

NHD-320240WG-BxTFH-VZ#

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
320240-	320 x 240 pixels
WG-	Display Type: Graphic
Bx-	Model
T-	White LED Backlight
F-	FSTN (+)
H-	Transflective, 6:00 view, Wide Temperature (-20°C ~+70°C)
VZ#-	Built-in Negative Voltage
	RoHS Compliant

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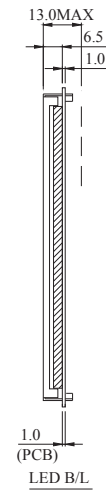
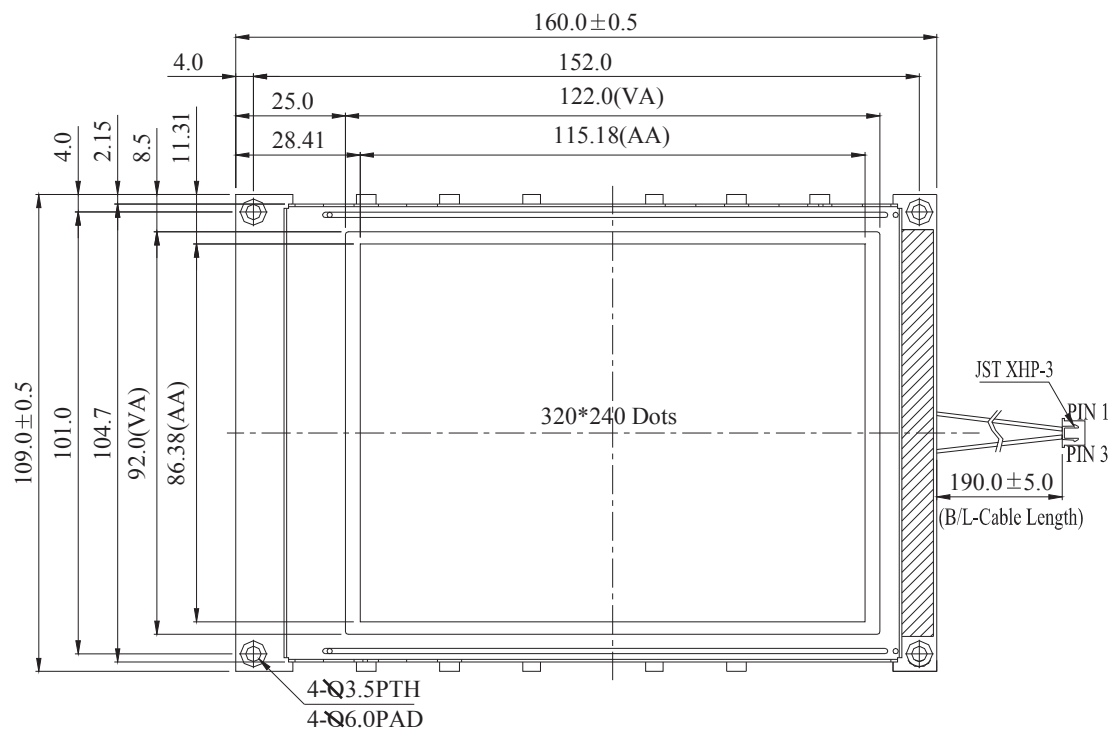
Document Revision History

Revision	Date	Description	Changed by
0	6/7/2007	Initial Release	-
1	4/20/2010	User guide reformat	MC
2	9/22/2011	Electrical characteristics updated	AK

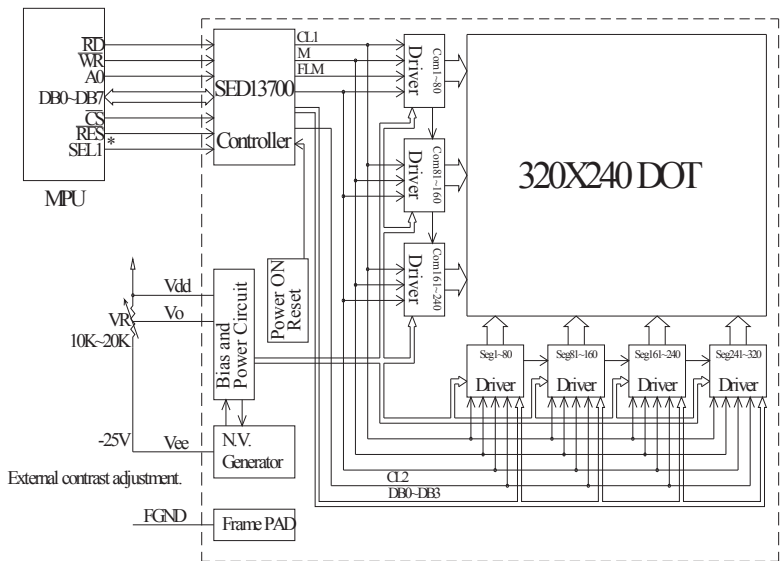
Functions and Features

- 320 x 240 pixels
- Built-in S1D13700 Controller
- +5.0V or +3.3V power supply
- RoHS Compliant

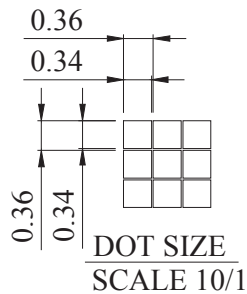
Mechanical Drawing



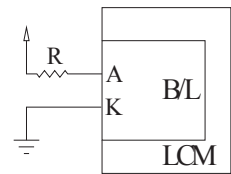
The non-specified tolerance of dimension is ±0.3mm.



*:6800 family or 8080family interface selectable.



LED B/L drive directly from A and K.



Newhaven Display

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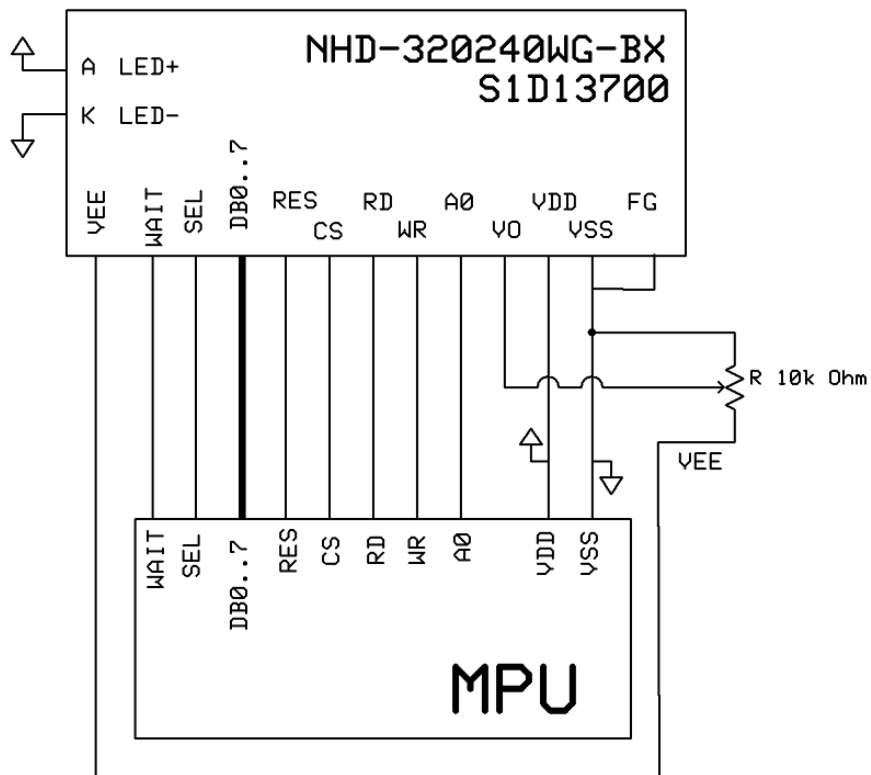
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+5.0V)
3	V0	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	FG	-	No Connect
20	NC	-	No Connect

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



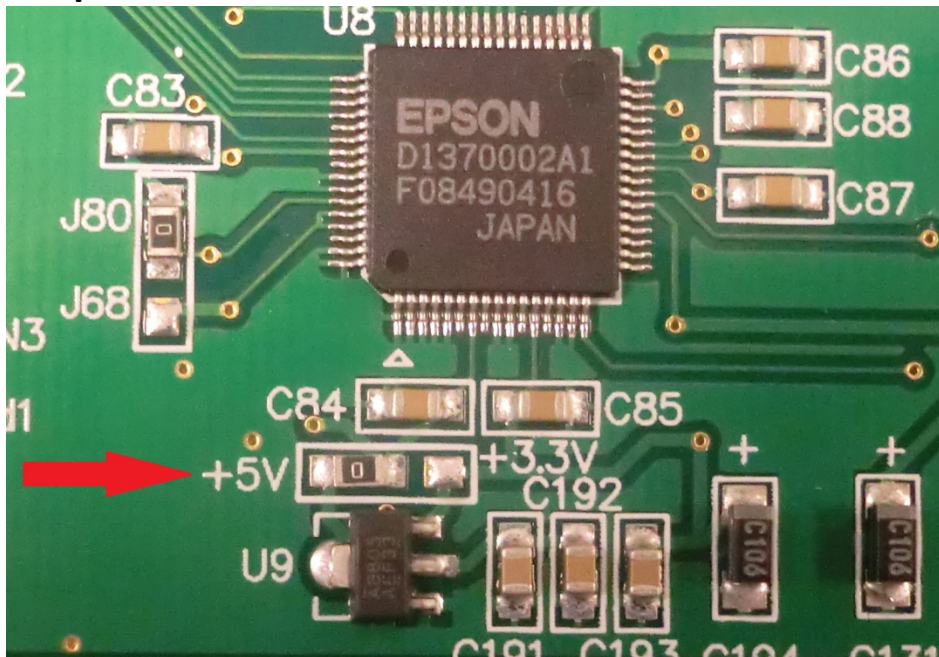
Electrical Characteristics

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		3.3	5.0	5.25	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	22.0	23.8	26.1	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	140	160	180	mA
Backlight Lifetime		ILED=160mA	-	50,000	-	Hrs

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	AV	Cr ≥ 2	-30	-	60	°
Viewing Angle - Horizontal	AH	Cr ≥ 2	-45	-	45	°
Contrast Ratio	Cr		-	5	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	150	200	ms

Jumper Selection



Controller Information

Built-in S1D13700. Download specification at http://www.newhavendisplay.com/app_notes/S1D13700.pdf

Table of Commands

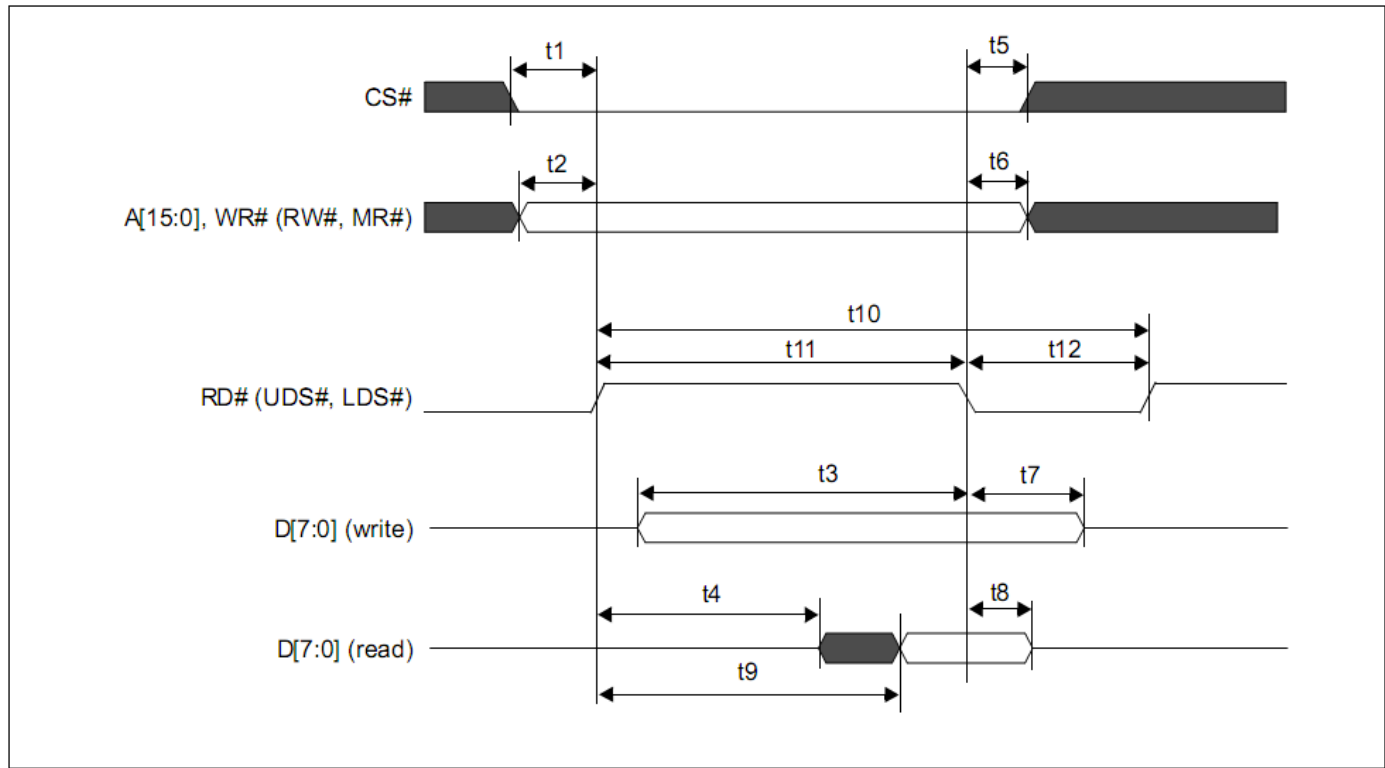
REG[01h] Horizontal Character Size Register							
Address = 8001h Default = 00h				Read/Write			
MOD		n/a		Horizontal Character Size bits 3-0			
7	6	5	4	3	2	1	0
REG[02h] Vertical Character Size Register							
Address = 8002h Default = 00h				Read/Write			
n/a			Vertical Character Size bits 3-0				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

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

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



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
  P1 = A
  Reset P3.1
  Reset P3.7
  Set P3.4
  Reset P3.4
  Set P3.7
  Set P3.1
End Sub

Sub Writedata
  Reset P3.0
  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
interface
  Reset P3.6
  Waitms 10
  Set P3.6
  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
End Sub

'A0 = H = Write command
'move data to P1
'chip select
'R/W
'E
'E
'R/W
'CS

'A0 = L = Write data

'SEL=1 = Motorola 6800 write
'RESET
'wait
'RESET done
'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
```

A = &H00	'4th screen address1
Call Writedata	
A = &H00	'4th screen address2
Call Writedata	
A = &H5A	'hdot scr
Call Writecom	
A = &H00	'horizontal pixel shift=0
Call Writedata	
A = &H5B	'overlay
Call Writecom	
A = &H00	'OR
Call Writedata	
A = &H5D	'cursor form
Call Writecom	
A = &H04	'5 pixels
Call Writedata	
A = &H86	'by 7 pixels
Call Writedata	
A = &H4C	'cursor direction = right
Call Writecom	
Call Clr	'clear the screen
A = &H59	'disp on/off
Call Writecom	
A = &H14	'on
Call Writedata	
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 , 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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms