

TIAN-MA MICROELECTRONICS CO., LTD

DEVICE SPECIFICATION FOR LCD MODULE

Model No. TM162WDA7

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To: _____

☐ CUSTOMER'S APPROVAL

DATE _____

By: _____

Presented

By: _____
Sell and Market Dep.

TIAN-MA MICRO ELECTRONICS
CO., LTD

REVISION RECORD

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

1 Display Specifications

1.1 Display type: STN

1.2 Display color*:

Display color: Blue-Black

Background: Gray

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 2 Line

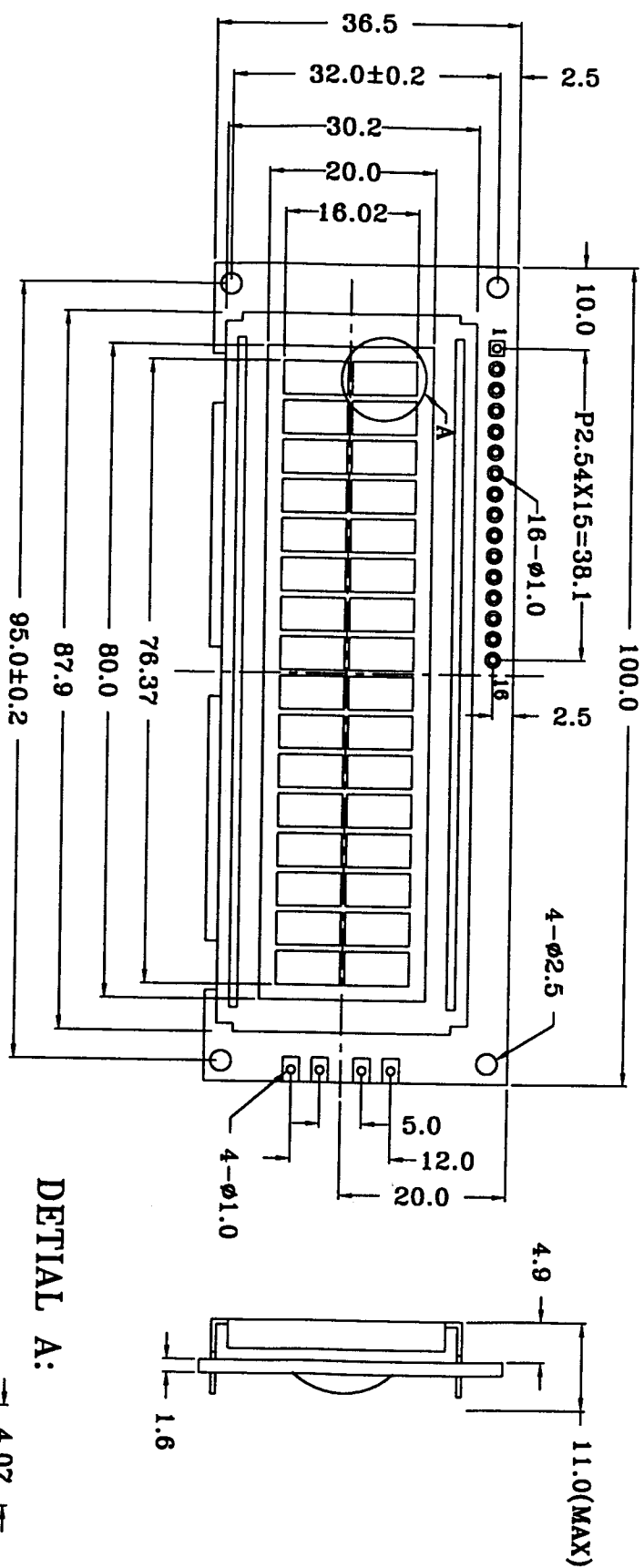
2.3 Display Fonts: 5 X 7 Dots+Cursor

2.4 Character Size: 4.07 X 7.76 (mm)

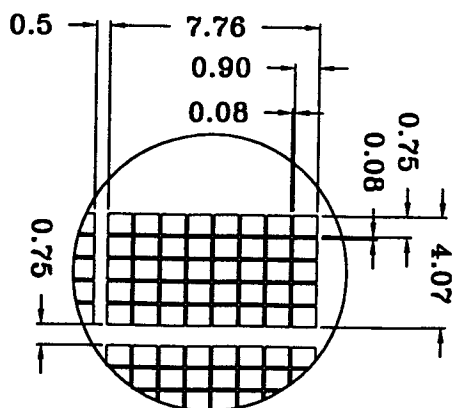
2.5 Dot Size: 0.75X0.90(mm)

2.6 Dot Pitch: 0.83X0.98 (mm)

2.7 Weight: 40 g

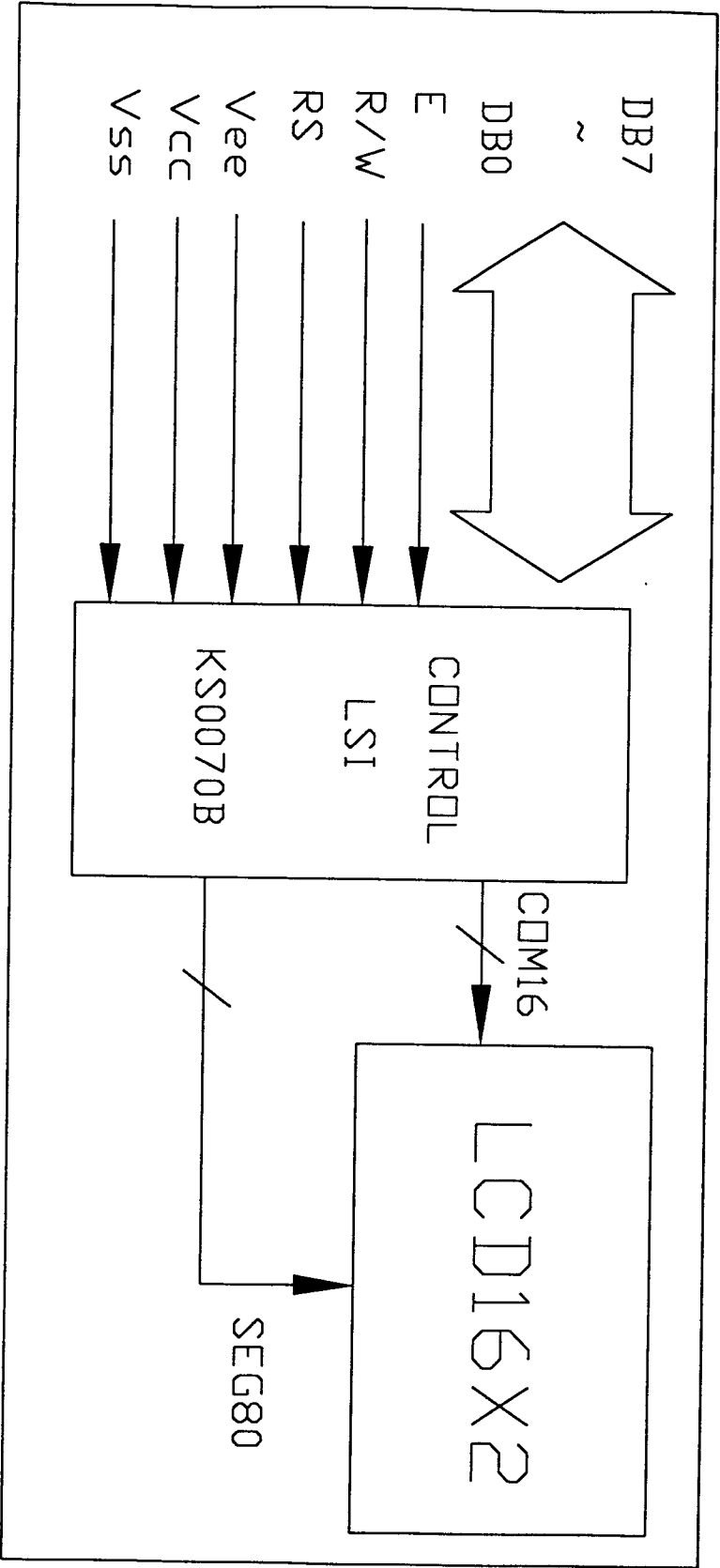


DETAIL A:



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Vss	Vdd	Vo	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	NC	NC

3 **Circuit Block Diagram**



4 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	0	7.0	V	
LCD Driving Voltage	$V_{DD}-V_{EE}$	0	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)		$V_{DD}-V_{SS}$	4.5	5.0	5.5	V	
Supply Voltage (LCD Drive)		$V_{DD}-V_{EE}$	-	4.5	-	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	

5.2 Interface Signals

Pin No.	Symbol	Level	Description
1	V _{SS}	0V	Ground
2	V _{CC}	5.0V	Power supply voltage for logic and LCD(+)
3	V ₀	0.5V	Power supply voltage for LCD(-)
4	RS	H/L	Instruction/Data Selects registers
5	R/W	H/L	Selects read or write
6	E	H/L	Enable Input
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	NC	-	No connection
16	NC	-	No connection

5.3 Interface Timing Chart:

AC Characteristics

(V_{DD} = 4.5 to 5.5 V, Ta = -30 to +85°C)

Mode	Item	Symbol	Min	Typ	Max	Unit
Write Mode (Refer to Fig-6)	E Cycle Time	tc	500	-	-	ns
	E Rise / Fall Time	tr,tf	-	-	25	
	E Pulse Width (High, Low)	tw	220	-	-	
	R/W and RS Setup Time	tsu1	40	-	-	
	R/W and RS Hold Time	th1	10	-	-	
	Data Setup Time	tsu2	60	-	-	
	Data Hold Time	th2	10	-	-	
Read Mode (Refer to Fig-7)	E Cycle Time	tc	500	-	-	ns
	E Rise / Fall Time	tr,tf	-	-	25	
	E Pulse Width (High, Low)	tw	220	-	-	
	R/W and RS Setup Time	tsu	40	-	-	
	R/W and RS Hold Time	th	10	-	-	
	Data Output Delay Time	t _O	-	-	120	
	Data Hold Time	t _{DH}	20	-	-	

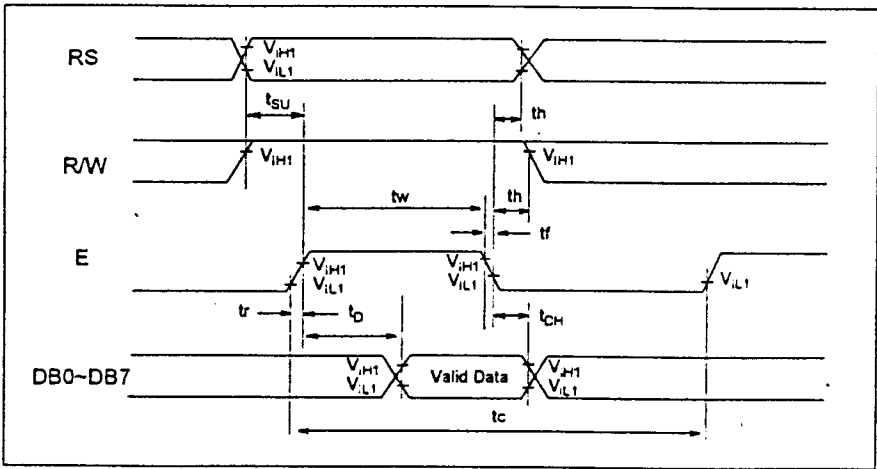


Fig-7. Read Mode Timing Diagram

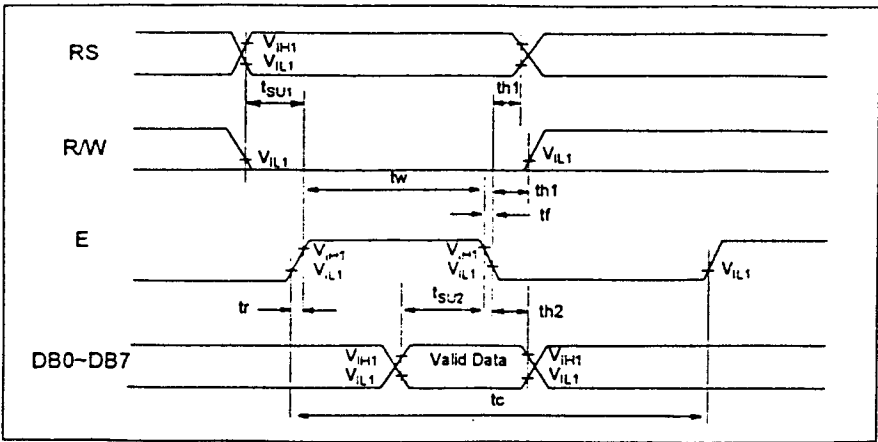


Fig-6. Write Mode Timing Diagram

5.4 Instruction Code

Instruction Table

Instruction	Instruction Code										Description	Execution Time (fosc = 270 kHz)
	RS	R	W	D8	D7	D6	D5	D4	D3	D2		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC.	1.53 ms
Return Home	0	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.	1.53 ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	D 0H	Assign cursor moving direction and enable the shift of entire display.	39 μs
Display ON/OFF Control	0	0	0	0	0	0	1	0	0	E	Set display (D), cursor (C) and blinking cursor (B) on/off control bit.	39 μs
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 μs
Function Set	0	0	0	0	1	DL	N	F	*	*	Set interface data length (DL : 4-bit/8-bit) numbers of display line (N : 1-line/2-line) Display font type (F:0 ...)	39 μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39 μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39 μs
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 μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43 μs

* NOTE : When you make an MPU program with checking the Busy Flag (D87) it must be necessary 1/2Fosc for executing the next instruction by falling E signal after the Busy Flag (D87) goes to "0".

CHARACTER GENERATOR ROM (KS0070B-14)

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

6.Optical Characteristics

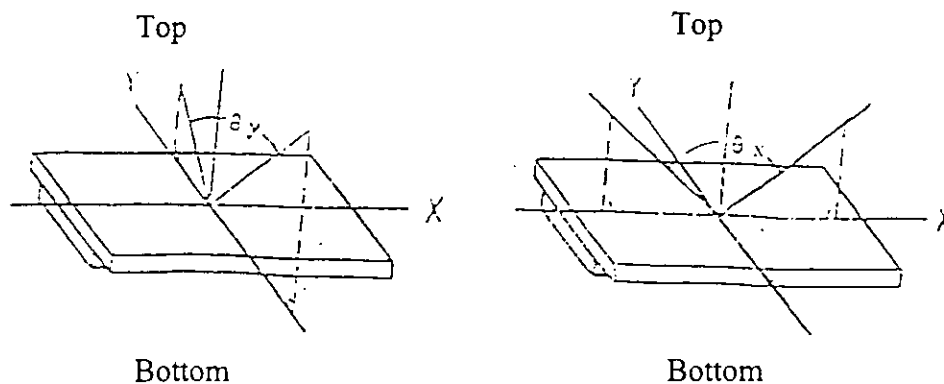
6.1 Optical Characteristics

Top=25℃

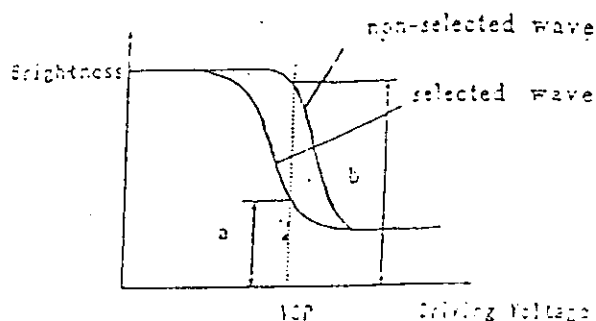
Item		Symbol	Condition		Min.	Typ.	Max.	Unit	Remark
Viewing Angle		θ_x	Cr>2	$\theta_y=0^\circ$	-35	--	10	Deg	
		θ_y		$\theta_x=0^\circ$	-30	--	30		
Contrast Ratio		Cr	$\theta_x=0^\circ$ $\theta_y=0^\circ$		3.0				
Response Time	Turn on	T _{on}	$\theta_x=0^\circ$ $\theta_y=0^\circ$				250	ms	
	Turn off	T _{off}					250		

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)

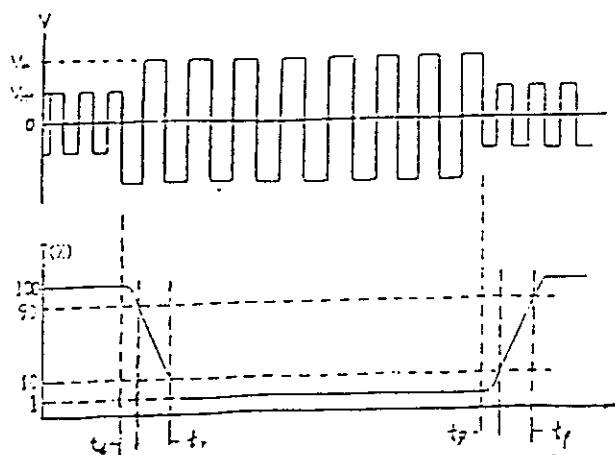


$$\text{Contrast Ratio} = b / a = \frac{\text{non-selected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25°C ;
- 2) Frame frequency: 84.4Hz

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



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

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

Measuring Condition:

- 1) Operating Voltage: 4.5V ;
- 2) Frame frequency: 84.4Hz

7. Reliability

7.1 Content of Reliability Test

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

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 $ \begin{array}{ccccccc} -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 60^{\circ}\text{C} & \longleftrightarrow & -20^{\circ}\text{C} \\ 30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \\ \longleftarrow & & & & & & \longrightarrow \\ & & & & & & \text{1 cycle} \end{array} $	-20°C/60°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s ² , 40min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s ² , 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									

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 alcoholSolvents 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.