

NHD-240128BZ-NSW-BTW

Graphic Liquid Crystal Display Module

| | |
|---------|----------------------------------|
| NHD- | Newhaven Display |
| 240128- | 240 x 128 pixels |
| BZ- | Model |
| N- | Transmissive |
| SW- | Side White LED Backlight |
| B- | STN - Blue (-) |
| T- | 12:00 view |
| W- | Wide Temperature (-20°C ~ +70°C) |
| | RoHS Compliant |

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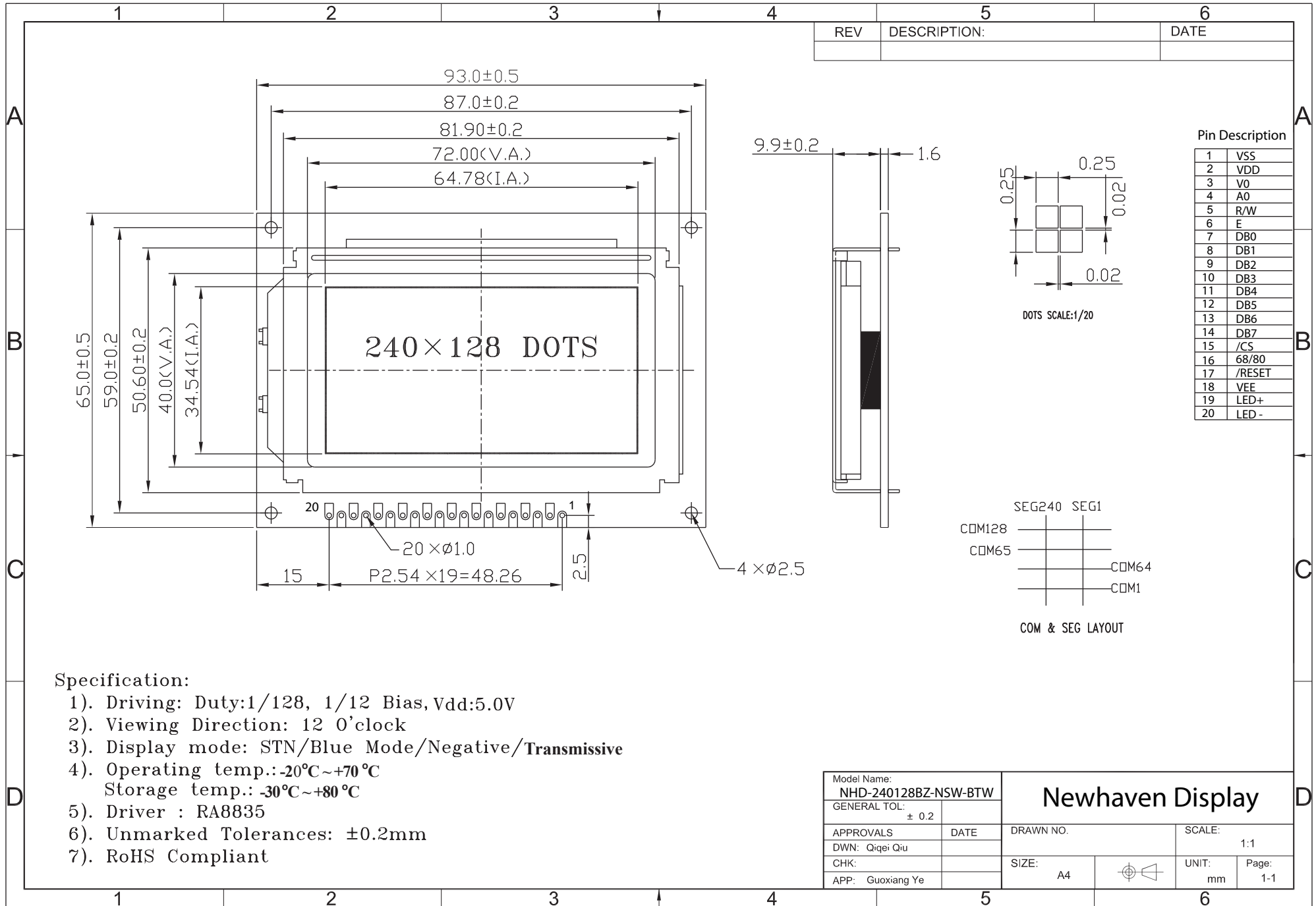
Document Revision History

| Revision | Date | Description | Changed by |
|----------|------------|--|------------|
| 0 | 10/5/2007 | Initial Release | - |
| 1 | 6/4/2008 | Update table of contents | CL |
| 2 | 4/22/2010 | User guide reformat | BE |
| 3 | 9/20/2010 | Pin description pin18/electrical characteristics updated | BE |
| 4 | 11/30/2010 | Update Mechanical Drawing / Block Diagram | AK |
| 5 | 6/13/2011 | Electrical characteristics/contrast updated | BE |
| 6 | 1/24/2012 | Pin description updated | AK |

Functions and Features

- 240 x 128 pixels
- Built-in RA8835 controller
- +5.0V Power Supply
- 1/128 duty, 1/12 bias
- RoHS Compliant

Mechanical Drawing



Specification:

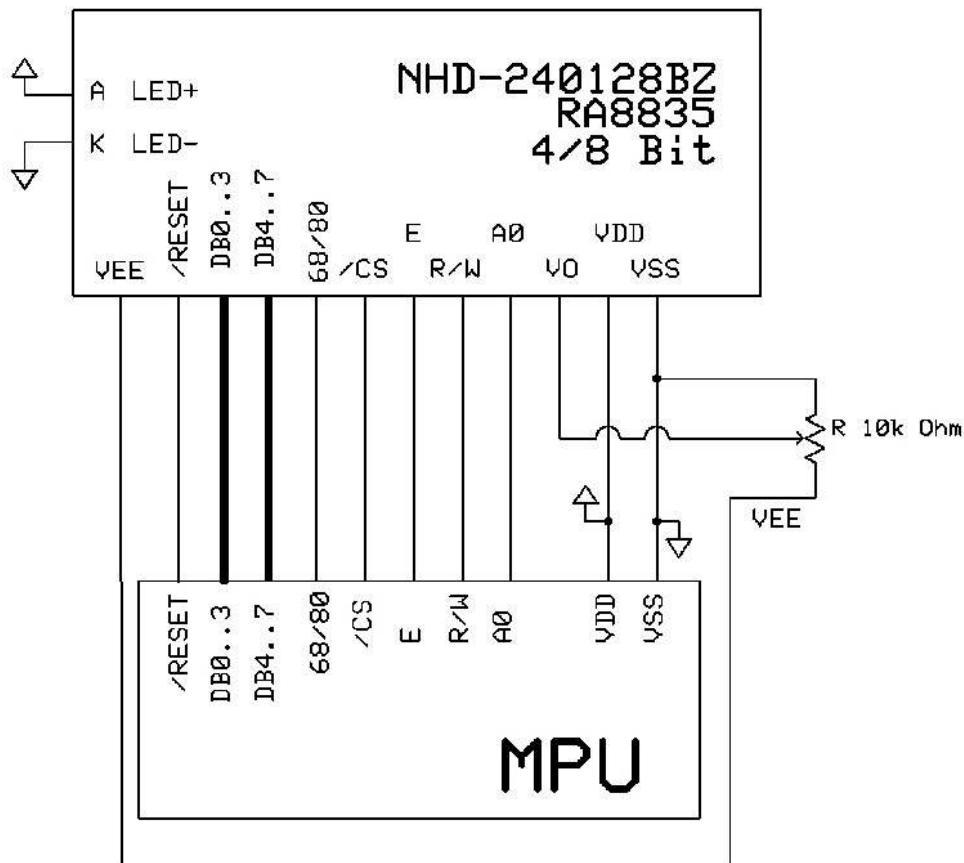
- 1). Driving: Duty:1/128, 1/12 Bias, Vdd:5.0V
- 2). Viewing Direction: 12 O'clock
- 3). Display mode: STN/Blue Mode/Negative/**Transmissive**
- 4). Operating temp.: -20°C~+70°C
Storage temp.: -30°C~+80°C
- 5). Driver : RA8835
- 6). Unmarked Tolerances: ±0.2mm
- 7). RoHS Compliant

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 19.2V) |
| 4 | A0 | MPU | Register Select signal. 0: data; 1: instruction |
| 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. |
| 7-10 | DB0-DB3 | MPU | Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation. |
| 11-14 | DB4-DB7 | MPU | Four high order bi-directional three-state data bus lines. |
| 15 | /CS | MPU | Active LOW Chip Select Signal |
| 16 | 68/80 | MPU | Interface Select Pin. 0: 8080 Family 1: 6800 Family |
| 17 | /RESET | MPU | Active LOW reset signal |
| 18 | VEE | Power Supply | Positive voltage supply output (+20V) |
| 19 | LED+ | Power Supply | Power supply for LED Backlight (+3.0V) |
| 20 | 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 | | 4.7 | 5.0 | 5.5 | V |
| Supply Current | IDD | VDD=5.0V | - | 3.5 | 5.5 | mA |
| Supply for LCD (contrast) | VDD-V0 | Ta=25° | - | -14.2 | - | V |
| "H" Level input | VIH | | 2.2 | - | VDD | V |
| "L" Level input | VIL | | 0 | - | 0.6 | V |
| "H" Level output | VOH | | 2.4 | - | - | V |
| "L" Level output | VOL | | - | - | 0.4 | V |
| | | | | | | |
| Backlight Supply Voltage | Vled | - | - | 3.0 | - | V |
| Backlight Supply Current | Iled | Vled=3.0V | - | 36 | - | mA |

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|--------|-----------|------|------|------|------|
| Viewing Angle - Vertical | AV | Cr ≥ 2 | - | 60 | - | ° |
| Viewing Angle - Vertical | AV | Cr ≥ 2 | - | 35 | - | ° |
| Viewing Angle – Horizontal | AH | Cr ≥ 2 | - | 40 | - | ° |
| Viewing Angle - Horizontal | AH | Cr ≥ 2 | - | 40 | - | ° |
| Contrast Ratio | Cr | | - | 6 | - | - |
| Response Time (rise) | Tr | - | - | 150 | 250 | ms |
| Response Time (fall) | Tf | - | - | 150 | 250 | ms |

Controller Information

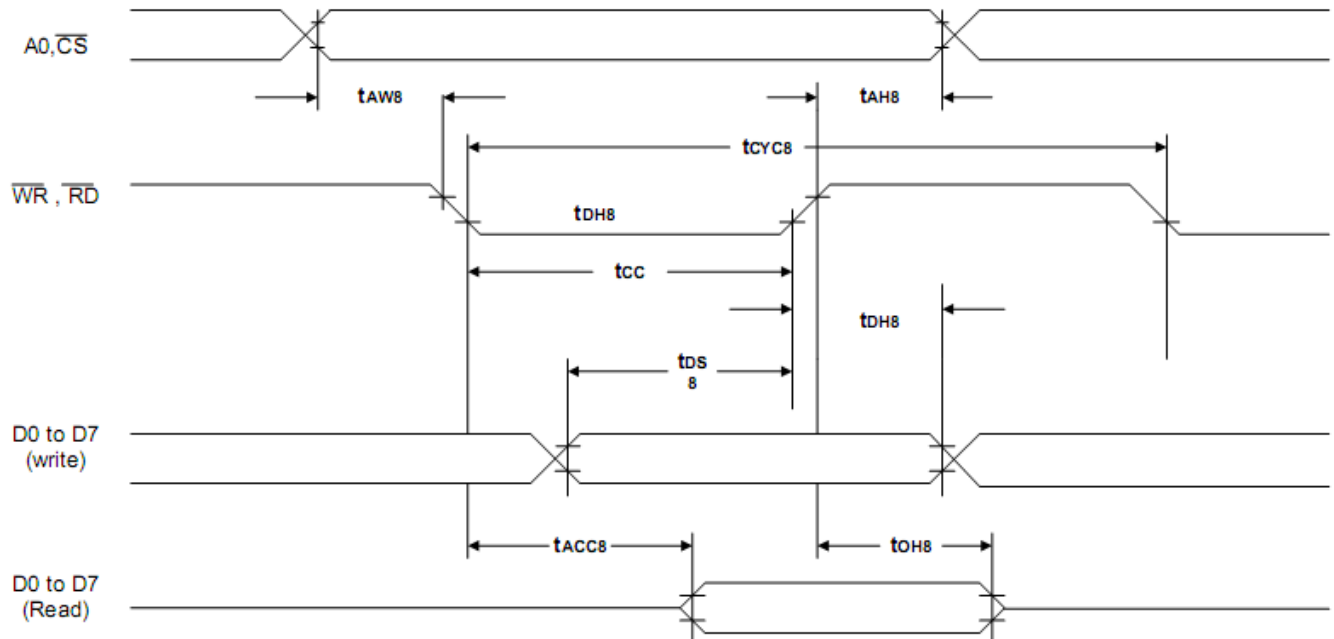
Built-in RA8835. Download specification at http://www.newhavendisplay.com/app_notes/RA8835.pdf

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 | 9-2-1 |
| | SLEEP IN | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 53 | Enter standby mode | 0 | 9-2-2 |
| 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 | 9-3-1 |
| | SCROLL | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 44 | Set display start address and display regions | 10 | 9-3-2 |
| | CSRFORM | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 5D | Set cursor type | 2 | 9-3-3 |
| | CGRAM ADR | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 5C | Set start address of character generator RAM | 2 | 9-3-6 |
| | CSRDIR | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | CD 1 | CD 0 | 4C to 4F | Set direction of cursor movement | 0 | 9-3-4 |
| | HDOT SCR | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 5A | Set horizontal scroll position | 1 | 9-3-7 |
| | OVLAY | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 5B | Set display overlay format | 1 | 9-3-5 |
| Drawing Control | CSRW | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 46 | Set cursor address | 2 | 9-r1 |
| | CSRR | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 47 | Read cursor address | 2 | 9-4-2 |
| Memory Control | MWRITE | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 42 | Write to display memory | — | 9-5-1 |
| | MREAD | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 43 | Read from display memory | — | 9-5-2 |

Timing Characteristics

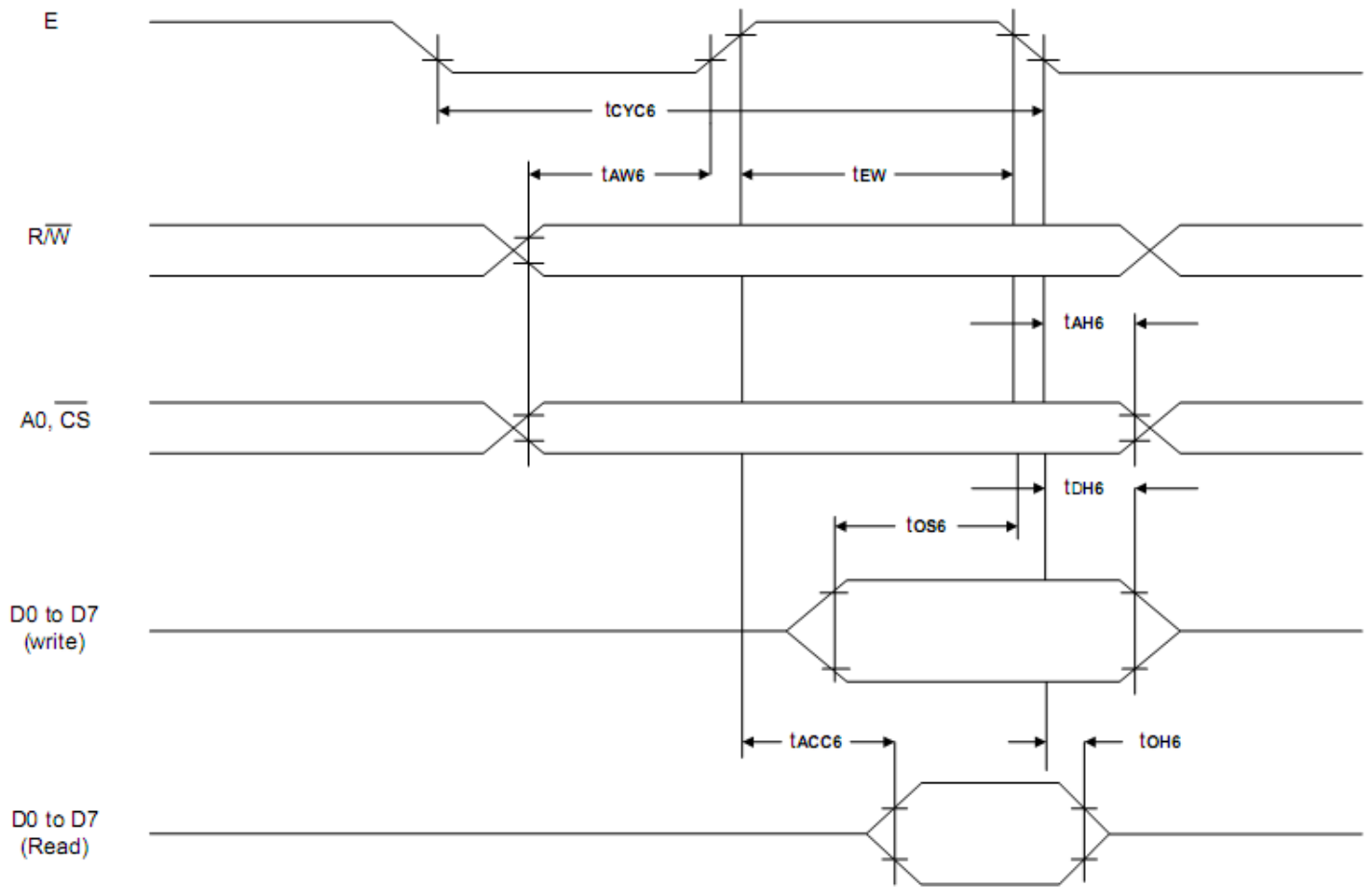
10-3-1 8080 Family Interface Timing



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

| 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 | |

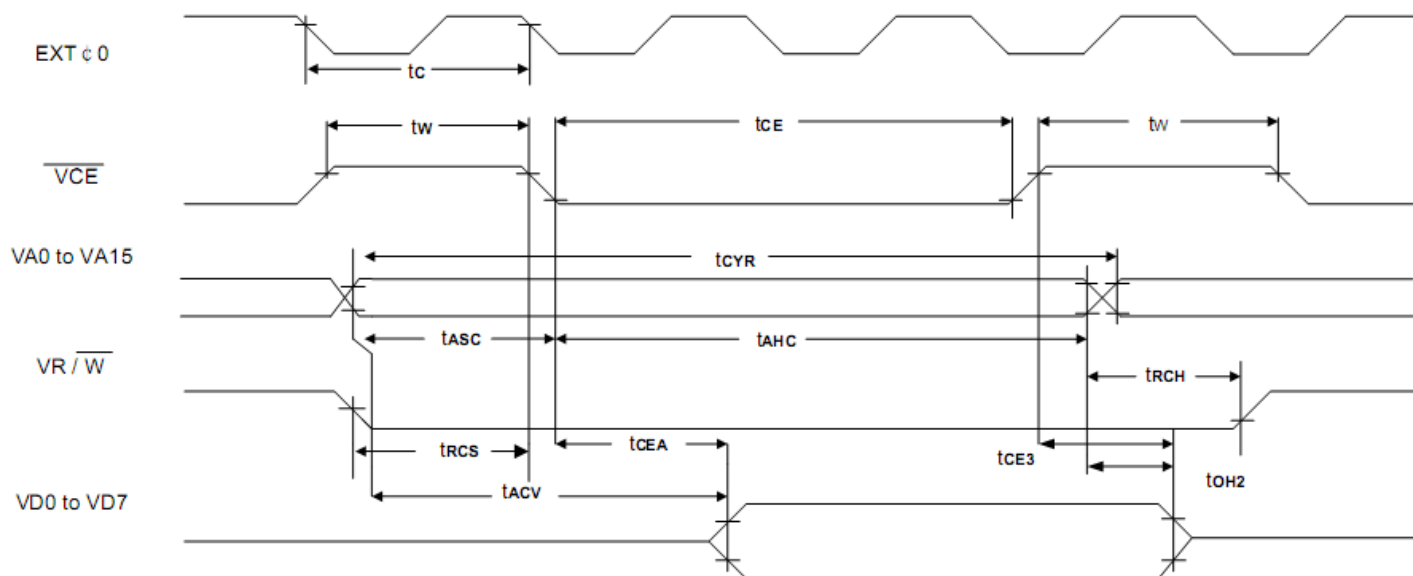
6800 Family Interface Timing



Ta = -20 to 75°C

| Signal | Symbol | Parameter | V _{DD} = 4.5 to 5.5V | | V _{DD} = 2.7 to 4.5V | | 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 | |

Display Memory Read Timing



Ta = -20 to 75°C

| Signal | Symbol | Parameter | V _{DD} = 4.5 to 5.5V | | V _{DD} = 2.7 to 4.5V | | Unit | Condition |
|-------------------------|------------------|--|-------------------------------|-----------------------|-------------------------------|-----------------------|------|-------------|
| | | | Min. | Max. | Min. | Max. | | |
| EXT Φ0 | t _C | Clock period | 100 | — | 125 | — | ns | CL = 100 pF |
| $\overline{\text{VCE}}$ | t _w | VCE HIGH-level pulse width | t _C - 50 | — | t _C - 50 | — | ns | |
| | t _{CE} | VCE LOW-level pulse width | 2t _C - 30 | — | 2t _C - 30 | — | ns | |
| VA0 to VA15 | t _{CYR} | Read cycle time | 3t _C | — | 3t _C | — | ns | |
| | t _{ASC} | Address setup time to falling edge of $\overline{\text{VCE}}$ | t _C - 70 | — | t _C - 100 | — | ns | |
| | t _{AHC} | Address hold time from falling edge of $\overline{\text{VCE}}$ | 2t _C - 30 | — | 2t _C - 40 | — | ns | |
| $\overline{\text{VRD}}$ | t _{RCS} | Read cycle setup time to falling edge of $\overline{\text{VCE}}$ | t _C - 45 | — | t _C - 60 | — | ns | |
| | t _{RCH} | Read cycle hold time from rising edge of $\overline{\text{VCE}}$ | 0.5t _C | — | 0.5t _C | — | ns | |
| VD0 to VD7 | t _{ACV} | Address access time | — | 3t _C - 100 | — | 3t _C - 115 | Ns | |
| | t _{CEA} | VCE access time | — | 2t _C - 80 | — | 2t _C - 90 | Ns | |
| | t _{OH2} | Output data hold time | 0 | — | 0 | — | ns | |
| | t _{CE3} | VCE to data off time | 0 | — | 0 | — | ns | |

Example Initialization Program

```
//-----  
sbit A0 = P3^0;  
sbit RW = P3^7;  
sbit E = P3^4;  
sbit CS = P3^1;  
sbit IM = P3^6;  
sbit RST = P3^2;  
  
//-----  
void Writecom(int A)  
{  
    CS = 0;  
    RW = 0;  
    A0 = 1;  
    E = 1;  
    P1 = A;  
    E = 1;  
}  
  
void Write(int A)  
{  
    CS = 0;  
    RW = 0;  
    A0 = 0;  
    E = 1;  
    P1 = A;  
    E = 1;  
}  
  
//-----  
void init()  
{  
    IM = 1;  
    RST = 0;  
    delay(10);  
    RST = 1;  
    delay(100);  
    Writecom(0x40);  
    Write(0x30);  
    Write(0x87);  
    Write(0x07);  
    Write(0x1D);  
    Write(0x50);  
    Write(0x80);  
    Write(0x1E);  
    Write(0x00);  
    Writecom(0x44);  
    Write(0x00);  
    Write(0x00);  
    Write(0x80);  
    Write(0x00);  
    Write(0x40);  
    Write(0x80);  
    Write(0x00);  
    Write(0x00);  
    Write(0x00);  
    Write(0x00);  
    Write(0x5A);  
    Write(0x00);  
    Write(0x5B);  
    Write(0x0C);  
    Write(0x4C);  
    Write(0x46);  
}
```

```
Write(0xB0);
Write(0xB0);
Write(0x42);
Write(0x00);

for(a = 0; a < 3840; a++)
{
    Write(0x00);
}
Writecom(0x46);
Write(0x60);
Write(0x09);
Writecom(0x42);
Write(0x00);
for(a = 0; a < 3840; a++)
{
    Write(0x00);
}
Writecom(0x59);
Write(0x04);
}
//-----
```

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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms