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NHD-320240WX-CoTFH-V#I040

Graphic Liquid Crystal Display Module

| | |
|---------|--|
| NHD- | Newhaven Display |
| 320240- | 320 x 240 Pixels |
| WX- | Display Type: Graphic |
| Co- | Model |
| T- | White LED Backlight |
| F- | FSTN (+) |
| H- | Transflective, 6:00 Optimal View, Wide Temperature |
| V#- | Built-in Positive Voltage |
| I040- | IST Driver |
| | RoHS Compliant |

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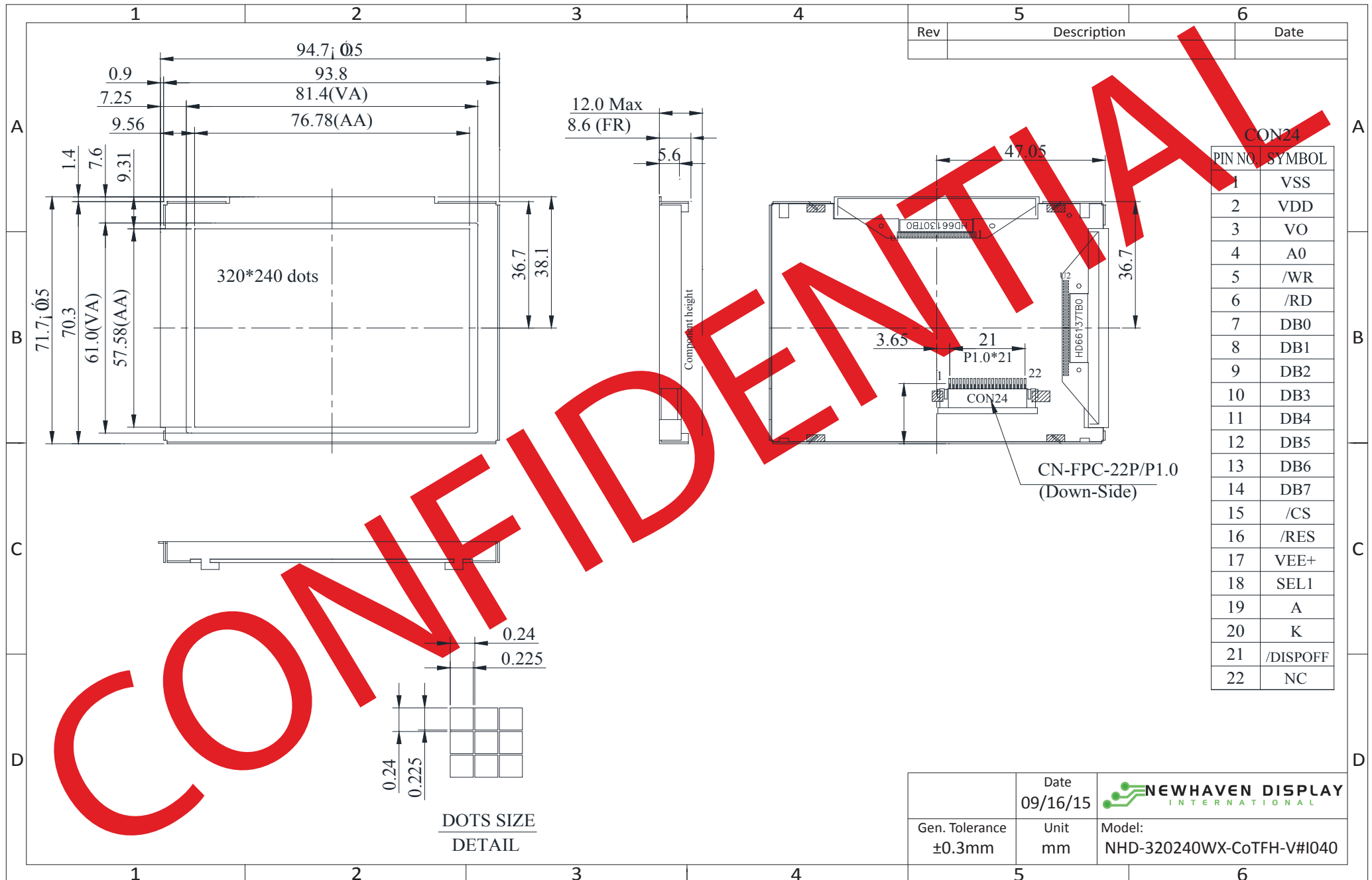
Document Revision History

| Revision | Date | Description | Changed by |
|----------|-----------|--|------------|
| 0 | 6/7/2007 | Initial Release | - |
| 1 | 4/26/2010 | User guide reformat | MC |
| 2 | 5/25/2010 | Contrast updated | BE |
| 3 | 6/3/2010 | Backlight Supply Current updated | MC |
| 4 | 2/3/2011 | Pin description/block diagram updated | AK |
| 5 | 2/4/2011 | Drawing/pin description/block diagram updated | AK |
| 6 | 10/8/2013 | Mechanical Drawing, Pin Description, Wiring Diagram, Electrical/Optical Characteristics updated Added Jumper Selection | ML |
| 7 | 9/16/2015 | Modified PCB, Supply for LCD (Contrast), Response Time, Supply Current and Backlight Current updated | SB |
| 8 | 6/6/16 | Updated Pin Description, Quality Information | TM |

Functions and Features

- 320 x 240 pixels
- Built-in RA8835 Controller
- +3.3V power supply
- RoHS Compliant

Mechanical Drawing



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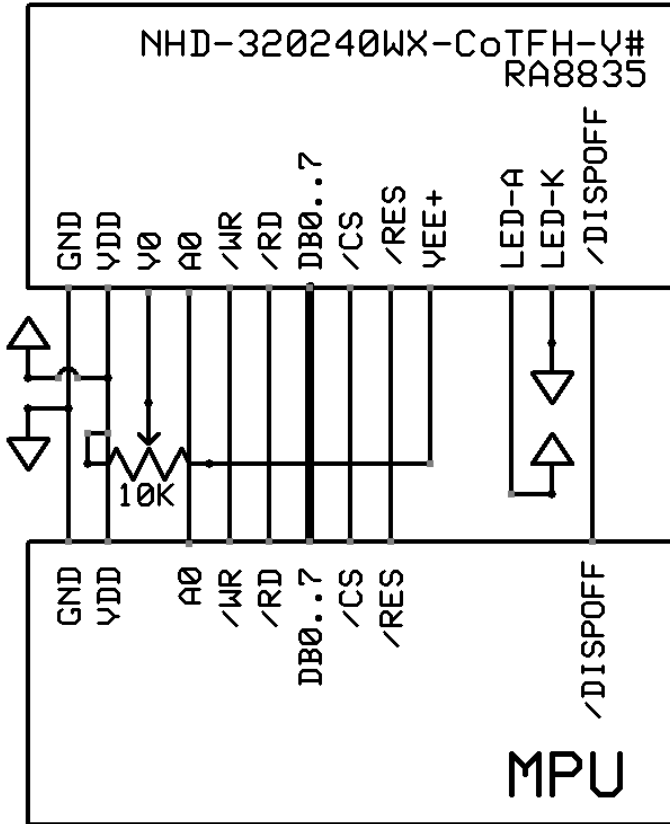
Pin Description

| Pin No. | Symbol | External Connection | Function Description |
|---------|------------|---------------------|--|
| 1 | GND | Power Supply | Ground |
| 2 | VDD | Power Supply | Supply Voltage for LCD and Logic (+3.3V) |
| 3 | V0 | Adj Power Supply | Supply Voltage for contrast (approx. +18.4V) |
| 4 | A0 | MPU | Register Select signal: '1' = Command, '0' = Data |
| 5 | /WR R/W | MPU | 8080: Active LOW Write signal 6800: Read/Write select signal: '1' = Read, '0' = Write |
| 6 | /RD E | MPU | 8080: Active LOW Read signal 6800: Operation Enable signal; Falling edge triggered |
| 7-14 | DB0-DB7 | MPU | 8-bit bi-directional data bus |
| 15 | /CS | MPU | Active LOW Chip Select signal |
| 16 | /RES | MPU | Active LOW Reset signal |
| 17 | VEE+ | Power Supply | Positive voltage output (+28V) |
| 18 | SEL1 | NC | No Connect (selected by on-board jumper JSEL) |
| 19 | LED-A | Power Supply | Backlight Anode (+3.5V) |
| 20 | LED-K | Power Supply | Backlight Cathode (Ground) |
| 21 | /DISPOFF | Power Supply | Active LOW Display OFF signal |
| 22 | NC | - | No Connect |

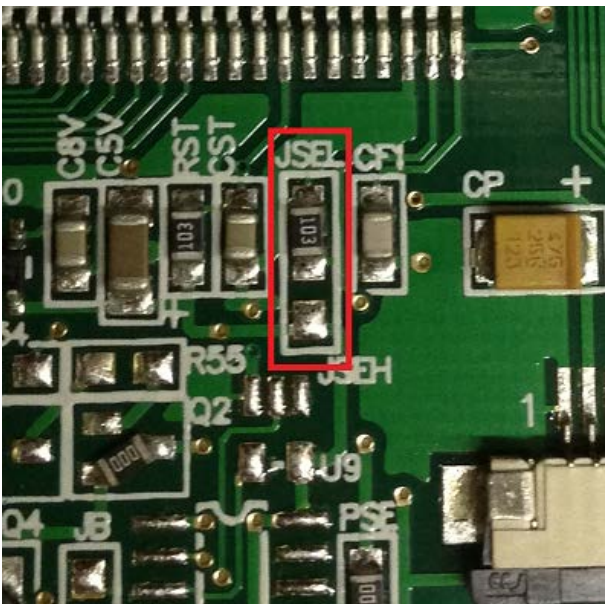
Recommended LCD connector: 22 pin, 1.0mm pitch FFC Connector

Backlight connector: On LCD Connector **Mates with:** ---

Wiring Diagram



Jumper Selection



JSEL = 8080 mode (default)

JSEH = 6800 mode

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 | - | 3.0 | 3.3 | 3.6 | V |
| Supply Current | IDD | VDD=3.3V Ta=25°C | - | 33.0 | - | mA |
| Supply for LCD (contrast) | V0 | | 21.1 | 21.7 | 22.3 | V |
| "H" Level input | VIH | - | 0.5*VDD | - | VDD | V |
| "L" Level input | VIL | - | GND | - | 0.2*VDD | V |
| "H" Level output | VOH | - | 2.4 | - | VDD | V |
| "L" Level output | VOL | - | GND | - | 0.4 | V |
| Backlight Supply Voltage | VLED | - | 3.4 | 3.5 | 3.6 | V |
| Backlight Supply Current | ILED | VLED=3.5V | 72 | 82 | 120 | mA |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------|--------|-----------|------|------|------|------|
| Optimal Viewing Angles | Top | Cr ≥ 2 | - | 30 | - | ° |
| | Bottom | | - | 60 | - | ° |
| | Left | | - | 45 | - | ° |
| | Right | | - | 45 | - | ° |
| Contrast Ratio | Cr | - | - | 5 | - | - |
| Response Time | Rise | Tr | - | 200 | 300 | ms |
| | Fall | Tf | - | 250 | 350 | ms |

Controller Information

Built-in RA8835 controller.

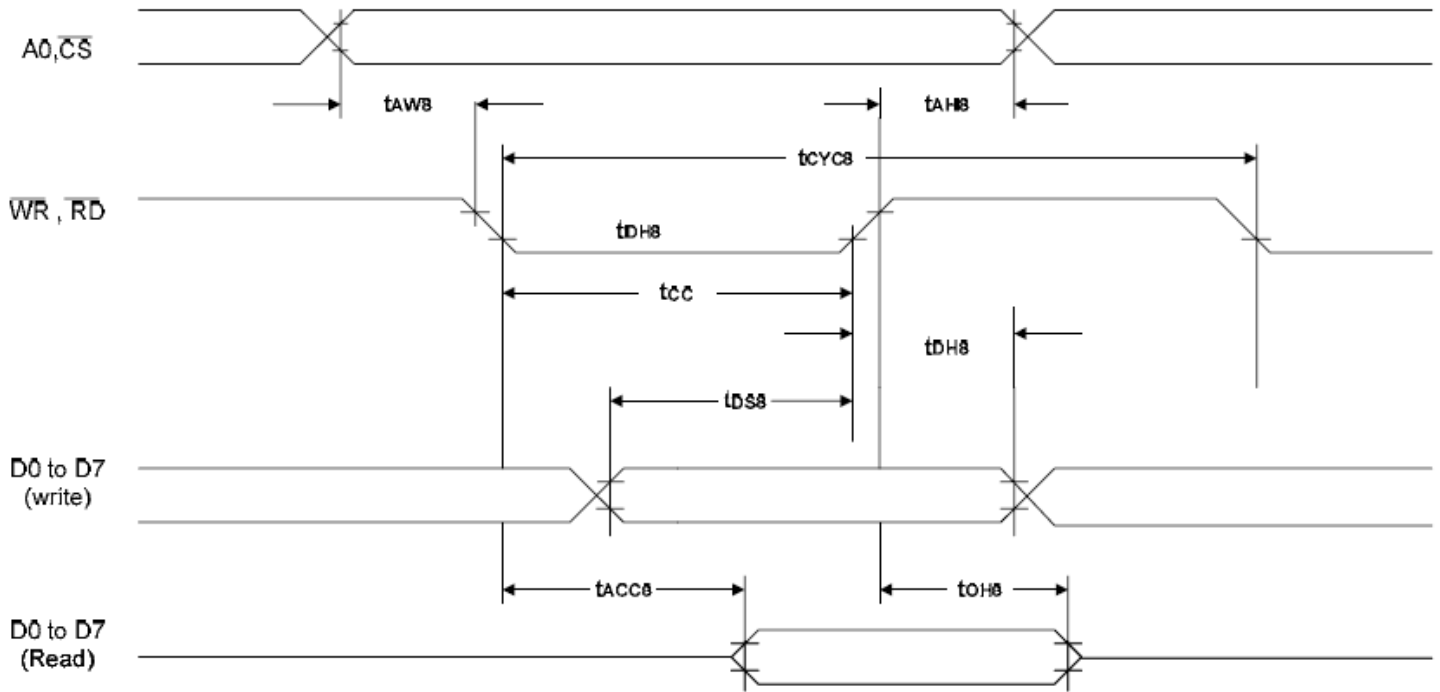
Please download specification at http://www.newhavendisplay.com/app_notes/RA8835.pdf

Table of Commands

| 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 | SYSTEM SET | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | Initialize device and display | 8 | 6-2-1 |
| | SLEEP IN | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 53 | Enter standby mode | 0 | 6-2-2 |
| Display Control | DISPLAY ON/OFF | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | D | 58, 59 | Enable and disable display and display flashing | 1 | 6-3-1 |
| | SCROLL | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 44 | Set display start address and display regions | 10 | 6-3-2 |
| | CSRFORM | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 5D | Set cursor type | 2 | 6-3-3 |
| | CGRAM ADR | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 5C | Set start address of character generator RAM | 2 | 6-3-6 |
| | CSRDIR | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | CD 1 | CD 0 | 4C to 4F | Set direction of cursor movement | 0 | 6-3-4 |
| | HDOT SCR | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 5A | Set horizontal scroll position | 1 | 6-3-7 |
| | OVLAY | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 5B | Set display overlay format | 1 | 6-3-5 |
| Drawing Control | CSRW | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 46 | Set cursor address | 2 | 6-4-1 |
| | CSRR | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 47 | Read cursor address | 2 | 6-4-2 |
| Memory Control | MWRITE | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 42 | Write to display memory | — | 6-5-1 |
| | MREAD | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 43 | Read from display memory | — | 6-5-2 |

Timing Characteristics

8080 Family Interface Timing



| Signal | Symbol | Parameter | $V_{DD} = 4.5$ to $5.5V$ | | $V_{DD} = 2.7$ to $4.5V$ | | Unit | Condition |
|--------------------------------|------------|-----------------------------|--------------------------|------|--------------------------|------|------|------------|
| | | | Min. | Max. | Min. | Max. | | |
| A_0, \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 | |

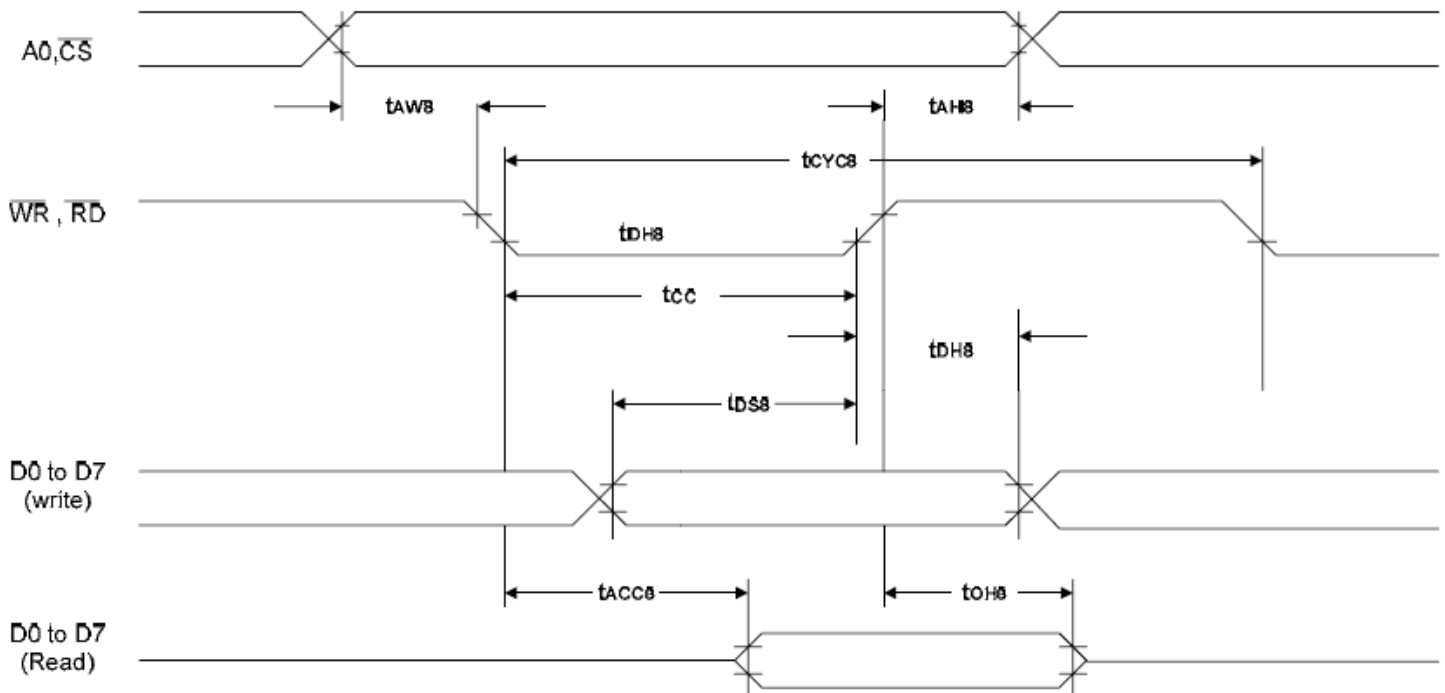
Note: For memory control and system control commands:

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

For all other commands:

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

6800 Family Interface Timing



| 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} , R/(W) | t_{CYC6} | System cycle time | note. | — | note. | — | ns | CL = 100 pF |
| | t_{AW6} | Address setup time | 0 | — | 10 | — | ns | |
| | t_{AH6} | Address hold time | 0 | — | 0 | — | ns | |
| D0 to D7 | t_{DS6} | Data setup time | 100 | — | 120 | — | ns | |
| | t_{DH6} | Data hold time | 0 | — | 0 | — | ns | |
| | t_{OH6} | Output disable time | 10 | 50 | 10 | 75 | ns | |
| | t_{ACC6} | Access time | — | 85 | — | 130 | ns | |
| E | t_{EW} | Enable pulse width | 120 | — | 150 | — | ns | |

Note: For memory control and system control commands:

$$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC6} = 4t_C + t_{EW} + 30$$

Example Initialization Code

```
//-----  
#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 8-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);
delay(5);
data_out(0x34);
data_out(0x87);
data_out(0x07);
data_out(0x27);
data_out(0x39);
data_out(0xEF);
data_out(0x28);
data_out(0x00);
comm_out(0x44);
data_out(0x00);
data_out(0x00);
data_out(0xEF);
data_out(0xB0);
data_out(0x04);
data_out(0xEF);
data_out(0x00);
data_out(0x00);
data_out(0x00);
data_out(0x00);
comm_out(0x5A);
data_out(0x00);
comm_out(0x5B);
data_out(0x00);
comm_out(0x58);
data_out(0x56);
comm_out(0x5D);
data_out(0x04);
data_out(0x86);
comm_out(0x4C);
comm_out(0x59);
data_out(0x16);
delay(5);
}
//-----
```

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 | – |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C , 200hrs | 1 |
| 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 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

Warranty Information

See Terms & Conditions at http://www.newhavendisplay.com/index.php?main_page=terms