NHD-0420DZ-FSW-FBW

Character Liquid Crystal Display Module

NHD-	Newhaven Display
0420-	4 lines x 20 characters
DZ-	Model
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
B-	6:00 view
W-	Wide Temperature (-20°C ~+70°C)
	RoHS Compliant

Document Revision History

Revision	Date	Description	Changed by
0	10/21/2008	Initial Release	-
1	1/21/2010	User Guide Reformat	MC
2	2/25/2010	Updated Mechanical Drawing	MC
3	3/19/2010	Updated Mechanical Drawing	BE
4	1/6/2011	Updated Controller Information	JT
5	5/6/2011	Electrical characteristics updated	AK
6	12/5/2011	Mechanical drawing updated	AK
7	9/24/2012	Updated mechanical drawing, electrical and optical characteristics. Added timing characteristics.	JN

Functions and Features

- 4 lines x 20 characters
- Built-in controllers (ST7066U)
- +5.0V Power Supply
- 1/16 duty, 1/5 bias
- RoHS compliant

Mechanical Drawing

Rev	Description	Date

98±0.5

10 P2.54*15=38.1 2.5

4 - Ø2.5

9.3 ± 0.5

14 (MAX)

1 16

60±0.5 55±0.5

20.8(A.A.) 25.2(V.A.) 41.7±0.2

70.4(A.A.)

76(V.A.)

87.3±0.2

93±0.5

1.6

Pin connections

Pin NO	Symbol
1	VSS
2	VDD
3	V0
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-

2.95 0.6

0.60 0.55 4.75

0.55 0.6

0.60

	Date	
	09/24/12	NEWHAVEN DISPLAY INTERNATIONAL
Gen. Tolerance	Unit	Model:
±0.3mm	mm	NHD-0420DZ-FSW-FBW

[3]
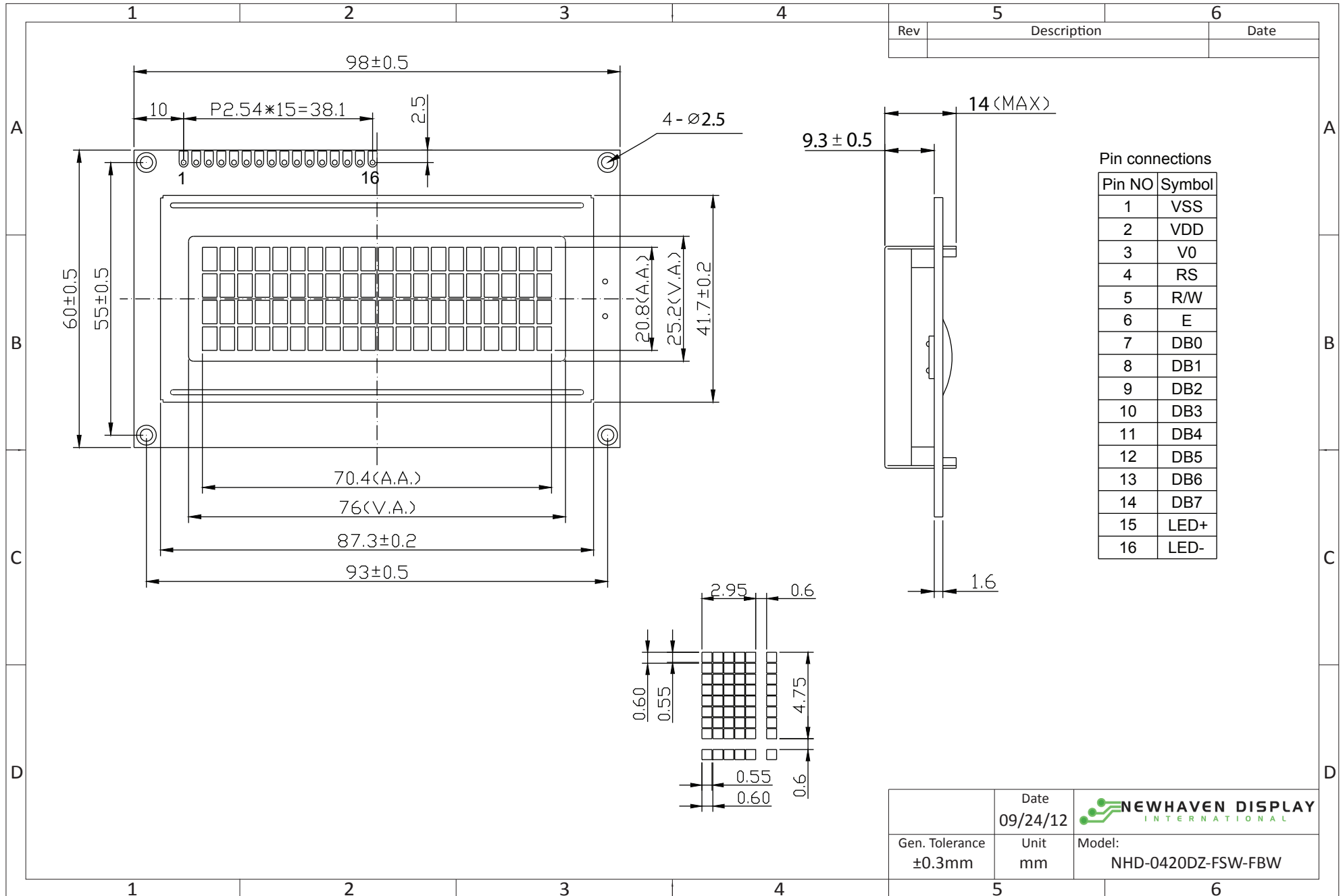
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply voltage for logic (+5.0V)
3	V0	Power Supply	Power supply for contrast (approx. 0.5V)
4	RS	MPU	Register select signal. RS=0: Command, RS=1: Data
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.
7-10	DB0-DB3	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
11-14	DB4-DB7	MPU	Four high order bi-directional three-state data bus lines.
15	LED+	Power Supply	Power supply for LED Backlight (+5.0V via on-board resistor)
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°C, VDD=5.0V	-	3.5	5.0	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	4.5	-	V
"H" Level input	Vih		0.7*VDD	-	VDD	V
"L" Level input	Vil		VSS	-	0.6	V
"H" Level output	Voh		3.9	-	VDD	V
"L" Level output	Vol		-	-	0.4	V
Backlight Supply Voltage	Vled	-	-	5.0	-	V
Backlight Supply Current	Iled	Vled=5.0V	30	-	40	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top	-		-	35	-	º
Viewing Angle – Bottom	-	Cr ≥ 2	-	60	-	º
Viewing Angle – Left	-		-	40	-	º
Viewing Angle – Right	-		-	40	-	º
Contrast Ratio	Cr	-	-	6	-	-
Response Time (rise)	Tr	-	-	150	250	ms
Response Time (fall)	Tf	-	-	150	250	ms

Controller Information

Built-in ST7066U controller.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7066U.pdf

Display character address code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	24	25	26	26	27
54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

Table of Commands

Instruction	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

Timing Characteristics

Writing data from MPU to ST7066U
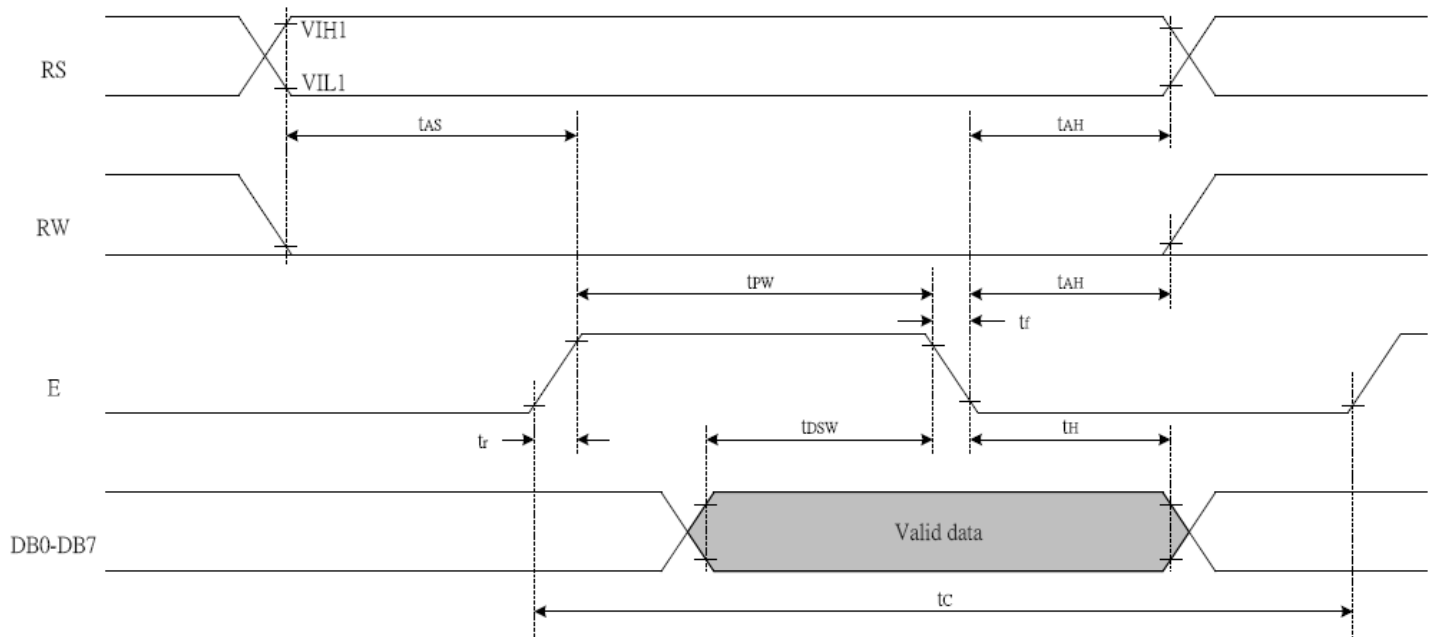
Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	460	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	80	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Reading data from ST7066U to MPU

Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	480	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	320	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Built-in Font Table

Upper 4 Bits → / Lower 4 Bits ↓	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	@	P	`	p				─	タ	ミ	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	ム	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	メ	β	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)		$	4	D	T	d	t			、	エ	ト	ヤ	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	ユ	σ	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			イ	ク	ネ	リ	√	x̄
xxxx1001	(2)		)	9	I	Y	i	y			ゥ	ケ	ノ	ル	˙	y
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	千
xxxx1011	(4)		+	;	K	[	k	{			オ	サ	ヒ	ロ	×	万
xxxx1100	(5)		,	<	L	¥	l	|			ャ	シ	フ	ワ	¢	円
xxxx1101	(6)		-	=	M	]	m	}			ュ	ス	ヘ	ン	Ł	÷
xxxx1110	(7)		.	>	N	^	n	→			ョ	セ	ホ	゛	ñ	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	█

Example Initialization Program

```
8-bit Initialization:
/*********************************************************/
void command(char i)
{
    P1 = i;                         //put data on output Port
    D_I =0;                         //D/I=LOW : send instruction
    R_W =0;                         //R/W=LOW : Write
    E  = 1;
    Delay(1);                       //enable pulse width  >= 300ns
      E  = 0;                       //Clock enable: falling edge
}
/*********************************************************/
void write(char i)
{
    P1 = i;                         //put data on output Port
    D_I =1;                         //D/I=HIGH : send data
    R_W =0;                         //R/W=LOW : Write
    E  = 1;
    Delay(1);                       //enable pulse width  >= 300ns
    E  = 0;                         //Clock enable: falling edge
}
/*********************************************************/
void init()
{
    E = 0;
    Delay(100);                     //Wait >40 msec after power is applied
    command(0x30);                  //command 0x30 = Wake up
    Delay(30);                      //must wait 5ms, busy flag not available
    command(0x30);                  //command 0x30 = Wake up #2
    Delay(10);                      //must wait 160us, busy flag not available
    command(0x30);                  //command 0x30 = Wake up #3
    Delay(10);                      //must wait 160us, busy flag not available
    command(0x38);                  //Function set: 8-bit/2-line
    command(0x10);                  //Set cursor
    command(0x0c);                  //Display ON; Cursor ON
    command(0x06);                  //Entry mode set
}
/*********************************************************/
```

4-bit Initialization:
```
/*******************************************************/
void command(char i)
{
      P1 = i;                        //put data on output Port
      D_I =0;                        //D/I=LOW : send instruction
      R_W =0;                        //R/W=LOW : Write
      Nybble();                      //Send lower 4 bits
      i = i<<4;                      //Shift over by 4 bits
      P1 = i;                        //put data on output Port
      Nybble();                      //Send upper 4 bits
}
/*******************************************************/
void write(char i)
{
      P1 = i;                        //put data on output Port
      D_I =1;                        //D/I=HIGH : send data
      R_W =0;                        //R/W=LOW : Write
      Nybble();                      //Clock lower 4 bits
      i = i<<4;                      //Shift over by 4 bits
      P1 = i;                        //put data on output Port
      Nybble();                      //Clock upper 4 bits
}
/*******************************************************/
void Nybble()
{
      E = 1;
      Delay(1);                      //enable pulse width  >= 300ns
      E = 0;                         //Clock enable: falling edge
}
/*******************************************************/
void init()
{
      P1 = 0;
      P3 = 0;
      Delay(100);                    //Wait >40 msec after power is applied
      P1 = 0x30;                     //put 0x30 on the output port
      Delay(30);                     //must wait 5ms, busy flag not available
      Nybble();                      //command 0x30 = Wake up
      Delay(10);                     //must wait 160us, busy flag not available
      Nybble();                      //command 0x30 = Wake up #2
      Delay(10);                     //must wait 160us, busy flag not available
      Nybble();                      //command 0x30 = Wake up #3
      Delay(10);                     //can check busy flag now instead of delay
      P1= 0x20;                      //put 0x20 on the output port
      Nybble();                      //Function set: 4-bit interface
      command(0x28);                 //Function set: 4-bit/2-line
      command(0x10);                 //Set cursor
      command(0x0F);                 //Display ON; Blinking cursor
      command(0x06);                 //Entry Mode set
}
/*******************************************************/
```

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