

NHD-0420AZ-FL-GBW-33V3

Character Liquid Crystal Display Module

NHD- Newhaven Display
0420- 4 lines x 20 characters
AZ- Model
F- Transflective
L- Yellow/Green LED backlight
G- STN- Gray
B- 6:00 view
W- Wide Temp. (-20°C ~+ 70°C)
33V3- 3.3 Vdd, 3.0 Volt backlight
RoHS Compliant

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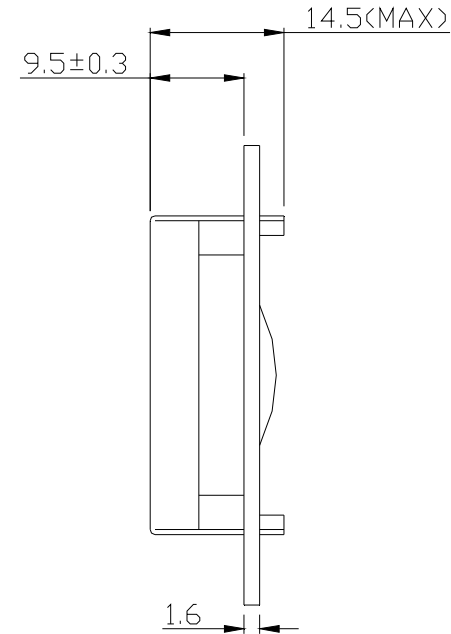
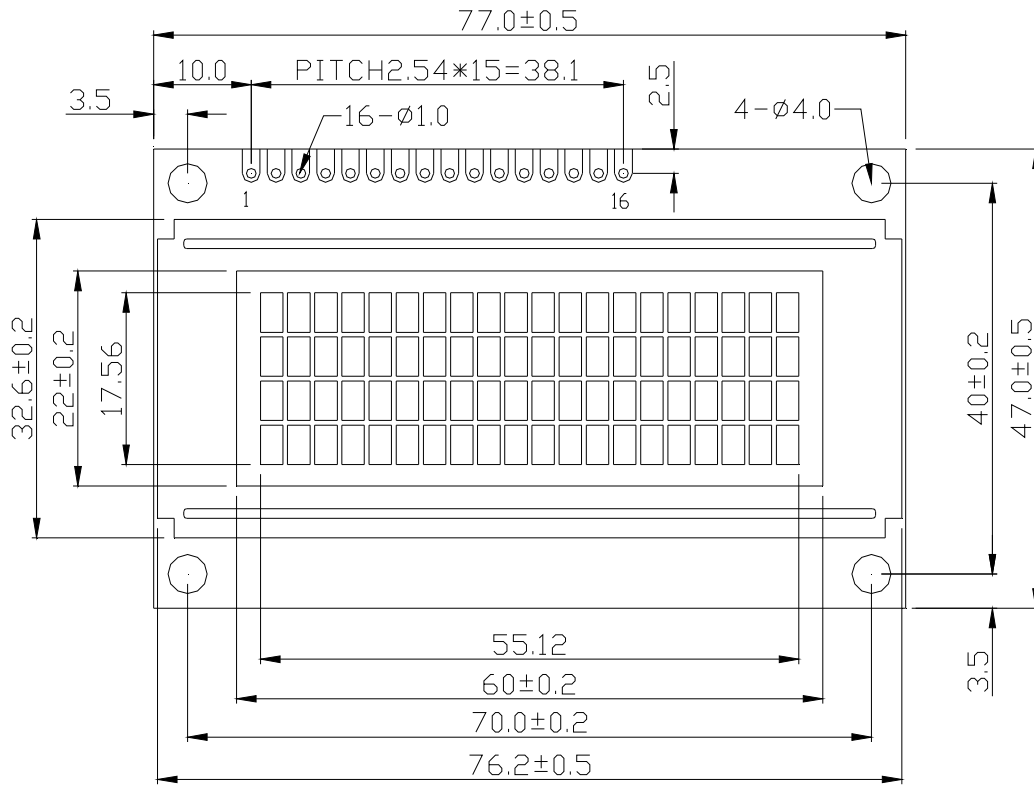
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Document Revision History

| Revision | Date | Description | Changed by |
|----------|----------|-----------------------------------|------------|
| 0 | 2/7/2012 | 33V – Improved Liquid; VDD = 3.3V | SB |

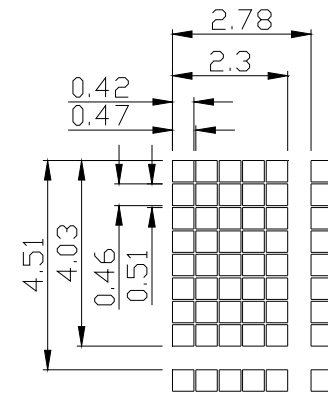
Functions and Features

- 4 lines x 20 characters
- Built-in controllers (ST7066U or equivalent)
- +3.3V Power Supply
- 1/16 duty, 1/5 bias
- RoHS compliant



PIN ASSIGNMENT

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



Notes:

- 1). Driver Method: 1/16duty, 1/4bias, VDD3.3V VLCD3.2V
- 2). Display Type: STN-Gray/Positive/Transflective/6:00 Visual Angle
- 3). Operating Temp: -20°C - 70°C /Storage Temp : -30°C - 80°C
- 4). Backlight Type: Yellow/Green Array /Vled3.0V/300mA
- 5). Driver: ST7066U or equivalent/4bit or 8bit MPU
- 6). RoHS Compliant

Newhaven Display

Model Name:

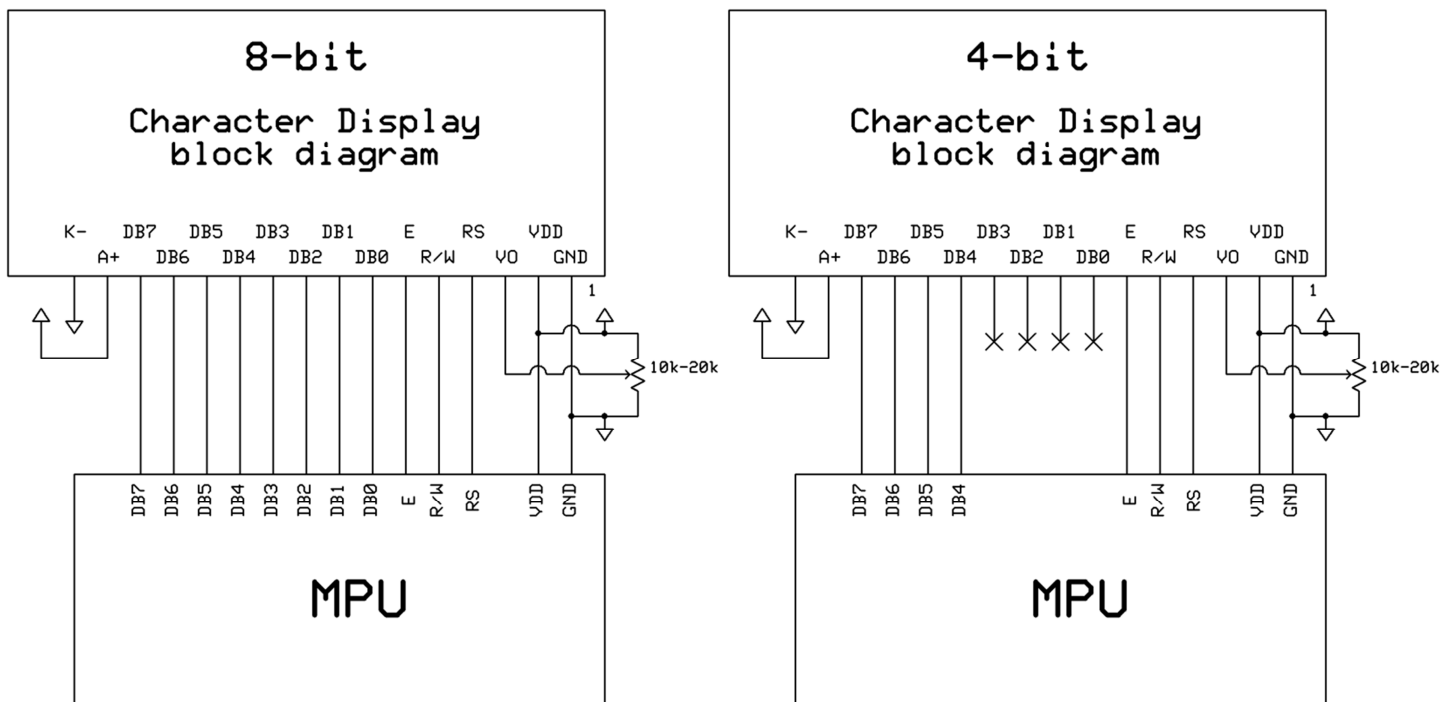
NHD-0420AZ-FL-GBW-33V3

Pin Description and Wiring Diagram

| Pin No. | Symbol | External Connection | Function Description |
|---------|---------|---------------------|--|
| 1 | Vss | Power Supply | Ground |
| 2 | VDD | Power Supply | Supply voltage for logic (+3.3V) |
| 3 | V0 | Power Supply | Power supply 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 | DB0-DB3 | MPU | For low order bi-directional three-state data bus lines. These four are not used during 4-bit operation. |
| 11-14 | DB4-DB7 | MPU | Four high order bi-directional three-state data bus lines. |
| 15 | LED+ | Power Supply | Power supply for LED Backlight (+3.0V) |
| 16 | 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 | | - | 3.3 | 5.5 | V |
| Supply Current | IDD | Ta=25°C, VDD=3.3V | - | 2 | 3.0 | mA |
| Supply for LCD (contrast) | VDD-V0 | Ta=25°C | - | 3.2 | - | 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 | - | - | 3.0 | - | V |
| Backlight Supply Current | Iled | Vled=3.0V | - | 300 | - | 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 ST7066U. Download specification at http://www.newhavendisplay.com/app_notes/ST7066U.pdf

Display character address code

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 | 13 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F | 50 | 51 | 52 | 53 |
| 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F | 20 | 21 | 22 | 24 | 25 | 26 | 26 | 27 |
| 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | 5E | 5F | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 |

Command Table

| 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 | 0 | 1 | Write "20H" to DDRA and set DDRAM address to "00H" from AC | 1.53ms |
| Return Home | 0 | 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. | 1.53ms |
| Entry mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | SH | Assign cursor moving direction And blinking of entire display | 39us |
| Display ON/OFF control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Set display (D), cursor (C), and Blinking of cursor (B) on/off Control bit. | |
| Cursor or Display shift | 0 | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | - | - | Set cursor moving and display Shift control bit, and the Direction, without changing of DDRAM data. | 39us |
| Function set | 0 | 0 | 0 | 0 | 0 | 1 | DL | N | F | - | - | Set interface data length (DL: 8-Bit/4-bit), numbers of display Line (N: =2-line/1-line) and, Display font type (F: 5x11/5x8) | 39us |
| Set CGRAM Address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | | Set CGRAM address in address counter. | 39us |
| Set DDRAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | | Set DDRAM address in address counter. | 39us |
| 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. | 0us |
| Write data To Address | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | Write data into internal RAM (DDRAM/CGRAM). | 43us |
| Read data From RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | Read data from internal RAM (DDRAM/CGRAM). | 43us |

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 | | | | - | 夕 | ミ | ル | ル |
| xxxx0001 | (2) | | ! | 1 | A | Q | a | q | | | 。 | ア | チ | △ | △ | q |
| xxxx0010 | (3) | | " | 2 | B | R | b | r | | | 「 | イ | ツ | × | ル | ル |
| xxxx0011 | (4) | | # | 3 | C | S | c | s | | | 」 | ウ | テ | モ | ミ | ル |
| xxxx0100 | (5) | | \$ | 4 | D | T | d | t | | | 、 | エ | ト | カ | ル | ル |
| xxxx0101 | (6) | | % | 5 | E | U | e | u | | | ・ | オ | ナ | 1 | ル | ル |
| xxxx0110 | (7) | | & | 6 | F | V | f | v | | | ヲ | カ | ニ | ヨ | ル | ル |
| xxxx0111 | (8) | | ' | 7 | G | W | g | w | | | ア | キ | ヌ | ウ | ル | ル |
| xxxx1000 | (1) | | (| 8 | H | X | h | x | | | イ | ク | ネ | リ | ル | ル |
| xxxx1001 | (2) | |) | 9 | I | Y | i | y | | | ウ | ケ | ル | ル | ル | ル |
| xxxx1010 | (3) | | * | : | J | Z | j | z | | | エ | コ | ハ | レ | ル | ル |
| xxxx1011 | (4) | | + | ; | K | [| k | [| | | オ | サ | ヒ | ロ | ル | ル |
| xxxx1100 | (5) | | , | < | L | ¥ | l | l | | | カ | シ | フ | ワ | ル | ル |
| xxxx1101 | (6) | | - | = | M |] | m |] | | | ユ | ズ | ハ | ン | ル | ル |
| xxxx1110 | (7) | | . | > | N | ^ | n | ^ | | | ヨ | セ | ホ | ッ | ル | ル |
| xxxx1111 | (8) | | / | ? | O | _ | o | _ | | | ッ | ソ | マ | ッ | ル | ル |

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=LOW : 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 >15 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 lower 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 lower 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;                //enable pulse width >= 300ns
    Delay(1);              //enable pulse width >= 300ns
    E = 0;                //Clock enable: falling edge
}
/*****/
void init()
{
    P1 = 0;
    P3 = 0;
    Delay(100);           //Wait >15 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 10 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | 10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes | 3 |
| Static electricity test | Endurance test applying electric static discharge. | VS=800V, RS=1.5kΩ, CS=100pF 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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms