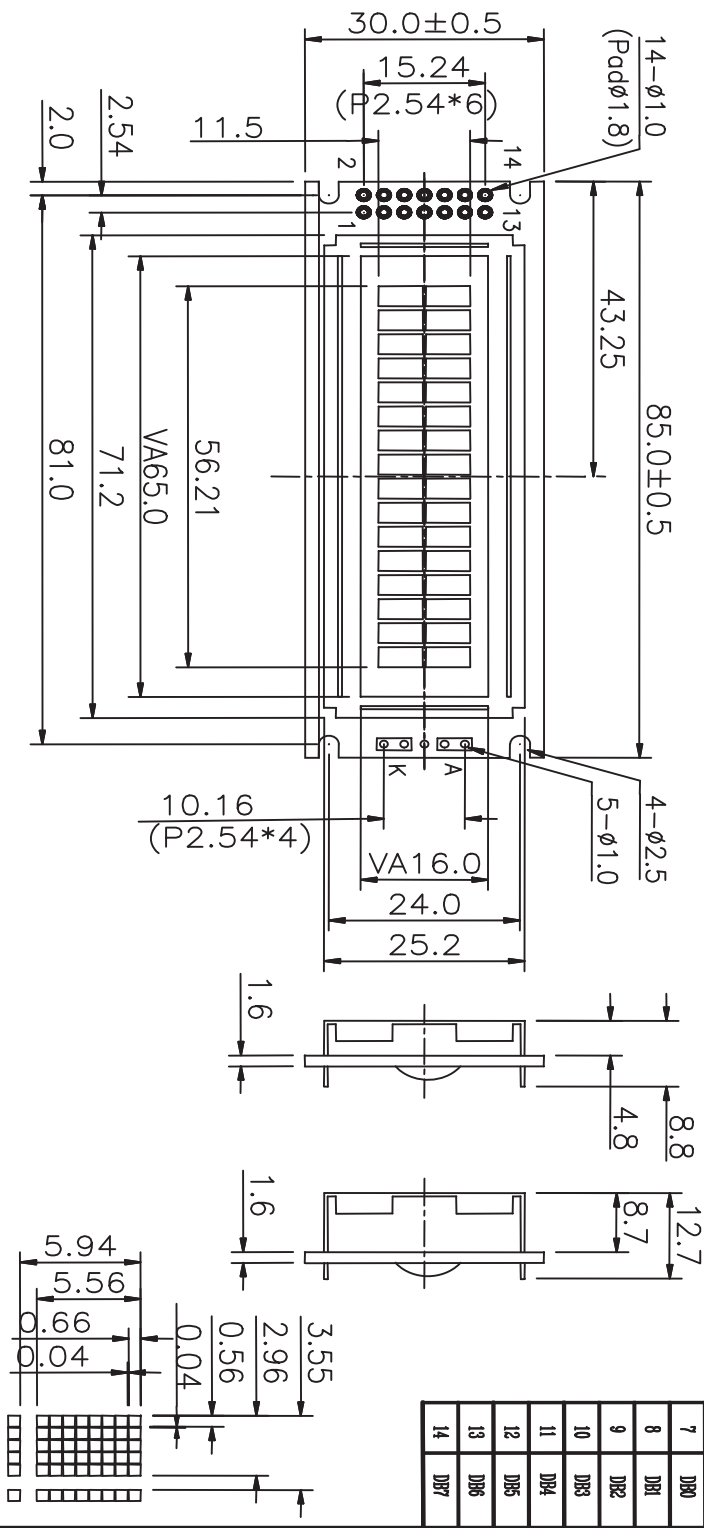


## GENERAL SPECIFICATION

| TIEM              | DESCRIPTION                                           |                                                    |                                                      |                                     |
|-------------------|-------------------------------------------------------|----------------------------------------------------|------------------------------------------------------|-------------------------------------|
| Product No        | SC1602BS*B-XA-GB-K                                    |                                                    |                                                      |                                     |
| LCD Type          | <input checked="" type="checkbox"/> STN Gray Positive | <input type="checkbox"/> STN Yellow Green Positive | <input type="checkbox"/> STN Blue Negative           |                                     |
|                   | <input type="checkbox"/> TN Negative                  |                                                    | <input type="checkbox"/> TN Positive                 |                                     |
|                   | <input type="checkbox"/> FSTN Negative White & Black  |                                                    | <input type="checkbox"/> FSTN Positive Black & White |                                     |
| Rear Polarizer    | <input checked="" type="checkbox"/> Reflective        | <input type="checkbox"/> Transflective             | <input type="checkbox"/> Transmissive                |                                     |
| Backlight Type    | <input checked="" type="checkbox"/> NO B/L            | <input type="checkbox"/> LED                       | <input type="checkbox"/> CCFL                        | <input type="checkbox"/> EL         |
| Backlight Color   | <input type="checkbox"/> Yellow Green                 | <input type="checkbox"/> Amber                     | <input type="checkbox"/> White                       | <input type="checkbox"/> Blue Green |
| View Direction    | <input checked="" type="checkbox"/> 6 O'clock         |                                                    | <input type="checkbox"/> 12 O'clock                  |                                     |
| Temperature Range | <input checked="" type="checkbox"/> Normal            |                                                    | <input type="checkbox"/> Wide                        |                                     |
| Frame             | <input checked="" type="checkbox"/> Black             |                                                    | <input type="checkbox"/> Silver                      |                                     |

### TO BE VERY CAREFUL !

The LCD driver ICs are made by CMOS process, which are very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.



SCALE 4:1

| NOTE | ITEM | CONTENT       | DATA       | REV | TOLERANCE | SCALE | UNIT | APVD | CHKD | DWVN | DATE       | CUSTOMER | APVL | TITLE | MODULE | MODEL   | DWG NO    | PAGE |
|------|------|---------------|------------|-----|-----------|-------|------|------|------|------|------------|----------|------|-------|--------|---------|-----------|------|
|      |      | CHANGE NUMBER | 2004.03.01 | 0   | X. ±0.30  | 1/1   | mm   | Hsu  | Hsu  | Gili | 2004.03.01 |          |      |       |        | SC1602B | A-A1-0009 | 1/1  |

| PIN NO | SIGNAL |
|--------|--------|
| 1      | VDD    |
| 2      | VSS    |
| 3      | V0     |
| 4      | RS     |
| 5      | R/W    |
| 6      | R      |
| 7      | DB0    |
| 8      | DB1    |
| 9      | DB2    |
| 10     | DB3    |
| 11     | DB4    |
| 12     | DB5    |
| 13     | DB6    |
| 14     | DB7    |

## ABSOLUTE MAXIMUM RATING

### (1) Electrical Absolute Ratings

| Item                   | Symbol          | Min. | Max.     | Unit | Note |
|------------------------|-----------------|------|----------|------|------|
| Power Supply for Logic | $V_{DD}-V_{SS}$ | -0.3 | 7.0      | Volt |      |
| Power Supply for LCD   | $V_{DD}-V_O$    | -0.3 | 10.0     | Volt |      |
| Input Voltage          | $V_I$           | -0.3 | $V_{DD}$ | Volt |      |
|                        |                 |      |          |      |      |
|                        |                 |      |          |      |      |
|                        |                 |      |          |      |      |

### (2) Environmental Absolute Maximum Ratings

| Item                           | Normal Temperature |       |          |       | Wide Temperature |       |          |       |
|--------------------------------|--------------------|-------|----------|-------|------------------|-------|----------|-------|
|                                | Operating          |       | Storage  |       | Operating        |       | Storage  |       |
|                                | Min,               | Max.  | Min,     | Max.  | Min,             | Max.  | Min,     | Max.  |
| Ambient Temperature            | 0°C                | +50°C | -20°C    | +70°C | -20°C            | +70°C | -30°C    | +80°C |
| Humidity(without condensation) | Note 2,4           |       | Note 3,5 |       | Note 4,5         |       | Note 4,6 |       |

Note 2  $T_a \leq 50^\circ\text{C}$ : 80% RH max

$T_a > 50^\circ\text{C}$ : Absolute humidity must be lower than the humidity of 85%RH at  $50^\circ\text{C}$

Note 3  $T_a$  at  $-20^\circ\text{C}$  will be <48hrs at  $70^\circ\text{C}$  will be <120hrs when humidity is higher than 70%.

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5  $T_a \leq 70^\circ\text{C}$ : 75RH max

$T_a > 70^\circ\text{C}$ : absolute humidity must be lower than the humidity of 75%RH at  $70^\circ\text{C}$

Note 6  $T_a$  at  $-30^\circ\text{C}$  will be <48hrs, at  $80^\circ\text{C}$  will be <120hrs when humidity is higher than 70%.

### ELECTRICAL CHARACTERISTICS

| Item                                     | Symbol          | Condition                          | Min. | Typ | Max.     | Unit | note |
|------------------------------------------|-----------------|------------------------------------|------|-----|----------|------|------|
| Power Supply for Logic                   | $V_{DD}-V_{SS}$ | -                                  | 4.5  | 5.0 | 5.5      | Volt |      |
| Input Voltage                            | $V_{IL}$        | L level                            | 0    | -   | 0.6      | Volt |      |
|                                          | $V_{IH}$        | H level                            | 2.2  | -   | $V_{DD}$ | Volt |      |
| LCM Recommend LCD Module Driving Voltage | $V_{DD}-V_O$    | $T_a=0^{\circ}C$                   | -    | -   | -        | Volt |      |
|                                          |                 | $T_a=25^{\circ}C$                  | 4.2  | 4.5 | 4.8      |      |      |
|                                          |                 | $T_a=50^{\circ}C$                  | -    | -   | -        |      |      |
| Power Supply Current for LCM             | $I_{DD}$        | $V_{DD}=5.0V$<br>$V_{DD}-V_O=4.5V$ | -    | 2.0 | 3.0      | mA   |      |
|                                          |                 |                                    |      |     |          |      |      |
|                                          |                 |                                    |      |     |          |      |      |
|                                          |                 |                                    |      |     |          |      |      |

### OPTICAL CHARACTERISTICS

| Item                | Symbol                      | Condition                              | Min. | Typ | Max. | Unit   | note |
|---------------------|-----------------------------|----------------------------------------|------|-----|------|--------|------|
| Viewing angle range | $\Phi f(12\text{ o'clock})$ | When $Cr \geq 1.4$                     | -    | 20  | -    | Degree | 9,10 |
|                     | $\Phi b(6\text{ o'clock})$  |                                        | -    | 40  | -    |        |      |
|                     | $\Phi l(9\text{ o'clock})$  |                                        | -    | 30  | -    |        |      |
|                     | $\Phi r(3\text{ o'clock})$  |                                        | -    | 30  | -    |        |      |
| Rise Time           | $T_r$                       | $V_{DD}-V_O=4.5V$<br>$T_a=25^{\circ}C$ | -    | 200 |      | mS     |      |
| Fall Time           | $T_f$                       |                                        | -    | 250 |      |        |      |
| Frame frequency     | Frm                         |                                        | -    | 64  | -    | Hz     | 8,10 |
| Contrast            | Cr                          |                                        | -    | 3.0 | -    |        | 7    |
|                     |                             |                                        |      |     |      |        |      |
|                     |                             |                                        |      |     |      |        |      |

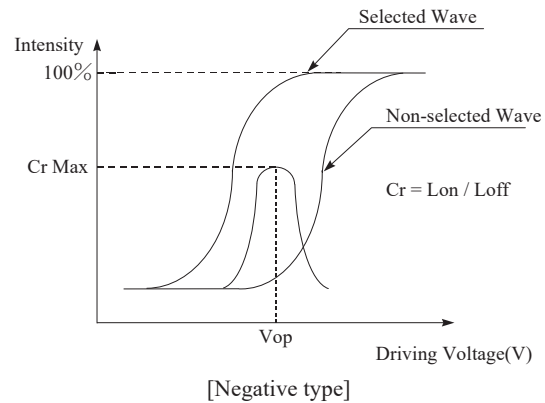
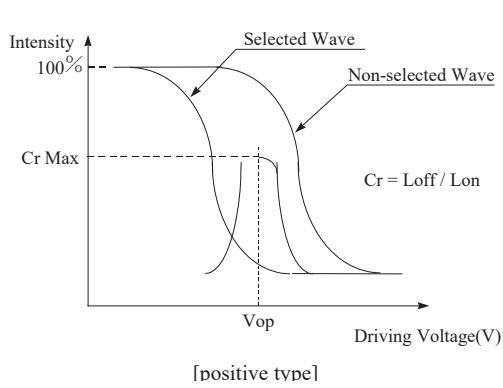
**MECHANICAL SPECIFICATION**

| ITEM           | DESCRIPTION                          |
|----------------|--------------------------------------|
| Product No.    | SC1602B                              |
| Module Size    | 85.0(W)×30.0(H)×8.8(LED=12.7) max(D) |
| Viewing Area   | 65.0(W)mm×16.0(H)mm                  |
| Dot Size       | 0.56(W)mm×0.66(H)mm                  |
| Dot Pitch      | 0.60(W)mm×0.70(H)mm                  |
| Display Format | 16 characters (W)×2 lines (H)        |
| Duty Ratio     | 1/16 Duty                            |
| Controller     | ST7066U or Equivalent                |

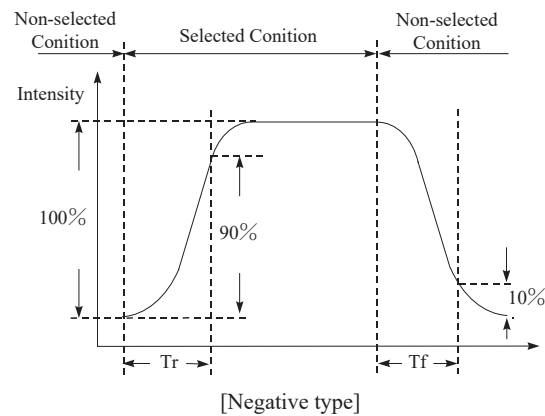
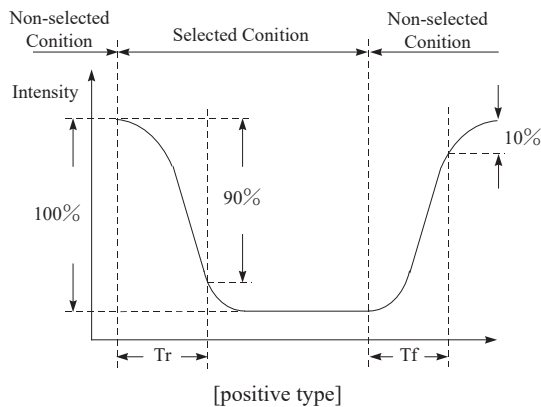
**INTERFACE PIN ASSIGNMENT**

| Pin No. | Pin Out | Level | Description          |
|---------|---------|-------|----------------------|
| 1       | VDD     | 5V    | Power Supply Voltage |
| 2       | VSS     | 0V    | Power Supply Ground  |
| 3       | Vo      | ---   | Contrast Adj         |
| 4       | RS      | H/L   | Register Select      |
| 5       | R/W     | H/L   | Read / Write         |
| 6       | E       | H,H→L | Enable Signal        |
| 7       | DB0     | H/L   | Data Bit 0           |
| 8       | DB1     | H/L   | Data Bit 1           |
| 9       | DB2     | H/L   | Data Bit 2           |
| 10      | DB3     | H/L   | Data Bit 3           |
| 11      | DB4     | H/L   | Data Bit 4           |
| 12      | DB5     | H/L   | Data Bit 5           |
| 13      | DB6     | H/L   | Data Bit 6           |
| 14      | DB7     | H/L   | Data Bit 7           |

## [Note 7] Definition of Operation Voltage ( $V_{op}$ )



## [Note 8] Definition of Response Time ( $T_r$ , $T_f$ )



### Conditions:

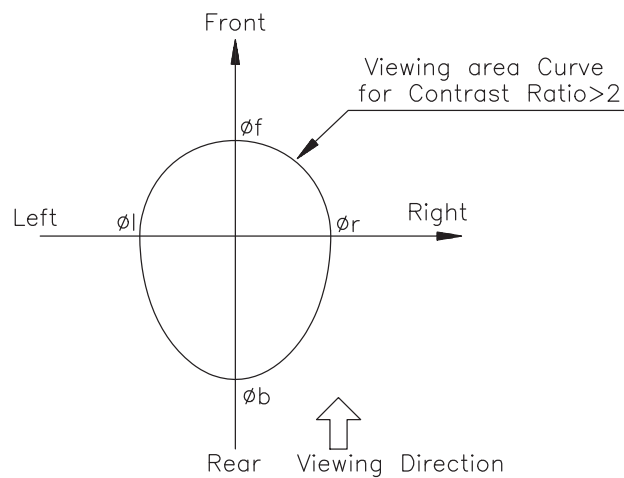
Operating Voltage :  $V_{op}$

Frame Frequency : 64 Hz

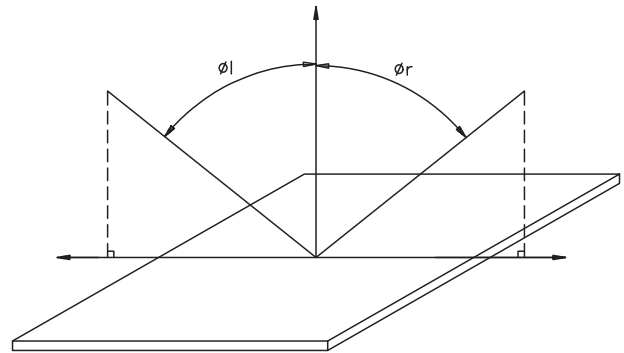
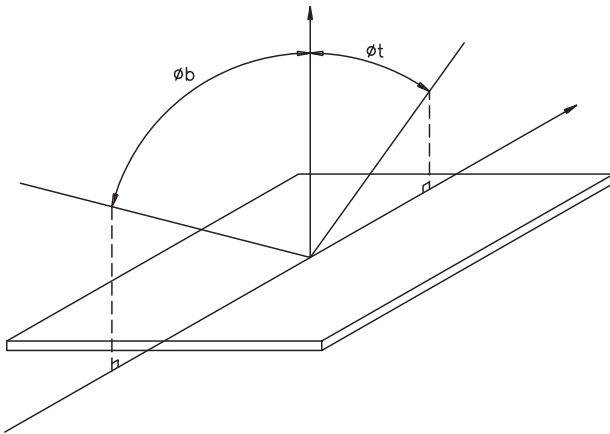
Viewing Angle( $\theta$ ,  $\phi$ ):  $0^\circ$ ,  $0^\circ$

Driving Wave form : 1/N duty, 1/a bias

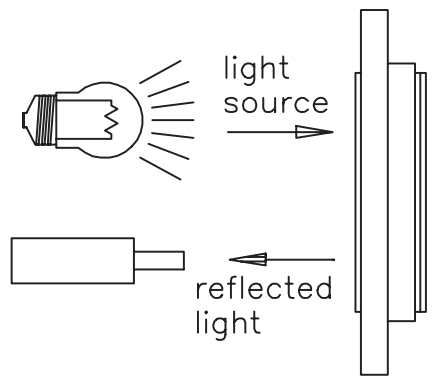
## [Note 9] Definition of Viewing Direction



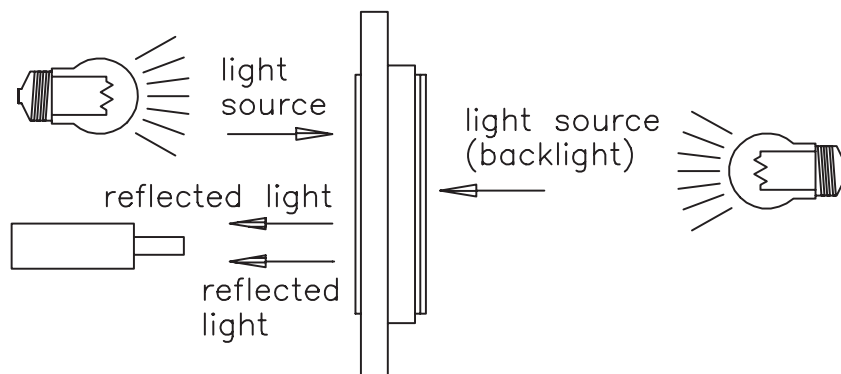
**[Note 10] Definition of viewing angle**



**[Note 11] Description of Measuring Equipment**

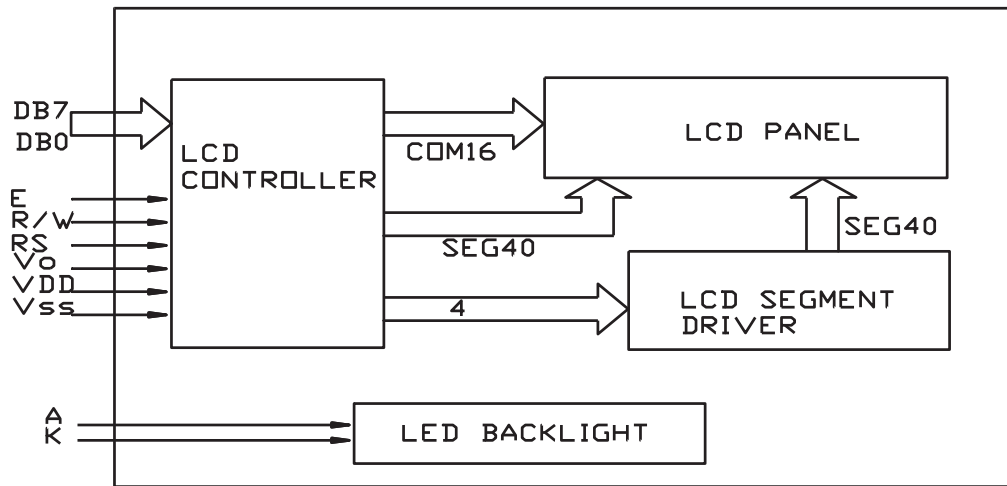


Reflective type

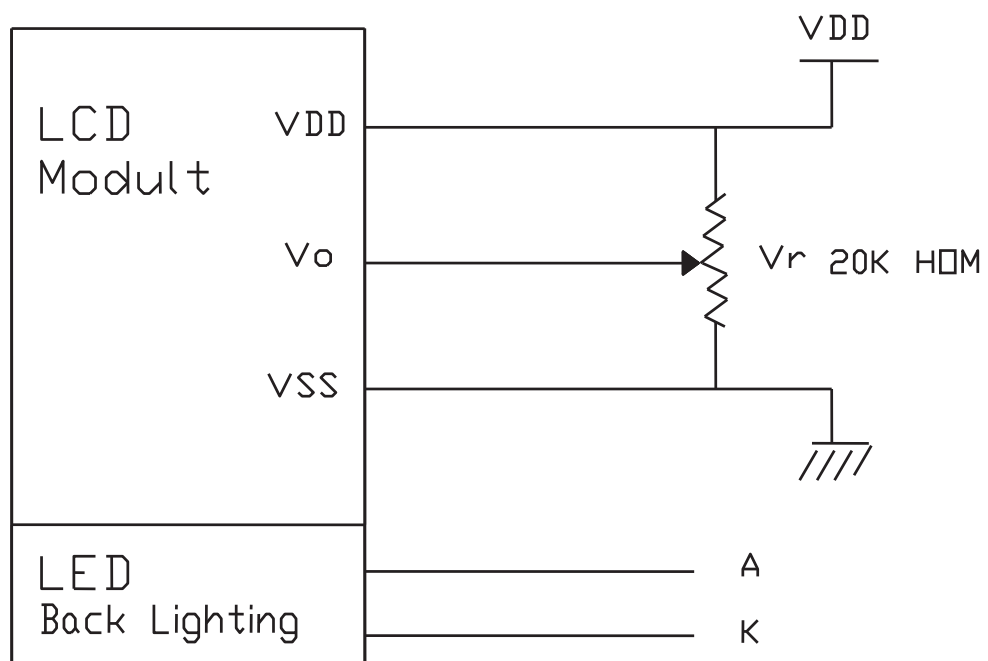


Transflective type

## BLOCK DIAGRAM



## POWER SUPPLY



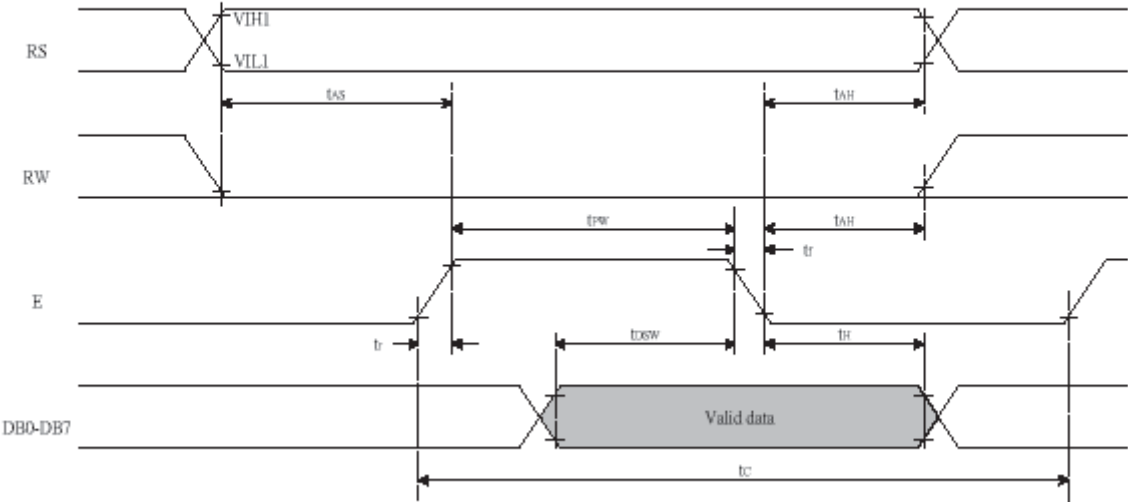
**TIMING CHARACTERISTICS**

TA=25°C ,VCC=5V

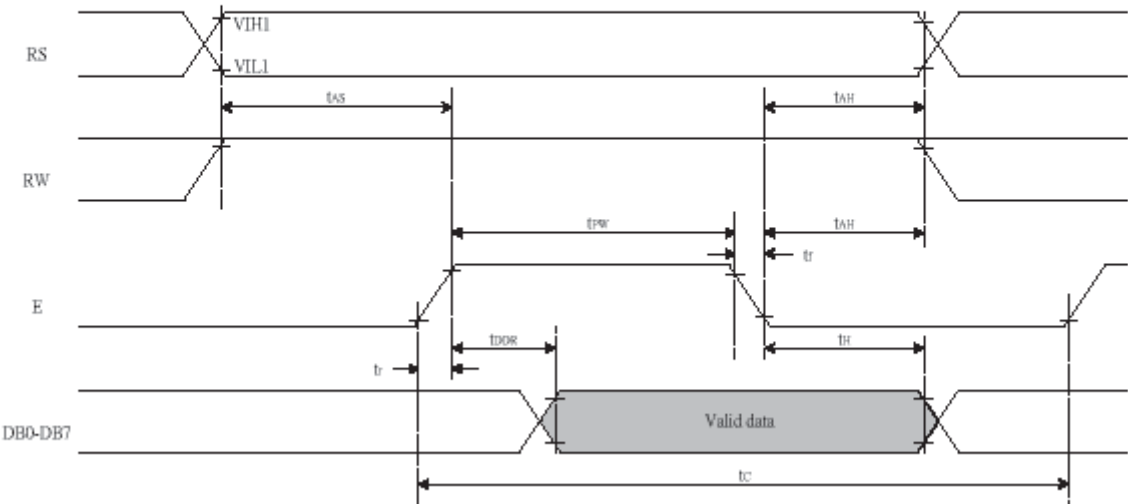
| Symbol                                               | Characteristics       | Test Condition  | Min. | Typ. | Max. | Unit |
|------------------------------------------------------|-----------------------|-----------------|------|------|------|------|
| <i>Internal Clock Operation</i>                      |                       |                 |      |      |      |      |
| f <sub>osc</sub>                                     | OSC Frequency         | R = 91KΩ        | 190  | 270  | 350  | KHz  |
| <i>External Clock Operation</i>                      |                       |                 |      |      |      |      |
| f <sub>EX</sub>                                      | External Frequency    | -               | 125  | 270  | 410  | KHz  |
|                                                      | Duty Cycle            | -               | 45   | 50   | 55   | %    |
| T <sub>R</sub> , T <sub>F</sub>                      | Rise/Fall Time        | -               | -    | -    | 0.2  | μs   |
| <i>Write Mode (Writing data from MPU to ST7066U)</i> |                       |                 |      |      |      |      |
| T <sub>C</sub>                                       | Enable Cycle Time     | Pin E           | 1200 | -    | -    | ns   |
| T <sub>PW</sub>                                      | Enable Pulse Width    | Pin E           | 140  | -    | -    | ns   |
| T <sub>R</sub> , T <sub>F</sub>                      | Enable Rise/Fall Time | Pin E           | -    | -    | 25   | ns   |
| T <sub>AS</sub>                                      | Address Setup Time    | Pins: RS,RW,E   | 0    | -    | -    | ns   |
| T <sub>AH</sub>                                      | Address Hold Time     | Pins: RS,RW,E   | 10   | -    | -    | ns   |
| T <sub>DSW</sub>                                     | Data Setup Time       | Pins: DB0 - DB7 | 40   | -    | -    | ns   |
| T <sub>H</sub>                                       | Data Hold Time        | Pins: DB0 - DB7 | 10   | -    | -    | ns   |
| <i>Read Mode (Reading Data from ST7066U to MPU)</i>  |                       |                 |      |      |      |      |
| T <sub>C</sub>                                       | Enable Cycle Time     | Pin E           | 1200 | -    | -    | ns   |
| T <sub>PW</sub>                                      | Enable Pulse Width    | Pin E           | 140  | -    | -    | ns   |
| T <sub>R</sub> , T <sub>F</sub>                      | Enable Rise/Fall Time | Pin E           | -    | -    | 25   | ns   |
| T <sub>AS</sub>                                      | Address Setup Time    | Pins: RS,RW,E   | 0    | -    | -    | ns   |
| T <sub>AH</sub>                                      | Address Hold Time     | Pins: RS,RW,E   | 10   | -    | -    | ns   |
| T <sub>DDR</sub>                                     | Data Setup Time       | Pins: DB0 - DB7 | -    | -    | 100  | ns   |
| T <sub>H</sub>                                       | Data Hold Time        | Pins: DB0 - DB7 | 10   | -    | -    | ns   |

## Read/Write Timing Chart

● Writing data from MPU to ST7066U



● Reading data from ST7066U to MPU



## Commands

| Instruction                | Instruction Code |     |     |     |     |     |     |     |     |     | Description                                                                                                                      | Description Time (270KHz) |
|----------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|                            | RS               | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |                                                                                                                                  |                           |
| Clear Display              | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | Write "20H" to DDRAM. and set DDRAM address to "00H" from AC                                                                     | 1.52 ms                   |
| Return Home                | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | x   | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 1.52 ms                   |
| Entry Mode Set             | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | S   | Sets cursor move direction and specifies display shift. These operations are performed during data write and read.               | 37 us                     |
| Display ON/OFF             | 0                | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   | D=1:entire display on<br>C=1:cursor on<br>B=1:cursor position on                                                                 | 37 us                     |
| Cursor or Display Shift    | 0                | 0   | 0   | 0   | 0   | 1   | S/C | R/L | x   | x   | Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.                                 | 37 us                     |
| Function Set               | 0                | 0   | 0   | 0   | 1   | DL  | N   | F   | x   | x   | DL:interface data is 8/4 bits<br>N:number of line is 2/1<br>F:font size is 5x11/5x8                                              | 37 us                     |
| Set CGRAM address          | 0                | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter                                                                                             | 37 us                     |
| Set DDRAM address          | 0                | 0   | 1   | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter                                                                                             | 37 us                     |
| 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 us                      |
| Write data to RAM          | 1                | 0   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Write data into internal RAM (DDRAM/CGRAM)                                                                                       | 37 us                     |
| Read data from RAM         | 1                | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Read data from internal RAM (DDRAM/CGRAM)                                                                                        | 37 us                     |

## Note:

Be sure the ST7066U is not in the busy state (BF = 0) before sending an instruction from the MPU to the ST7066U. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to Instruction Table for the list of each instruction execution time.

## Reset Function

### Initializing by Internal Reset Circuit

An internal reset circuit automatically initializes the IC when the power is turned on. The following instructions are executed during the initialization. The busy flag (BF) is kept in the busy state until the initialization ends (BF = 1). The busy state lasts for 40 ms after VCC rises to 4.5 V.

1. Display clear

2. Function set:

DL = 1; 8-bit interface data

N = 0; 1-line display

F = 0; 5x8 dot character font

3. Display on/off control:

D = 0; Display off

C = 0; Cursor off

B = 0; Blinking off

4. Entry mode set:

I/D = 1; Increment by 1

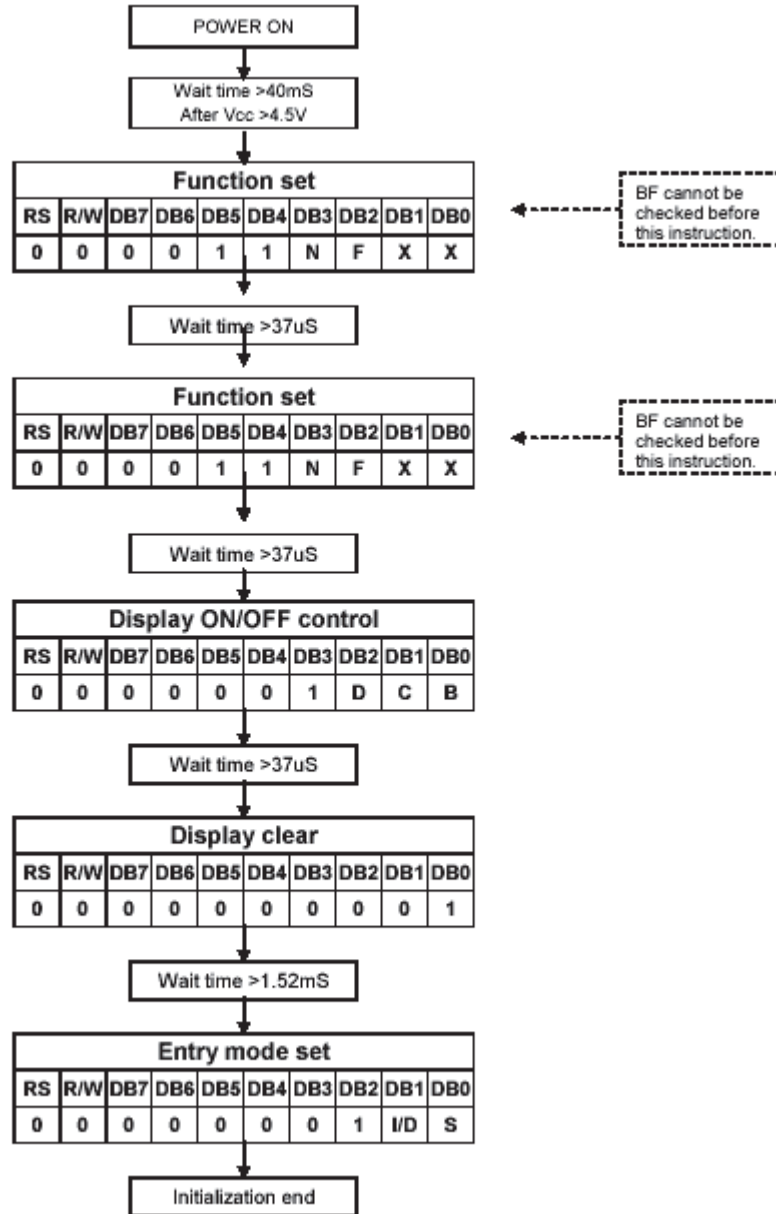
S = 0; No shift

#### Note:

If the electrical characteristics conditions listed in the table Power Supply Conditions are not met, the internal reset circuit will not operate normally and will fail to initialize the IC. For such a case, initialization must be performed by the MPU as explain by the following figures.

## Initializing by Instruction

8 bit Interface( fosc =270KHZ)



## DD RAM ADDRESSING

### For 10\*4 Display

|           |    |    |    |    |    |    |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|
|           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
| DD RAM    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
| Address   | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 | 13 |
|           | 5A | 5B | 5C | 5D | 5E | 5F | 50 | 51 | 52 | 53 |

### For 16\*1 Display

|           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Character | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| DD RAM    | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |
| Address   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

### For 16\*2 or 8\*2 Display

|           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 8  | 9  | 0A | 0B | 0C | 0D | 0E | 0F |
| DD RAM    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |
| Address   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

### For 16\*4 Display

|           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| DD RAM    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |
| Address   | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F |
|           | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | 5E | 5F |

### For 20\*2 Display

|           |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
|           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | --- | --- | 17 | 18 | 19 | 20 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 10 | 11 | 12 | 13 |
| DD RAM    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 50 | 51 | 52 | 53 |
| Address   |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |

### For 20\*4 Display

|           |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
|           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | --- | --- | 17 | 18 | 19 | 20 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 10 | 11 | 12 | 13 |
| DD RAM    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 50 | 51 | 52 | 53 |
| Address   | 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | --- | --- | 24 | 25 | 26 | 27 |
|           | 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | --- | --- | 64 | 65 | 66 | 67 |

### For 40\*2 Display

|           |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
|           | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | --- | --- | 37 | 38 | 39 | 40 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 24 | 25 | 26 | 27 |
| DD RAM    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 64 | 65 | 66 | 67 |
| Address   |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |

### For 40\*4 Display

|           |    |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |
|-----------|----|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
|           | E  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | --- | --- | 37 | 38 | 39 | 40 |
| Character |    | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 24 | 25 | 26 | 27 |
| DD RAM    | E1 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 64 | 65 | 66 | 67 |
| Address   |    |    |    |    |    |    |    |    |    |    |    |     |     |    |    |    |    |
|           | E2 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 24 | 25 | 26 | 27 |
|           |    | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 64 | 65 | 66 | 67 |

### CG RAM MAPPING

| Character Code<br>(DD RAM data)      | CG RAM Address                       | Character Patterns<br>(CG RAM data)                                                                               |                                                   |
|--------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| 7 6 5 4 3 2 1 0<br>High Low          | 5 4 3 2 1 0<br>High Low              | 7 6 5 4 3 2 1 0<br>High Low                                                                                       |                                                   |
| 0 0 0 0 * 0 0 0                      | 0 0 0                                | 0 1 1 0 0<br>1 0 0 1 0<br>0 0 1 0 0<br>0 1 0 0 0<br>1 1 1 1 0<br>1 0 1 0 0<br>0 0 0 0 0<br>0 0 0 0 0              | ←Character Pattern<br><br><br><br><br><br>←Cursor |
| 0 0 0 0 * 0 0 1                      | 0 0 1                                | 1 1 1 1 1<br>1 0 0 0 1<br>1 0 1 0 1<br>1 0 1 1 1<br>1 0 1 0 1<br>1 0 1 0 1<br>1 0 0 0 1<br>1 1 1 1 1<br>0 0 0 0 0 | ←Character Pattern<br><br><br><br><br><br>←Cursor |
| ⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮ | ⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮ | ⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮<br>⋮                                                                              |                                                   |
| 0 0 0 0 * 1 1 1                      | 1 1 1                                | 1 1 1 1 1<br>1 0 0 0 1<br>1 1 1 0 1<br>1 0 0 0 1<br>1 0 1 1 1<br>1 0 0 0 1<br>1 0 0 0 1<br>1 1 1 1 1<br>0 0 0 0 0 | ←Character Pattern<br><br><br><br><br><br>←Cursor |

## CHARACTER FONT TABLE

| Upper<br>4 bit<br>Lower<br>4 bit | LLLL | LLHH | LLHL | LLHH | LHLL | LHLH | LHHL | LHHH | HLLL | HLLH | HHLH | HHLH | HHLL | HHHL | HHHL | HHHH |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| LLLL                             |      |      |      | 0    | 1    | 2    | 3    | 4    |      |      |      |      | 一    | 二    | 三    | 四    |
| LLHH                             |      |      | !    | 5    | A    | B    | C    | D    |      |      |      |      | 。    | ア    | チ    | △    |
| LLHL                             |      |      | "    | 6    | E    | F    | G    | H    |      |      |      |      | 「    | イ    | ウ    | ×    |
| LLHH                             |      |      | #    | 7    | I    | J    | K    | L    |      |      |      |      | 」    | ウ    | テ    | モ    |
| LHLL                             |      |      | \$   | 8    | O    | P    | Q    | R    |      |      |      |      | 、    | エ    | ト    | カ    |
| LHLH                             |      |      | %    | 9    | S    | T    | U    | V    |      |      |      |      | ・    | オ    | ナ    | ユ    |
| LHHL                             |      |      | &    | A    | F    | U    | F    | V    |      |      |      |      | ヲ    | カ    | ニ    | ヨ    |
| LHHH                             |      |      | '    | B    | W    | 9    | W    |      |      |      |      |      | ヲ    | キ    | ヌ    | ラ    |
| HLLL                             |      |      | (    | C    | H    | ×    | H    | ×    |      |      |      |      | ィ    | ウ    | キ    | リ    |
| HLLH                             |      |      | )    | D    | I    | Y    | i    | Y    |      |      |      |      | ち    | ケ    | ル    | リ    |
| HLHL                             |      |      | *    | E    | J    | Z    | j    | Z    |      |      |      |      | エ    | コ    | レ    | ジ    |
| HLHH                             |      |      | +    | F    | K    | L    | k    | L    |      |      |      |      | オ    | サ    | ロ    | ×    |
| HHLL                             |      |      | ,    | G    | L    | ¥    | I    | I    |      |      |      |      | カ    | シ    | フ    | ワ    |
| HHLH                             |      |      | -    | H    | M    | J    | m    | J    |      |      |      |      | ユ    | ス    | へ    | シ    |
| HHHL                             |      |      | .    | I    | N    | ^    | n    | ^    |      |      |      |      | ヨ    | セ    | ホ    | °    |
| HHHH                             |      |      | /    | J    | O    | _    | O    | +    |      |      |      |      | ッ    | リ    | マ    | 〃    |

## HANDLING PRECAUTION

### 1. Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be taken when handling the LCD Modules.

### 2. Caution of LCD handling & 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
- Kettle
- Aromatics

### 3. Caution against static charge

The LCD Module uses C-MOSLSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

### 4. Packaging

-Modules use 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.

## 5. Caution for operation

-It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shortens LCD life.

An electrochemical reaction due to direct current causes LCD deterioration. Avoid the use of direct current drive.

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

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the relative condition of 40 °C, 50%RH or less is required.

## 6. Storage

In the case of storing for a long period of time (for instance. For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.

- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.

-Storing with no touch on polarizer surface by anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

## 7. Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.

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