# 华田信科电子有限公司

## HTDISPLAY ELECTRONICS CO.,LTD.

*The professional LCD manufacturer*

*www.htdisplay.com*

# SPECIFICATIONS

Product Name:  __LCD Module__

Model Part Number:  _HC080202C-VA_

Revision:  ___A___    Date:  _2019-11-20_

| Prepared By: | Reviewed By: | Approved By: |
|---|---|---|
| SZX | HY | WS |

Customer: _____

Customer Approved Result: _____ □ OK _____ □ NG _____

Customer Confirmed Message: _____

_____

Approved By: _____    Date: _____

# Contents

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HTdisplay ELECTRONICS CO.,LTD

## Record of History

The following table tracks the history of the changes made to this document.

| Release Date | Rev. | Summary | Design |
|---|---|---|---|
| 2019.11.20 | A | Origin Released | SZX |
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# 1. Technology Specifications

## 1.1 Features

| S/N | ITEM | | SPEC |
|---|---|---|---|
| 1 | Display Format | : | 8*2 Character |
| 2 | Display Mode | : | STN, Y-G, Positive |
| 3 | Polarizer Mode | : | Transflective |
| 4 | Driving Method | : | 1/16Duty, 1/5 Bias, Vop 4.4V |
| 5 | Viewing Direction | : | 6 O'clock |
| 6 | Backlight | : | LED Yellow/Green |
| 7 | Controller | : | ST7066-0A |
| 8 | Interface | : | 4-Bit/8-Bit Parallel |
| 9 | Weight | : | —— |

## 1.2 Mechanical Specifications

| Item | Description | Unit |
|---|---|---|
| Character Matrix | 8×2 | |
| Module Dimension | 40(L) ×35.9(W) ×13.5(max) | mm |
| Viewing Area | 30.4(L) ×13.9 (W) | mm |
| Active Area | 26.4(L)×9.9(W) | mm |
| Character Size | 2.97(W) × 4.75(H) | mm |
| Character Pitch | 3.55(W) X 5.15(H) | mm |
| Dot Size | 0.55(L) ×0.55(W) | mm |
| Dot Pitch | 0.60(L) ×0.60(W) | mm |

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### 1.3 Interface Functions

| Pin no. | Symbol | I/O | Function |
|---------|--------|-----|----------|
| 1 | VSS | P | Power Ground |
| 2 | VDD | P | Power supply for logic(+5.0V) |
| 3 | V0 | P | LCD DRIVING VOLTAGE |
| 4 | RS | H/L | L: instruction; H: data |
| 5 | R/W | H/L | Read write control ,"0":write,"1":read |
| 6 | E | H | Write/Read Control Clock |
| 7 | DB0 | H/L | Data bus 0 |
| 8 | DB1 | H/L | Data bus 1 |
| 9 | DB2 | H/L | Data bus 2 |
| 10 | DB3 | H/L | Data bus 3 |
| 11 | DB4 | H/L | Data bus 4 |
| 12 | DB5 | H/L | Data bus 5 |
| 13 | DB6 | H/L | Data bus 6 |
| 14 | DB7 | H/L | Data bus 7 |
| 15 | LED+ | P | Power supply for LED(+5.0V) |
| 16 | LED- | P | Power supply for LED |

| REV | DESCRIPTION | BY | DATE |
|-----|-------------|-----|------|
| A | First issue | HK | 2019.11.20 |
| B | Add Operating Temp&Storage Temp | HK | 2019.11.20 |
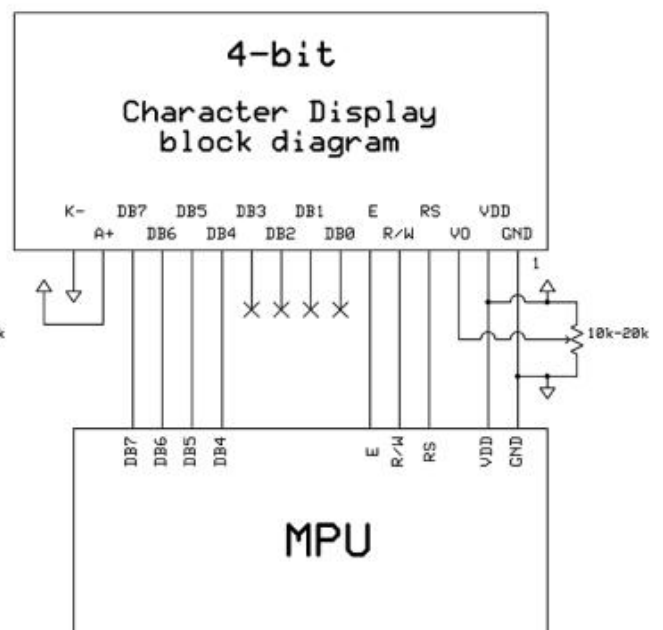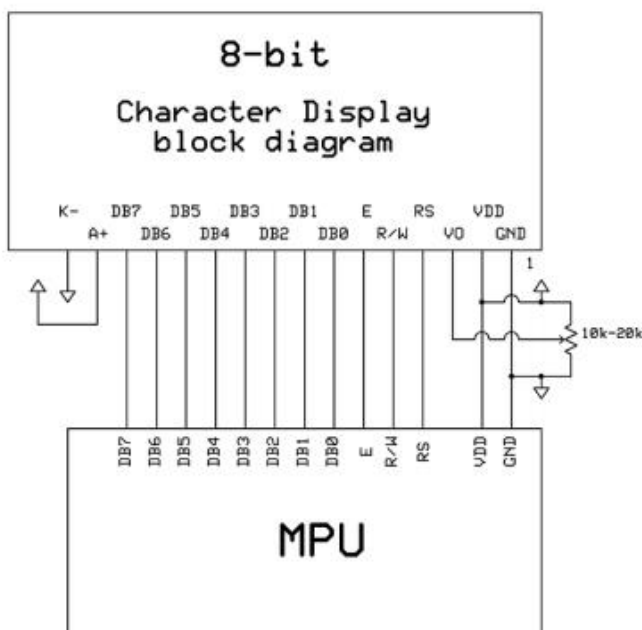
## PIN ASSIGNMENT

| 1 | VSS |
|---|-----|
| 2 | VDD |
| 3 | V0 |
| 4 | RS |
| 5 | R/W |
| 6 | E |
| 7~14 | DB0~DB7 |
| 15 | LED+ |
| 16 | LED- |

40.00±0.5(Outline)
36.30(Frame)
30.40 (VA)
26.40 (AA)
(1.85)
(4.80)
(6.80)
(12.38)
P2.54*(8-1)=17.78
16-ø1.00
2.13
2.54
2  16
1  15
(13.45)
(11.45)
(6.80)
(3.40)

13.50(MAX)
1.60±0.15(PCB)
9.0±0.5
(0.50)

9.90 (AA)
13.90 (VA)
23.70 (Frame)
30.50±0.5 (Hole)

5.40
3.40
36.00±0.5(Hole)
(2.00)
4.00
ø2.00

0.60
0.55
0.55
0.60
5.15
4.75
2.95
3.35

2:1

LED-
5.0V
R
LED+
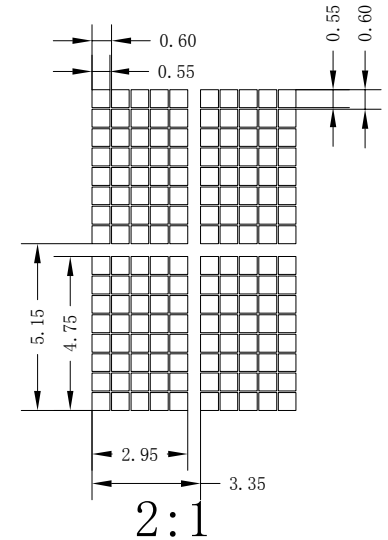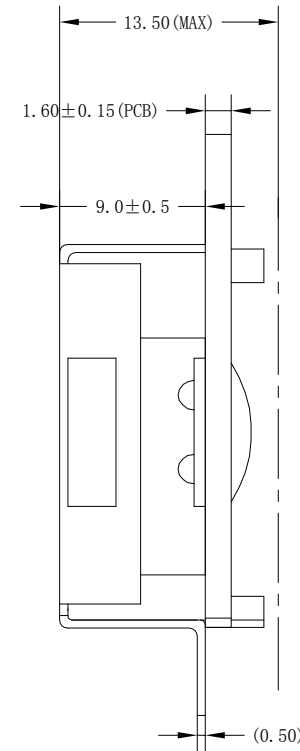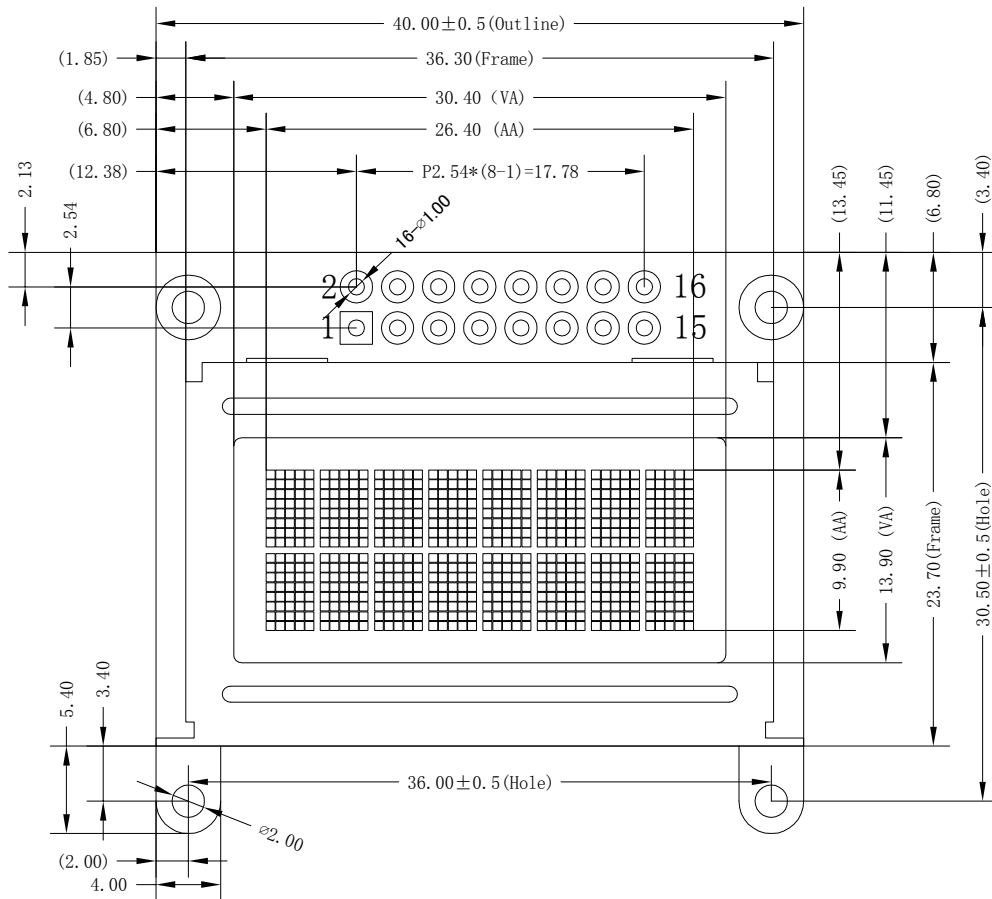
## NOTES:
1. Driver: 1/16Duty,1/5Bias
2. Voltage: 5.0V VDD,4.4V VLCD;Contrast is adjustable
3. Display Mode: STN Positive/Yellow—Green/Transflective
4. Optimal View: 6:00
5. Backlight: Yellow—Green LED;VLED=5.0V,ILED(typ)=80mA
6. Driver IC: ST7066U—0A
7. Interface: 4/8—Bits Parallel
8. Operating Temp : −20℃～+70℃
9. Storage Temp：−30℃～+80℃
10. MARK WITH ”*” ARE IMPORTANT DIMENSIONS
    MARK WITH ”()” ARE REFERENCE DIMENSIONS
11. ROHS

VDD
V0
VSS
LCM
10K
VDD-V0:LCD DRIVING VOLTAGE
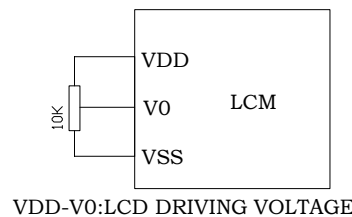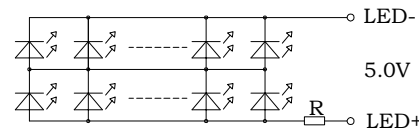
| LHD HTDISPLAY Co.,Ltd. | DRAWING No. : HC080202C-VA | |
|---|---|---|
| | DRAWING TITLE: OUTLINE | |
| | FILE NO. : 1 | |
| DESIGN | HK | 2019.11.20 | REV. : A | SCALE: 1:1 |
| CHECKED | WS | 2019.11.20 | PROJECTION: | UNIT: mm |
| APPROVED | ZXY | 2019.11.20 | | SHEET: 1/1 |

## 2、Absolute Maximum Ratings

| Item | Symbol | Min. | Max. | Unit |
|------|--------|------|------|------|
| Supply Voltage (Logic) | VDD-VSS | -0.3 | 7 | V |
| Supply Voltage (LCD) | VLCD | VDD-10 | VDD+0.3 | V |
| Input Voltage | $V_{IN}$ | -0.3 | VDD+0.3 | V |
| Operating Temperature | Topr | -20 | 70 | ℃ |
| Storage Temperature | Tstg | -30 | 80 | ℃ |
| LED Reverse Current | Ir | | | uA |

## 3、Electrical Characteristics

### 3.1 DC Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------|--------|-----------|------|------|------|------|
| Operating Voltage | VDD | | 4.8 | 5.0 | 5.2 | V |
| LCD Voltage | VLCD | Ta = 25℃ | 4.2 | 4.4 | 4.6 | V |
| Input High Voltage (Except OSC1) | $V_{IH1}$ | | 0.7VDD | -- | VDD | V |
| Input Low Voltage (Except OSC1) | $V_{IL1}$ | | -0.3 | -- | 0.6 | V |
| Input High Voltage (OSC1) | $V_{IH2}$ | | VDD-1 | -- | VDD | |
| Input Low Voltage (OSC1) | $V_{IL2}$ | | -- | -- | 1.0 | |
| Output High Voltage (DB0 - DB7) | $V_{OH1}$ | $I_{OH}$ = -1.0mA | 3.9 | -- | VDD | V |
| Output Low Voltage (DB0 - DB7) | $V_{OL1}$ | $I_{OL}$ = 1.0mA | -- | -- | 0.4 | V |
| Output High Voltage (Except DB0 - DB7) | $V_{OH2}$ | $I_{OH}$ = -0.04mA | 0.9 VDD | -- | VDD | |
| Output Low Voltage (Except DB0 - DB7) | $V_{OL2}$ | $I_{OL}$ = 0.04mA | -- | -- | 0.1 VDD | |
| Frame Frequency | Ff | Ta = 25℃ | | -- | | Hz |
| Operating Current | IDD | Ta = 25℃ | | -- | -- | mA |

## 3.2 Optical Characteristics(Ta=25 ℃)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Response time | Ton | 25℃ | -- | 150 | 240 | ms |
| | Toff | 25℃ | -- | 200 | 300 | ms |
| Contrast ration | CR | θy =+10 ° | 2 | 10 | | - |
| Viewing Angle | θy | CR≥2 | -60 | | +40 | ° |
| | θx | | -60 | | +60 | ° |
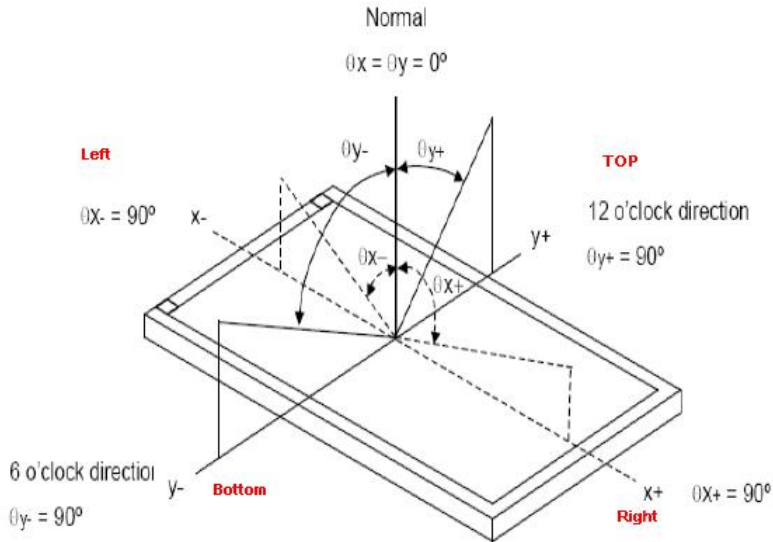

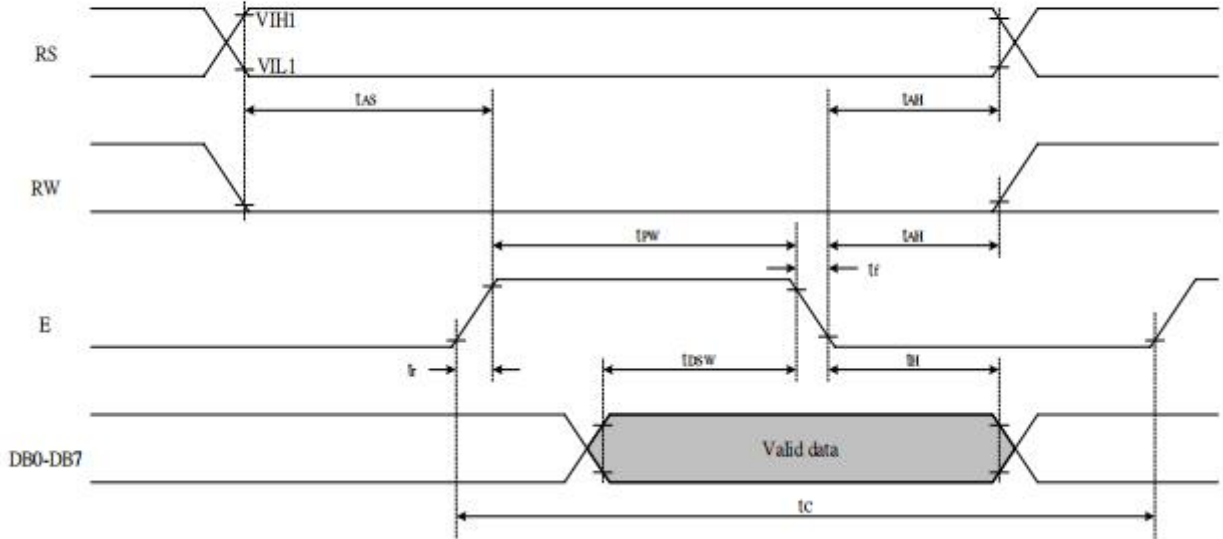
**Definition of Contrast**


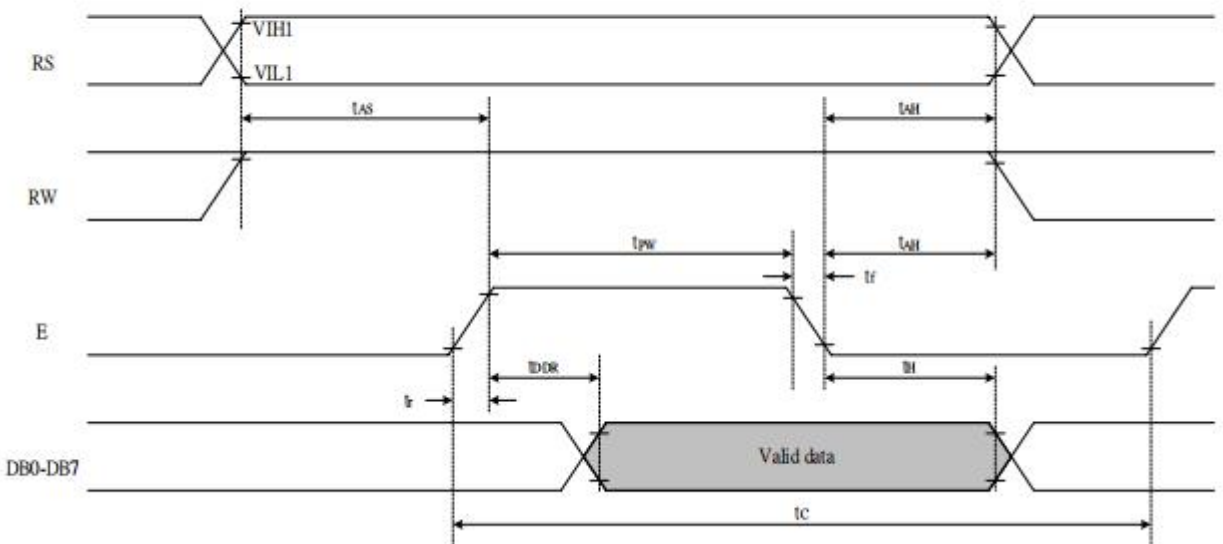
$Cr=Boff/Bon$
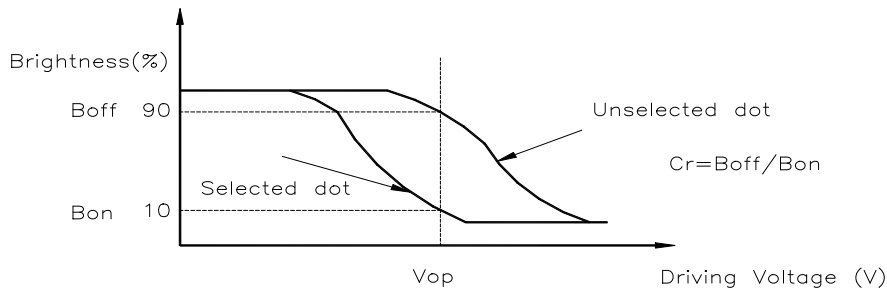
**Definition of Response Time**
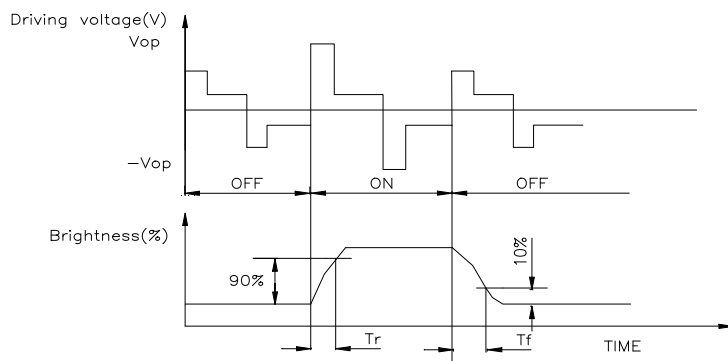
## 4. Timing Characteristics

● **Writing data from MPU to ST7066U**



● **Reading data from ST7066U to MPU**

| Symbol | Characteristics | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| | | *Internal Clock Operation* | | | | |
| $f_{OSC}$ | OSC Frequency | R = 91KΩ | 190 | 270 | 350 | KHz |
| | | *External Clock Operation* | | | | |
| $f_{EX}$ | External Frequency | - | 125 | 270 | 410 | KHz |
| | Duty Cycle | - | 45 | 50 | 55 | % |
| $T_R, T_F$ | Rise/Fall Time | - | - | - | 0.2 | μs |
| | | *Write Mode (Writing data from MPU to ST7066U)* | | | | |
| $T_C$ | Enable Cycle Time | Pin E | 1200 | - | - | ns |
| $T_{PW}$ | Enable Pulse Width | Pin E | 140 | - | - | ns |
| $T_R, T_F$ | Enable Rise/Fall Time | Pin E | - | - | 25 | ns |
| $T_{AS}$ | Address Setup Time | Pins: RS,RW,E | 0 | - | - | ns |
| $T_{AH}$ | Address Hold Time | Pins: RS,RW,E | 10 | - | - | ns |
| $T_{DSW}$ | Data Setup Time | Pins: DB0 - DB7 | 40 | - | - | ns |
| $T_H$ | Data Hold Time | Pins: DB0 - DB7 | 10 | - | - | ns |

# 5、Display Control Instruction
## 5.1 Code Summary

Instruction Table:

| Instruction | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Description Time (270KHz) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Instruction Code | | | | | | |
| 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 C=1:cursor on 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 N:number of line is 2/1 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 |

## 5.2 LCM Initial

void ST7066_INIT(void)

{

    wr_cmd(0x38);//8-bit,2 lines,5X8 dots

    wr_cmd(0x08);//display off

    wr_cmd(0x01);//clear disram, set DDRAM address 0

    wr_cmd(0x06);//increament by 1, no shift

    wr_cmd(0x0C);//display on, cursor off, blink off

}

## 5.3 Character Table

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## HTdisplay ELECTRONICS CO.,LTD



NO.7066-0A

## 6、LED Backlight Characteristics(Ta = 25℃)

| Item | Symbol | Min. | Typ. | Max. | Condition | Unit |
|---|---|---|---|---|---|---|
| Forward Current | If | 50 | 80 | 100 | Vf=5.0V | mA |
| Reverse Current | Ir | | | 20 | 5.0V/LED | uA |
| Luminance | Lv | -- | -- | -- | Vf=5.0V | cd/m2 |
| Unlformlty | Avg | 75 | | | Vf=5.0V | % |
| Dominant Wave Length | λ D | 565 | -- | 575 | Vf=5.0V | nm |

## 7、Precautions For use of LCD Module

### 7.1 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 VA.

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.

## 7.2 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.

## 7.3 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 VA

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.

## 7.4 Soldering Precautions

Soldering should apply to I/O terminals only.

Soldering temperature is 320℃+(-)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.

## 7.5 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 VAies with the viewing angle, ambient temperature, and driving voltage. Adjust the driving voltage for the best contrast by installing external VAiable 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.

## 7.6 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℃~ -15℃  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.

## 8. Quality Specification

8.1 Manner of test:

The test must be under 40W fluorescent light, and the distance of view must be at 30cm.

The test direction is based on around -10°- 30° of Vertical line.

8.2 Quality specification

It shall be based on GB2828-87, Apply level II, Normal inspection by single sampling.

| | IETM | CHECK LEVEL | AQL |
|---|---|---|---|
| MAJOR (MA) | .LIQUID CRYSTAL LEAKAGE<br>.WRONG POLARIZER<br>.OUTSIDE DIMENSION<br>.SEGMENT MISSING<br>.SEGMENT SHORT | II | 0.25 |
| MINOR (MI) | 1.BLACK SPOTS OR WHITE SPOTS.<br>2.FOREIGN SUBSTANCE,<br>3.WHITE SPOTS,<br>4.PINHOLE,SEGMENT<br>5.DEFORMATION SCRATCHS(GLASS & POLARIZER),<br>6.SEGMENT DEFECT,<br>7.AIR BUBBLES BETWEEN GLASS & POLARIZER,<br>8.COLOR VARIATION,GLASS CHIPS,<br>9.OTHER VISUAL DEFECTS. | II | 1.0 |

8.3   Definition of area:

8.3.1  Ⅰ  area: viewing area

Ⅱ  area: outside viewing area
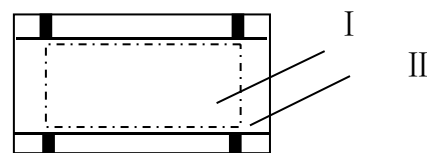
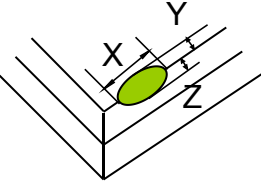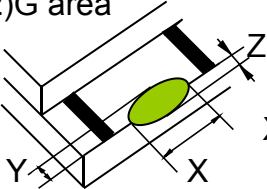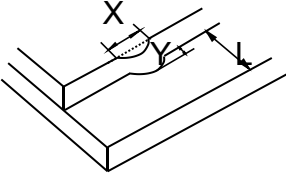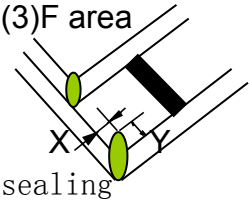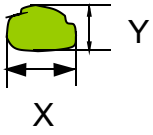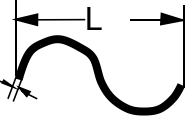8.3.2   A area: The glass area outside sealant.
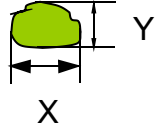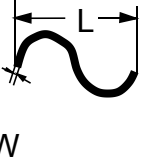
G area: Electrode pad area.

F area: Without electrode pad area.
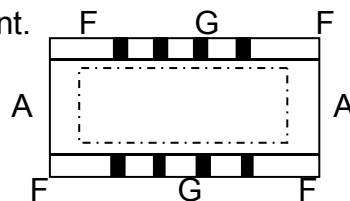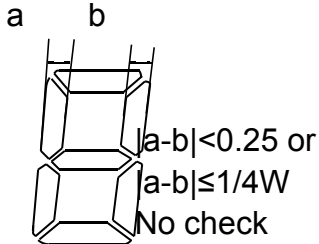
8.4 Standard of appearance test: (unit: mm)

| № | Items | Criterion | Checking manner |
|---|---|---|---|

| 1 | Substrate crack<br><br>X: defect Length<br><br>Y: defect Width<br><br>Z: defect Depth<br><br>T: glass Thickness<br><br>N: defect QTY<br><br>L:Connector Width | (1) A area<br><br>X≤3.0  Y：Don't allowed hurt sealing  Z≥T/2  N≤3<br>X≤5.0  Y：Don't allowed hurt sealing Z≤T/2  N≤3<br>X≤1.0 Y≤0.5 Z≤T/3 No check<br><br>(2)G area<br><br>X≤3.0  Y≤0.5  Z≤T/2  N≤2<br><br>X≤total length  Y≤1/4L N≤1<br>Over the drawing tolerance is not allowed<br><br>(3)F area<br><br>X≤2.0  Y≤3  Z≤T  N≤3<br>Don't allowed hurt sealing | checking with eyes |
| 2 | Black spot white spot D=(X+Y)/2<br><br>Line | (1)<br>0.2<D≤0.25  N≤1<br>0.1<D≤0.2  N≤3<br>D≤0.1  No check<br><br>(2)<br>L≤2.0  W≤0.03  N≤2<br>L≤1.0  W≤0.05  N≤1 | Checking on the table with light and polarizer and checking with eyes directly. |

| № | Items | Criterion | Checking manner |
|---|---|---|---|
| 3 | Polarizer Bubble | D≤0.15   No check <br> 0.15<D≤0.4   N≤2 | Checking on the table with light and polarizer, and checking with eyes directly |
| 4 | Rainbow <br><br> Color | Allow tiny rainbow <br><br> Allow 5% color contrast or accord limitative sample | Checking on the table with light and polarizer, And checking with eyes directly |
| 5 | END   Seal | 1.   Dimension accord design require <br> 2.   Inject   depth（d）: 1/5D≤d≤D <br> （D：seal design depth） | Checking with eyes |
| 6 | Polarizer or pad appearance | No dirty | Checking with eyes |

8.5 Standard of display test

| № | Items | Criterion | | Checking manner |
|---|---|---|---|---|
| 1 | Black   spot white   spot D=(X+Y)/2 <br><br> Line | (1) <br>  <br> X <br><br> (2)  <br> W | 0.2<D≤0.25   N≤1 <br> 0.1<D≤0.2   N≤3 <br> D≤0.1   No check <br><br> L≤2.0   W≤0.03   N≤2 <br> L≤1.0   W≤0.05   N≤1 | Checking   at   the display   state |
| 2 | Pin hole D=(A+B)/2 W: segment width |  | W≤0.4 D≤0.20 <br> And   D≤1/2W N≤1 <br> W>0.4 D≤0.25 <br> And D≤1/3W N≤2 <br> D≤0.05 No check | Checking   at   the display   state |

| 3 | Different width of segment | a    b<br>|a-b|<0.25 or<br>|a-b|≤1/4W<br>No check | Checking at the display state |
|---|---|---|---|

## 9. Reliability

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

| Test Item | Test Condition | Note |
|---|---|---|
| High Temperature Operation | 70 ºC , 240hr | 2 |
| Low Temperature Operation | -20ºC, 240hr | 2 |
| Humidity Operation | 40ºC,90%RH, 240hr | 1,2 |
| High Temperature Store | 80ºC,240hr. | 2 |
| Low Temperature Store | -30ºC,240hr | 2 |
| thermal shock storage | -30 ºC /80 ºC,left for 1 hour each temperature, transition time 1 minutes,10 cycles | For module |
| Mechanical Shock | State 762mm, concrete floor, 1 corner,3edges,6faces, the 1st | For carton box |
| Mechanical Vibration | Vibration per minute: 200vibrations per minute The vibration direction:  X,Y,Z direction total 1.5h | For module |

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 4 hour storage in normal

conditions (15~35ºC,45± 20%RH)

### 9.2MTTF （Mean-Time-To-Fail）

The LCD is designed to meet the MTTF by 50,000 hours under normal room conditions

(25℃, 45± 20%RH,without sun-shine