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# NHD-240128WG-AFTI-VZ#-C5

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
240128-	240 x 128 Pixels
WG-	Display Type: Graphic
A-	Model
F-	White CCFL Backlight
T-	FSTN (-)
I-	Transmissive, 6:00 Optimal View, Wide Temperature
VZ#-	Built-in Negative Voltage
C5-	Special 5-pin Backlight Connector
	<b>RoHS Compliant</b>

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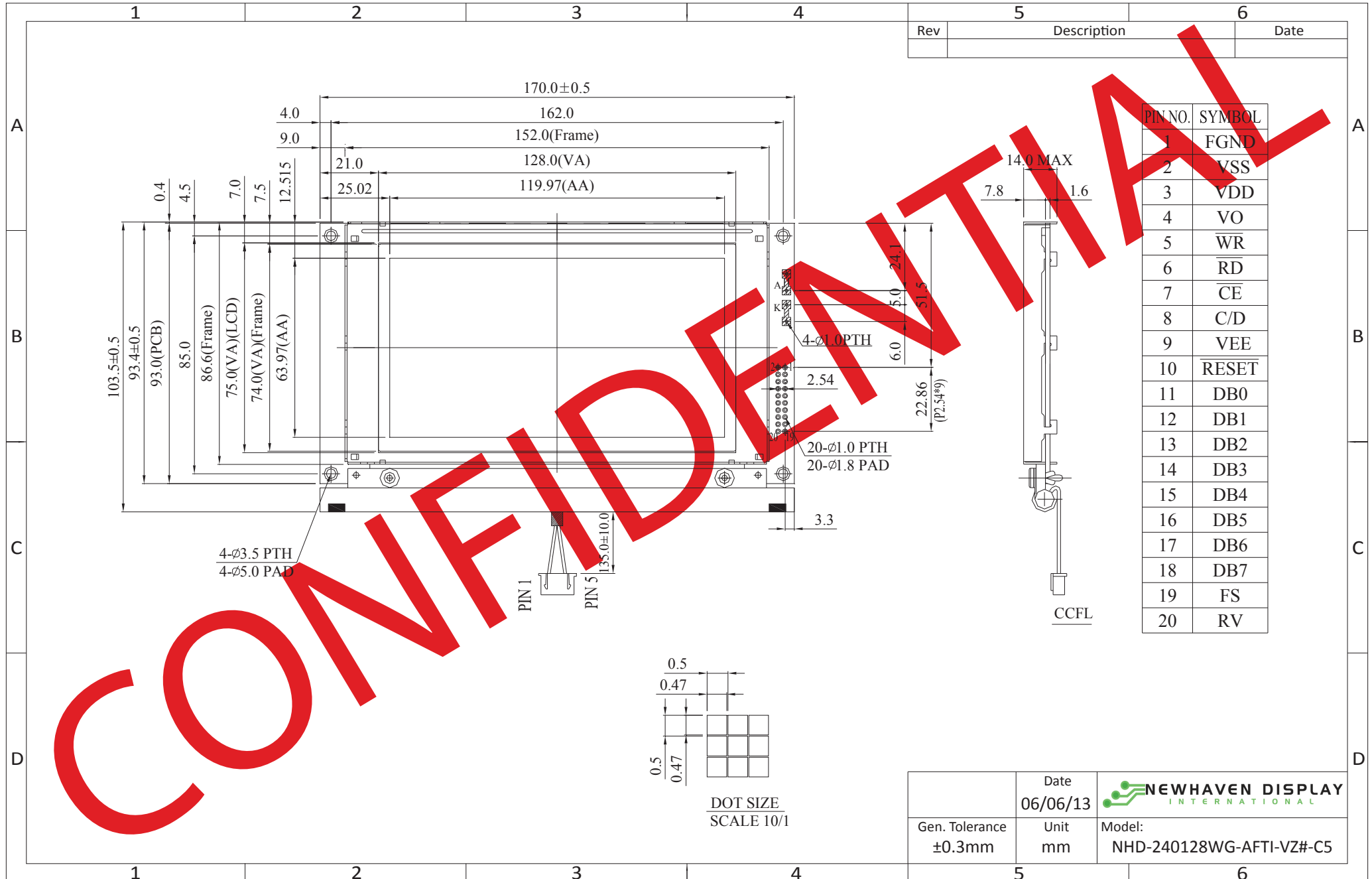
## Document Revision History

Revision	Date	Description	Changed by
0	4/28/2010	User guide reformat	MC
1	7/1/2010	Pin description updated	MP
2	6/6/2013	Drawing page and Electrical characteristics updated	KA

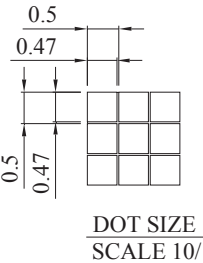
## Functions and Features


- 240 x 128 pixels
- Built-in RA6963 controller
- +5.0V power supply
- White CCFL Backlight
- RoHS compliant

# Mechanical Drawing



Rev	Description	Date



	Date 06/06/13	 <b>NEWHAVEN DISPLAY</b> INTERNATIONAL
Gen. Tolerance ±0.3mm	Unit mm	

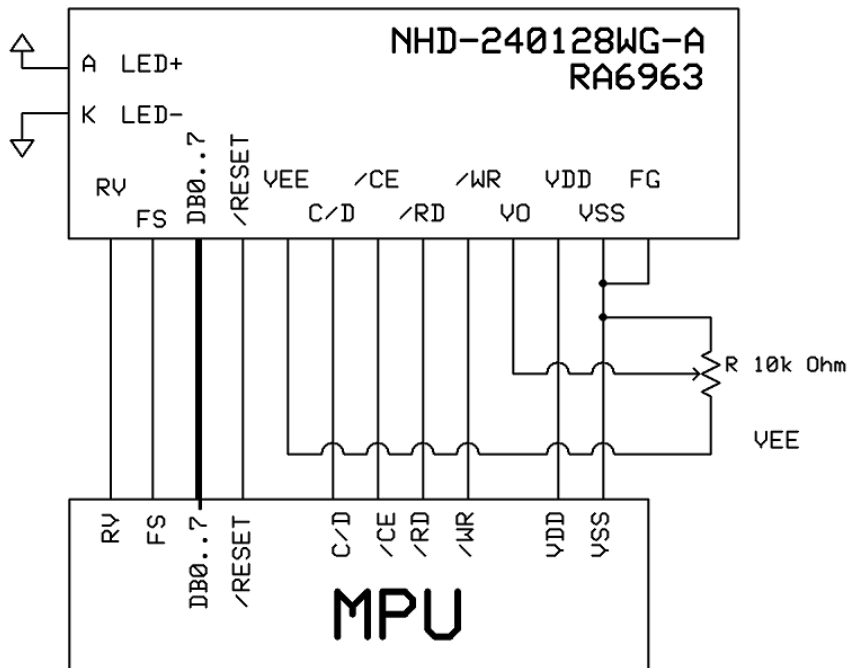
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	FGND	Power Supply	Frame Ground
2	VSS	Power Supply	Ground
3	VDD	Power Supply	Power supply for LCD and logic (+5.0V)
4	VO	Adj Power Supply	Power supply for contrast (approx. -13.0V)
5	$\overline{\text{WR}}$	MPU	Active LOW Write signal
6	$\overline{\text{RD}}$	MPU	Active LOW Read signal
7	$\overline{\text{CE}}$	MPU	Active LOW Chip Enable signal
8	C/D	MPU	Command/Data select signal. CD=1: Command, CD=0: Data
9	VEE	Power Supply	Negative voltage output (-16V)
10	$\overline{\text{RESET}}$	MPU	Active LOW Reset signal
11-18	DB0~DB7	MPU	8-bit bi-directional three-state data bus lines.
19	FS	Power Supply	Font Select signal. H:6x8, L:8x8
20	RV	MPU	Display mode signal. RV=1: Reverse display, RV=0: normal

**Recommended LCD connector:** 20 pin, 2.54mm pitch pins

**Backlight connector:** JST p/n: XHP-5    **Mates with:** JST p/n: B 5B-XH-A



## 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		3.0	5.0	5.5	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	-	23.0	-	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	17.5	18.0	18.5	V
"H" Level input	VIH		0.8*VDD	-	VDD	V
"L" Level input	VIL	-	0	-	0.2*VDD	V
"H" Level output	VOH	-	VDD-0.3	-	VDD	V
"L" Level output	VOL	-	0	-	0.3	V
Backlight Supply Voltage	VL		351	390	429	Vrms
Backlight Supply Current	IL		4.5	5.0	5.5	mArms
Backlight Lifetime			20,000	-	-	Hrs
Backlight Brightness		IL=5.0mArms	900	-	-	Cd/m <sup>2</sup>

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		Cr ≥ 2	-	30	-	°
Viewing Angle – Bottom			-	60	-	°
Viewing Angle – Left			-	45	-	°
Viewing Angle – Right			-	45	-	°
Contrast Ratio	Cr		-	5	-	-
Response Time (rise)	Tr	-	-	150	200	ms
Response Time (fall)	Tf	-	-	150	200	ms

## Controller Information

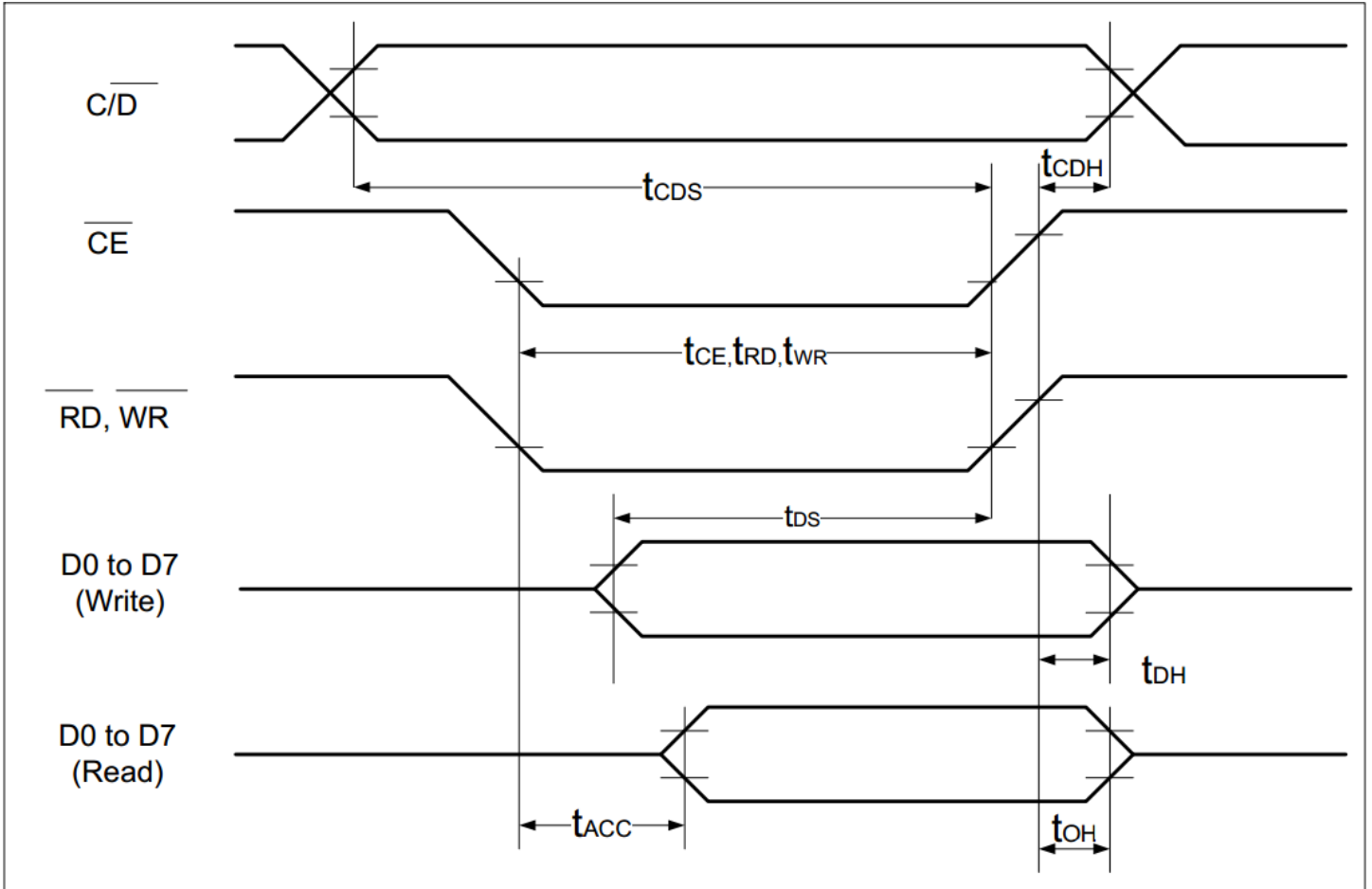
Built-in RA6963 Controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/RA6963.pdf](http://www.newhavendisplay.com/app_notes/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
C/ $\overline{D}$ Set Up Time	$t_{CDS}$	--	100	--	ns
C/ $\overline{D}$ 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



# Built-in Font Table

LSB \ MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
3	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
4	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	v	w	x	y	z	{		}	~	
6	Q	U	E	A	A	A	A	Q	E	E	E	i	i	i	A	A
7	E	E	E	o	o	o	o	U	U	U	U	U	U	U	U	U

## Example Program Code

```
//-----  
Sub Writecom  
P1 = A                'move data to port 1  
Set P3.0              'set I/D for instruction  
Reset P3.1            'reset /CS  
Reset P3.4            'reset /WR  
Set P3.1              'set /CS  
Set P3.4              'set /WR  
End Sub  
  
Sub Writedata  
P1 = A                'move data to port 1  
Reset P3.0            'reset I/D for instruction  
Reset P3.1            'reset /CS  
Reset P3.4            'toggle /CS and /WR  
Set P3.1              'set /CS  
Set P3.4              'set /WR  
End Sub  
  
//-----  
Sub Init  
Set P3.6  
Set P3.7  
Reset P3.3            'reset FS  
A = &H00  
Call Writedata  
Call Writedata        'text address = 0000h  
A = &H40  
Call Writecom         'text home address set  
A = &H00  
Call Writedata  
A = &H40               'graphic home address = 4000h  
Call Writedata  
A = &H42  
Call Writecom         'graphic home address set  
A = &H1E  
Call Writedata  
A = &H00               'text area address = 001Eh  
Call Writedata  
A = &H41  
Call Writecom         'text area control set  
A = &H1E  
Call Writedata  
A = &H00               'graphic area = 001Eh  
Call Writedata  
A = &H43  
Call Writecom         'graphic area control set  
A = &H80  
Call Writecom         'set display mode  
End Sub
```

## 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, 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C, 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 96hrs	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, 96hrs	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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information

See Terms & Conditions at [http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)