Display Elektronik GmbH

# DATA SHEET

## LCD MODULE

# DEM 122032B – SYH-LY

**Product specification** **Version : 1**

**05/Sep/2006**

# DOCUMENT REVISION HISTORY

| Version | DATE | DESCRIPTION | CHANGED BY |
|---|---|---|---|
| 00 | Sep-5-2006 | First issue | |
| 01 | Sep-5-2006 | Change print | |

# CONTENTS

# 1. FUNCTIONS & FEATURES

| | |
|---|---|
| 1.1. Format | : 122x32dots |
| 1.2. LCD mode | : STN / Positive transflective mode / Yellow-green |
| 1.3. Viewing direction | : 6 o'clock |
| 1.4. Driving scheme | : 1/32 Duty cycle, 1/5 Bias |
| 1.5. Power supply voltage($V_{DD}$) | : 5.0 Volt (typ.) |
| 1.6. LCD driving voltage | : 4.8 Volt (typ.) |
| 1.7. Operation temp | : -20 ~ 70°C |
| 1.8. Storage temp | : -30 ~ 80°C |
| 1.9. Backlight | : LED, Yellow-green, Lightbox |

# 2. MECHANICAL SPECIFICATIONS

| | |
|---|---|
| 2.1. Module size | : 84.0 x 44.0 x 13.5 mm(max.) |
| 2.2. Viewing area | : 61.0 x 19.5 mm |
| 2.3. Dot pitch | : 0.44 x 0.49 mm |
| 2.4. Dot size | : 0.40 x 0.45 mm |

# 3. BLOCK DIAGRAM

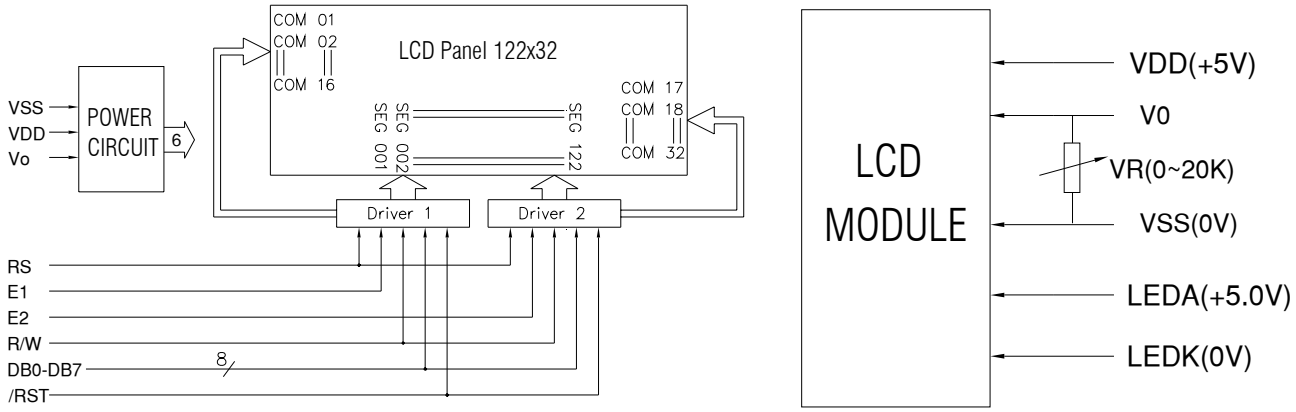



Figure 1. Block diagram

# 4. DIMENSIONAL OUTLINE

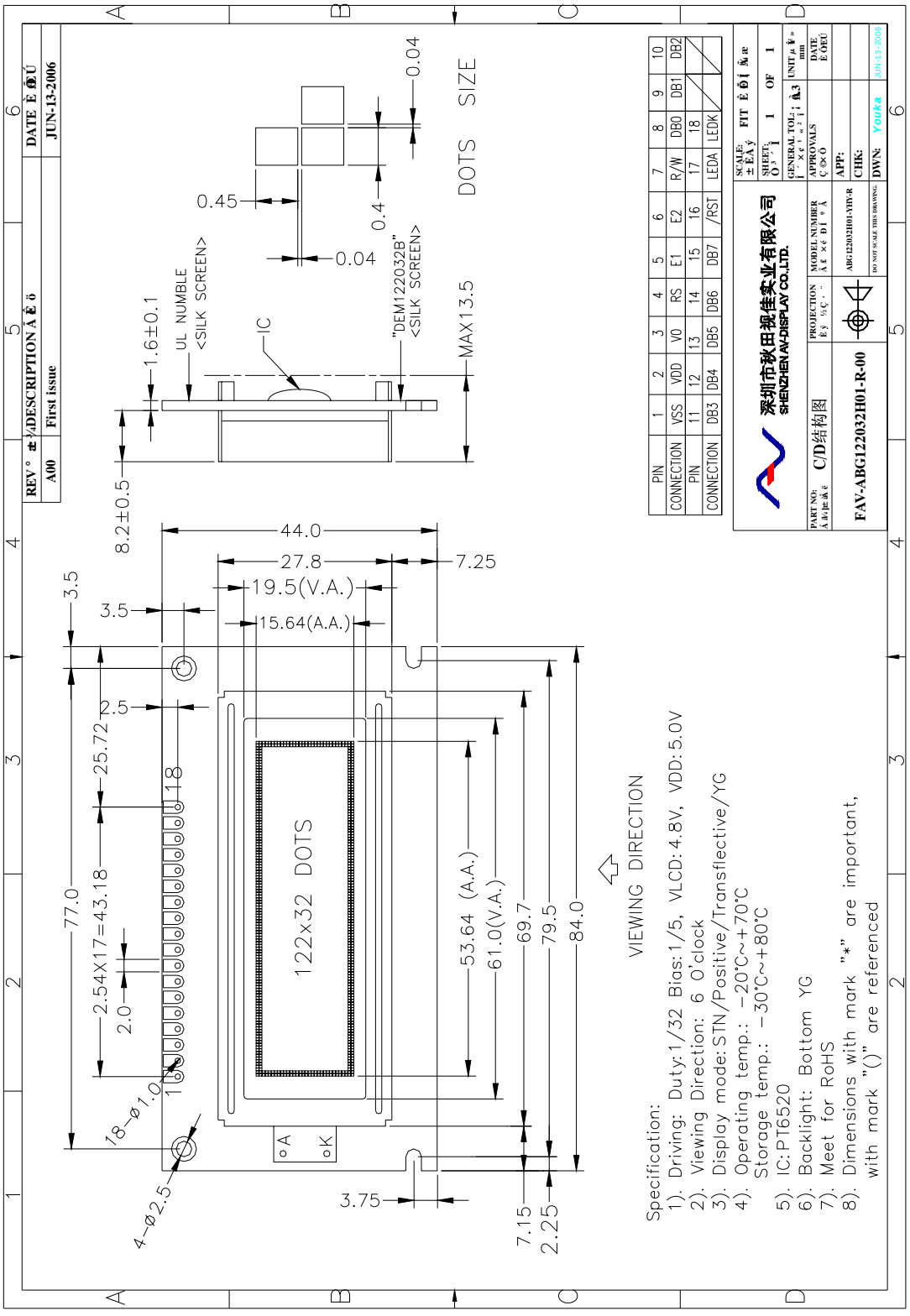



Figure 2. Dimensional outline

# 5. PIN DESCRIPTION

| No. | Symbol | Function |
|---|---|---|
| 1 | VSS | GND(0V) |
| 2 | VDD | Power supply (+5V) |
| 3 | VO | Supply voltage for LCD drive |
| 4 | RS | Register selection. (H: Data register L: Instruction register) |
| 5 | E1 | Enable signal for IC1(left half of the panel) |
| 6 | E2 | Enable signal for IC2(right half of the panel) |
| 7 | R/W | Read /write selection. (H: Read L: write) |
| 8~15 | DB0~DB7 | Data bus lines |
| 16 | /RST | Reset signal(The rise of the signal is for active and keep RET='h') |
| 17 | LED+ (A) | Power supply for backlight(+5V) |
| 18 | LED- (K) | Power supply for backlight(0V) |

# 6. MAXIMUM ABSOUTE LIMIT

**(For IC)**

**Absolute Maximum Ratings**

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage (1) | Vss | -8.0 to +0.3 | V |
| Supply voltage (2) | V5 | -16.5 to +0.3 | V |
| Supply voltage (3) | V1, V4, V2, V3 | V5 to +0.3 | V |
| Input voltage | VIN | Vss -0.3 to +0.3 | V |
| Output voltage | VO | Vss -0.3 to +0.3 | V |
| Power dissipation | PD | 250 | mW |
| Operating temperature | Topr | -30 to +85 | deg. C |
| Storage temperature | Tstg | -65 to +150 | deg. C |
| Soldering temperature time at lead | Tsol | 260, 10 | deg. C, s |

Notes :

1. All voltages are specified relative to VDD= 0 V.
2. The following relation must be always hold
   $VDD \geqq V2 \geqq V3 \geqq V4 \geqq V5$
3. Exceeding the absolute maximum ratings may cause permanent damage to the device. Functional operation under these conditions is not implied.
4. Moisture resistance of flat packages can be reduced by the soldering process, so care should be taken to avoid thermally stressing the package during board assembly.

# 7. ELECTRICAL CHARACTERISTICS

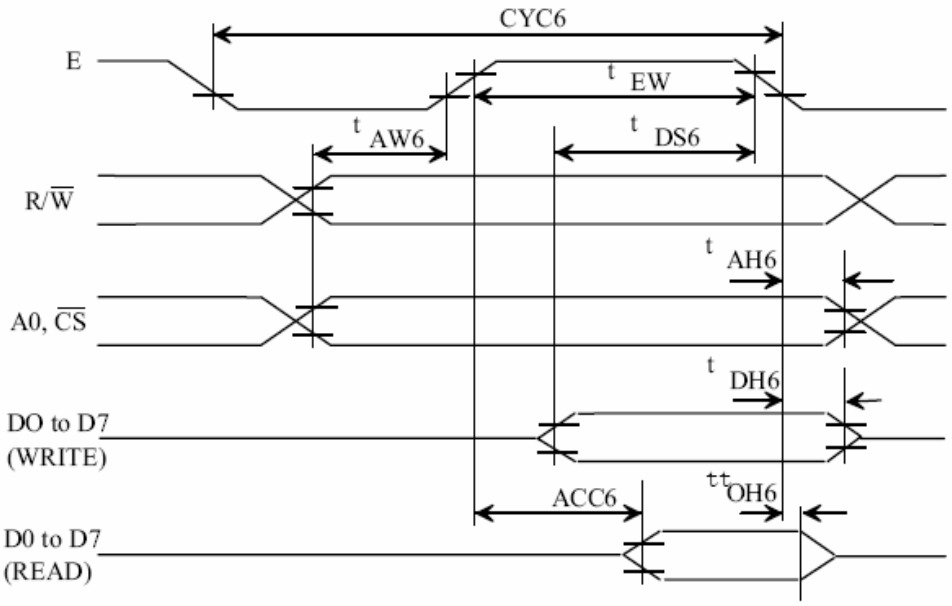
(VDD=0V, VSS=-5V)

| Parameter | | Symbol | Condition | | Min | Typ | Max | Unit | Applicable Pin |
|---|---|---|---|---|---|---|---|---|---|
| Operating voltage (1)*1 | Recommended | VSS | | | -5.5 | -5.0 | -4.5 | V | VSS |
| | Potential | | | | -7.0 | - | -2.4 | V | |
| Operating voltage (2) | Recommended | V5 | | | -13 | - | -3.5 | V | V5 |
| | Potential | | | | -13 | - | - | V | |
| | Potential | V1, V2 | | | 0.6xV5 | - | VDD | V | V1, V2 |
| | Potential | V3, V4 | | | V5 | - | 0.4xV5 | V | V3, V4 |
| High input voltage | | VIHT | | | VSS+2.0 | - | VDD | V | *2, *3 |
| | | VIHC | | | 0.2xVSS | - | VDD | | |
| | | VIHT | VSS=-3v | | 0.2xVSS | - | VDD | | *2, *3 |
| | | VIHC | VSS=-3v | | 0.2xVSS | - | VDD | | |
| Low input voltage | | VILT | | | VSS | - | VSS+0.8 | | *2, *3 |
| | | VILC | | | VSS | - | 0.8xVSS | | |
| | | VILT | VSS=-3v | | VSS | - | 0.85xVSS | | *2, *3 |
| | | VILC | VSS=-3v | | VSS | - | 0.8xVSS | | |
| High output voltage | | VOHT | IOH=-3.0mA | | VSS+2.4 | - | - | V | OSC2 *4, *5 |
| | | VOHC1 | IOH=-2.0mA | | VSS+2.4 | - | - | | |
| | | VOHC2 | IOH=-120Ma | | 0.2xVSS | - | - | | |
| | | VOHT | VSS=-3v | IOH=-2mA | 0.2xVSS | | | V | *4, *5 OSC2 |
| | | VOHC1 | VSS=-3v | IOH=-2mA | 0.2xVSS | | | | |
| | | VOHC2 | VSS=-3v | IOH=-50µA | 0.2xVSS | | | | |
| Low output voltage | | VOLT | IOL=3.0mA | | - | - | VSS+0.4 | V | OSC2 *4, *5 |
| | | VOLT1 | IOL=2.0mA | | - | - | VSS+0.4 | | |
| | | VOLT2 | IOL=120µA | | - | - | 0.8xVSS | | |
| | | VOLT | VSS=-3v | IOL=2mA | | | 0.8xVSS | V | *4, *5 OSC2 |
| | | VOLC1 | VSS=-3v | IOL=2mA | | | 0.8xVSS | | |
| | | VOLC2 | VSS=-3v | IOL=50µA | | | 0.8xVSS | | |
| Input leak current | | ILI | | | -1 | - | 1 | µA | *6 |
| Output leak current | | ILO | | | -3 | - | 3 | µA | *7 |
| LCD driver ON resistance | | RON | Ta=25°C | V5=-5.0V | - | 5 | 7.5 | KΩ | SEG0~60 COM0~15 |
| | | | | V5=-3.5V | - | 10 | 50 | | |
| Static current consumption | | IDDQ | CS=CL=VDD | | - | 0.05 | 1 | µA | VDD |
| Dynamic current dissipation | External CLK | During IDD (1) | During display Vs=-5.0V | Rf=1MΩ | - | 9.5 | 15 | µA | VDD |
| | Oscillator | | During display V5=-5V VSS =-3V | Rf=1 MΩ | - | 6.0 | 12 | µA | |
| | | IDD (2) | During access Tcyc = 200kHz | | - | 300 | 500 | µA | VDD |
| | | | VSS=-3V, During access Tcyc = 200 kHz | | | 150 | 300 | | |
| Input terminal capacity | | CIN | Ta=25°C, f=1MHz | | - | 5.0 | 8 | pF | All input terminals |
| Oscillation frequency | | Fosc | Rf=1MΩ+2% | VSS=-5.0V | 15 | 18 | 21 | kHz | *4, *5 OSC2 |
| | | | Rf=1MΩ +2% | VSS=-3.0V | 11 | 16 | 21 | | |
| Reset time | | tR | | | 1.0 | - | | µs | RES |
| Hysteresis | | VH | | | 0.05VSS | 0.1VSS | - | V | |

Notes: 1. A wide range of operating voltages is guaranteed, except in case of abrupt voltage fluctuations during MPU access.
2. A0, D0~D7, E, R/W and CS pins
3. CL, FR, M/S and RES pins
4. A0, E, R/W, CS, CL, RES, M/S pins

# 8. TIMING CHARACTERISTICS

- **MPU Bus Read/Write II (68-family MPU)**




Ta= -20 to 75 deg. C. Vss= -5V ± 10 unless stated otherwise

| Parameter | | Symbol | Condition | Rating | | Unit | Signal |
|---|---|---|---|---|---|---|---|
| | | | | min | max | | |
| System cycle time | | tCYC6 | | 1,000 | -- | ns | A0, CS, R/W |
| Address setup time | | tAW6 | | 20 | -- | ns | |
| Address hold time | | tAH6 | | 10 | -- | ns | |
| Data setup time | | tDS6 | | 80 | -- | ns | D0 to D7 |
| Data hold time | | tDH6 | | 10 | -- | ns | |
| Output disable time | | tOH6 | CL= 100pF | 10 | 60 | ns | |
| Access time | | tACC6 | | -- | 90 | ns | |
| Enable pulsewidth | Read | tEW | | 100 | -- | ns | E |
| | Write | | | 8 | -- | ns | |

**Notes : 1. tCYC6 is the cycle time of CS. E=H. not the cycle time of E.**
**2. Increase parameter values by 200% when Vss= -3.0V.**
**3. all inputs must have a rise and fall time of less than 15 ns.**

# 9. CONTROL AND DISPLAY INSTRUCTION

| Command | Code | | | | | | | | | | | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A0 | RD | WR | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
| Display On/Off | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0/1 | Turns display on or off.<br>1 : ON, 0 : OFF |
| Display start line | 0 | 1 | 0 | 1 | 1 | 0 | Display start address (0 to 31) | | | | | Specifies RAM line corresponding to top line of display. |
| Set page address | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | Page (0 to 3) | | Sets display RAM page in page address register. |
| Set column (segment) address | 0 | 1 | 0 | 0 | Column address (0 to 79) | | | | | | | Sets display RAM column address in column address registser. |
| Read status | 0 | 0 | 1 | Busy | ADC | ON/OFF | Reset | 0 | 0 | 0 | 0 | Reads the following status :<br>BUSY 1 : Busy<br>0 : Ready<br>ADC 1 : CW output<br>0 : CCW output<br>ON/OFF 1 : Display off<br>0 : Display on<br>RESET 1 : Being reset<br>0 : Normal |
| Write display data | 1 | 1 | 0 | Write data | | | | | | | | Writes data from data bus into display RAM. |
| Read display data | 1 | 0 | 1 | Read data | | | | | | | | Reads data from display RAM onto data bus. |
| Select ADC | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0/1 | 0 : CW output, 1 : CCW output |
| Statis drive ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0/1 | Selects static driving operation.<br>1 : Static drive, 0 : Normal driving |
| Select duty | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0/1 | Selects LCD duty cycle<br>1 : 1/32, 0 : 1/16 |
| Read-Modify -Write | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Read-modify-write ON |
| End | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | Read-modify-write OFF |
| Reset | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Software reset |

# 10. BACK LIGHT CHARACTERISTICS

LCD Module with bottom Backlight

**ELECTRICAL RATINGS**

Ta = 25°C

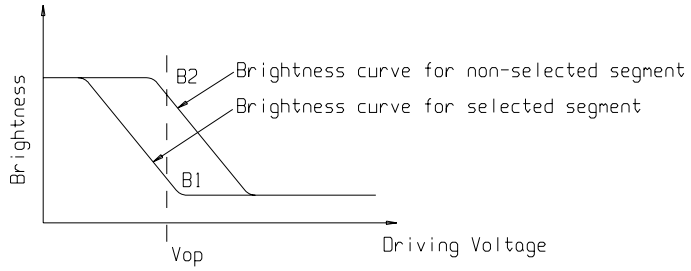
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage | VF | IF=100mA | 3.85 | 4.05 | 4.25 | V |
| Reverse Current | IR | VR=8V | --- | --- | 1 | mA |
| Luminous Intensity (With LCD dots off) | IV | IF=100mA | 125 | 179 | --- | $Cd/m^2$ |
| Wave length | λρ | IF=100mA | | 568 | | nm |
| Color | Yellow-green | | | | | |
| External use at pin 17/18 | 5 Volt with approx. 140mA (typ.) | | | | | |

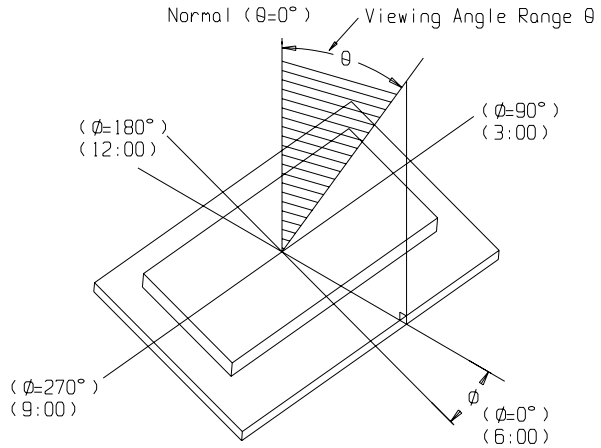
# 11. ELECTRO-OPTICAL CHARACTERISTICS

( $V_{OP}$ =4.8V, Ta = 25°C )

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Voltage | Vop | Ta = -20°C | 5.0 | 5.2 | 5.4 | V |
| | | Ta = 25°C | 4.6 | 4.8 | 5.0 | |
| | | Ta = 70°C | 4.2 | 4.4 | 4.6 | |
| Response time | Tr | Ta = 25°C | --- | 185 | --- | ms |
| | Tf | | --- | 200 | --- | ms |
| Contrast | Cr | Ta = 25°C | --- | 4 | --- | --- |
| Viewing angle range | θ | Cr≥ 2 | -40 | --- | +40 | deg |
| | Φ | | -40 | --- | +40 | deg |

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$



## 12. PRECAUTION FOR USING LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

**General Precautions:**

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting DISPLAY.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

**Static Electricity Precautions:**

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded when ever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working enches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

**Soldering Precautions:**

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C$\pm$10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

**Operation Precautions:**

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

**Limited Warranty**

DISPLAY LCDs and modules are not consumer products, but may be incorporated by DISPLAY's customers into consumer products or components thereof, DISPLAY does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of DISPLAY is limited to repair or replacement on the terms set forth below. DISPLAY will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between DISPLAY and the customer, DISPLAY will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with DISPLAY general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the ailures or defect.