

# NHD-320240WG-BxTGH-VZ#-3VR

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
320240-	320 x 240 pixels
WG-	Display Type: Graphic
Bx-	Model
T-	White LED Backlight
G-	STN- Gray
H-	Transflective, 6:00 view, Wide Temperature (-20°C ~+70°C)
VZ#-	Built-in Negative Voltage
3VR-	3.3V Vdd, Frame Ground
	<b>RoHS Compliant</b>

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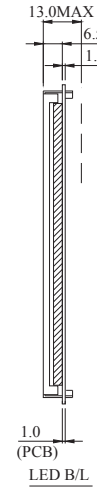
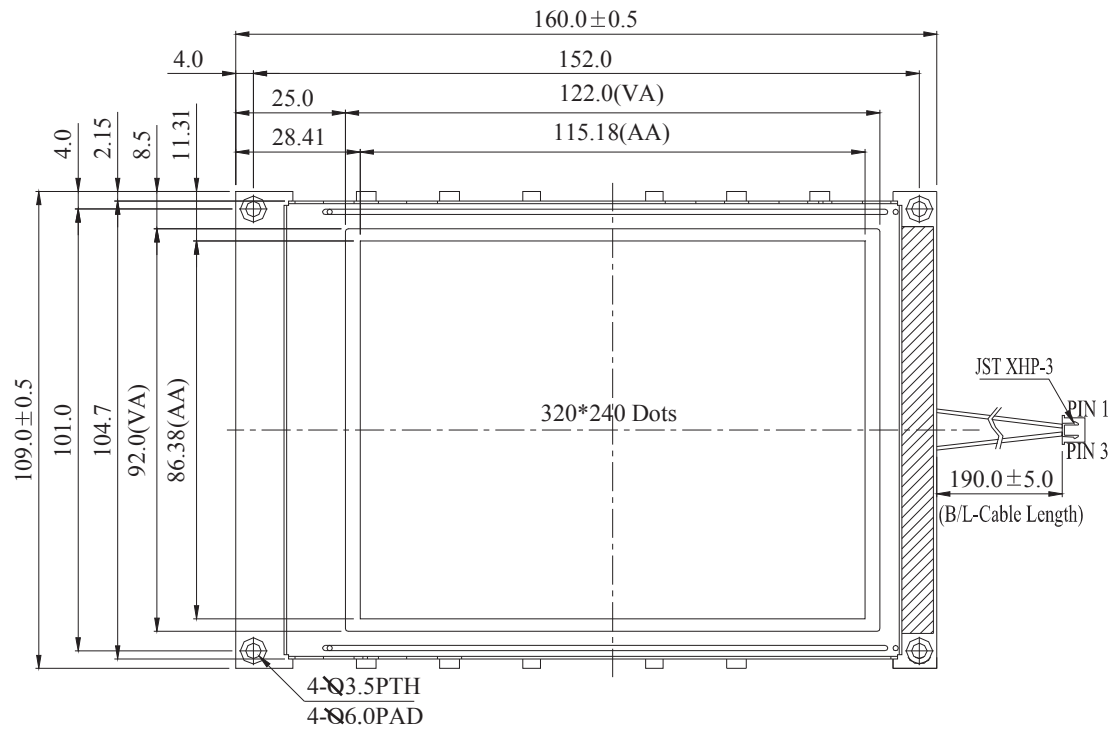
## Document Revision History

Revision	Date	Description	Changed by
0	6/7/2007	Initial Release	-
1	3/16/2010	User guide reformat	MC
2	9/2/2010	Mechanical drawing update	MP

## Functions and Features

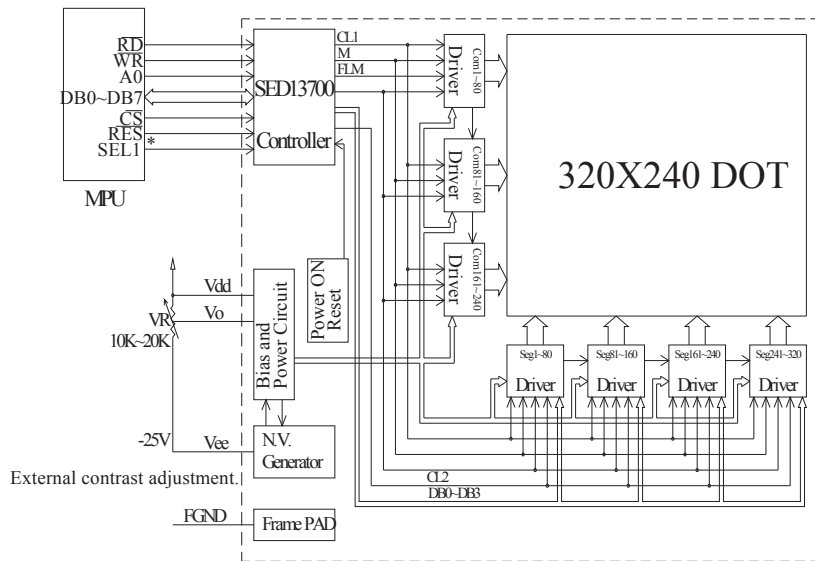
- 320 x 240 pixels
- Built-in S1D13700 Controller
- +3.3V power supply
- RoHS Compliant

# Mechanical Drawing

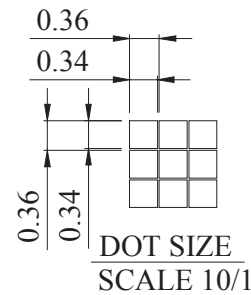


The non-specified tolerance of dimension is 0.3mm.

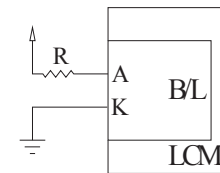
PIN NO.	SYMBOL
1	VSS
2	VDD
3	Vo
4	A0
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	/CS
16	/RST
17	Vee
18	NC
19	NC
20	WAIT



\*:6800 family or 8080family interface selectable.



LED B/L drive directly from A and K.



Newhaven Display

NHD-320240WG-BXTGH-VZ-3VR

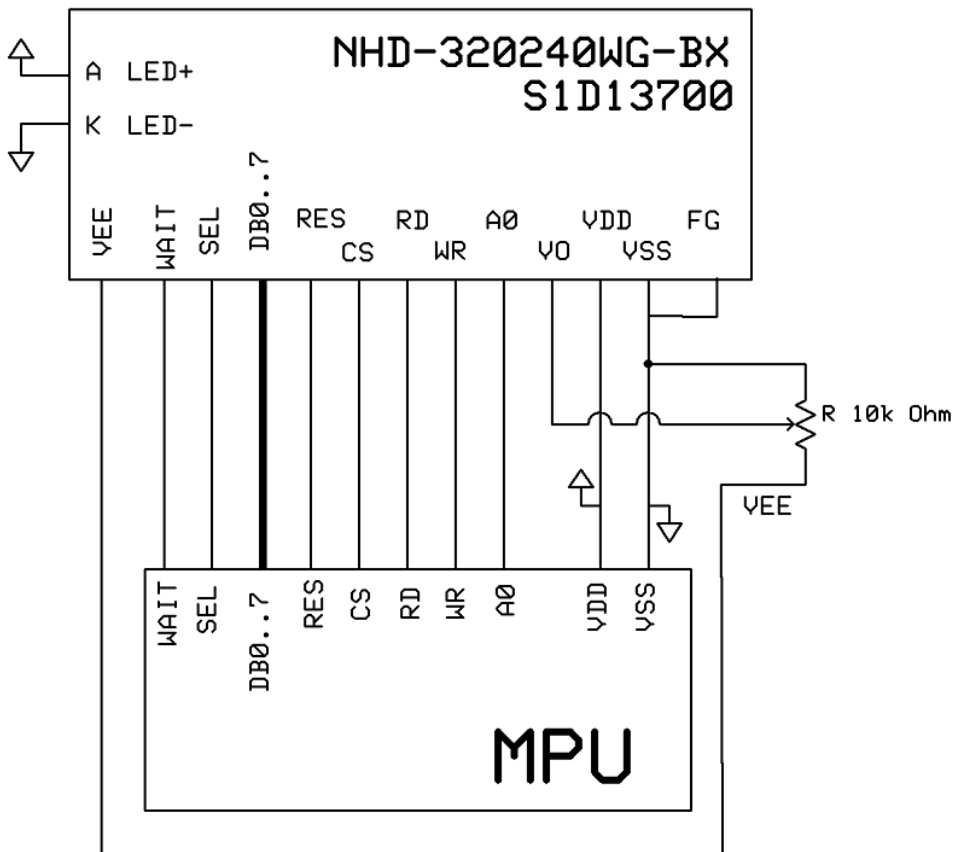
## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+3.3V)
3	VO	Adj Power Supply	Power supply for contrast (approx. -18.8V)
4	A0	MPU	Register select signal. A0=0: Command, A0=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.
7-14	DB0-DB7	MPU	Bi-directional three-state data bus lines.
15	/CS	MPU	Active LOW chip select
16	/RST	MPU	Active LOW reset signal
17	VEE	Power Supply	Negative voltage output (-25V)
18	NC	-	No Connect
19	NC	-	No Connect
20	WAIT	MPU	Check Busy

**Recommended LCD connector:** 1.0mm pitch, 20-pos FFC connector

**Backlight connector:** JST p/n: XHP-3

**Mates with:** JST p/n: B 3B-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	3.3	3.5	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	65.0	75.0	85.0	mA
Supply for LCD (contrast)	VDD-VLCD	Ta=25°C	20.0	21.8	24.1	V
"H" Level input	VIH		0.5VDD	-	VDD	V
"L" Level input	VIL	-	0	-	0.2VDD	V
"H" Level output	VOH	-	-0.4VDD	-	-	V
"L" Level output	VOL	-	-	-	0.4	V
Backlight Supply Voltage	VLED		3.4	3.5	3.6	V
Backlight Supply Current	ILED	VLED=3.5V	120	160	180	mA
Backlight Lifetime		ILED=160mA	-	50,000	-	Hrs

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	AV	Cr ≥ 3	-20	-	40	°
Viewing Angle - Horizontal	AH	Cr ≥ 3	-30	-	30	°
Contrast Ratio	Cr		-	3	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	150	200	ms

## Controller Information

Built-in S1D13700. Download specification at [http://www.newhavendisplay.com/app\\_notes/S1D13700.pdf](http://www.newhavendisplay.com/app_notes/S1D13700.pdf)

## Table of Commands

<b>REG[01h] Horizontal Character Size Register</b>							
Address = 8001h    Default = 00h							Read/Write
MOD	n/a			Horizontal Character Size bits 3-0			
7	6	5	4	3	2	1	0
<b>REG[02h] Vertical Character Size Register</b>							
Address = 8002h    Default = 00h							Read/Write
n/a			Vertical Character Size bits 3-0				
7	6	5	4	3	2	1	0
<b>REG[03h] Character Bytes Per Row Register</b>							
Address = 8003h    Default = 00h							Read/Write
Character Bytes Per Row bits 7-0							
7	6	5	4	3	2	1	0
<b>REG[04h] Total Character Bytes Per Row Register</b>							
Address = 8004h    Default = 00h							Read/Write
Total Character Bytes Per Row bits 7-0							
7	6	5	4	3	2	1	0
<b>REG[05h] Frame Height Register</b>							
Address = 8005h    Default = 00h							Read/Write
Frame Height bits 7-0							
7	6	5	4	3	2	1	0
<b>REG[06h] Horizontal Address Range Register 0</b>							
Address = 8006h    Default = 00h							Read/Write
Horizontal Address Range bits 7-0							
7	6	5	4	3	2	1	0
<b>REG[07h] Horizontal Address Range Register 1</b>							
Address = 8007h    Default = 00h							Read/Write
Horizontal Address Range bits 15-8							
7	6	5	4	3	2	1	0
<b>REG[08h] Power Save Mode Register</b>							
Address = 8008h    Default = 01h							Read/Write
n/a						Power Save Mode Enable	
7	6	5	4	3	2	1	0
<b>REG[09h] Display Enable Register</b>							
Address = 8009h    Default = 00h							Read/Write
n/a						Display Enable	
7	6	5	4	3	2	1	0
<b>REG[0Ah] Display Attribute Register</b>							
Address = 800Ah    Default = 00h							Read/Write
SAD3 Attribute bits 1-0		SAD2 Attribute bits 1-0		SAD1 Attribute bits 1-0		Cursor Attribute bits 1-0	
7	6	5	4	3	2	1	0
<b>REG[0Bh] Screen Block 1 Start Address Register 0</b>							
Address = 800Bh    Default = 00h							Read/Write
Screen Block 1 Start Address bits 7-0 (LSB)							
7	6	5	4	3	2	1	0
<b>REG[0Ch] Screen Block 1 Start Address Register 1</b>							
Address = 800Ch    Default = 00h							Read/Write
Screen Block 1 Start Address bits 15-8 (MSB)							
7	6	5	4	3	2	1	0
<b>REG[0Dh] Screen Block 1 Size Register</b>							
Address = 800Dh    Default = 00h							Read/Write
Screen Block 1 Size bits 7-0							
7	6	5	4	3	2	1	0

<b>REG[0Eh] Screen Block 2 Start Address Register 0</b>								Read/Write
Address = 800Eh Default = 00h								
Screen Block 2 Start Address bits 7-0 (LSB)								
7	6	5	4	3	2	1	0	
<b>REG[0Fh] Screen Block 2 Start Address Register 1</b>								Read/Write
Address = 800Fh Default = 00h								
Screen Block 2 Start Address bits 15-8 (MSB)								
7	6	5	4	3	2	1	0	
<b>REG[10h] Screen Block 2 Size Register</b>								Read/Write
Address = 8010h Default = 00h								
Screen Block 2 Size bits 7-0								
7	6	5	4	3	2	1	0	
<b>REG[11h] Screen Block 3 Start Address Register 0</b>								Read/Write
Address = 8011h Default = 00h								
Screen Block 3 Start Address bits 7-0 (LSB)								
7	6	5	4	3	2	1	0	
<b>REG[12h] Screen Block 3 Start Address Register 1</b>								Read/Write
Address = 8012h Default = 00h								
Screen Block 3 Start Address bits 15-8 (MSB)								
7	6	5	4	3	2	1	0	
<b>REG[13h] Screen Block 4 Start Address Register 0</b>								Read/Write
Address = 8013h Default = 00h								
Screen Block 4 Start Address bits 7-0 (LSB)								
7	6	5	4	3	2	1	0	
<b>REG[14h] Screen Block 4 Start Address Register 1</b>								Read/Write
Address = 8014h Default = 00h								
Screen Block 4 Start Address bits 15-8 (MSB)								
7	6	5	4	3	2	1	0	
<b>REG[15h] Cursor Width Register</b>								Read/Write
Address = 8015h Default = 00h								
n/a				Cursor Width bits 3-0				
7	6	5	4	3	2	1	0	
<b>REG[16h] Cursor Height Register</b>								Read/Write
Address = 8016h Default = 00h								
Cursor Mode	n/a			Cursor Height bits 3-0				
7	6	5	4	3	2	1	0	
<b>REG[17h] Cursor Shift Direction Register</b>								Read/Write
Address = 8017h Default = 00h								
n/a					Cursor Shift Direction bits 1-0			
7	6	5	4	3	2	1	0	
<b>REG[18h] Overlay Register</b>								Read/Write
Address = 8018h Default = 00h								
n/a			3 Layer Overlay Select	Screen Block 3 Display Mode	Screen Block 1 Display Mode	Layer Composition Method bits 1-0		
7	6	5	4	3	2	1	0	
<b>REG[19h] Character Generator RAM Start Address Register 0</b>								Read/Write
Address = 8019h Default = 00h								
CGRAM Start Address bits 7-0 (LSB)								
7	6	5	4	3	2	1	0	
<b>REG[1Ah] Character Generator RAM Start Address Register 1</b>								Read/Write
Address = 801Ah Default = 00h								
CGRAM Start Address bits 15-8 (MSB)								
7	6	5	4	3	2	1	0	
<b>REG[1Bh] Horizontal Pixel Scroll Register</b>								Read/Write
Address = 801Bh Default = 00h								
n/a				Horizontal Pixel Scroll bits 2-0				
7	6	5	4	3	2	1	0	

<b>REG[1Ch] Cursor Write Register 0</b>								Write Only
Address = 801Ch    Default = 00h								
Cursor Write bits 7-0 (LSB)								
7	6	5	4	3	2	1	0	
<b>REG[1Dh] Cursor Write Register 1</b>								Write Only
Address = 801Dh    Default = 00h								
Cursor Write bits 15-8 (MSB)								
7	6	5	4	3	2	1	0	
<b>REG[1Eh] Cursor Read Register 0</b>								Read Only
Address = 801Eh    Default = 00h								
Cursor Read bits 7-0 (LSB)								
7	6	5	4	3	2	1	0	
<b>REG[1Fh] Cursor Read Register 1</b>								Read Only
Address = 801Fh    Default = 00h								
Cursor Read bits 15-8 (MSB)								
7	6	5	4	3	2	1	0	
<b>REG[20h] Bit-Per-Pixel Select Register</b>								Read/Write
Address = 8020h    Default = 00h								
n/a					Bit-Per-Pixel Select bits 1-0			
7	6	5	4	3	2	1	0	

## Timing Characteristics

### 7.3.5 M6800 Family Bus Indirect Interface Timing

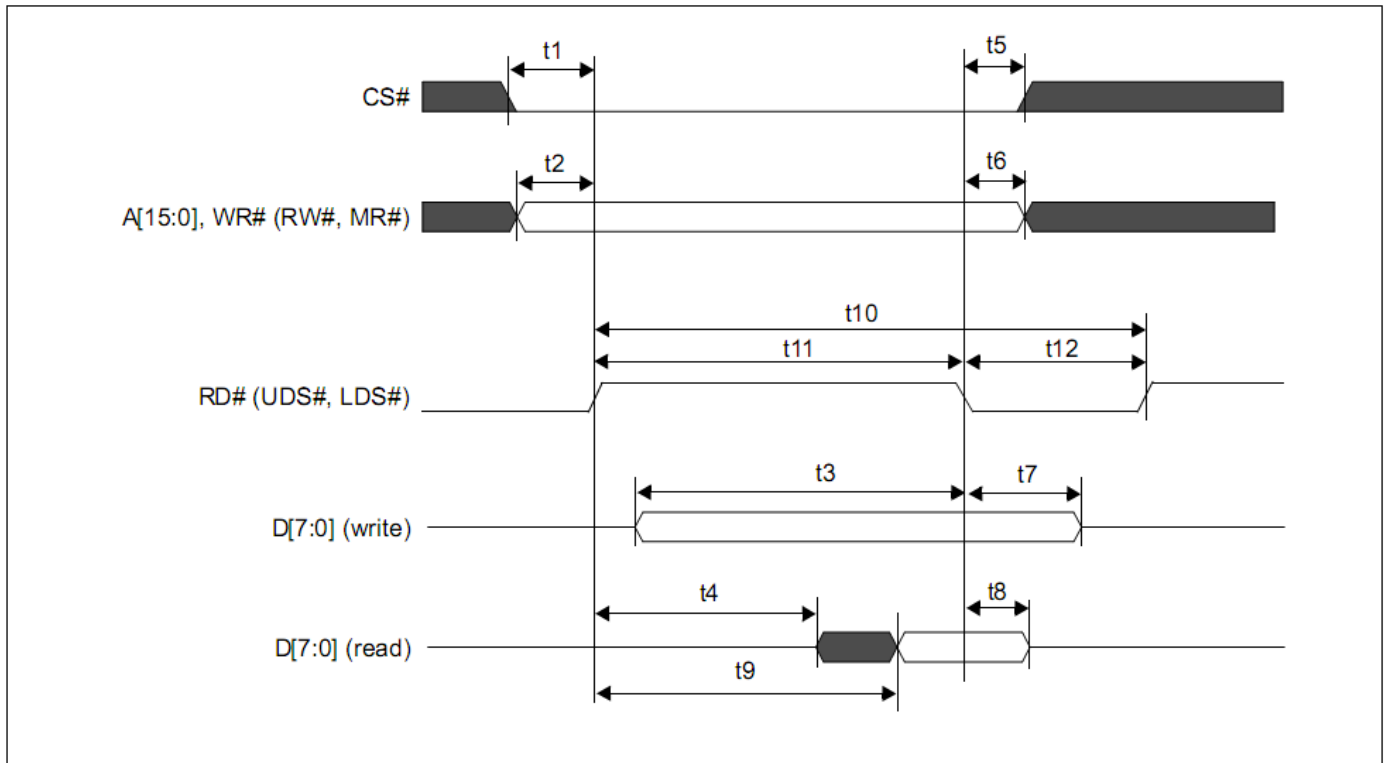


Figure 7-7 M6800 Family Bus Indirect Interface Timing



Table 7-7 M6800 Family Bus Indirect Interface Timing

Symbol	Parameter	3.3 Volt		5.0 Volt		Units
		Min	Max	Min	Max	
t1	CS# setup time	5	—	5	—	ns
t2	A[15:0] setup time	5	—	5	—	ns
t3	D[7:0] setup time to RD# falling edge (write cycle)	Note 2	—	Note 2	—	ns
t4	RD# rising edge to D[7:0] driven (read cycle)	3	—	3	—	ns
t5	CS# hold time	7	—	7	—	ns
t6	A[15:0] hold time	7	—	7	—	ns
t7	D[7:0] hold time from RD# falling edge (write cycle)	5	—	5	—	ns
t8	D[7:0] hold time from RD# falling edge (read cycle)	2	55	2	55	ns
t9	RD# rising edge to valid Data	—	Note 3	—	Note 3	ns
t10	RD# cycle time	Note 4	—	Note 4	—	ns
t11	RD# pulse active time	5	—	5	—	Ts
t12	RD# pulse inactive time	Note 5	—	Note 5	—	ns

## Example Initialization Program:

```
//-----
Sub Writecom
Set P3.0                                'A0 = H = Write command
P1 = A                                  'move data to P1
Reset P3.1                               'chip select
Reset P3.7                               'R/W
Set P3.4                                  'E
Reset P3.4                               'E
Set P3.7                                  'R/W
Set P3.1                                  'CS
End Sub

Sub Writedata
Reset P3.0                                'A0 = L = Write data
P1 = A
Reset P3.1
Reset P3.7
Set P3.4
Reset P3.4
Set P3.7
Set P3.1
End Sub
//-----
Sub Init
Set P3.2                                  'SEL=1 = Motorola 6800 write
interface
Reset P3.6                               'RESET
Waitms 10                                'wait
Set P3.6                                 'RESET done
```

```

Waitms 100
A = &H40
Call Writecom
A = &H30
Call Writedata
A = &H87
Call Writedata
A = &H07
Call Writedata
A = &H27
Call Writedata
A = &H50
Call Writedata
A = &HEF
Call Writedata
A = &H28
Call Writedata
A = &H00
Call Writedata
A = &H44
Call Writecom
A = &H00
Call Writedata
A = &H00
Call Writedata
A = &HEF
Call Writedata
A = &HB0
Call Writedata
A = &H04
Call Writedata
A = &HEF
Call Writedata
A = &H00
Call Writedata
A = &H00
Call Writedata
A = &H00
Call Writedata
A = &H00
Call Writedata
A = &H5A
Call Writecom
A = &H00
Call Writedata
A = &H5B
Call Writecom
A = &H00
Call Writedata
A = &H5D
Call Writecom
A = &H04
Call Writedata
A = &H86
Call Writedata
A = &H4C
Call Writecom

Call Clr

A = &H59
Call Writecom
A = &H14
Call Writedata
End Sub
//-----

```

```

'wait
'system set command

'set parameters

'horizontal character size=8

'vertical character size=8

'display addresses per line

'total address range per line

'240 display lines

'virtual address1

'virtual address2

'scroll

'start address1

'start address2

'240 lines

'2nd screen start1

'2nd screen start2

'2nd screen 240 lines

'3rd screen address1

'3rd screen address2

'4th screen address1

'4th screen address2

'hdot scr

'horizontal pixel shift=0

'overlay

'OR

'cursor form

'5 pixels

'by 7 pixels

'cursor direction = right

'clear the screen

'disp on/off

'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 , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	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 and Terms & Conditions

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

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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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«JONHON» (основан в 1970 г.)

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«FORSTAR» (основан в 1998 г.)

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(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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