NHD-0440WH-ATMI-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
M-	STN- Blue (Negative)
I-	Transmissive, 6:00 view, Wide Temp. (-20°C ~+70°C)
JT#-	English and Japanese standard font
	RoHS Compliant

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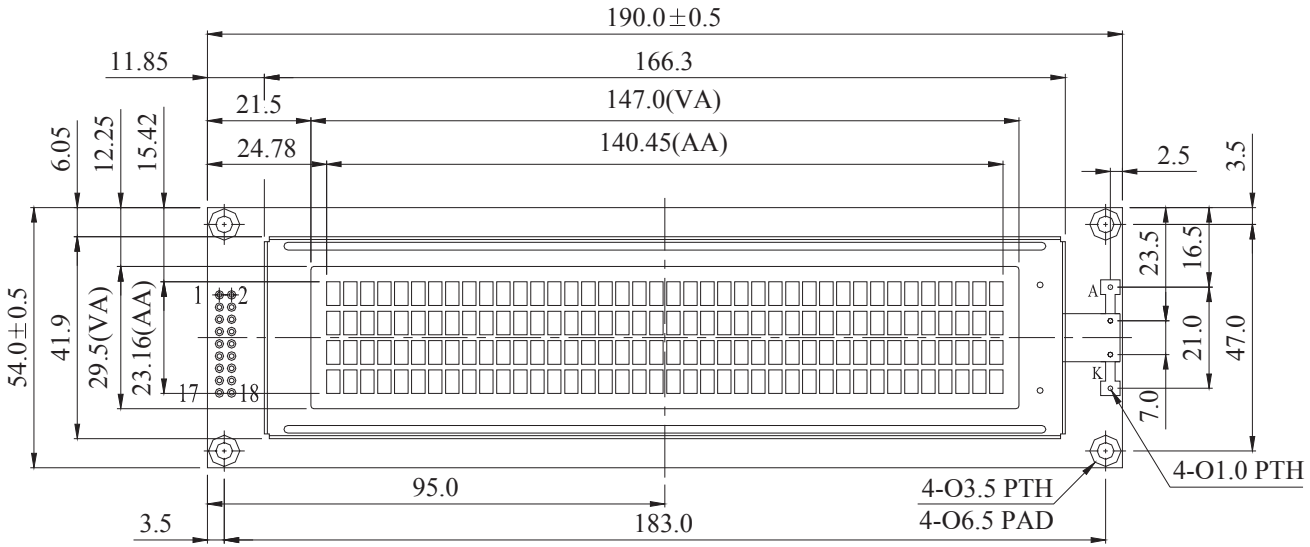
Document Revision History

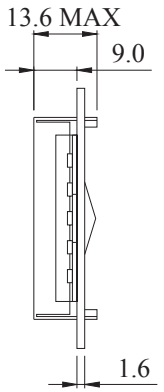
Revision	Date	Description	Changed by
0	**10/21/2008**	**Initial Release**	**-**
1	**11/3/2009**	**User Guide Reformat**	**MC**
2	**11/16/2009**	**Updated Block diagram and initialization code**	**MC**
3	**12/16/2009**	**Updated Backlight Supply Current**	**MC**
4	**1/4/2011**	**Update 2nd controller information**	**JT**
5	**5/6/2011**	**Electrical characteristics updated**	**AK**

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**

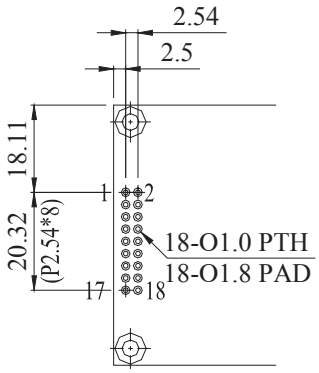
Mechanical Drawing



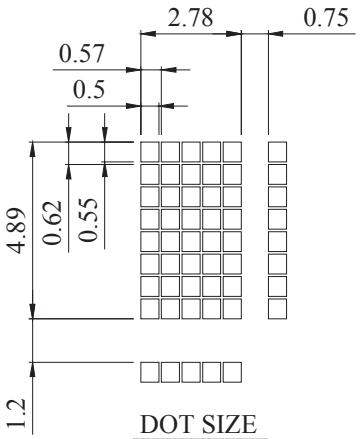


LED B/L

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/Vee
17	LED +
18	LED -



PIN DETAIL



DOT SIZE
SCALE 5/1

The non-specified tolerance of dimension is ±0.3mm.

Newhaven Display
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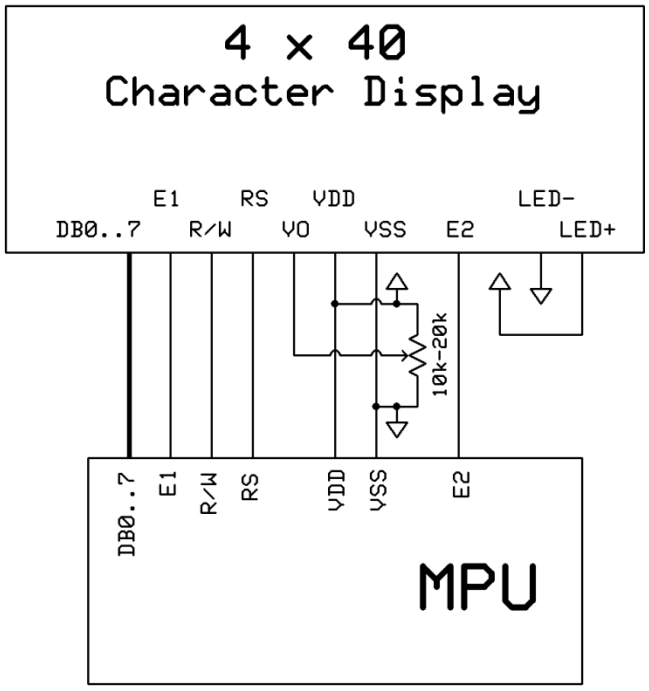
Pin Description and Wiring Diagram

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	V0	Power Supply	Power supply for contrast (approx. 0.5V)
13	Vss	Power Supply	Ground
14	VDD	Power Supply	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	Power supply for LED backlight (+3.5V)
18	LED-	Power Supply	Ground for backlight

Recommended LCD connector: 2.54mm pitch pins
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		4.75	5.0	5.25	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	-	1.2	-	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	4.5	-	V
"H" Level input	Vih		0.7 VDD	-	VDD	V
"L" Level input	Vil		0	-	0.6	V
"H" Level output	Voh		3.9	-	-	V
"L" Level output	Vol		-	-	0.4	V
Backlight Supply Voltage	Vled	-	-	3.5	-	V
Backlight Supply Current	Iled	Vled=3.5V	50	80	100	mA
Backlight Lifetime	-	-	-	50,000	-	Hrs

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Vertical (top)	AV	Cr ≥ 2	-	25	-	º
Viewing Angle – Vertical (bottom)	AV	Cr ≥ 2	-	70	-	º
Viewing Angle – Horizontal (left)	AH	Cr ≥ 2	-	30	-	º
Viewing Angle – Horizontal (right)	AH	Cr ≥ 2	-	30	-	º
Contrast Ratio	Cr		-	2	-	-
Response Time (rise)	Tr	-	-	120	150	ms
Response Time (fall)	Tf	-	-	120	150	ms

Controller Information

Built-in ST7066U Download specification at http://www.newhavendisplay.com/app_notes/ST7066U.pdf

Display character address code

DDRAM address

Display position

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

DDRAM address

Command Table

Instruction	Instruction Code										Description	Description Time (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 "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL:interface data is 8/4 bits N:number of line is 2/1 F:font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37 us
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 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

Built-in Font Table

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	@	P	`	p				ー	タ	ミ	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	ム	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	メ	ß	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)		$	4	D	T	d	t			、	エ	ト	ヤ	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	ユ	σ	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ァ	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			ィ	ク	ネ	リ	√	x̄
xxxx1001	(2)		)	9	I	Y	i	y			ゥ	ケ	ノ	ル	-¹	y
xxxx1010	(3)		*	:	J	Z	j	z			ェ	コ	ハ	レ	j	千
xxxx1011	(4)		+	;	K	[	k	{			ォ	サ	ヒ	ロ	ˣ	万
xxxx1100	(5)		,	<	L	¥	l	|			ャ	シ	フ	ワ	¢	円
xxxx1101	(6)		−	=	M	]	m	}			ュ	ス	ヘ	ン	ŧ	÷
xxxx1110	(7)		.	>	N	^	n	→			ョ	セ	ホ	゛	ñ	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	■

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 , 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

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