

NHD-12232AZ-FSW-GBW

Graphic Liquid Crystal Display Module

NHD- Newhaven Display
12232- 122 x 32 Pixels
AZ- Model
F- Transflective
SW- Side White LED Backlight
G- STN Positive, Gray
B- 6:00 Optimal View
W- Wide Temperature
RoHS Compliant

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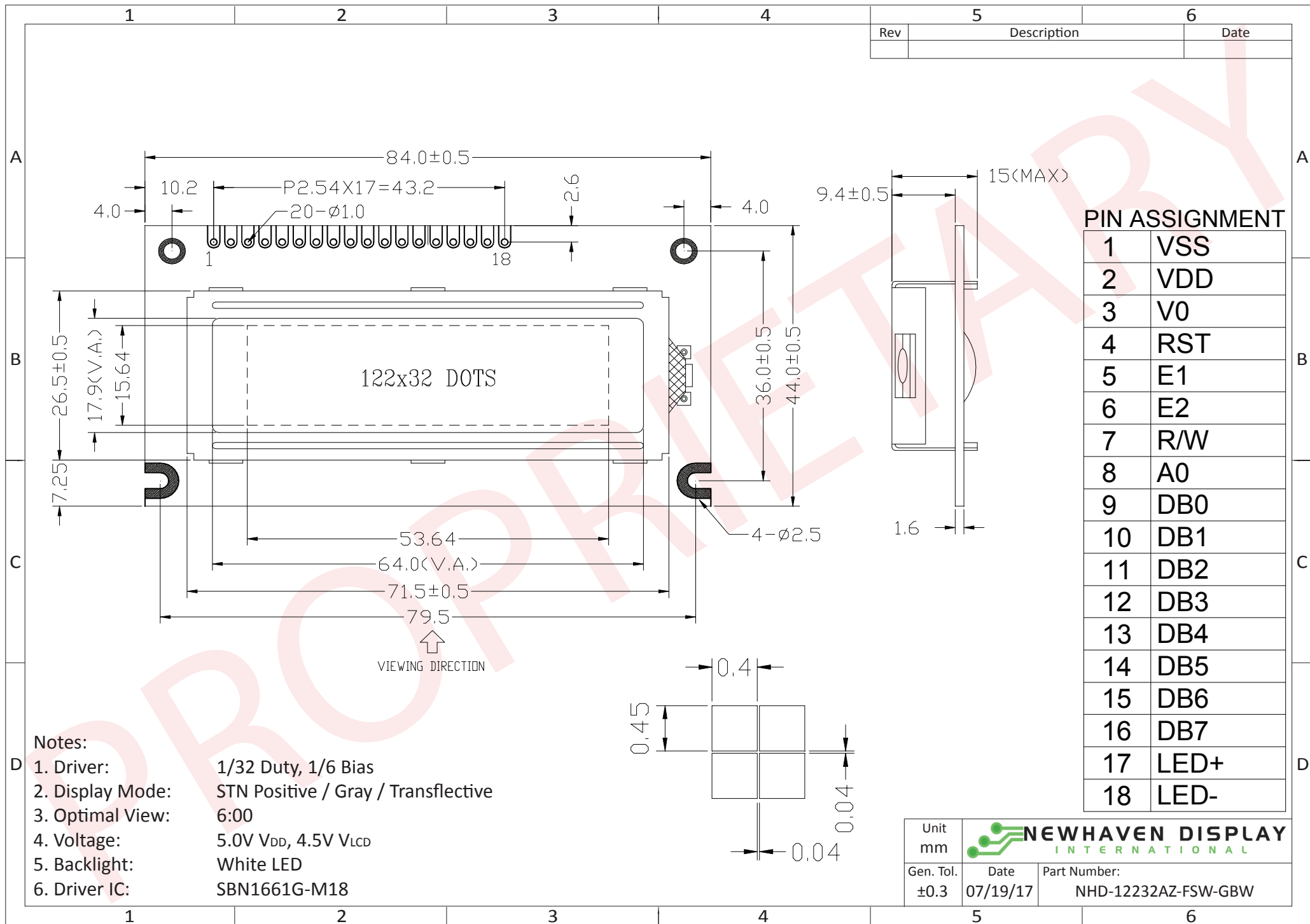
Document Revision History

Revision	Date	Description	Changed by
0	10/22/08	Initial Release	-
1	3/16/10	User guide reformat	BE
2	4/15/10	Controller update	BE
3	8/5/10	Electrical Characteristics Update	MP
4	6/2/11	Mechanical drawing updated	AK
5	10/25/11	Electrical characteristics updated	AK
6	1/27/12	Pin description updated	AK
7	4/19/12	Sample code updated	SB
8	7/27/15	Mechanical Drawing, Controller Information Updated, Electrical and Optical Characteristics Updated, Table of Commands	SB
9	9/26/16	Updated Electrical & Optical Characteristics	SB
10	6/27/17	Mechanical Drawing & Backlight Characteristics Updated	SB
11	7/19/17	Bezel Tolerance Updated	SB

Functions and Features

- 122 x 32 pixels
- Built-in SBN1661G_M18 Controller
- +5.0V power supply
- 1/32 duty cycle; 1/6 bias
- RoHS Compliant

Mechanical Drawing

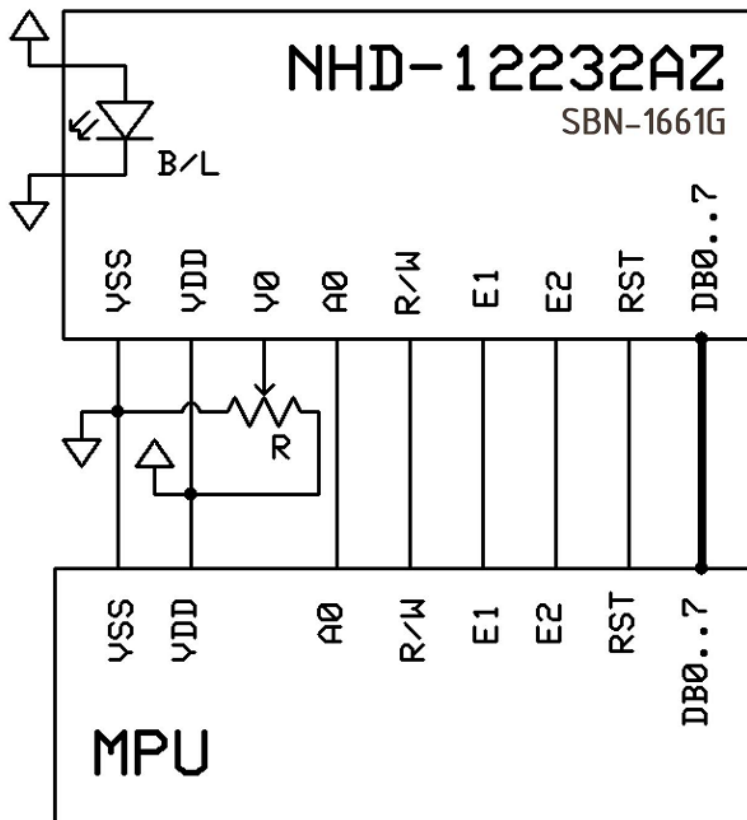


Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V _{SS}	Power Supply	Ground
2	V _{DD}	Power Supply	Supply Voltage for logic (+5.0V)
3	V ₀	Adj. Power Supply	Supply Voltage for contrast (approx. 0.5V)
4	RST	MPU	Active LOW Reset signal
5	E1	MPU	Operation Enable signal. Falling edge triggered, SEG (1~60)
6	E2	MPU	Operation Enable signal. Falling edge triggered, SEG (61~120)
7	R/W	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
8	A0	MPU	Register Select signal. A0=0: Command, A0=1: Data
9-16	DB0-DB7	MPU	This is an 8-bit bi-directional data bus
17	LED+	Power Supply	Backlight Anode (15 mA @ 5V)
18	LED-	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 2.54mm pitch pins

Backlight connector: - Mates with: -



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	4.8	5.0	5.2	V
Supply Current	I_{DD}	$V_{DD} = 5.0V$ $T_{OP} = 25^{\circ}C$	0.5	1.0	3.0	mA
Supply for LCD (contrast)	V_{LCD}		4.3	4.5	4.7	V
"H" Level input	V_{IH}	-	3.5	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	1.1	V
"H" Level output	V_{OH}	-	$V_{DD} - 0.3$	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.3	V
Backlight Supply Current	I_{LED}	-	-	15	20	mA
Backlight Supply Voltage	V_{LED}	$I_{LED} = 15\text{ mA}$	4.8	5.0	5.2	V

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	$\phi Y+$	CR ≥ 2	-	40	-	°
	Bottom	$\phi Y-$		-	60	-	°
	Left	$\theta X-$		-	60	-	°
	Right	$\theta X+$		-	60	-	°
Contrast Ratio	CR	-	2	5	-	-	
Response Time	Rise	T_R	$T_{OP} = 25^{\circ}C$	-	150	250	ms
	Fall	T_F		-	200	300	ms

Controller Information

Built-in SBN1661G_M18 Controller.

Please download specification at http://www.newhavendisplay.com/app_notes/SBN1661G.pdf

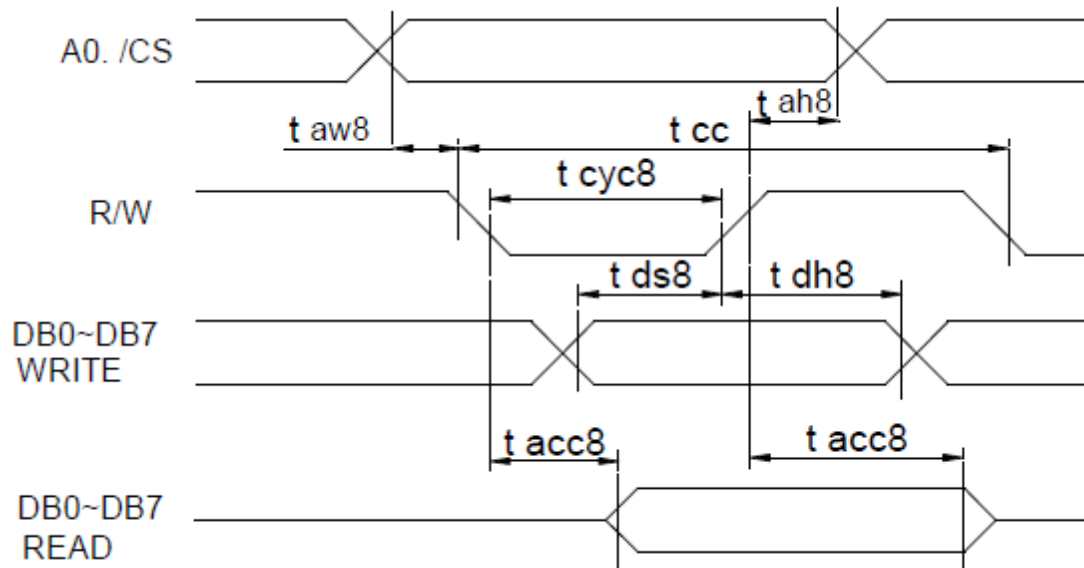
Table of Commands

Parameter	A0	E	RW	D7	D6	D5	D4	D3	D2	D1	D0	Note
Display ON /OFF	0	1	0	1	0	1	0	1	1	1	0/1	Turns display on or off 1: ON ; 0 : OFF
Display start line	0	1	0	1	1	0	Display start address (0 to 31)				Specifies RAM line corresponding to top line of display	
Set page address	0	1	0	1	0	1	1	1	0	Page (0 to 3)		Sets display RAM page in page address register
Set column (segment) address	0	1	0	0	Column address (0 to 79)							Sets display RAM column address in column address register
Read status	0	0	1	Busy	ADC	ON/OFF	RESET	0	0	0	0	Reads the following status: BUSY 1: Busy 0: Ready ADC 1: CW output 0: CCW output ON/OFF 1: Display off 0: Display on RESET 1: Being reset 0: Normal
Write display data	1	1	0	Write data								Write data from data bus into display RAM
Read display data	1	0	1	Read data								Read data from display RAM onto data bus
Select ADC	0	1	0	1	0	1	0	0	0	0	0/1	0: CW output 1: CCW output
Static driver ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Selects static driving operation. 1: static driver, 0: Normal driving
Select duty	0	1	0	1	0	1	0	1	0	0	0/1	Select LCD duty cycle 1: 1/32, 0: 1/16
Read-modify write	0	1	0	1	1	1	0	0	0	0	0	Read-modify-write ON
End	0	1	0	1	1	1	0	1	1	1	0	Read-modify-write OFF
Reset	0	1	0	1	1	1	0	0	0	1	0	Software reset

Timing Characteristics

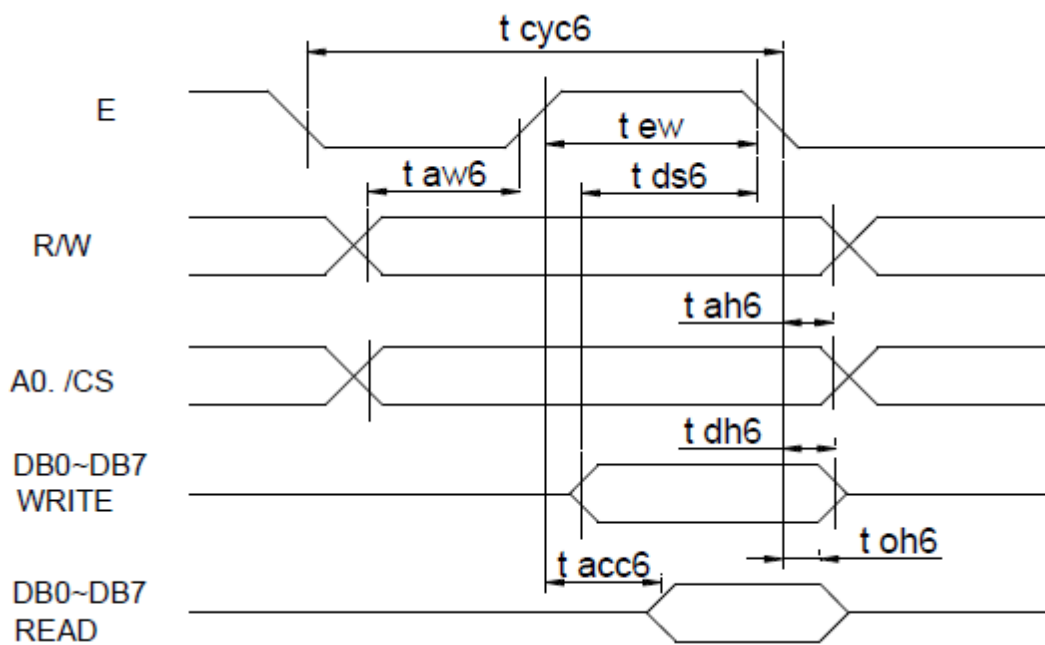
MPU bus Read/Write (8080 Interface)

Item	symbol	Conditions	Min.	Max.	unit
System cycle time	t_{cyc8}	—	1000	—	ns
Address setup time	t_{aw8}	—	20	—	ns
Address hold time	t_{ah8}	—	10	—	ns
Data setup time	t_{ds8}	—	80	—	ns
Data hold time	t_{dh8}	—	10	—	ns
Control pulse width	t_{cc}	—	200	—	ns
RD access time	t_{cc8}	CL=100pf	—	90	ns
Output disable time	t_{ch8}	—	10	60	ns



MPU bus Read/Write (6800 Interface)

Item	symbol	Conditions	Min.	Max.	unit
System cycle time	t_{cyc8}	—	1000	—	ns
Address setup time	t_{aw8}	—	20	—	ns
Address hold time	t_{ah8}	—	10	—	ns
Data setup time	t_{ds8}	—	80	—	ns
Data hold time	t_{dh8}	—	10	—	ns
Control pulse width	t_{cc}	—	200	—	ns
RD access time	t_{cc8}	CL=100pf	—	90	ns
Output disable time	t_{ch8}	—	10	60	ns



Example Initialization Program

```
/******  
void Comleft(char i)  
{  
  P1 = i;  
  R_W = 0;  
  D_I = 0;  
  E1 = 1;  
  delay(2);  
  E1 = 0;  
}  
  
void Comright(char i)  
{  
  P1 = i;  
  R_W = 0;  
  D_I = 0;  
  E2 = 1;  
  delay(2);  
  E2 = 0;  
}  
  
void Writeleft(char i)  
{  
  P1 = i;  
  R_W = 0;  
  D_I = 1;  
  E1 = 1;  
  delay(2);  
  E1 = 0;  
}  
  
void Writeright(char i)  
{  
  P1 = i;  
  R_W = 0;  
  D_I = 1;  
  E2 = 1;  
  delay(2);  
  E2 = 0;  
}  
/******  
void bothSides(char i)  
{  
  Comleft(i);  
  Comright(i);  
}  
/******  
  
void init()  
{  
  P1 = 0;  
  P3 = 0;  
  RST = 0;          //Reset RST  
  delay(1);  
  RST = 1;          //Reset RST= M68 Interface  
  delay(10);  
  D_I = 0;  
  R_W = 1;  
  
  bothSides(0xE2); //0xE2 – Software reset  
  delay(10);  
  bothSides(0xA4); //0xA4 – Static Driver off  
  bothSides(0xA9); //0xA9 – select 1/32 duty  
  bothSides(0xA0); //0xA0 – Memory/Segment mapping normal  
  bothSides(0xEE); //0xEE – End  
  bothSides(0xC0); //0xC0 – start at line address 0x00  
  bothSides(0xAF); //0xAF – display on  
}  
/******  
/******
```

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 , 48 hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 48 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 48 hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 48 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 , 48hrs	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 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