# TIANMA
# MICROELECTRONICS CO., LTD

## DEVICE SPECIFICATION FOR LCD MODULE

### Model No.  TM82ADCW6

| Prepared by: 王维嵩 | Date: 12/ネ-2000 |
|---|---|
| Checked by: 潘 武 | Date: 12/ -2000 |
| Verified by: 阎 建 | Date: -2000 |
| Approved by: | Date: 13/ネ-2000 |

To: _____
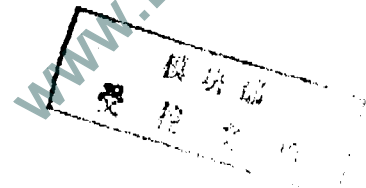
☐CUSTOMER'S APPROVAL

DATE _____

By: _____

Presented

By: _____

Sell and Market   Dep.

TIANMA MICRO ELECTRONICS
CO., LTD

# 1 Display Specifications

1.1 Display type:   STN

1.2 Display color*:

    Display color:   Blue-Black

    Background color:   Gray

1.3 Polarizer mode:   Transflective/Positive

1.4 Viewing Angle:   6:00

1.5 Driving Duty:   1/16

1.6 Backlight:   LED

    *   Color tone is slightly changed by temperature and driving voltage.


# 2 Mechanical Specifications

2.1 Outline Dimensions:   Refer to outline drawing on page: 2

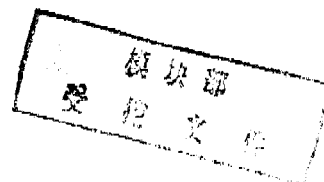2.2 Display Format:     8 Characters X 2 Lines

2.3 Display Fonts:      5 X 7 dots+Cursor

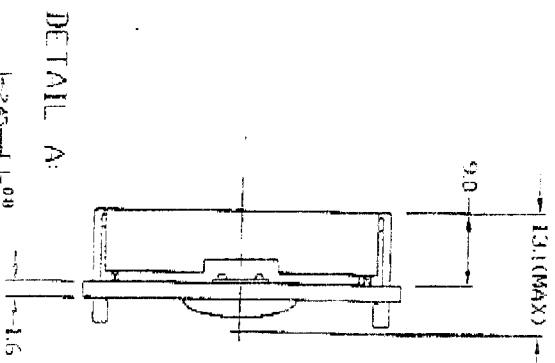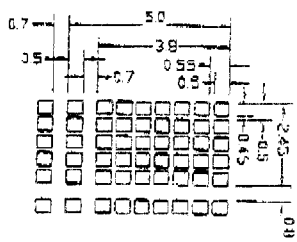2.4 Character Size:    2.45 X 5.0 (mm)
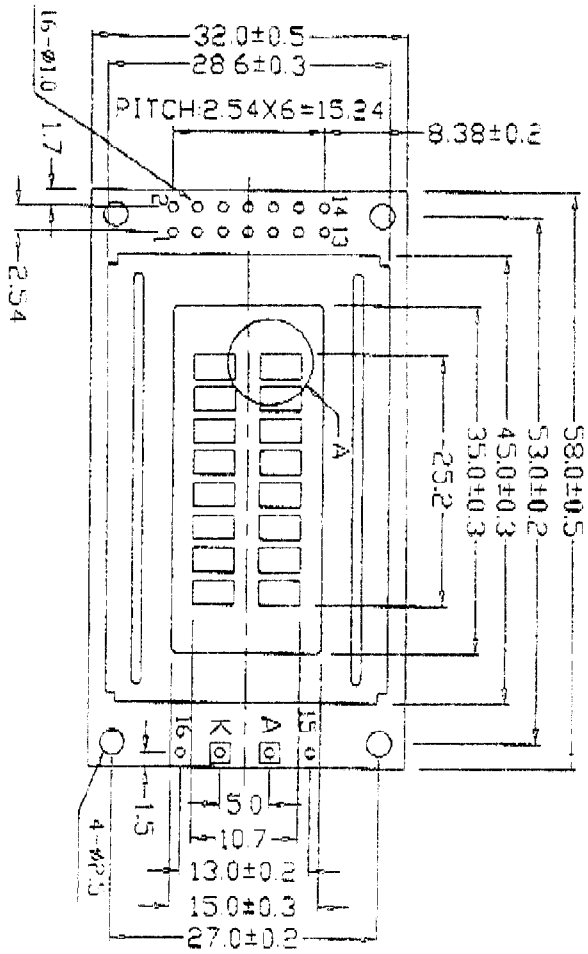
2.5 Dot Size:        0.45X0.5(mm)

2.6 Dot Pitch:       0.5X0.55(mm)

2.7 Weight:         15g

16-Ø1.0

32.0±0.5
28.6±0.3
PITCH:2.54X6=15.24
8.38±0.2

1.7
2.54

58.0±0.5
53.0±0.2
45.0±0.3
35.0±0.3
25.2

A

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vss | Vcc | Vee | RS | R/W | E | DB0 | DB1 | DB2 | DB3 | DB4 | DB5 | DB6 | DB7 | A | K |

16 ○  K ○  A ○  15

5.0
10.7
13.0±0.2
15.0±0.3
27.0±0.2

4-M2.5

1.5

DETAIL A:

0.7
5.0
3.5
3.9
0.55
0.7
2.45
0.5
0.45
0.8

9.0
13.1(MAX)
1.6

Page: 2

# 3  Circuit Block Diagram



DB7
~
DB0

E
R/W
RS
Vee
Vcc
Vss

CONTROL
LSI

KS0066UP-00

SEG40

COM16

LCD
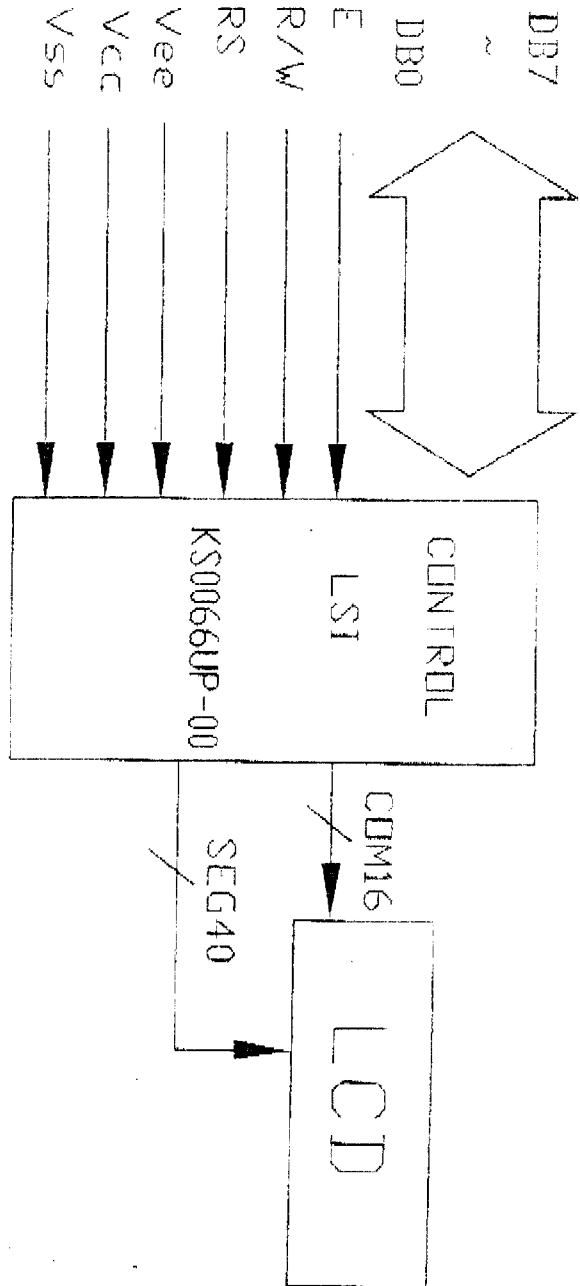
## 4 Absolute Maximum Ratings

| Item | Symbol | Min. | Max. | Unit | Remark |
|------|--------|------|------|------|--------|
| Power Supply Voltage | $V_{DD}-V_{SS}$ | -0.3 | 7.0 | V | |
| LCD Driving Voltage | $V_{DD}-V_{EE}$ | -0.3 | 13.0 | | |
| Operating Temperature Range | $T_{OP}$ | -20 | +70 | ℃ | No Condensation |
| Storage Temperature Range | $T_{ST}$ | -30 | +80 | | |

## Electrical Specifications and Instruction Code

### 5.1 Electrical characteristics

| Item | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|------|------|--------|------|------|------|------|--------|
| Supply Voltage (Logic) | | $V_{DD}-V_{SS}$ | 4.5 | 5.0 | 5.5 | V | |
| Supply Voltage (LCD Drive) | | $V_{DD}-V_{EE}$ | - | 4.7 | - | V | |
| Input Signal Voltage | 'H'Level | $V_{IH}$ | $0.7V_{DD}$ | - | $V_{DD}+0.3$ | V | |
| | 'L'Level | $V_{IL}$ | -0.3 | - | $0.2\,V_{DD}$ | V | |
| Supply current (Logic) | | $I_{DD}$ | - | - | 4.0 | mA | |
| Supply current (LCD Drive) | | $I_{EE}$ | - | - | 3.5 | mA | |
| Supply Current (LED) | | $I_{LED}$ | - | - | 138.6 | mA | |
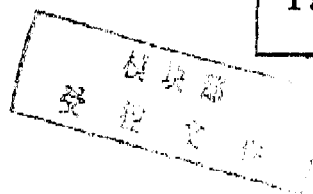
## 5.2 Interface Signals

| Pin No. | Symbol | Level | Description |
|---------|--------|-------|-------------|
| 1 | Vss | 0V | Ground |
| 2 | Vcc | 5.0V | Power supply voltage for logic and LCD(+) |
| 3 | VEE | 0.3V | Power supply voltage for LCD(-) |
| 4 | RS | H/L | Selects registers |
| 5 | R/W | H/L | Selects read or write |
| 6 | E | H/L | Starts data read/write |
| 7 | DB0 | H/L | Data bit0 |
| 8 | DB1 | H/L | Data bit1 |
| 9 | DB2 | H/L | Data bit2 |
| 10 | DB3 | H/L | Data bit3 |
| 11 | DB4 | H/L | Data bit4 |
| 12 | DB5 | H/L | Data bit5 |
| 13 | DB6 | H/L | Data bit6 |
| 14 | DB7 | H/L | Data bit7 |
| 15 | A | 4.2V | The positive electrode of LED backlight |
| 16 | K | 0V | The negative electrode of LED backlight |

## 5.3 Interface Timing Chart:



Write Operation
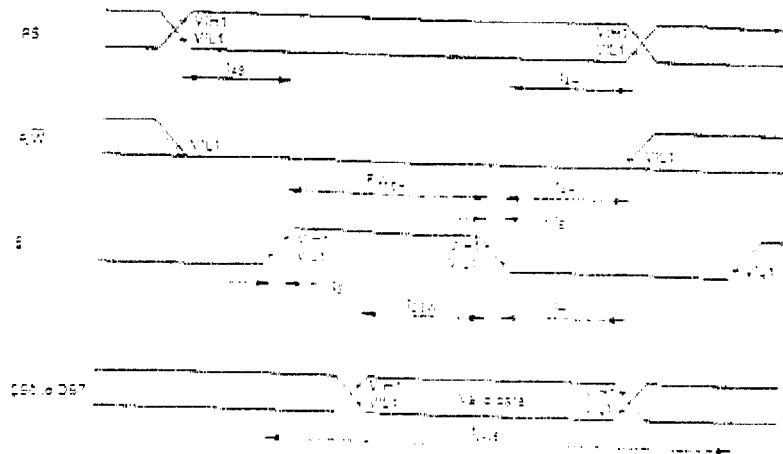
Read Operation
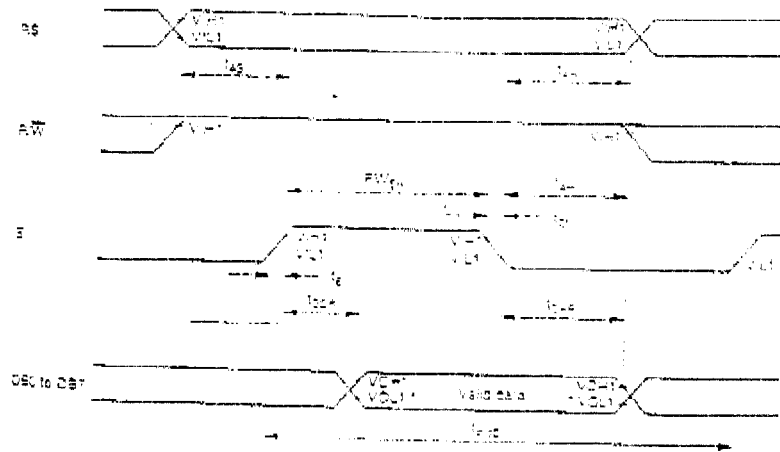
# 5.4 Instruction Code

| Instruction | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Execution Time (max) (when $f_{cp}$ or $f_{osc}$ is 270 kHz) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clear display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Clears entire display and sets DDRAM address 0 in address counter. | 1.52 ms |
| Return home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | — | Sets DDRAM address 0 in address counter. Also returns display from being shifted to original position. DDRAM contents remain unchanged. | 1.52 ms |
| Entry mode set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Sets cursor move direction and specifies display shift. These operations are performed during data write and read. | 37 μs |
| Display on/off control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Sets entire display (D) on/off, cursor on/off (C), and blinking of cursor position character (B). | 37 μs |
| Cursor or display shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | — | — | Moves cursor and shifts display without changing DDRAM contents. | 37 μs |
| Function set | 0 | 0 | 0 | 0 | 1 | DL | N | F | — | — | Sets interface data length (DL), number of display lines (N), and character font (F). | 37 μs |
| Set CGRAM address | 0 | 0 | 0 | 1 | ACG | ACG | ACG | ACG | ACG | ACG | Sets CGRAM address. CGRAM data is sent and received after this setting. | 37 μs |
| Set DDRAM address | 0 | 0 | 1 | ADD | ADD | ADD | ADD | ADD | ADD | ADD | Sets DDRAM address. DDRAM data is sent and received after this setting. | 37 μs |
| Read busy flag & address | 0 | 1 | BF | AC | AC | AC | AC | AC | AC | AC | Reads busy flag (BF) indicating internal operation is being performed and reads address counter contents. | 0 μs |
| Write data to CG or DDRAM | 1 | 0 | Write data | | | | | | | | Writes data into DDRAM or CGRAM | 37 μs $t_{ADD} = 4$ μs* |
| Read data from CG or DDRAM | 1 | 1 | Read data | | | | | | | | Reads data from DDRAM or CGRAM | 37 μs $t_{ADD} = 4$ μs* |

I/D = 1: Increment
I/D = 0: Decrement
S = 1: Accompanies display shift
S/C = 1: Display shift
S/C = 0: Cursor move
R/L = 1: Shift to the right
R/L = 0: Shift to the left
DL = 1: 8 bits, DL = 0: 4 bits
N = 1: 2 lines, N = 0: 1 line
F = 1: 5 × 10 dots, F = 0: 5 × 8 dots
BF = 1: Internally operating
BF = 0: Instructions acceptable

DDRAM: Display data RAM
CGRAM: Character generator RAM
ACG: CGRAM address
ADD: DDRAM address (corresponds to cursor address)
AC: Address counter used for both DD and CGRAM addresses

Execution time changes when frequency changes
Example:
When $f_{cp}$ or $f_{osc}$ is 250 kHz,
$37 \text{ μs} \times \frac{270}{250} = 40 \text{ μs}$

# 6.Optical Characteristics

## 6.1 Optical Characteristics

<div align="right">Top=25℃</div>

| Item | | Symbol | Condition | | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Viewing Angle | | $\theta_x$ | Cr>2 | $\theta_y=0°$ | -30 | -- | 30 | Deg | |
| | | $\theta_y$ | | $\theta_x=90°$ | -35 | -- | 20 | | |
| Contrast Ratio | | Cr | $\theta_x=0°$ $\theta_y=0°$ | | 4.0 | | | | |
| Response Time | Turn on | $T_{on}$ | $\theta_x=0°$ $\theta_y=0°$ | | | | 250 | ms | |
| | Turn off | $T_{off}$ | | | | | 250 | | |

## 6.2 Definition of optical characteristics

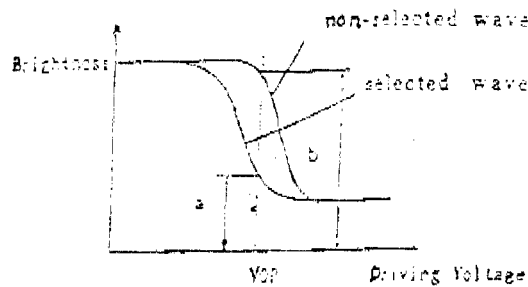### 6.2.1 Definition of viewing Angle(see fig. as follow)

Top                                          Top



Bottom                                       Bottom
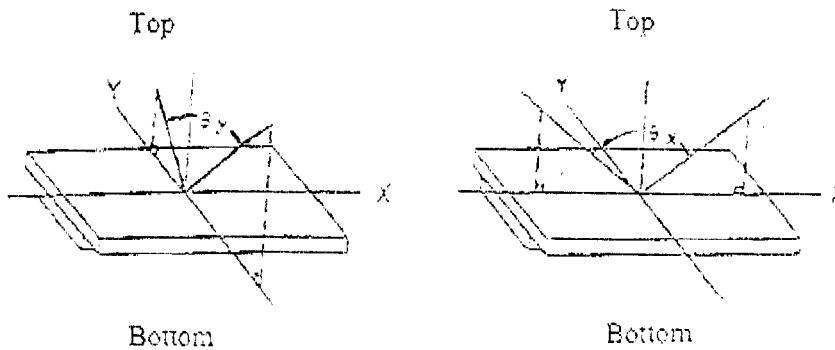
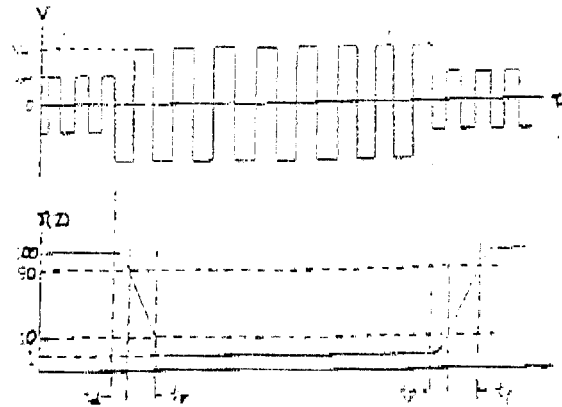### 6.2.2 Definition of Contrast Ratio(see fig. as follow)



$$\text{Contrast Ratio} = b \,/\, a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

    1) Ambient Temperature: 25℃ ;     2) Frame frequency: 64Hz

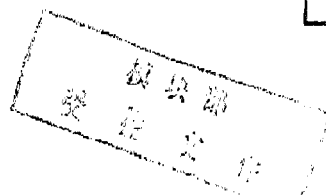### 6.2.3 Definition of Response time(see fig. as follow)



    Turn-on   time: $t_{on} = t_d + t_r$

    Turn-off   time: $t_{off} = t_d + t_f$

Measuring Condition:

  1) Operating Voltage: 4.7V ;     2) Frame frequency: 64Hz

# 7. Reliability

## 7.1 Content of Reliablity Test                    ($T_{op}$=25℃)

| No. | Test Item | Content of Test | Test condition |
|---|---|---|---|
| 1 | High Temperature Storage | Endurance test applying the high storage temperature for a long time | 80℃ 240H |
| 2 | Low Temperature Storage | Endurance test applying the low storage temperature for a long time | -30℃ 240H |
| 3 | High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time | 70℃ 240H |
| 4 | Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time | -20℃ 240H |
| 5 | High Temperature /Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time | 60℃ 95%RH 240H |
| 6 | Temperature Cycle | Endurance test applying the low and high temperature cycle<br><br>-30℃ ←→ 25℃ ←→ 80℃ ←→ 25℃<br>30min    5min    30min    5min<br>←——————————————→<br>1 cycle | -30℃/80℃ 10 cycles |
| 7 | Vibration Test (package state) | Endurance test applying the vibration during transportation | 10Hz~500Hz, $100m/s^2$, 120min |
| 8 | Shock Test (package state) | Endurance test applying the shock during transportation | Half-sinewave, $300m/s^2$, 18ms |
| 9 | Atmospheric Pressure Test | Endurance test applying the atmospheric pressure during transportation by air | 25kPa 16H |
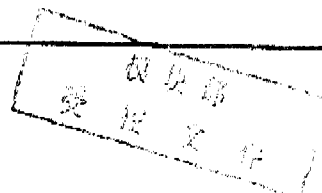
## 7.2 Failure Judgment Criterion

| Criterion Item | Test Item No. | | | | | | | | | Failure Judgement Criterion |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Basic Specification | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Out of the basic Specification |
| Electrical specification | 0 | 0 | 0 | 0 | 0 | | | | | Out of the electrical specification |
| Mechanical Specification | | | | | | | 0 | 0 | | Out of the mechanical specification |
| Optical Characteristic | 0 | 0 | 0 | 0 | 0 | 0 | | | 0 | Out of the optical specification |
| Remark | Basic specification = Optical specification + Mechanical specification | | | | | | | | | |

# 8 Precautions for use of LCD Modules

## 8.1 Handling Precautions

8.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

8.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

8.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

8.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

8.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

    —Isopropyl alcohol

    — Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

    — Water

    —Ketone

    —Aromatic solvents

8.1.6 Do not attempt to disassemble the LCD Module.

8.1.7 If the logic circuit power is off, do not apply the input signals.

8.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environwent.

    a. Be sure to ground the body when handling the LCD Modules.

    b. Tools required for assembly, such as soldering irons, must be properly ground.

    c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

    d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.
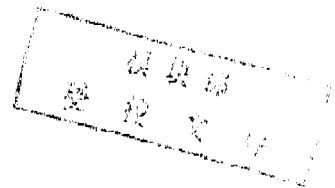
8.2    Storage precautions

8.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the  light of fluorescent lamps.

8.2.2 The LCD modules should be stored under the storage temperature range. If  the LCD modules will be stored for a long time, the recommend condition is:

temperature :          $0°C \sim 40°C$

relatively humidity:   $\leqslant 80\%$

8.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

8.3   The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.