

NHD-14432WG-ATFH-V#T

Graphic Liquid Crystal Display Module

| | |
|--------|--|
| NHD- | Newhaven Display |
| 14432- | 144 x 32 pixels |
| WG- | Display type: Graphic |
| A- | Model |
| T- | White LED backlight |
| F- | FSTN (+) |
| H- | Transflective, 6:00 View, Wide Temperature (-20°C ~ +70°C) |
| V#T- | Built-in Positive Voltage |
| | RoHS Compliant |

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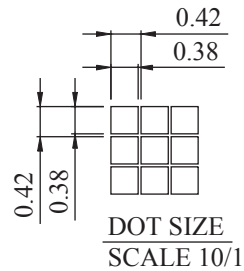
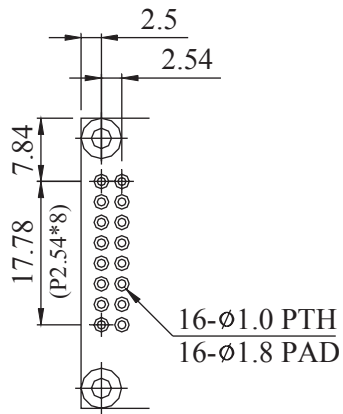
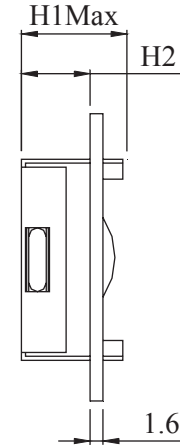
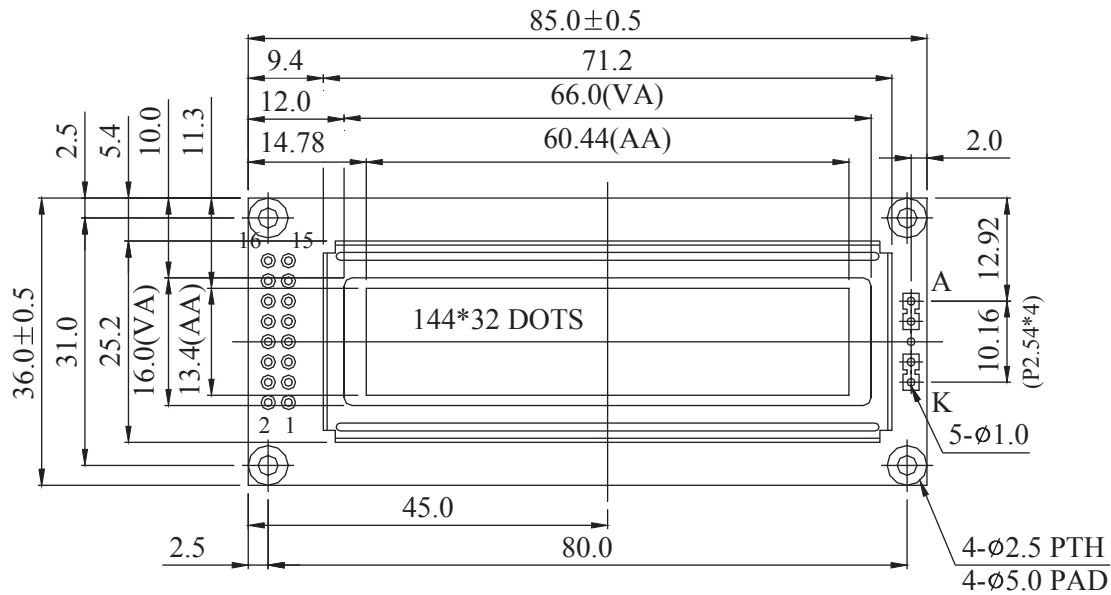
Document Revision History

| Revision | Date | Description | Changed by |
|----------|-----------|-----------------------|------------|
| 0 | 2/28/2008 | Initial Release | - |
| 1 | 4/5/2010 | User guide reformat | BE |
| 2 | 5/5/2010 | Updates | BE |
| 3 | 5/10/2010 | BLOCK DIAGRAM UPDATED | BE |
| 4 | 5/25/2010 | Contrast updated | BE |
| | | | |

Functions and Features

- 144x32 pixels
- Built-in ST7920 Controller
- +5.0V power supply
- 1/32 duty
- RoHS Compliant

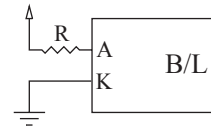
Mechanical Drawing



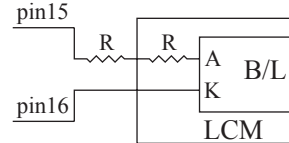
PIN DETAIL

LED B/L Drive Method

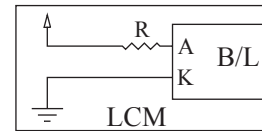
1. Drive from A, K



2. Drive from pin15, pin16



3. Drive from Vdd, Vss



(Contrast performance may go down.)

| PIN NO. | SYMBOL |
|---------|--------|
| 1 | Vss |
| 2 | Vdd |
| 3 | Vo |
| 4 | RS |
| 5 | R/W |
| 6 | E |
| 7 | DB0 |
| 8 | DB1 |
| 9 | DB2 |
| 10 | DB3 |
| 11 | DB4 |
| 12 | DB5 |
| 13 | DB6 |
| 14 | DB7 |
| 15 | LED+ |
| 16 | LED- |

LED H/L B/L

| | High | Low |
|----|------|------|
| H1 | 13.2 | 12.1 |
| H2 | 8.6 | 7.5 |

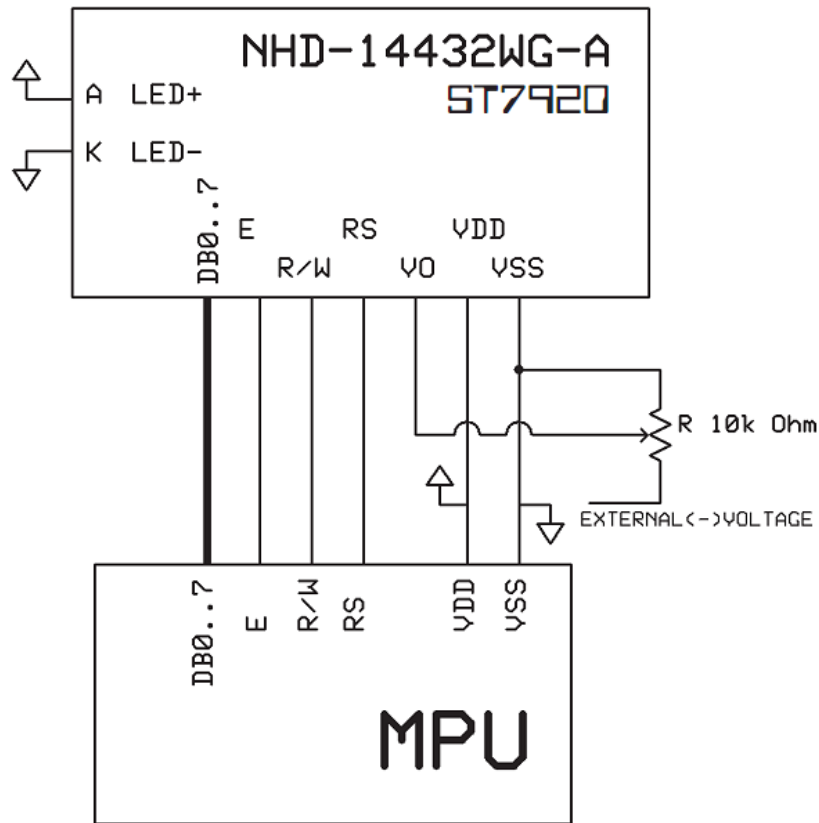
| | |
|-------------------------|----------------------|
| Newhaven Display | |
| Part No. | NHD-14432WG-ATFH-V#T |

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. +4.8V) |
| 4 | RS | MPU | Register select: 1=Data, 0=Instruction |
| 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. |
| 7-14 | DB0-DB7 | MPU | This is an 8-bit-directional data bus |
| 15 | LED+ | Power Supply | Power for LED backlight (+3.5V) |
| 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 | | 4.5 | 5.0 | 5.5 | V |
| Supply Current | IDD | Ta=25°, VDD=5.0V | 1.6 | 2.2 | 3.5 | mA |
| Supply for LCD (contrast) | V0 | Ta=25° | | 4.8 | | V |
| "H" Level input | Vih | | 0.7VDD | | VDD | V |
| "L" Level input | Vil | | -0.3 | | 0.6 | V |
| "H" Level output | Voh | | 0.8VDD | | VDD | V |
| "L" Level output | Vol | | 0 | | 0.4 | V |
| | | | | | | |
| Backlight Supply Voltage | Vled | | - | 3.5 | 3.9 | V |
| Backlight Supply Current | Iled | Vled=3.5V | - | 40 | 80 | mA |
| Backlight Lifetime | - | Iled=40mA | - | 50,000 | - | Hrs. |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------------------|--------|-----------|------|------|------|------|
| Viewing Angle - Vertical (top) | AH | Cr ≥ 2 | - | 20 | - | ° |
| Viewing Angle- Vertical (bottom) | AH | Cr ≥ 2 | - | 40 | - | ° |
| Viewing Angle- Horizontal (left) | AV | Cr ≥ 2 | - | 30 | - | ° |
| Viewing Angle - Horizontal (right) | AV | Cr ≥ 2 | - | 30 | - | ° |
| Contrast Ratio | Cr | | | 3 | | |
| Response Time (rise) | Tr | | | 200 | 300 | ms |
| Response Time (fall) | Tf | | | 200 | 300 | ms |

Controller Information

Built-in ST7920. Download specification at http://www.newhavendisplay.com/app_notes/ST7920.pdf

Table of Commands

Instruction set 1: (RE=0: basic instruction)

| Ins | code | | | | | | | | | | Description | Exec time (540KHZ) |
|-----------------------------|------|----|-----|-----|-----|-----|-----|-----|-----|-------|--|-----------------------|
| | RS | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| CLEAR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Fill DDRAM with "20H", and set DDRAM address counter (AC) to "00H" | 1.6 ms |
| HOME | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 X | Set DDRAM address counter (AC) to "00H", and put cursor to origin ; the content of DDRAM are not changed | 72us |
| ENTRY MODE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D S | Set cursor position and display shift when doing write or read operation | 72us |
| DISPLAY ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C B | D=1: display ON C=1: cursor ON B=1: blink ON | 72 us |
| CURSOR DISPLAY CONTROL | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | X | X | Cursor position and display shift control ; the content of DDRAM are not changed | 72 us |
| FUNCTION SET | 0 | 0 | 0 | 0 | 1 | DL | X | 0 | RE | X X | DL=1 8-BIT interface DL=0 4-BIT interface RE=1: extended instruction RE=0: basic instruction | 72 us |
| SET CGRAM ADDR. | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address to address counter (AC) Make sure that in extended instruction SR=0 (scroll or RAM address select) | 72 us |
| SET DDRAM ADDR. | 0 | 0 | 1 | 0 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address to address counter (AC) AC6 is fixed to 0 | 72 us |
| READ BUSY FLAG (BF) & ADDR. | 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Read busy flag (BF) for completion of internal operation, also Read out the value of address counter (AC) | 0 us |
| WRITE RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data to internal RAM (DDRAM/CGRAM/IRAM/GDRAM) | 72 us |
| READ RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM/IRAM/GDRAM) | 72 us |

Instruction set 2: (RE=1: extended instruction)

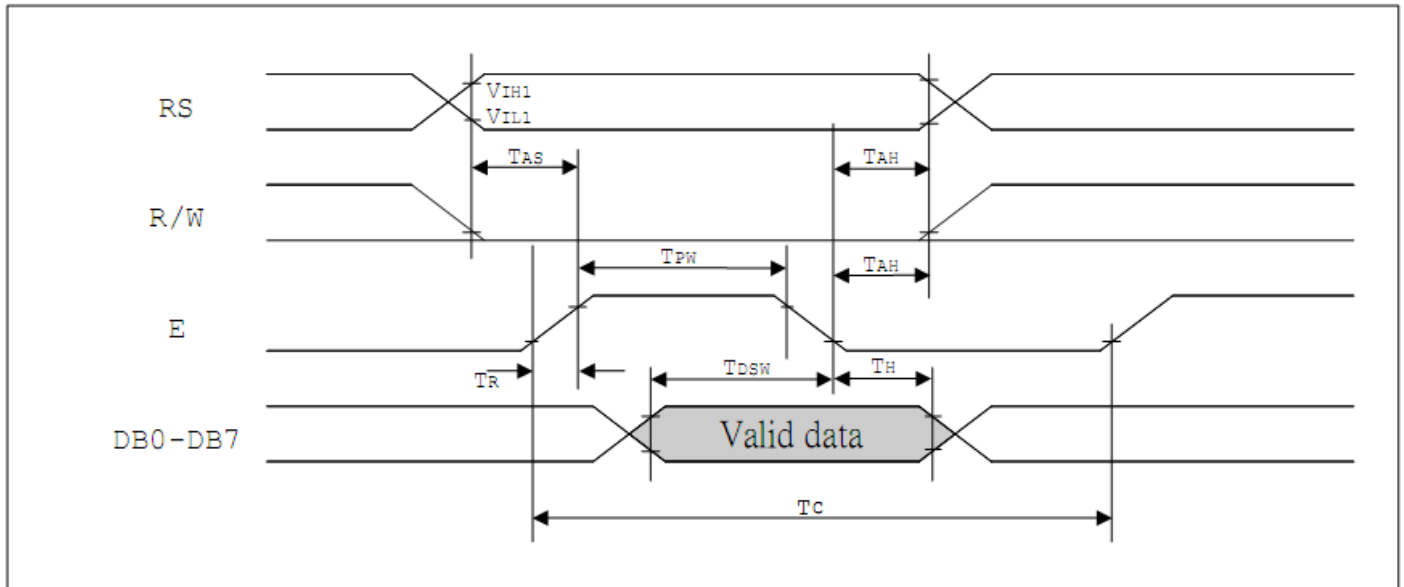
| Inst. | code | | | | | | | | | | description | Exec. time (540KHZ) |
|-------------------------------------|------|----|-----|-----|-----|-----|-----|---------|-----|-----|--|------------------------|
| | RS | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| STAND BY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Enter stand by mode, any other instruction can terminate (Com1..32 halted, only Com33 ICON can display) | 72 us |
| SCROLL or RAM ADDR. SELECT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | SR | SR=1: enable vertical scroll position SR=0: enable IRAM address (extended instruction) SR=0: enable CGRAM address(basic instruction) | 72 us |
| REVERSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | R1 | R0 | Select 1 out of 4 line (in DDRAM) and decide whether to reverse the display by toggling this instruction R1,R0 initial value is 00 | 72 us |
| EXTENDED FUNCTION SET | 0 | 0 | 0 | 0 | 1 | DL | X | 1 RE | G | 0 | DL=1 8-BIT interface DL=0 4-BIT interface RE=1: extended instruction set RE=0: basic instruction set G=1 :graphic display ON G=0 :graphic display OFF | 72 us |
| SET IRAM or SCROLL ADDR | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | SR=1: AC5~AC0 the address of vertical scroll SR=0: AC3~AC0 the address of ICON RAM | 72 us |
| SET GRAPHIC RAM ADDR. | 0 | 0 | 1 | 0 | 0 | 0 | AC3 | AC2 | AC1 | AC0 | Set GDRAM address to address counter (AC) First set vertical address and the horizontal address by consecutive writing Vertical address range AC6...AC0 Horizontal address range AC3...AC0 | 72 us |

Timing Characteristics

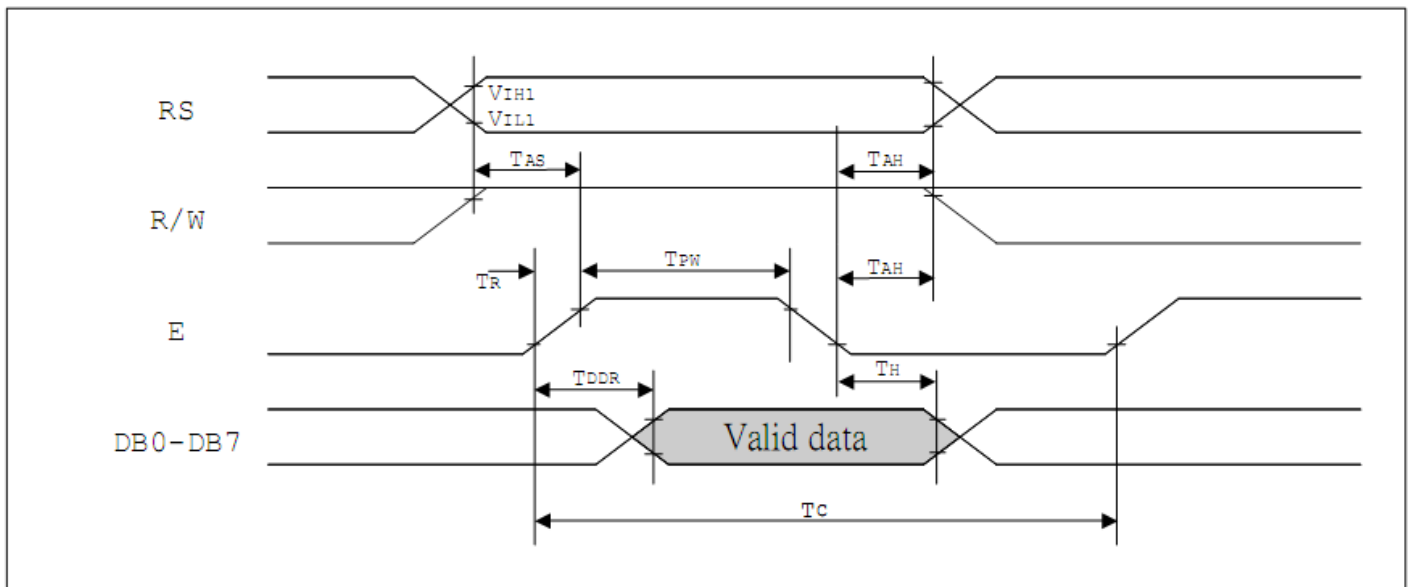
DC Characteristics ($T_A = 25^{\circ}\text{C}$, $V_{DD} = 2.7\text{ V} - 4.5\text{ V}$)

| Symbol | Characteristics | Test Condition | Min. | Typ. | Max. | Unit |
|------------|---|--|--------------|------|-------------|---------------|
| V_{DD} | Operating Voltage | - | 2.7 | - | 5.5 | V |
| V_{LCD} | LCD Voltage | $V_0 - V_{SS}$ | 3.0 | - | 7 | V |
| I_{CC} | Power Supply Current | $f_{OSC} = 530\text{KHz}$, $V_{DD} = 3.0\text{V}$ $R_f = 18\text{K}\Omega$ | - | 0.20 | 0.45 | mA |
| V_{IH1} | Input High Voltage (Except OSC1) | - | $0.7V_{DD}$ | - | V_{DD} | V |
| V_{IL1} | Input Low Voltage (Except OSC1) | - | -0.3 | - | 0.6 | V |
| V_{IH2} | Input High Voltage (OSC1) | - | $V_{DD} - 1$ | - | V_{DD} | V |
| V_{IL2} | Input Low Voltage (OSC1) | - | - | - | 1.0 | V |
| V_{OH1} | Output High Voltage (DB0 - DB7) | $I_{OH} = -0.1\text{mA}$ | $0.8V_{DD}$ | - | V_{DD} | V |
| V_{OL1} | Output Low Voltage (DB0 - DB7) | $I_{OL} = 0.1\text{mA}$ | - | - | 0.1 | V |
| V_{OH2} | Output High Voltage (Except DB0 - DB7) | $I_{OH} = -0.04\text{mA}$ | $0.8V_{DD}$ | - | V_{DD} | V |
| V_{OL2} | Output Low Voltage (Except DB0 - DB7) | $I_{OL} = 0.04\text{mA}$ | - | - | $0.1V_{DD}$ | V |
| I_{LEAK} | Input Leakage Current | $V_{IN} = 0\text{V to } V_{DD}$ | -1 | - | 1 | μA |
| I_{PUP} | Pull Up MOS Current | $V_{DD} = 3\text{V}$ | 22 | 27 | 32 | μA |

MPU write data to ST7920



MPU read data from ST7920



Example Initialization Program

```
//-----  
#include <REG52.H>  
#include "AL.h"  
sbit ID = P3^0;  
sbit RW = P3^7;  
sbit E = P3^4;  
  
//-----  
void Init()  
{  
    Wcom(0x38);  
    Wcom(0x0C);  
    Wcom(0x06);  
    Wcom(0x02);  
    Wcom(0x01);  
    delay(10);  
    Row = 0x80;  
    for(Counthi = 1; Counthi <=32; Counthi++)  
    {  
        Wcom(0x3E);  
        Wcom(Row);  
        Wcom(0x80);  
        for(Count = 1; Count <=40; Count++)  
        {  
            Wdata(0x00);  
        }  
        Row++;  
    }  
}  
  
//-----  
void Wcom(char i)  
{  
    P1 = i;  
    ID = 0; //Reset P3.0  
    RW = 0; //Reset P3.7  
    E = 1; //Set P3.4  
    delay(1);  
    E = 0; //Reset P3.4  
}  
  
void Wdata(char i)  
{  
    P1 = i;  
    ID = 1; //Set P3.0  
    RW = 0; //Reset P3.7  
    E = 1; //Set P3.4  
    delay(1);  
    E = 0; //Reset P3.4  
}
```

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

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