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# NHD-240128WG-ATFH-VZ#

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
240128-	240 x 128 pixels
WG-	Display Type: Graphic
A-	Model
T-	White LED Backlight
F-	FSTN (+)
H-	Transflective, 6:00 view, Wide Temperature (-20°C ~+70°C)
VZ#-	Built-in Negative Voltage
	<b>RoHS Compliant</b>

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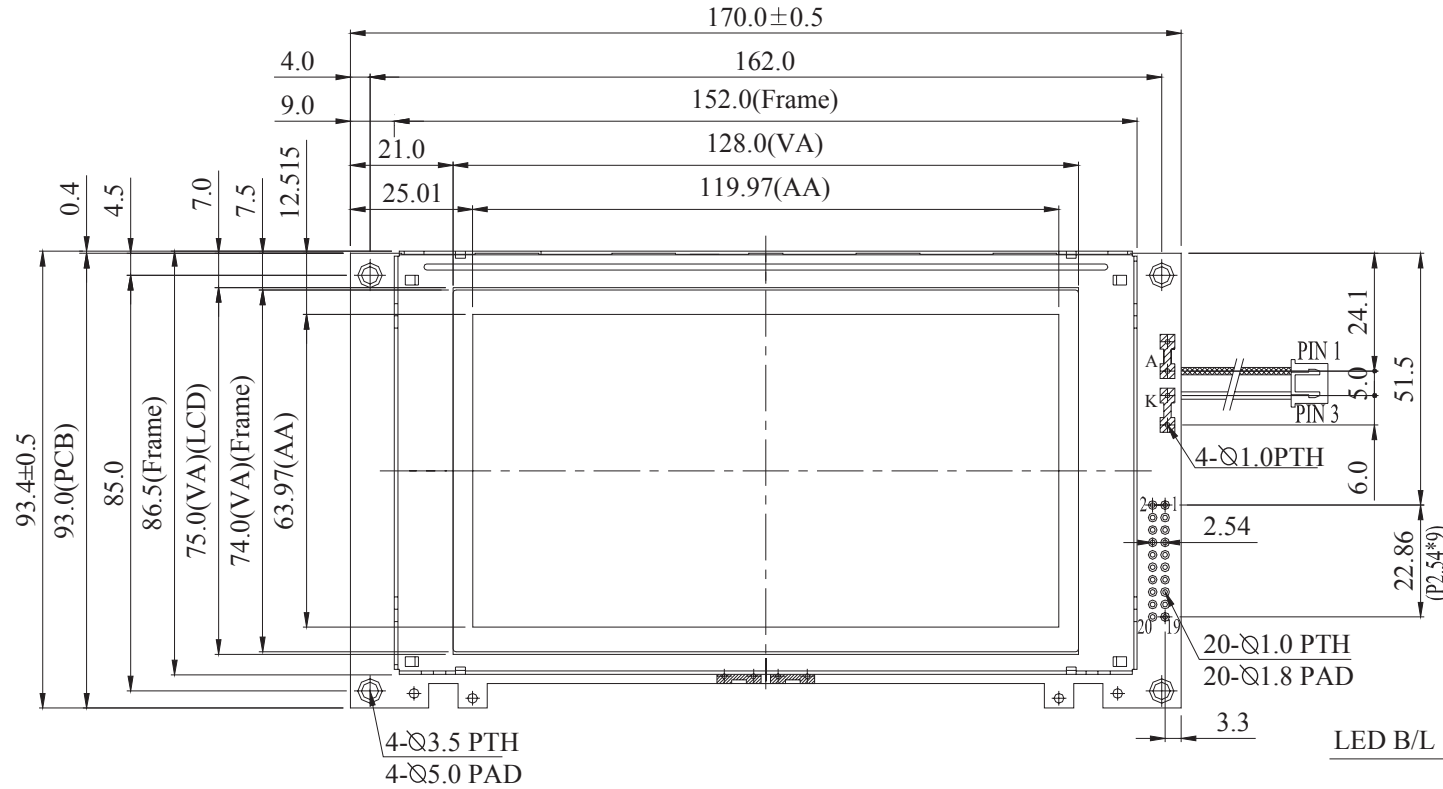
## Document Revision History

Revision	Date	Description	Changed by
0	4/28/2010	User guide reformat	MC
1	2/9/2011	Pin description updated	AK
2	4/26/2011	Electrical characteristics updated	AK
3	4/13/2012	Mechanical drawing updated	AK

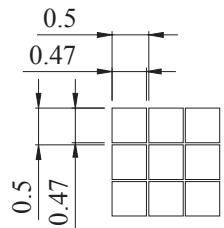
## Functions and Features

- 240 x 128 pixels
- Built-in RA6963 Controller
- +5.0V power supply
- RoHS Compliant

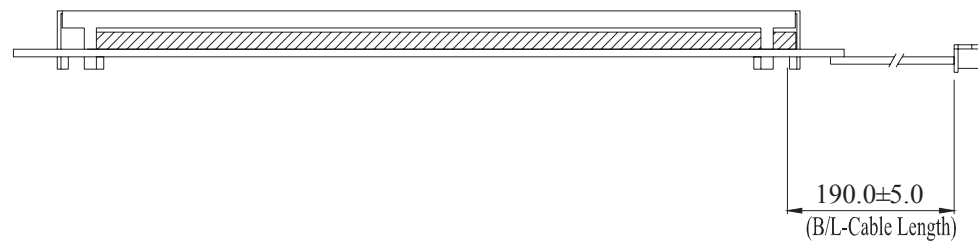
# Mechanical Drawing



PIN NO.	SYMBOL
1	FGND
2	VSS
3	VDD
4	V0
5	$\overline{WR}$
6	RD
7	$\overline{CE}$
8	C/D
9	VEE
10	$\overline{RESET}$
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	FS
20	RV



DOT SIZE  
 SCALE 10/1



Newhaven Display

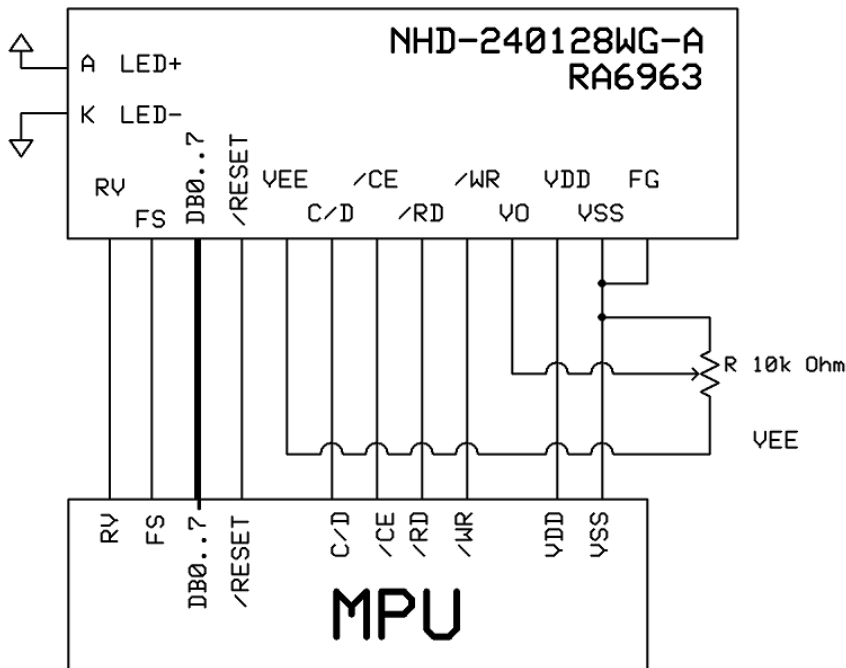
NHD-240128WG-ATFH-VZ#

## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	FGND	Power Supply	Frame Ground
2	VSS	Power Supply	Ground
3	VDD	Power Supply	Power supply for logic (+5.0V)
4	VO	Adj Power Supply	Power supply for contrast (approx. -13.0V)
5	$\overline{\text{WR}}$	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
6	$\overline{\text{RD}}$	MPU	Active LOW read
7	$\overline{\text{CE}}$	MPU	Active LOW chip select signal
8	C/D	MPU	Register select signal. CD=1: Command, CD=0: Data
9	VEE	Power Supply	Negative voltage output (-22V)
10	RESET	MPU	Active LOW reset signal
11-18	DB0~DB7	MPU	Bi-directional three-state data bus lines.
19	FS	Power Supply	Font select signal. H:6x8, L:8x8
20	RV	MPU	Display mode signal. RV=1: Reverse display, RV=0: normal

**Recommended LCD connector:** 20 pin, 2.54mm pitch pins

**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		4.75	5.0	5.25	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	-	23.0	-	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	16.3	18.0	20.1	V
"H" Level input	VIH		VDD-2.2	-	VDD	V
"L" Level input	VIL	-	0	-	0.8	V
"H" Level output	VOH	-	VDD-0.3	-	VDD	V
"L" Level output	VOL	-	0	-	0.3	V
Backlight Supply Voltage	VLED		3.4	3.5	3.6	V
Backlight Supply Current	ILED	VLED=3.5V	98	112	125	mA
Backlight Lifetime		ILED=160mA	-	50,000	-	Hrs
Backlight Brightness	IV	ILED=160mA	180	230	-	CD/M <sup>2</sup>

## Optical Characteristics

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

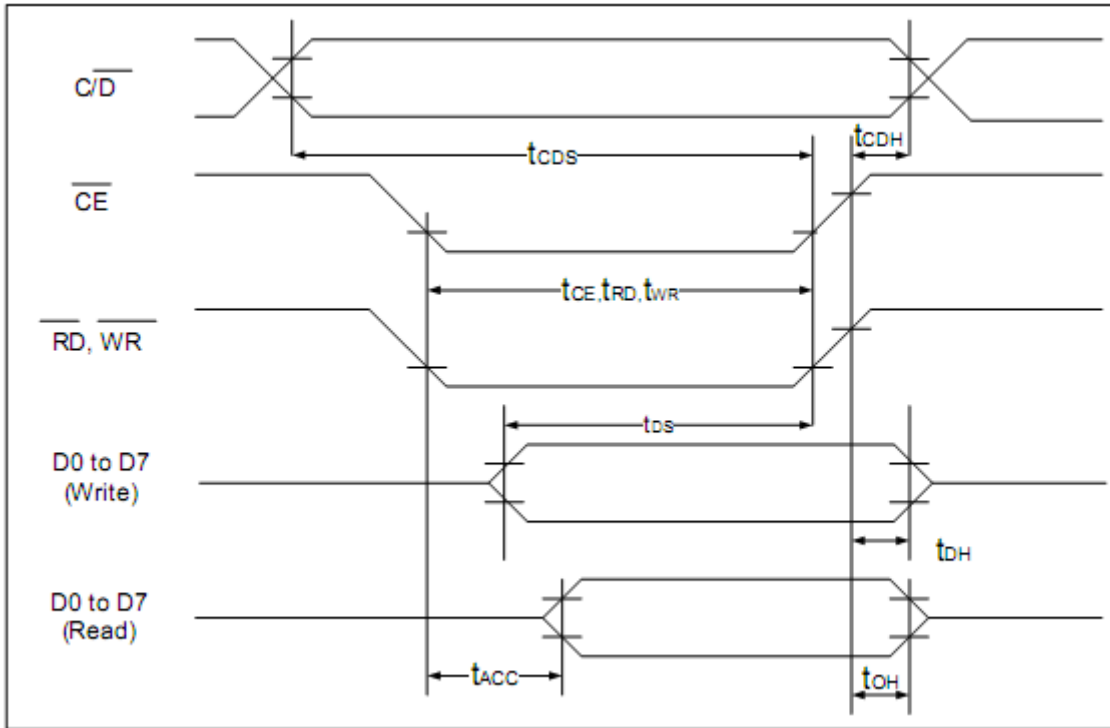
## Controller Information

Built-in RA6963. Download specification at [http://www.newhavendisplay.com/app\\_notes/RA6963.pdf](http://www.newhavendisplay.com/app_notes/RA6963.pdf)

## Table of Commands

Command	Code	D1	D2	Function
<b>Registers Setting</b>	00100001	X address	Y address	Set cursor pointer
	00100010	Data	00h	Set Offset Register
	00100100	Low address	High address	Set Address pointer
<b>Set Control Word</b>	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00h	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00h	Set Graphic Area
<b>Mode Set</b>	1000X000	--	--	OR mode
	1000X001	--	--	EXOR mode
	1000X011	--	--	AND mode
	1000X100	--	--	Text Attribute mode
	10000XXX	--	--	Internal CG ROM mode
	10001XXX	--	--	External CG RAM mode
<b>Display Mode</b>	10010000	--	--	Display off
	1001XX10	--	--	Cursor on, blink off
	1001XX11	--	--	Cursor on, blink on
	100101XX	--	--	Text on, graphic off
	100110XX	--	--	Text off, graphic on
	100111XX	--	--	Text on, graphic on
<b>Cursor Pattern Select</b>	10100000	--	--	1-line cursor
	10100001	--	--	2-line cursor
	10100010	--	--	3-line cursor
	10100011	--	--	4-line cursor
	10100100	--	--	5-line cursor
	10100101	--	--	6-line cursor
	10100110	--	--	7-line cursor
	10100111	--	--	8-line cursor
<b>Data Read/Write</b>	11000000	Data	--	Data Write and Increment ADP
	11000001	--	--	Data Read and Increment ADP
	11000010	Data	--	Data Write and Decrement ADP
	11000011	--	--	Data Read and Decrement ADP
	11000100	Data	--	Data Write and Non-variable ADP
	11000101	--	--	Data Read and Non-variable ADP
<b>Data auto Read/Write</b>	10110000	--	--	Set Data Auto Write
	10110001	--	--	Set Data Auto Read
	10110010	--	--	Auto Reset
<b>Screen Peek</b>	11100000	--	--	Screen Peek
<b>Screen Copy</b>	11101000			Screen Copy
<b>Bit Set/Reset</b>	11110XXX	--	--	Bit Reset
	11111XXX	--	--	Bit Set
	1111X000	--	--	Bit 0 (LSB)
	1111X001	--	--	Bit 1
	1111X010	--	--	Bit 2
	1111X011	--	--	Bit 3
	1111X100	--	--	Bit 4
	1111X101	--	--	Bit 5
	1111X110	--	--	Bit 6
1111X111	--	--	Bit 7 (MSB)	
<b>Screen Reverse</b>	11010000	Data	--	Whole screen reverse

## Timing Characteristics



( $V_{DD}=+5V\pm 5\%$ ,  $GND=0V$ ,  $T_a = -20$  to  $+70^\circ C$ )

Item	Symbol	Test Conditions	Min.	Max.	Unit
C/D Set Up Time	$t_{CDS}$	--	100	--	ns
C/D Hold Time	$t_{CDH}$	--	10	--	ns
CE, RD, WR Pulse Width	$t_{CE}, t_{RD}, t_{WR}$	--	80	--	ns
Data Set Up Time	$t_{DS}$	--	80	--	ns
Data Hold Time	$t_{DH}$	--	40	--	ns
Access Time	$t_{ACC}$	--	--	150	ns
Output Hold Time	$t_{OH}$	--	10	50	ns



# Font Table

Upper 4 Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH
LLLL		0	1	2	3	4	5	6
LLLH	!	7	8	9	;	;	;	;
LLHL	"	;	;	;	;	;	;	;
LLHH	#	;	;	;	;	;	;	;
LHLL	\$	;	;	;	;	;	;	;
LHLH	%	;	;	;	;	;	;	;
LHHL	&	;	;	;	;	;	;	;
LHHH	'	;	;	;	;	;	;	;
HLLL	(	;	;	;	;	;	;	;
HLLH	)	;	;	;	;	;	;	;
HLHL	*	;	;	;	;	;	;	;
HLHH	+	;	;	;	;	;	;	;
HHLL	,	;	;	;	;	;	;	;
HHLH	-	;	;	;	;	;	;	;
HHHL	.	;	;	;	;	;	;	;
HHHH	/	;	;	;	;	;	;	;

## Initialization Code

```
//-----  
Sub Writecom  
P1 = A           'move data to port 1  
Set P3.0         'set I/D for instruction  
Reset P3.1       'reset /CS  
Reset P3.4       'reset /WR  
Set P3.1         'set /CS  
Set P3.4         'set /WR  
End Sub  
  
Sub Writedata  
P1 = A           'move data to port 1  
Reset P3.0       'reset I/D for instruction  
Reset P3.1  
Reset P3.4       'toggle /CS and /WR  
Set P3.1  
Set P3.4  
End Sub  
  
//-----  
Sub Init  
Set P3.6  
Set P3.7  
Reset P3.3       'reset FS  
A = &H00  
Call Writedata  
Call Writedata  'text address = 0000h  
A = &H40  
Call Writecom   'text home address set  
A = &H00  
Call Writedata  
A = &H40        'graphic home address = 4000h  
Call Writedata  
A = &H42  
Call Writecom   'graphic home address set  
A = &H1E  
Call Writedata  
A = &H00        'text area address = 001Eh  
Call Writedata  
A = &H41  
Call Writecom   'text area control set  
A = &H1E  
Call Writedata  
A = &H00        'graphic area = 001Eh  
Call Writedata  
A = &H43  
Call Writecom   'graphic area control set  
A = &H80  
Call Writecom   'set display mode  
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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)