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# NHD-12864WG-FTTI-VZ#000

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
12864-	128 x 64 pixels
WG-	Display Type: Graphic
F-	Model
T-	White LED Backlight
T-	FSTN (-)
I-	Transmissive, Wide Temperature (-20°C ~ +70°C) 6:00 view
VZ#-	Built-in Negative voltage
000-	2x10 straight vertical header (Molex 10-89-7201 or equiv) for CON1: RA=18Ω SMT 1206 resistor & short J1

**RoHS Compliant**

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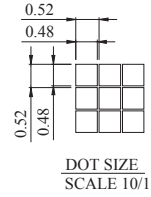
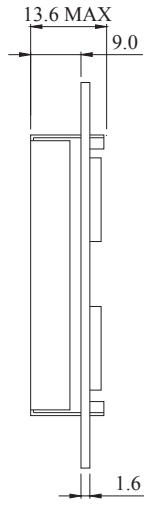
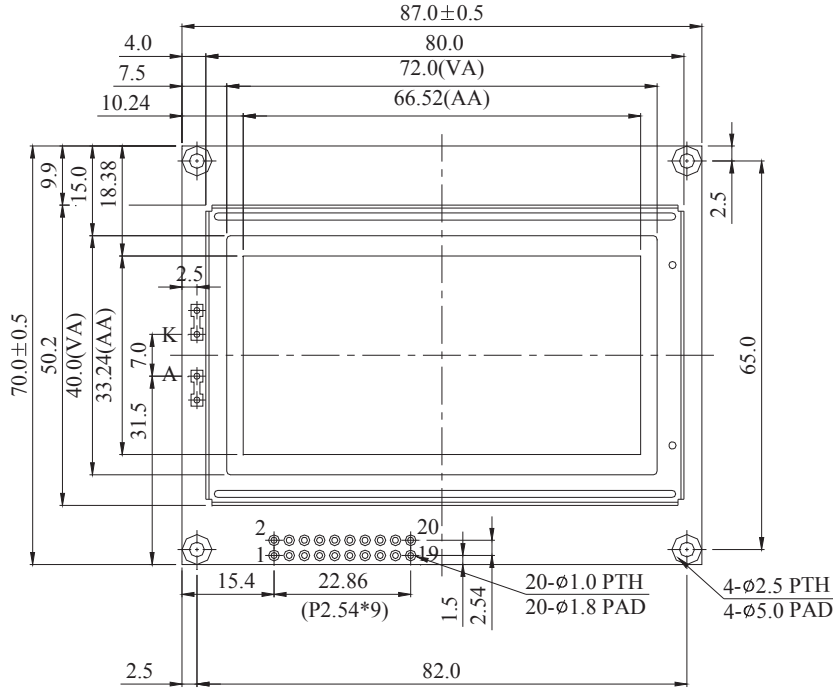
## Document Revision History

Revision	Date	Description	Changed by
0	10/22/2008	Initial Release	-
1	3/23/2010	User guide reformat	BE
2	5/6/2010	Block diagram/initialization updated	BE

## Functions and Features

- 128 x 64 pixels
- Built-in RA6963 Controller
- +5.0V power supply
- 1/64 duty cycle
- RoHS Compliant

Mechanical Drawing



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	/RST
17	V <sub>ee</sub>
18	MD2
19	FS1
20	HLT

LED B/L

**Newhaven Display**

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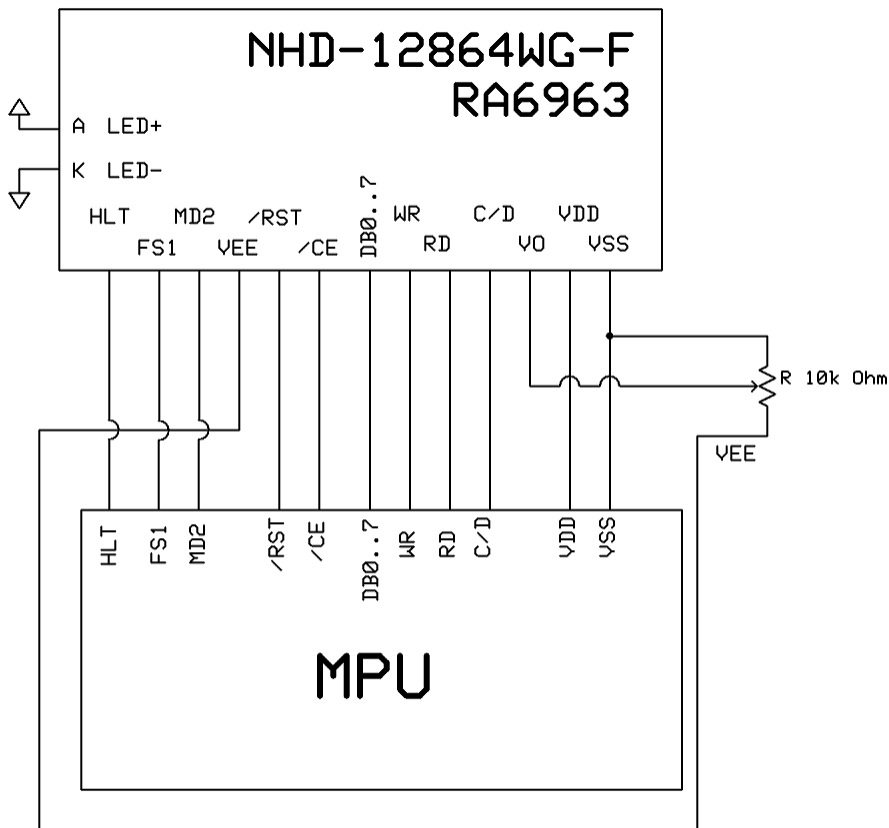
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+5.0V)
3	V0	Adj.Power Supply	Power Supply for contrast (approx. -3.0V )
4	C/D	MPU	Register select signal. C/D=0: DATA C/D=1: COMMAND
5	/RD	MPU	Active LOW Read signal
6	/WR	MPU	Active LOW Write signal
7-14	DB0-DB7	MPU	Bi-directional 8-bit data bus
15	/CE	MPU	Active LOW Chip enable
16	/RST	MPU	Active LOW Reset Signal
17	Vee	Power Supply	Negative voltage output (-5.0V)
18	MD2	MPU	Column select; H:32 column; L: 40 column
19	FS1	MPU	Font Select: 1: 6x8 fonts, 0: 8x8 fonts
20	HLT	MPU	Clock operating stop signal
A	LED+	Power Supply	Power Supply for LED Backlight (+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	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°, VDD=5.0V	12.0	16.0	20.0	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°	-	8.0	-	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	65	80	100	mA
Backlight Lifetime	-	ILED=80mA	-	50,000	-	Hrs.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical (top)	AV	Cr ≥ 2	-	30	-	°
Viewing Angle - Vertical (bottom)	AV	Cr ≥ 2	-	60	-	°
Viewing Angle - Horizontal (left)	AH	Cr ≥ 2	-	45	-	°
Viewing Angle – Horizontal (right)	AH	Cr ≥ 2	-	45	-	°
Contrast Ratio	Cr		-	5	-	-
Response Time (rise)	Tr	-	-	150	200	ms
Response Time (fall)	Tf	-	-	150	200	ms

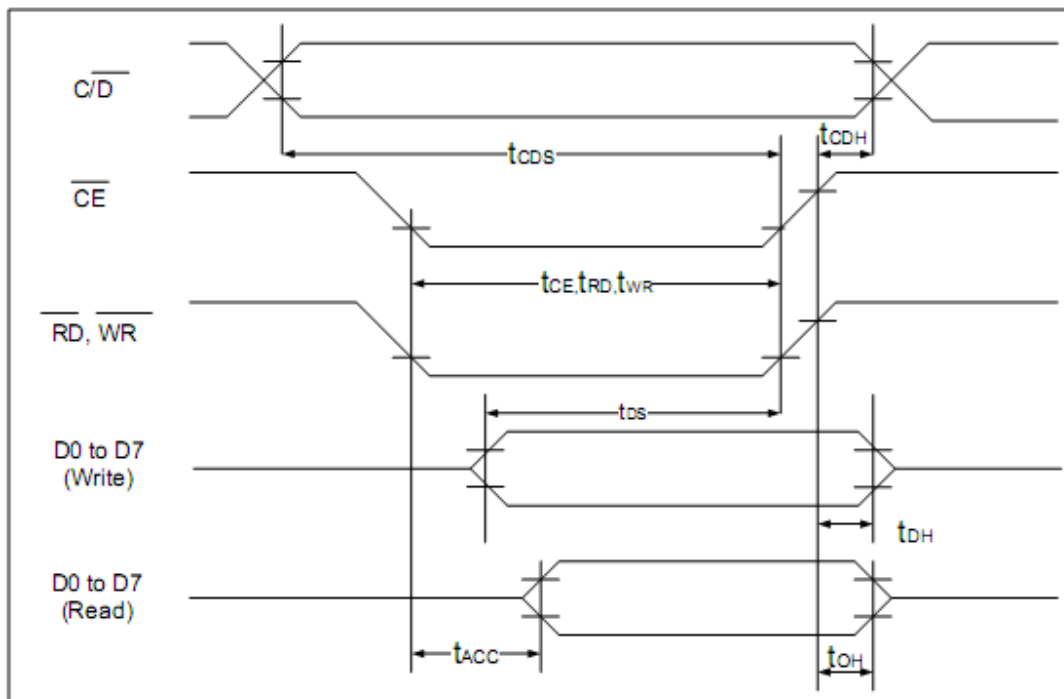
## Controller Information

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
$\overline{C/D}$ 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

```
//=====
#define LCM_PORT P1 //DB0~DB7,DATA BUS
sbit CD = P3^0; // DATA / INSTRUCTION
sbit FS = P3^1; // CHIP ENABLE
sbit MD2 = P3^2; // CHIP RESET
sbit RESET = P3^3; // CHOICE CHIP1
sbit CE = P3^4; // CHIP READ/WRITE
sbit WR = P3^6; // CHOICE CHIP2
sbit RD = P3^7;
//-----
// initial T6963C
//-----
void Initial_T6963C()
{
    /*write text home address=0000h */
    Write_data(0x00);
    Write_data(0x00);
    Write_command(0x40);

    Write_data(0x80);
    Write_data(0x00);
    Write_command(0x42);

    /*write text area address*/
    Write_data(0x10);
    Write_data(0x00);
    Write_command(0x41);

    /*write graphic area address*/
    Write_data(0x10);
    Write_data(0x00);
    Write_command(0x43);

    /*set display mode Display mode set (Graphic only enable)*/
    Write_command(0x80);
    /*Graphic display enable*/
    Write_command(0x98);
}
//-----
// Write Data Function
//-----
void Write_data(data){
    P1=data;
    CD=0;

    CE=0;
    WR=0;

    CE=1;
    WR=1;
}
//-----
// Write Command Function
//-----
void Write_command(command){
    P1 = command;
    CD=1;

    CE=0;
    WR=0;
    CE=1;
    WR=1;
}
//=====
```

## 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)