

# NHD-12864WG-FTGH-VZ#

## Graphic Liquid Crystal Display Module

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

**Newhaven Display International, Inc.**

2661 Galvin Ct.

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

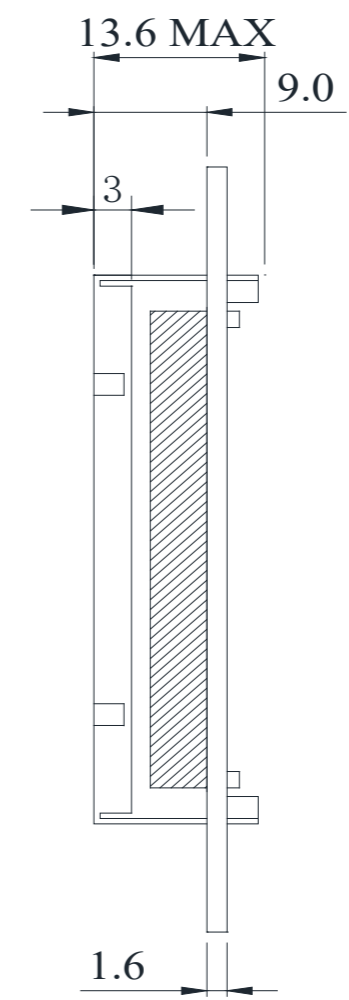
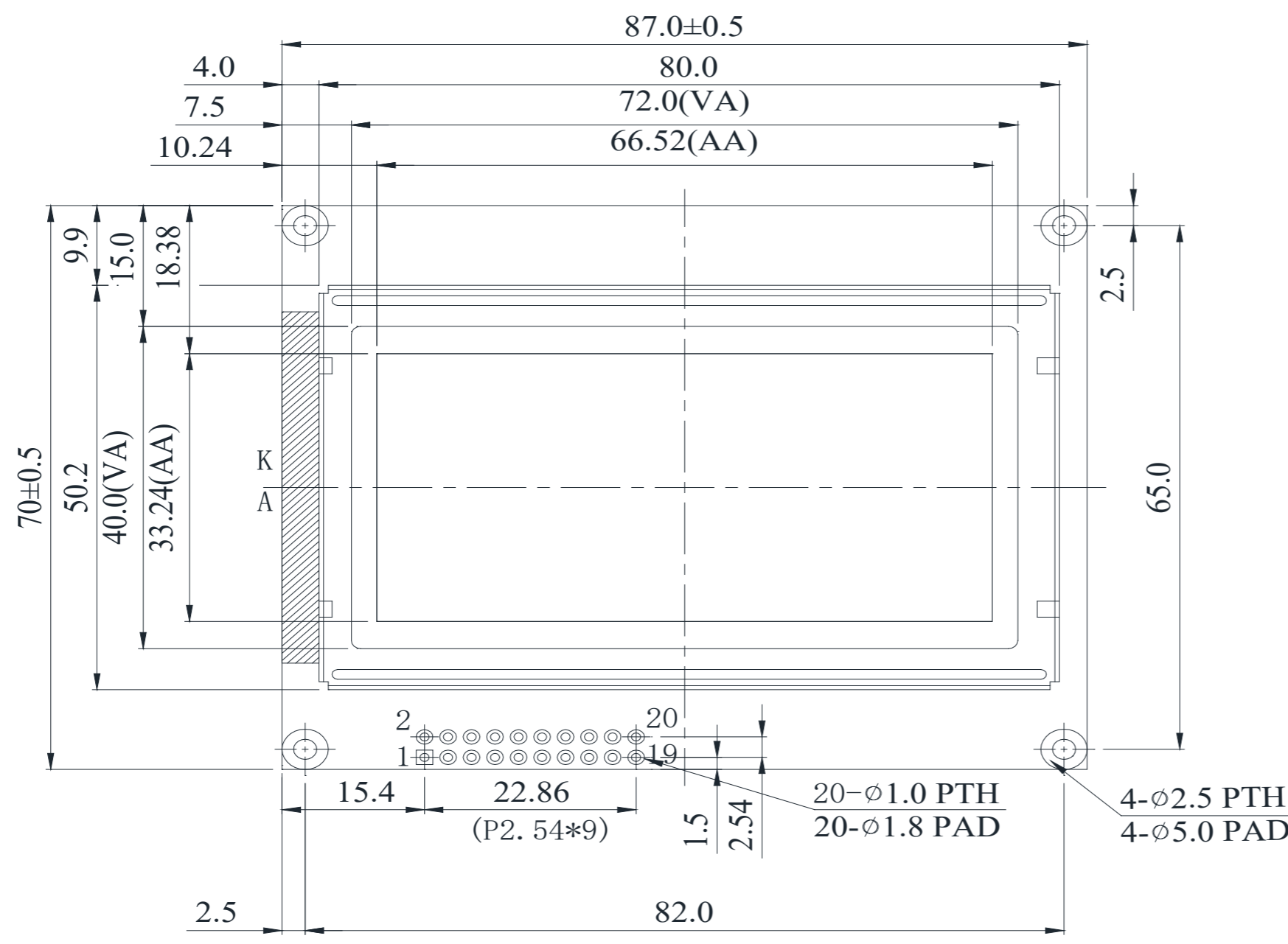
Revision	Date	Description	Changed by
0	10/30/2008	Initial Release	-
1	3/23/2010	User guide reformat	BE
2	5/6/2010	Block diagram/initialization updated	BE
3	5/28/2020	Updated 2D Drawing, Electrical Characteristics, Quality Information, Supply Voltage Range	AS

## Functions and Features

- 128 x 64 pixels
- Built-in RA6963 Controller
- +5.0V power supply
- 1/64 duty cycle
- RoHS Compliant

# Mechanical Drawing

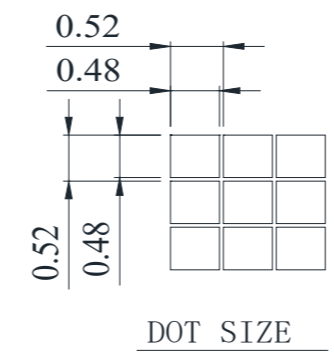
SYMBOL	REVISION	DATE



## Pin Assignment

PIN NO.	SYMBOL
1	V <sub>SS</sub>
2	V <sub>DD</sub>
3	V <sub>O</sub>
4	C/D
5	$\overline{\text{RD}}$
6	$\overline{\text{WR}}$
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	$\overline{\text{CE}}$
16	$\overline{\text{RESET}}$
17	V <sub>EE</sub>
18	MD2
19	FS1
20	HLT

- Notes:
1. Driver: 1/64 Duty
  2. Display Mode: STN Positive / Gray / Transflective
  3. Optimal View: 6:00
  4. Voltage: 5.0V V<sub>DD</sub>, 8.0V V<sub>LCD</sub>
  5. Backlight: White LED
  6. Driver IC: RA6963



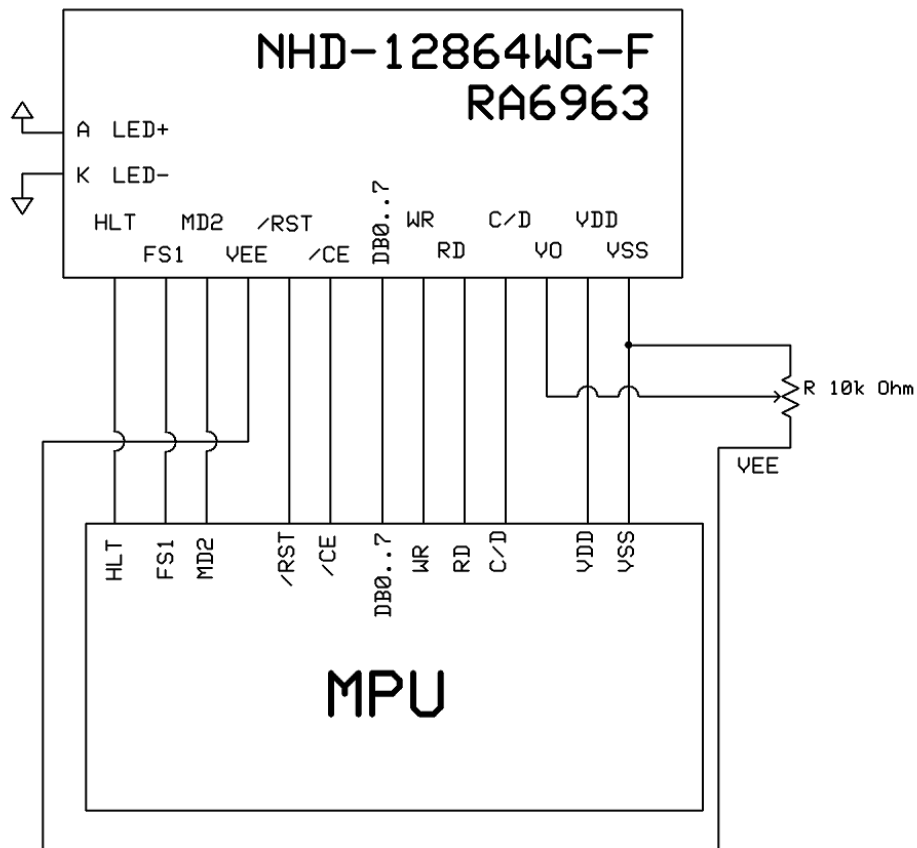
STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)		
LINEAR: ±0.3mm	DRAWING/PART NUMBER: NHD-12864WG-FTGH-VZ#	REVISION: X:X
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: A. Shah	APPROVED BY: A. Shah
	DRAWN DATE: 5/27/20	APPROVED DATE: 5/27/20
DO NOT SCALE DRAWING	SHEET 1 OF 1	
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V <sub>SS</sub>	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Power supply for logic (+5.0V)
3	V <sub>0</sub>	Adj.Power Supply	Power Supply for contrast (approx. -3.0V )
4	C/D	MPU	Register select signal. C/D=0: DATA C/D=1: COMMAND
5	/RD	MPU	Active LOW Read signal
6	/WR	MPU	Active LOW Write signal
7-14	DB0-DB7	MPU	Bi-directional 8-bit data bus
15	/CE	MPU	Active LOW Chip enable
16	/RST	MPU	Active LOW Reset Signal
17	V <sub>EE</sub>	Power Supply	Negative voltage output (-5.0V)
18	MD2	MPU	Column select; H:32 column; L: 40 column
19	FS1	MPU	Font Select: 1 : 6x8 fonts, 0 : 8x8 fonts
20	HLT	MPU	Clock operating stop signal
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	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>		4.5	5.0	5.5	V
Supply Current	I <sub>DD</sub>	T <sub>OP</sub> = 25°C, V <sub>DD</sub> = 5.0V	3.0	7.0	15.0	mA
Supply for LCD (contrast)	V <sub>LCD</sub>	T <sub>OP</sub> = 25°C	7.8	8.0	8.2	V
"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>	-	0.15 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	V <sub>DD</sub> -0.3	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.3	V
Backlight Supply Voltage	V <sub>LED</sub>	-	3.4	3.5	3.6	V
Backlight Supply Current	I <sub>LED</sub>	V <sub>LED</sub> =3.5V	48	64	80	mA
Backlight Lifetime	-	I <sub>LED</sub> = 64mA	-	50,000	-	Hrs.

## Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	20	-	°
	Bottom	φY-		-	40	-	°
	Left	θX-		-	30	-	°
	Right	θX+		-	30	-	°
Contrast Ratio		CR	-	-	3	-	-
Response Time	Rise	T <sub>R</sub>	T <sub>OP</sub> = 25°C	-	200	300	ms
	Fall	T <sub>F</sub>		-	250	350	ms

## Controller Information

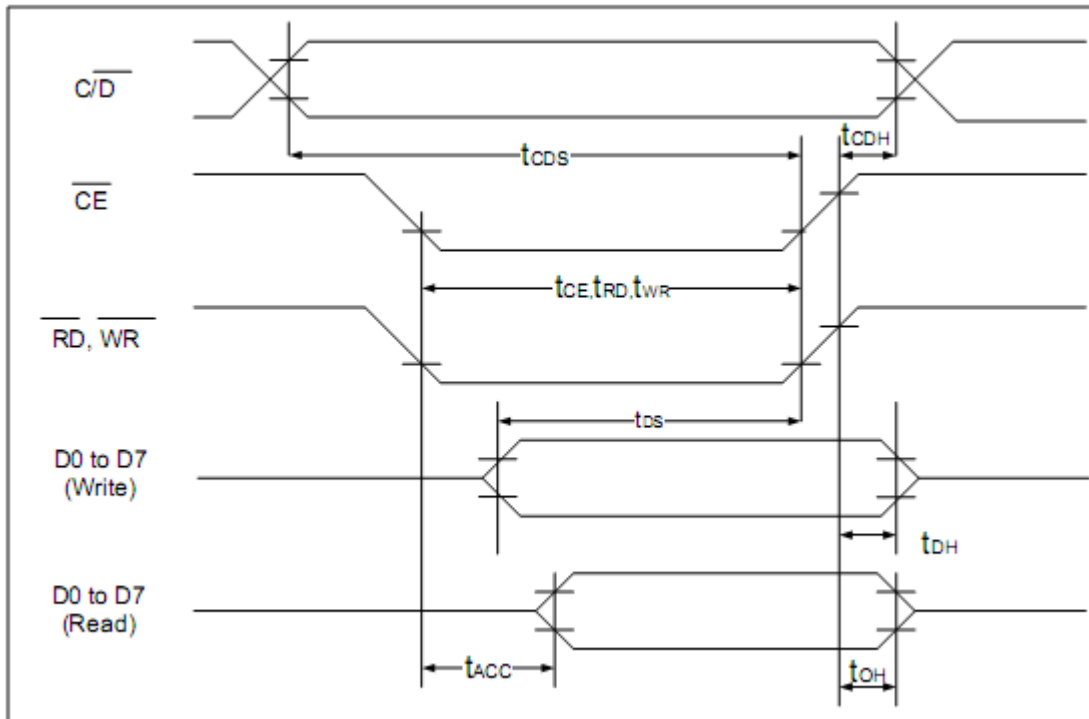
Built-in RA6963 Controller.

Please download specification at <https://www.newhavendisplay.com/appnotes/datasheets/LCDs/RA6963.pdf>

## Table of Commands

Command	Code	D1	D2	Function
<b>Registers Setting</b>	00100001	X address	Y address	Set cursor pointer
	00100010	Data	00h	Set Offset Register
	00100100	Low address	High address	Set Address pointer
<b>Set Control Word</b>	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
<b>Mode Set</b>	1000X000	--	--	OR mode
	1000X001	--	--	EXOR mode
	1000X011	--	--	AND mode
	1000X100	--	--	Text Attribute mode
	10000XXX	--	--	Internal CG ROM mode
	10001XXX	--	--	External CG RAM mode
<b>Display Mode</b>	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
<b>Cursor Pattern Select</b>	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
<b>Data Read/Write</b>	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
<b>Data auto Read/Write</b>	10110000	--	--	Set Data Auto Write
	10110001	--	--	Set Data Auto Read
	10110010	--	--	Auto Reset
<b>Screen Peek</b>	11100000	--	--	Screen Peek
<b>Screen Copy</b>	11101000			Screen Copy
<b>Bit Set/Reset</b>	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)
<b>Screen Reverse</b>	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
$\overline{C/D}$ Set Up Time	$t_{CDS}$	--	100	--	ns
$\overline{C/D}$ 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

```
//=====
#define LCM_PORT P1 //DB0~DB7, DATA BUS
sbit CD = P3^0; // DATA / INSTRUCTION
sbit FS = P3^1; // CHIP ENABLE
sbit MD2 = P3^2; // CHIP RESET
sbit RESET = P3^3; // CHOICE CHIP1
sbit CE = P3^4; // CHIP READ/WRITE
sbit WR = P3^6; // CHOICE CHIP2
sbit RD = P3^7;
//-----
// initial T6963C
//-----
void Initial_T6963C()
{
    /*write text home address=0000h */
    Write_data(0x00);
    Write_data(0x00);
    Write_command(0x40);

    Write_data(0x80);
    Write_data(0x00);
    Write_command(0x42);

    /*write text area address*/
    Write_data(0x10);
    Write_data(0x00);
    Write_command(0x41);

    /*write graphic area address*/
    Write_data(0x10);
    Write_data(0x00);
    Write_command(0x43);

    /*set display mode Display mode set (Graphic only enable)*/
    Write_command(0x80);
    /*Graphic display enable*/
    Write_command(0x98);
}
//-----
// Write Data Function
//-----
void Write_data(data) {
    P1=data;
    CD=0;

    CE=0;
    WR=0;

    CE=1;
    WR=1;
}
//-----
// Write Command Function
//-----
void Write_command(command) {
    P1 = command;
    CD=1;

    CE=0;
    WR=0;
    CE=1;
    WR=1;
}
//=====
```



## 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 , 200 Hrs.	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200 Hrs.	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200 Hrs.	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200 Hrs.	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 , 96 Hrs.	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, for 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: =±800V, 330Ω, 150pF Contact=±600V, 330Ω, 150pF Ten Times	

**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)