

# NHD-320240WG-BoTMI-VZ#

## Graphic Liquid Crystal Display Module

|         |                                                          |
|---------|----------------------------------------------------------|
| NHD-    | Newhaven Display                                         |
| 320240- | 320 x 240 pixels                                         |
| WG-     | Display Type: Graphic                                    |
| Bo-     | Model                                                    |
| T-      | WhiteLED Backlight                                       |
| M-      | STN- Negative Blue                                       |
| I-      | Transmissive, 6:00 view, Wide Temperature (-20°C ~+70°C) |
| VZ#-    | Built-in Negative Voltage                                |
|         | <b>RoHS Compliant</b>                                    |

### Newhaven Display International, Inc.

2511 Technology Drive, Suite 101

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

[www.newhavendisplay.com](http://www.newhavendisplay.com)

[nhtech@newhavendisplay.com](mailto:nhtech@newhavendisplay.com)

[nhsales@newhavendisplay.com](mailto:nhsales@newhavendisplay.com)

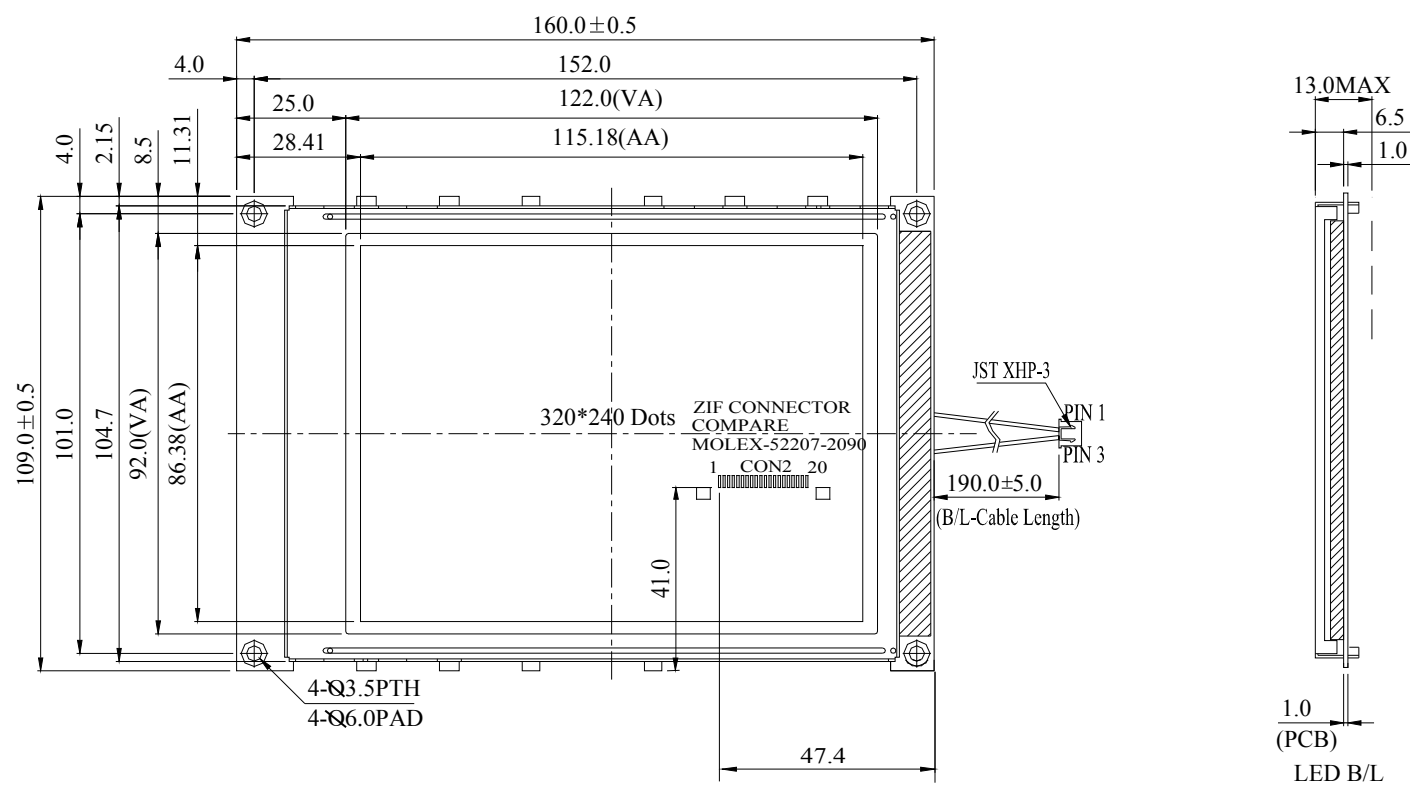
## Document Revision History

| Revision | Date       | Description                                   | Changed by |
|----------|------------|-----------------------------------------------|------------|
| 0        | 6/7/2007   | Initial Release                               | -          |
| 1        | 4/16/2010  | User guide reformat                           | MC         |
| 2        | 11/15/2010 | Mechanical Drawing updated with ZIF connector | BE         |
|          |            |                                               |            |

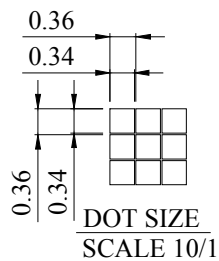
## Functions and Features

- 320 x 240pixels
- Built-in RA8835Controller
- +5.0V power supply
- RoHS Compliant

# Mechanical Drawing



| PIN NO. | SYMBOL |
|---------|--------|
| 1       | VSS    |
| 2       | Vcc    |
| 3       | Vo     |
| 4       | A0     |
| 5       | R/W    |
| 6       | E      |
| 7       | DB0    |
| 8       | DB1    |
| 9       | DB2    |
| 10      | DB3    |
| 11      | DB4    |
| 12      | DB5    |
| 13      | DB6    |
| 14      | DB7    |
| 15      | /CS    |
| 16      | /RST   |
| 17      | Vee    |
| 18      | NC     |
| 19      | FG     |
| 20      | NC     |



The non-specified tolerance of dimension is  $\pm 0.3\text{mm}$ .

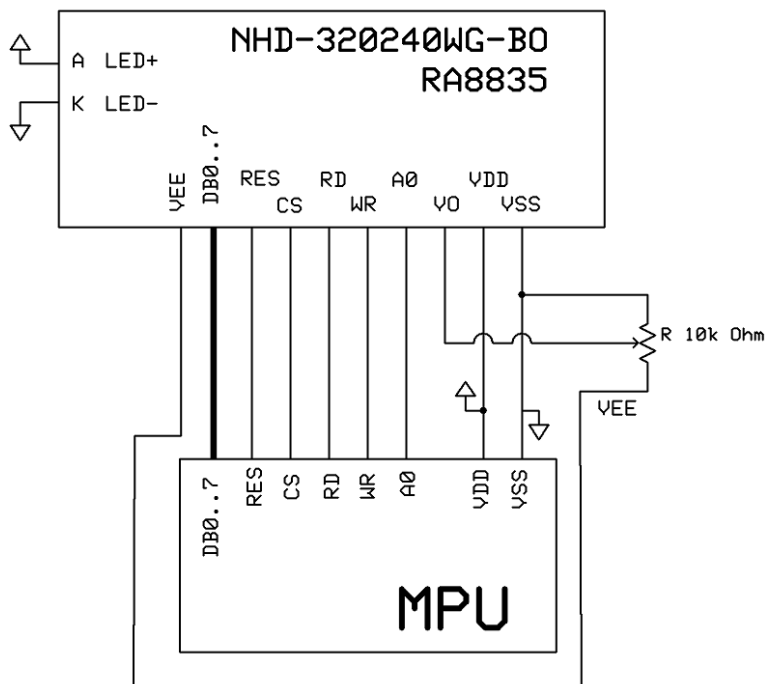
Newhaven Display  
NHD-320240WG-BoTMI-VZ#

## 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. -19.0V)           |
| 4       | A0      | MPU                 | Register select signal. A0=0: Command, A0=1: Data    |
| 5       | R/W     | MPU                 | Read/Write select signal, R/W=1: Read R/W: =0: Write |
| 6       | E       | MPU                 | Operation enable signal. Falling edge triggered.     |
| 7-14    | DB0-DB7 | MPU                 | Bi-directional three-state data bus lines.           |
| 15      | /CS     | MPU                 | Active LOW chip select                               |
| 16      | /RST    | MPU                 | Active LOW reset signal                              |
| 17      | VEE     | Power Supply        | Negative voltage output (-25V)                       |
| 18      | NC      | -                   | No Connect                                           |
| 19      | FG      | -                   | No Connect                                           |
| 20      | NC      | -                   | No Connect                                           |

**Recommended LCD connector:** 1.0mm pitch, 20-pos FFC connector

**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      |                   | 4.5    | 5.0    | 5.5    | V    |
| Supply Current              | IDD      | Ta=25°C, VDD=5.0V | 95.0   | 100.0  | 110.0  | mA   |
| Supply for LCD (contrast)   | VDD-VLCD | Ta=25°C           | 22.0   | 24.0   | 26.0   | V    |
| "H" Level input             | VIH      |                   | 0.5VDD | -      | VDD    | V    |
| "L" Level input             | VIL      | -                 | 0      | -      | 0.2VDD | V    |
| "H" Level output            | VOH      | -                 | 2.4    | -      | -      | V    |
| "L" Level output            | VOL      | -                 | -      | -      | 0.4    | V    |
|                             |          |                   |        |        |        |      |
| Backlight Supply Voltage    | VLED     |                   | 3.4    | 3.5    | 3.6    | V    |
| Backlight Supply Current    | ILED     | VLED=3.5V         | 120    | 160    | 240    | mA   |
| Backlight Lifetime          |          | ILED=160mA        | -      | 50,000 | -      | Hrs  |

## Optical Characteristics

| Item                       | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|--------|-----------|------|------|------|------|
| Viewing Angle - Vertical   | AV     | Cr ≥3     | -40  | -    | 20   | °    |
| Viewing Angle - Horizontal | AH     | Cr ≥3     | -30  | -    | 30   | °    |
| Contrast Ratio             | Cr     |           | -    | 3    | -    | -    |
| Response Time (rise)       | Tr     | -         | -    | 150  | 200  | ms   |
| Response Time (fall)       | Tf     | -         | -    | 150  | 200  | ms   |

## Controller Information

Built-in RA8835. Download specification at [http://www.newhavendisplay.com/app\\_notes/RA8835.pdf](http://www.newhavendisplay.com/app_notes/RA8835.pdf)

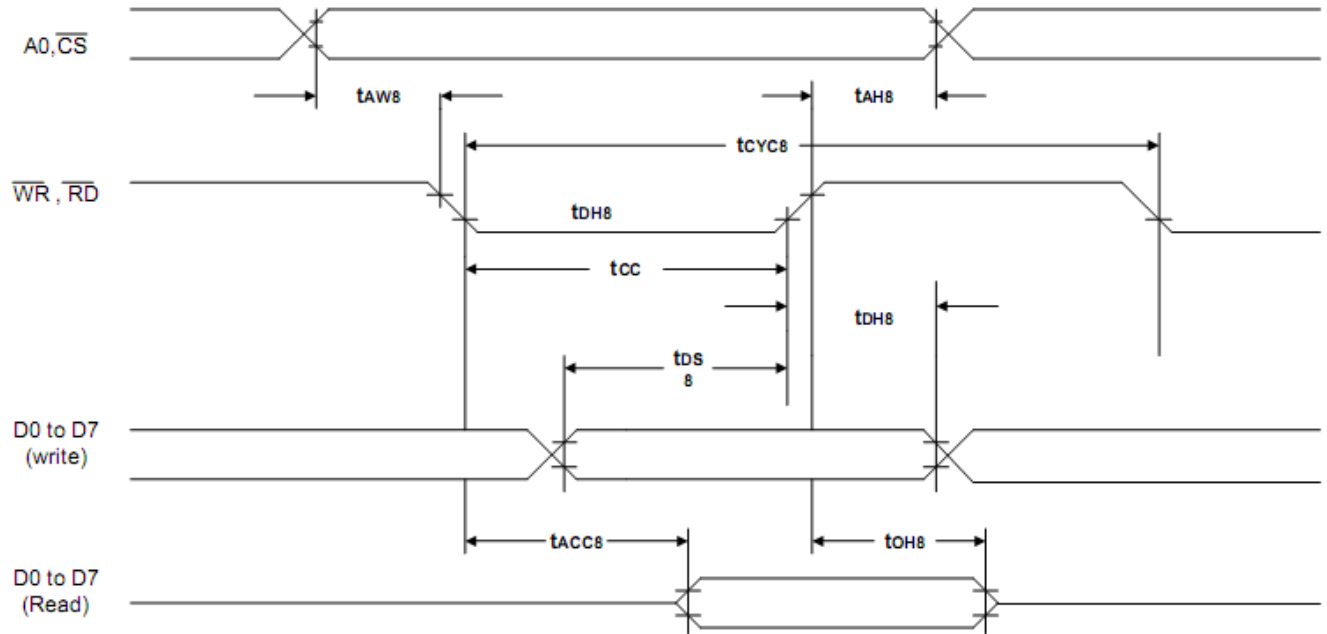
## Table of Commands

Table-1: Command Set

| Class           | Command               | Code |    |    |    |    |    |    |    |    |      |      | Hex      | Command Description                             | Command Read Parameters |         |
|-----------------|-----------------------|------|----|----|----|----|----|----|----|----|------|------|----------|-------------------------------------------------|-------------------------|---------|
|                 |                       | RD   | WR | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1   | D0   |          |                                                 | No. of Bytes            | Section |
| System Control  | <b>SYSTEM SET</b>     | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0    | 0    | 40       | Initialize device and display                   | 8                       | 9-2-1   |
|                 | <b>SLEEP IN</b>       | 1    | 0  | 1  | 0  | 1  | 0  | 1  | 0  | 0  | 1    | 1    | 53       | Enter standby mode                              | 0                       | 9-2-2   |
| Display Control | <b>DISPLAY ON/OFF</b> | 1    | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 0    | D    | 58, 59   | Enable and disable display and display flashing | 1                       | 9-3-1   |
|                 | <b>SCROLL</b>         | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 0    | 0    | 44       | Set display start address and display regions   | 10                      | 9-3-2   |
|                 | <b>CSRFORM</b>        | 1    | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 1  | 0    | 1    | 5D       | Set cursor type                                 | 2                       | 9-3-3   |
|                 | <b>CGRAM ADR</b>      | 1    | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 1  | 0    | 0    | 5C       | Set start address of character generator RAM    | 2                       | 9-3-6   |
|                 | <b>CSRDIR</b>         | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 1  | 1  | CD 1 | CD 0 | 4C to 4F | Set direction of cursor movement                | 0                       | 9-3-4   |
|                 | <b>HDOT SCR</b>       | 1    | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 1    | 0    | 5A       | Set horizontal scroll position                  | 1                       | 9-3-7   |
|                 | <b>OVLAY</b>          | 1    | 0  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 1    | 1    | 5B       | Set display overlay format                      | 1                       | 9-3-5   |
| Drawing Control | <b>CSRW</b>           | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 1    | 0    | 46       | Set cursor address                              | 2                       | 9-r1    |
|                 | <b>CSRR</b>           | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 1    | 1    | 47       | Read cursor address                             | 2                       | 9-4-2   |
| Memory Control  | <b>MWRITE</b>         | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 1    | 0    | 42       | Write to display memory                         | —                       | 9-5-1   |
|                 | <b>MREAD</b>          | 1    | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 1    | 1    | 43       | Read from display memory                        | —                       | 9-5-2   |

# Timing Characteristics

## 10-3-1 8080 Family Interface Timing



$T_a = -20 \text{ to } 75^\circ\text{C}$

| Signal                         | Symbol     | Parameter                   | $V_{DD} = 4.5 \text{ to } 5.5\text{V}$ |      | $V_{DD} = 2.7 \text{ to } 4.5\text{V}$ |      | Unit | Condition  |
|--------------------------------|------------|-----------------------------|----------------------------------------|------|----------------------------------------|------|------|------------|
|                                |            |                             | Min.                                   | Max. | Min.                                   | Max. |      |            |
| $A0, \overline{CS}$            | $t_{AH8}$  | Address hold time           | 10                                     | —    | 10                                     | —    | ns   | CL = 100pF |
|                                | $t_{AW8}$  | Address setup time          | 0                                      | —    | 0                                      | —    | ns   |            |
| $\overline{WR}, \overline{RD}$ | $t_{CYC8}$ | System cycle time           | note.                                  | —    | note.                                  | —    | ns   |            |
|                                | $t_{CC}$   | Strobe pulse width          | 120                                    | —    | 150                                    | —    | ns   |            |
| D0 to D7                       | $t_{DS8}$  | Data setup time             | 120                                    | —    | 120                                    | —    | ns   |            |
|                                | $t_{DH8}$  | Data hold time              | 5                                      | —    | 5                                      | —    | ns   |            |
|                                | $t_{ACC8}$ | $\overline{RD}$ access time | —                                      | 50   | —                                      | 80   | ns   |            |
|                                | $t_{OH8}$  | Output disable time         | 10                                     | 50   | 10                                     | 55   | ns   |            |

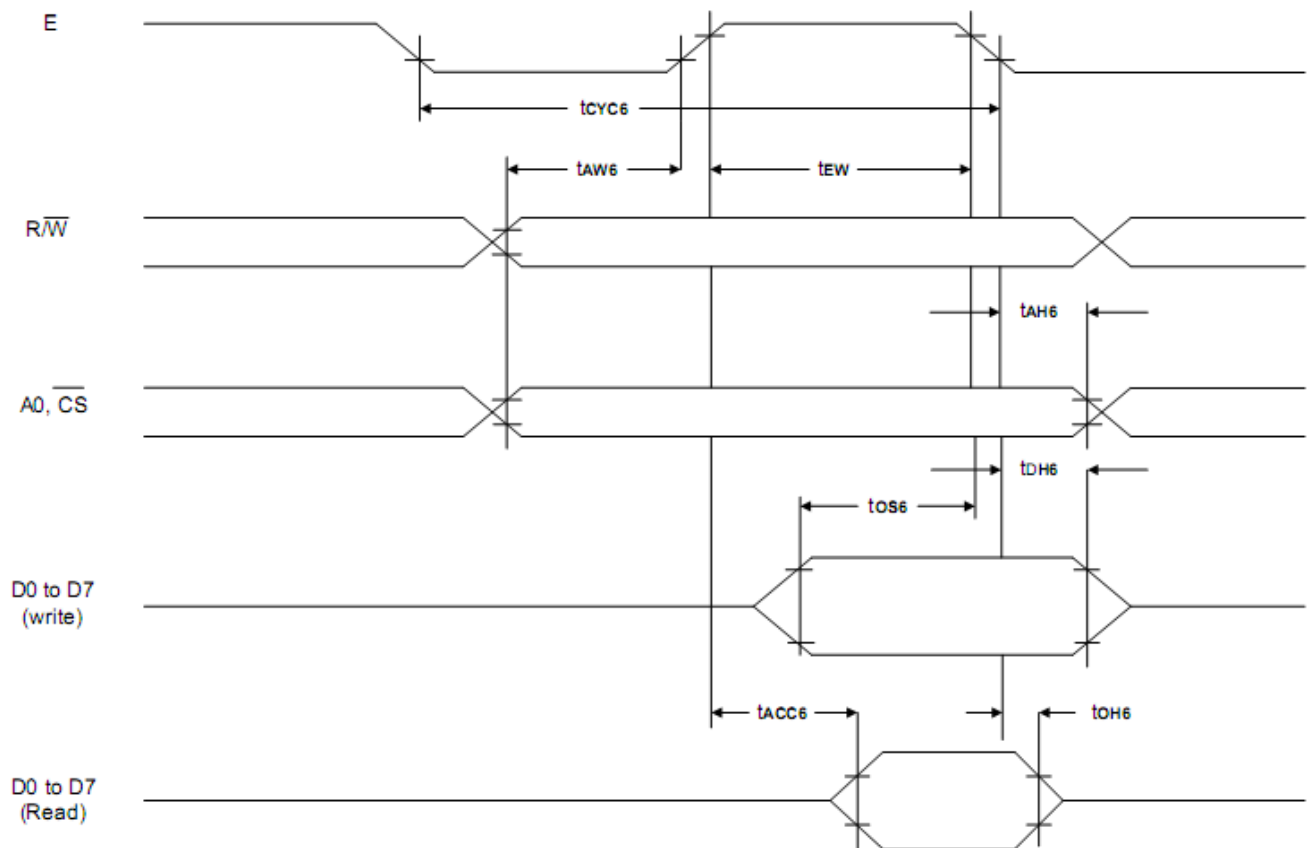
**Note:** For memory control and system control commands:

$$t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC8} = 4t_C + t_{CC} + 30$$

### 10-3-2 6800 Family Interface Timing



Ta = -20 to 75°C

| Signal                              | Symbol            | Parameter           | V <sub>DD</sub> = 4.5 to 5.5V |      | V <sub>DD</sub> = 2.7 to 4.5V |      | Unit | Condition   |
|-------------------------------------|-------------------|---------------------|-------------------------------|------|-------------------------------|------|------|-------------|
|                                     |                   |                     | Min.                          | Max. | Min.                          | Max. |      |             |
| A0, $\overline{\text{CS}}$ , R/(/W) | t <sub>CYC6</sub> | System cycle time   | note.                         | —    | note.                         | —    | ns   | CL = 100 pF |
|                                     | t <sub>AW6</sub>  | Address setup time  | 0                             | —    | 10                            | —    | ns   |             |
|                                     | t <sub>AH6</sub>  | Address hold time   | 0                             | —    | 0                             | —    | ns   |             |
| D0 to D7                            | t <sub>DS6</sub>  | Data setup time     | 100                           | —    | 120                           | —    | ns   |             |
|                                     | t <sub>DH6</sub>  | Data hold time      | 0                             | —    | 0                             | —    | ns   |             |
|                                     | t <sub>OH6</sub>  | Output disable time | 10                            | 50   | 10                            | 75   | ns   |             |
|                                     | t <sub>ACC6</sub> | Access time         | —                             | 85   | —                             | 130  | ns   |             |
| E                                   | t <sub>EW</sub>   | Enable pulse width  | 120                           | —    | 150                           | —    | ns   |             |

**Note:** For memory control and system control commands:

$$t_{\text{CYC6}} = 2t_{\text{C}} + t_{\text{EW}} + t_{\text{CEA}} + 75 > t_{\text{ACV}} + 245$$

For all other commands:

$$t_{\text{CYC6}} = 4t_{\text{C}} + t_{\text{EW}} + 30$$

## Example Initialization Program:

```
//-----
#define A0 P3_0
#define RW P3_7
#define E P3_4
#define CS P3_1
#define RESET P3_6

//-----
void data_out(unsigned char i) //Data Output 16-bit Bus Interface
{
    A0 = 0;
    P1 = i;
    CS = 0;
    RW = 0;
    E = 1;
    delay(1);
    E = 0;
    RW = 1;
    CS = 1;
}

void comm_out(unsigned char j) //Command Output 8-bit Bus Interface
{
    A0 = 1;
    P1 = j;
    CS = 0;
    RW = 0;
    E = 1;
    delay(1);
    E = 0;
    RW = 1;
    CS = 1;
}

//-----
//          Initialization For RA8835
//-----
void resetLCD()
{
    RESET = 0;
    delay(5);
    RESET = 1;
    delay(10);
}

void init_LCD()
{
    comm_out(0x40);
```

## 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 -<br>>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<br>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)

# AMEYA360

Components Supply Platform

Authorized Distribution Brand :



Website :

Welcome to visit [www.ameya360.com](http://www.ameya360.com)

Contact Us :

➤ Address :

401 Building No.5, JiuGe Business Center, Lane 2301, Yishan Rd  
Minhang District, Shanghai , China

➤ Sales :

Direct    +86 (21) 6401-6692  
Email     amall@ameya360.com  
QQ        800077892  
Skype     ameyasales1 ameyasales2

➤ Customer Service :

Email     service@ameya360.com

➤ Partnership :

Tel        +86 (21) 64016692-8333  
Email     mkt@ameya360.com