

# NHD-2.8-25664UCY2

## Graphic OLED Display Module

NHD-	Newhaven Display
2.8-	2.8" Diagonal Size
25664-	256 x 64 Pixel Resolution
UC-	Model
Y-	Emitting Color: Yellow
2-	3V Power Supply

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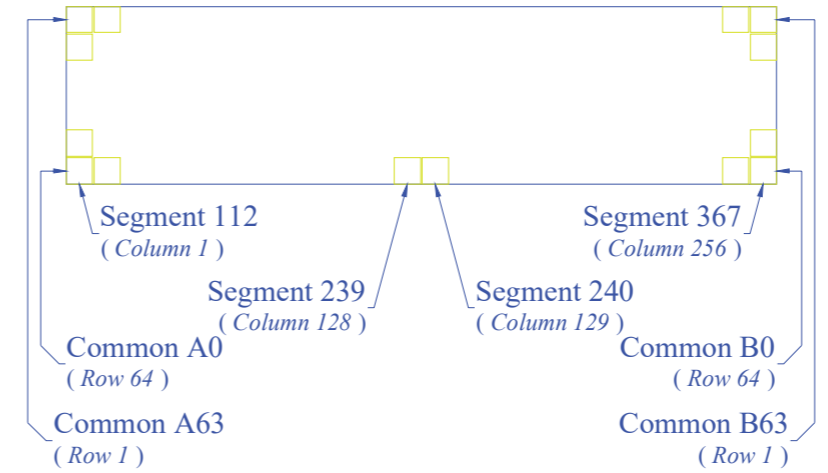
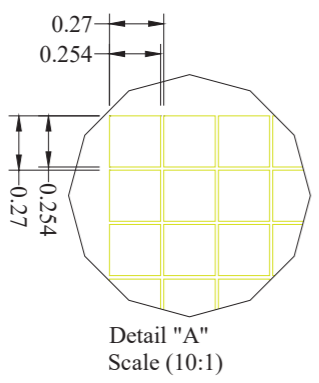
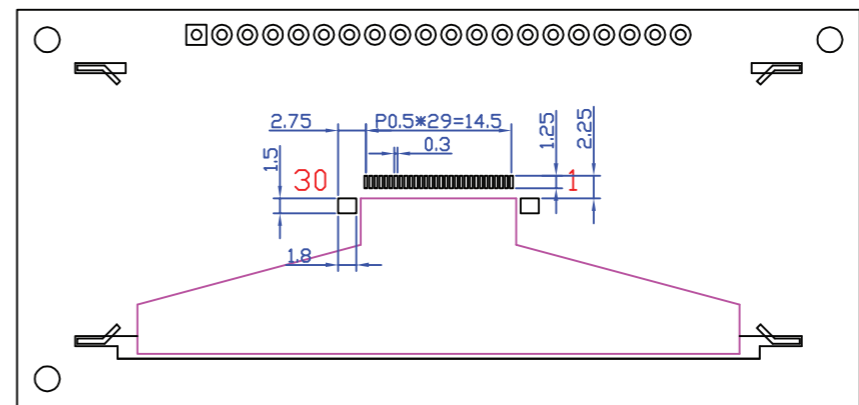
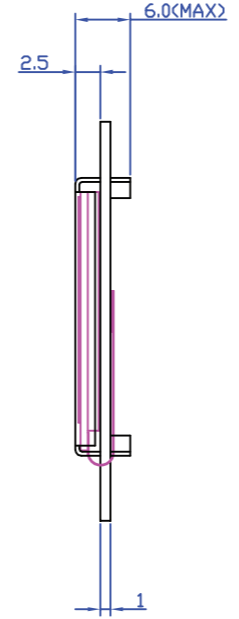
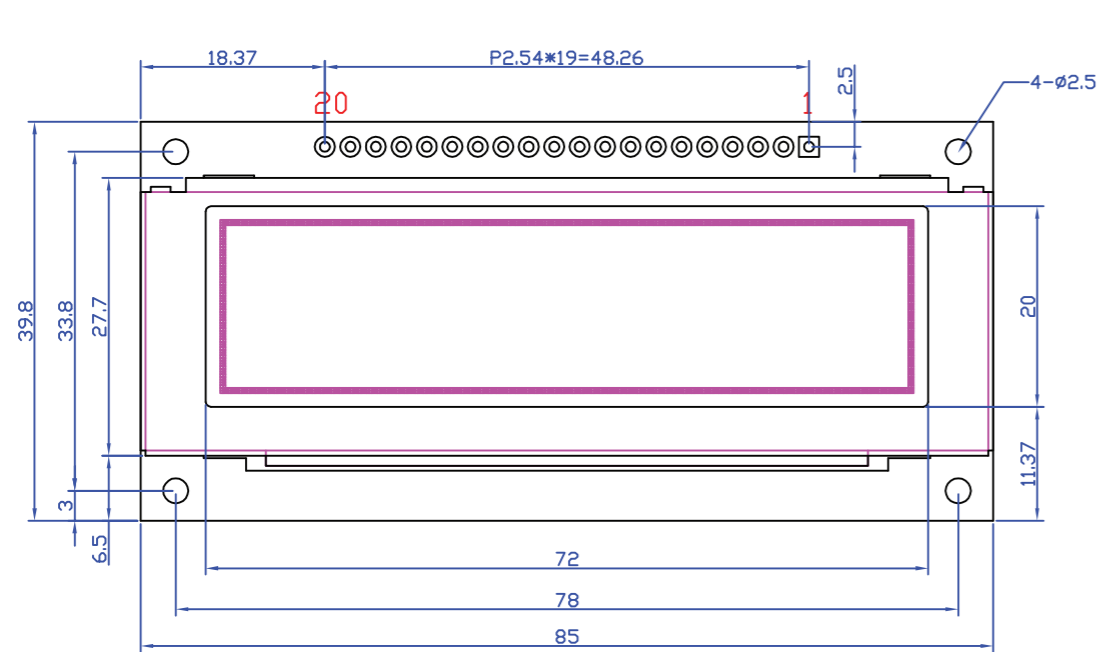
## Document Revision History

Revision	Date	Description	Changed by
0	5/1/11	Initial Product Release	-
1	2/22/13	Electrical characteristics and mechanical drawing updated	JN
2	3/16/20	Electrical Characteristics & Segment Layout Updated	SB
3	10/23/20	Updated Supply Voltage Range: (3V/3.3V/3.5V) to (2.8V/3V/3.3V)	AS

## Functions and Features

- 256 x 64 pixel resolution
- Built-in SSD1322 controller
- Parallel or serial MPU interface
- Single, low voltage power supply
- RoHS compliant

SYMBOL	REVISION	DATE



Pin No.	Symbol
1	VSS
2	VDD
3	NC
4	D/C
5	R/W or /WR
6	E or /RD
7-14	DB0 – DB7
15	NC
16	/RES
17	/CS
18	NC
19	BS1
20	BS0

- Notes:**
- 1. Driver: 1/64 Duty
  - 2. Display Type: PMOLED
  - 3. Voltage: 3V VDD
  - 4. Emitting Color: Yellow
  - 5. Driver IC: SD1322
  - 6. Interface: 8-Bit 68XX/80XX Parallel, 3-/4-Wire SPI

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

**NEWHAVEN DISPLAY INTERNATIONAL**

DRAWING/PART NUMBER: NHD-2.8-25664UCY2

REVISION: 1.0

SIZE: A3

SCALE: NS

SHEET 1 OF 1

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# Interface Description

## Parallel Interface:

Pin No.	Symbol	External Connection	Function Description
1	V <sub>SS</sub>	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Supply Voltage for OLED and logic.
3	NC	-	No Connect
4	D/C	MPU	Register select signal. D/C=0: Command; D/C=1: Data
5	R/W or /WR	MPU	<b>6800-interface:</b> Read/Write select signal, R/W=1: Read; R/W=0: Write <b>8080-interface:</b> Active LOW Write signal.
6	E or /RD	MPU	<b>6800-interface:</b> Operation enable signal. Falling edge triggered. <b>8080-interface:</b> Active LOW Read signal.
7-14	DB0 – DB7	MPU	8-bit Bi-directional data bus lines.
15	NC	-	No Connect
16	/RES	MPU	Active LOW Reset signal.
17	/CS	MPU	Active LOW Chip Select signal.
18	NC	-	No Connect
19	BS1	MPU	MPU Interface Select signal.
20	BS0	MPU	MPU Interface Select signal.

## Serial Interface:

Pin No.	Symbol	External Connection	Function Description
1	V <sub>SS</sub>	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Supply Voltage for OLED and logic.
3	NC	-	No Connect
4	D/C	MPU	Register select signal. D/C=0: Command; D/C=1: Data Tie LOW for 3-wire Serial Interface.
5-6	V <sub>SS</sub>	Power Supply	Ground
7	SCLK	MPU	Serial Clock signal.
8	SDIN	MPU	Serial Data Input signal.
9	NC	-	No Connect
10-14	V <sub>SS</sub>	Power Supply	Ground
15	NC	-	No Connect
16	/RES	MPU	Active LOW Reset signal.
17	/CS	MPU	Active LOW Chip Select signal.
18	NC	-	No Connect
19	BS1	MPU	MPU Interface Select signal.
20	BS0	MPU	MPU Interface Select signal.

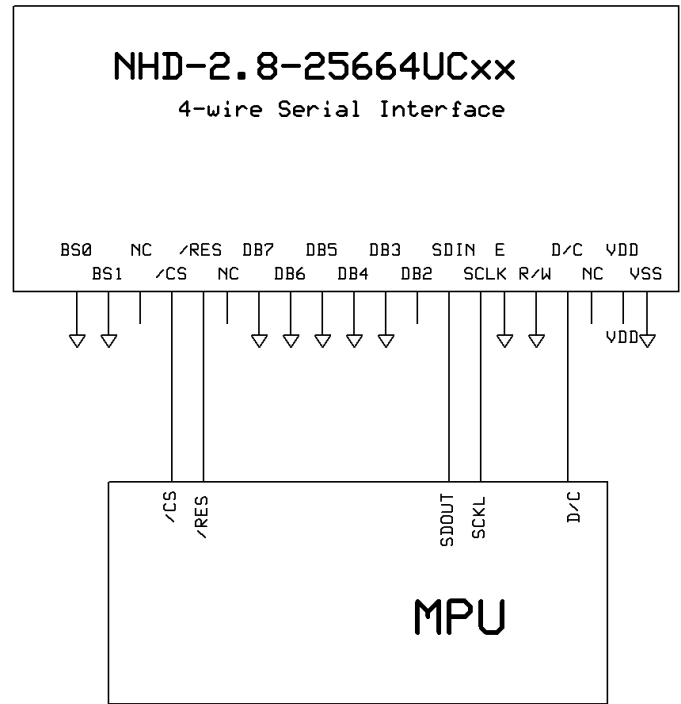
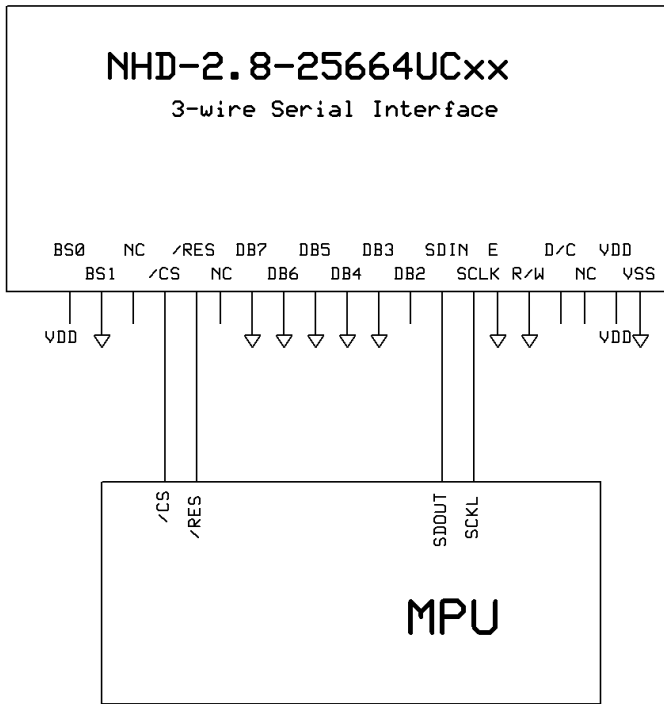
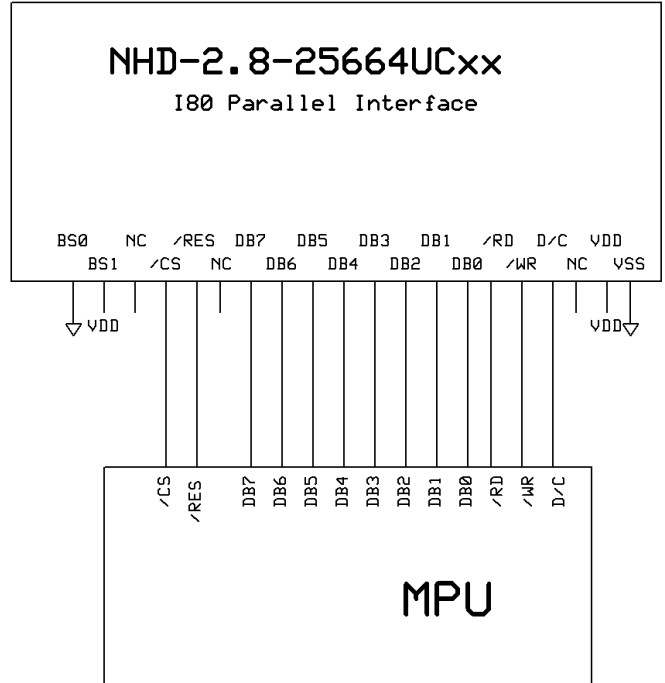
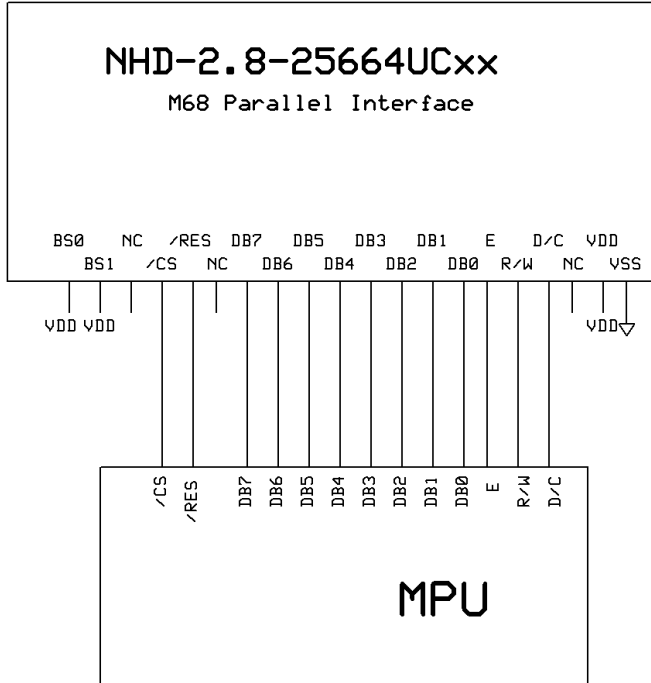
## MPU Interface Pin Selections

Pin Name	6800 Parallel 8-bit interface	8080 Parallel 8-bit interface	3-wire Serial Interface	4-wire Serial Interface
BS1	1	1	0	0
BS0	1	0	1	0

## MPU Interface Pin Assignment Summary

Bus Interface	Data/Command Interface								Control Signals				
	D7	D6	D5	D4	D3	D2	D1	D0	E	R/W	/CS	D/C	/RES
8-bit 6800	D[7:0]								E	R/W	/CS	D/C	/RES
8-bit 8080	D[7:0]								/RD	/WR	/CS	D/C	/RES
3-wire SPI	Tie LOW				NC	SDIN	SCLK	Tie LOW		/CS	Tie LOW	/RES	
4-wire SPI	Tie LOW				NC	SDIN	SCLK	Tie LOW		/CS	D/C	/RES	

## Wiring Diagrams



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-40	-	+85	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-40	-	+90	°C
Supply Voltage	V <sub>DD</sub>	-	2.8	3.0	3.3	V
Supply Current (display)	I <sub>DD</sub>	50% ON, V <sub>DD</sub> =3.0V	-	150	175	mA
		100% ON, V <sub>DD</sub> =3.0V	-	250	275	mA
Sleep Mode Current	I <sub>DD_SLEEP</sub>	-	-	-	10	µA
“H” Level input	V <sub>IH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
“L” Level input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.2 * V <sub>DD</sub>	V
“H” Level output	V <sub>OH</sub>	-	0.9 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
“L” Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.1 * V <sub>DD</sub>	V

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top	φY+		-	80	-	°
Viewing Angle – Bottom	φY-		-	80	-	°
Viewing Angle – Left	θX-		-	80	-	°
Viewing Angle – Right	θX+		-	80	-	°
Contrast Ratio	CR	-	10,000:1	-	-	-
Response Time (rise)	T <sub>R</sub>	-	-	10	-	µs
Response Time (fall)	T <sub>F</sub>	-	-	10	-	µs
Brightness	L <sub>V</sub>	T <sub>OP</sub> = 25°C	60	80	-	cd/m <sup>2</sup>
Lifetime	-	50% Checkerboard	40,000	60,000	-	Hrs

**Note:** Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as Hours until **Half-Brightness**. The Display OFF command can be used to extend the lifetime of the display.

Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly.

## Controller Information

Built in SSD1322 Controller

For detailed information please download datasheet: [http://www.newhavendisplay.com/app\\_notes/SSD1322.pdf](http://www.newhavendisplay.com/app_notes/SSD1322.pdf)

## **6800-MPU Parallel Interface**

The parallel interface consists of 8 bi-directional data pins, R/W, D/C, E, and /CS.

A LOW on R/W indicates write operation, and HIGH on R/W indicates read operation.

A LOW on D/C indicates “Command” read or write, and HIGH on D/C indicates “Data” read or write.

The E input serves as data latch signal, while /CS is LOW. Data is latched at the falling edge of E signal.

Function	E	R/W	/CS	D/C
Write Command	↓	0	0	0
Read Status	↓	1	0	0
Write Data	↓	0	0	1
Read Data	↓	1	0	1

## **8080-MPU Parallel Interface**

The parallel interface consists of 8 bi-directional data pins, /RD, /WR, D/C, and /CS.

A LOW on D/C indicates “Command” read or write, and HIGH on D/C indicates “Data” read or write.

A rising edge of /RS input serves as a data read latch signal while /CS is LOW.

A rising edge of /WR input serves as a data/command write latch signal while /CS is LOW.

Function	/RD	/WR	/CS	D/C
Write Command	1	↑	0	0
Read Status	↑	1	0	0
Write Data	1	↑	0	1
Read Data	↑	1	0	1

Alternatively, /RD and /WR can be kept stable while /CS serves as the data/command latch signal.

Function	/RD	/WR	/CS	D/C
Write Command	1	0	↑	0
Read Status	0	1	↑	0
Write Data	1	0	↑	1
Read Data	0	1	↑	1

## **Serial Interface (4-wire)**

The 4-wire serial interface consists of serial clock SCLK, serial data SDIN, D/C, and /CS.

D0 acts as SCLK and D1 acts as SDIN. D2 should be left open. D3~D7, E, and R/W should be connected to GND.

Function	/RD	/WR	/CS	D/C	D0
Write Command	Tie LOW	Tie LOW	0	0	↑
Write Data	Tie LOW	Tie LOW	0	1	↑

SDIN is shifted into an 8-bit shift register on every rising edge of SCLK in the order of D7, D6,...D0.

D/C is sampled on every eighth clock and the data byte in the shift register is written to the GDRAM or command register in the same clock.

Note: Read is not available in serial mode.

### **Serial Interface (3-wire)**

The 3-wire serial interface consists of serial clock SCLK, serial data SDIN, and /CS.

D0 acts as SCLK and D1 acts as SDIN. D2 should be left open. D3~D7, E, R/W, and D/C should be connected to GND.

Function	/RD	/WR	/CS	D/C	D0
Write Command	Tie LOW	Tie LOW	0	Tie LOW	↑
Write Data	Tie LOW	Tie LOW	0	Tie LOW	↑

SDIN is shifted into an 9-bit shift register on every rising edge of SCLK in the order of D/C, D7, D6,...D0.

D/C (first bit of the sequential data) will determine if the following data byte is written to the Display Data RAM (D/C = 1) or the command register (D/C = 0).

Note: Read is not available in serial mode.

For detailed protocol information, see datasheet: [http://www.newhavendisplay.com/app\\_notes/SSD1322.pdf](http://www.newhavendisplay.com/app_notes/SSD1322.pdf)



## Example Initialization Sequence:

```
Set_Command_Lock(0x12);           // Unlock Basic Commands (0x12/0x16)
Set_Display_On_Off(0x00);         // Display Off (0x00/0x01)
Set_Column_Address(0x1C,0x5B);
Set_Row_Address(0x00,0x3F);
Set_Display_Clock(0x91);          // Set Clock as 80 Frames/Sec
Set_Multiplex_Ratio(0x3F);        // 1/64 Duty (0x0F~0x3F)
Set_Display_Offset(0x00);         // Shift Mapping RAM Counter (0x00~0x3F)
Set_Start_Line(0x00);             // Set Mapping RAM Display Start Line (0x00~0x7F)
Set_Remap_Format(0x14);           // Set Horizontal Address Increment
                                   // Column Address 0 Mapped to SEG0
                                   // Disable Nibble Remap
                                   // Scan from COM[N-1] to COM0
                                   // Disable COM Split Odd Even
                                   // Enable Dual COM Line Mode
Set_GPIO(0x00);                   // Disable GPIO Pins Input
Set_Function_Selection(0x01);      // Enable Internal VDD Regulator
Set_Display_Enhancement_A(0xA0,0xFD); // Enable External VSL
Set_Contrast_Current(0x9F);        // Set Segment Output Current
Set_Master_Current(0x0F);          // Set Scale Factor of Segment Output Current Control
//Set_Gray_Scale_Table();          // Set Pulse Width for Gray Scale Table
Set_Linear_Gray_Scale_Table();     //set default linear gray scale table
Set_Phase_Length(0xE2);            // Set Phase 1 as 5 Clocks & Phase 2 as 14 Clocks
Set_Display_Enhancement_B(0x20);   // Enhance Driving Scheme Capability (0x00/0x20)
Set_Precharge_Voltage(0x1F);       // Set Pre-Charge Voltage Level as 0.60*VCC
Set_Precharge_Period(0x08);        // Set Second Pre-Charge Period as 8 Clocks
Set_VCOMH(0x07);                  // Set Common Pins Deselect Voltage Level as 0.86*VCC
Set_Display_Mode(0x02);            // Normal Display Mode (0x00/0x01/0x02/0x03)
Set_Partial_Display(0x01,0x00,0x00); // Disable Partial Display
Set_Display_On_Off(0x01);
```

## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Test the endurance of the display at high storage temperature.	+90°C, 240hrs	2
Low Temperature storage	Test the endurance of the display at low storage temperature.	-40°C, 240hrs	1,2
High Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature.	+85°C, 240hrs	2
Low Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at low temperature.	-40°C, 240hrs	1,2
High Temperature / Humidity Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature with high humidity.	+60°C, 90% RH, 240hrs	1,2
Thermal Shock resistance	Test the endurance of the display by applying electric stress (voltage & current) during a cycle of low and high temperatures.	-40°C,30min -> 25°C,5min -> 85°C,30min = 1 cycle 100 cycles	
Vibration test	Test the endurance of the display by applying vibration to simulate transportation and use.	10-22Hz, 15mm amplitude. 22-500Hz, 1.5G 30min in each of 3 directions X, Y, Z	3
Atmospheric Pressure test	Test the endurance of the display by applying atmospheric pressure to simulate transportation by air.	115mbar, 40hrs	3
Static electricity test	Test the endurance of the display by applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 2 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.

**Evaluation Criteria:**

- 1: Display is fully functional during operational tests and after all tests, at room temperature.
- 2: No observable defects.
- 3: Luminance >50% of initial value.
- 4: Current consumption within 50% of initial value

## Precautions for using OLEDs/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)