# User Manual (Technical specification)

HG1286471C-bT62L-VD

## 1 General information

This is a 128*64 LCD module Technical specification, The module built-in controller/Driver （AIP31107/AIP31108）.

## 2 Specifications

### 2.1 General Specifications

Table 1 Features

| S/N | Item | SPEC |
|---|---|---|
| 1 | Display Format | 128×64 Dots |
| 2 | Display Mode | STN, Blue,Negative |
| 3 | Polarizer Mode | Transmissive |
| 4 | Driving Method | 1/64Duty, 1/9 Bias,9.15V Vop |
| 5 | Viewing Direction | 6 O'clock |
| 6 | Backlight | LED, White color |
| 7 | Controller/Driver | AIP31107/AIP31108*2 or Equivalent |
| 8 | Interface | 8-Bit Parallel 6800 Interface |
| 9 | Weight | —— |

### 2.2 Mechanical Specification

Table 2 Mechanical Dimension

| Item | Description | Unit |
|---|---|---|
| Module Dimension | 75.0(W)×52.7(H)×8.9MAX.(T) | mm |
| Viewing Area | 72.0(W)×40.0(H) | mm |
| Active Area | 60.0(W)×32.4(H) | mm |
| Dot Size | 0.4 (W)×0.4 (H ) | mm |
| Dot Pitch | 0.43(W)×0.43(H ) | mm |
| Character Matrix | —— | dots |
| Character Size | —— | mm |

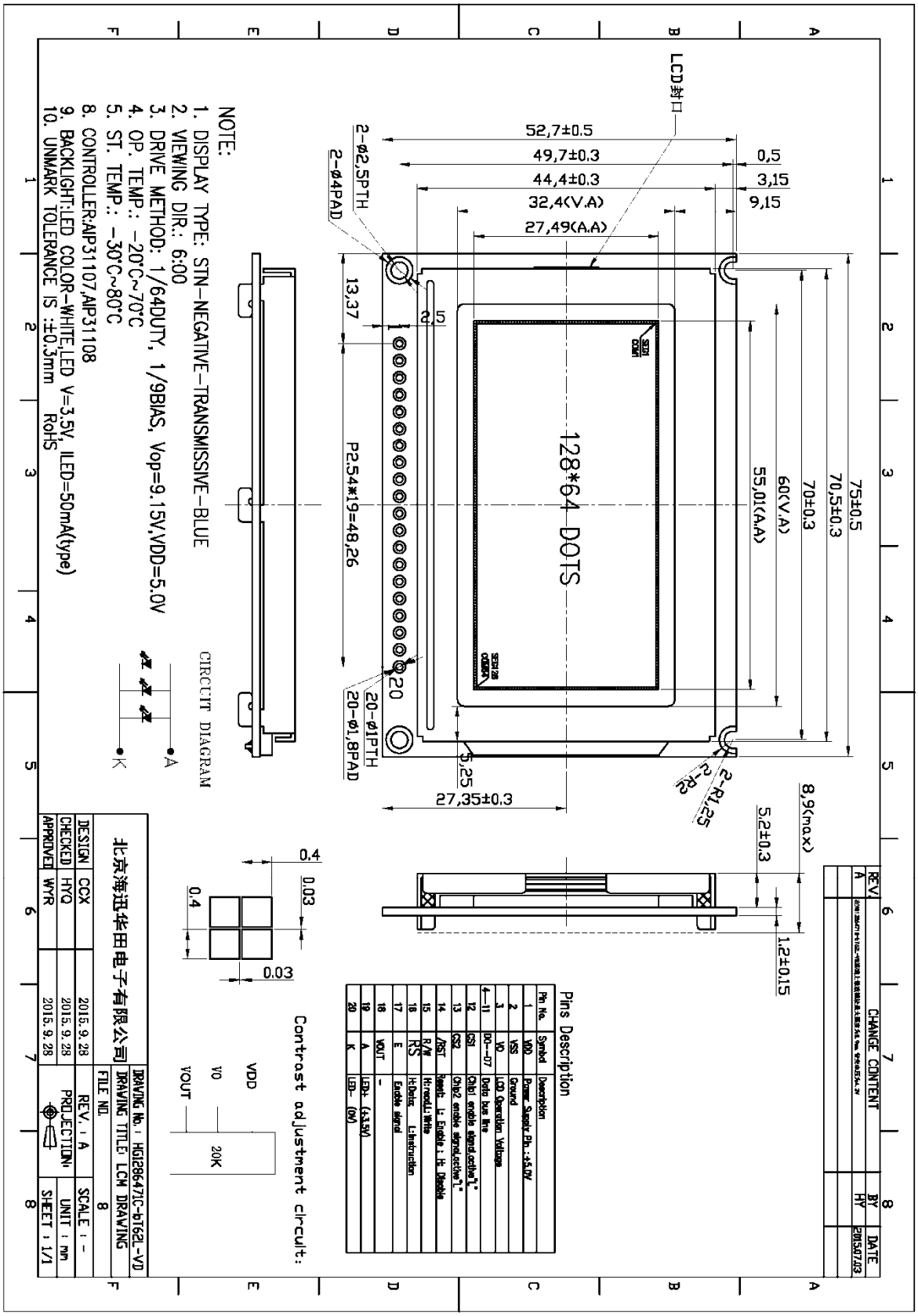



Diagram 1 Mechanical Outline Drawing

### 2.3 System Block Diagram

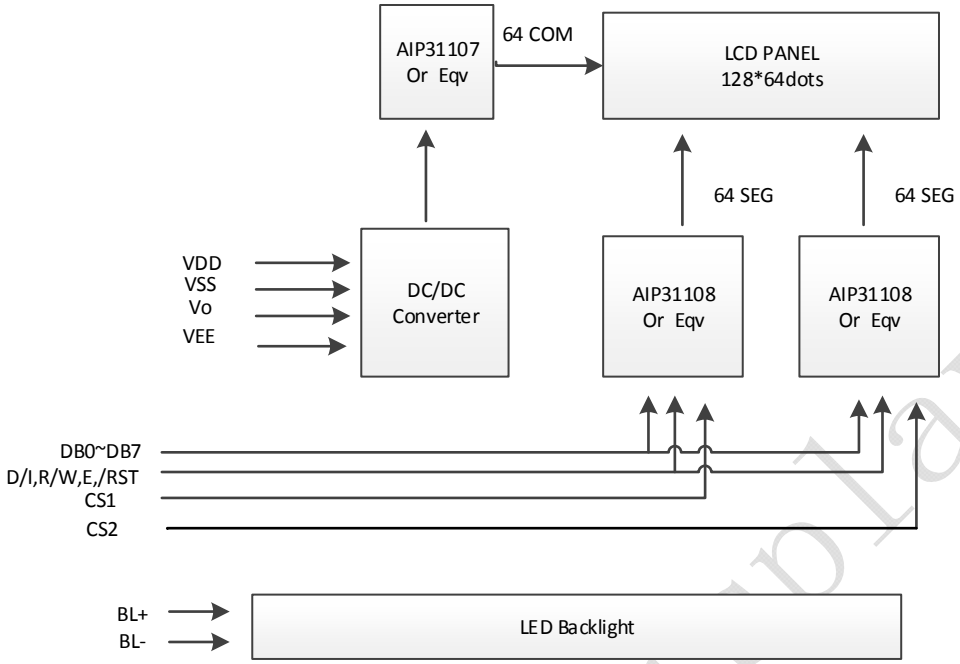



Diagram 2 System Block Diagram

## 3 Terminal Functions

Table 3 Interface Description

| PIN No | Symbol | Level | Function |
|---|---|---|---|
| 1 | VDD | Power | Power supply for logic(+5.0V) |
| 2 | VSS | Power | Power Ground |
| 3 | VO | --- | LCD Operation Voltage(Diagram 1) |
| 4-11 | DB0~DB7 | I/O | Data bus |
| 12 | CS1 | H/L | H:Chip Selected L:Chip Unselected (Column 1~64) |
| 13 | CS2 | H/L | H:Chip Selected L:Chip Unselected (Column 65~128) |
| 14 | /RST | H/L | Reset: L: Enable; H: Disable |
| 15 | R/W | H/L | Read write control ,“0”:write,“1”:read |
| 16 | RS(D/I) | H/L | L: instruction; H: data |
| 17 | E | H | Write/Read Control Clock |
| 18 | VOUT | ---- | LCD Operation Voltage(Diagram 1) |
| 19 | BL+ | A | LED+(+3.5V) |
| 20 | BL- | K | LED-(0V) |

## 4 Absolute Maximum Ratings

Table 4 parameter list

| Item | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Supply Voltage (Logic) | $V_{DD}$-$V_{SS}$ | -0.3 | 7.0 | V |

| | | | | |
|---|---|---|---|---|
| Supply Voltage | LCD | VEE-0.3 | VDD+0.3 | 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 (Ta=25 $^{o}$C)

Table 5 DC Characteristics list

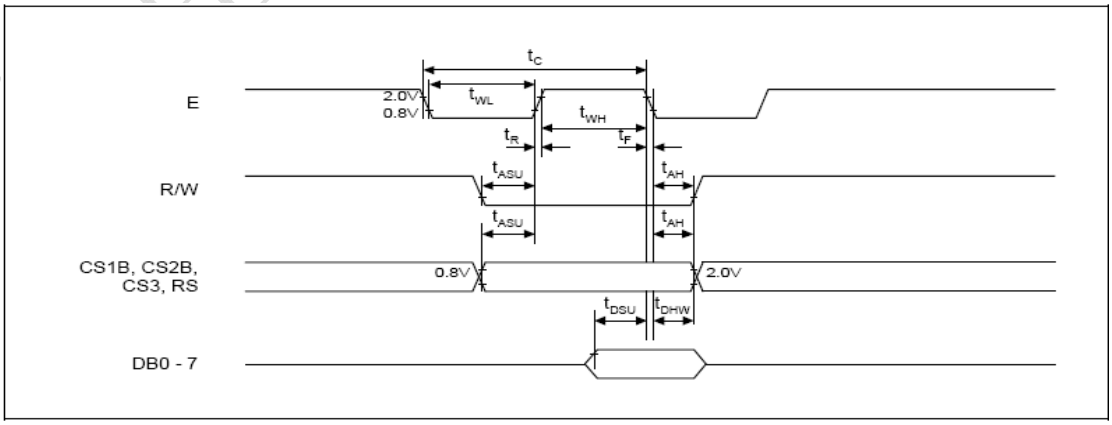
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage(Logic) | VDD | | 4.8 | 5.0 | 5.2 | V |
| Supply Voltage(LCD Drive) | VDD-VO | Ta = 25℃ | -- | 9.15 | -- | V |
| Input High Voltage | VIH | | 0.7VDD | —— | VDD | V |
| Input Low Voltage | VIL | | 0 | —— | 0.8 | V |
| Output High Voltage | VOH | IOH=-0.2mA | 2.4 | —— | —— | V |
| Output Low Voltage | VOL | IOL=1.6mA | 0 | —— | 0.4 | V |

## 5.2 LED Backlight Characteristics

Table 6 Backlit parameter list

| Item | Symbol | Min. | Typ. | Max. | Condition | Unit |
|---|---|---|---|---|---|---|
| Forward Current | Vf | 2.9 | 3.0 | 3.2 | If =45mA | V |
| Reverse Current | Ir | -- | -- | 30 | Vr=5V | uA |
| Chromaticity coordinate | X | 0.26 | | 0.31 | If =45mA | |
| | Y | 0.26 | | 0.31 | If =45mA | |
| Luminance | Lv | 960 | 1080 | 1280 | If =45mA | cd/m$^2$ |
| Uniformity | Avg | 75 | | | If =45mA | % |

## 5.3 Ac Characteristics



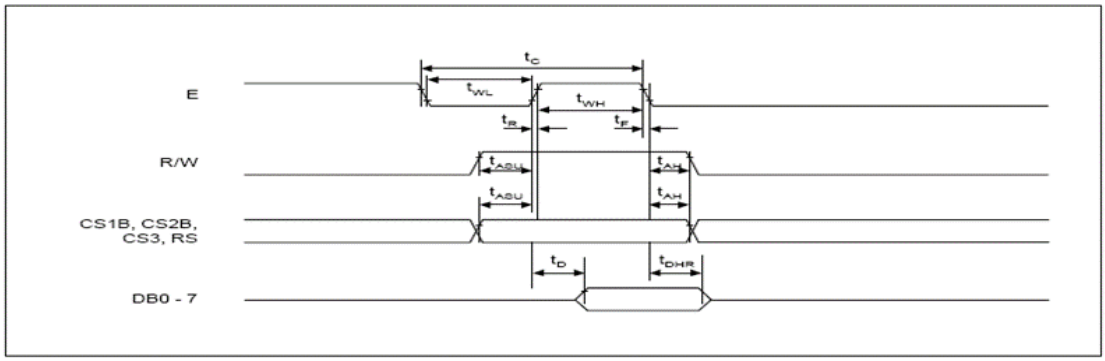



Diagram 3 Write/ Read Timing

Table 7 Parameter list

| 项目 | 符号 | 最小值 | 典型值 | 最大值 | 单位 |
|---|---|---|---|---|---|
| System cycle time(E) | tC | 1000 | – | – | ns |
| Enable H pulse width (E) | tWH | 450 | – | – | ns |
| Enable L pulse width(E) | tWL | 450 | – | – | ns |
| Rise time(E) | tR | – | – | 25 | ns |
| Failling time(E) | tF | – | – | 25 | ns |
| Address setup time | tASU | 140 | – | – | ns |
| Address hold time | tAH | 10 | – | – | ns |
| Data setup time | tDSU | 200 | – | – | ns |
| Data delay time | tD | – | – | 320 | ns |
| Data hold time(Write) | tDHW | 10 | – | – | ns |
| Data hold time(Read) | tDHR | 20 | – | – | ns |

# 6 Instruction Set

## 6.1 Command Definitions

Table 8 Command Definitions

| 指令 | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Display Off/On | L | L | L | L | H | H | H | H | H | L/H | Turns on the LCD panel when high, and turns it off when low |
| Set Y Address | L | L | L | H | Y Address (0 - 63) | | | | | | SetsYaddress of display RAM inregister |
| Set Page Address | L | L | H | L | H | H | H | Page (0 - 7) | | | Sets the display RAM page in Page Address register |
| Set display start line | L | L | H | H | Display start address (0 - 63) | | | | | | Specifies RAM display line for COM0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Read status | L | H | Busy | L | on /off | Reset | L | L | L | L | Busy:H, Free:L;<br>Display On:L, Display Off:H;<br>Reset:H, normal:L; |
| Write display data | H | L | Write display data | | | | | | | | Writes data in display RAM |
| Read display data | H | H | Read display data | | | | | | | | Reads data from display RAM |

More details please refer to AIP31107/AIP31108 datasheet.

# 7 Hardware and software application examples

With 51 MCU as an example

## 7.1 Hardware circuit connection

| 模块接口 | | 8051 接口 | | 模块接口 | | 8051 接口 | |
|---|---|---|---|---|---|---|---|
| 1 | VDD | | VCC | 11 | D7 | | P1.7 |
| 2 | VSS | | GND | 12 | /CS1 | | P3.0 |
| 3 | V0 | | | 13 | /CS2 | | P3.1 |
| 4 | D0 | | P1.0 | 14 | /RST | | P3.4 |
| 5 | D1 | | P1.1 | 15 | R/W | | P3.5 |
| 6 | D2 | | P1.2 | 16 | RS | | P3.6 |
| 7 | D3 | | P1.3 | 17 | E | | P3.7 |
| 8 | D4 | | P1.4 | 18 | | | |
| 9 | D5 | | P1.5 | 19 | A | | |
| 10 | D6 | | P1.6 | 20 | K | | |

Diagram 4 Hardware circuit connection

## 7.2 Initialization Operation

```
/MCU Interface Defination
sbit CS1=P3^0;
sbit CS2=P3^1;
sbit RS=P3^6;
sbit RW=P3^5;
sbit E=P3^7;
sbit RST=P3^4;
#define DataPort  P1
void initial()
{  CS1=1;CS2=1;
   wr_cmd(0x3f);                                    // Display On
```

```
    wr_cmd(0xc0);                                   // Set display start line
}
```

### 7.3 Reset Operation

```
RST = 0;delay();delay();
RST = 1;delay();
```

### 7.4 Write Display RAM Data

```
void wr_dat(uchar dat)
{   E=0;                    _nop_();_nop_();
    RS=1;                   _nop_();_nop_();
    RW=0;                   _nop_();_nop_();
    DataPort = dat;         _nop_();_nop_();
    E=1;                    _nop_();_nop_();
    E=0;                    _nop_();_nop_();
}
void wr_dots(uchar dat1,uchar dat2,uint Is_Twice)   //Write Data To DDRAM
{
    uint page_cnt,col_cnt;
    uchar pg_address;
    CS1=1;CS2=1;_nop_();_nop_();
    pg_address = 0xB8;                              // Set Page Address
    for (page_cnt=0;page_cnt<8;page_cnt++)
    {
            wr_cmd(pg_address);                     //Set Page Address(X Address)
        wr_cmd(0x40);                               //Set Address(Y Address)
        for (col_cnt=0;col_cnt<16;col_cnt++)
        {
            if (Is_Twice == 0)
            {   wr_dat(dat1);
                wr_dat(dat2);
                wr_dat(dat1);
                wr_dat(dat2);
            }
            else
            {   wr_dat(dat1);
                wr_dat(dat1);
                wr_dat(dat2);
                wr_dat(dat2);
            }
        }
      pg_address ++;
    }
delayms();
```

```
}
```

### 7.5 Write Instruction Code

```
void wr_cmd(uchar cmd)
{
   E=0;              _nop_();_nop_();
   RS=0;             _nop_();_nop_();
   RW=0;             _nop_();_nop_();
   DataPort = cmd;_nop_();_nop_();
   E=1;              _nop_();_nop_();
   E=0;              _nop_();_nop_();
}
```

### 7.6 Display Chinese Character Example

```
void disp_bmp(uchar_code *bmparea)
{
   uint page_cnt,col_cnt;
   uchar pg_address;
   CS1=1;CS2=0;
   _nop_();_nop_();
      pg_address=0xb8;                          // Set Page Address(X Address)
   wr_cmd(0xc0);                                // Set display start line
   for(page_cnt=0;page_cnt<8;page_cnt++)
   {
         wr_cmd(pg_address);
         wr_cmd(0x40);
            for(col_cnt=0;col_cnt<64;col_cnt++)
               wr_dat(bmparea[page_cnt*128 + col_cnt]);
            pg_address++;
   }
      delay();                                  //delay
      CS1=0;CS2=1;
   _nop_();_nop_();
      pg_address=0xb8;
   wr_cmd(0xc0);
   for(page_cnt=0;page_cnt<8;page_cnt++)
   {
         wr_cmd(pg_address);
         wr_cmd(0x40);
            for(col_cnt=0;col_cnt<64;col_cnt++)
               wr_dat(bmparea[page_cnt*128 + col_cnt + 64]);
            pg_address++;
   }
   delayms();                                   //delay
```

}

# 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 1MΩ 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.

## 9 Quality Specification

### 9.1 acceptable quality level

Table 9 acceptable quality level

| Inspection items | Sampling procedures | AQL |
|---|---|---|
| Visual-operating (Electro-optical) | GB2828-81<br>Inspection level Ⅱ<br>Normal inspection<br>Single sample inspection | 0.65 |
| Visual-not operating | GB2828-81<br>Inspection level Ⅱ<br>Normal inspection<br>Single sample inspection | 1.5 |
| Dimension measurement | GB2828-81<br>Inspection level Ⅱ<br>Normal inspection<br>Single sample inspection | 1.5 |

### 9.2 inspection conditions

-Room temperature: 25±3 oC

-Humidity: 65±20%RH

### 9.3 inspection standards

#### 9.3.1 Visual while operating

Table 10 Inspection standards

| Items to be inspected | Inspection standard |
|---|---|
| No display | If any pattern is not active at all, they can be rejected. |
| Irregular operating | No irregular operating are allowed<br>Appeared different display, which they should be chosen in the pattern, or appeared in different position where they should be chosen. |
| Irregular display | Any segment doesn't active, they can be rejected. |
| Over current | The total current required to activate the module should not be exceed the MAX current in specification. |
| View angles | Valves that don't meet the minimum value noted in the specification. they can be rejected. |
| Contrast | Valves that don't meet the minimum value noted in the specification, they can be reject. |
| .LCD operate voltage | Meet the specification. |

#### 9.3.2 Visual while not operating

Table 11 Inspection standards

| Module dimension | Meet the module outline drawing, not exceed the tolerance. |
|---|---|
| LCD panel scratch | Following scratches inside the effective viewing area considered as the defects when their width & length are larger than the following combinations.<br>Number:one or more Width: 0.1 length: 3.0<br>three or more Width: 0.05 length: 2.0<br>three or more Width: 0.03 length: 3.0<br>When the defects exceed this, it can be rejected. |

## 10 Reliability

### 10.1 Standard Specification for Reliability of General-purpose LCM

Table 12 Reliability

| Test Item | Test Condition | Note |
|---|---|---|
| High Temperature Store | 80°C, 4hr. | 2 |
| Low Temperature Store | -30°C , 4hr | 2 |
| Humidity Store | 40°C,90~95%RH, 96hr | 1,2 |
| High Temperature Operation | 70°C,typical operating conditions, 4hr | 2 |
| Low Temperature Operation | -20°C,typical operating conditions, 4hr | 2 |
| Mechanical Vibration | 10~55Hz sweep, 3G, ampl=0.75mm(max) XYZ for 20 min, each. | |

Note 1: Condensation of water is not permitted on the module.
Note 2: The module should be inspected after 2 hour storage in normal conditions (15~35°C,45~65%RH)

### 10.2 MTTF （Mean-Time-To-Fail）

The LCD is designed to meet the MTTF by 50,000 hours under normal room conditions (25℃,65%RH,without sun-shine)

# 11 Technical support

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