

# NHD-24064WG-ATGH-VZ#

## Graphic Liquid Crystal Display Module

|        |                                                            |
|--------|------------------------------------------------------------|
| NHD-   | Newhaven Display                                           |
| 24064- | 240 x 64 pixels                                            |
| WG-    | Display Type: Graphic                                      |
| A-     | Model                                                      |
| T-     | White LED Backlight                                        |
| G-     | STN- Gray                                                  |
| H-     | Transflective, 6:00 view, Wide Temperature (-20°C ~ +70°C) |
| VZ#-   | With Built-in Negative Voltage Supply                      |
|        | <b>RoHS Compliant</b>                                      |

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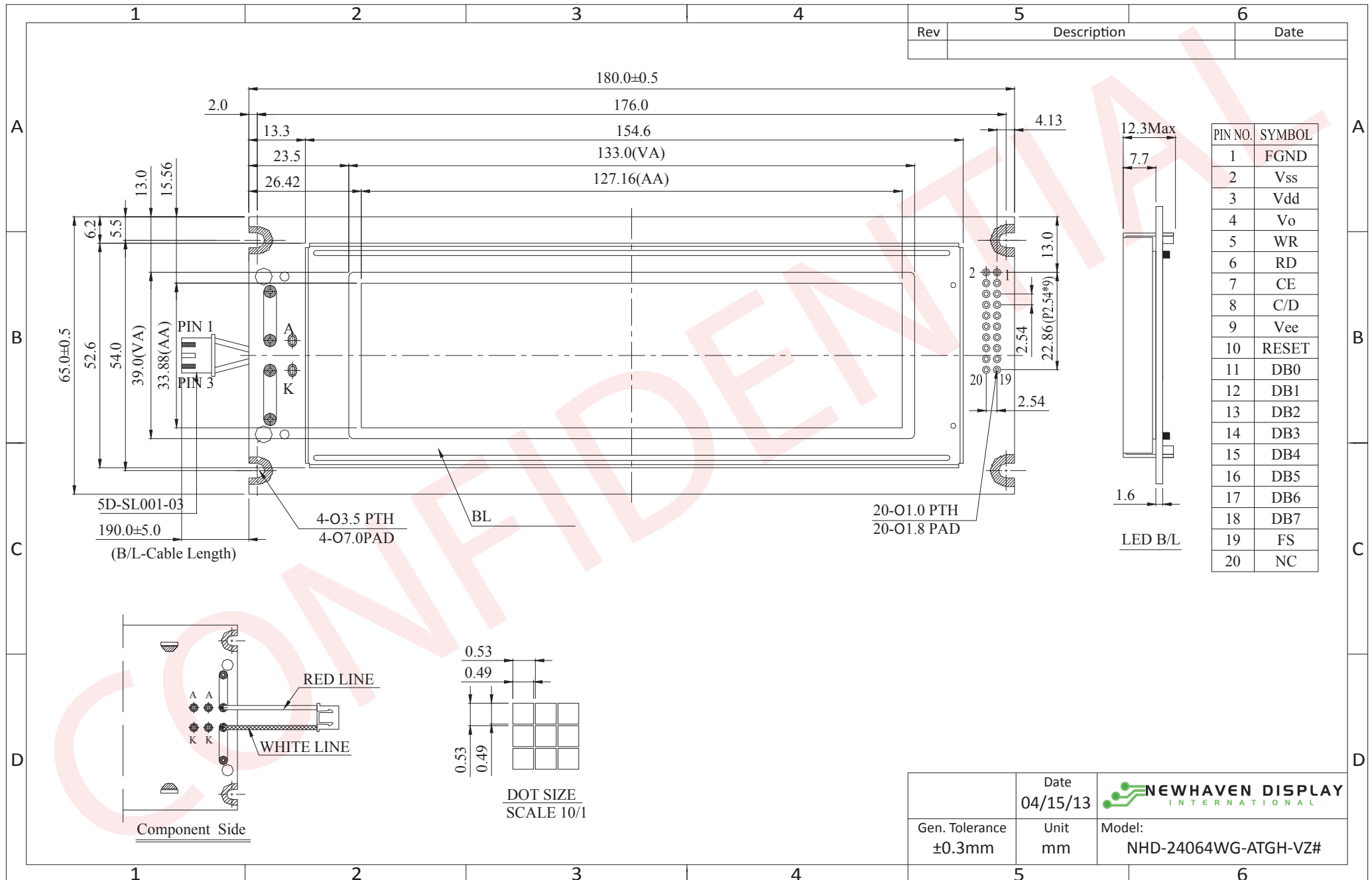
## Document Revision History

| Revision | Date       | Description                                                    | Changed by |
|----------|------------|----------------------------------------------------------------|------------|
| 0        | 2/28/2008  | Initial Release                                                | -          |
| 1        | 4/19/2010  | User guide reformat                                            | BE         |
| 2        | 5/14/2010  | Mechanical drawing update                                      | MP         |
| 3        | 11/16/2010 | Pin description update                                         | AK         |
| 4        | 5/16/2012  | Optical characteristics updated                                | AK         |
| 5        | 4/15/2013  | Drawing page and Electrical & Optical Characteristics updated. | JN         |
| 6        | 5/3/2013   | Added font table                                               | JN         |

## Functions and Features

- 240 x 64 pixels
- Built-in RA6963 controller
- +5.0V Power Supply
- 1/64 duty
- RoHS Compliant

# Mechanical Drawing



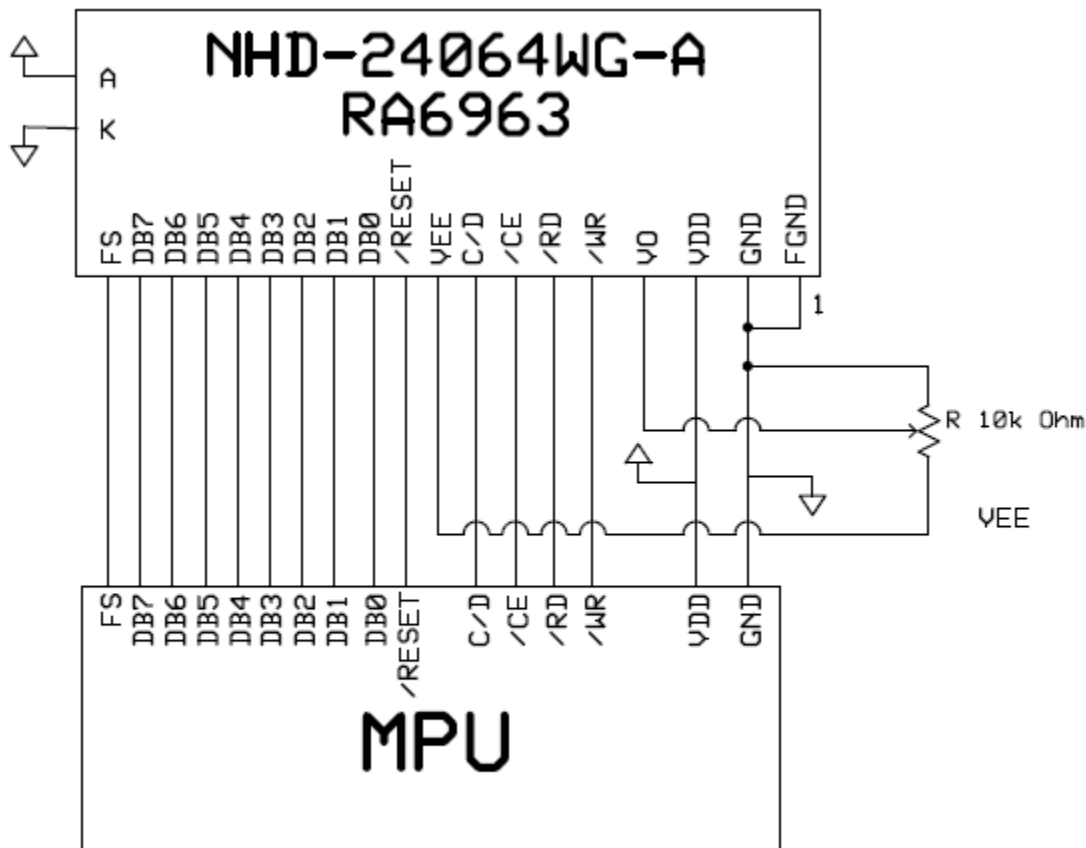
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## Pin Description and Wiring Diagram

| Pin No. | Symbol  | External Connection | Function Description                              |
|---------|---------|---------------------|---------------------------------------------------|
| 1       | FGND    | Power Supply        | Frame Ground                                      |
| 2       | VSS     | Power Supply        | Ground                                            |
| 3       | VDD     | Power Supply        | Power supply for logic (+5.0V)                    |
| 4       | VO      | Adj. Power Supply   | Power supply for contrast (approx. -7V)           |
| 5       | /WR     | MPU                 | Active LOW Write signal                           |
| 6       | /RD     | MPU                 | Active LOW Read signal                            |
| 7       | /CE     | MPU                 | Active LOW chip enable                            |
| 8       | C/D     | MPU                 | Register select signal C/D=0: DATA C/D=1: COMMAND |
| 9       | VEE     | Power Supply        | Negative voltage output (-10V)                    |
| 10      | RESET   | MPU                 | Active LOW reset signal                           |
| 11~18   | DB0~DB7 | MPU                 | 8-bit Bi-directional data bus                     |
| 19      | FS      | MPU                 | Font Select: 1=6x8 fonts, 0=8x8 fonts             |
| 20      | NC      | -                   | No Connect                                        |
| A       | LED+    | Power Supply        | Power supply for LED Backlight (+3.5V)            |
| K       | LED-    | Power Supply        | Ground for Backlight                              |

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

**Backlight connector:** JST-XHP-3 **Mates with:** B 3B-XH-A



## 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    | VDD=5.0V     | -       | 16     | -    | mA   |
| Supply for LCD (contrast)   | VDD-V0 | Ta=25°       | -       | 12.0   | -    | V    |
| "H" Level input             | VIH    |              | VDD-2.2 | -      | VDD  | V    |
| "L" Level input             | VIL    |              | 0       | -      | 0.8  | V    |
| "H" Level output            | VOH    |              | VDD-0.3 | -      | VDD  | V    |
| "L" Level output            | VOL    |              | 0       | -      | 0.3  | V    |
|                             |        |              |         |        |      |      |
| Backlight Supply Voltage    | Vled   | -            | 3.4     | 3.5    | 3.6  | V    |
| Backlight Supply Current    | Iled   | Vled=3.5V    | 80      | 100    | 125  | mA   |
| Backlight Lifetime          | -      | Iled=100mA   | -       | 50,000 | -    | Hrs. |

## Optical Characteristics

| Item                  | Symbol | Condition | Min. | Typ. | Max. | Unit |
|-----------------------|--------|-----------|------|------|------|------|
| Viewing Angle - Top   |        | Cr ≥ 2    | -    | 20   | -    | °    |
| Viewing Angle- Bottom |        |           | -    | 40   | -    | °    |
| Viewing Angle- Left   |        |           | -    | 30   | -    | °    |
| Viewing Angle - Right |        |           | -    | 30   | -    | °    |
| Contrast Ratio        | Cr     |           | -    | 3    | -    |      |
| Response Time (rise)  | Tr     | -         | -    | 200  | 300  | ms   |
| Response Time (fall)  | Tf     | -         | -    | 200  | 300  | ms   |

## Controller Information

Built-in RA6963 controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/RA6963.pdf](http://www.newhavendisplay.com/app_notes/RA6963.pdf)

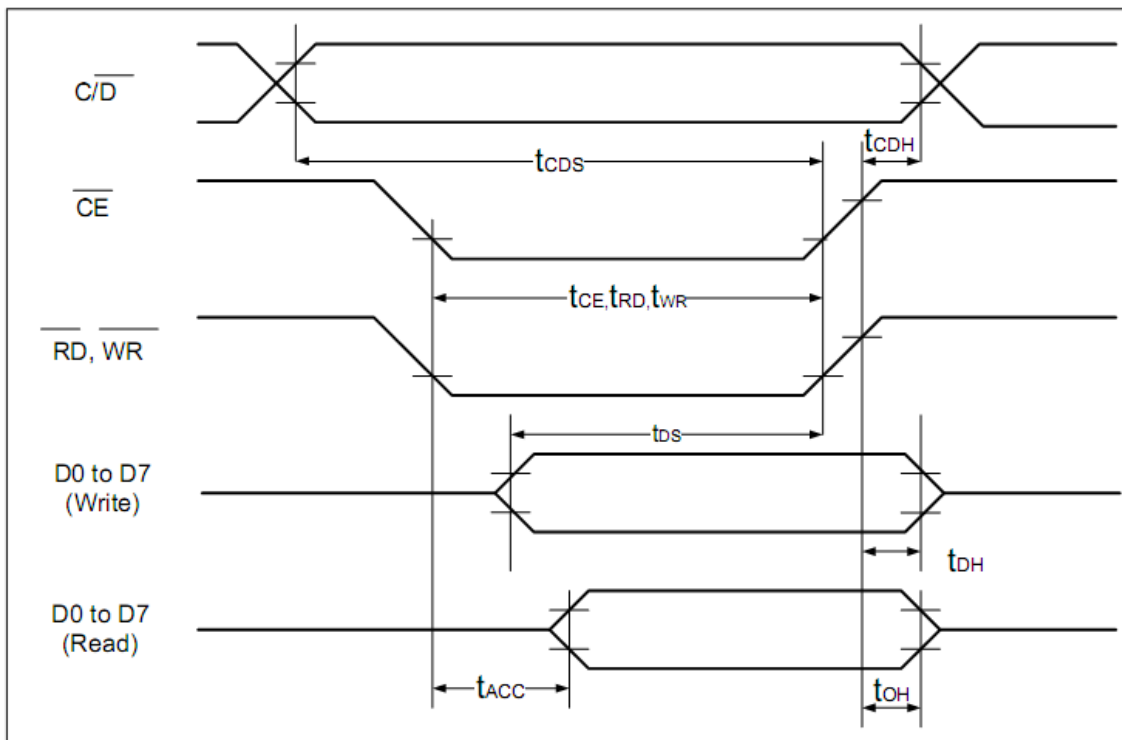
## Table of Commands

| Command               | Code     | D1          | D2           | Function                        |
|-----------------------|----------|-------------|--------------|---------------------------------|
| Registers Setting     | 00100001 | X address   | Y address    | Set cursor pointer              |
|                       | 00100010 | Data        | 00h          | Set Offset Register             |
|                       | 00100100 | Low address | High address | Set Address pointer             |
| Set Control Word      | 01000000 | Low address | High address | Set Text Home Address           |
|                       | 01000001 | Columns     | 00h          | Set Text Area                   |
|                       | 01000010 | Low address | High address | Set Graphic Home Address        |
|                       | 01000011 | Columns     | 00h          | Set Graphic Area                |
| Mode Set              | 1000X000 | --          | --           | OR mode                         |
|                       | 1000X001 | --          | --           | EXOR mode                       |
|                       | 1000X011 | --          | --           | AND mode                        |
|                       | 1000X100 | --          | --           | Text Attribute mode             |
|                       | 10000XXX | --          | --           | Internal CG ROM mode            |
|                       | 10001XXX | --          | --           | External CG RAM mode            |
| Display Mode          | 10010000 | --          | --           | Display off                     |
|                       | 1001XX10 | --          | --           | Cursor on, blink off            |
|                       | 1001XX11 | --          | --           | Cursor on, blink on             |
|                       | 100101XX | --          | --           | Text on, graphic off            |
|                       | 100110XX | --          | --           | Text off, graphic on            |
|                       | 100111XX | --          | --           | Text on, graphic on             |
| Cursor Pattern Select | 10100000 | --          | --           | 1-line cursor                   |
|                       | 10100001 | --          | --           | 2-line cursor                   |
|                       | 10100010 | --          | --           | 3-line cursor                   |
|                       | 10100011 | --          | --           | 4-line cursor                   |
|                       | 10100100 | --          | --           | 5-line cursor                   |
|                       | 10100101 | --          | --           | 6-line cursor                   |
|                       | 10100110 | --          | --           | 7-line cursor                   |
|                       | 10100111 | --          | --           | 8-line cursor                   |
| Data Read/Write       | 11000000 | Data        | --           | Data Write and Increment ADP    |
|                       | 11000001 | --          | --           | Data Read and Increment ADP     |
|                       | 11000010 | Data        | --           | Data Write and Decrement ADP    |
|                       | 11000011 | --          | --           | Data Read and Decrement ADP     |
|                       | 11000100 | Data        | --           | Data Write and Non-variable ADP |
|                       | 11000101 | --          | --           | Data Read and Non-variable ADP  |
| Data auto Read/Write  | 10110000 | --          | --           | Set Data Auto Write             |
|                       | 10110001 | --          | --           | Set Data Auto Read              |
|                       | 10110010 | --          | --           | Auto Reset                      |
| Screen Peek           | 11100000 | --          | --           | Screen Peek                     |
| Screen Copy           | 11101000 |             |              | Screen Copy                     |
| Bit Set/Reset         | 11110XXX | --          | --           | Bit Reset                       |
|                       | 11111XXX | --          | --           | Bit Set                         |
|                       | 1111X000 | --          | --           | Bit 0 (LSB)                     |
|                       | 1111X001 | --          | --           | Bit 1                           |
|                       | 1111X010 | --          | --           | Bit 2                           |
|                       | 1111X011 | --          | --           | Bit 3                           |
|                       | 1111X100 | --          | --           | Bit 4                           |
|                       | 1111X101 | --          | --           | Bit 5                           |
|                       | 1111X110 | --          | --           | Bit 6                           |
|                       | 1111X111 | --          | --           | Bit 7 (MSB)                     |
| Screen Reverse        | 11010000 | Data        | --           | Whole screen reverse            |

# Timing Characteristics

( $V_{DD}=+5V\pm 5\%$ ,  $GND=0V$ ,  $T_a = -20$  to  $+70^\circ C$ )

| Item                                                            | Symbol                         | Test Conditions | Min. | Max. | Unit |
|-----------------------------------------------------------------|--------------------------------|-----------------|------|------|------|
| C/ $\overline{D}$ Set Up Time                                   | $t_{CDS}$                      | --              | 100  | --   | ns   |
| C/ $\overline{D}$ Hold Time                                     | $t_{CDH}$                      | --              | 10   | --   | ns   |
| $\overline{CE}$ , $\overline{RD}$ , $\overline{WR}$ Pulse Width | $t_{CE}$ , $t_{RD}$ , $t_{WR}$ | --              | 80   | --   | ns   |
| Data Set Up Time                                                | $t_{DS}$                       | --              | 80   | --   | ns   |
| Data Hold Time                                                  | $t_{DH}$                       | --              | 40   | --   | ns   |
| Access Time                                                     | $t_{ACC}$                      | --              | --   | 150  | ns   |
| Output Hold Time                                                | $t_{OH}$                       | --              | 10   | 50   | ns   |



# Built-in Font Table

| LSB \ MSB | 0 | 1 | 2 | 3 | 4  | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|-----------|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
| 0         |   | ! | " | # | \$ | % | & | ' | ( | ) | * | + | , | - | . | / |
| 1         | 0 | 1 | 2 | 3 | 4  | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? |
| 2         | a | A | B | C | D  | E | F | G | H | I | J | K | L | M | N | O |
| 3         | P | Q | R | S | T  | U | U | W | X | Y | Z | [ | \ | ] | ^ | _ |
| 4         | Y | a | b | c | d  | e | f | g | h | i | j | k | l | m | n | o |
| 5         | P | q | r | s | t  | u | v | w | x | y | z | { |   | } | ~ |   |
| 6         | Q | ü | é | á | â  | ã | ä | å | ø | ë | è | ì | í | î | ï | ä |
| 7         | é | æ | Æ | ö | ö  | ö | ü | ü | ü | ö | ö | ø | ø | ¥ | ℞ | £ |



## Example Initialization Program

```
void command(int A)
{
    P1 = A;
    ID = 1;           //Command
    CE = 0;
    WRT = 0;
    WRT = 1;
    CE = 1;
}

void data(int A)
{
    P1 = A;
    ID = 0;          //Data
    CE = 0;
    WRT = 0;
    WRT = 1;
    CE = 1;
}

void init()
{
    RST = 1;
    RDD = 1;
    F_S = 1;
    data(0x00);
    data(0x00);
    commnd(0x40);    //Set Text Home Address
    data(0x00);     //Low Address Columns
    data(0x40);     //High Address
    command(0x42);  //Set Graphic Home Address
    data(0x1E);     //Low Address Columns
    data(0x00);     //High Address
    command(0x41);  //Set Text Area
    data(0x1E);     //Low Address Columns
    data(0x00);     //High Address
    command(0x43);  //Set Graphic Area
    command(0x80);  //Mode Set to 'OR' mode
}
```

## 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 , 200hrs                                                                      | 2    |
| Low Temperature storage               | Endurance test applying the low storage temperature for a long time.                                                            | -30°C , 200hrs                                                                      | 1,2  |
| High Temperature Operation            | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.                    | +70°C, 200hrs                                                                       | 2    |
| Low Temperature Operation             | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.                     | -20°C , 200hrs                                                                      | 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. | +60°C , 90% RH , 96hrs                                                              | 1,2  |
| Thermal Shock resistance              | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.                  | -20°C,30min -> 25°C,5min -> 70°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)