

# NHD-12864WG-FTFH-VZ#

## Graphic Liquid Crystal Display Module

|        |                                                           |
|--------|-----------------------------------------------------------|
| NHD-   | Newhaven Display                                          |
| 12864- | 128 x 64 pixels                                           |
| WG-    | Display Type: Graphic                                     |
| F-     | Model                                                     |
| T-     | White LED Backlight                                       |
| F-     | FSTN (+)                                                  |
| H-     | Transflective, Wide Temperature (-20°C ~ +70°C) 6:00 view |
| VZ#-   | Built-in Negative voltage                                 |
|        | <b>RoHS Compliant</b>                                     |

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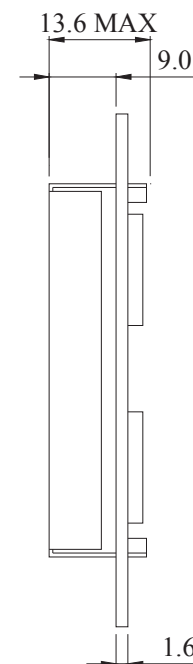
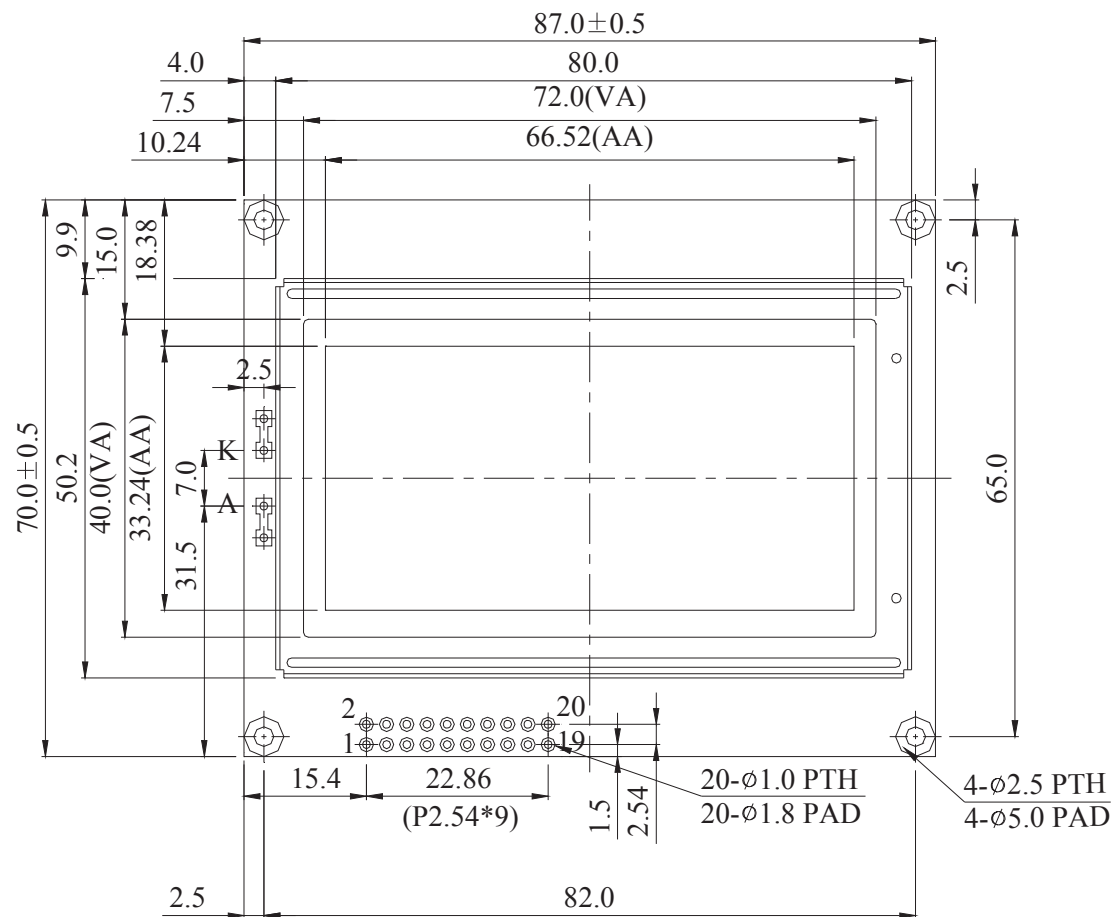
## Document Revision History

| 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         |
|          |            |                                      |            |

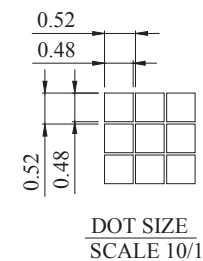
## Functions and Features

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

# Mechanical Drawing



LED B/L



| 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             |

# Newhaven Display

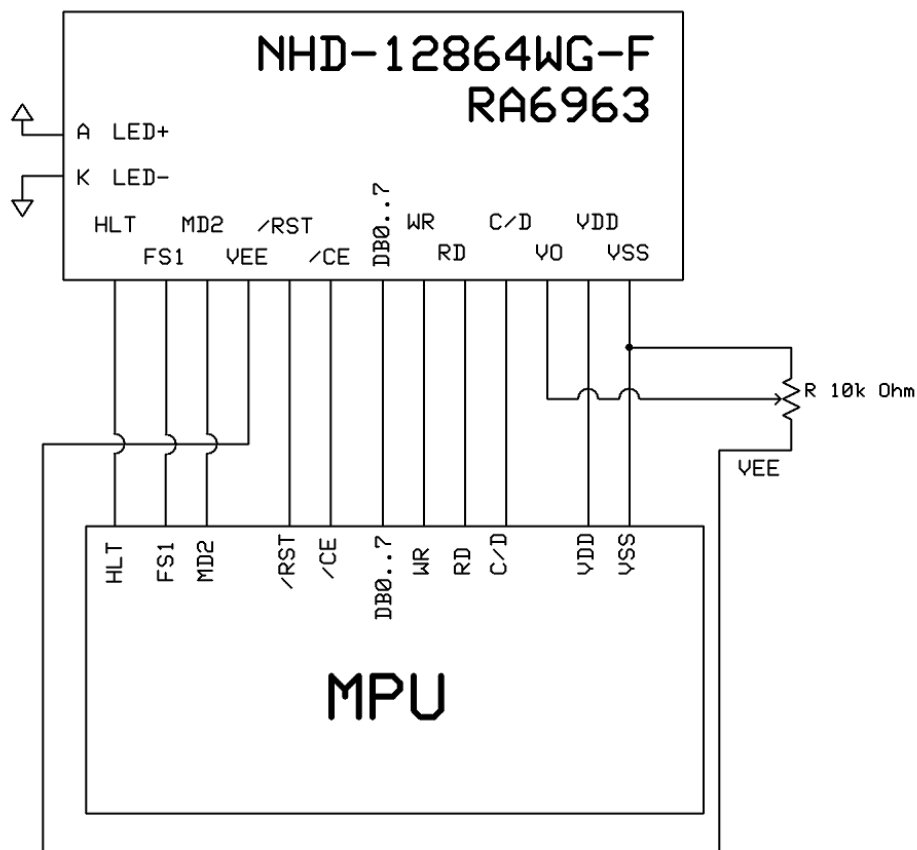
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## Pin Description and Wiring Diagram

| 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    | -    | 20   | -    | °    |
| Viewing Angle - Vertical (bottom)  | AV     | Cr ≥ 2    | -    | 40   | -    | °    |
| Viewing Angle - Horizontal (left)  | AH     | Cr ≥ 2    | -    | 30   | -    | °    |
| Viewing Angle – Horizontal (right) | AH     | Cr ≥ 2    | -    | 30   | -    | °    |
| Contrast Ratio                     | Cr     |           | -    | 3    | -    | -    |
| Response Time (rise)               | Tr     | -         | -    | 150  | 200  | ms   |
| Response Time (fall)               | Tf     | -         | -    | 150  | 200  | ms   |

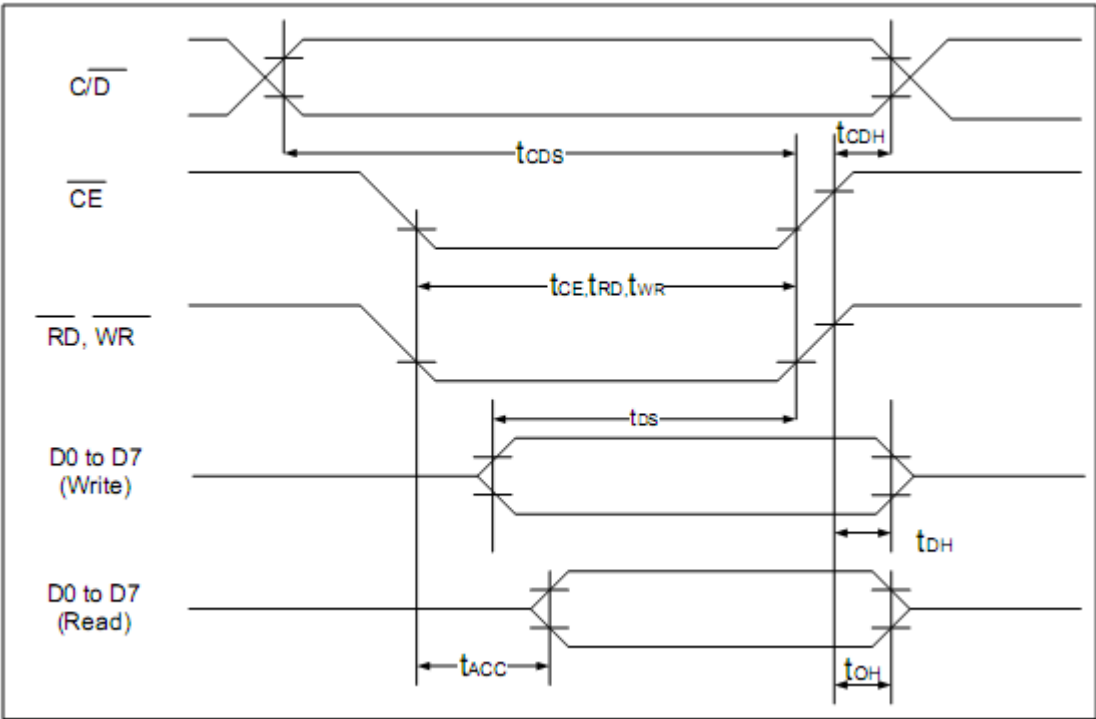
## Controller Information

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                        |
|-----------------------|----------|-------------|--------------|---------------------------------|
| Registers Setting     | 00100001 | X address   | Y address    | Set cursor pointer              |
|                       | 00100010 | Data        | 00h          | Set Offset Register             |
|                       | 00100100 | Low address | High address | Set Address pointer             |
| Set Control Word      | 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                |
| Mode Set              | 1000X000 | --          | --           | OR mode                         |
|                       | 1000X001 | --          | --           | EXOR mode                       |
|                       | 1000X011 | --          | --           | AND mode                        |
|                       | 1000X100 | --          | --           | Text Attribute mode             |
|                       | 10000XXX | --          | --           | Internal CG ROM mode            |
|                       | 10001XXX | --          | --           | External CG RAM mode            |
| Display Mode          | 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             |
| Cursor Pattern Select | 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                   |
| Data Read/Write       | 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  |
| Data auto Read/Write  | 10110000 | --          | --           | Set Data Auto Write             |
|                       | 10110001 | --          | --           | Set Data Auto Read              |
|                       | 10110010 | --          | --           | Auto Reset                      |
| Screen Peek           | 11100000 | --          | --           | Screen Peek                     |
| Screen Copy           | 11101000 | --          | --           | Screen Copy                     |
| Bit Set/Reset         | 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)                     |
| Screen Reverse        | 11010000 | Data        | --           | Whole screen reverse            |

Timing Characteristics



(  $V_{DD}=+5V\pm5\%$ ,  $GND=0V$ ,  $T_a= -20$  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<br>10 cycles                       |      |
| Vibration test                        | Endurance test applying vibration to simulate transportation and use.                                                           | 10-55Hz , 15mm amplitude.<br>60 sec in each of 3 directions X,Y,Z<br>For 15 minutes | 3    |
| Static electricity test               | Endurance test applying electric static discharge.                                                                              | VS=800V, RS=1.5kΩ, CS=100pF<br>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)