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# HTM12864H

## LCD Module User Manual

Shenzhen HOT Display Technology Co., Ltd.

Rev.	Descriptions	Date
01	Prelimiay Release	2012-7-13

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# 1. Basic Specifications

## 1.1 Display Specifications

1>LCDDisplayMode	STN, Positive, Transflective
2>Viewing Angle	6H
3>Driving Method	1/64 Duty, 1/9 Bias
4>Interface	6800 MPU interface(8 Bit Bus)
5>Backlight:	4 Pcs White LED (Parallel)
6>Controller/Driver	SBN0064G or EQUIV

## 1.2 Mechanical Specifications

1>Outline Dimension	63.20X52.20 X11.50mm (See attached Outline Drawing for Data)
2>Active Area	49.88(L)x31.32(W)
3>Pixel Pitch	0.49(L)x0.39(W)

## 1.3 Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Power Supply Voltage	V <sub>CC</sub>	-0.3	+5.5	V	V <sub>SS</sub> =0v
Input Voltage	V <sub>IN</sub>	-0.3	V <sub>DD</sub> +3.1	V	V <sub>SS</sub> =0v
LCD Driver Supply Voltage	V <sub>GH-VSS</sub>	-	-12.0	V	-
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	No Condensation
Storage Temperature	T <sub>st</sub>	-30	+80	°C	No Condensation
Storage Humidity	H <sub>d</sub>	-	T <sub>a</sub> <40	°C	

## 1.4 DC Electrical Characteristics

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Logic Supply Voltage	IOVCC	1.65	4.5	5.5	V	-
Input High Voltage	V <sub>IH</sub>	0.7 IOVCC	--	IOVCC	V	-
Input Low Voltage	V <sub>IL</sub>	-0.3	-	0.3 V <sub>DD</sub>	V	-
Output H Voltage	V <sub>OH</sub>	0.8 IOVCC		-	V	-
Output L Voltage	V <sub>OL</sub>	-	-	0.2 IOVCC	V	-
Supply Current	I	-	-	60	mA	V <sub>bl</sub> =4.5V

## 2. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage	V <sub>DD</sub>	-0.3	+5.5	V	V <sub>SS</sub> = 0V
Input Voltage	V <sub>IN</sub>	-0.3	V <sub>DD</sub> +0.3	V	V <sub>SS</sub> = 0V
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	No Condensation
Storage Temperature	T <sub>st</sub>	-30	+80	°C	No Condensation

## 3. Electrical Characteristics

### 3.1 DC Characteristics

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Operating Voltage	V <sub>DD</sub>	4.5	5.0	5.5	V	V <sub>DD</sub>
Input High Voltage	V <sub>IH</sub>	2.0	-	V <sub>DD</sub>	V	/CS1,/RES,RS,R/W, E,D0~D7
Input Low Voltage	V <sub>IL</sub>	V <sub>SS</sub>	-	0.3 x V <sub>DD</sub>	V	
Output High Voltage	V <sub>OH</sub>	2.4	-	V <sub>DD</sub>	V	D0~D7
Output Low Voltage	V <sub>OL</sub>	-	-	0.4	V	D0~D7
Input Leakage Current	I <sub>LI</sub>	-1.0	-	1.0	μA	V <sub>DD</sub>
Output Leakage Current	I <sub>Lo</sub>	-	1.5	-	mA	V <sub>DD</sub>
Supply Step-up output voltage Circuit	VLCDIN	-8.0	-10.0	-12.0	V	V <sub>SS</sub>

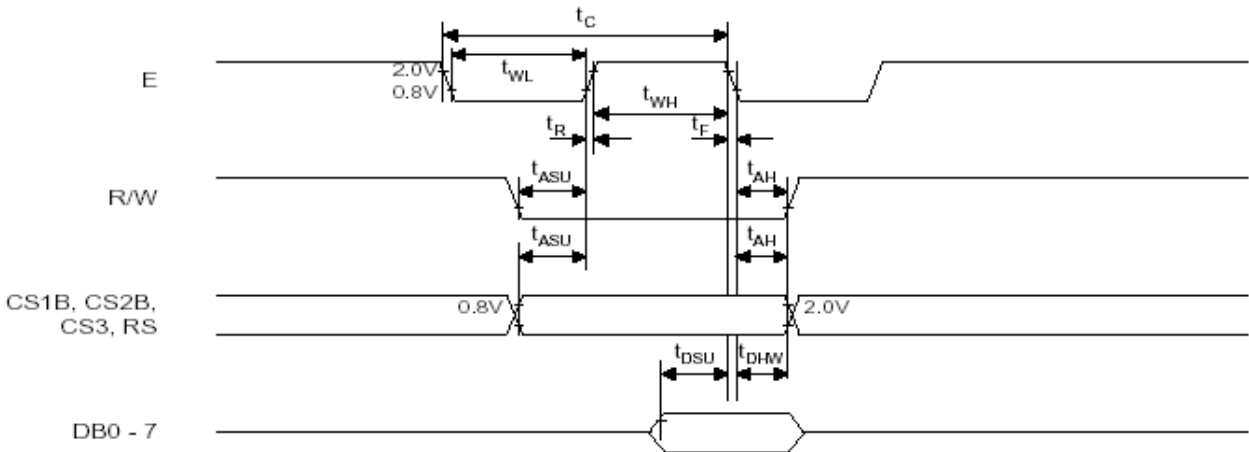
### 3.2 LED Backlight Circuit

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V <sub>f</sub> BLA	-	5.0	-	V	V <sub>DD</sub>
Forward Current	I <sub>f</sub> BLA	-	60	80	mA	4 PCS LED

### 3.3 AC Characteristics

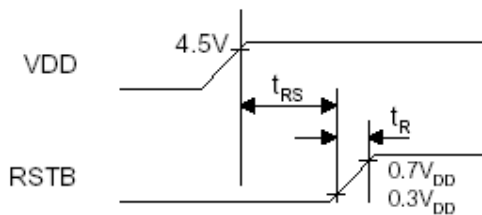
#### 6800 Mode System Bus Timing

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

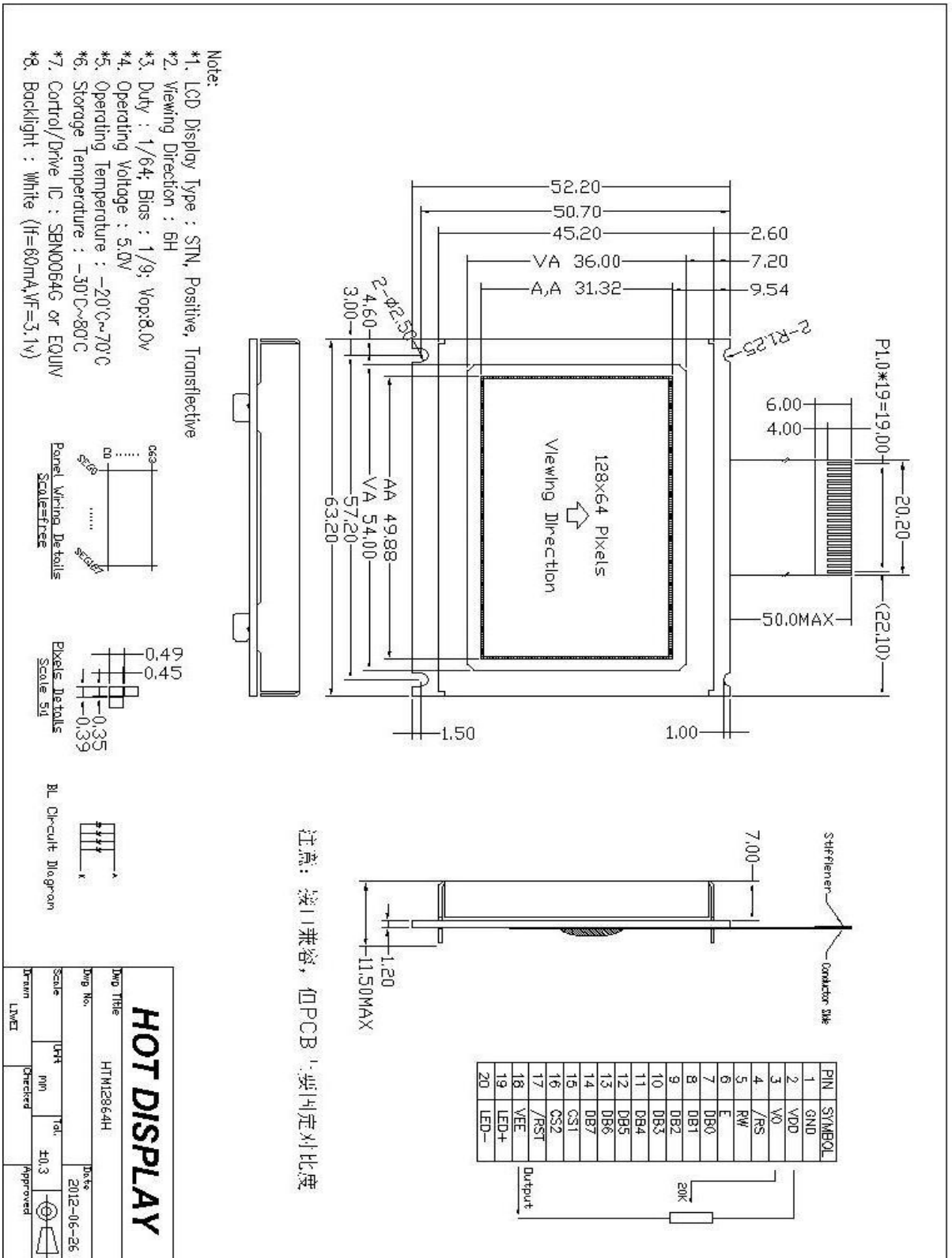


### 3.4 Rest Timing

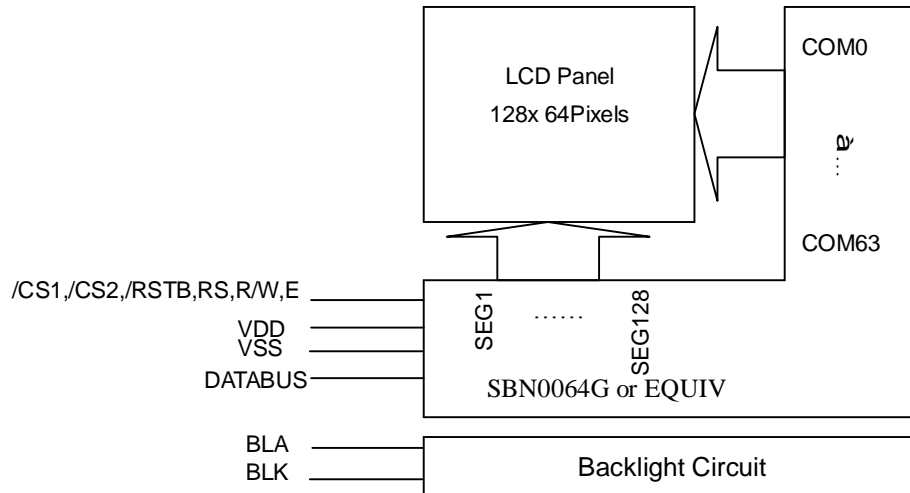
Item	Symbol	Min	Typ	Max	Unit
Reset time	$t_{RS}$	1.0	-	-	us
Rise time	$t_R$	-	-	200	ns



### 4. Structure Block



#### 4.1 Circuit Diagram



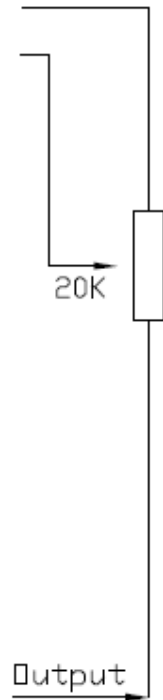
#### 4.2 Terminal Function

Pin No.	Pin Name	Function
1	GND	VSS
2	VDD	LCD Positive(5.0V)
3	V0	LCD Adjust
4	RS	H:Data; L: Instruction
5	R/W	H:Read ; L: Write.
6	E	Enable signal.
7~14	DB0~DB7	Data Buss
15	/CS1	Chip selection input 1 (Low effective)
16	/CS2	Chip selection input 2 (Low effective)
17	/RST	Reset Signal input
18	VEE	About -10.0V
19	LED+	Bcaklight Positive(5.0V)
20	LED-	Bcaklight Negative(VSS)

## 5. Function specifications

### 5.1 The Parallel Interface

PIN	SYMBOL
1	GND
2	VDD
3	V0
4	/RS
5	RW
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	CS1
16	CS2
17	/RST
18	VEE
19	LED+
20	LED-





## 5.2 Display Commands

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.

```

void WrateC(uchar cmd)
{
Cselect();
R_S=0;
RW=0;
P1=cmd;
E=1;
E=0;
CS1=1;CS2=1;
}
void WriteData(uchar dat)
{
Cselect();
R_S=1;
RW=0;
P1=dat;
E=1;
E=0;

```

```

CS1=1;CS2=1;}
void Cselect()
{
if(chip_select==0)
{CS1=0;CS2=1;}
if(chip_select==1)
{CS1=1;CS2=0;}
}
void Setadd(uchar column,uchar page)
{
if(column<64)
chip_select=0;
else
{ chip_select=1; column-=63; }
WrateC(page+0xB8);
WrateC(column+0x40);
}

```

**5.3 Basic Operating Sequence  
Initialization Sequence**

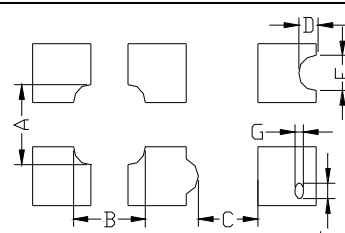
	Code Function										Note	
	A0	D7	D6	D5	D4	D3	D2	D1	D0	hex		
Turn on Power Supply VDD & VSS While maintaining /RES at LOW	-	-	-	-	-	-	-	-	-	-	-	
Wait until power supply is stabilized	-	-	-	-	-	-	-	-	-	-	-	
Release the /RES Reset Signal (/RES = High)	-	-	-	-	-	-	-	-	-	-		
START LINE	0	1	1	0	0	0	0	0	0	C0H	Sets the X address at the X address register.	
DISPLAY ON	0	0	0	1	1	1	1	1	1	3FH		
SET PAGE	0	1	0	1	1	8	0	0	0	B8H	Sets the X address at the X address register.	
SET ADDRESS	0	0	1	0	0	0	0	0	0	40H	Sets the Y address in the Y address counter.	
WRITE DATA	1	X	X	X	X	X	X	X	X	XXH	DISPLAY DATA	

**Example: Clear The LCD**

```

void ClearLCD()
{
    uchar page,column;
    chip_select=0;
    WrateC(0x3f);
    WrateC(0xC0);
    chip_select=1;
    WrateC(0x3f);
    WrateC(0xC0);
    for(page=0;page<8;page++)
    {
        for(column=0;column<128;column++)
        {
            Setadd(column,page);
            WriteData(0x00);
        }
    }
}
    
```

## 6. Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size $\Phi$ (mm)      Acceptable number $\Phi \leq 0.3$ Ignore (note) $0.3 < \Phi \leq 0.45$ 3 $0.45 < \Phi \leq 0.6$ 1 $0.6 < \Phi$ 0	Minor
3) Black / White line	Length (mm)    Width (mm)      Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 <p style="text-align: center;"> <math>\frac{A+B \leq 0.28}{2}</math>    <math>0 &lt; C</math>    <math>\frac{D+E \leq 0.25}{2}</math>    <math>\frac{F+G \leq 0.25}{2}</math> </p> <p>Note: 1) Up to 3 damages acceptable  2) Not allowed if there are two or more pinholes every three-fourth inch.</p>	Minor
5) Spot-like contrast irregularity	Size $\Phi$ (mm)      Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size $\Phi$ (mm)      Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 0	Minor
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with "2) Black/white spot", and "3) Black/White line".	Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball, solder hips)	(1) $0.45 < \Phi$ , $N \geq 1$ (2) $0.3 < \Phi \leq 0.45$ , $N \geq 1$ , $\Phi$ : Average diameter of solder ball (unit: mm) (3) $0.5 < L$ , $N \geq 1$ , L: Average length of solder chip (unit: mm)	Minor
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

## 8. Handling Precautions

### 8.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged.

And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

### 8.2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketene
- Aromatics

### 8.3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to  $V_{dd}$  or  $V_{ss}$ . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### 8.4 Packaging

- Module employs LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

### 8.5 Caution for operation

-It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.

-An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

### 8.6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

### 8.7 Safety

-It is recommendable to crush damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

-When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.