

# NHD-0108CZ-RN-GBW-33V

## Character Liquid Crystal Display Module

|       |                       |
|-------|-----------------------|
| NHD-  | Newhaven Display      |
| 0108- | 1 Line x 8 Characters |
| CZ-   | Model                 |
| R-    | Reflective            |
| N-    | No Backlight          |
| G-    | STN Positive, Gray    |
| B-    | 6:00 Optimal View     |
| W-    | Wide Temperature      |
| 33V-  | 3.3V Power Supply     |
|       | <b>RoHS Compliant</b> |

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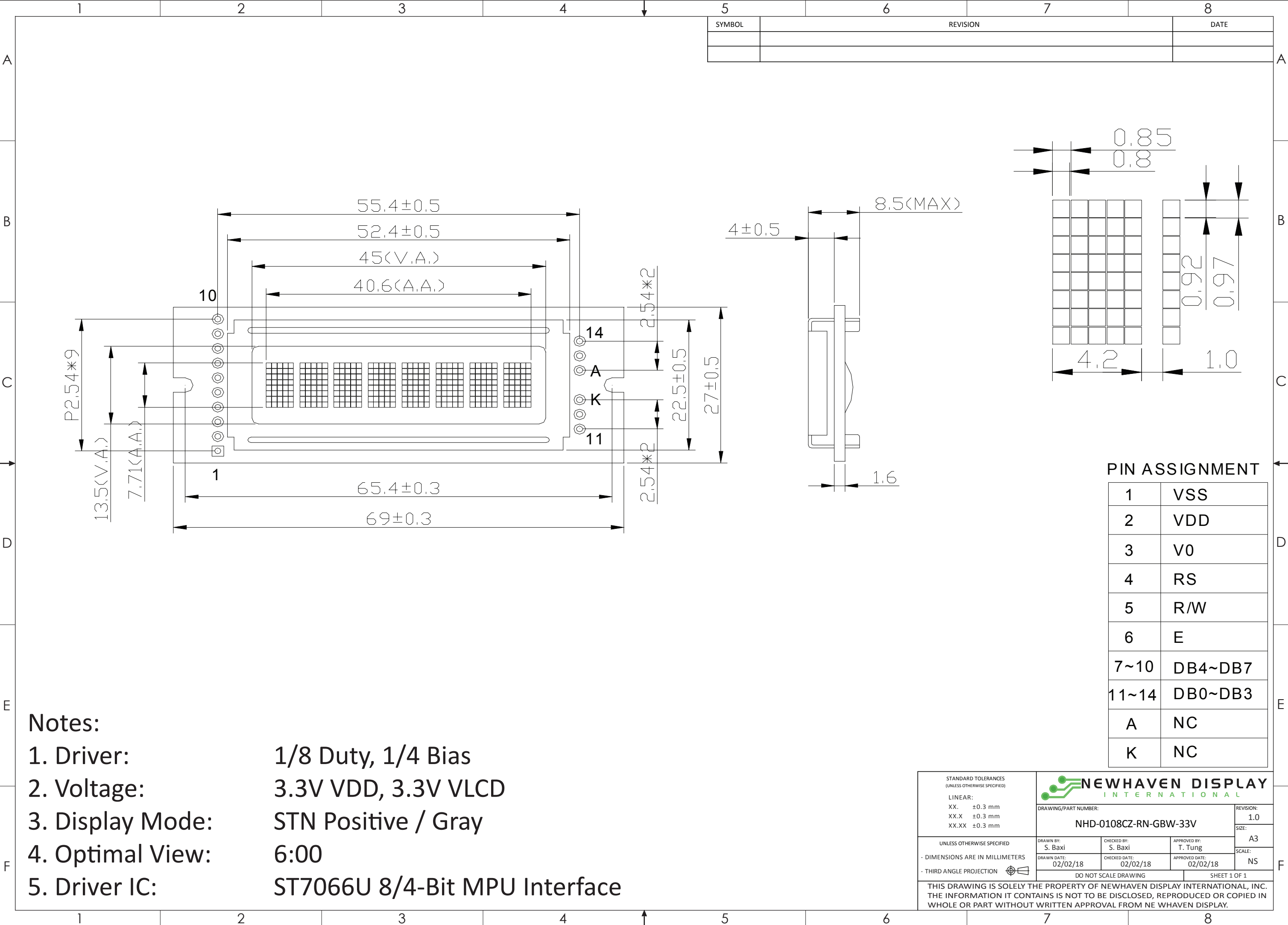
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## Document Revision History

| Revision | Date    | Description                                              | Changed by |
|----------|---------|----------------------------------------------------------|------------|
| 0        | 1/31/12 | 3.3V Liquid Crystal Panel Implemented                    | SB         |
| 1        | 2/2/18  | Mechanical, Electrical & Optical Characteristics Updated | SB         |

## Functions and Features

- 1 line x 8 characters
- Built-in controller (ST7066U)
- +3.3V power supply
- 1/8 duty, 1/4 bias
- RoHS compliant



Notes:

|                  |                               |
|------------------|-------------------------------|
| 1. Driver:       | 1/8 Duty, 1/4 Bias            |
| 2. Voltage:      | 3.3V VDD, 3.3V VLCD           |
| 3. Display Mode: | STN Positive / Gray           |
| 4. Optimal View: | 6:00                          |
| 5. Driver IC:    | ST7066U 8/4-Bit MPU Interface |

STANDARD TOLERANCES  
(UNLESS OTHERWISE SPECIFIED)  
  
LINEAR:  
XX.     ±0.3 mm  
XX.X   ±0.3 mm  
XX.XX  ±0.3 mm

**NEWHAVEN DISPLAY**  
INTERNATIONAL

|                                                      |  |                           |
|------------------------------------------------------|--|---------------------------|
| DRAWING/PART NUMBER:<br><b>NHD-0108CZ-RN-GBW-33V</b> |  | REVISION:<br>1.0          |
| DRAWN BY:<br>S. Baxi                                 |  | CHECKED BY:<br>S. Baxi    |
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| DRAWN DATE:<br>02/02/18                              |  | CHECKED DATE:<br>02/02/18 |
| APPROVED DATE:<br>02/02/18                           |  | SCALE:<br>NS              |

DO NOT SCALE DRAWING     SHEET 1 OF 1

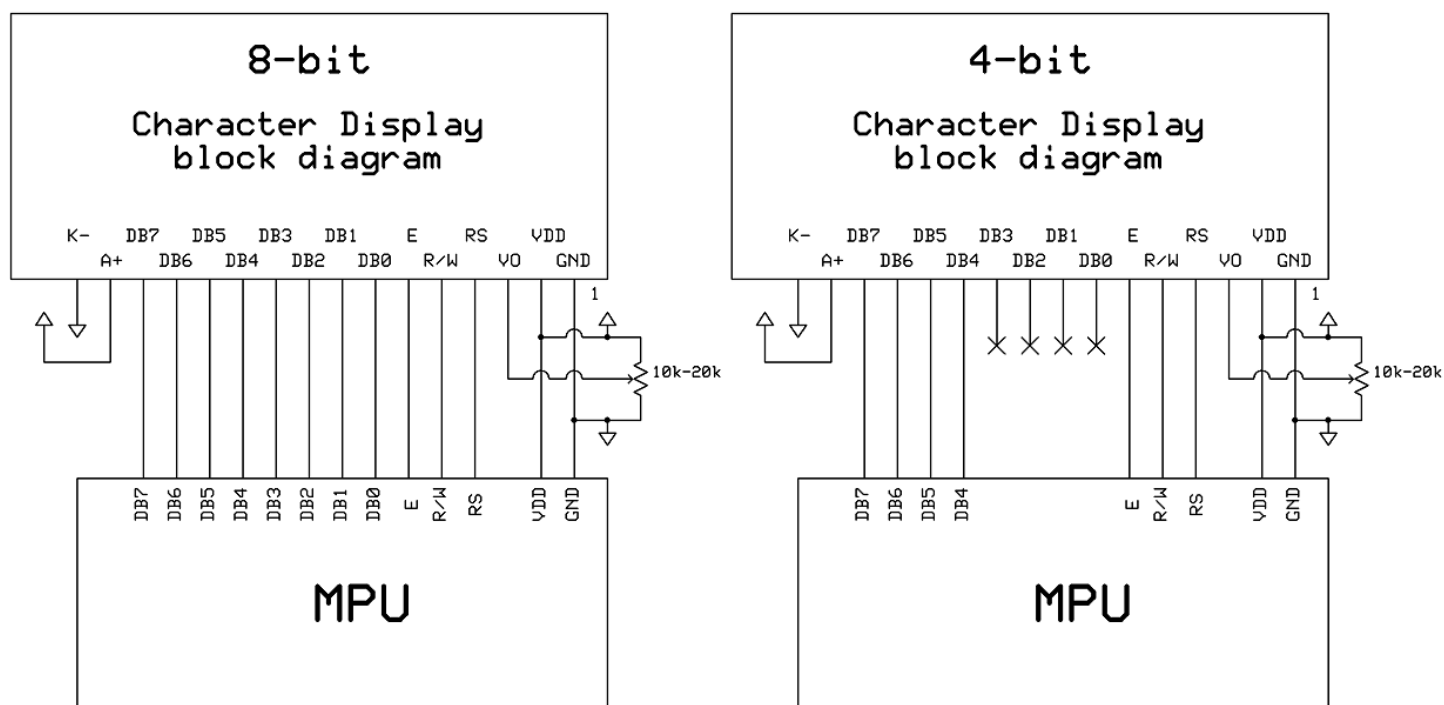
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## Pin Description and Wiring Diagram

| Pin No. | Symbol          | External Connection | Function Description                                                                                      |
|---------|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------|
| 1       | V <sub>SS</sub> | Power Supply        | Ground                                                                                                    |
| 2       | V <sub>DD</sub> | Power Supply        | Supply Voltage for Logic (+3.3V)                                                                          |
| 3       | V <sub>0</sub>  | Adj. Power Supply   | Supply Voltage for Contrast (approx. 0.1V)                                                                |
| 4       | RS              | MPU                 | Register Select signal. RS=0: Command, RS=1: Data                                                         |
| 5       | R/W             | MPU                 | Read/Write select signal, R/W=1: Read R/W: =0: Write                                                      |
| 6       | E               | MPU                 | Operation Enable signal. Falling edge triggered.                                                          |
| 7-10    | DB4 – DB7       | MPU                 | Four high order bi-directional three-state data bus lines.                                                |
| 11-14   | DB0 – DB3       | MPU                 | Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation. |
| A       | NC              | -                   | No Connect                                                                                                |
| K       | NC              | -                   | No Connect                                                                                                |

**Recommended LCD connector:** 2.54mm pitch pins

**Backlight connector:** ---      **Mates with:** ---



## Electrical Characteristics

| Item                        | Symbol           | Condition                                        | Min.                   | Typ. | Max.                  | Unit |
|-----------------------------|------------------|--------------------------------------------------|------------------------|------|-----------------------|------|
| Operating Temperature Range | T <sub>OP</sub>  | Absolute Max                                     | -20                    | -    | +70                   | °C   |
| Storage Temperature Range   | T <sub>ST</sub>  | Absolute Max                                     | -30                    | -    | +80                   | °C   |
| Supply Voltage              | V <sub>DD</sub>  | -                                                | 3.1                    | 3.3  | 3.5                   | V    |
| Supply Current              | I <sub>DD</sub>  | V <sub>DD</sub> = 5.0V<br>T <sub>OP</sub> = 25°C | 0.5                    | 1.0  | 2.5                   | mA   |
| Supply for LCD (contrast)   | V <sub>LCD</sub> |                                                  | 3.1                    | 3.3  | 3.5                   | V    |
| "H" Level input             | V <sub>IH</sub>  | -                                                | 0.7 * V <sub>DD</sub>  | -    | V <sub>DD</sub>       | V    |
| "L" Level input             | V <sub>IL</sub>  | -                                                | V <sub>SS</sub>        | -    | 0.6                   | V    |
| "H" Level output            | V <sub>OH</sub>  | -                                                | 0.75 * V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    |
| "L" Level output            | V <sub>OL</sub>  | -                                                | V <sub>SS</sub>        | -    | 0.2 * V <sub>DD</sub> | V    |

## Optical Characteristics

| Item                   |        | Symbol         | Condition              | Min. | Typ. | Max. | Unit |
|------------------------|--------|----------------|------------------------|------|------|------|------|
| Optimal Viewing Angles | Top    | φY+            | CR ≥ 2                 | -    | 40   | -    | °    |
|                        | Bottom | φY-            |                        | -    | 60   | -    | °    |
|                        | Left   | θX-            |                        | -    | 60   | -    | °    |
|                        | Right  | θX+            |                        | -    | 60   | -    | °    |
| Contrast Ratio         |        | CR             | -                      | 2    | 5    | -    | -    |
| Response Time          | Rise   | T <sub>R</sub> | T <sub>OP</sub> = 25°C | -    | 150  | 250  | ms   |
|                        | Fall   | T <sub>F</sub> |                        | -    | 200  | 300  | ms   |

## Controller Information

Built-in ST7066U controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7066U.pdf](http://www.newhavendisplay.com/app_notes/ST7066U.pdf)

## DDRAM Address

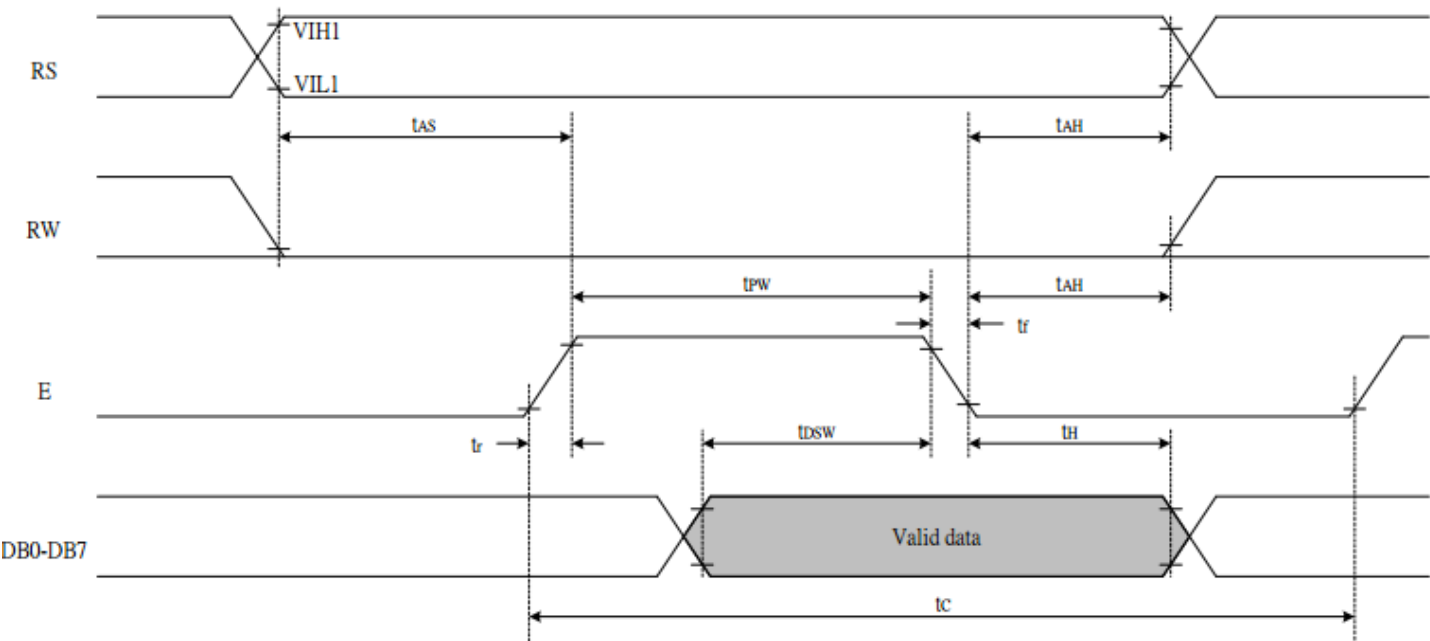
| Location      | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
|---------------|----|----|----|----|----|----|----|----|
| Address (Hex) | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |

## Table of Commands

| Instruction                | Instruction code |     |     |     |     |     |     |     |     |     | Description                                                                                                                      | Execution time (fosc= 270 KHZ) |
|----------------------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
|                            | 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                                                                      | 1.52ms                         |
| Return Home                | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | -   | Set DDRAM Address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. | 1.52ms                         |
| Entry mode Set             | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | SH  | Sets cursor move direction and specifies display shift. These parameters are performed during data write and read.               | 37μs                           |
| Display ON/OFF control     | 0                | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   | D=1: Entire display on<br>C=1: Cursor on<br>B=1: Blinking cursor on                                                              | 37μs                           |
| Cursor or Display shift    | 0                | 0   | 0   | 0   | 0   | 1   | S/C | R/L | -   | -   | Sets cursor moving and display shift control bit, and the direction without changing DDRAM data.                                 | 37μs                           |
| Function set               | 0                | 0   | 0   | 0   | 1   | DL  | N   | F   | -   | -   | DL: Interface data is 8/4 bits<br>N: Number of lines is 2/1<br>F: Font size is 5x11/5x8                                          | 37μs                           |
| Set CGRAM Address          | 0                | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter                                                                                             | 37μs                           |
| Set DDRAM Address          | 0                | 0   | 1   | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address in address counter.                                                                                            | 37μs                           |
| 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.           | 0s                             |
| Write data To Address      | 1                | 0   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Write data into internal RAM (DDRAM/CGRAM).                                                                                      | 37μs                           |
| Read data From RAM         | 1                | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | Read data from internal RAM (DDRAM/CGRAM).                                                                                       | 37μs                           |

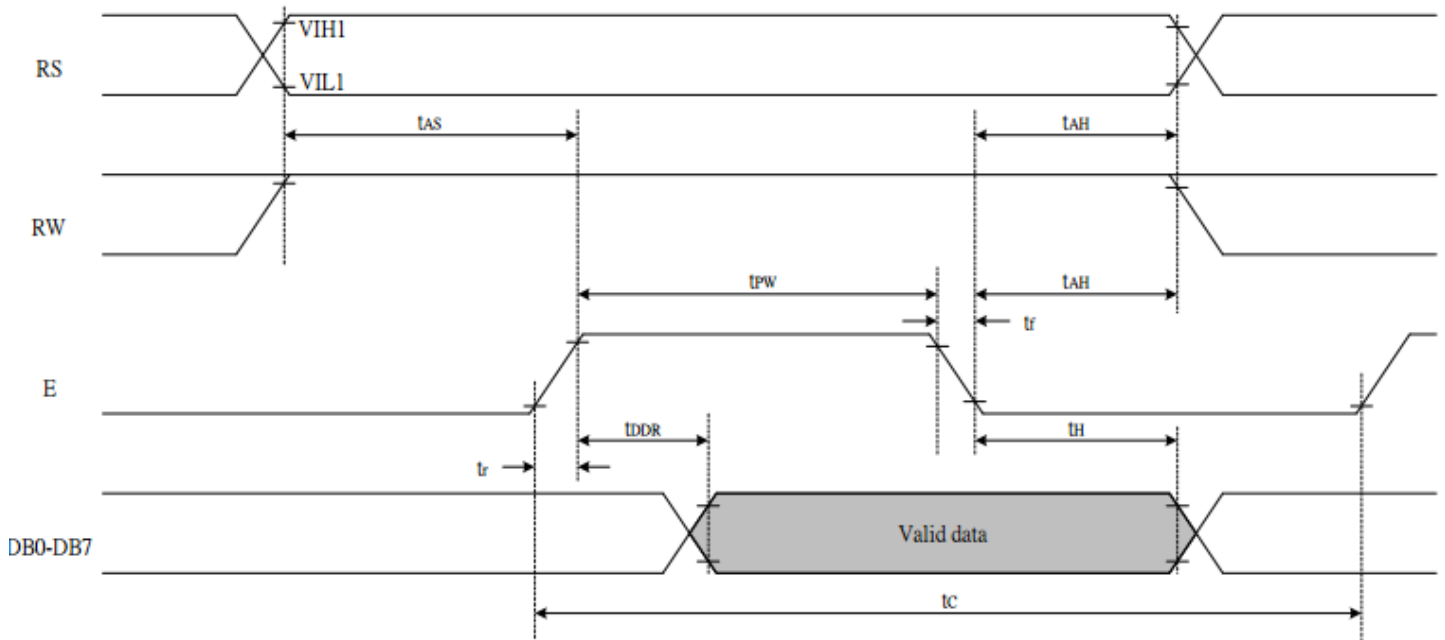
# Timing Characteristics

## Writing data from MPU to ST7066U



| Write Mode (Writing data from MPU to ST7066U) |                       |                 |      |   |    |    |
|-----------------------------------------------|-----------------------|-----------------|------|---|----|----|
| $T_C$                                         | Enable Cycle Time     | Pin E           | 1200 | - | -  | ns |
| $T_{PW}$                                      | Enable Pulse Width    | Pin E           | 460  | - | -  | 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 | 80   | - | -  | ns |
| $T_H$                                         | Data Hold Time        | Pins: DB0 - DB7 | 10   | - | -  | ns |

## Reading data from ST7066U to MPU



| Read Mode (Reading Data from ST7066U to MPU) |                       |                 |      |   |     |    |
|----------------------------------------------|-----------------------|-----------------|------|---|-----|----|
| $T_C$                                        | Enable Cycle Time     | Pin E           | 1200 | - | -   | ns |
| $T_{PW}$                                     | Enable Pulse Width    | Pin E           | 480  | - | -   | 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 |
| $T_{DDR}$                                    | Data Setup Time       | Pins: DB0 - DB7 | -    | - | 320 | ns |
| $T_H$                                        | Data Hold Time        | Pins: DB0 - DB7 | 10   | - | -   | ns |

## Built-in Font Table

| b7-b4<br>b3-b0 |                  | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|----------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0000           | CG<br>RAM<br>(1) |      |      | 0    | 8    | P    | ^    | P    |      |      |      |      | —    | 9    | 3    | o    | p    |
| 0001           | (2)              |      | !    | 1    | A    | Q    | a    | 9    |      |      |      | .    | 7    | 7    | 4    | ä    | q    |
| 0010           | (3)              |      | "    | 2    | B    | R    | b    | r    |      |      |      | 7    | 4    | 9    | ×    | p    | o    |
| 0011           | (4)              |      | #    | 3    | C    | S    | c    | s    |      |      |      | 7    | 9    | 7    | e    | e    | o    |
| 0100           | (5)              |      | \$   | 4    | D    | T    | d    | t    |      |      |      | √    | I    | t    | t    | μ    | o    |
| 0101           | (6)              |      | %    | 5    | E    | U    | e    | u    |      |      |      | .    | 3    | 6    | 1    | o    | 0    |
| 0110           | (7)              |      | &    | 6    | F    | V    | f    | v    |      |      |      | 7    | 0    | 2    | o    | p    | Σ    |
| 0111           | (8)              |      | '    | 7    | G    | W    | g    | w    |      |      |      | 7    | 7    | 3    | 7    | g    | π    |
| 1000           | (1)              |      | (    | 8    | H    | X    | h    | x    |      |      |      | 4    | 0    | 3    | 7    | 7    | Σ    |
| 1001           | (2)              |      | )    | 9    | I    | Y    | i    | y    |      |      |      | o    | 7    | 7    | o    | 7    | y    |
| 1010           | (3)              |      | *    | :    | J    | Z    | j    | z    |      |      |      | ±    | o    | o    | 7    | j    | 7    |
| 1011           | (4)              |      | +    | ;    | K    | L    | k    | l    |      |      |      | 3    | 9    | o    | o    | 3    | 7    |
| 1100           | (5)              |      | ,    | <    | L    | *    | 1    | 1    |      |      |      | 7    | 9    | 7    | 7    | 7    | 7    |
| 1101           | (6)              |      | —    | =    | M    | I    | m    | 7    |      |      |      | ±    | 3    | 3    | o    | t    | ÷    |
| 1110           | (7)              |      | .    | >    | N    | ^    | n    | ÷    |      |      |      | o    | o    | o    | 3    | o    |      |
| 1111           | (8)              |      | /    | ?    | 0    | _    | o    | +    |      |      |      | o    | 7    | 7    | 3    | o    | ■    |

## Example Initialization Program

8-bit Initialization:

```

/*****/
void command(char i)
{
    P1      = i;                //put data on output Port
    D_I     = 0;                //D/I=LOW : send instruction
    R_W     = 0;                //R/W=LOW : Write
    E       = 1;
    Delay(1);                    //enable pulse width  >= 300ns
    E       = 0;                //Clock enable: falling edge
}
/*****/
void write(char i)
{
    P1      = i;                //put data on output Port
    D_I     = 1;                //D/I=HIGH : send data
    R_W     = 0;                //R/W=LOW : Write
    E       = 1;
    Delay(1);                    //enable pulse width  >= 300ns
    E       = 0;                //Clock enable: falling edge
}
/*****/
void init()
{
    E       = 0;
    Delay(100);                  //Wait >40 msec after power is applied
    command(0x30);               //command 0x30 = Wake up
    Delay(30);                   //must wait 5ms, busy flag not available
    command(0x30);               //command 0x30 = Wake up #2
    Delay(10);                   //must wait 160us, busy flag not available
    command(0x30);               //command 0x30 = Wake up #3
    Delay(10);                   //must wait 160us, busy flag not available
    command(0x38);               //Function set: 8-bit/2-line
    command(0x10);               //Set cursor
    command(0x0c);               //Display ON; Cursor ON
    command(0x06);               //Entry mode set
}
/*****/
```

```

4-bit Initialization:
/*****/
void command(char i)
{
    P1      = i;          //put data on output Port
    D_I     = 0;          //D/I=LOW : send instruction
    R_W     = 0;          //R/W=LOW : Write
    Nybble();             //Send upper 4 bits
    i       = I << 4;     //Shift over by 4 bits
    P1      = i;          //put data on output Port
    Nybble();             //Send upper 4 bits
}
/*****/
void write(char i)
{
    P1      = i;          //put data on output Port
    D_I     = 1;          //D/I=HIGH : send data
    R_W     = 0;          //R/W=LOW : Write
    Nybble();             //Clock upper 4 bits
    i       = I << 4;     //Shift over by 4 bits
    P1      = i;          //put data on output Port
    Nybble();             //Clock upper 4 bits
}
/*****/
void Nybble()
{
    E       = 1;
    Delay(1);             //enable pulse width >= 300ns
    E       = 0;          //Clock enable: falling edge
}
/*****/
void init()
{
    P1      = 0;
    P3      = 0;
    Delay(100);           //Wait >40 msec after power is applied
    P1 = 0x30;            //put 0x30 on the output port
    Delay(30);            //must wait 5ms, busy flag not available
    Nybble();             //command 0x30 = Wake up
    Delay(10);            //must wait 160us, busy flag not available
    Nybble();             //command 0x30 = Wake up #2
    Delay(10);            //must wait 160us, busy flag not available
    Nybble();             //command 0x30 = Wake up #3
    Delay(10);            //can check busy flag now instead of delay
    P1      = 0x20;        //put 0x20 on the output port
    Nybble();             //Function set: 4-bit interface
    command(0x28);        //Function set: 4-bit/2-line
    command(0x10);        //Set cursor
    command(0x0F);        //Display ON; Blinking cursor
    command(0x06);        //Entry Mode set
}
/*****/

```

## Quality Information

| Test Item                             | Content of Test                                                                                                                 | Test Condition                                                                      | Note |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------|
| High Temperature storage              | Endurance test applying the high storage temperature for a long time.                                                           | +80°C , 48hrs                                                                       | 2    |
| Low Temperature storage               | Endurance test applying the low storage temperature for a long time.                                                            | -30°C , 48hrs                                                                       | 1,2  |
| High Temperature Operation            | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.                    | +70°C 48hrs                                                                         | 2    |
| Low Temperature Operation             | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.                     | -20°C , 48hrs                                                                       | 1,2  |
| High Temperature / Humidity Operation | Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time. | +40°C , 90% RH , 48hrs                                                              | 1,2  |
| Thermal Shock resistance              | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.                  | 0°C,30min -> 25°C,5min -> 50°C,30min = 1 cycle<br>10 cycles                         |      |
| Vibration test                        | Endurance test applying vibration to simulate transportation and use.                                                           | 10-55Hz , 15mm amplitude.<br>60 sec in each of 3 directions X,Y,Z<br>For 15 minutes | 3    |
| Static electricity test               | Endurance test applying electric static discharge.                                                                              | VS=800V, RS=1.5kΩ, CS=100pF<br>One time                                             |      |

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.

## Precautions for using LCDs/LCMs

See Precautions at [www.newhavendisplay.com/specs/precautions.pdf](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)

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