

MA  
ONICS CO., LTD

TIAN-  
MICROELECTRO

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Http://www.lcdfriends.com

N FOR LCD MODULE

DEVICE SPECIFICATION

M161AAAG

Model No. \_\_\_\_\_

Date: 2/5-99
Date: 2/5-99
Date: 2/5-99
Date:

Prepared by: 杨洪涛
Checked by: 王彩荣
Verified by: 许菲光
Approved by:

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Presented

To: \_\_\_\_\_

CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

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CO., LTD

REVISION RECORD

Date	Ref. Page	Revision No.	Revision Items	Check & Approval

發行人  
受控文件

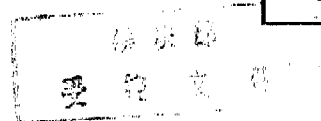
## 1 Display Specifications

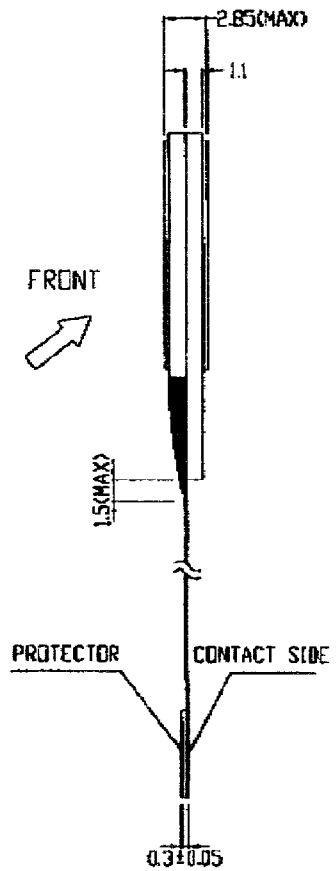
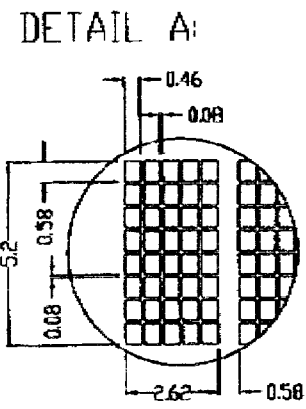
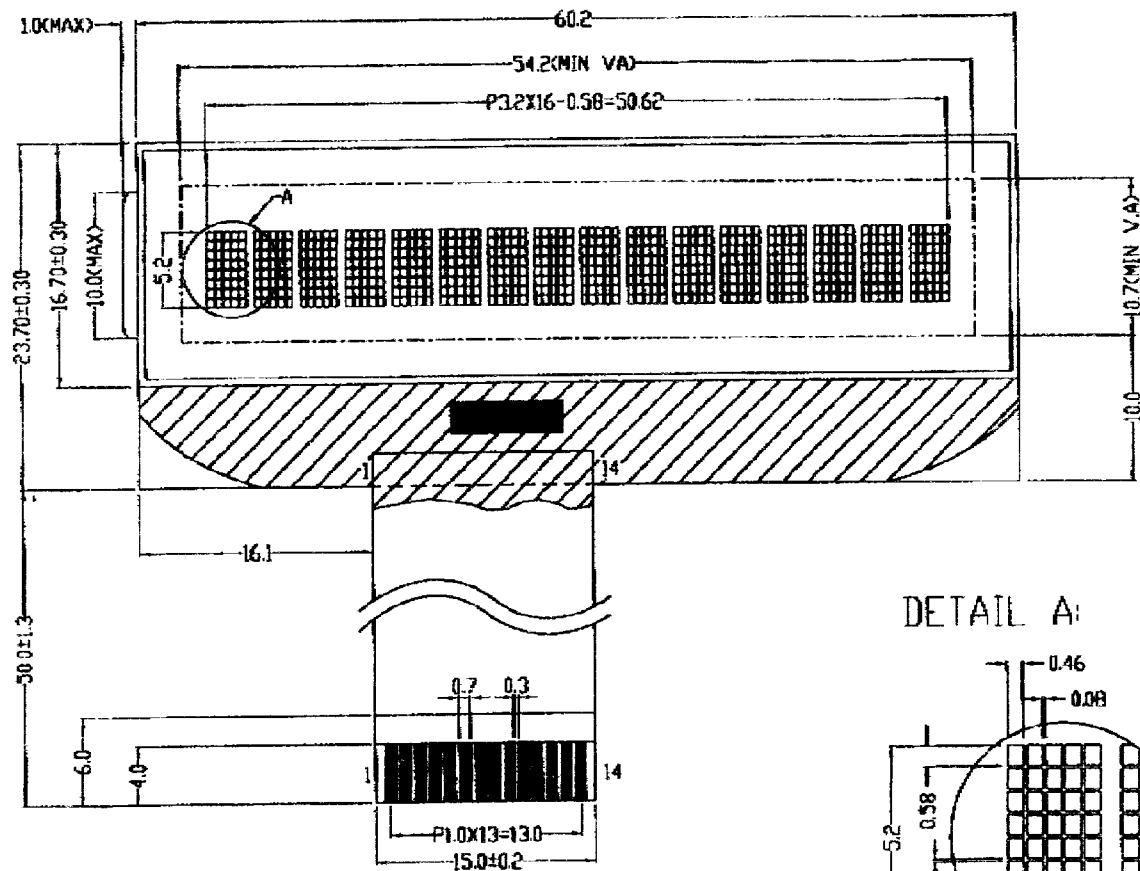
- 1.1 Display type: TN
- 1.2 Display color\*: Black/White
- 1.3 Polarizer mode: Reflective/Positive
- 1.4 Viewing Angle: 6:00
- 1.5 Driving Duty: 1/16

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

## 2 Mechanical Specifications

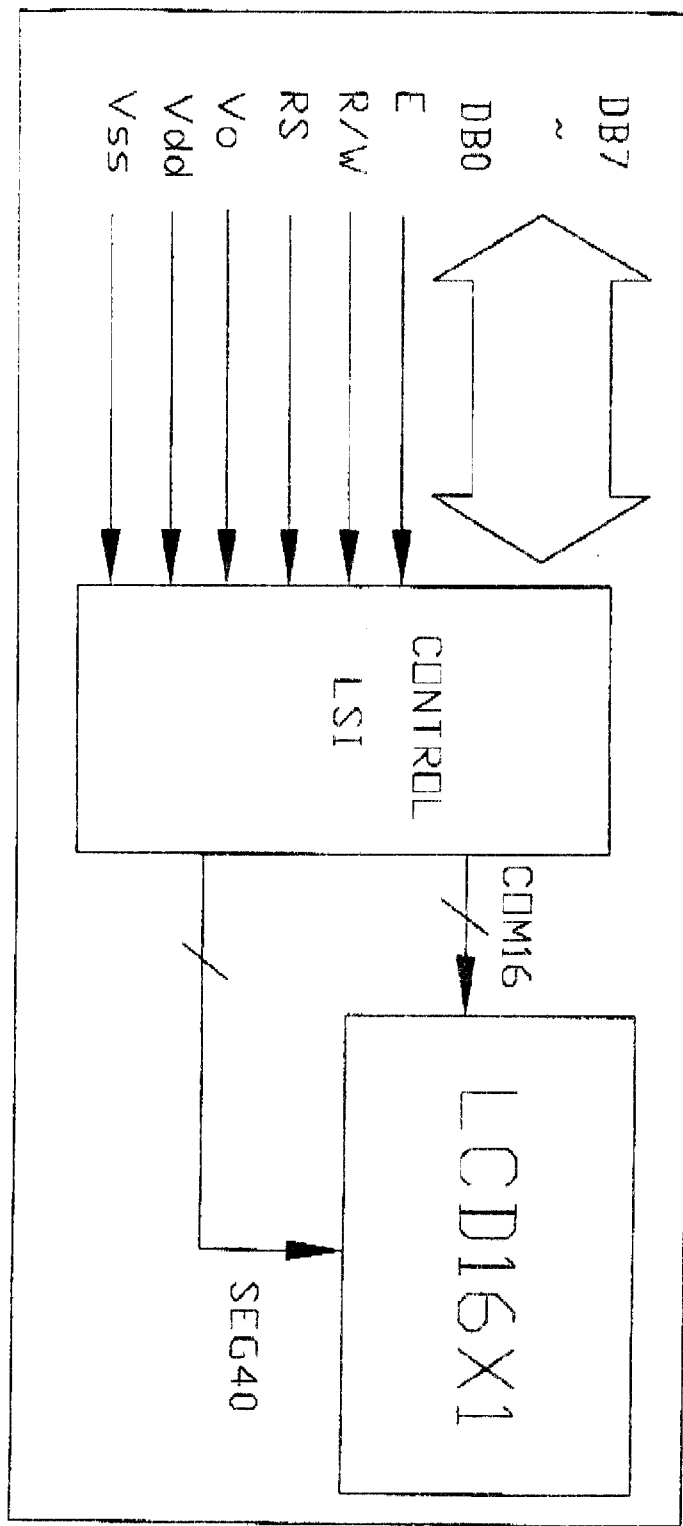
- 2.1 Outline Dimensions: Refer to outline drawing on page: 2
- 2.2 Display Format: 16 Characters X 1 Line
- 2.3 Display Fonts: 5 X 7 Dots+Cursor
- 2.4 Character Size: 2.62 X 5.2 (mm)
- 2.5 Dot Size: 0.46X0.58(mm)
- 2.6 Dot Pitch: 0.54X0.66 (mm)
- 2.7 Weight: 8.5 g





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### 3 Circuit Block Diagram



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#### 4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	4.5	5.5	V	
LCD Driving Voltage	$V_{DD}-V_{EE}$	-	5.5		
Operating Temperature Range	$T_{OP}$	0	+50	°C	No Condensation
Storage Temperature Range	$T_{ST}$	-20	+60		

#### 5 Electrical Specifications and Instruction Code

##### 5.1 Electrical characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark	
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	2.7	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	-	$0.2V_{DD}$	V	
Supply current (Logic)	$I_{DD}$	-	-	3.0	mA		
Supply current (LCD Drive)	$I_{EE}$	-	-	1.0	mA		

## 5.2 Interface Signals

Pin No.	Symbol	Level	Description
1	DB7	H/L	Data bit7
2	DB6	H/L	Data bit6
3	DB5	H/L	Data bit5
4	DB4	H/L	Data bit4
5	DB3	H/L	Data bit3
6	DB2	H/L	Data bit2
7	DB1	H/L	Data bit1
8	DB0	H/L	Data bit0
9	E	H/L	Enable Input
10	R/W	H/L	Selects read or write
11	RS	H/L	Instruction/Data Selects registers
12	V <sub>o</sub>	0.3V	Power supply voltage for LCD(-)
13	V <sub>dd</sub>	5.0V	Power supply voltage for logic and LCD(+)
14	V <sub>SS</sub>	0V	Ground

### 5.3 Interface Timing Chart:

#### AC Characteristics

( $V_{DD} = 4.5 - 5.5V$ ,  $T_a = -30 - + 85^{\circ}C$ )

Mode	Characteristic	Symbol	Min	Typ	Max	Unit
Write Mode (Refer to Fig-3)	E Cycle Time	$t_c$	500	-	-	ns
	E Rise / Fall Time	$t_r, t_f$	-	-	20	
	E Pulse Width (High, Low)	$t_w$	230	-	-	
	R/W and RS Setup Time	$t_{su1}$	40	-	-	
	R/W and RS Hold Time	$t_{h1}$	10	-	-	
	Data Setup Time	$t_{su2}$	80	-	-	
	Data Hold Time	$t_{h2}$	10	-	-	
Read Mode (Refer to Fig-4)	E Cycle Time	$t_c$	500	-	-	ns
	E Rise / Fall Time	$t_r, t_f$	-	-	20	
	E Pulse Width (High, Low)	$t_w$	230	-	-	
	R/W and RS Setup Time	$t_{su}$	40	-	-	
	R/W and RS Hold Time	$t_h$	10	-	-	
	Data Output Delay Time	$t_p$	-	-	120	
	Data Hold Time	$t_{DH}$	20	-	-	

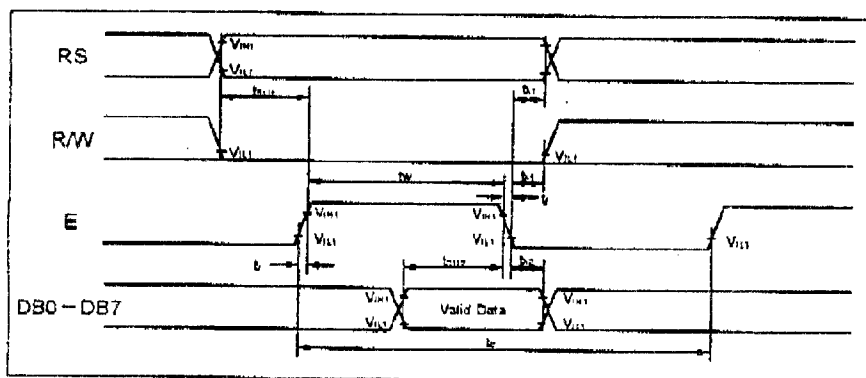


Fig-3. Write Mode Timing Diagram

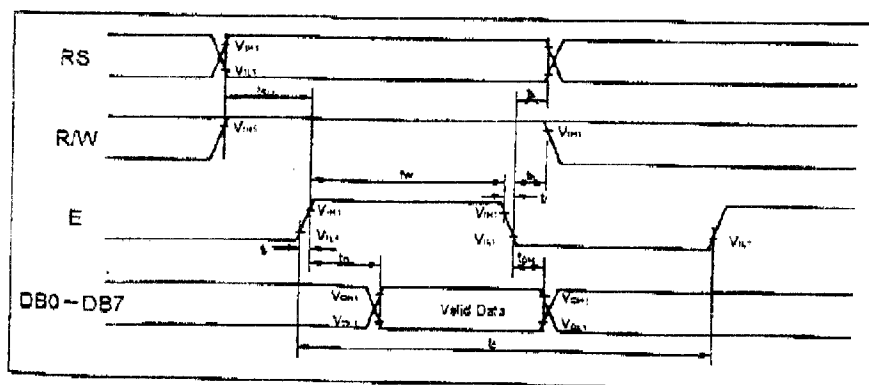


Fig-4. Read Mode Timing Diagram



## 5.4 Instruction Code

Instruction	Instruction Code										Description	Execution Time (fosc=270 kHz)		
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0				
Test Mode	0	0	0	0	0	0	0	0	0	0	0	Device test mode (When 4-bit interface mode) No operation (When 8-bit interface mode)	-	
Clear Display	0	0	0	0	0	0	0	0	0	1	1	Write "00H" to DDRAM and set DDRAM address to "00H" from AC.	820µs	
Return Home	0	0	0	0	0	0	0	0	0	1	0	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	820µs	
Entry Mode Set	0	0	0	0	0	0	0	1	10	5	5	Assign cursor moving direction and enable entire display shift.	37µs	
Display ON/OFF Control	0	0	0	0	0	0	1	0	0	5	5	At display(D), cursor(C), and blinking of cursor position character on/off control(B).	37µs	
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	-	Cursor and Display shift and their direction control without changing DDRAM data.	37µs	
Function Set	0	0	0	0	1	DL	A	-	M0	M1	M1	Set interface data (assign D0: DDRAM addressing mode (A) and COM/SEG output pattern(M0/M1)).	37µs	
Set CGRAM Address	0	0	0	1	-	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	37µs
Set DDRAM Address	0	0	1	-	-	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	37µs
Read Busy flag and Address	DDRAM	0	1	BF	-	-	AC4	AC3	AC2	AC1	AC0	Whether in internal operation or not can be known by reading BF. The contents of address counter can also be read.	0µs	
	CGRAM				-	-	AC4	AC3	AC2	AC1	AC0			
Write Data to RAM	DDRAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43µs	
	CGRAM			-	-	-	D4	D3	D2	D1	D0			
Read Data from RAM	DDRAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43µs	
	CGRAM			-	-	-	D4	D3	D2	D1	D0			

NOTE: the asterisk means "don't care".

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| I/D = 1 : Increment,               | I/D = 0 : Decrement               |
| S = 1 : Shift enable,              | S = 0 : Shift disable             |
| S/C = 1 : Display shift,           | S/C = 0 : Move cursor             |
| R/L = 1 : Shift right,             | R/L = 0 : Shift left              |
| DL = 1 : 8 bit interface,          | DL = 0 : 4 bit interface          |
| A = 0 : DDRAM addressing mode 0,   | A = 1 : DDRAM addressing mode 1   |
| M0 = 0 : COM/SEG output pattern A, | M0 = 1 : COM/SEG output pattern B |
| M1 = 0 : 1 line 16 characters,     | M1 = 1 : 2 line 8 characters      |
| BF = 1 : System is in operation    | BF = 0 : System is ready          |

## 6. Optical Characteristics

### 6.1 Optical Characteristics

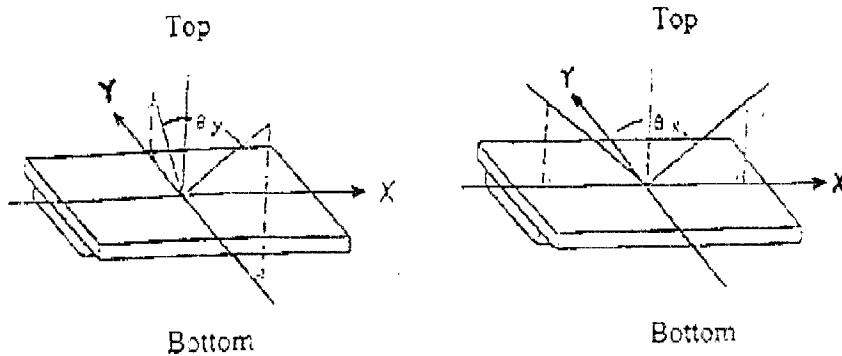
Top=25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	$\theta_x$	$Cr > 2$	$\theta_y = 0^\circ$	-35	--	10	Deg
	$\theta_y$						
Contrast Ratio	Cr	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	3.0				
Response Time	Turn on	$\theta_x = 0^\circ$ $\theta_y = 0^\circ$			150	ms	
	Turn off						

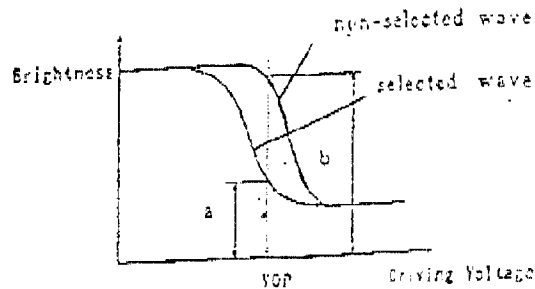


## 6.2 Definition of optical characteristics

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



### 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 °C ;
- 2) Frame frequency: 105.6Hz

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

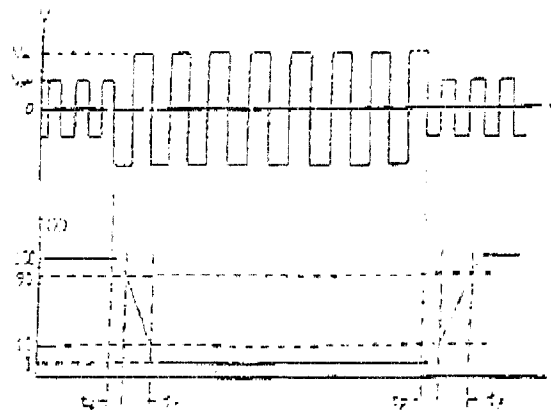
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Turn-on time:  $t_{on} = t_d + t_r$

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

Measuring Condition:

- 1) Operating Voltage: 4.7V ;
- 2) Frame frequency: 105.6Hz



## 7. Reliability

### 7.1 Content of Reliability Test

( $T_{OP}=25^{\circ}C$ )

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	60°C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20°C 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	50°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	0°C 96H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $-20^{\circ}C \longleftrightarrow 25^{\circ}C \longleftrightarrow 60^{\circ}C \longleftrightarrow -20^{\circ}C$ 30min    5min    30min    5min ←-----→ 1 cycle	-20°C/60°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s <sup>2</sup> , 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s <sup>2</sup> , 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 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									

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## **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 environment.
  - 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 :  $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

relatively humidity:  $\leq 80\%$

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.

