

NHD-320240WG-BxTGK-VZ#-3VR-C

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
K-	Transflective, 6:00 view, Wide Temperature (-20°C ~+70°C)
VZ#-	Built-in Negative Voltage
3VR-	3.3V Vdd, Frame Ground
C-	Flat Flex Cable soldered on
	RoHS Compliant

Newhaven Display International, Inc.

2511 Technology Drive, Suite 101

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com

nhsales@newhavendisplay.com

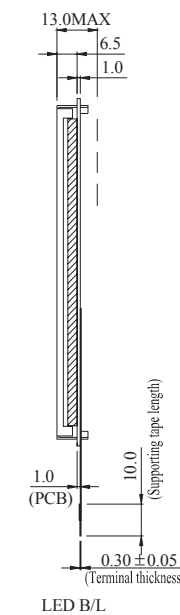
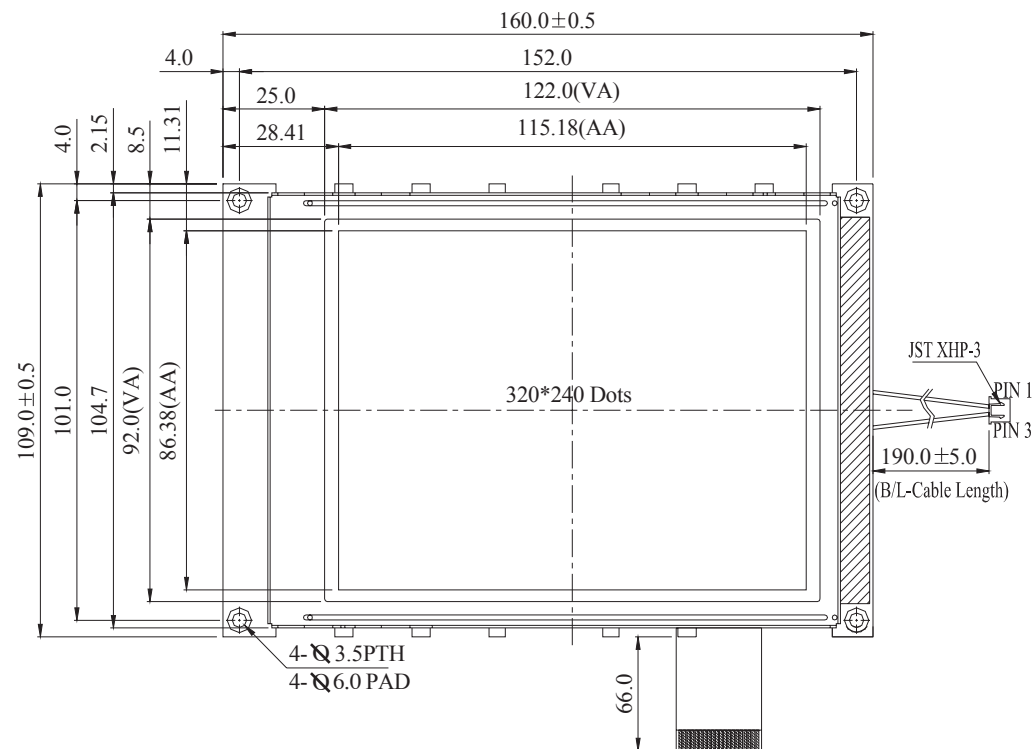
Document Revision History

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

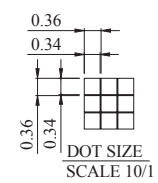
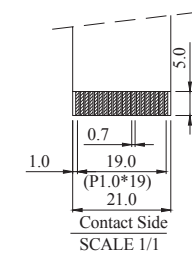
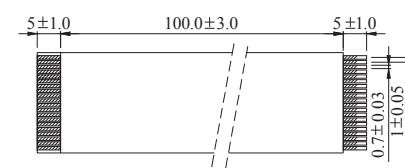
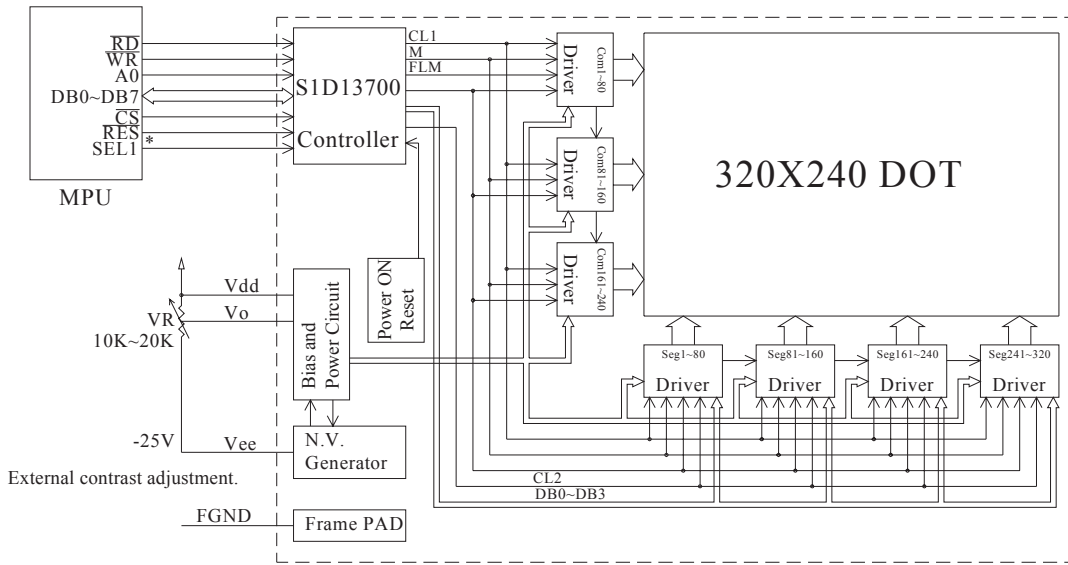
Functions and Features

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

Mechanical Drawing



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



Newhaven Display

NHD-320240WG-BxTGK-VZ#-3VR-C

*:6800 family or 8080family interface selectable.

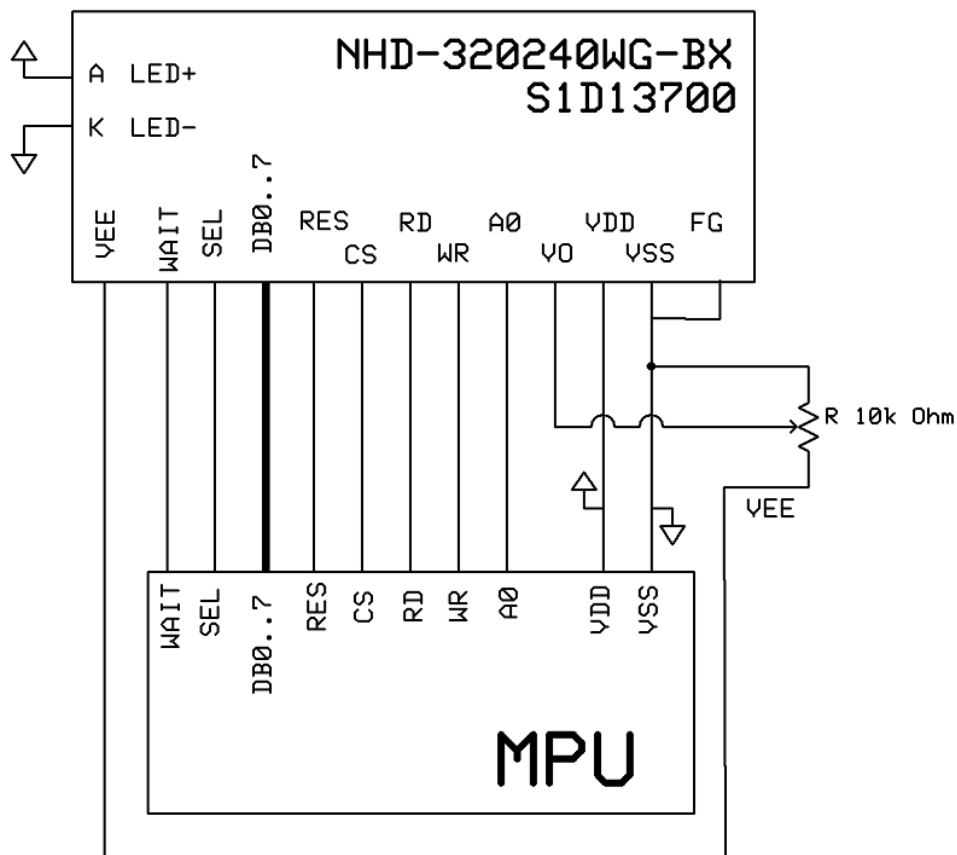
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+3.3V)
3	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	NC	-	No Connect
20	WAIT	MPU	Check busy

Recommended LCD 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	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	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

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

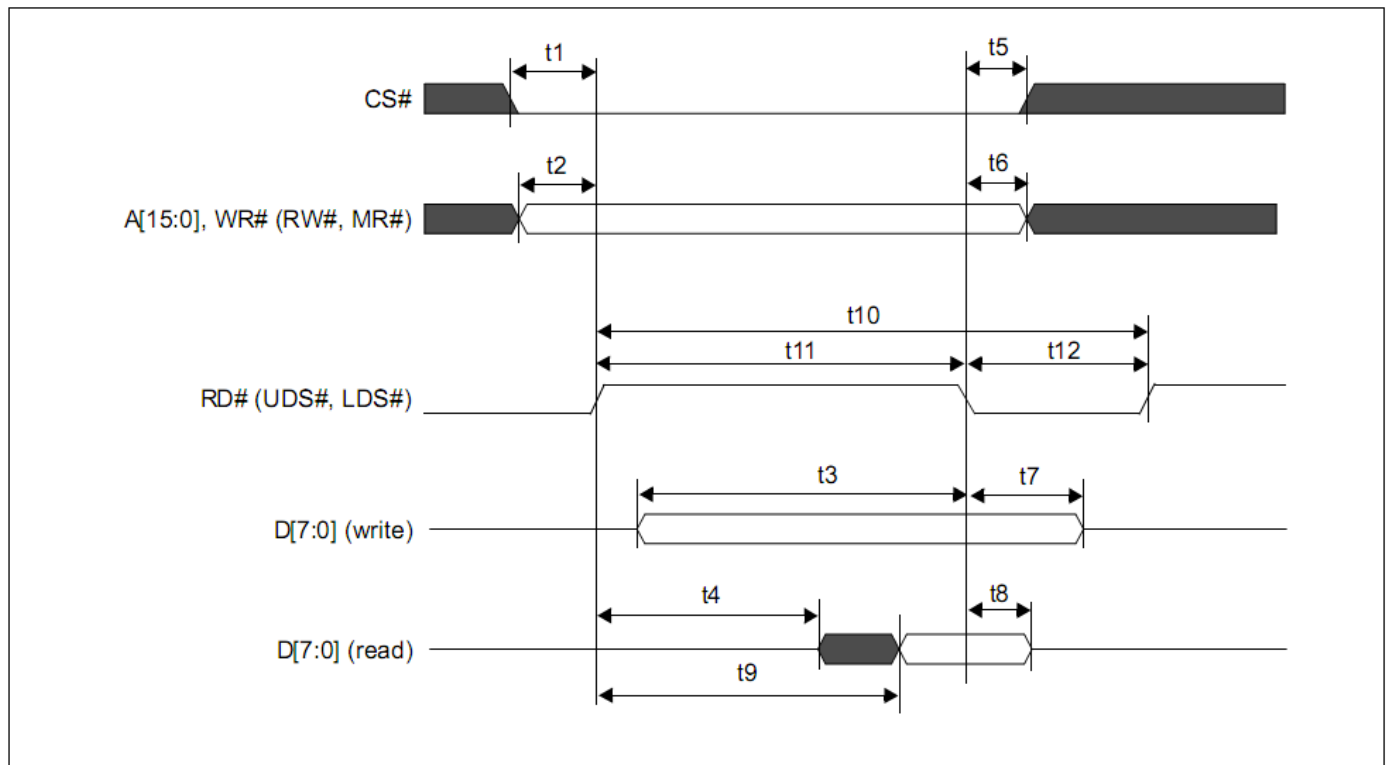


Figure 7-7 M6800 Family Bus Indirect Interface Timing

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	'wait
A = &H40	'system set command
Call Writecom	
A = &H30	'set parameters
Call Writedata	
A = &H87	'horizontal character size=8
Call Writedata	
A = &H07	'vertical character size=8
Call Writedata	
A = &H27	'display addresses per line
Call Writedata	
A = &H50	'total address range per line
Call Writedata	
A = &HEF	'240 display lines
Call Writedata	
A = &H28	'virtual address1
Call Writedata	
A = &H00	'virtual address2
Call Writedata	
A = &H44	'scroll
Call Writecom	
A = &H00	'start address1
Call Writedata	
A = &H00	'start address2
Call Writedata	
A = &HEF	'240 lines
Call Writedata	
A = &HB0	'2nd screen start1
Call Writedata	
A = &H04	'2nd screen start2
Call Writedata	
A = &HEF	'2nd screen 240 lines
Call Writedata	
A = &H00	'3rd screen address1
Call Writedata	
A = &H00	'3rd screen address2
Call Writedata	
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