# DOT MATRIX
# LIQUID CRYSTAL DISPLAY
# MODULE

## G16080-2 **Serial**

# USER‘ MANUAL

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

| PROPOSED BY | | APPROVED |
|---|---|---|
| Design | Approved | |
| | | |

0755-25324802

# CONTENTS

# 1. GENERAL AND CHARACTERISTICS

| | | |
|---|---|---|
| **Dot Matrix Format** | 160 × 80 dots | |
| **Controller IC** | LC7981 or equivalent | |
| **Dimensional Outline** | 100.0 (W) X 54.0 (H) X 9.5 (D) mm | 100.0 (W) X 54.0 (H) X 14.0 (D) mm |
| **Viewing Area** | 72.0W × 39.0H mm | |
| **Active Viewing Area** | 67.17W × 33.57H mm | |
| **Dot Pitch** | 0.42W × 0.42H mm | |
| **Dot Size** | 0.39W × 0.39H mm | |
| | STN, Gray, 1/80 Duty, 1/9 Bias, 6 O'clock | |
| | STN, Yellow Green, 1/80 Duty, 1/9 Bias, 6 O'clock | |
| | STN, Gray, 1/80 Duty, 1/9 Bias, 6 O'clock, EL Backlight (Color is Blue) | |
| | STN, Yellow Green, 1/80 Duty, 1/9 Bias, 6 O'clock, EL Backlight (Color is White) | |
| | STN, Gray, 1/80 Duty, 1/9 Bias, 6 O'clock, LED Backlight (Color is Yellow Green) | |
| | STN, Yellow Green, 1/80 Duty, 1/9 Bias, 6 O'clock, LED Backlight (Color is Yellow Green) | |

# 2. ABSOLUTE MAXIMUM RATINGS:

2.1 Electrical absolute maximum rating

| ITEM | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| Logic Circuit Supply Voltage | $V_{DD}$ - $V_{SS}$ | 0 | 7.0 | V |
| LCD Driver Circuit Supply Voltage | $V_{DD}$ - $V_{EE}$ | 0 | 15.0 | V |
| Input Voltage | $V_I$ | $V_{SS}$ | $V_{DD}$ | V |
| Operating Temperature | $T_{OP}$ | -20 | +70 | ℃ |
| Storage Temperature | $T_{ST}$ | -30 | +80 | ℃ |

2.2 Environmental absolute maximum ratings

| ITEM | OPERATING | | STORAGE | | COMMENT |
|---|---|---|---|---|---|
| | MIN | MAX | MIN | MAX | |
| Ambient Temperature | 0/-20 | 50/70 | -10/-30 | 60/80 | Norm/Extended Note (1) |
| Humidity | Note (2) | | Note (2) | | Without condensation |
| Vibration | -- | 4.9m/s$^2$ | -- | 19.6m/s$^2$ | XYZ directions |
| Shock | -- | 29.4m/s$^2$ | -- | 490.0m/s$^2$ | XYZ directions |

Note (1) Ta at 60℃ : 50 HR MAX

Note (2) Ta ≦40℃ : 90% RH MAX

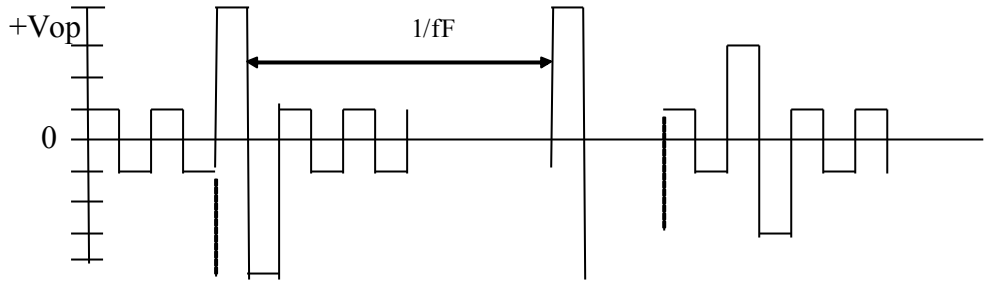
Ta ＞40℃ : Absolute humidity must be lower than the humidity of 90% at 40℃.

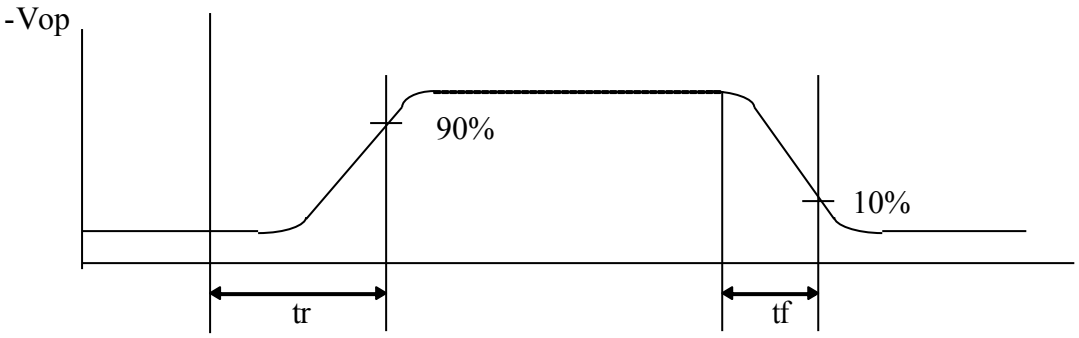
(Note 1) Definition of response time and measuring condition. Response time should be measured at the point of the most smallest response in all segments under the following condition.

a) Temperature 25℃

b) Frame frequency 64 Hz

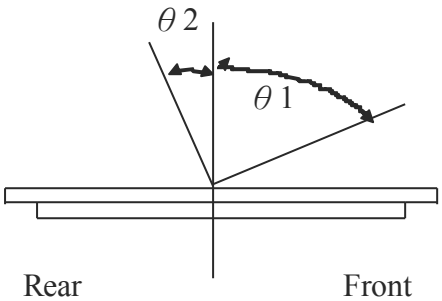
c) Viewing angle $\theta$=0°, $\varphi$=0°



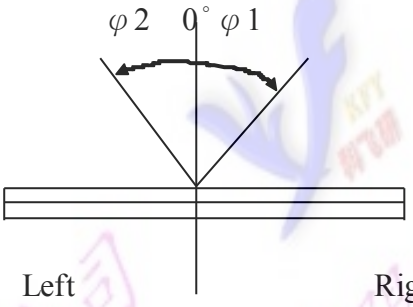



(Note 2) Definition of viewing angle

Front-Rear direction




Right-Left direction




## 3. ELECTRICAL CHARACTERISTICS

$V_{SS}$ = 0V, Ta = 25℃

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Logic Circuit Power Supply | $V_{DD}$ - $V_{SS}$ | -- | 4.75 | 5.0 | 5.25 | V |
| LCD Driver Power Supply | $V_{DD}$ - $V_{EE}$ | -- | -- | 10.0 | -- | V |
| Input Voltage | $V_{IH}$ | $V_{DD}$ = 5V±0.25 | 0.7*$V_{DD}$ | -- | $V_{DD}$ | V |
| | $V_{IL}$ | | 0 | -- | 0.3*$V_{DD}$ | V |
| Power Supply Current | $I_{DD}$ | $V_{DD}$ = 5V | -- | -- | 10.0 | mA |
| | $I_{EE}$ | $V_{EE}$ = -10V | -- | -- | 2.0 | mA |

## 4. ELECTRO-OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT | REF. |
|---|---|---|---|---|---|---|---|
| Rise Time | Tr | 25℃ | -- | 396 | -- | mS | Note 1 |
| Fall Time | Tf | 25℃ | -- | 109 | -- | mS | Note 1 |
| Contrast | Cr | 25℃ | -- | 12.3 | -- | -- | Note 3 |
| Viewing Angle | $\theta$ | 25℃ & | 50 | -- | -- | DEG | Note 2 |
| | $\varphi$ 1, $\varphi$ 2 | Cr ≧ 3 | -- | 40 | -- | DEG | Note 2 |
| Frame Frequency | Ff | 25℃ | -- | 64 | -- | Hz | -- |

Note 1&2 : See previous page.

Note 3 : Contrast ration is defined under the following condition.

Cr = reflectance value of non-selected condition ÷ reflectance value of selected condition.

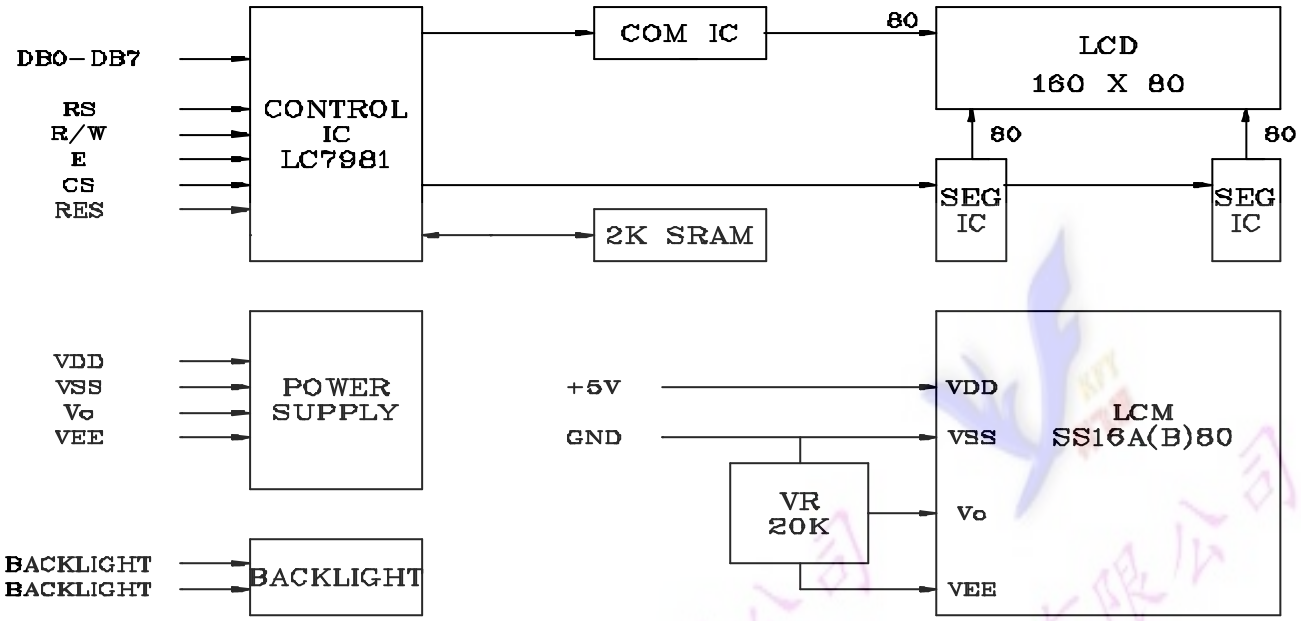
(a) Temperature..... 25℃

(b) Frame frequency..... 64 Hz

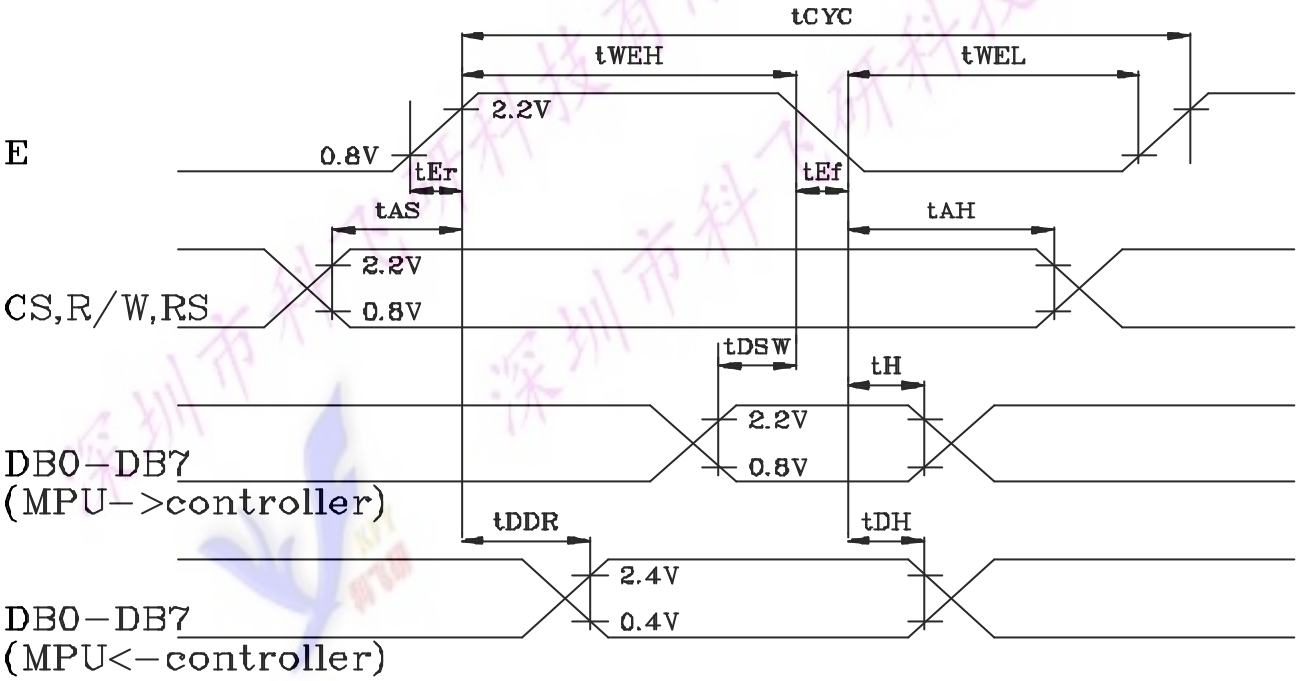
(c) Viewing angle..... $\theta$ =0°, $\varphi$ =0°

(d) Operating voltage..... 12.5V

## 5. BLOCK DIAGRAM AND POWER SUPPLY



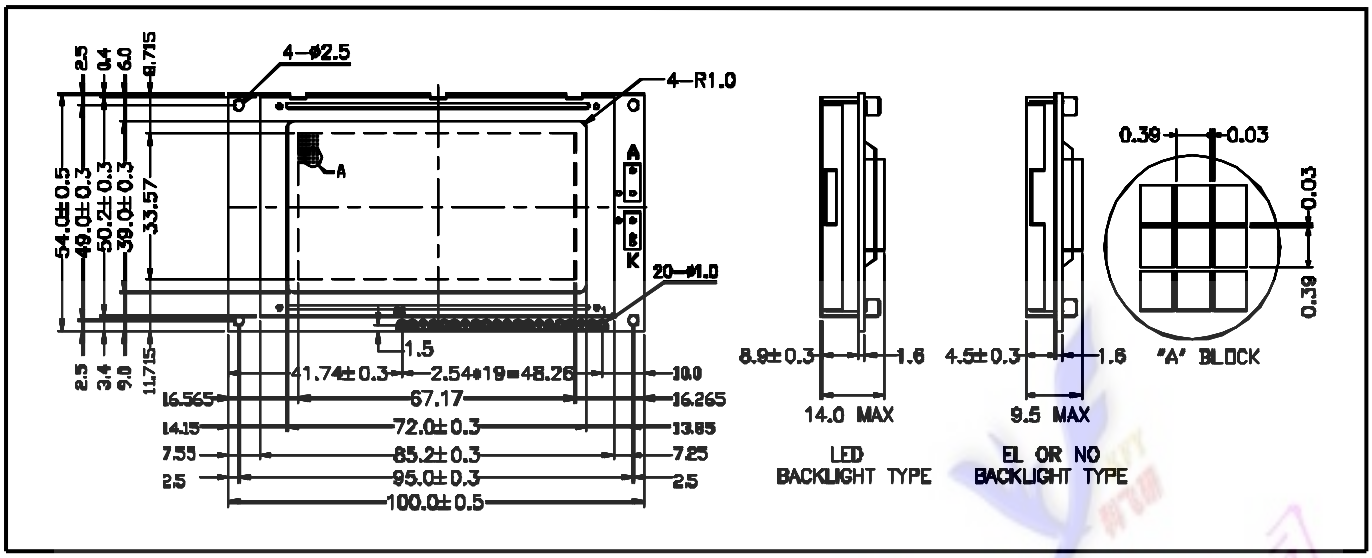

## 6. TIMING CHARACTERISTICS




| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Enable cycle time | tCYC | 1000 | -- | -- | ns |
| Enable pulse width High/Low level | tWEH,tWEL | 450 | -- | -- | ns |
| Enable rise/fall time | tEr,tEf | -- | -- | 25 | ns |
| Setup time | tAS | 140 | -- | -- | ns |
| Data setup time | tDSW | 225 | -- | -- | ns |
| Data delay time | tDDR | -- | -- | 225 | ns* |
| Data hold time | tH | 10 | -- | -- | ns |
| Address hold time | tAH | 10 | -- | -- | ns |
| Output data hold time | tDH | 20 | -- | -- | ns |

Note: * The following load circuit is connected for specification

# 7. DIMENSION OUTLINE AND PIN CONNECTIONS




| NO. | SYMBOL | FUNCTION | NO. | SYMBOL | FUNCTION |
|---|---|---|---|---|---|
| 1 | VSS | Ground | 11 | DB4 | Data bus line |
| 2 | VDD | Power supply for logic circuit | 12 | DB5 | Data bus line |
| 3 | Vo | Power supply for LCD circuit | 13 | DB6 | Data bus line |
| 4 | D/I | Data/Instruction | 14 | DB7 | Data bus line |
| 5 | R/W | Read / Write | 15 | /CS | Chip enable |
| 6 | E | Enable Signal | 16 | /RES | Controller reset |
| 7 | DB0 | Data bus line | 17 | VEE | Negative voltage output |
| 8 | DB1 | Data bus line | 18 | N.C | |
| 9 | DB2 | Data bus line | 19 | A(EL1) | LED + (EL Backlight 1) |
| 10 | DB3 | Data bus line | 20 | K(EL2) | LED – (EL Backlight 2) |

# 8. POWER SUPPLY FOR BACKLIGHT

| ITEM | LED Backlight | EL Backlight |
|---|---|---|
| Use Inverter Type | -- | SDEC-I002A |
| Color | Yellow Green | Blue / White |
| Backlight Input Voltage | DC +4.2 V | AC 90 ~ 110 V |
| Backlight Frequency | -- | 400 ~ 700 Hz |
| Backlight Current | 300 mA | -- |
| Inverter Input Voltage | -- | DC +5 V |
| Inverter Current Density | -- | 40 mA |
| Half-Life Time | 50,000 HR. | 3,000 HR. |

# 9. DISPLAY CONTROL INSTRUCTIONS

## 9.1 Description of command

Display is controlled by writing data into the instruction register and 13 data registers. The RS signal distinguishes the instruction register from the data registers. 8-bit data is written into the instruction register with RS=1, and the code of data register is specified. After that, the 8-bit data is written in the data register and the specified instruction is executed with RS=0. During the execution of the instruction, no new instruction can be accepted. Since the busy flag is set during this, read the busy flag and make sure it is 0 before writing the next instruction.

### 9.1.1 Mode Control

Code $"00" (hexadecimal) written into the instruction register specifies the mode control register.

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mode Control Register | 0 | 0 | 0 | 0 | Mode Data | | | | | |

| DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Cursor/blink | CG | Graphic/Character |
|---|---|---|---|---|---|---|---|---|
| | | 0 | 0 | | | Cursor OFF | | |
| | | 0 | 1 | | | Cursor ON | Internal | |
| | | 1 | 0 | | 0 | Cursor OFF, Character blink | CG | |
| | | 1 | 1 | | | Cursor blink | | |
| 1/0 | 1/0 | 0 | 0 | 0 | | Cursor OFF | | Character Mode |
| | | 0 | 1 | | | Cursor ON | Internal | |
| | | 1 | 0 | | 1 | Cursor OFF, Character blink | CG | |
| | | 1 | 1 | | | Cursor blink | | |
| | | 0 | 0 | 1 | 0 | | | Graphic Mode |

1: Master Mode 0: Slave Mode *Normal is set Master Mode
1: Display ON 0: Display OFF

### 9.1.2 Set Character Pitch

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Character Pitch Register | 0 | 0 | (Vp -1) Binary | | | | 0 | (Hp -1) Binary | | |

Vp indicates the number of vertical dots per character. The space between the vertically-displayed characters is considered for determination. This value is meaningful only during character display (in the character mode) and becomes invalid in the graphic mode. The Hp indicates the number of horizontal dots per character in display including the space between horizontally-displayed characters. In the graphic mode, the Hp indicates the number of bits of 1 byte display data to be displayed. Three Hp values:

| Hp | DB2 | DB1 | DB0 | |
|---|---|---|---|---|
| 6 | 1 | 0 | 1 | Horizontal character pitch 6 |
| 7 | 1 | 1 | 0 | Horizontal character pitch 7 |
| 8 | 1 | 1 | 1 | Horizontal character pitch 8 |

### 9.1.3 Set Number of Characters

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Number of Character Register | 0 | 0 | 0 | (Hn -1) Binary | | | | | | |

Hn indicates the number of horizontal characters in the character mode r the number of horizontal bytes in the graphic mode. If the total sum of horizontal dots on the screen is taken as n, n = Hp x Hn .
Hn can be set with an even number of 2 to 128 (decimal).

### 9.1.4 Set Number of Time Division (inverse of display duty ratio)

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Character Pitch Register | 0 | 0 | (Nx -1) Binary | | | | | | | |

Nx indicates the number of time division in multiplex display. 1/Nx is a display duty ration.
A value of 1 to 128 (decimal) can be set to Nx.

### 9.1.5 Set Cursor Position

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Cursor Position Register | 0 | 0 | 0 | 0 | 0 | 0 | (Cp -1) Binary | | | |

Cp indicates the position in a character where the cursor is displayed in the character mode. For example, in 5x7 dot font, the cursor is displayed under a character by specifying Cp=8 (decimal). The cursor horizontal length is equal to the horizontal character pitch Hp. A value of 1 to 16 (decimal) can be set to Cp. If a smaller value than the number of vertical character pitches Vp is set (Cp ≦ Vp), and a character is overlapped with the cursor, the cursor has higher priority of display (at cursor display ON). If Cp is greater than Vp, no cursor is displayed. The cursor horizontal length is equal to Hp.

### 9.1.6 Set Display Start Low Order Address

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Display Start Address Register (low order byte) | 0 | 0 | (Start low order address) Binary | | | | | | | |

### 9.1.7 Set Display start High Order Address

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Display Start Address Register (high order byte) | 0 | 0 | (Start high order address) Binary | | | | | | | |

These instructions cause display start addresses to be written in the display start address registers. The display start address indicates a RAM address at which the data displayed at the top left end on the screen is stored. In the graphic mode, the start address is composed of high/low order 16 bits. In the character display, it is composed of he lower 4 bits of high order address (DB3 - DB4) and 8 bits of low order address. The upper 4 bits of high order address are ignored.

### 9.1.8 Set Cursor Address (low order) (RAM write low order address)

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| Cursor Address Counter (low order byte) | 0 | 0 | (Cursor low order address) Binary | | | | | | | |

### 9.1.9 Set Cursor Address (high order) (RAM write high address)

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| Cursor Address Counter (high order byte) | 0 | 0 | (Vp -1) Binary | | | | 0 | (Hp -1) Binary | | |

These instructions cause cursor addresses to be written in the cursor address counters. The cursor address indicates and address for sending or receiving display data and character codes to or from the RAM. Namely, data at address specified by the cursor address are read/written. In the character mode, the cursor is displayed at the digit specified by the cursor address. A cursor address consists of the low-order address (8 bits) and the high-order address (8 bits). Satisfy the following requirements.

| | | |
|---|---|---|
| 1 | When you want to rewrite (set) both the low order address and the high order address. | Set the low order address and then set the high order address. |
| 2 | When you want to rewrite only the low order address. | Don‘t fail to set the high order address again after setting the low order address. |
| 3 | When you want to rewrite only the high order address. | Set the high order address. You don‘t have to set the low order address again. |

The cursor address counter is a 16 bit up-count with SET and RESET functions. When the bit N Changes from 1 to 0, the bit N+1 is added by 1. When setting the low order address, the LSB (bit 1) of the high order address is added by 1 if the MSB (bit *) of the low order address changes from 1 to 0. Therefore, set both the low order address and the high order address as shown in above table.

### 9.1.10 Write Display Data

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| RAM | 0 | 0 | MSB (pattern data, character code) LSB | | | | | | | |

After the code $“OC” is written into the instruction register with RS=1, 8 bit data with RS=0 should be written into the data register. This data is transferred to the RAM specified by the cursor address as display data or character code. The cursor address is increased by 1 after this operation.

### 9.1.11 Read Display Data

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| RAM | 0 | 0 | MSB (pattern data, character code) LSB | | | | | | | |

Data can be read from the RAM with RS=0 after writing code $“0D” into the instruction register. The read procedure is as follows:

This instruction outputs the contents of data output register on Data Bus (DB0 to DB7) and then transfers RAM data specified by a cursor address to the data output register, also increasing the cursor address by 1. After setting the cursor address, correct data is not output at the first read but at the second time. Thus, make one dummy read when reading data after setting the cursor address.

### 9.1.12 Set Bit

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Instruction Register | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Bit Set Register | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |

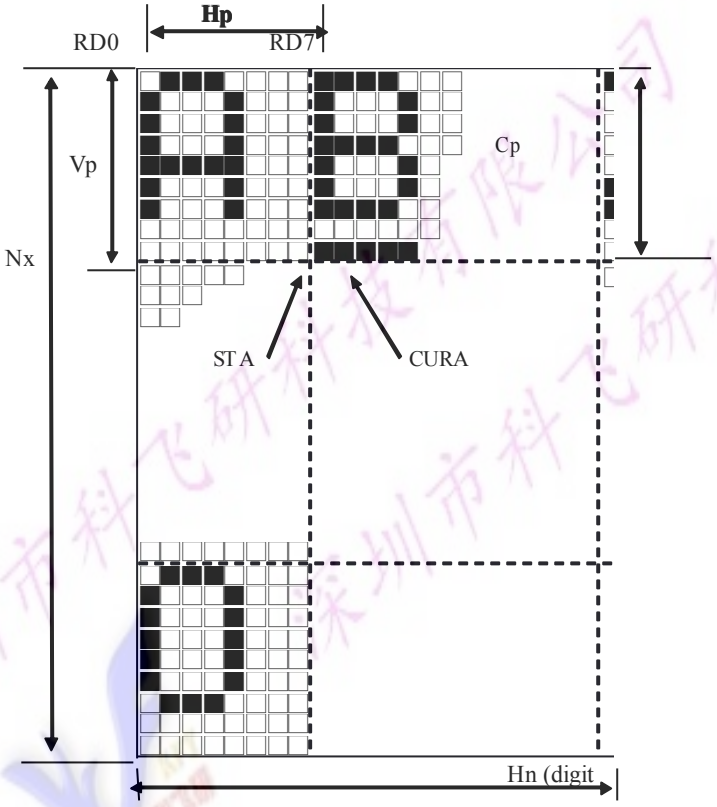
The Clear/Set bit instruction sets 1 bit in a byte of display data RAM to 0 or 1, respectively. The position of the bit in a byte is specified by NB and RAM address is specified by cursor address. After the execution of the instruction, the cursor address is automatically increased by 1. NB is a value of 1 to 8. NB=1 and NB=8 indicates LSB and MSB, respectively.

### 9.1.13 Read Busy Flag

| REGISTER | R/W | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Busy Flag | 0 | 1 | 1/0 | * | | | | | | |

When the read mode is set with RS=1, the busy flag is output to DB7. The busy flag is set to 1 during the execution of any of instructions (1) to (13). After the execution, it is set to 0. The next instruction can be accepted. No instruction can be accepted when busy flag=1. Before executing an instruction or writing data, perform a busy flag check to make sure that busy flag is 0. When data is written in the register (RS=1), no busy flag changes. Thus, no busy flag check is required just after the write operation into the instruction register with RS=1. The busy flag can be read without specifying any instruction register.

## 9.2 Display variables



| Symbol | Name | Meaning | Value |
|---|---|---|---|
| Hp | Horizontal character pitch | Lateral character pitch | 6 to 8 dots |
| Hn | Number of horizontal characters | Number of lateral characters per line (number of digits) in the character mode or number of bytes per line in the graphic mode. | 2 to 128 digits (an even number) |
| Vp | Vertical character pitch | Longitudinal character pitch. | 1 to 16 dots |
| Cp | Cursor position | Line number on which the cursor can be displayed. | |
| nx | Number of time division | Inverse of display duty ratio | 1 to 128 lines |

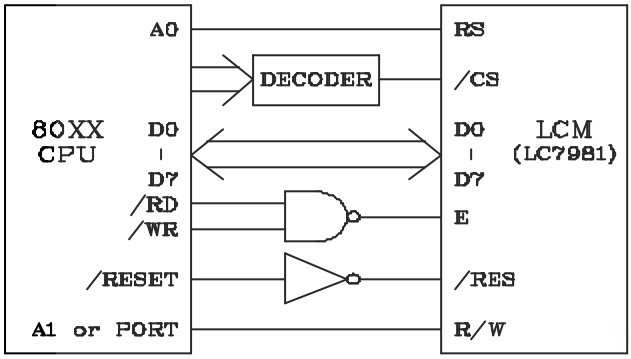
Note: If the number of vertical dots on screen is taken as m, and the number of horizontal dots as n,
1/m = 1/Nx = display duty ratio
n = Hp x Hn, m/Vp = Number of display lines
Cp ≦ Vp

9.3 Initialize LCM register set list

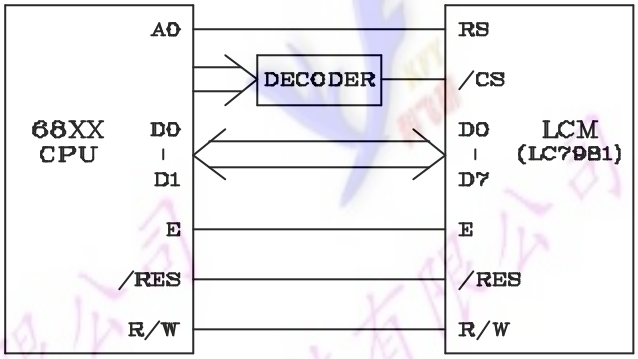
| **Register number** | **0H** | **1H** | **2H** | **3H** | **4H** | **8H** | **9H** | **AH** | **BH** |
|---|---|---|---|---|---|---|---|---|---|
| **Character mode** | 1CH | 77H | 13H | 4FH | 07H | 00H | 00H | 00H | 00H |
| **Graphics mode** | 12H | 77H | 13H | 4FH | 07H | 00H | 00H | 00H | 00H |

## 10. INTERFACE FOR LCM

10.1 Interface to 80 family




10.2 Interface to 68 family




## 11. RELIABILITY CONDITION

| | | | TN Type | | STN Type | |
|---|---|---|---|---|---|---|
| | | | Normal Temp. | Wide Temp. | Normal Temp. | Wide Temp. |
| Viewing Angle | Horizontal Φ | | ±30 ° | ±30 ° | ±30 ° | ±30 ° |
| | Vertical Θ(㎜) | | 10 °to 30 ° | 10 °to 30 ° | -10 °to 40 ° | -10 °to 40 ° |
| Operating Temperature | | | -10 to 70℃ | -25 to 80℃ | 0 to 50℃ | *-20 to 70℃ |
| Storage Temperature | | | -20 to 80℃ | -35 to 90℃ | -20 to 70℃ | *-30 to 80℃ |
| High Temperature (Power Off) | | | 240 Hours @70℃ | 240 Hours @90℃ | 240 Hours @65℃ | 240 Hours @75℃ |
| Low Temperature (Power Off) | | | 240 Hours @-20℃ | 240 Hours @-35℃ | 240 Hours @-15℃ | 240 Hours @-25℃ |
| High Temperature (Power On) | | | 240 Hours @70℃ | 240 Hours @80℃ | 240 Hours @60℃ | 240 Hours @70℃ |
| Low Temperature (Power On) | | | 240 Hours @-10℃ | 240 Hours @-25℃ | 240 Hours @-10℃ | 240 Hours @-20℃ |
| High Temperature & High Humidity | | | 55℃/90%RH 240 Hours | 75℃/90%RH 240 Hours | 45℃/90%RH 240 Hours | 65℃/90%RH 240 Hours |
| Thermal Shock 5 Cycle | C B A | A | 60min@-20℃ | 60min@-35℃ | 60min@-20℃ | 60min@-30℃ |
| | | B | 5min@25℃ | 5min@25℃ | 5min@25℃ | 5min@25℃ |
| | | C | 60min@70℃ | 60min@90℃ | 60min@70℃ | 60min@80℃ |
| Expected Lift | | | 50,000 Hours | 50,000 Hours | 50,000 Hours | 50,000 Hours |

*Wide temp. version may not available for some products, Please consult our sales engineer or respresentative.

## 12. FUNCTIONAL TEST & INSPECTION CRITERIA

### 12.1 Sample plan

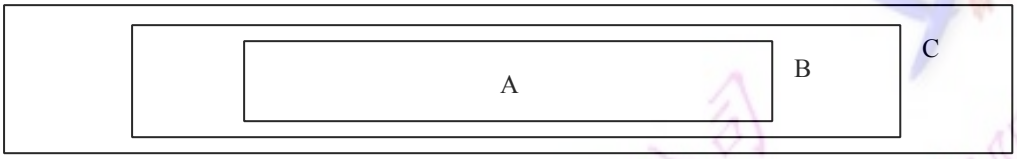
Sample plan according to MIL-STD-105D level 2, and acceptance/rejection criteria is.

Base on : Major defect : AQL 0.65 Minor defect : AQL 2.5

### 12.2 Inspection condition

Viewing distance for cosmetic inspection is 30cm with bare eyes, and under an environment of 800 lus (20W) light intensity. All direction for inspecting the sample should be within 45° against perpendicular line.

### 12.3 Definition of Inspection Zone in LCD




Zone A : Character / Digit area

Zone B : Viewing area except Zone A ( Zone A + Zone B = minimum Viewing area )

Zone C : Outside viewing area ( invisible area after assembly in customer's product )

Note : As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

### 12.4 Major Defect

All functional defects such as open ( or missing segment ), short, contrast differential, excess power consumption, smearing, leakage, etc. and overall outline dimension beyond the drawing. Are classified as major defects.

## 12.5 Minor Defect

Except the Major defects above, all cosmetic defects are classified as minor defects.

<table>
<tr><th>Item No.</th><th>Item to be Inspected</th><th colspan="5">Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="6">1.</td><td rowspan="6">Spot defect<br>( Defects in spot from )</td><td rowspan="2">Zone size (mm)</td><td colspan="3">Acceptable Qty</td><td rowspan="6">Minor</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ ≦0.15</td><td colspan="2">Acceptable ( clutering of spot not allowed )</td><td>Accepta-ble</td></tr>
<tr><td>0.15 ≦ Φ ≦0.20</td><td>1</td><td>2</td><td rowspan="3"></td></tr>
<tr><td>0.20 ≦ Φ ≦0.25</td><td>0</td><td>1</td></tr>
<tr><td>Φ>0.25</td><td>0</td><td>0</td></tr>
<tr><td colspan="5">Remarks : for dark/white spot, size Φ is defined as Φ=1/2(X+Y)</td></tr>
<tr><td rowspan="8">2.</td><td rowspan="8">Line defect ( Defects in line form )</td><td colspan="2">Size (mm)</td><td colspan="3">Acceptable Qty</td><td rowspan="8">Minor</td></tr>
<tr><td>L<br>Length</td><td>W<br>Width</td><td colspan="3">Zone</td></tr>
<tr><td></td><td></td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Accep-table</td><td>W≦0.02</td><td>Accep-table</td><td></td><td>Accep-table</td></tr>
<tr><td>L≦3.0</td><td>W≦0.03</td><td>2</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>L>2.5</td><td>W≦0.03</td><td>0</td></tr>
<tr><td>L≦3.0</td><td>0.03<W≦0.05</td><td>2</td></tr>
<tr><td>L>2.5</td><td>0.03<W≦0.05</td><td>0</td></tr>
<tr><td colspan="2"></td><td>W>0.05</td><td colspan="3">Counted as spot defect ( Follows item 12.5.1 )</td></tr>
<tr><td colspan="5">Remarks: The total of spot defect and line defect shall not exceed four.</td></tr>
<tr><td>3.</td><td>Orientation defect ( such as misalignment of L/C)</td><td colspan="5">Not allowed inside viewing area ( Zone A or Zone B )</td><td>Minor</td></tr>
<tr><td rowspan="6">4.</td><td rowspan="6">Polarizing</td><td colspan="5">12.5.4.1 Polarizer Position<br>1. Shifting in Position Should not exceed the glass outline dimension.<br>2. Incomplete covering of the viewing area due to Shifting is not allowed.</td><td rowspan="6">Minor</td></tr>
<tr><td colspan="5">12.5.4.2 Seratches, bubble or dent on Glass/ Polarizer/Reflector, Bubble between Polarizer & Reflector/Glass:</td></tr>
<tr><td rowspan="3">Size (mm)</td><td colspan="3">Acceptable Qty</td><td rowspan="3"></td></tr>
<tr><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ ≦0.20</td><td colspan="2">Acceptable</td><td>Accep-table</td></tr>
<tr><td>0.20<Φ ≦0.50</td><td colspan="2">3</td><td rowspan="3"></td></tr>
<tr><td>0.50<Φ ≦1.00</td><td colspan="2">2</td></tr>
<tr><td>Φ>1.00</td><td colspan="2">0</td></tr>
</table>

## 13. CG ROM PATTERN

CHARACTER PATTERN CHART (5×7 DOTS +CURSOR)

| Higher 4 bit / Lower 4 bit | 0000 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XXXX0000 | CG RAM (1) | | | | | | | | | | | | |
| XXXX0001 | (2) | | | | | | | | | | | | |
| XXXX0010 | (3) | | | | | | | | | | | | |
| XXXX0011 | (4) | | | | | | | | | | | | |
| XXXX0100 | (5) | | | | | | | | | | | | |
| XXXX0101 | (6) | | | | | | | | | | | | |
| XXXX0110 | (7) | | | | | | | | | | | | |
| XXXX0111 | (8) | | | | | | | | | | | | |
| XXXX1000 | (1) | | | | | | | | | | | | |
| XXXX1001 | (2) | | | | | | | | | | | | |
| XXXX1010 | (3) | | | | | | | | | | | | |
| XXXX1011 | (4) | | | | | | | | | | | | |
| XXXX1100 | (5) | | | | | | | | | | | | |
| XXXX1101 | (6) | | | | | | | | | | | | |
| XXXX1110 | (7) | | | | | | | | | | | | |
| XXXX1111 | (8) | | | | | | | | | | | | |