

# NHD-12232AZ-FL-YBW

## Graphic Liquid Crystal Display Module

|        |                            |
|--------|----------------------------|
| NHD-   | Newhaven Display           |
| 12232- | 122 x 32 Pixels            |
| AZ-    | Model                      |
| F-     | Transflective              |
| L-     | Yellow/Green LED Backlight |
| Y-     | STN - Yellow/Green         |
| B-     | 6:00 Optimal View          |
| W-     | Wide Temperature           |
|        | <b>RoHS Compliant</b>      |

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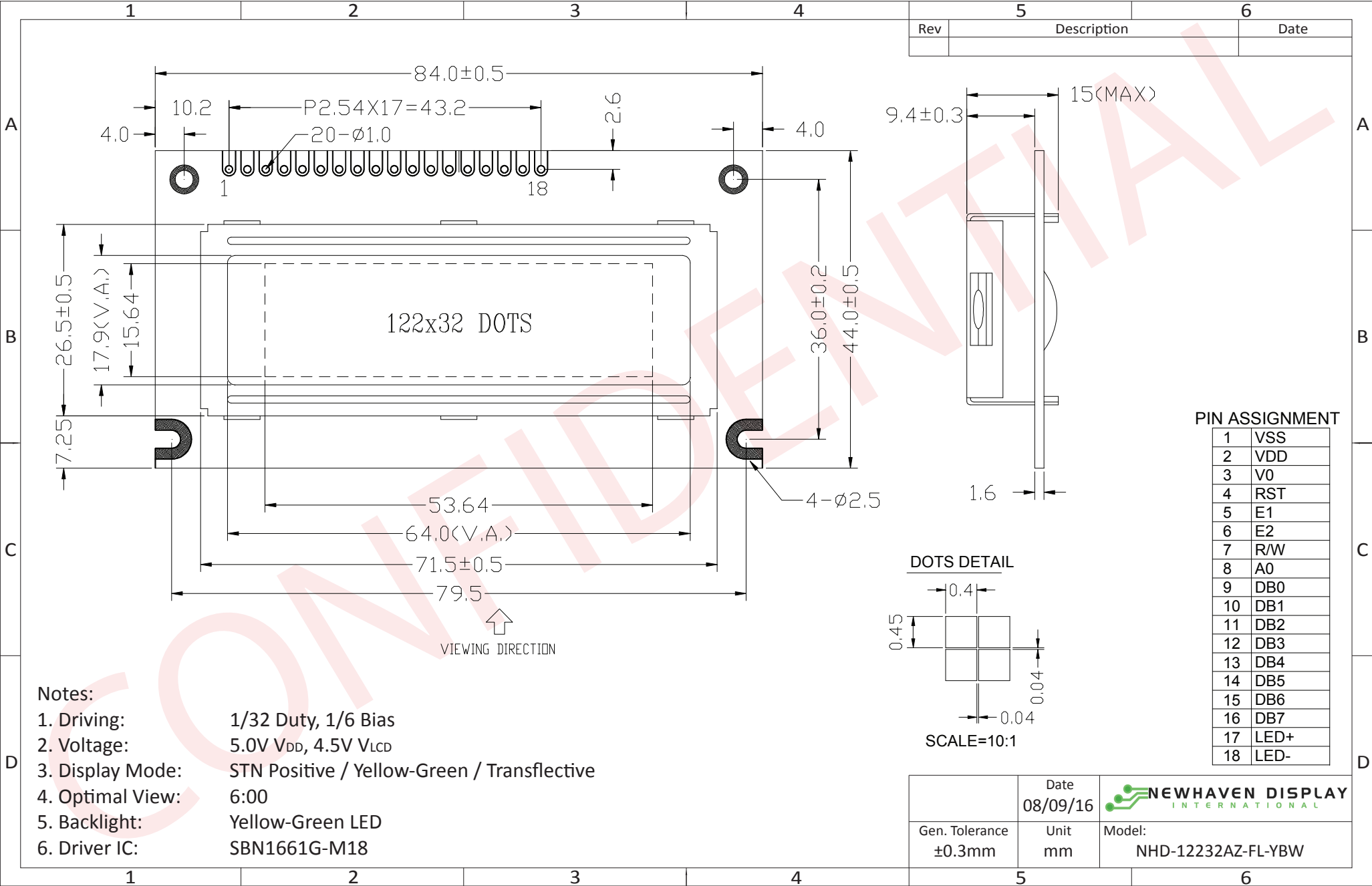
## Document Revision History

| Revision | Date       | Description                                            | Changed by |
|----------|------------|--------------------------------------------------------|------------|
| 0        | 10/22/2008 | Initial Release                                        | -          |
| 1        | 3/16/2010  | User guide reformat                                    | BE         |
| 2        | 4/15/2010  | Controller update                                      | BE         |
| 3        | 5/5/2010   | Block Diagram update                                   | BE         |
| 4        | 8/5/2010   | Electrical Characteristics Update                      | MP         |
| 5        | 10/25/2011 | Electrical characteristics updated                     | AK         |
| 6        | 4/19/2012  | Sample code updated                                    | SB         |
| 7        | 2/8/16     | Updated Controller Information, Datasheet Reformat     | SB         |
| 8        | 8/9/16     | Mechanical Drawing, Electrical & Optical Char. Updated | SB         |

## Functions and Features

- 122 x 32 pixels
- Built-in SBN1661G\_M18 Controller
- +5.0V power supply
- 1/32 duty cycle; 1/9 bias
- RoHS Compliant

Mechanical Drawing



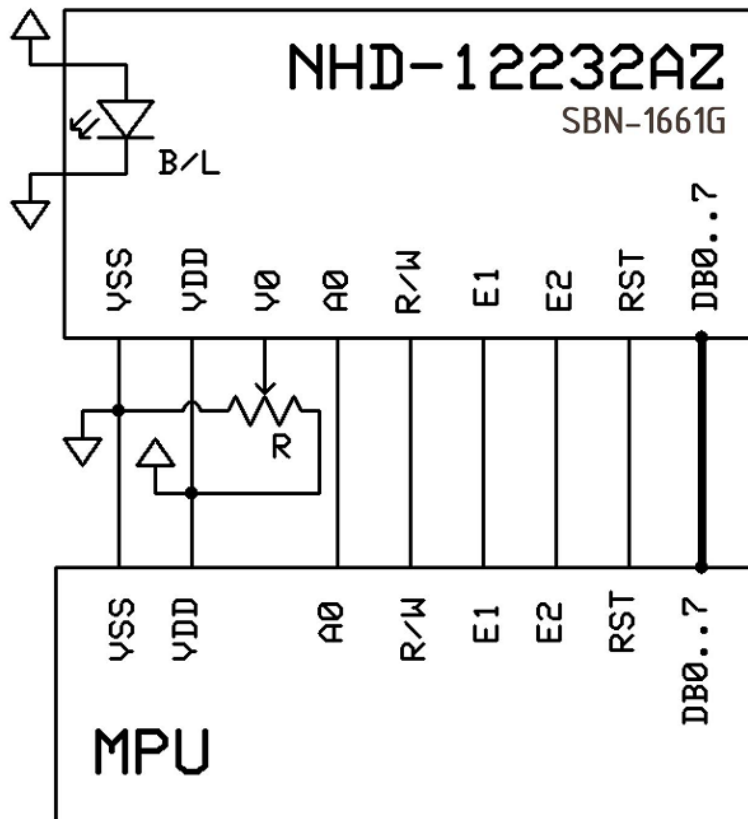
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## Pin Description and Wiring Diagram

| 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    | Power supply for contrast (approx. 0.5V)                      |
| 4       | RST             | MPU                 | Active LOW Reset signal                                       |
| 5       | E1              | MPU                 | Operation enable signal. Falling edge triggered, SEG (1~60)   |
| 6       | E2              | MPU                 | Operation enable signal. Falling edge triggered, SEG (61~120) |
| 7       | R/W             | MPU                 | Read/Write select signal, R/W=1: Read R/W: =0: Write          |
| 8       | A0              | MPU                 | Register select signal. A0=0: Command, A0=1: Data             |
| 9-16    | DB0-DB7         | MPU                 | This is an 8-bit bi-directional data bus                      |
| 17      | LED+            | Power Supply        | Power supply for LED Backlight (+5.0V via on-board resistor)  |
| 18      | 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 | $T_{OP}$  | Absolute Max                              | -20      | -    | +70      | °C   |
| Storage Temperature Range   | $T_{ST}$  | Absolute Max                              | -30      | -    | +80      | °C   |
| Supply Voltage              | $V_{DD}$  | -                                         | 4.8      | 5.0  | 5.2      | V    |
| Supply Current              | $I_{DD}$  | $V_{DD} = 5.0V$<br>$T_{OP} = 25^{\circ}C$ | 0.5      | 0.6  | 2.0      | mA   |
| Supply for LCD (contrast)   | $V_{LCD}$ |                                           | 4.3      | 4.5  | 4.7      | V    |
| "H" Level input             | $V_{IH}$  | -                                         | 2.2      | -    | $V_{DD}$ | V    |
| "L" Level input             | $V_{IL}$  | -                                         | $V_{SS}$ | -    | 0.6      | V    |
| "H" Level output            | $V_{OH}$  | -                                         | 2.4      | -    | $V_{DD}$ | V    |
| "L" Level output            | $V_{OL}$  | -                                         | $V_{SS}$ | -    | 0.4      | V    |
|                             |           |                                           |          |      |          |      |
| Backlight Supply Voltage    | $V_{LED}$ | -                                         | 4.8      | 5.0  | 5.2      | V    |
| Backlight Supply Current    | $I_{LED}$ | $V_{LED} = 5.0V$                          | 100      | 120  | 140      | mA   |

## Optical Characteristics

| Item                   |        | Symbol      | Condition              | Min. | Typ. | Max. | Unit |
|------------------------|--------|-------------|------------------------|------|------|------|------|
| Optimal Viewing Angles | Top    | $\phi Y+$   | $CR \geq 2$            | -    | 40   | -    | °    |
|                        | Bottom | $\phi Y-$   |                        | -    | 60   | -    | °    |
|                        | Left   | $\theta X-$ |                        | -    | 60   | -    | °    |
|                        | Right  | $\theta X+$ |                        | -    | 60   | -    | °    |
| Contrast Ratio         |        | CR          | -                      | 2    | 5    | -    | -    |
| Response Time          | Rise   | $T_R$       | $T_{OP} = 25^{\circ}C$ | -    | 150  | 250  | ms   |
|                        | Fall   | $T_F$       |                        | -    | 200  | 300  | ms   |

## Controller Information

Built-in SBN1661G\_M18 controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/SBN1661G.pdf](http://www.newhavendisplay.com/app_notes/SBN1661G.pdf)

## Table of Commands

| COMMAND            | COMMAND CODE                                     |    |    |    |    |    |    |    | FUNCTION                                          |
|--------------------|--------------------------------------------------|----|----|----|----|----|----|----|---------------------------------------------------|
|                    | D7                                               | D6 | D5 | D4 | D3 | D2 | D1 | D0 |                                                   |
| Write Display Data | Data to be written into the Display Data Memory. |    |    |    |    |    |    |    | Write a byte of data to the Display Data Memory.  |
| Read Display Data  | Data read from the Display Data Memory.          |    |    |    |    |    |    |    | Read a byte of data from the Display Data Memory. |
| Read-Modify-Write  | 1                                                | 1  | 1  | 0  | 0  | 0  | 0  | 0  | Start Read-Modify-Write operation.                |
| END                | 1                                                | 1  | 1  | 0  | 1  | 1  | 1  | 0  | Stop Read-Modify-Write operation.                 |
| Software Reset     | 1                                                | 1  | 1  | 0  | 0  | 0  | 1  | 0  | Software Reset.                                   |

## Timing Characteristics

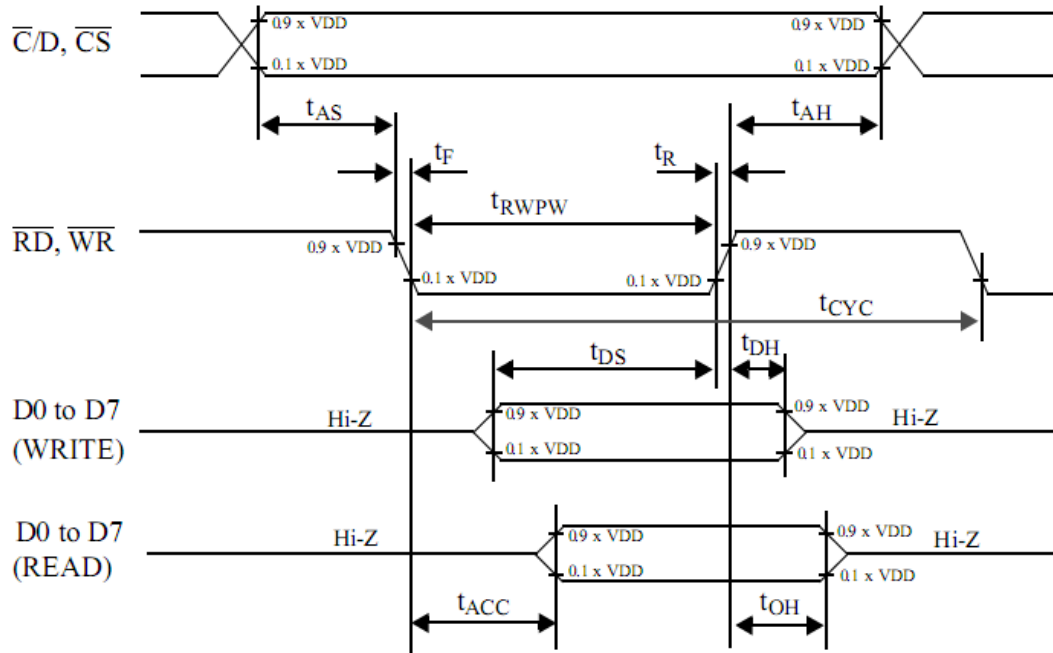


Fig.22 AC timing for interface with a 80-type microcontroller

$V_{DD} = 5\text{ V} \pm 10\%$ ;  $V_{SS} = 0\text{ V}$ ;  $T_{amb} = -20\text{ }^{\circ}\text{C}$  to  $+75\text{ }^{\circ}\text{C}$ .

| symbol     | parameter                            | min. | max. | test conditons    | unit |
|------------|--------------------------------------|------|------|-------------------|------|
| $t_{AS}$   | Address set-up time                  | 20   |      |                   | ns   |
| $t_{AH}$   | Address hold time                    | 10   |      |                   | ns   |
| $t_F, t_R$ | Read/Write pulse falling/rising time |      | 15   |                   | ns   |
| $t_{RWPW}$ | Read/Write pulse width               | 200  |      |                   | ns   |
| $t_{CYC}$  | System cycle time                    | 1000 |      |                   | ns   |
| $t_{DS}$   | Data setup time                      | 80   |      |                   | ns   |
| $t_{DH}$   | Data hold time                       | 10   |      |                   | ns   |
| $t_{ACC}$  | Data READ access time                |      | 90   | CL= 100 pF.       | ns   |
| $t_{OH}$   | Data READ output hold time           | 10   | 60   | Refer to Fig. 23. | ns   |

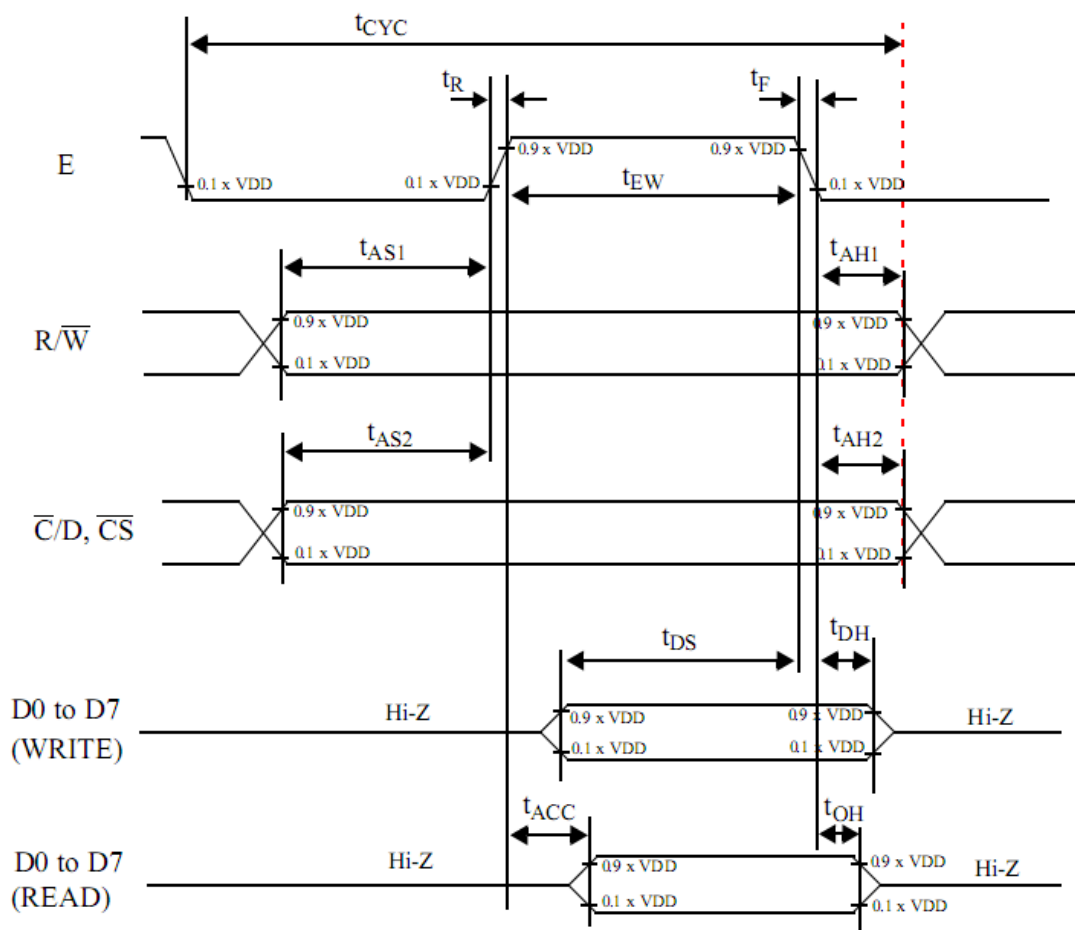


Fig.24 AC timing for interface with a 68-type microcontroller

$V_{DD} = 5\text{ V} \pm 10\%$ ;  $V_{SS} = 0\text{ V}$ ;  $T_{amb} = -20\text{ }^{\circ}\text{C}$  to  $+75\text{ }^{\circ}\text{C}$ .

| symbol     | parameter                                                           | min. | max. | test conditons    | unit |
|------------|---------------------------------------------------------------------|------|------|-------------------|------|
| $t_{AS1}$  | Address set-up time with respect to $\overline{R/W}$                | 20   |      |                   | ns   |
| $t_{AS2}$  | Address set-up time with respect to $\overline{C/D}, \overline{CS}$ | 20   |      |                   | ns   |
| $t_{AH1}$  | Address hold time with respect to $\overline{R/W}$                  | 10   |      |                   | ns   |
| $t_{AH2}$  | Address hold time respect with to $\overline{C/D}, \overline{CS}$   | 10   |      |                   | ns   |
| $t_F, t_R$ | Enable (E) pulse falling/rising time                                |      | 15   |                   | ns   |
| $t_{CYC}$  | System cycle time                                                   | 1000 |      | Note 1            | ns   |
| $t_{EWR}$  | Enable pulse width for READ                                         | 100  |      |                   | ns   |
| $t_{EWW}$  | Enable pulse width for WRITE                                        | 80   |      |                   | ns   |
| $t_{DS}$   | Data setup time                                                     | 80   |      |                   | ns   |
| $t_{DH}$   | Data hold time                                                      | 10   |      |                   | ns   |
| $t_{ACC}$  | Data access time                                                    |      | 90   | CL= 100 pF.       | ns   |
| $t_{OH}$   | Data output hold time                                               | 10   | 60   | Refer to Fig. 23. | ns   |



## Example Initialization Program:

```
/******  
void Comleft(char i)  
{  
    P1 = i;  
    R_W = 0;  
    D_I = 0;  
    E1 = 1;  
    delay(2);  
    E1 = 0;  
}  
  
void Comright(char i)  
{  
    P1 = i;  
    R_W = 0;  
    D_I = 0;  
    E2 = 1;  
    delay(2);  
    E2 = 0;  
}  
  
void Writeleft(char i)  
{  
    P1 = i;  
    R_W = 0;  
    D_I = 1;  
    E1 = 1;  
    delay(2);  
    E1 = 0;  
}  
  
void Writeright(char i)  
{  
    P1 = i;  
    R_W = 0;  
    D_I = 1;  
    E2 = 1;  
    delay(2);  
    E2 = 0;  
}  
/******  
void bothSides(char i)  
{  
    Comleft(i);  
    Comright(i);  
}  
/******  
  
void init()  
{  
    P1 = 0;  
    P3 = 0;  
    RST = 0;           //Reset RST  
    delay(1);  
    RST = 1;           //Reset RST= M68 Interface  
    delay(10);  
    D_I = 0;  
    R_W = 1;  
  
    bothSides(0xE2);    //0xE2 – Software reset  
    delay(10);  
    bothSides(0xA4);    //0xA4 – Static Driver off  
    bothSides(0xA9);    //0xA9 – select 1/32 duty  
    bothSides(0xA0);    //0xA0 – Memory/Segment mapping normal  
    bothSides(0xEE);    //0xEE – End  
    bothSides(0xC0);    //0xC0 – start at line address 0x00  
    bothSides(0xAF);    //0xAF – display on  
}  
/******
```

## 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)