number of Characters | 16 characters x 2 Lines      | —    |
| Module dimension     | 80.0 x 36.0 x 13.2(MAX)      | mm   |
| View area            | 66.0 x 16.0                  | mm   |
| Active area          | 56.2 x 11.5                  | mm   |
| Dot size             | 0.55 x 0.65                  | mm   |
| Dot pitch            | 0.60 x 0.70                  | mm   |
| Character size       | 2.95 x 5.55                  | mm   |
| Character pitch      | 3.55 x 5.95                  | mm   |
| LCD type             | FSTN Positive, Transflective |      |
| Duty                 | 1/16                         |      |
| View direction       | 6 o'clock                    |      |
| Backlight Type       | LED, Triple-color            |      |

## 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   | $V_{DD}-V_0$    | $T_a=-20^{\circ}\text{C}$ | —   | —   | 5.2      | V    |
|                          |                 | $T_a=25^{\circ}\text{C}$  | —   | 3.7 | —        | V    |
|                          |                 | $T_a=70^{\circ}\text{C}$  | 3.1 | —   | —        | V    |
| Input High Volt.         | $V_{IH}$        | —                         | 0.7 | —   | $V_{DD}$ | V    |
| Input Low Volt.          | $V_{IL}$        | —                         | 0   | —   | 0.6      | V    |
| Output High Volt.        | $V_{OH}$        | —                         | 3.9 | —   | $V_{DD}$ | V    |
| Output Low Volt.         | $V_{OL}$        | —                         | 0   | —   | 0.4      | V    |
| Supply Current           | $I_{DD}$        | $V_{DD}=5\text{V}$        | 1.0 | 1.2 | 1.5      | mA   |

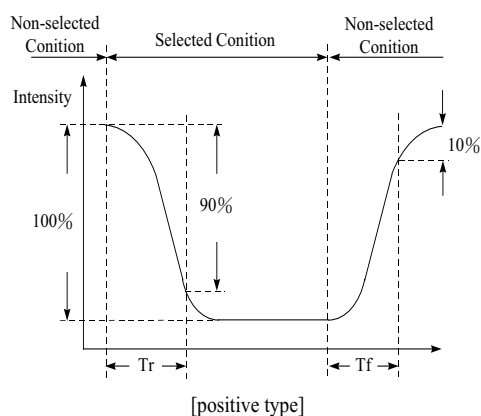
## 6. Optical Characteristics

| Item           | Symbol        | Condition   | Min | Typ | Max | Unit |
|----------------|---------------|-------------|-----|-----|-----|------|
| View Angle     | (V) $\theta$  | $CR \geq 5$ | 30  | —   | 60  | deg  |
|                | (H) $\varphi$ | $CR \geq 5$ | -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               | —          | Supply power for LED +                   |
| 16      | R               | —          | Supply power for Red -                   |
| 17      | G               |            | Supply power for Green -                 |
| 18      | B               |            | Supply power for Blue -                  |

## 8. Contour Drawing & Block Diagram



|                   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Character located | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| DDRAM address     | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| DDRAM address     | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |



## 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)

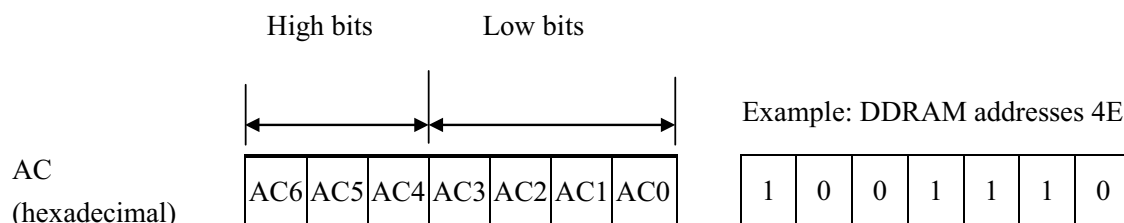
When the busy flag is 1, the controller LSI is in the internal operation mode, and the next instruction will not be accepted. When RS=0 and R/W=1, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

### 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 80×8 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 9 10 11 12 13 14 15 16

|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

2-Line by 16-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.

**Table 1.**

For 5 \* 8 dot character patterns

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






























































































































































































































For 5 \* 10 dot character patterns

[illegible]

■ : " 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                                                                                 | HHHL                                                                                  | HHHH                                                                                  |
|----------------------------------|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| LLLL                             | CG<br>RAM<br>(1) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| LLHH                             | 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 "00H" to DDRAM and set DDRAM address to "00H" from AC                                                                        | 1.53ms                          |
| 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.   | 1.53ms                          |
| Entry Mode Set             | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | SH  | Assign cursor moving direction and enable the shift of entire display.                                                             | 39 $\mu$ s                      |
| Display ON/OFF Control     | 0                | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   | Set display (D), cursor (C), and blinking of cursor (B) on/off control bit.                                                        | 39 $\mu$ 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 of DDRAM data.                                | 39 $\mu$ s                      |
| Function Set               | 0                | 0   | 0   | 0   | 1   | DL  | N   | F   | —   | —   | Set interface data length (DL:8-bit/4-bit), numbers of display line (N:2-line/1-line)and, display font type (F:5x11 dots/5x8 dots) | 39 $\mu$ s                      |
| Set CGRAM Address          | 0                | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter.                                                                                              | 39 $\mu$ s                      |
| Set DDRAM Address          | 0                | 0   | 1   | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter.                                                                                              | 39 $\mu$ 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).                                                                                        | 43 $\mu$ s                      |
| Read Data from RAM         | 1                | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Read data from internal RAM (DDRAM/CGRAM).                                                                                         | 43 $\mu$ s                      |

\* "—" : don't care

## 12. Timing Characteristics

### 12.1 Write Operation

- Writing data from MPU



$T_a=25^{\circ}\text{C}$ ,  $V_{DD}=5.0\text{V}$

| Item                               | Symbol     | Min  | Typ | Max | Unit |
|------------------------------------|------------|------|-----|-----|------|
| Enable cycle time                  | $T_C$      | 1200 | —   | —   | ns   |
| Enable pulse width                 | $T_{PW}$   | 140  | —   | —   | ns   |
| Enable rise/fall time              | $T_R, T_F$ | —    | —   | 25  | ns   |
| Address set-up time (RS, R/W to E) | $t_{AS}$   | 0    | —   | —   | ns   |
| Address hold time                  | $t_{AH}$   | 10   | —   | —   | ns   |
| Data set-up time                   | $t_{DSW}$  | 40   | —   | —   | ns   |
| Data hold time                     | $t_H$      | 10   | —   | —   | ns   |

## 12.2 Read Operation

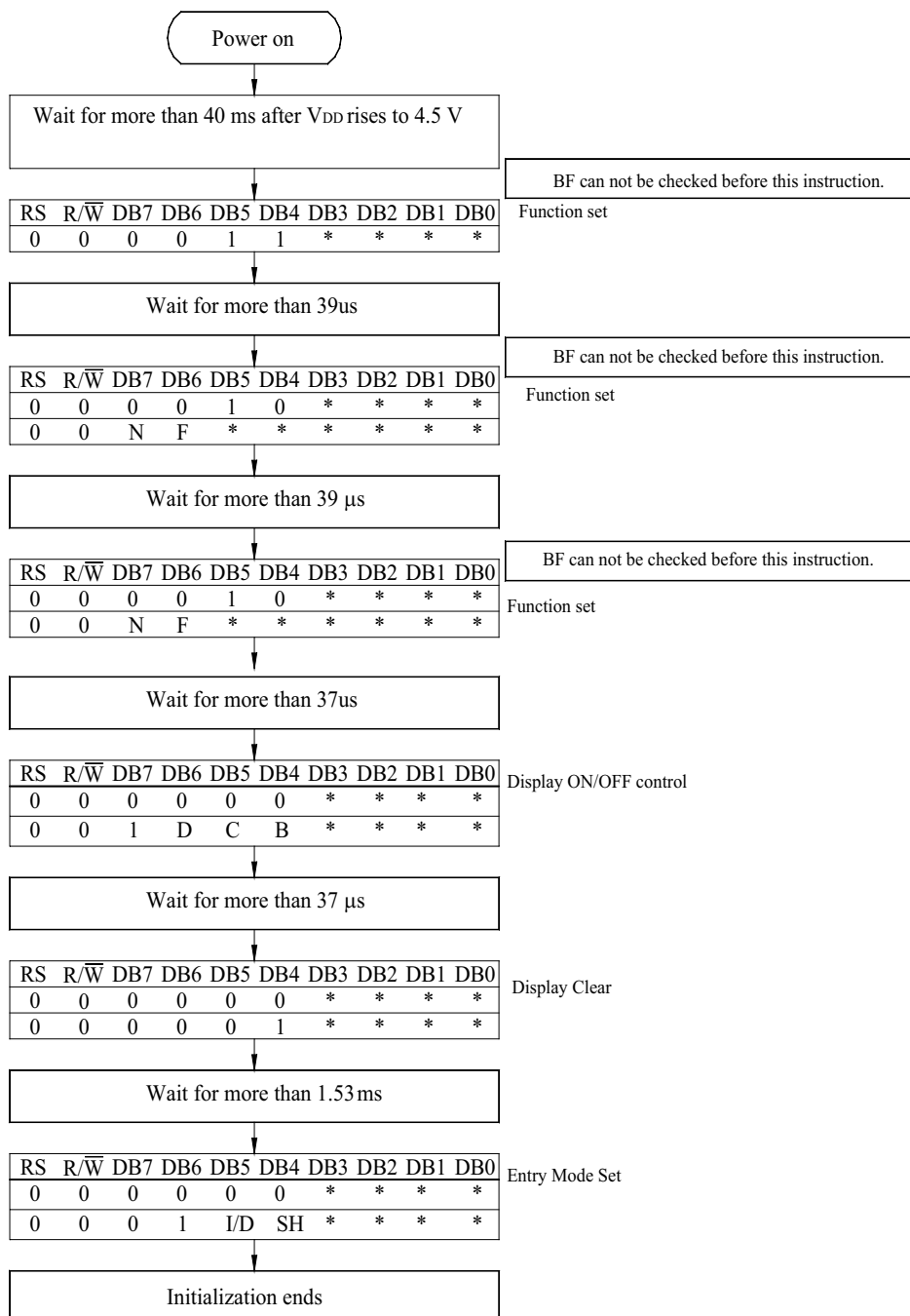
- Reading data from ST7066U



$T_a=25^{\circ}\text{C}$ ,  $V_{DD}=5\text{V}$

| Item                               | Symbol     | Min  | Typ | Max | Unit |
|------------------------------------|------------|------|-----|-----|------|
| Enable cycle time                  | $T_C$      | 1200 | —   | —   | ns   |
| Enable pulse width (high level)    | $T_{PW}$   | 140  | —   | —   | ns   |
| Enable rise/fall time              | $T_R, T_F$ | —    | —   | 25  | ns   |
| Address set-up time (RS, R/W to E) | $t_{AS}$   | 0    | —   | —   | ns   |
| Address hold time                  | $t_{AH}$   | 10   | —   | —   | ns   |
| Data delay time                    | $t_{DDR}$  | —    | —   | 100 | ns   |
| Data hold time                     | $t_H$      | 10   | —   | —   | ns   |

## 13. Initializing of LCM



4-Bit Interface





8-Bit Ineterface

## 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 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=1.5kΩ<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     | ILED             | R | 20  | 24   | 28  | mA                | V=5.0V                         |
|                    |                  | G | 25  | 30   | 34  |                   |                                |
|                    |                  | B | 25  | 30   | 34  |                   |                                |
| Supply Voltage     | V                |   | 4.9 | 5.0  | 5.1 | V                 | —                              |
| Reverse Voltage    | VR               |   | —   | 7.0  | —   | V                 | —                              |
| Luminous Intensity | IV               | R | 32  | 40   | —   | CD/M <sup>2</sup> | ILED(red)=24mA                 |
|                    |                  | G | 140 | 180  |     |                   | ILED(green)=30mA               |
|                    |                  | B | 22  | 28   |     |                   | ILED(blue)=30mA                |
| Wave Length        | λ                | R | 620 | 625  | 630 | nm                | —                              |
|                    |                  | G | 515 | 520  | 525 |                   |                                |
|                    |                  | B | 465 | 470  | 475 |                   |                                |
| Life Time          | R                |   | 80K | 100K |     | Hr.               | ILED≤15mA<br>For each LED Lamp |
|                    | G                |   | 40K | 50K  |     |                   |                                |
|                    | B                |   | 40K | 50K  |     |                   |                                |
| Color              | Red, Green, Blue |   |     |      |     |                   |                                |

#### Note:

1. The LED B/L of “triple color” is designed for voltage driving, user have to follow The drive voltage that can make driving current in safety range (current between minimum and maximum).
2. Owing to having 3 chips in one LED lamp, which caused many combinations of different wave length. This situation will caused wave length shifting while driving 2 colors or more in the same time.
3. The luminous intensity is measured on B/L surface only.

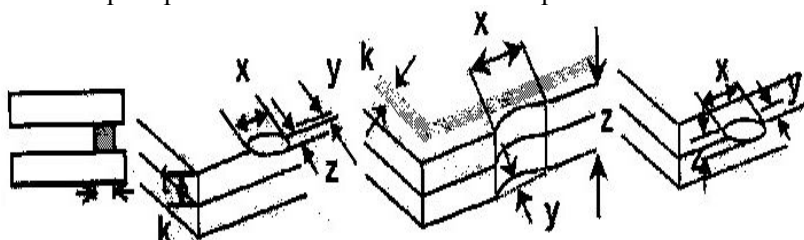
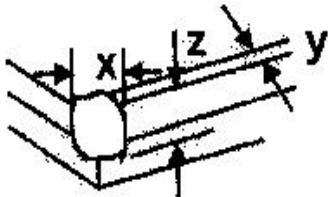
## 1 Backlight Drive Method



The driving circuit of suggestion is showed as above, owing to B/L being designed In parallel mode, so user can use transistor 、FET or TRIC to control.

## 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><tr><th>SIZE</th><th>Acceptable Q TY</th></tr><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></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><tr><th>Length</th><th>Width</th><th>Acceptable Q TY</th></tr><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></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.<br><table><tr><th>Size <math>\Phi</math></th><th>Acceptable Q TY</th></tr><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></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         | <p>Symbols Define:</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>6.1 General glass chip :</p> <p>6.1.1 Chip on panel surface and crack between panels:</p>  <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 <math>1/3k</math></td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>⊙If there are 2 or more chips, x is total length of each chip.</p> <p>6.1.2 Corner crack:</p>  <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 <math>1/3k</math></td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>⊙If there are 2 or more chips, x is the total length of each chip.</p> | 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> <div>  <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> </div> <p>6.2.2 Non-conductive portion:</p> <div>  <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> <div> <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.</p> <p>⊙ If the product will be heat sealed by the customer, the alignment mark not be damaged.</p> </div> </div> <p>6.2.3 Substrate protuberance and internal crack.</p> <div>  <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> </div> | 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.                                                       |      |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.