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# NHD-160128WG-BTMI-VZ#-1

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
160128-	160 x 128 pixels
WG-	Display Type: Graphic
B-	Model
T-	White LED backlight
M-	STN- Blue (-)
I-	Transmissive, 6:00 View, Wide Temperature (-20°C ~ +70°C)
VZ-	Built-in Negative Voltage
#-1	Selectable Font size (Default: 7 x 8 Font)
	<b>RoHS Compliant</b>

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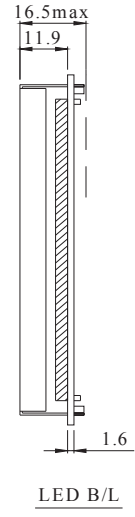
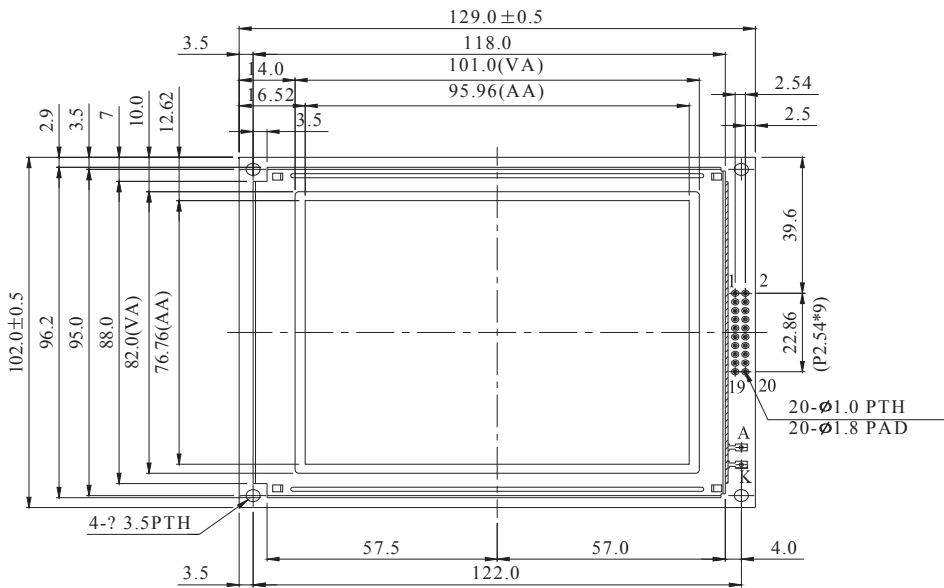
## Document Revision History

Revision	Date	Description	Changed by
0	3/16/2010	Initial Release	-
1	4/13/2010	User guide reformat	BE
2	4/21/2010	Block diagram update	BE
3	5/14/2010	Updated Input and Output Voltages in Electrical Characteristics	MC

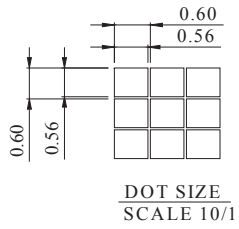
## Functions and Features

- 160 x 128 pixels
- Built-in RA6963 Controller
- +5.0V power supply
- 1/128 duty
- RoHS Compliant

Mechanical Drawing



PIN NO.	SYMBOL
1	FG
2	V <sub>ss</sub>
3	VDD
4	V <sub>o</sub>
5	V <sub>ee</sub>
6	WR
7	RD
8	CE
9	C/D
10	HALT
11	RESET
12	DB0
13	DB1
14	DB2
15	DB3
16	DB4
17	DB5
18	DB6
19	DB7
20	NC



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

<b>Newhaven Display</b>
NHD-160128WG-BTMI-VZ#-1

## Pin Description and Wiring Diagram

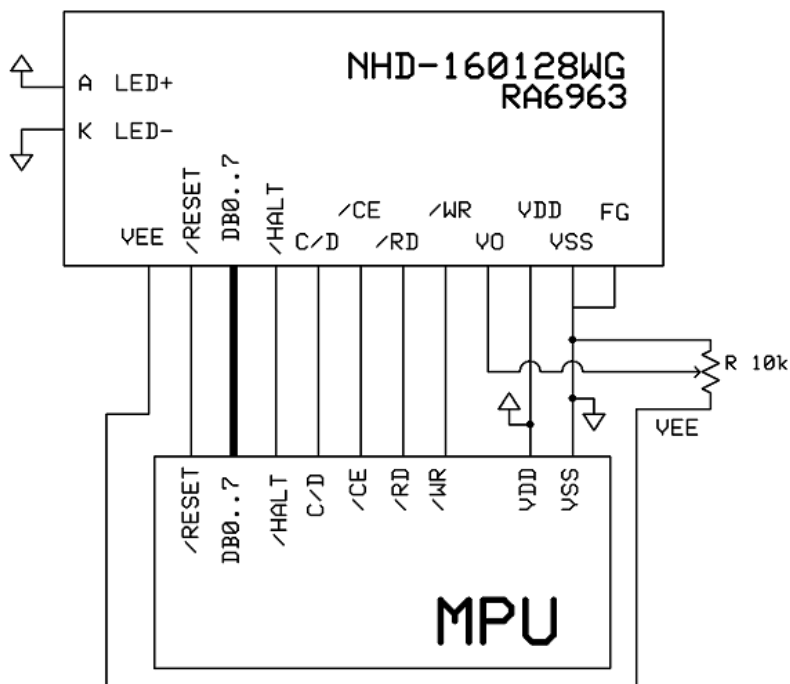
Pin No.	Symbol	External Connection	Function Description
1	FG	Power Supply	Frame Ground
2	VSS	Power Supply	Ground
3	VDD	Power Supply	Power supply for Logic (+5.0V)
4	V0	Adj. Power Supply	Power supply for contrast (approx. -14.2V)
5	VEE	Power Supply	Negative voltage output (-16.0V)
6	/WR	MPU	Active LOW Write signal
7	/RD	MPU	Active LOW Read signal
8	/CE	MPU	Active LOW Chip Select signal.
9	C/D	MPU	Register select signal. C/D=1: Command C/D=0: Data
10	/HALT	-	Active LOW Clock operating stop signal
11	/RESET	MPU	Active LOW Reset signal
12-19	DB0-DB7	MPU	This is an 8-bit Bi-directional data bus
20	NC	-	No Connect
A	LED+	Power Supply	Power for LED backlight (+3.5V)
K	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 2.54mm pitch pins

Backlight connector: - Mates with: -

### Font Size Jumper Settings:

Font Size	JF0H	JF0L	JF1H	JF1L
5 x 8	Short	Open	Short	Open
6 x 8	Open	Short	Short	Open
7 x 8 (Default)	Short	Open	Open	Short
8 x 8	Open	Short	Open	Short



## 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		4.5	5.0	5.5	V
Supply Current	IDD	Ta=25°, VDD=5.0V	30	42	50	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°	18.8	19.2	19.6	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	115.2	128	200	mA
Backlight Lifetime	-	Iled=128mA	-	50,000	-	Hrs.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical (top)	AH	Cr ≥ 2	-	20	-	°
Viewing Angle- Vertical (bottom)	AH	Cr ≥ 2	-	40	-	°
Viewing Angle- Horizontal (left)	AV	Cr ≥ 2	-	30	-	°
Viewing Angle - Horizontal (right)	AV	Cr ≥ 2	-	30	-	°
Contrast Ratio	Cr			3		
Response Time (rise)	Tr			200	300	ms
Response Time (fall)	Tf			200	300	ms

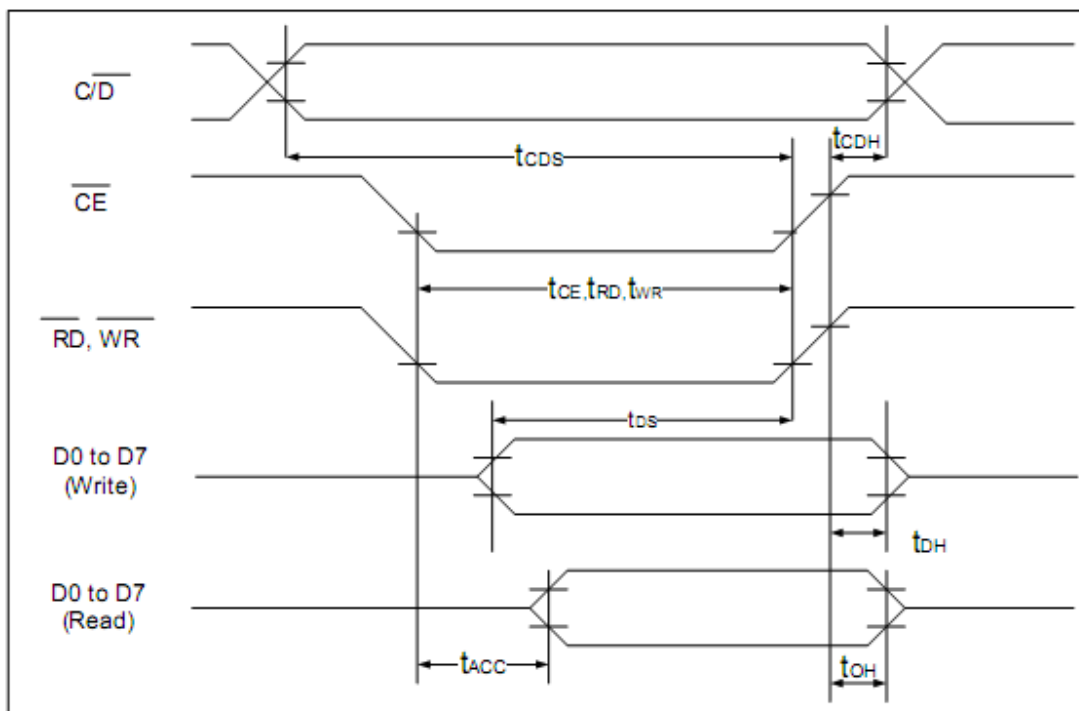
## Controller Information

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	--	--
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
$\overline{C/D}$ Set Up Time	$t_{CDS}$	--	100	--	ns
$\overline{C/D}$ Hold Time	$t_{CDH}$	--	10	--	ns
$\overline{CE}$ , $\overline{RD}$ , $\overline{WR}$ 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



## Example Initialization Program

```
//-----  
sbit ID = P3^1;  
sbit CS = P3^1;  
sbit RW = P3^0;  
sbit CE = P3^4;  
//sbit READ = P0^0;  
sbit FS = P3^2;  
sbit RST = P3^6;  
  
//-----  

```

## 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](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)