

# NHD-12864WG-BTGH-T#N

## Graphic Liquid Crystal Display Module

|        |   |
|--------|---|
| NHD-   | Newhaven Display  |
| 12864- | 128 x 64 pixels   |
| WG-    | Display Type: Graphic                                     |
| B-     | Model   |
| T-     | White LED Backlight                                       |
| G-     | STN- Gray   |
| H-     | Transflective, Wide Temperature (-20°C ~ +70°C) 6:00 view |
| T#N-   | Built-in Temperature Compensation Circuit                 |
|        | <b>RoHS Compliant</b>                                     |

**Newhaven Display International, Inc.**

2511 Technology Drive, Suite 101

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

[www.newhavendisplay.com](http://www.newhavendisplay.com)

[nhtech@newhavendisplay.com](mailto:nhtech@newhavendisplay.com)

[nhsales@newhavendisplay.com](mailto:nhsales@newhavendisplay.com)

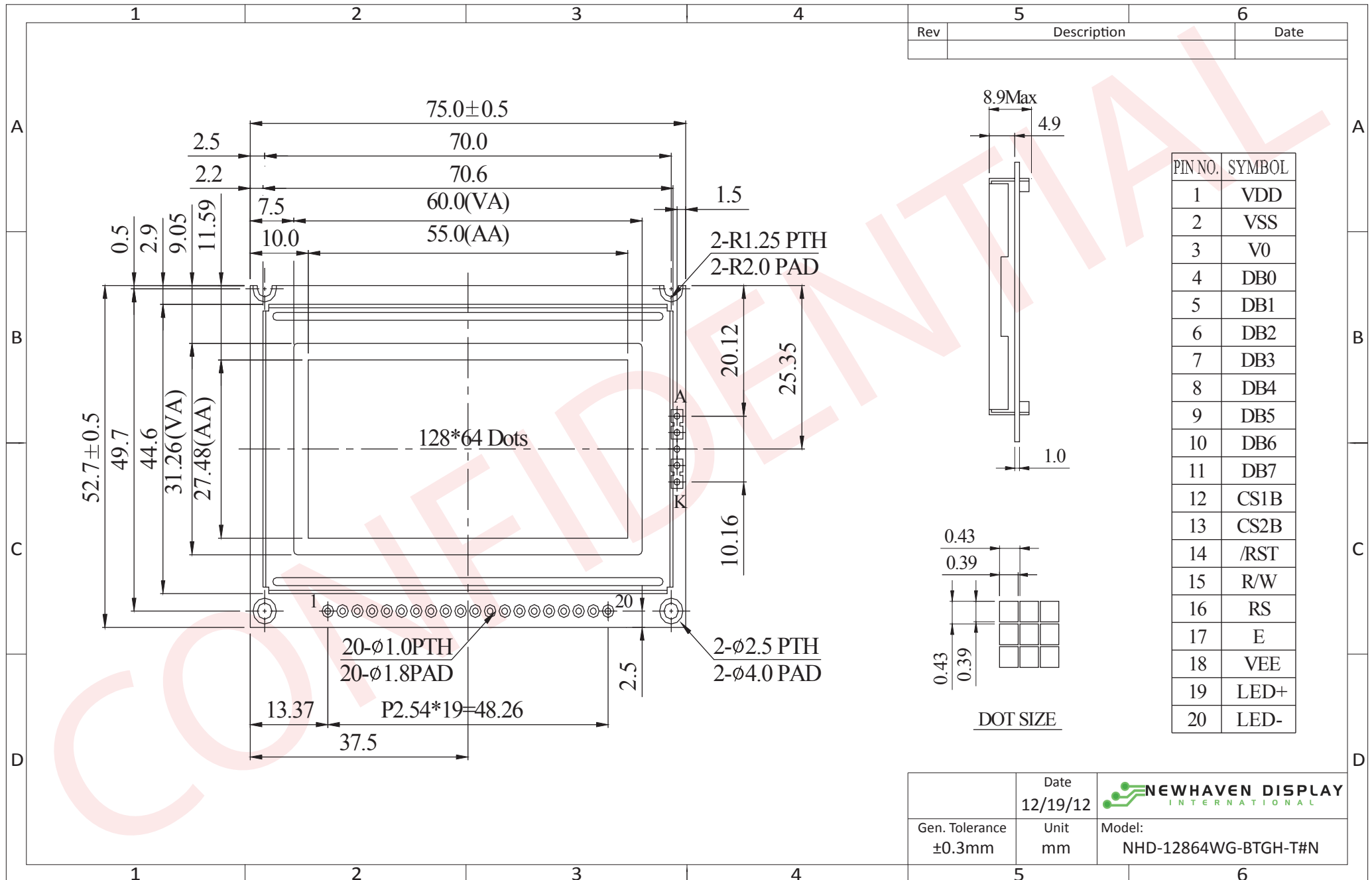
## Document Revision History

| Revision | Date       | Description                          | Changed by |
|----------|------------|--------------------------------------|------------|
| 0        | 2/28/2008  | Initial Release                      | -          |
| 1        | 3/22/2009  | User guide reformat                  | BE         |
| 2        | 4/14/2010  | Block diagram/Initialization updated | BE         |
| 3        | 2/16/2011  | Mechanical drawing updated           | AK         |
| 4        | 12/19/2012 | Controller information updated       | AK         |

## Functions and Features

- 128 x 64 pixels
- Built-in NT7108C controller
- +5.0V power supply
- 1/64 duty cycle
- RoHS Compliant

# Mechanical Drawing



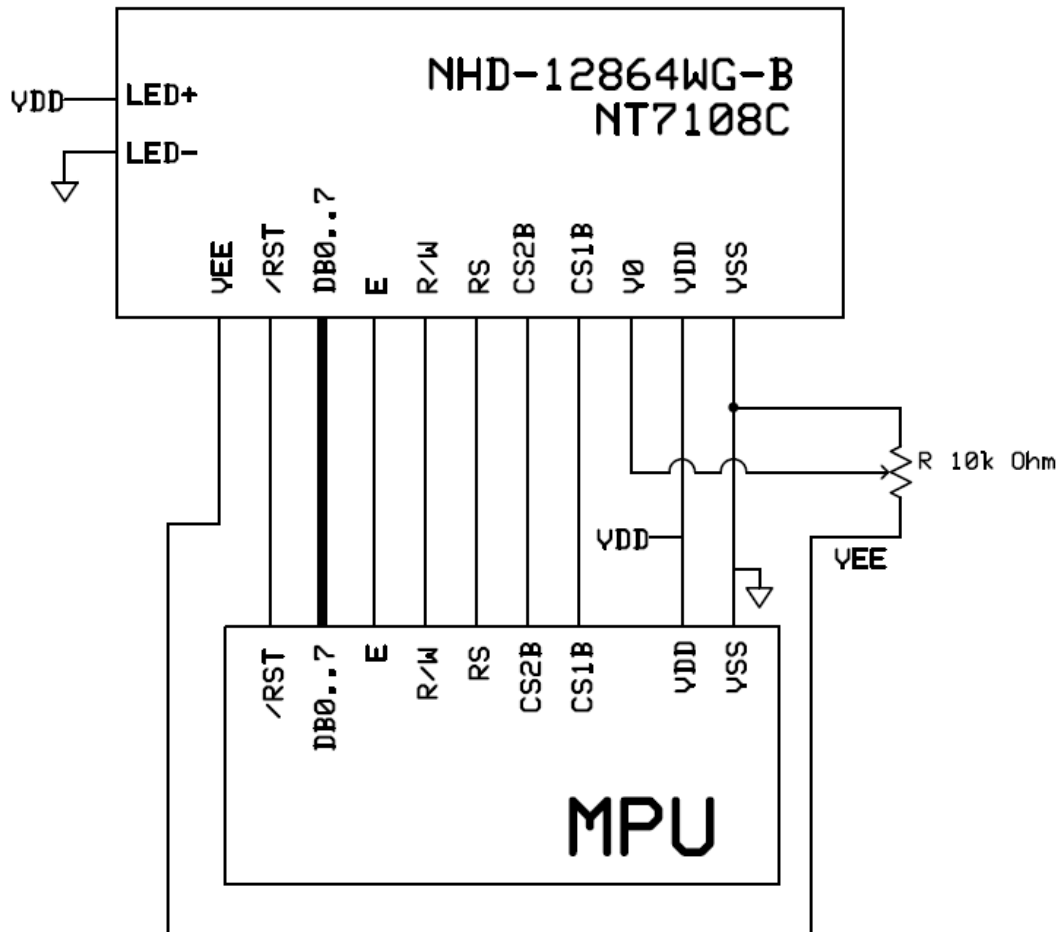
The drawing contained herein is the exclusive property of Newhaven Display International, Inc. and shall not be copied, reproduced, and/or disclosed in any format without permission.

## Pin Description and Wiring Diagram

| Pin No. | Symbol  | External Connection | Function Description  |
|---------|---------|---------------------|---|
| 1       | VDD     | Power Supply        | Power supply for logic (+5.0V)  |
| 2       | VSS     | Power Supply        | Ground  |
| 3       | V0      | Adj.Power Supply    | Power Supply for contrast (approx. -3.5V )  |
| 4-11    | DB0-DB7 | MPU                 | Bi-directional 8-bit data bus   |
| 12      | CS1B    | MPU                 | Chip Selection: CS1=H, CS2=L : select IC1 (left side)<br>CS1=L, CS2=H : select IC2 (right side) |
| 13      | CS2B    | MPU                 |   |
| 14      | /RST    | MPU                 | Active LOW Reset Signal   |
| 15      | R/W     | MPU                 | Read/Write select signal. R/W=1: Read R/W: =0: Write  |
| 16      | RS      | MPU                 | Register select: 1=Data, 0= Instruction   |
| 17      | E       | MPU                 | Operation enable signal. Falling edge triggered.  |
| 18      | VEE     | Power Supply        | Negative voltage output (-10V)  |
| 19      | LED+    | Power Supply        | Power for LED Backlight (+3.5V)   |
| 20      | 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°, VDD=5.0V | -       | 1.5  | -       | mA   |
| Supply for LCD (contrast)   | VDD-V0 | Ta=25°           | -       | 8.5  | -       | V    |
| "H" Level input             | Vih    |                  | 0.7*VDD | -    | VDD     | V    |
| "L" Level input             | Vil    | -                | 0       | -    | 0.3*VDD | V    |
| "H" Level output            | Voh    | -                | 2.4     | -    | -       | V    |
| "L" Level output            | Vol    | -                | -       | -    | 0.4     | V    |
|                             |        |                  |         |      |         |      |
| Backlight Supply Voltage    | VLED   | -                | -       | 3.5  | 3.7     | V    |
| Backlight Supply Current    | ILED   | VLED=3.5V        | -       | 80   | 120     | mA   |

## 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 NT7108C controller.

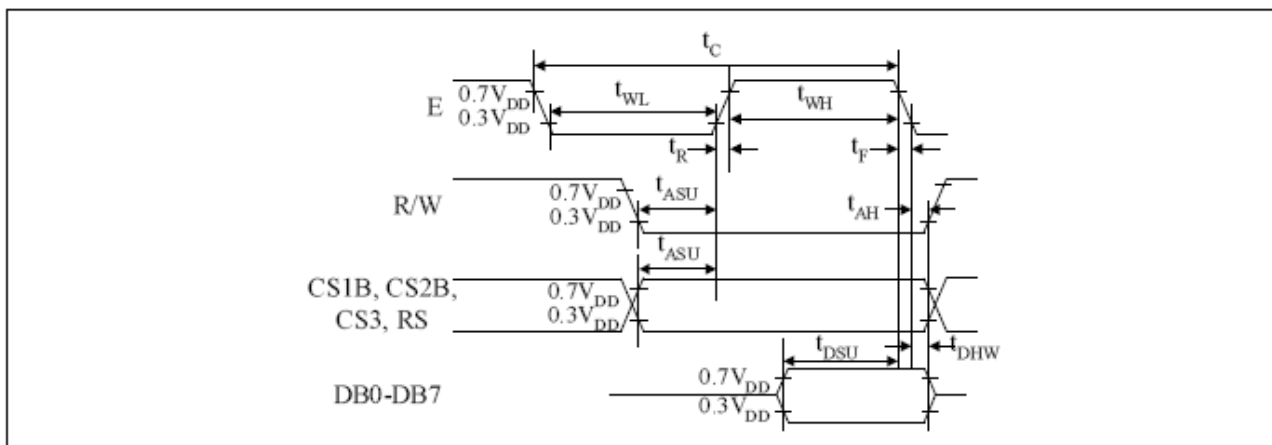
Please download specification at [http://www.newhavendisplay.com/app\\_notes/NT7108.pdf](http://www.newhavendisplay.com/app_notes/NT7108.pdf)

## Table of Commands

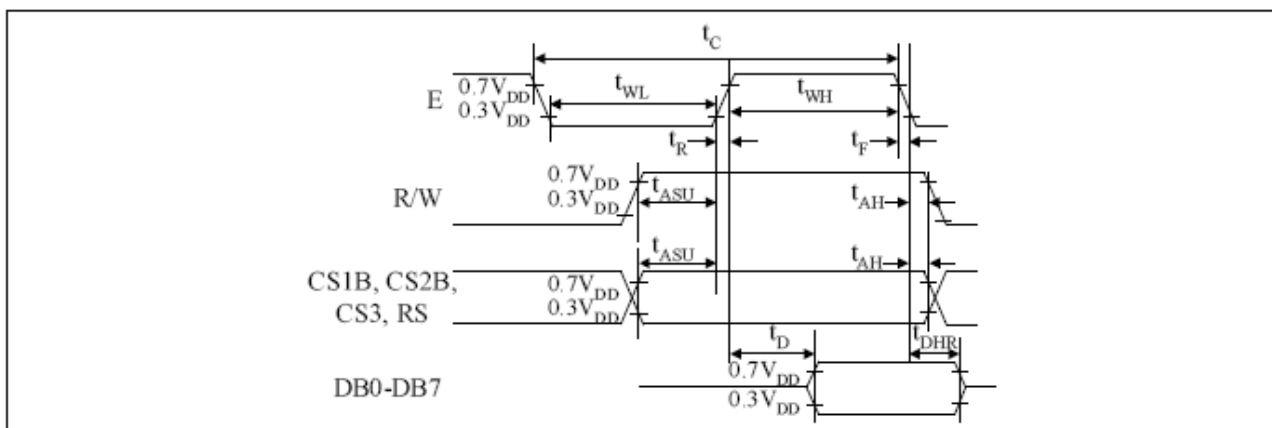
| Instruction                    | RS | R/W | DB7        | DB6 | DB5                       | DB4   | DB3 | DB2        | DB1 | DB0 | Function  |   |
|--------------------------------|----|-----|------------|-----|---------------------------|-------|-----|------------|-----|-----|---|---|
| Display on/off                 | L  | L   | L          | L   | H                         | H     | H   | H          | H   | L/H | Controls the display on or off. Internal status and display RAM data is not affected.<br>L:OFF, H:ON                      |   |
| Set address (Y address)        | L  | L   | L          | H   | Y address (0-63)          |       |     |            |     |     | Sets the Y address in the Y address counter.  |   |
| Set page (X address)           | L  | L   | H          | L   | H                         | H     | H   | Page (0-7) |     |     | Sets the X address at the X address register.   |   |
| Display Start line (Z address) | L  | L   | H          | H   | Display start line (0-63) |       |     |            |     |     | Indicates the display data RAM displayed at the top of the screen.  |   |
| Status read                    | L  | H   | Busy       | L   | On/Off                    | Reset | L   | L          | L   | L   | Read status.<br>BUSY L: Ready<br>H: In operation<br>ON/OFF L: Display ON<br>H: Display OFF<br>RESET L: Normal<br>H: Reset |   |
| Write display data             | H  | L   | Write data |     |                           |       |     |            |     |     |   | Writes data (DB0: 7) into display data RAM. After writing instruction, Y address is increased by 1 automatically. |
| Read display data              | H  | H   | Read data  |     |                           |       |     |            |     |     |   | Reads data (DB0: 7) from display data RAM to the data bus.  |

## Timing Characteristics

| Characteristic         | Symbol    | Min  | Type | Max | Unit |
|------------------------|-----------|------|------|-----|------|
| E cycle                | $t_c$     | 1000 | -    | -   | ns   |
| E high level width     | $t_{WH}$  | 450  | -    | -   |      |
| E low level width      | $t_{WL}$  | 450  | -    | -   |      |
| E rise time            | $t_R$     | -    | -    | 25  |      |
| E fall time            | $t_F$     | -    | -    | 25  |      |
| Address set-up time    | $t_{ASU}$ | 140  | -    | -   |      |
| Address hold time      | $t_{AH}$  | 10   | -    | -   |      |
| Data set-up time       | $t_{DSU}$ | 200  | -    | -   |      |
| Data delay time        | $t_D$     | -    | -    | 320 |      |
| Data hold time (write) | $t_{DHW}$ | 10   | -    | -   |      |
| Data hold time (read)  | $t_{DHR}$ | 20   | -    | -   |      |



**MPU Write Timing**



**MPU Read Timing**

## Example Initialization Program

```
'-----  
'DB0-DB7    7-14          P1  
'CS2B       16           P3.6  
'CS1B       15           P3.1  
'/RST       17           P3.2  
'R/W        5            P3.7  
'RS         4            P3.0  
'E          6            P3.4  
'-----  
Sub Init  
  Reset P3.2  
  Set P3.2  
  Reset P3.4  
  Reset P3.0  
  Reset P3.7  
  Reset P3.6  
  Reset P3.1  
  A = &H3F  
  Call Comleft                'display on  
  Call Comright              'display on  
End Sub  
'-----  
Sub Comleft  
  P1 = A  
  Set P3.6  
  Reset P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.6  
End Sub  
  
Sub Comright  
  P1 = A  
  Set P3.1  
  Reset P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.1  
End Sub  
  
Sub Writeleft  
  P1 = A  
  Set P3.6  
  Set P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.6  
End Sub  
  
Sub Writerright  
  P1 = A  
  Set P3.1  
  Set P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.1  
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 , 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)