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
	RoHS Compliant

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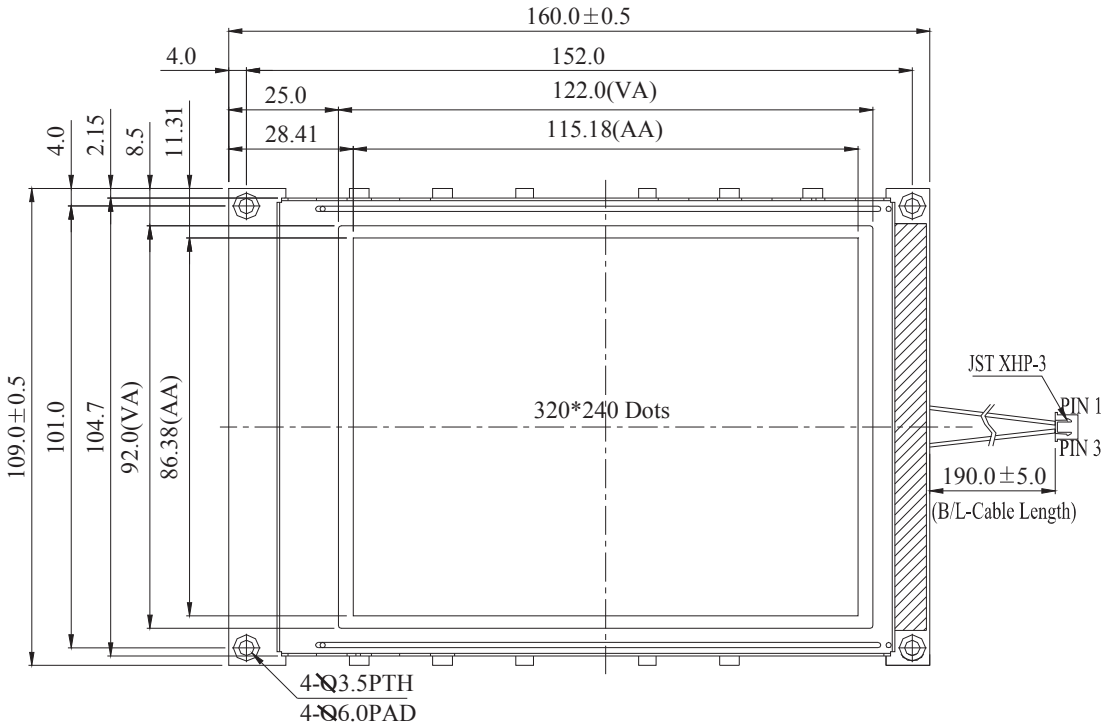
Document Revision History

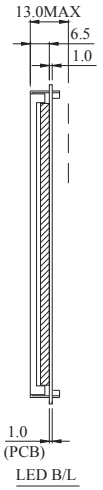
Revision	Date	Description	Changed by
0	6/7/2007	Initial Release	-
1	3/16/2010	User guide reformat	MC
2	9/2/2010	Mechanical drawing update	MP

Functions and Features

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

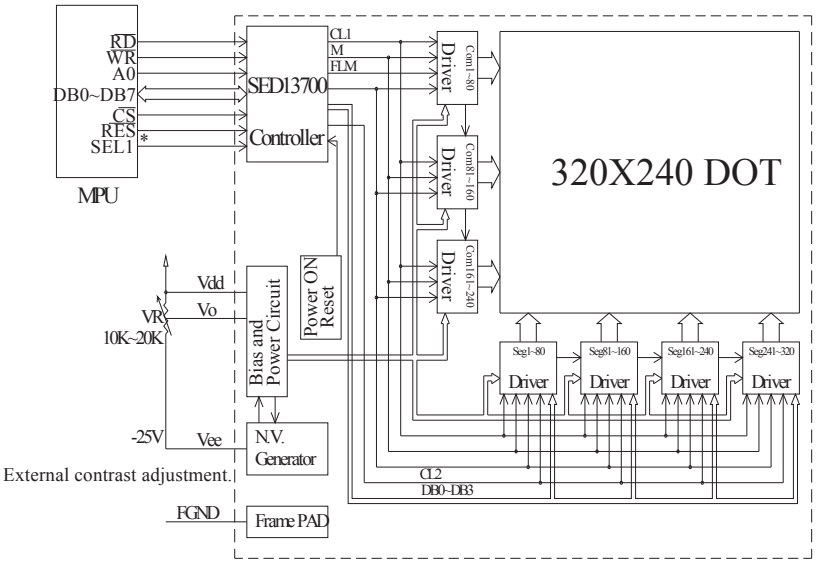
Mechanical Drawing



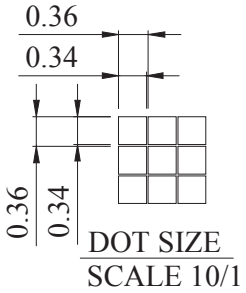


The non-specified tolerance of dimension is 0.3mm.

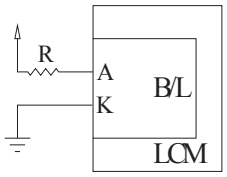
PIN NO.	SYMBOL
1	VSS
2	VDD
3	Vo
4	A0
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	/CS
16	/RST
17	Vee
18	NC
19	NC
20	WAIT



*:6800 family or 8080family interface selectable.



LED B/L drive directly from A and K.

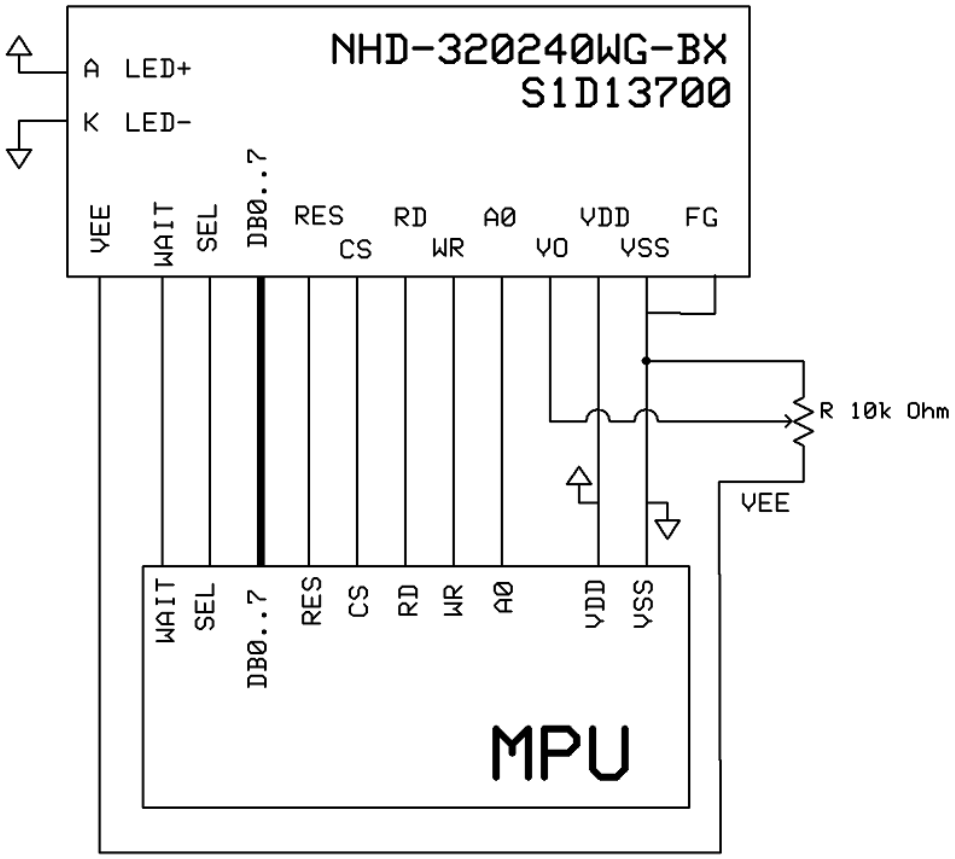


Newhaven Display
NHD-320240WG-BXTGH-VZ-3VR

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	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: 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	º
Viewing Angle - Horizontal	AH	Cr ≥ 3	-30	-	30	º
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

7	6	5	4	3	2	1	0
MOD	n/a			Horizontal Character Size bits 3-0			

REG[02h] Vertical Character Size Register
Address = 8002h Default = 00h Read/Write

7	6	5	4	3	2	1	0
n/a				Vertical Character Size bits 3-0			

REG[03h] Character Bytes Per Row Register
Address = 8003h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Character Bytes Per Row bits 7-0							

REG[04h] Total Character Bytes Per Row Register
Address = 8004h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Total Character Bytes Per Row bits 7-0							

REG[05h] Frame Height Register
Address = 8005h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Frame Height bits 7-0							

REG[06h] Horizontal Address Range Register 0
Address = 8006h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Horizontal Address Range bits 7-0							

REG[07h] Horizontal Address Range Register 1
Address = 8007h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Horizontal Address Range bits 15-8							

REG[08h] Power Save Mode Register
Address = 8008h Default = 01h Read/Write

7	6	5	4	3	2	1	0
n/a							Power Save Mode Enable

REG[09h] Display Enable Register
Address = 8009h Default = 00h Read/Write

7	6	5	4	3	2	1	0
n/a							Display Enable

REG[0Ah] Display Attribute Register
Address = 800Ah Default = 00h Read/Write

7	6	5	4	3	2	1	0
SAD3 Attribute bits 1-0		SAD2 Attribute bits 1-0		SAD1 Attribute bits 1-0		Cursor Attribute bits 1-0	

REG[0Bh] Screen Block 1 Start Address Register 0
Address = 800Bh Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 1 Start Address bits 7-0 (LSB)							

REG[0Ch] Screen Block 1 Start Address Register 1
Address = 800Ch Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 1 Start Address bits 15-8 (MSB)							

REG[0Dh] Screen Block 1 Size Register
Address = 800Dh Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 1 Size bits 7-0							

REG[0Eh] Screen Block 2 Start Address Register 0

Address = 800Eh Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 2 Start Address bits 7-0 (LSB)							

REG[0Fh] Screen Block 2 Start Address Register 1

Address = 800Fh Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 2 Start Address bits 15-8 (MSB)							

REG[10h] Screen Block 2 Size Register

Address = 8010h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 2 Size bits 7-0							

REG[11h] Screen Block 3 Start Address Register 0

Address = 8011h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 3 Start Address bits 7-0 (LSB)							

REG[12h] Screen Block 3 Start Address Register 1

Address = 8012h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 3 Start Address bits 15-8 (MSB)							

REG[13h] Screen Block 4 Start Address Register 0

Address = 8013h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 4 Start Address bits 7-0 (LSB)							

REG[14h] Screen Block 4 Start Address Register 1

Address = 8014h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Screen Block 4 Start Address bits 15-8 (MSB)							

REG[15h] Cursor Width Register

Address = 8015h Default = 00h Read/Write

7	6	5	4	3	2	1	0
n/a				Cursor Width bits 3-0			

REG[16h] Cursor Height Register

Address = 8016h Default = 00h Read/Write

7	6	5	4	3	2	1	0
Cursor Mode	n/a			Cursor Height bits 3-0			

REG[17h] Cursor Shift Direction Register

Address = 8017h Default = 00h Read/Write

7	6	5	4	3	2	1	0
n/a						Cursor Shift Direction bits 1-0	

REG[18h] Overlay Register

Address = 8018h Default = 00h Read/Write

7	6	5	4	3	2	1	0
n/a			3 Layer Overlay Select	Screen Block 3 Display Mode	Screen Block 1 Display Mode	Layer Composition Method bits 1-0	

REG[19h] Character Generator RAM Start Address Register 0

Address = 8019h Default = 00h Read/Write

7	6	5	4	3	2	1	0
CGRAM Start Address bits 7-0 (LSB)							

REG[1Ah] Character Generator RAM Start Address Register 1

Address = 801Ah Default = 00h Read/Write

7	6	5	4	3	2	1	0
CGRAM Start Address bits 15-8 (MSB)							

REG[1Bh] Horizontal Pixel Scroll Register

Address = 801Bh Default = 00h Read/Write

7	6	5	4	3	2	1	0
n/a					Horizontal Pixel Scroll bits 2-0		

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

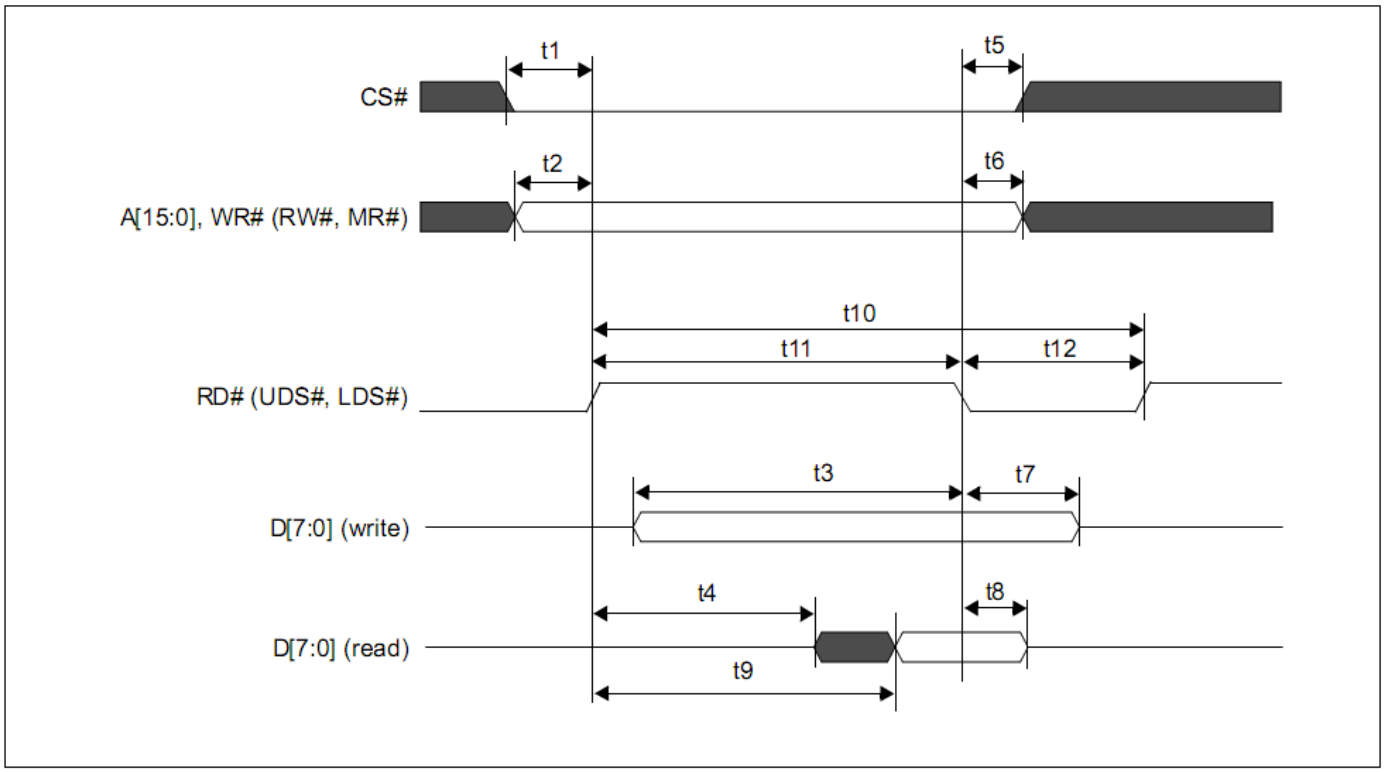


Figure 7-7 M6800 Family Bus Indirect Interface Timing

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