GLOMORE

GT-G12864A-BTSESW

LCD

128 x 64 Graphic LCD Display,
Blue STN, Transmissive, Negative,
White LED backlight

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1. Record of Revision

The following table tracks the history of the changes made to this document.

Date	Rev.	Summary	Design	Check
2013-04-13	1.0	Orign Released		

2. Scope

This specification is applied to the liquid crystal display module GT-G12864A-BTSESW
It's a STN, Negative LCD module and display 128*64 dots.

3. Technology Specifications

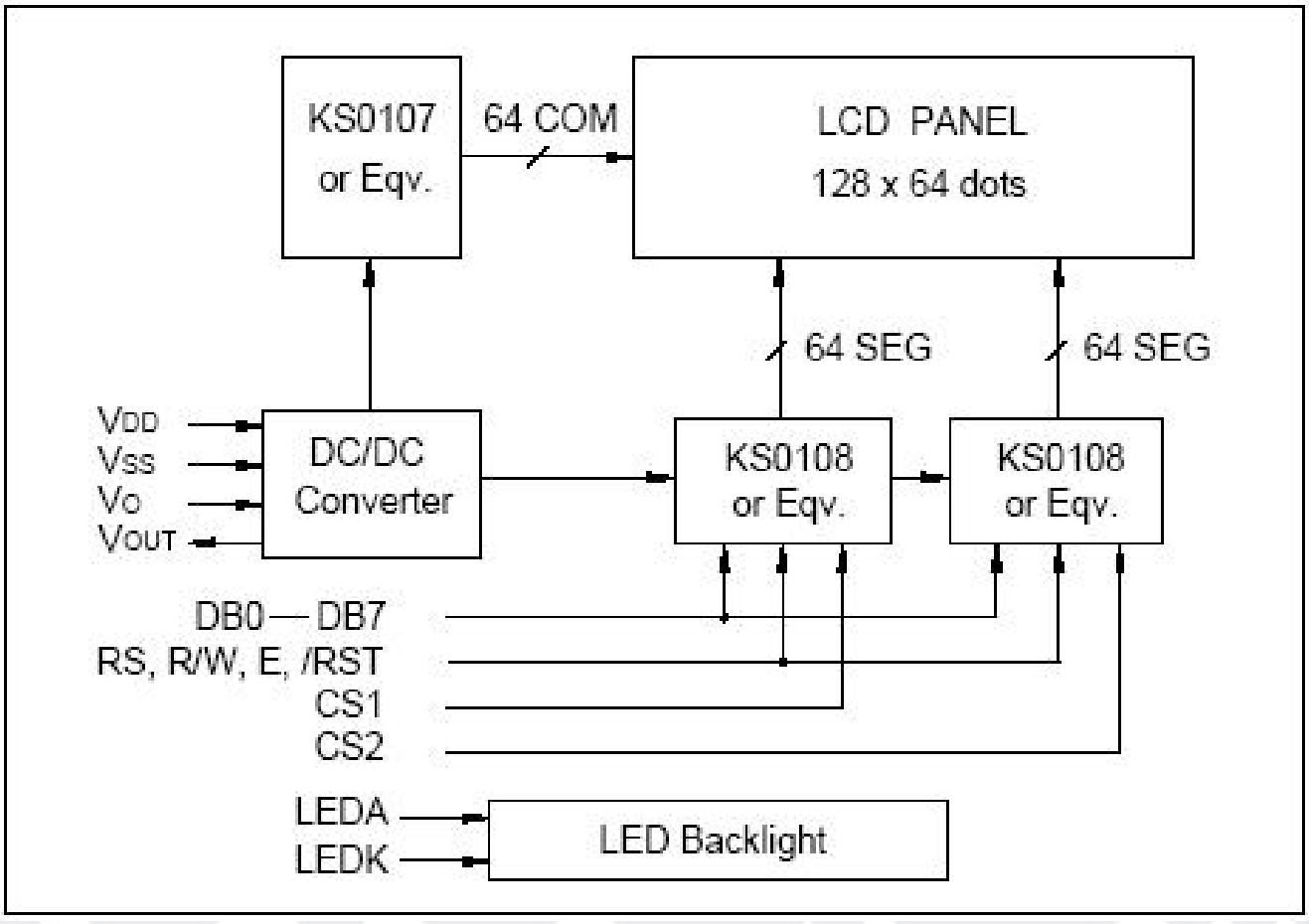
3.1 Features

- Display Format : 128×64 Dots
- Display Mode : STN,Negative,Transmissive-Blue
- Polarizer Mode : Transmissive
- Driving Method : 1/64Duty, 1/9 Bias
- Viewing Direction : 6 O'clock
- Backlight : LED, White
- Weight : ——
- Controller : S6B0108 or Equivalent.
- Interface : 8-Bit Parallel Interface

3.2 Mechanical Specifications

Item	Description	Unit
Module Dimension	93.0(W) × 70.0(H) × 14.5(Max)(T)	mm
Viewing Area	72.0(W) × 39.0(H)	mm
Active Area	66.5(W) × 33.2(H)	mm
Dot Size	0.48(W) × 0.48(H)	mm
Dot Pitch	0.52(W) × 0.52(H)	mm
Character Matrix	——	dots
Character Size	——	mm

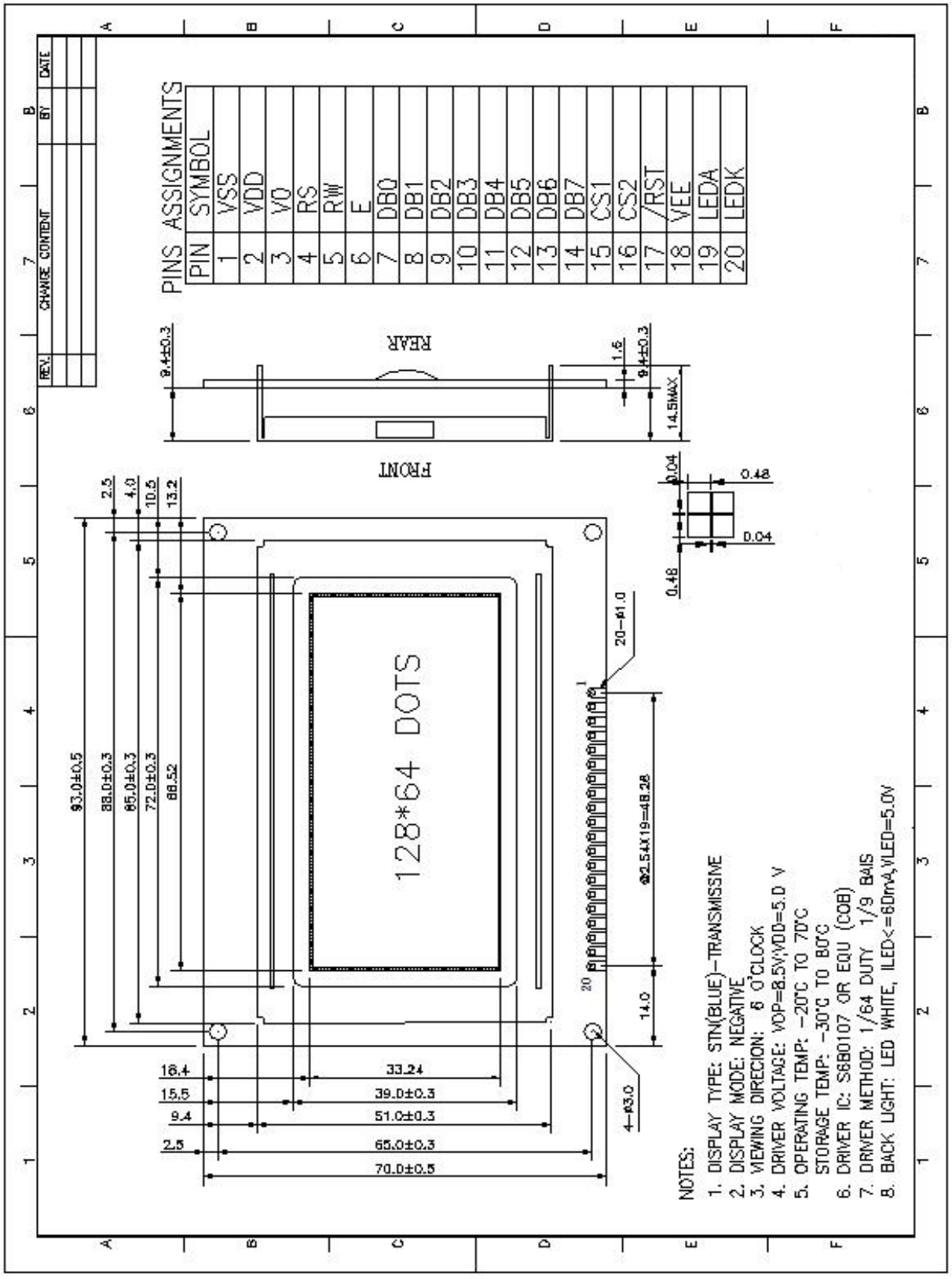
3.3 System Block Diagram



3.4 Terminal Functions

PIN No.	Symbol	Level	Function
1	V_{SS}	——	Power Ground
2	V_{DD}	——	Power supply for logic(+5.0V)
3	V0	——	Power supply for LCD
4	D/I	H/L	Register selection H: Display data L: Instruction code
5	R/W	H/L	Read/Write selection H: Read operation L: Write operation
6	E	H,H→L	Enable signal
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	CS1	H/L	Chip selection for half-left screen, active "H"
16	CS2	H/L	Chip selection for half-right screen, active "H"
17	/RST	H/L	Reset signal, active "L"
18	VEE	——	Negative Voltage Output(-10.0V)
19	LEDA	——	Power supply for LED backlight（+5.0V）
20	LEDK	——	Power supply for LED backlight（0V）

3.5 Dimensional Outline



4. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	V_{DD}-V_{SS}	-0.3	7.0	V
Supply Voltage (LCD)	V_{DD}-V0	-0.3	19.0	V
Input Voltage	VI	-0.3	VDD+0.3	V
Operating Temperature	Topr	-20	70	℃
Storage Temperature	Tstg	-30	80	℃

5. Electrical Characteristics

5.1 DC Characteristics

Item	**Symbol**	**Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
Supply Voltage (Logic)	VDD		4.5	5.0	5.5	V
Supply Voltage (LCD Drive)	VDD-VO	Ta = 25℃	——	11.0	——	V
Input High Voltage	VIH		2.0	——	VDD	V
Input Low Voltage	VIL		-0.3	——	0.8	V
Output High Voltage	VOH	IOH=-0.2mA	2.4	——	VDD	V
Output Low Voltage	VOL	IOL=1.6mA	0	——	0.4	V

5.2 AC Characteristics

Characteristic	Symbol	Min	Typ	Max	Unit
E cycle	t_C	1000	-	-	ns
E high level width	t_{WH}	450	-	-	ns
E low level width	t_{WL}	450	-	-	ns
E rise time	t_R	-	-	25	ns
E fall time	t_F	-	-	25	ns
Address set-up time	t_{ASU}	140	-	-	ns
Address hold time	t_{AH}	10	-	-	ns
Data set-up time	t_{DSU}	200	-	-	ns
Data delay time	t_D	-	-	320	ns
Data hold time (write)	t_{DHW}	10	-	-	ns
Data hold time (read)	t_{DHR}	20	-	-	ns

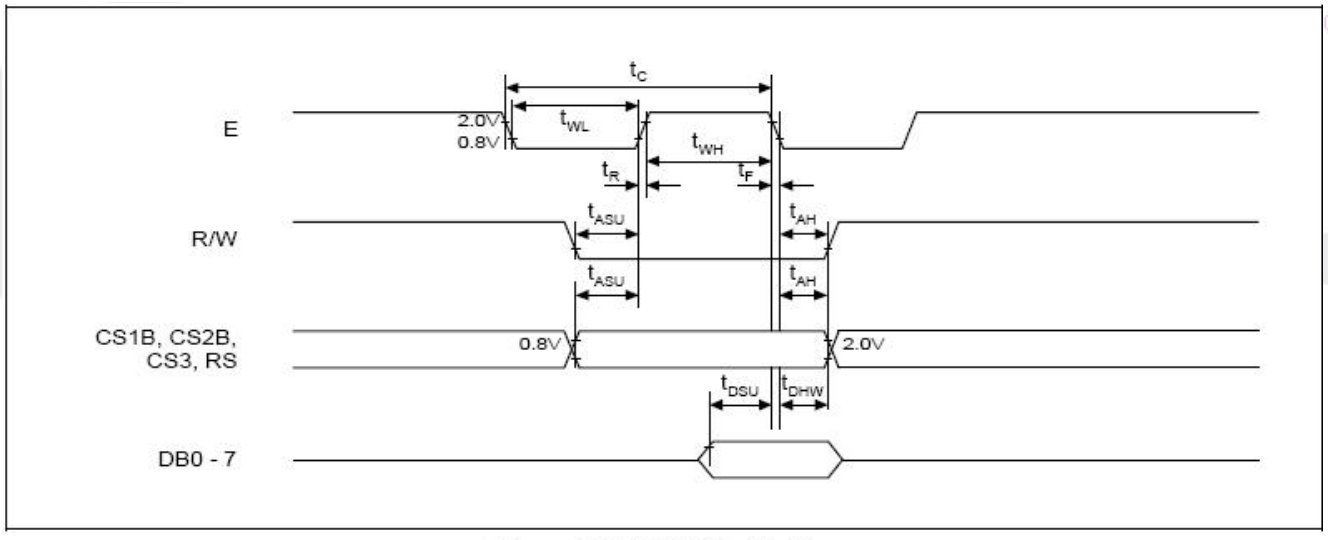


Figure 3. MPU Write Timing

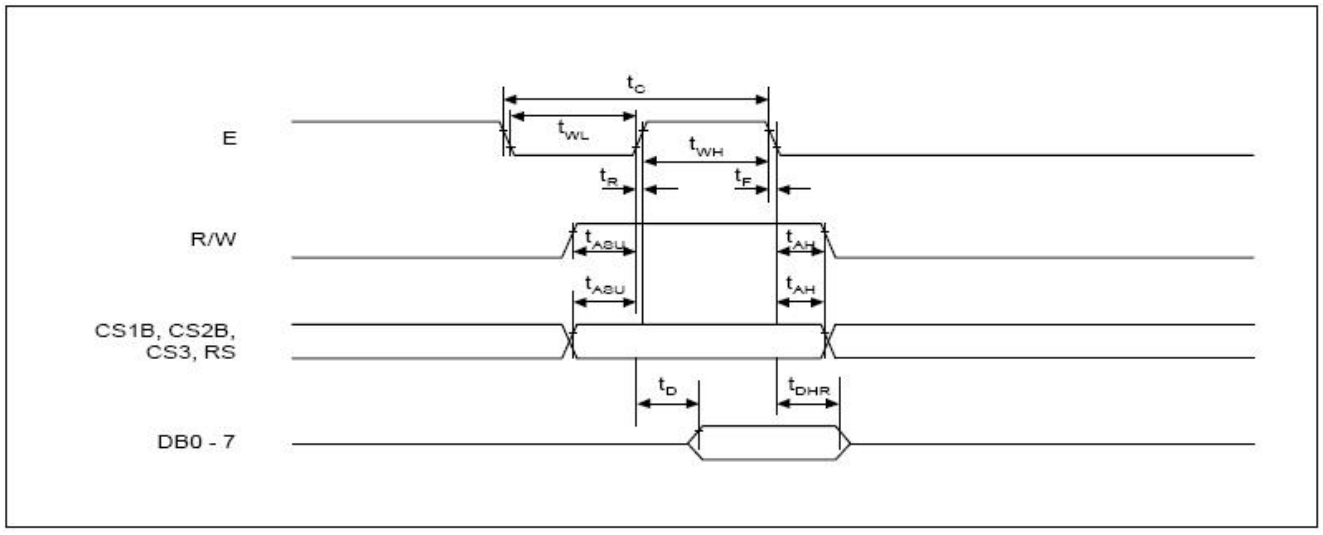


Figure 4. MPU Read Timing

6. LED Backlight Characteristics(Ta = 25℃)

Item	Symbol	Min.	Typ.	Max.	Condition	Unit
Forward Voltage	Vf	3.0	3.2	3.4	If =60mA	V
Reverse Current	Ir					uA
Peak Wave Length	λp				If = 60mA	nm
Spectral Line Half Width	Δλ					nm
Luminance	Lv	250			If = 60mA	cd/m^2
ElectroStatic Discharge	ESD					V

7. DISPLAY CONTROL INSTRUCTION

7.1 Summary

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display on/off	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L: OFF, H: ON
Set address (Y address)	L	L	L	H	Y address (0 - 63)						Sets the Y address in the Y address counter.
Set page (X address)	L	L	H	L	H	H	H	Page (0 - 7)			Sets the X address at the X address register.
Display start line (Z address)	L	L	H	H	Display start line (0 - 63)						Indicates the display data RAM displayed at the top of the screen.
Status read	L	H	Busy	L	On / Off	Reset	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset
Write display data	H	L	Write data								Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read display data	H	H	Read data								Reads data (DB0: 7) from display data RAM to the data bus.

7.2 Explanation of Instruction

7.2.1 Display On/Off

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

The display data appears when D is 1 and disappears when D is 0. Though the data is not on the screen with D =0, it remains in the display data RAM. Therefore, you can make it appear by changing D = 0 into D = 1.

7.2.2 SET ADDRESS (Y ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0 - AC5) of the display data RAM is set in the Y address counter. An address is set by instruction and increased by 1 automatically by read or write operations of display data.

7.2.3 SET PAGE (X ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address(AC0 - AC2) of the display data RAM is set in the X address register. Writing or reading to or from MPU is executed in this specified page until the next page is set.

7.2.4 DISPLAY START LINE (Z ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0 - AC5) of the display data RAM is set in the display start line register and displayed at the top of the screen. When the display duty cycle is 1/64 or others(1/32 - 1/64), the data of total line number of LCD screen, from the line specified by display start line instruction, is displayed.

7.2.5 Status Read

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BUSY	0	ON/OFF	RESET	0	0	0	0

This instruction reads out the internal status.

· BUSY

When BUSY is 1, the Chip is executing internal operation and no instructions are accepted.

When BUSY is 0, the Chip is ready to accept any instructions.

· ON/OFF

When ON/OFF is 1, the display is OFF.

When ON/OFF is 0, the display is ON.

· RESET

When RESET is 1, the system is being initialized.

In this condition, no instructions except status read can be accepted.

When RESET is 0, initializing has finished and the system is in the usual operation condition.

7.2.6 Write Display Data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0 - D7) into the display data RAM. After writing instruction, Y address is increased by 1 automatically.

7.2.7 Read Display Data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Reads data (D0 - D7) from the display data RAM. After reading instruction, Y address is increased by 1 automatically.

8. Precautions For use of LCD Module

8.1 Handling Precautions

LCD modules are assembled and adjusted with a high degree of precision, do not applying excessive shocks to it or making any alterations or modifications to it, the following precautions should be taken when handing.

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

— 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.

— Do not apply excessive force on the surface of display or the adjoining areas of LCD module since this may cause the color tone to vary.

— If the display surface of LCD module becomes contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, 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

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

— To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following sections when handling the module:

- Terminal electrode sections.
- Part of pattern wiring on TAB, etc.

8.2 Electro-Static Discharge Control

— The IC mounted on the LCD is very susceptible to static electricity. To protect them from static electricity which your body and clothing collect, connect your body to the ground via a resistor of some 1M Ω so that electricity should discharge connect the resistor close to your body in the grounding line and protect yourself from electric shock hazard.

— Module should be store in antistatic bag or other containers resistant to static after remove from its original package.

— The LCD modules use CMOS LSI drivers, so customers are recommend that any unused input terminal would be connected to VDD or VSS, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

— In order to reduce the generation of static electricity, a relative humidity of 50-60% is recommended.
— The LCD module is coated with a film to protect the display surface. Take care when peeling off this protective film since static electricity may be charged.
— Tools required for assembly, such as soldering irons, must be properly grounded.

8.3 Design Precautions

— The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operating characteristics may be adversely affected.
— To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.
— The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range. Also, keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.
— Sufficiently notice the mutual noise interference occurred by peripheral devices.
— To cope with EMI, take measures basically on outputting side.
— If DC is impressed on the liquid crystal display panel, display definition is rapidly deteriorated by the electrochemical reaction that occurs inside the liquid crystal display panel. To eliminate the opportunity of DC impressing, be sure to maintain the AC characteristics of the input signals sent to the LCD Module.

8.4 Soldering Precautions

Soldering should apply to I/O terminals only.
— Soldering temperature is 280℃+(-)10℃.
— Soldering time 3-4 seconds.
— Eutectic solder (rosin flux filled) should be used.
— Only properly grounded soldering iron should be used.
— If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation and LCD surface should be covered during soldering to prevent any damage to flux spatters.
— When remove the lead wires from the I/O terminals, use proper de-soldering methods, e.g. suction type de-soldering irons. Do not repeat wiring by soldering more than three times at the pads and plated though holes may be damaged.

8.5 Operational Precautions

— Do not remove the panel or frame from the liquid crystal display module.
— Power supplies should always be turned on before the independent input signal sources turned on, and input signals should be turned off before power supplies turned off.
— The IC would break down if the driving voltage exceeds the limit. Make sure of electrical

specifications, particularly the supply voltage.

— It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

— Some font will be abnormally displayed when the display area is pushed hard during operation. But It resumes normal condition after turning off once.

— The response of the display is slow when the ambient temperature is below the lower limit, and the display surface appears dark everywhere when the ambient temperature is above the upper limit, in any case, id does not mean failure. It operates properly in the normal operating temperature range.

— The contrast of the liquid crystal display varies with the viewing angle, ambient temperature, and driving voltage. Adjust the driving voltage for the best contrast by installing external variable switch.

— If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

— Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions. Therefore it must be used under the relative condition of 50% RH.

8.6 Storage Precautions

— Take care to minimize corrosion of the electrodes. Water droplets or a current flow in a high humidity environment accelerates corrosion of the electrodes.

— When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the LCD module in sealed polyethylene bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperature below 0). The temperature range of 0℃~ -30℃ and at low humidity is recommended.

Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.