

NHD-C12864M1R-FSW-FTW-3V6

COG (Chip-On-Glass) Liquid Crystal Display Module

NHD-	Newhaven Display
C12864-	128 x 64 pixels
M1R-	Model
F-	Transflective
SW-	Side White LED backlight
F-	FSTN (+)
T-	12:00 view
W-	Wide Temp (-20°C ~ +70°C)
3V6-	3.3Vdd, 6 Volt Backlight
	RoHS Compliant

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Document Revision History

Revision	Date	Description	Changed by
0	5/6/2009	Initial Release	-
1	10/13/2009	User guide reformat	MC
2	11/20/2009	Updated backlight supply current	MC
3	6/22/2010	Updated drawing to include bkl adhesive	CL
4	2/3/2011	Updated drawing with pin numbers	AK
5	2/13/2011	Change controller to ST7565R	CL
6	3/28/2011	Controller information updated	AK

Functions and Features

- 128 x 64 pixels
- 8080 or 6800 MPU interface
- Built-in ST7565R controller
- +3.3V power supply
- 1/64 duty cycle; 1/9 bias
- RoHS Compliant
- 3M 9080 adhesive on backlight assembly

<http://multimedia.3m.com/mws/mediawebserver?66666UuZjcFSLXTt4XfEnxfyEVuQEcuZgVs6EVs6E666666-->

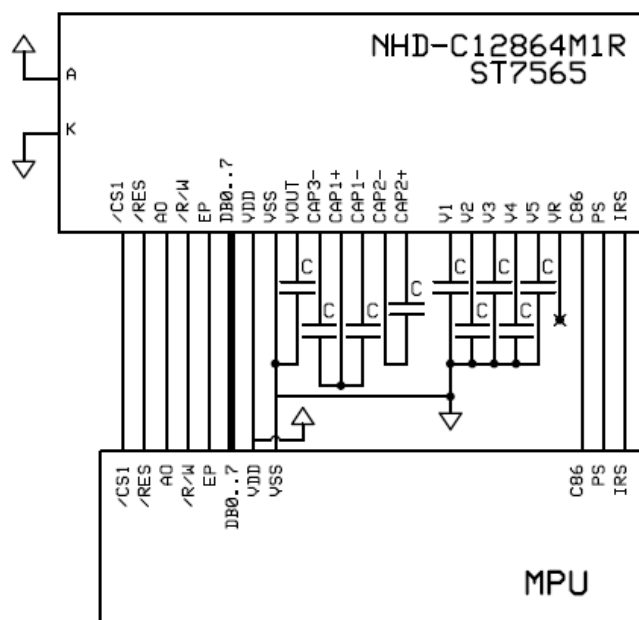
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	/CS1	MPU	Active LOW chip select
2	/RES	MPU	Active LOW Reset signal
3	A0	MPU	Register select signal. 0: instruction; 1: data register
4	/R/W;/WR	MPU	Read/write select signal. R/W=1: Read R/W=0: Write
5	EP;/RD	MPU	Operation enable signal. Falling edge triggered.
6	DB0	MPU	Parallel Interface DB0-DB7: Bi-directional 8-bit data bus
7	DB1	MPU	
8	DB2	MPU	
9	DB3	MPU	
10	DB4	MPU	
11	DB5	MPU	
12	DB6;SCL	MPU	
13	DB7;SI	MPU	Serial Interface: DB0-DB5: No connect in serial mode DB6= Serial clock (SCL) DB7= Serial data input (SI)
14	VDD	Power Supply	Power supply for LCD and logic (+3.3V)
15	VSS	Power Supply	Ground
16	VOOUT	Power Supply	Connect to 1uF cap to VSS
17	CAP3-	Power Supply	Connect to 1uF cap to CAP1+ (PIN-18)
18	CAP1+	Power Supply	Connect to 1uF cap to CAP3-(PIN17) and CAP1-(PIN19)
19	CAP1-	Power Supply	Connect to 1uF cap to CAP1+ (PIN-18)
20	CAP2-	Power Supply	Connect to 1uF cap to CAP2+ (PIN-21)
21	CAP2+	Power Supply	Connect to 1uF cap to CAP2- (PIN-20)
22	V1	Power Supply	1.0uF-2.2uF cap to VSS
23	V2	Power Supply	1.0uF-2.2uF cap to VSS
24	V3	Power Supply	1.0uF-2.2uF cap to VSS
25	V4	Power Supply	1.0uF-2.2uF cap to VSS
26	V5	Power Supply	1.0uF-2.2uF cap to VSS
27	VR	-	No Connect
28	C86	MPU	Select MPU interface pin. C86=H: 6800; C86=L: 8080
29	PS	MPU	Parallel/Serial select. PS= H: Parallel; PS=L: Serial
30	/IRS	MPU	Internal resistor select (high to use internal resistors)

Recommended LCD connector: 0.5mm Pitch, 30 pin FFC. Molex p/n: 52892-3095

Backlight connector: --

Mates with: --



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	5.5	V
Supply Current	IDD	Ta=25°C, VDD=3.3V	-	0.35	0.45	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	9.5	-	V
"H" Level input	Vih		2.2	-	VDD	V
"L" Level input	Vil		0	-	0.6	V
"H" Level output	Voh		2.4	-	-	V
"L" Level output	Vol		-	-	0.4	V
LED Backlight voltage	VLED		-	6.2	-	V
LED Backlight current	ILED	VLED=6.2V	-	15	20	mA

Optical Characteristics

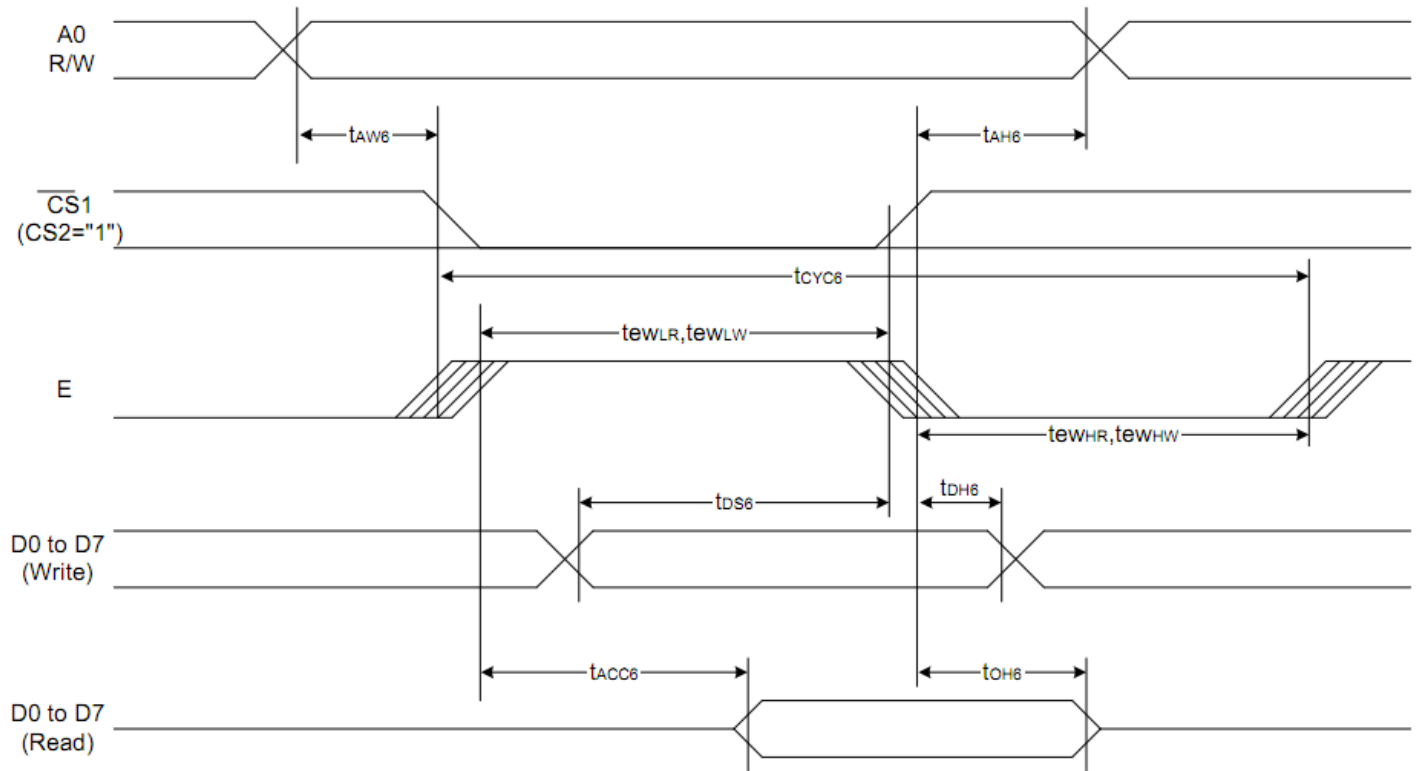
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	K	CR ≥ 2	-60	-	+35	°
Viewing Angle - Horizontal	Φ	CR ≥ 2	-40	-	+40	°
Contrast Ratio	CR		-	6	-	-
Response Time (rise)	Tr		-	150	250	ms
Response Time (fall)	Tf		-	150	250	ms

Controller Information

Built-in ST7565R. Download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

Timing Characteristics

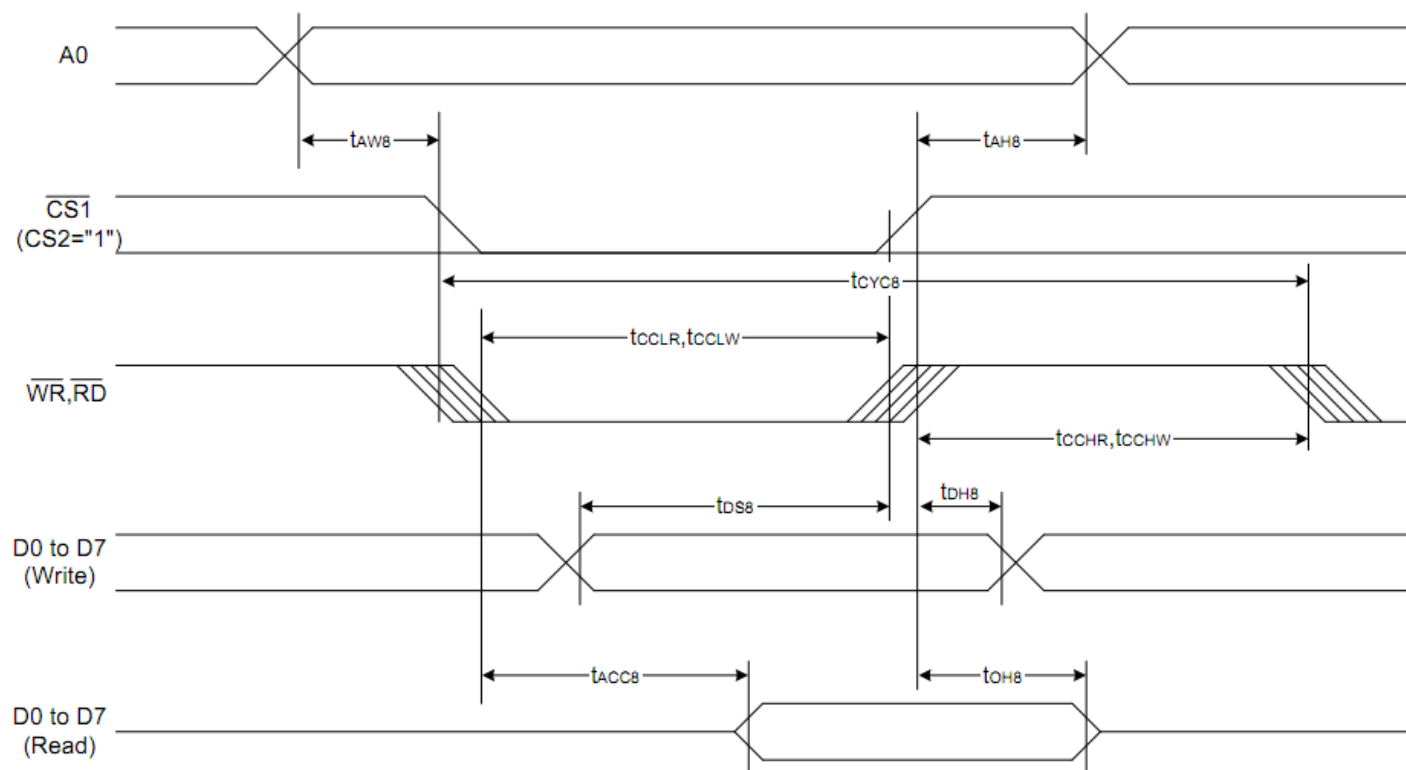
System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



($V_{DD} = 3.3V, T_a = -30 \text{ to } 85^\circ\text{C}$)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	—	ns
Address setup time		t_{AW6}		0	—	
System cycle time		t_{CYC6}		240	—	
Enable L pulse width (WRITE)	WR	t_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EWHW}		80	—	
Enable L pulse width (READ)	RD	t_{EWLR}		80	—	
Enable H pulse width (READ)		t_{EWHR}		140	—	
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH6}	$C_L = 100 \text{ pF}$	5	50	

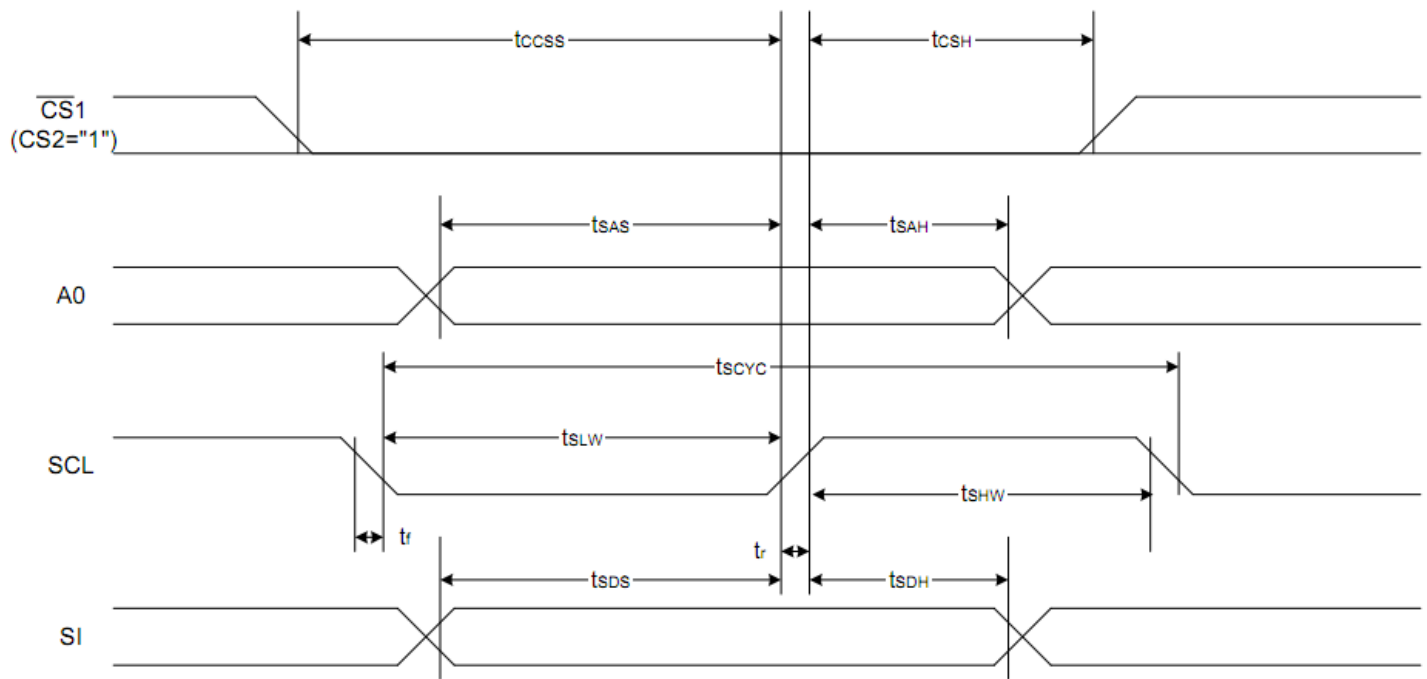
System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



($V_{DD} = 3.3V$, $T_a = -30$ to $85^{\circ}C$)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8		0	—	Ns
Address setup time		tAW8		0	—	
System cycle time		tCYC8		240	—	
Enable L pulse width (WRITE)	WR	tCCLW		80	—	
Enable H pulse width (WRITE)		tCCHW		80	—	
Enable L pulse width (READ)	RD	tCCLR		140	—	
Enable H pulse width (READ)		tCCHR		80	—	
WRITE Data setup time	D0 to D7	tDS8		40	—	
WRITE Address hold time		tDH8		0	—	
READ access time		tACC8	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		tOH8	$C_L = 100 \text{ pF}$	5	50	

The 4-line SPI Interface



($V_{\text{DD}} = 3.3\text{V}$, $T_{\text{a}} = -30$ to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width		T_{shw}		25	—	
SCL "L" pulse width		T_{SLW}		25	—	
Address setup time	A0	T_{SAS}		20	—	
Address hold time		T_{SAH}		10	—	
Data setup time	SI	T_{SDS}		20	—	
Data hold time		T_{SDH}		10	—	
CS-SCL time	CS	T_{CSS}		20	—	
CS-SCL time		T_{CSH}		40	—	

Table of Commands

Command	Command Code										Function	
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1		D0
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address					Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0	1	0	0	0	0	1 0	Most significant column address Least significant column address			Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.	
(5) Status read	0	0	1	Status			0	0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data							Writes to the display RAM	
(7) Display data read	1	0	1	Read data							Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(12) Read-modify-write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V ₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V ₀ output voltage electronic volume register
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0 1	0: Sleep mode, 1: Normal mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

Example Initialization Program

```
'-----  
Sub Init  
Reset P3.7          'set Read/write to '0' for write  
Reset P3.0          'RS  
Set P3.1            'reset  
Reset P3.4 'E  
'Set P3.3  
'Reset P3.3  
Waitms 2  
'Set P3.3  
Waitms 20  
A = &HA2            '1/9 BIAS  
Call Writecom  
A = &HA0            'ADC SELECT , NORMAL  
Call Writecom  
A = &HC8            'COM OUTPUT REVERSE  
Call Writecom  
A = &HA4            'DISPLAY ALL POINTS NORMAL  
Call Writecom  
A = &H40            'DISPLAY START LINE SET  
Call Writecom  
A = &H25            'INTERNAL RESISTOR RATIO  
Call Writecom  
A = &H81            'ELECTRONIC VOLUME MODE SET  
Call Writecom  
A = &H10            'ELECTRONIC VOLUME  
Call Writecom  
A = &H2F            'POWER CONTROLLER SET  
Call Writecom  
A = &HAF            'DISPLAY ON  
Call Writecom  
End Sub
```

```
'-----  
Sub Writecom  
Reset P3.0          'A0 low  
Reset P3.7          'R/W low  
Set P3.6            'CS1  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
End Sub
```

```
Sub Writedata  
Set P3.0            'A0 high  
Reset P3.7          'R/W low  
Set P3.6            'CS1  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
End Sub
```

```
'-----
```

Quality Information

See full Quality Specification at: http://www.newhavendisplay.com/specs/quality_spec.pdf

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C , 48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 48hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 48hrs	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.	+40°C , 90% RH , 48hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-0°C,30min -> 25°C,5min -> 50°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