

# NHD-240128WG-BTML-VZ#

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
240128-	240 x 128 Pixels
WG-	Display Type: Graphic
B-	Model
T-	White LED Backlight
M-	STN Negative, Blue
L-	Transmissive, 12:00 Optimal View, Wide Temperature
VZ#-	Built-in Negative Voltage

**RoHS Compliant**

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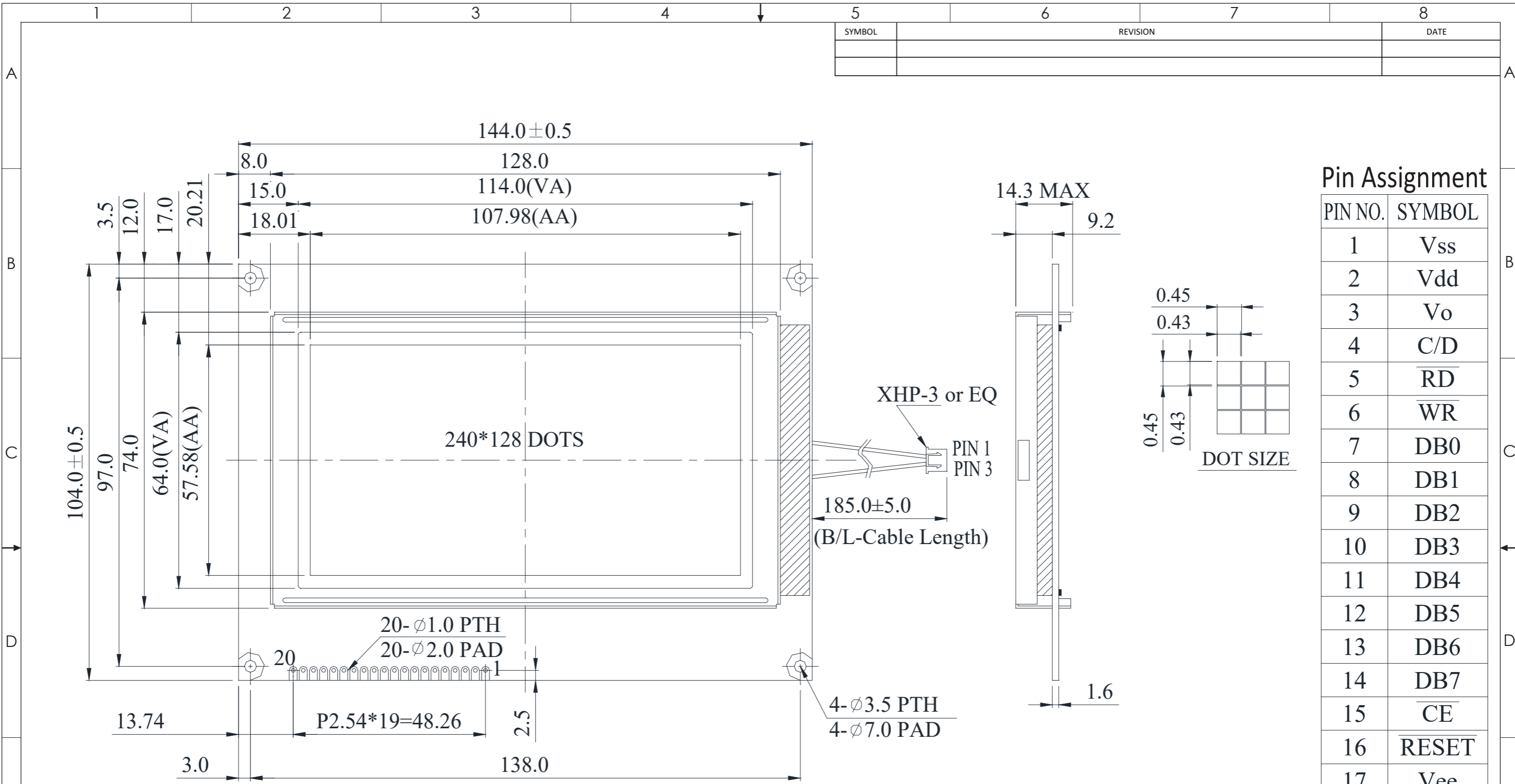
## Document Revision History

Revision	Date	Description	Changed by
0	3/13/09	Initial Release	-
1	4/26/10	User guide reformat	BE
2	3/3/11	Electrical characteristics updated	AK
3	4/29/11	Pin description updated	AK
4	5/14/14	Mechanical drawing, Electrical characteristics updated	ML
5	3/28/18	Backlight Cable Length, Supply Current & Optical Characteristics Updated	SB
6	1/8/19	Backlight Characteristics Updated	SB
7	6/23/20	Updated Logic Voltages, Quality Information	AS

## Functions and Features

- 240 x 128 pixels
- Built-in RA6963 controller
- +5.0V power supply
- 1/128 duty
- RoHS compliant

SYMBOL	REVISION	DATE



### Pin Assignment

PIN NO.	SYMBOL
1	V <sub>SS</sub>
2	V <sub>DD</sub>
3	V <sub>O</sub>
4	C/D
5	RD
6	WR
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	CE
16	RESET
17	V <sub>EE</sub>
18	MD2
19	FS1
20	NC

- Notes:**
1. Driver: 1/128 Duty
  2. Voltage: 5.0V VDD, 19.5V VLCD
  3. Display Mode: STN Negative / Blue / Transmissive
  4. Optimal View: 12:00
  5. Backlight: White LED
  6. Driver IC: RA6963

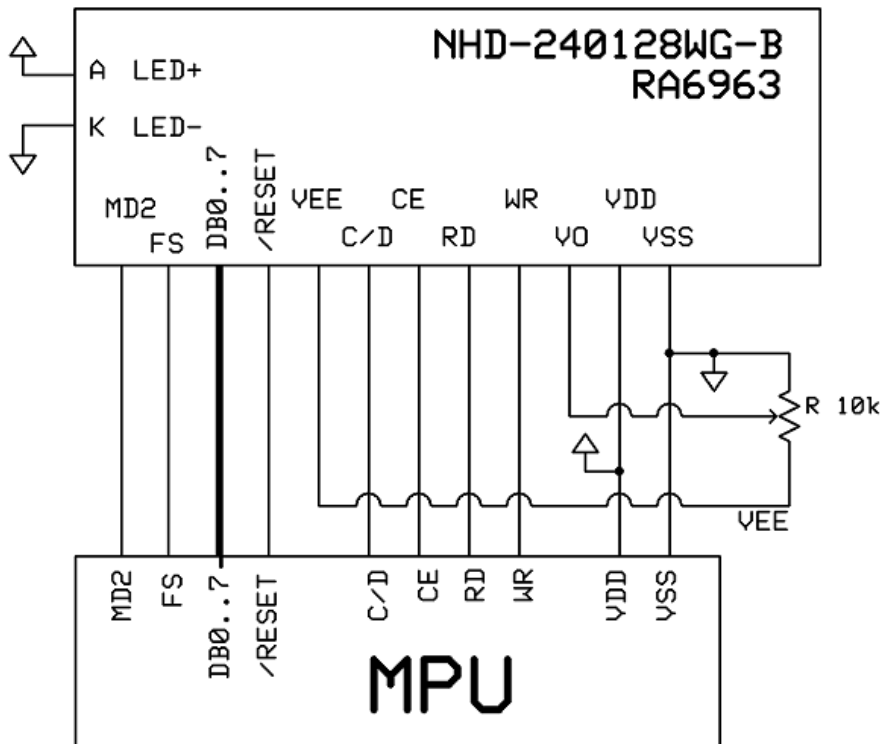
STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)	NEWHAVEN DISPLAY INTERNATIONAL	
	LINEAR: ±0.3mm	DRAWING/PART NUMBER: NHD-240128WG-BTML-VZ#
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: A. Shah	APPROVED BY: A. Shah
	DRAWN DATE: 06/23/20	APPROVED DATE: 06/23/20
DO NOT SCALE DRAWING		REVISION: 1.0 SIZE: A3 SCALE: NS
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V <sub>SS</sub>	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Power supply for Logic (+5.0V)
3	V <sub>0</sub>	Adj. Power Supply	Supply Voltage for Contrast (approx. -14.5V)
4	C/D	MPU	Command/Data selection: '1' = Command, '0' = Data
5	/RD	MPU	Active LOW Read signal
6	/WR	MPU	Active LOW Write signal
7-14	DB0-DB7	MPU	8-bit bi-directional data bus
15	/CE	MPU	Active LOW Chip Enable signal
16	/RESET	MPU	Active LOW Reset signal
17	VEE	Power Supply	Negative Voltage output (-16V)
18	MD2	MPU	Display size signal: '1' = 32 columns, '0' = 40 columns
19	FS	MPU	Font Selection: '1' = 6x8, '0' = 8x8
20	NC	-	No Connect
A	LED+	Power Supply	Supply Voltage for LED backlight (60mA @ 3.5V)
K	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	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	3.0	5.0	5.5	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 5.0V	12	25	50	mA
Supply for LCD (contrast)	V <sub>LCD</sub>	T <sub>OP</sub> = 25°C	18.9	19.5	20.1	V
"H" Level input	V <sub>IH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.15 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	V <sub>DD</sub> - 0.3	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.3	V
Backlight Supply Current	I <sub>LED</sub>	-	-	60	85	mA
Backlight Supply Voltage	V <sub>LED</sub>	I <sub>LED</sub> = 60 mA	3.4	3.5	3.6	V

\*The LED of the backlight is driven by current; 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	CR ≥ 2	-	-	40	°
	Bottom		-	-	20	°
	Left		-	-	30	°
	Right		-	-	30	°
Contrast Ratio	CR	-	-	3	-	-
Response Time	Rise	T <sub>OP</sub> = 25°C	-	200	300	ms
	Fall		-	250	350	ms

## Controller Information

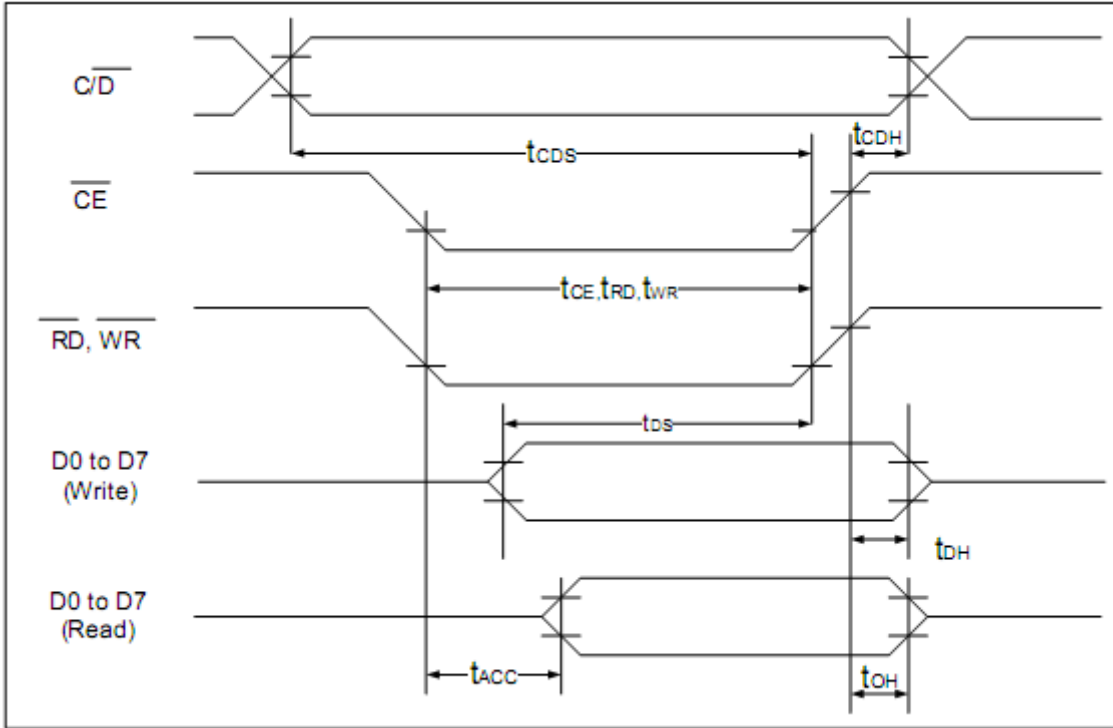
Built-in RA6963 controller.

Please 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
	1000XXX	--	--	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
$\overline{C/D}$ 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

# Built-in Font Table

LSB \ MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
3	P	Q	R	S	T	U	U	W	X	Y	Z	[	\	]	^	_
4	'	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	v	w	x	y	z	{		}	~	
6	Q	Ü	Š	š	À	á	Â	ç	È	É	Ê	Ë	Ì	Í	Î	Ï
7	Ë	Æ	Œ	Ö	ö	Ö	Ü	ü	Û	ü	Û	Ø	€	¥	℞	ƒ



## Example Program 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, 1.5mm amplitude. 60 secs in each of 3 directions X, Y, Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±800V 150pF/330Ω, 10 Times	
		Contact: ±600V 150pF/330Ω, 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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information

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