NHD-0224WH-ATDI-JT#

Character Liquid Crystal Display Module

NHD-	Newhaven Display
0224-	2 lines x 24 characters
WH-	Display Type: Character
A-	Model
T-	White LED B/L
D-	FSTN Negative (double film)
I-	Transmissive, Wide Temp. 6:00 view
JT#-	English and Japanese standard font
	RoHS Compliant

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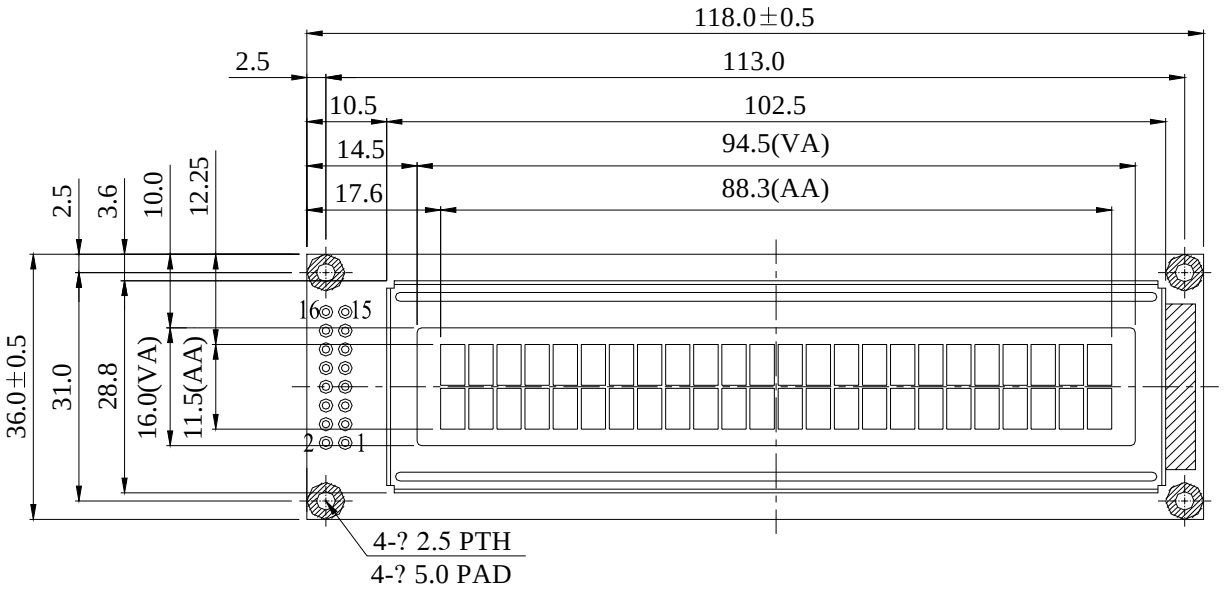
Document Revision History

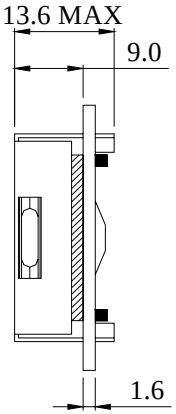
Revision	Date	Description	Changed by
0	7/27/2009	Initial Release	BE

Functions and Features

- **2 lines x 24 characters**
- **Built-in SPLC780D (or equivalent) controller**
- **5V power supply**
- **1/16 duty, 1/5 bias**

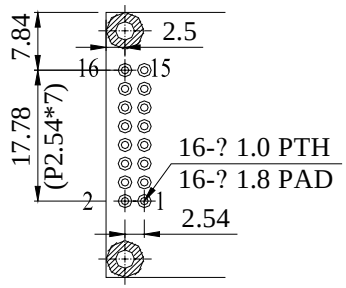
Mechanical Drawing



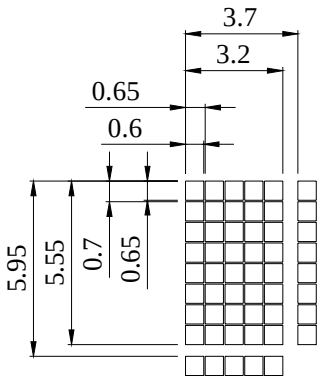


LED B/L

PIN NO.	SYMBOL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/$\overline{W}$
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K



PIN DETAIL
SCALE 1/1

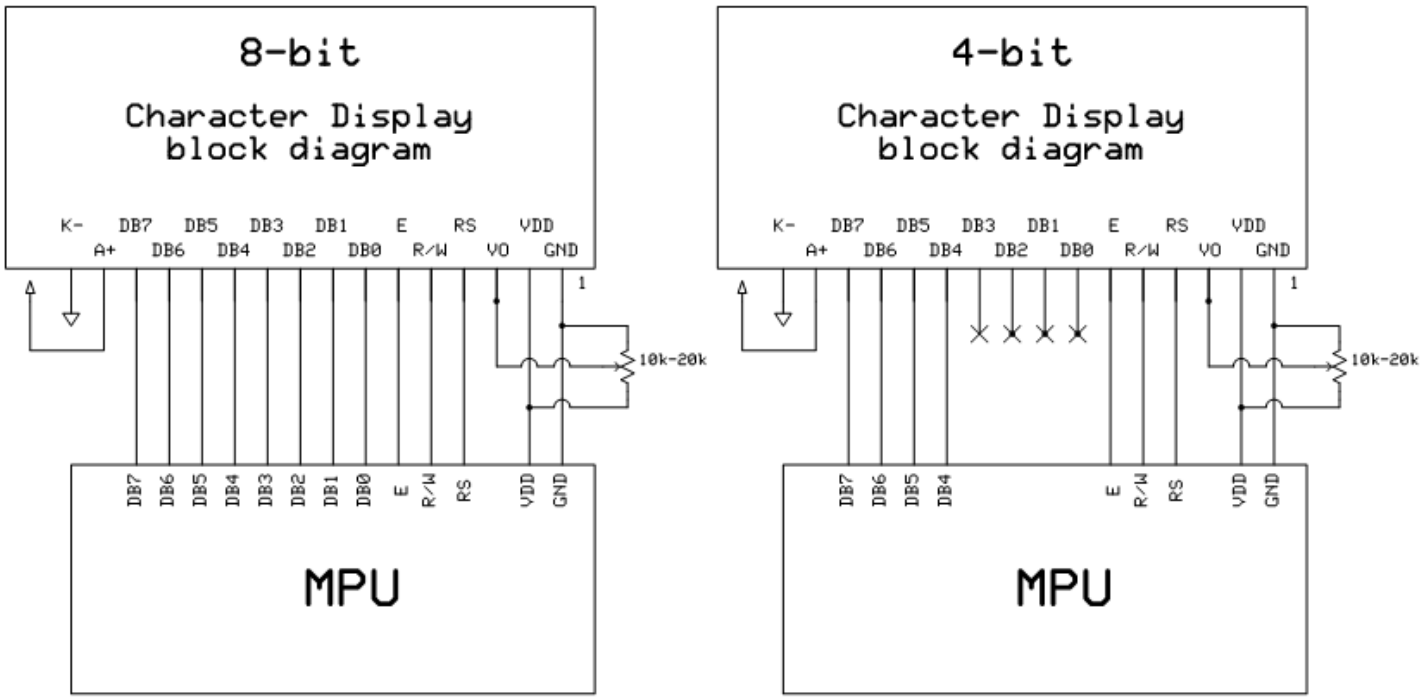


DOT SIZE
SCALE 5/1

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V_{SS}	Power Supply	Ground
2	V_{DD}	Power Supply	Supply Voltage for logic (5.0V)
3	V_0	Adj Power Supply	Power supply for contrast (approx. 0.5V)
4	RS	MPU	Register select signal. RS=0: Command, RS=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.
7-10	DB0-DB3	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
11-14	DB4 – DB7	MPU	Four high order bi-directional three-state data bus lines.
15	A	Power Supply	Power supply for LED Backlight (+3.5V)
16	K	Power Supply	Ground for Backlight

Recommended LCD connector: 2.54mm pitch, 16-pin dual-row
Backlight connector: Anode at pin-15; Cathode at pin-16 of 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-Vss		4.5	5.0	5.5	V
Supply Current	IDD	VDD=5.0V	1.0	1.2	1.5	mA
Supply for LCD (contrast)	VLCD	Ta=25°C	3.8	4.5	5.5	V
"H" Level input	Vih		0.7	-	VDD	V
"L" Level input	Vil		Vss	-	0.6	V
"H" Level output	Voh		3.9	-	-	V
"L" Level output	Vol		-	-	0.4	V
Backlight Supply Voltage	V	-	3.4	3.5	3.6	V
Backlight Supply Current	Iled	-	28.8	32	50	mA

Optical Characteristics

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

Controller Information

Built-in SPLC780D. Download specification at http://www.newhavendisplay.com/app_notes/SPLC780D.pdf

Table of Commands

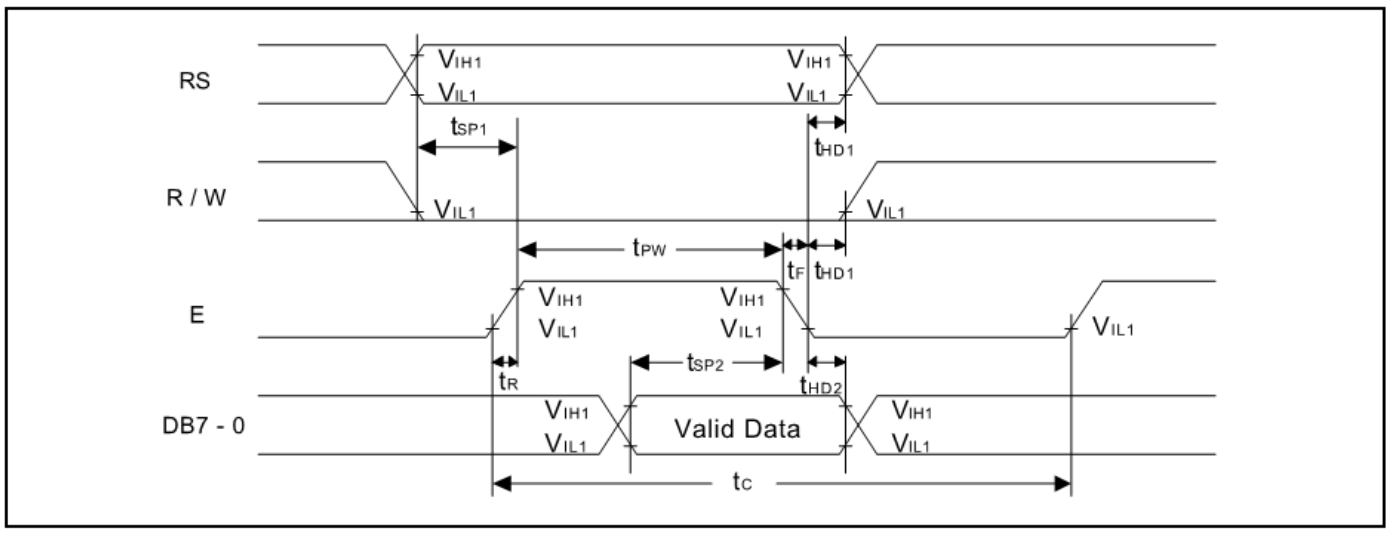
Instruction	Instruction Code										Description	Execution time (fosc=270Khz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write “00H” to DDRAM and set DDRAM address to “00H” from AC	1.53ms
Return Home	0	0	0	0	0	0	0	0	1	—	Set DDRAM address to “00H” from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display.	39 μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor (C), and blinking of cursor (B) on/off control bit.	39 μs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	—	—	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	39 μs
Function Set	0	0	0	0	1	DL	N	F	—	—	Set interface data length (DL:8-bit/4-bit), numbers of display line (N:2-line/1-line)and, display font type (F:5×11 dots/5×8 dots)	39 μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39 μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39 μs
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43 μs

＊ ”—”：don’t care

Display Character address code:

Character located	1	2	3	4	5	6	----------	19	20	21	22	23	24
DDRAM address	00	01	02	03	04	05	----------	12	13	14	15	16	17
DDRAM address	40	41	42	43	44	45	----------	52	53	54	55	56	57

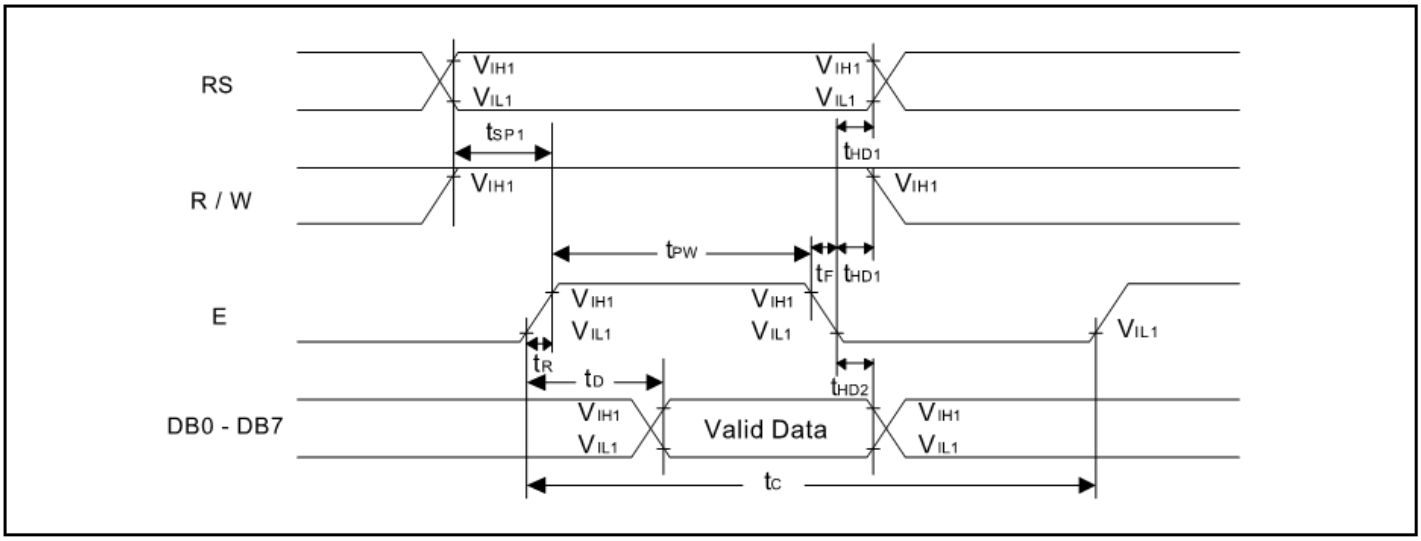
Write mode timing diagram



Ta=25℃, VDD=5.0V

Item	Symbol	Min	Typ	Max	Unit
Enable cycle time	T_C	1200	–	–	ns
Enable pulse width	T_{PW}	140	–	–	ns
Enable rise/fall time	T_R,T_F	–	–	25	ns
Address set-up time (RS, R/W to E)	t_{AS}	0	–	–	ns
Address hold time	t_{AH}	10	–	–	ns
Data set-up time	t_{DSW}	40	–	–	ns
Data hold time	t_H	10	–	–	ns

Read Mode diagram



Built-in Font Table

Upper 4 bit / Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)															
LLLH	(2)															
LLHL	(3)															
LLHH	(4)															
LHLL	(5)															
LHLH	(6)															
LHHL	(7)															
LHHH	(8)															
HLLL	(1)															
HLLH	(2)															
HLHL	(3)															
HLHH	(4)															
HHLL	(5)															
HHLH	(6)															
HHHL	(7)															
HHHH	(8)															

Example Initialization Program

```
'INIT-----------------------------------------------------------------------
A = &H30
Call Writecom                                                   'wake up
Waitms 100
Call Writecom                                                   'wake up
Waitms 10
Call Writecom                                                   'wake up
Waitms 10
A = &H38                                                        'function set
Call Writecom
A = &H10                                                        'shift display=no
Call Writecom
A = &H0C                                                        'display on
Call Writecom
A = &H06                                                        'entry mode set
Call Writecom

'-----------------------------------------------------------------------------
Sub Writecom
P1 = A
Reset P3.0                                                      'instruction
Set P3.4                                                        'E
Set P3.7                                                        'RW
Waitms 1
Reset P3.4                                                      'E
Reset P3.7                                                      'RW
End Sub

Sub Writedata
P1 = A
Set P3.0                                                        'data
Set P3.4                                                        'E
Set P3.7                                                        'RW
Waitms 1
Reset P3.4                                                      'E
Reset P3.7                                                      'RW
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