NHD-0440WH-ATFH-JT#

Character Liquid Crystal Display Module

NHD-	Newhaven Display
0440-	4 Lines x 40 Characters
WH-	Display Type: Character
A-	Model
T-	White LED Backlight
F-	FSTN Positive
H-	Transflective, 6:00 Optimal View, Wide Temp.
JT#-	JT- English and Japanese Standard Font
	RoHS Compliant

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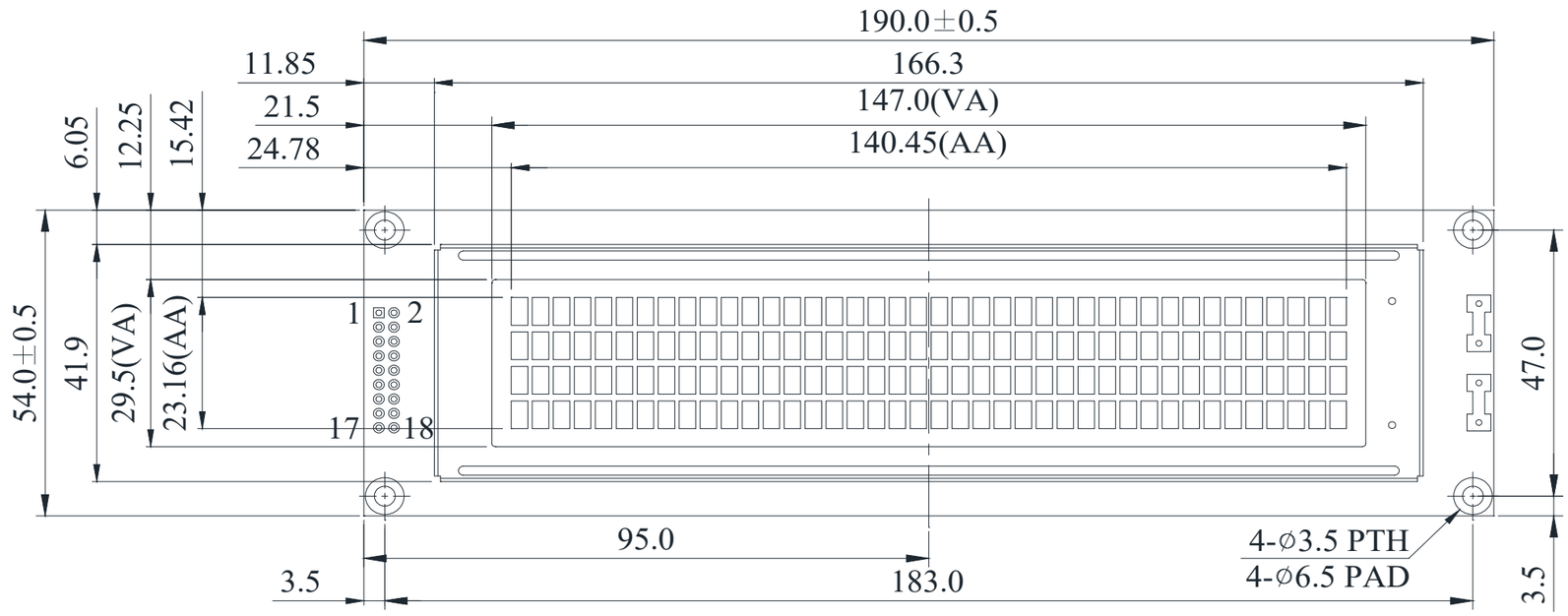
Document Revision History

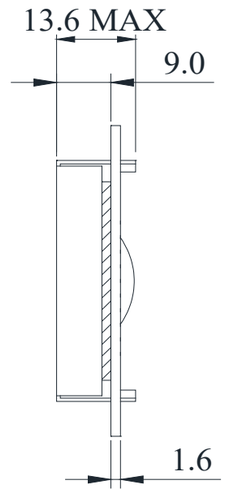
Revision	Date	Description	Changed by
0	10/21/08	Initial Release	-
1	11/3/09	User Guide Reformat	MC
2	11/16/09	Updated Block diagram and initialization code	MC
3	1/5/11	Update driver information	JT
4	5/6/11	Electrical characteristics updated	AK
5	10/7/16	Mechanical Drawing, Electrical & Optical Char. Updated	TM
6	7/25/17	Backlight & Supply Current Updated	SB
8	5/2/19	Electrical & Backlight Characteristics Updated	SB

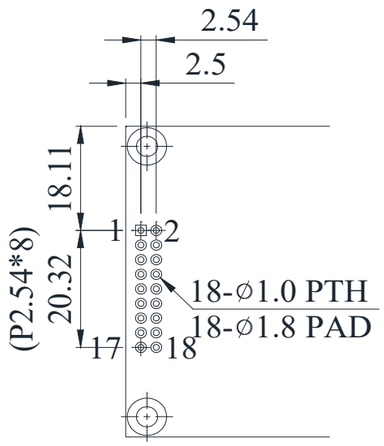
Functions and Features

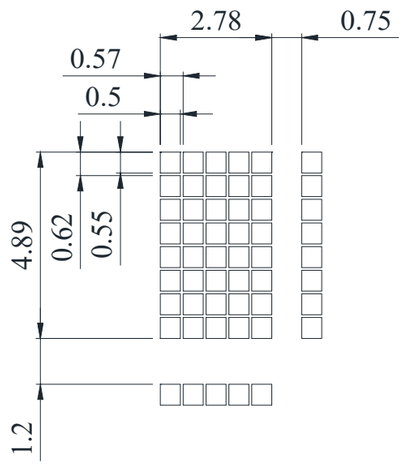
- **4 lines x 40 characters**
- **2 Built-in controllers (ST7066U)**
- **+5.0V Power Supply**
- **1/16 duty, 1/5 bias**
- **RoHS compliant**

SYMBOL	REVISION	DATE









PIN NO.	SYMBOL
1	DB7
2	DB6
3	DB5
4	DB4
5	DB3
6	DB2
7	DB1
8	DB0
9	E1
10	R/$\overline{W}$
11	RS
12	Vo
13	Vss
14	Vdd
15	E2
16	NC
17	A
18	K

Notes:

1. Driving: 1/16 duty, 1/5 bias
2. Voltage: 5V V_{DD}, 4.35V V_{LCD}
3. Display Type: FSTN Positive, Transflective
4. Optimal View: 6:00
5. Backlight: White LED
6. Driver IC: ST7066U 8/4-bit MPU Interface

STANDARD TOLERANCE:
(UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

UNLESS OTHERWISE SPECIFIED:

- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-0440WH-ATFH-JT#

REVISION: 1.0

SIZE: A3

SCALE: NS

DRAWN BY: S. Baxi

APPROVED BY: S. Baxi

DRAWN DATE: 5/2/19

APPROVED DATE: 5/2/19

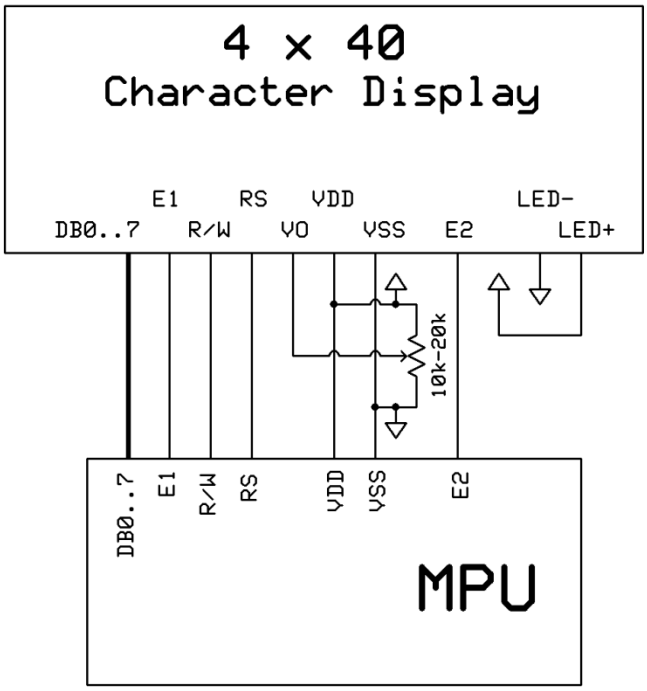
DO NOT SCALE DRAWING

SHEET 1 OF 1

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1-4	DB7-DB4	MPU	Four high order bi-directional three-state data bus lines.
5-8	DB3-DB0	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
9	E1	MPU	Operation Enable signal. Falling edge triggered for top 2 lines.
10	R/W	MPU	Read/Write select signal, R/W=1: Read R/W=0: Write
11	RS	MPU	Register Select signal. RS=0: Command, RS=1: Data
12	V_0	Power Supply	Power supply for contrast (approx. 0.65V)
13	V_{SS}	Power Supply	Ground
14	V_{DD}	Power Supply	Power supply voltage for logic (+5.0V)
15	E2	MPU	Operation enable signal. Falling edge triggered for bottom 2 lines.
16	NC	-	No Connect
17	LED+	Power Supply	Backlight Anode (+3.5V)
18	LED-	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 2.54mm pitch pins
Backlight connector: --- **Mates with:** ---



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	4.5	5.0	5.5	V
Supply Current	I_{DD}	Ta=25°C, VDD=5.0V	1.8	3.5	7.0	mA
Supply for LCD (contrast)	V_{LCD}		4.2	4.35	4.5	V
"H" Level input	V_{IH}	-	0.7 * V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	0	-	0.6	V
"H" Level output	V_{OH}	-	3.9	-	V_{DD}	V
"L" Level output	V_{OL}	-	0	-	0.4	V
Backlight Supply Current	I_{LED}	-	-	64	80	mA
Backlight Supply Voltage	V_{LED}	I_{LED} = 64mA	3.4	3.5	3.6	V

*The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	30	-	o
	Bottom	φY-		-	60	-	o
	Left	θX-		-	45	-	o
	Right	θX+		-	45	-	o
Contrast Ratio		CR	-	-	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	200	ms
	Fall	T_F		-	150	200	ms

Controller Information

Built-in ST7066U Controller.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7066U.pdf

DDRAM address

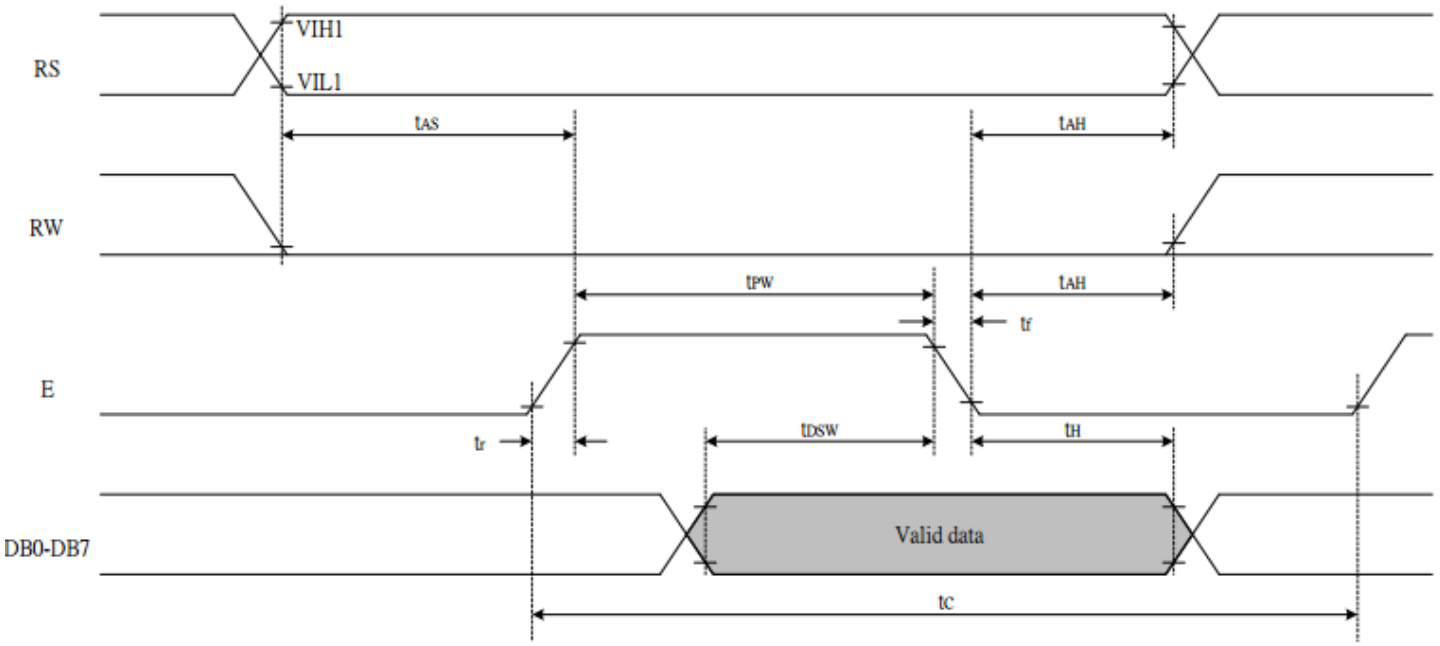
1	2	3	4	5	-	-	-	-	-	-	-	-	-	-	36	37	38	39	40
00	01	02	03	04	-	-	-	-	-	-	-	-	-	-	23	24	25	26	27
40	41	42	43	44	-	-	-	-	-	-	-	-	-	-	63	64	65	66	67
00	01	02	03	04	-	-	-	-	-	-	-	-	-	-	23	24	25	26	27
40	41	42	43	44	-	-	-	-	-	-	-	-	-	-	63	64	65	66	67

Table of Commands

Instruction	Instruction code										Description	Execution time (fosc= 270 KHZ
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write “20H” to DDRAM and set DDRAM address to “00H” from AC	1.52ms
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.	1.52ms
Entry mode Set	0	0	0	0	0	0	0	1	I/D	SH	Sets cursor move direction and specifies display shift. These parameters are performed during data write and read.	37μs
Display ON/ OFF control	0	0	0	0	0	0	1	D	C	B	D=1: Entire display on C=1: Cursor on B=1: Blinking cursor on	37μs
Cursor or Display shift	0	0	0	0	0	1	S/C	R/L	-	-	Sets cursor moving and display shift control bit, and the direction without changing DDRAM data.	37μs
Function set	0	0	0	0	1	DL	N	F	-	-	DL: Interface data is 8/4 bits N: Number of lines is 2/1 F: Font size is 5x11/5x8	37μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	37μs
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.	0s
Write data To Address	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	37μs
Read data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	37μs

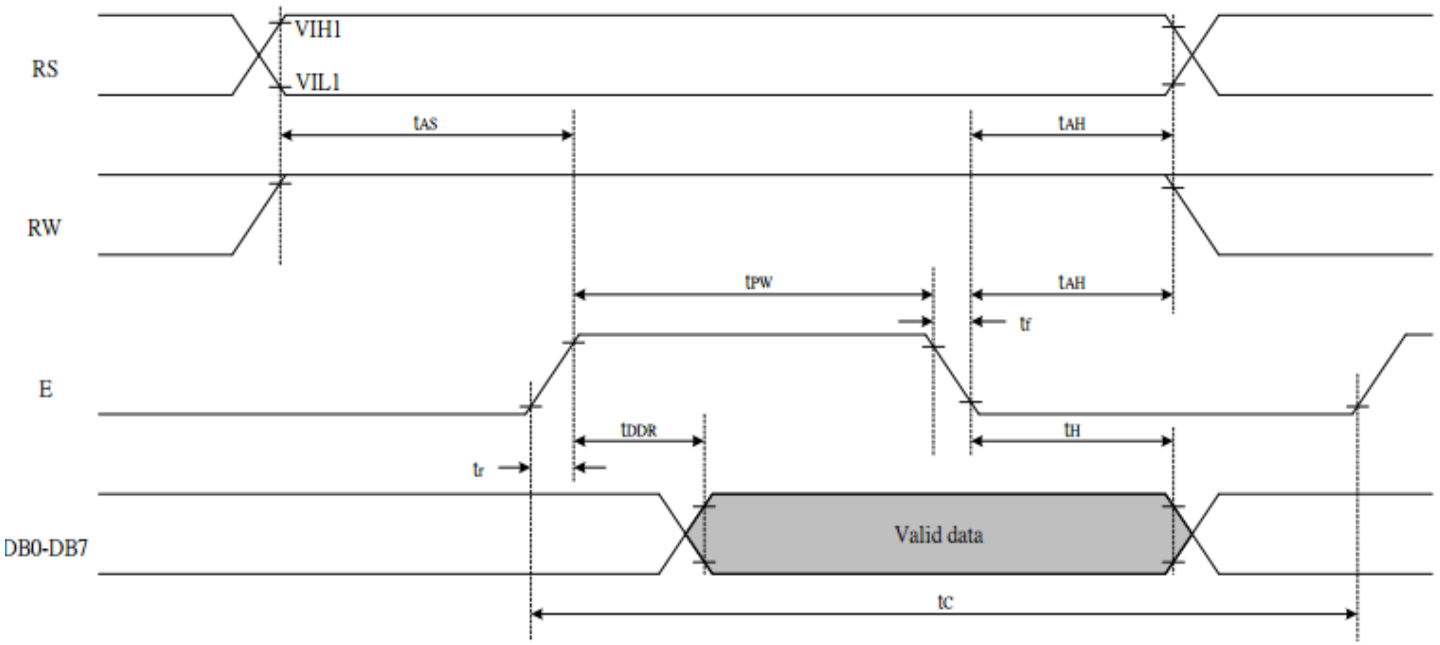
Timing Characteristics

Writing data from MPU to ST7066U



Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R,T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Reading data from ST7066U to MPU



Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Built-in Font Table

Example Initialization Program

```
/*************************************************************************/
void command1(char i) //Top half of the display
{
P1 = i;
W = 0;
RS = 0;
E1 = 1;
delay(2);
E1 = 0;
}
void command2(char i) //Bottom half of the display
{
P1 = i;
W = 0;
RS = 0;
E2 = 1;
delay(2);
E2 = 0;
}
/*************************************************************************/
void writedata1(char i) //Top half of the display
{
P1 = i;
W = 0;
RS = 1;
E1 = 1;
delay(2);
E1 = 0;
}
void writedata2(char i) //Bottom half of the display
{
```



```
P1 = i;
W = 0;
RS = 1;
E2 = 1;
delay(2);
E2 = 0;
}
/*************************************************************************/
void init_LCD()
{
delay(15);
command1(0x30); //Wake up
command2(0x30);
delay(5);
command1(0x30); //Wake up
command2(0x30);
delay(5);
command1(0x30); //Wake up
command2(0x30);
delay(5);
command1(0x38); //Function Set = 8bit mode; 2-line; 5x8
command2(0x38);
command1(0x08); //Turn off display
command2(0x08);
command1(0x01); //Clear display
command2(0x01);
command1(0x06); //Entry mode cursor increment
command2(0x06);
command1(0x0c); //Turn on display; no cursor
command2(0x0c);
}
/*************************************************************************/
```

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 For 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm 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=330kΩ, CS=150pF For 10 times	

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

See Terms & Conditions at http://www.newhavendisplay.com/index.php?main_page=terms

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