

# NHD-240128WG-BTFH-VZ#

## Graphic Liquid Crystal Display Module

|         |                                                            |
|---------|------------------------------------------------------------|
| NHD-    | Newhaven Display                                           |
| 240128- | 240 x 128 pixels                                           |
| WG-     | Display Type: Graphic                                      |
| B-      | Model                                                      |
| T-      | White LED backlight                                        |
| F-      | FSTN (+)                                                   |
| H-      | Transflective, 6:00 View, Wide Temperature (-20°C ~ +70°C) |
| VZ#-    | Built-in Negative Voltage                                  |
|         | <b>RoHS Compliant</b>                                      |

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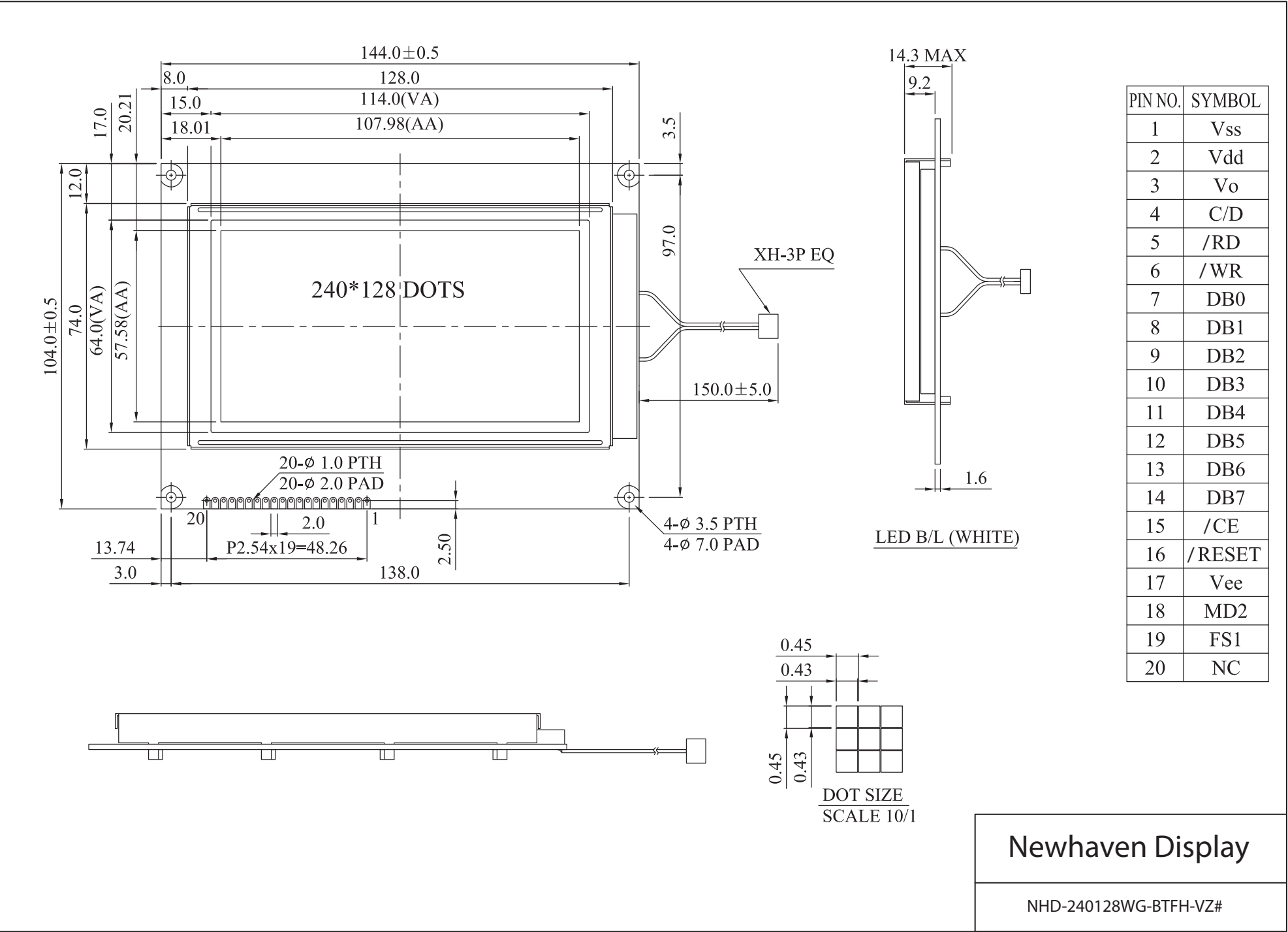
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## Document Revision History

| Revision | Date      | Description                        | Changed by |
|----------|-----------|------------------------------------|------------|
| 0        | 3/3/2008  | Initial Release                    | -          |
| 1        | 4/26/2010 | User guide reformat                | BE         |
| 2        | 3/3/2011  | Electrical characteristics updated | AK         |
| 3        | 4/29/2011 | Pin description updated            | AK         |

## Functions and Features

- 240 x 128 pixels
- Built-in RA6963 Controller
- +5.0V power supply
- 1/128 duty
- RoHS Compliant

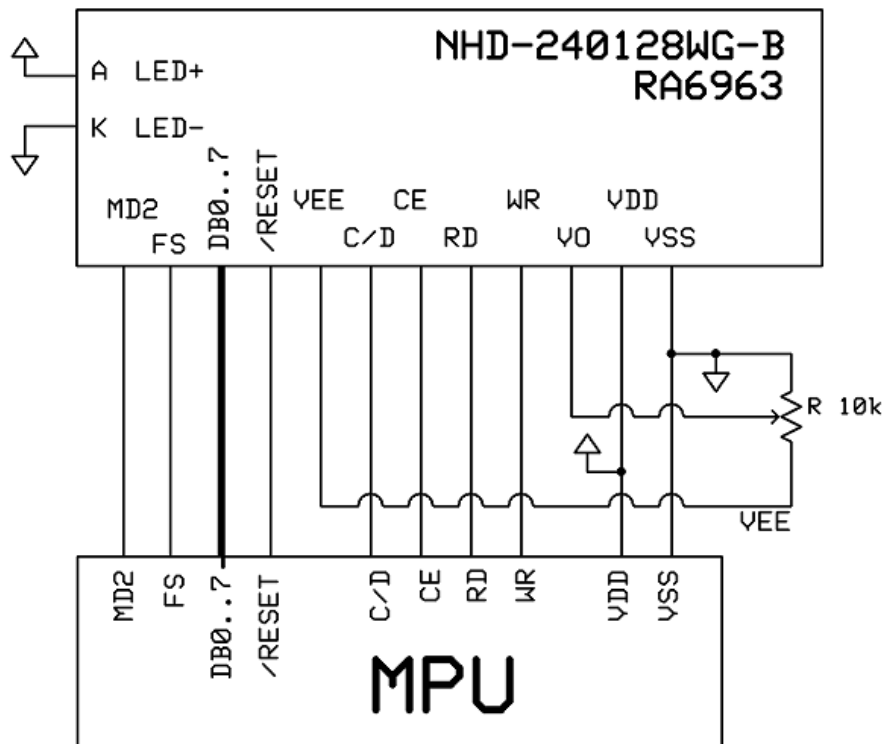


## Pin Description and Wiring Diagram

| Pin No. | Symbol  | External Connection | Function Description                               |
|---------|---------|---------------------|----------------------------------------------------|
| 1       | VSS     | Power Supply        | Ground                                             |
| 2       | VDD     | Power Supply        | Power supply for Logic (+5.0V)                     |
| 3       | V0      | Adj. Power Supply   | Power supply for contrast (approx. -14.5V)         |
| 4       | C/D     | MPU                 | Register select signal. C/D=1: Command C/D=0: Data |
| 5       | /RD     | MPU                 | Active LOW Read signal                             |
| 6       | /WR     | MPU                 | Active LOW Write signal                            |
| 7-14    | DB0-DB7 | MPU                 | This is an 8-bit Bi-directional data bus           |
| 15      | /CE     | MPU                 | Active LOW Chip Select signal                      |
| 16      | /RESET  | MPU                 | Active LOW Reset signal                            |
| 17      | VEE     | Power Supply        | Negative voltage output (-16.0V)                   |
| 18      | MD2     | MPU                 | Display size signal. H: 32 columns; L: 40 columns  |
| 19      | FS      | MPU                 | Font select signal. H: 6x8, L: 8x8                 |
| 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:** -      **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     | 5.0    | 5.25 | V    |
| Supply Current              | IDD    | Ta=25°, VDD=5.0V | 45      | 55     | 60   | mA   |
| Supply for LCD (contrast)   | VDD-V0 | Ta=25°           | -       | 19.5   | -    | 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        | 160     | 180    | 225  | mA   |
| Backlight Lifetime          | -      | Iled=180mA       | -       | 50,000 | -    | Hrs. |

## Optical Characteristics

| Item                               | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|--------|-----------|------|------|------|------|
| Viewing Angle - Vertical (top)     | AH     | Cr ≥ 2    | -    | 30   | -    | °    |
| Viewing Angle- Vertical (bottom)   | AH     | Cr ≥ 2    | -    | 60   | -    | °    |
| Viewing Angle- Horizontal (left)   | AV     | Cr ≥ 2    | -    | 45   | -    | °    |
| Viewing Angle - Horizontal (right) | AV     | Cr ≥ 2    | -    | 45   | -    | °    |
| Contrast Ratio                     | Cr     |           |      | 5    |      |      |
| Response Time (rise)               | Tr     |           |      | 150  | 200  | ms   |
| Response Time (fall)               | Tf     |           |      | 150  | 200  | ms   |

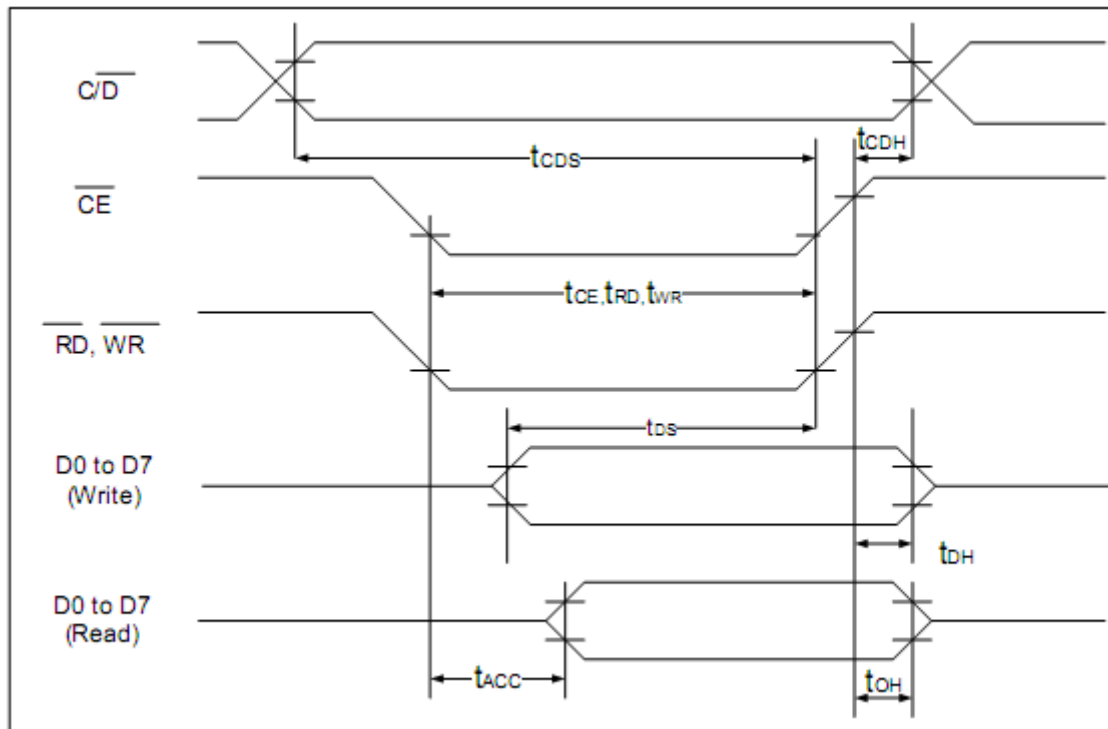
## Controller Information

Built-in RA6963. 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



( $V_{DD}=+5V\pm5\%$ ,  $GND=0V$ ,  $T_a = -20$  to  $+70^\circ\text{C}$ )

| 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   |

## Example Initialization Program

```
//-----
Sub Writecom
P1 = A                'move data to port 1
Set P3.0              'set I/D for instruction
Reset P3.1            'reset /CS
Reset P3.4            'reset /WR
Set P3.1              'set /CS
Set P3.4              'set /WR
End Sub

Sub Writedata
P1 = A                'move data to port 1
Reset P3.0            'reset I/D for instruction
Reset P3.1
Reset P3.4            'toggle /CS and /WR
Set P3.1
Set P3.4
End Sub

//-----
Sub Init
Set P3.6
Set P3.7
Reset P3.3            'reset FS
A = &H00
Call Writedata
Call Writedata        'text address = 0000h
A = &H40
Call Writecom         'text home address set
A = &H00
Call Writedata
A = &H40              'graphic home address = 4000h
Call Writedata
A = &H42
Call Writecom         'graphic home address set
A = &H1E
Call Writedata
A = &H00              'text area address = 001Eh
Call Writedata
A = &H41
Call Writecom         'text area control set
A = &H1E
Call Writedata
A = &H00              'graphic area = 001Eh
Call Writedata
A = &H43
Call Writecom         'graphic area control set
A = &H80
Call Writecom         'set display mode
End Sub
```

## 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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