

# NHD-0440WH-ATFH-JT#

## Character Liquid Crystal Display Module

|       |                                                     |
|-------|-----------------------------------------------------|
| NHD-  | Newhaven Display                                    |
| 0440- | 4 lines x 40 characters                             |
| WH-   | Display Type: Character                             |
| A-    | Model                                               |
| T-    | White LED Backlight                                 |
| F-    | FSTN (+)                                            |
| H-    | Transflective, 6:00 view, Wide Temp. (-20°C ~+70°C) |
| JT#-  | JT- English and Japanese standard font              |
|       | <b>RoHS Compliant</b>                               |

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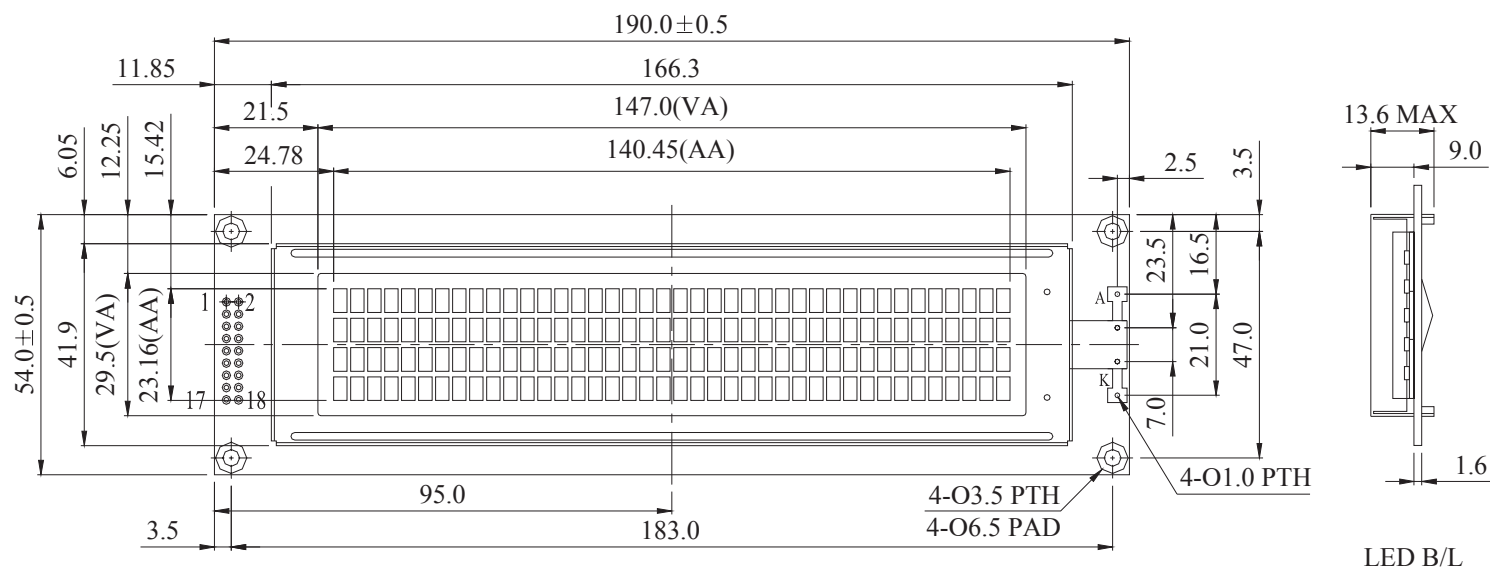
## Document Revision History

| Revision | Date       | Description                                   | Changed by |
|----------|------------|-----------------------------------------------|------------|
| 0        | 10/21/2008 | Initial Release                               | -          |
| 1        | 11/3/2009  | User Guide Reformat                           | MC         |
| 2        | 11/16/2009 | Updated Block diagram and initialization code | MC         |
| 3        | 1/5/2011   | Update driver information                     | JT         |

## Functions and Features

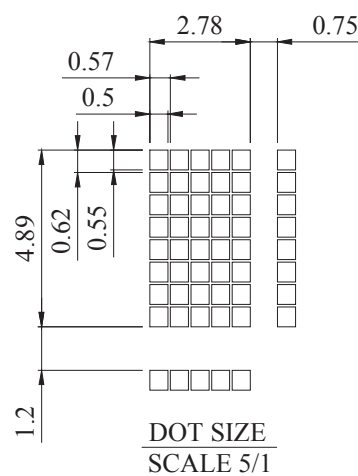
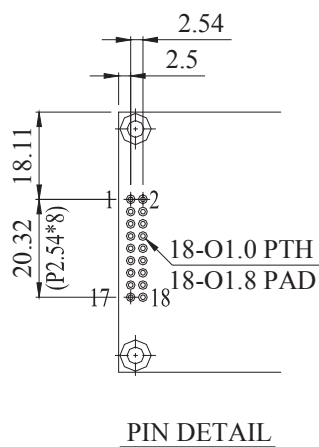
- 4 lines x 40 characters
- 2 Built-in controllers (SPLC780D or ST7066U)
- +5.0V Power Supply
- 1/16 duty, 1/5 bias
- RoHS compliant

# Mechanical Drawing



| PIN NO. | SYMBOL             |
|---------|--------------------|
| 1       | DB7                |
| 2       | DB6                |
| 3       | DB5                |
| 4       | DB4                |
| 5       | DB3                |
| 6       | DB2                |
| 7       | DB1                |
| 8       | DB0                |
| 9       | E1                 |
| 10      | R/ $\overline{W}$  |
| 11      | RS                 |
| 12      | V <sub>o</sub>     |
| 13      | V <sub>ss</sub>    |
| 14      | V <sub>dd</sub>    |
| 15      | E2                 |
| 16      | NC/V <sub>ee</sub> |
| 17      | LED +              |
| 18      | LED -              |

The non-specified tolerance of dimension is  $\pm 0.3\text{mm}$ .



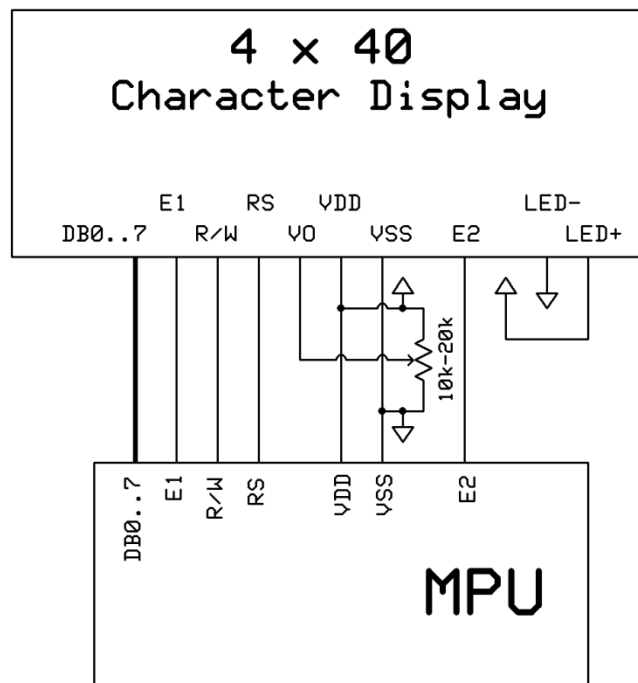
|                     |
|---------------------|
| Newhaven Display    |
| NHD-0440WH-ATFH-JT# |

## Pin Description and Wiring Diagram

| Pin No. | Symbol  | External Connection | Function Description                                                                                      |
|---------|---------|---------------------|-----------------------------------------------------------------------------------------------------------|
| 1-4     | DB7-DB4 | MPU                 | Four high order bi-directional three-state data bus lines.                                                |
| 5-8     | DB3-DB0 | MPU                 | Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation. |
| 9       | E1      | MPU                 | Operation enable signal. Falling edge triggered for top 2 lines.                                          |
| 10      | R/W     | MPU                 | Read/Write select signal, R/W=1: Read R/W:=0: Write                                                       |
| 11      | RS      | MPU                 | Register select signal. RS=0: Command, RS=1: Data                                                         |
| 12      | V0      | Power Supply        | Power supply for contrast (approx. 0.5V)                                                                  |
| 13      | Vss     | Power Supply        | Ground                                                                                                    |
| 14      | VDD     | Power Supply        | Supply voltage for logic (+5.0V)                                                                          |
| 15      | E2      | MPU                 | Operation enable signal. Falling edge triggered for bottom 2 lines.                                       |
| 16      | NC      | -                   | No Connect                                                                                                |
| 17      | LED+    | Power Supply        | Power supply for LED backlight (+3.5V)                                                                    |
| 18      | LED-    | Power Supply        | Ground for backlight                                                                                      |

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

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



## Electrical Characteristics

| Item                        | Symbol | Condition         | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|-------------------|------|------|------|------|
| Operating Temperature Range | Top    | Absolute Max      | -20  | -    | +70  | °C   |
| Storage Temperature Range   | Tst    | Absolute Max      | -30  | -    | +80  | °C   |
| Supply Voltage              | VDD    |                   | 4.75 | 5.0  | 5.25 | V    |
| Supply Current              | IDD    | Ta=25°C, VDD=5.0V | -    | 1.2  | -    | mA   |
| Supply for LCD (contrast)   | VDD-V0 | Ta=25°C           | -    | 4.5  | -    | V    |
| "H" Level input             | Vih    |                   | 3.5  | -    | VDD  | V    |
| "L" Level input             | Vil    |                   | 0    | -    | 0.6  | V    |
| "H" Level output            | Voh    |                   | 2.4  | -    | -    | V    |
| "L" Level output            | Vol    |                   | -    | -    | 0.4  | V    |
|                             |        |                   |      |      |      |      |
| Backlight Supply Voltage    | Vled   | -                 | -    | 3.5  | -    | V    |
| Backlight Supply Current    | Iled   | Vled=3.5V         | 50   | 80   | 100  | mA   |

## Optical Characteristics

| Item                               | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|--------|-----------|------|------|------|------|
| Viewing Angle – Vertical (top)     | AV     | Cr ≥ 2    | -    | 25   | -    | °    |
| Viewing Angle – Vertical (bottom)  | AV     | Cr ≥ 2    | -    | 70   | -    | °    |
| Viewing Angle – Horizontal (left)  | AH     | Cr ≥ 2    | -    | 30   | -    | °    |
| Viewing Angle – Horizontal (right) | AH     | Cr ≥ 2    | -    | 30   | -    | °    |
| Contrast Ratio                     | Cr     |           | -    | 2    | -    | -    |
| Response Time (rise)               | Tr     | -         | -    | 120  | 150  | ms   |
| Response Time (fall)               | Tf     | -         | -    | 120  | 150  | ms   |

## Controller Information

Built-in SPLC780D. Download specification at [http://www.newhavendisplay.com/app\\_notes/SPLC780D.pdf](http://www.newhavendisplay.com/app_notes/SPLC780D.pdf)

Built-in ST7066U. Download specification at [http://www.newhavendisplay.com/app\\_notes/ST7066U.pdf](http://www.newhavendisplay.com/app_notes/ST7066U.pdf)

## Display character address code

DDRAM address

|    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Display position |    |    |    |    |
|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|------------------|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  | - | - | - | - | - | - | - | - | - | - | 36               | 37 | 38 | 39 | 40 |
| 00 | 01 | 02 | 03 | 04 | - | - | - | - | - | - | - | - | - | - | 23               | 24 | 25 | 26 | 27 |
| 40 | 41 | 42 | 43 | 44 | - | - | - | - | - | - | - | - | - | - | 63               | 64 | 65 | 66 | 67 |
| 00 | 01 | 02 | 03 | 04 | - | - | - | - | - | - | - | - | - | - | 23               | 24 | 25 | 26 | 27 |
| 40 | 41 | 42 | 43 | 44 | - | - | - | - | - | - | - | - | - | - | 63               | 64 | 65 | 66 | 67 |

DDRAM address

## Built-in Font Table

| Lower<br>4 Bits | Upper 4<br>Bits  | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|-----------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| xxxx0000        | CG<br>RAM<br>(1) |      |      | 0    | 1    | A    | Q    | a    | q    |      |      |      | -    | 9    | ≡    | α    | ρ    |
| xxxx0001        | (2)              |      |      | !    | 1    | A    | Q    | a    | q    |      |      | 。    | ア    | チ    | △    | ä    | q    |
| xxxx0010        | (3)              |      |      | "    | 2    | B    | R    | b    | r    |      |      | 「    | イ    | ウ    | ×    | ß    | θ    |
| xxxx0011        | (4)              |      |      | #    | 3    | C    | S    | c    | s    |      |      | 」    | ウ    | テ    | モ    | ε    | ∞    |
| xxxx0100        | (5)              |      |      | \$   | 4    | D    | T    | d    | t    |      |      | 、    | エ    | ト    | ハ    | μ    | Ω    |
| xxxx0101        | (6)              |      |      | %    | 5    | E    | U    | e    | u    |      |      | ・    | オ    | ナ    | 1    | ε    | ü    |
| xxxx0110        | (7)              |      |      | &    | 6    | F    | V    | f    | v    |      |      | ヲ    | カ    | ニ    | ヨ    | ρ    | Σ    |
| xxxx0111        | (8)              |      |      | '    | 7    | G    | W    | g    | w    |      |      | ア    | キ    | ヌ    | ラ    | g    | π    |
| xxxx1000        | (1)              |      |      | (    | 8    | H    | X    | h    | x    |      |      | イ    | ク    | ネ    | リ    | √    | ∞    |
| xxxx1001        | (2)              |      |      | )    | 9    | I    | Y    | i    | y    |      |      | ウ    | ケ    | ノ    | ル    | '    | γ    |
| xxxx1010        | (3)              |      |      | *    | :    | J    | Z    | j    | z    |      |      | エ    | コ    | ハ    | レ    | j    | 千    |
| xxxx1011        | (4)              |      |      | +    | ;    | K    | [    | k    | {    |      |      | オ    | サ    | ヒ    | ロ    | ×    | 万    |
| xxxx1100        | (5)              |      |      | ,    | <    | L    | ¥    | l    | l    |      |      | ヤ    | シ    | フ    | ワ    | Φ    | 円    |
| xxxx1101        | (6)              |      |      | -    | =    | M    | ]    | m    | }    |      |      | ユ    | ズ    | ハ    | ン    | も    | ÷    |
| xxxx1110        | (7)              |      |      | 。    | >    | N    | ^    | n    | →    |      |      | ヨ    | セ    | ホ    | °    | ñ    |      |
| xxxx1111        | (8)              |      |      | /    | ?    | O    | _    | o    | ←    |      |      | ッ    | リ    | マ    | °    | ö    | ■    |

## Example Initialization Program

```
/******  
  
void command1(char i)          //Top half of the display  
  
{  
  
    P1 = i;  
  
    W = 0;  
  
    RS = 0;  
  
    E1 = 1;  
  
    delay(2);  
  
    E1 = 0;  
  
}  
  
void command2(char i)          //Bottom half of the display  
  
{  
  
    P1 = i;  
  
    W = 0;  
  
    RS = 0;  
  
    E2 = 1;  
  
    delay(2);  
  
    E2 = 0;  
  
}  
  
/******  
  
void writedata1(char i)        //Top half of the display  
  
{  
  
    P1 = i;  
  
    W = 0;  
  
    RS = 1;  
  
    E1 = 1;  
  
    delay(2);  
  
    E1 = 0;  
  
}  
  
void writedata2(char i)        //Bottom half of the display
```

```

{

    P1 = i;

    W = 0;

    RS = 1;

    E2 = 1;

    delay(2);

    E2 = 0;

}

/*****/

void init_LCD()

{

    delay(15);

    command1(0x30);    //Wake up

    command2(0x30);

    delay(5);

    command1(0x30);    //Wake up

    command2(0x30);

    delay(5);

    command1(0x30);    //Wake up

    command2(0x30);

    delay(5);

    command1(0x38);    //Function Set = 8bit mode; 2-line; 5x8

    command2(0x38);

    command1(0x08);    //Turn off display

    command2(0x08);

    command1(0x01);    //Clear display

    command2(0x01);

    command1(0x06);    //Entry mode cursor increment

    command2(0x06);

    command1(0x0c);    //Turn on display; no cursor

    command2(0x0c);

}

/*****/

```



## 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)