

# NHD-0440WH-ATMI-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                                |
| M-    | STN- Blue (Negative)                               |
| I-    | Transmissive, 6:00 view, Wide Temp. (-20°C ~+70°C) |
| JT#-  | English and Japanese standard font                 |
|       | <b>RoHS Compliant</b>                              |

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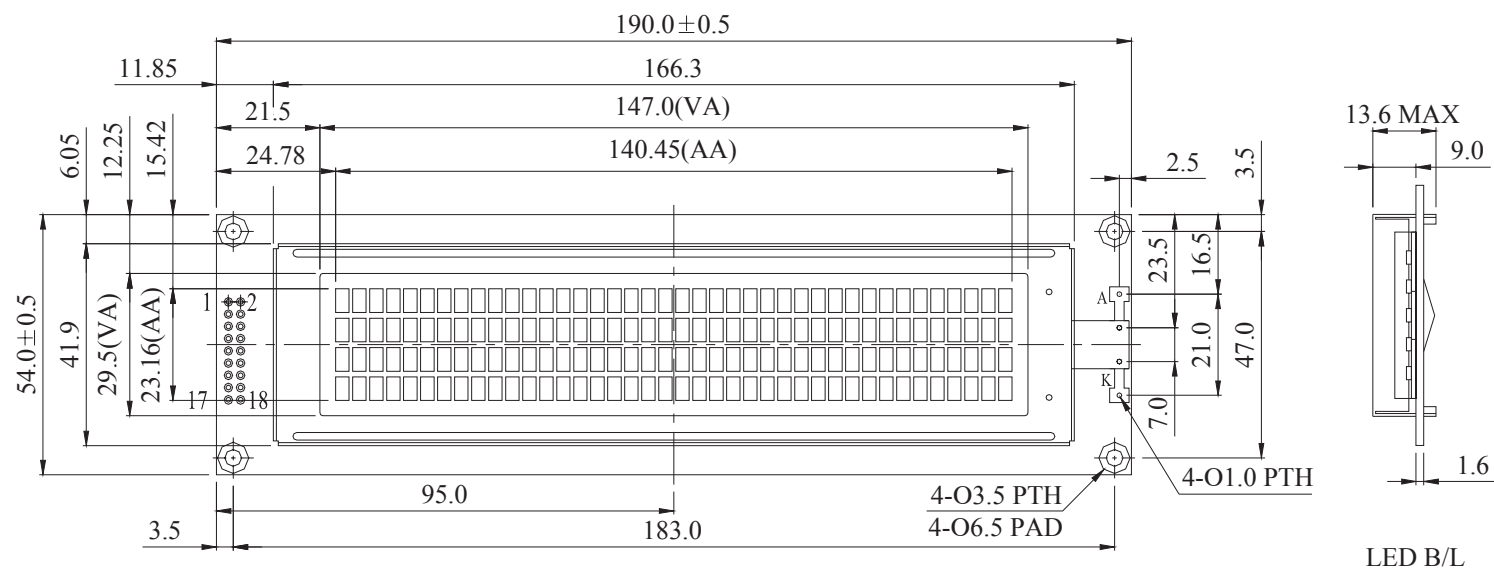
## Document Revision History

| 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        | 12/16/2009 | Updated Backlight Supply Current              | MC         |
| 4        | 1/4/2011   | Update 2 <sup>nd</sup> controller information | JT         |
| 5        | 5/6/2011   | Electrical characteristics updated            | AK         |

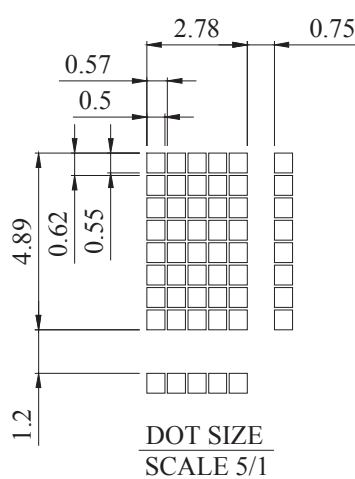
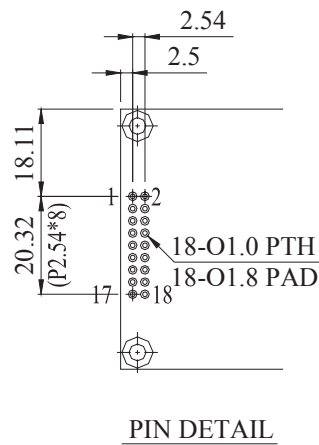
## Functions and Features

- 4 lines x 40 characters
- 2 Built-in controllers (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/W    |
| 11      | RS     |
| 12      | Vo     |
| 13      | Vss    |
| 14      | Vdd    |
| 15      | E2     |
| 16      | NC/Vee |
| 17      | LED +  |
| 18      | LED -  |



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

Newhaven Display

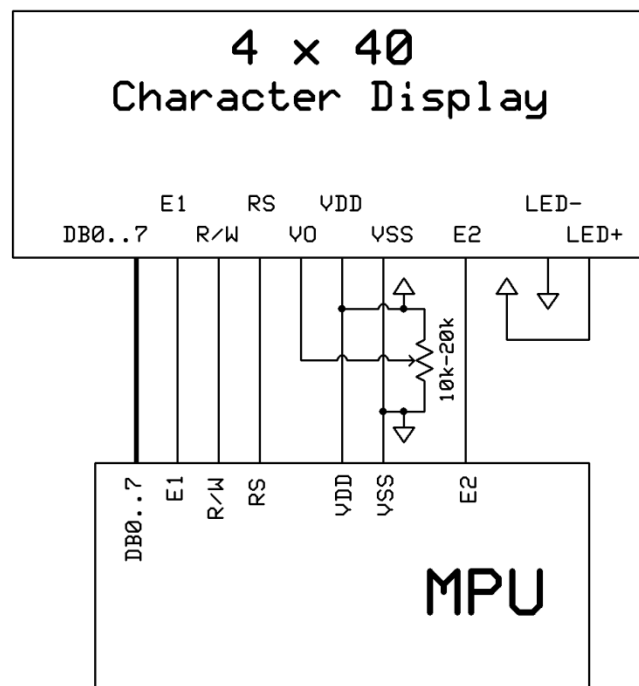
NHD-0440WH-ATMI-JT#

## 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    |                   | 0.7 VDD | -      | VDD  | V    |
| "L" Level input             | Vil    |                   | 0       | -      | 0.6  | V    |
| "H" Level output            | Voh    |                   | 3.9     | -      | -    | 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   |
| Backlight Lifetime          | -      | -                 | -       | 50,000 | -    | Hrs  |

## 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 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

## Command Table

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

## Built-in Font Table

| Lower 4 Bits \ Upper 4 Bits | 0000       | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|-----------------------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| xxxx0000                    | CG RAM (1) |      |      | 0    | a    | P    | `    | P    |      |      |      | -    | 9    | ≡    | α    | p    |
| xxxx0001                    | (2)        |      | !    | 1    | A    | Q    | a    | q    |      |      | 。    | ア    | チ    | △    | ä    | q    |
| xxxx0010                    | (3)        |      | "    | 2    | B    | R    | b    | r    |      |      | 「    | イ    | ツ    | ×    | 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    | ル    | ル    | ˆ    | y    |
| 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    | ¢    | 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)

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